

COMPREHENSIVE WATER SYSTEM PLAN

FOR

CITY OF BATTLE GROUND, WASHINGTON

May 2013



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EXECUTIVE SUMMARY

Purpose and Compliance

The purpose of this Comprehensive Water System Plan is to document the City of Battle Ground's (City's) water system infrastructure and evaluate the system's physical and financial adequacy to provide water to existing customers and projected growth within the water service area. This plan includes an inventory of existing facilities, development of criteria for water system analysis, a hydraulic analysis of water system performance, a capital improvement program (CIP) based on the hydraulic analysis and a financial plan to fund the proposed CIP and assess existing revenue and expenses. This plan also includes an assessment of the City's groundwater resources, water rights, operations and water use efficiency program.

This plan follows the Washington State Department of Health Office of Drinking Water's guidelines for Water System Plans and complies with Washington Administrative Code (WAC) 246-290-100.

Water System Overview

The City relies primarily on groundwater wells for its municipal supply. The City currently maintains eight (8) groundwater wells and two (2) emergency interties with Clark Public Utilities (CPU). The City uses its own groundwater wells as the primary source of supply for the system, supplementing with water from the CPU interties as necessary during peak usage periods. The City's wells are chlorinated, using liquid sodium hypochlorite, for disinfection and liquid sodium fluoride is added for dental benefits. Some of the City's wells also receive iron and manganese treatment.

Water supplied from the City's wells and CPU is stored in six (6) water storage reservoirs. Five (5) of these reservoirs, located on Tuke's Mountain, provide gravity supply to the majority of the City's distribution system which is served from a single pressure zone, the Main Pressure Zone, at an approximate hydraulic grade line (HGL) of 544 feet. The sixth reservoir, Horsethief Reservoir, provides suction supply to the adjacent Horsethief Pump Station which pumps water into the distribution system and up to the Tukes Mountain storage reservoirs. A second pump station, the Tukes Mountain Pump Station, provides added pressure to serve homes that are too high in elevation to receive adequate service pressure by gravity from the Tuke's Mountain reservoirs. This area is referred to as the Tukes Mountain Pressure Zone.

Service Area

The City currently serves residential, commercial, multi-family, and institutional customers within the city limits and less than 10 residences outside the city limits. Some residents within the city limits are served by CPU. The City and CPU have established, through

interlocal agreements, that CPU will continue to serve any of its existing service area that is annexed by the City. Consistent with the City's policies, any area within the Urban Growth Area that is annexed and is not currently served by CPU will be served by the City.

Projected Population, Equivalent Residential Units (ERUs) and Water Demand

The City has experienced rapid growth over the last two (2) decades, growing from a population of less than 4,000 in 1990 to approximately 17,780 in 2011. The City's growth is expected to continue, reaching over 34,000 residents in 2031. Future population and water demand projections for the City's water service area were developed based on population data from the Washington State Office of Financial Management, City water production records and customer billing data. City staff estimate that approximately 75 percent of the City's population is within the water service area.

Although the water service area population differs from the City's population, it is anticipated that city-wide growth will reflect growth within the water service area. Based on recent population growth within the City, projected water service area population at the 6-year planning horizon in 2018 is estimated based on an annual average growth rate of 1.5 percent. Beyond 2018, through the 20-year planning horizon population growth is projected based on an annual average growth rate of 3.93 percent as presented in the City's *2004 Comprehensive Plan*. The smaller growth rate for the 6-year planning horizon is considered appropriate for the current development climate in the City.

The demand of each customer class, such as residential, commercial or multi-family, can be expressed in terms of ERUs for demand forecasting and establishing system capacities. One (1) ERU is equivalent to the average amount of water used by a single family residence. The number of ERUs represented by the water demand of customer groups other than residential is determined from the total demand of the customer group and the demand per ERU calculated from the single family residential demand data. Table ES-1 presents the projected service area population, ERUs and water demands for current 2012, 6-year and 20-year planning horizons.

Water System Evaluation Criteria, Analysis and Deficiencies

The City's supply, pumping, storage, and distribution facilities were analyzed based on industry standard criteria developed by the Washington State Department of Health. The water demand forecasts summarized in Table ES-1 are used in conjunction with these criteria to assess the adequacy of the water system to deliver sufficient quantities of water under peak or fire flow conditions at acceptable pipeline velocities and system pressures as well as to assess the system's reliability.

**ES-1
Population and Demand Projections Summary**

Projection Year	Estimated Service Area Population	ERUs	Pressure Zone	Water Demands		
				ADD (mgd)	MDD (mgd)	PHD (gpm)
Current 2012	13,535	6,618	Main	1.27	2.84	3,245
			Tukes Mt.	0.02	0.05	53
			Total	1.29	2.89	3,298
6-Year 2018	14,800	7,236	Main	1.39	3.11	3,540
			Tukes Mt.	0.02	0.05	58
			Total	1.41	3.16	3,598
20-Year 2032	25,390	12,412	Main	2.38	5.33	6,012
			Tukes Mt.	0.04	0.09	98
			Total	2.42	5.42	6,110

Notes:

1. ERU projections are based on ERU growth rates equivalent to the population growth rates presented in Table 2-6.
2. 195 gpd/ERU was used to forecast future average daily demand based on historical demand per ERU.
3. MDD projections are calculated by multiplying the ADD by the peaking factor 2.24.
4. PHD is projected from MDD using the estimating method described in the *December 2009 DOH Water System Design Manual*.
5. Tukes Mountain Pressure Zone demand is estimated as 1.6 percent of total system demand.

Water Supply

Supply capacity is evaluated by comparing existing and projected MDD for the City’s service area to the total available supply from all sources and the City’s existing water rights. Existing water rights are sufficient to support projected water system MDD through 2018. Currently, the City cannot use their full water rights because existing wells do not have adequate operational capacity. Based on the City’s current understanding of the potential to expand the capacity of existing wells to utilize the full water rates and volumes, no further groundwater expansion is anticipated within the City. If the City is able to drill additional wells and transfer the location of existing water rights there will still be a need for wholesale supply over the 20-year planning period. The City is currently coordinating with CPU to participate in the development of regional water supply and transmission facilities to serve the north Clark County area.

The current maximum operational supply will be insufficient within the 6-year planning horizon due to the decline of existing well yields. To address this known operational deficiency, the City is moving forward with plans to construct a larger intertie with CPU that would initially provide a supply of 1,000 gallons per minute (gpm) or 1.44 mgd. This new intertie would include provisions for a future capacity of 3,000 gpm (4.32 mgd) as CPU develops new water sources. Under existing conditions, supply reliability is deficient for

some criteria. However, with the planned addition of the 1,000 gpm CPU intertie and its eventual expansion to 3,000 gpm, all supply reliability criteria will be met within the 20-year planning period.

The City is also considering the replacement of Well No. 7 or 8, if necessary, to maintain adequate well yields pending the construction of the new intertie and associated regional groundwater supply facilities. Based on long-range demand forecasting and the uncertainty of continued supply capacity from the City's existing groundwater wells, Battle Ground is currently coordinating with CPU to develop agreements for expanding the intertie capacity and participation in the Paradise Point regional groundwater supply to a total capacity of 4,000 gpm.

Pump Stations

The capacity requirements for booster pumping facilities vary based on whether the pump station is supplying a reservoir which then serves customers by gravity in an "open pressure zone" or supplying constant pressure to an area, referred to as a "closed pressure zone". In the City's water system there are two (2) pump stations, the Horsethief and Tukes Mountain pump stations. The Horsethief Booster Pump Station supplies the Main Zone which is an open pressure zone because the HGL is dictated by water levels in the Tukes Mountain Reservoirs. The Tukes Mountain Pump Station supplies the closed Tukes Mountain Pressure Zone with constant pressure water service.

Although there is an apparent MDD deficiency at the Horsethief Pump Station in 2032, before recommending expanded station capacity, it is important to consider the contribution of supply sources simultaneously serving Main Zone customers. The capacity of existing Wells 1, 2, 4 and 5 and the existing CPU intertie offset the Horsethief Pump Station deficiency in 2032. No additional capacity is recommended at the Horsethief Pump Station.

The existing Tukes Mountain Pump Station meets capacity criteria through 2032, with or without the largest pump in service. The current configuration of the Tukes Mountain Pump Station meets all reliability criteria. No additional capacity is recommended at the Tukes Mountain Pump Station.

Storage Reservoirs

Water system storage is provided for different purposes which are represented by the following storage components: operational, equalizing, standby, fire, and dead storage.

- Operational storage is used to supply the water system under normal demand conditions.
- Equalizing storage must be provided when supply source pumping capacity cannot meet periodic peak demands.
- Standby, or emergency, storage is used to provide a measure of reliability should supply sources fail or unusual conditions impose higher demands than anticipated.

- Fire suppression storage provides adequate volume to supply the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement.
- Dead storage is defined as water that cannot be used because it is stored at an elevation that is too low to provide sufficient pressure by gravity within the service area.

Storage capacity and reliability for the City’s system is assessed on a system-wide basis, including customer demands from both the Main and Tukes Mountain Pressure Zones. The entire volume of the Horsethief Reservoir is considered dead storage because it is not capable of supplying the water system by gravity but only through the Horsethief Pump Station. The storage evaluation indicates that the City’s system will meet storage requirements through the 6-year planning period, but will become deficient before 2032. A new Main Zone storage reservoir with an approximate capacity of 1.4 million gallons (MG) should be planned in approximately 2023, when existing storage is estimated to become deficient. Current storage volume and operational features satisfy all reliability criteria.

Transmission and Distribution Piping

The City’s existing distribution and transmission mains were evaluated using a hydraulic network analysis model to determine if the system is sized and looped adequately to provide the necessary flow rates and service pressures to meet existing and future demands. The results of the modeling analysis indicate that the system effectively maintains a minimum pressure of 30 psi to all customers under the PHD condition. However, for the MDD plus fire flow condition, three (3) existing piping deficiencies were identified:

- An estimated 550 linear foot (LF) section of existing 2-inch main along SW 2nd Court, north of SW 4th Street. This 2-inch main should be upgraded to an 8-inch waterline that can deliver fire flows under the MDD condition at the minimum required 20 psi residual pressure, as well as reduce pipeline velocities to acceptable levels.
- A portion of the existing 2-inch main along SW 3rd Street extending from S Parkway Avenue. It is recommended that approximately 50 LF of this main between the 8-inch existing main on S Parkway Avenue and an existing fire hydrant on SW 3rd Street be upsized to meet fire flow, pressure and recommended pipeline velocity requirements. The remainder of the existing 2-inch main is located within private property and could continue to provide nominal residential demands.
- An estimated 1,190 LF of 6-inch main along NE Grace Avenue, between NE 6th Street and NE 10th Streets, should be upgraded to an 8-inch main to meet fire flow residual pressure requirements.

Construction of transmission main improvements as part of the overall transmission grid, extending on SW 20th Avenue, are also included in the CIP, anticipating that City transportation projects may occur prior to other potential drivers of this improvement associated with development in this area of the City.

Within the last 15 years, the City has undertaken a rigorous CIP that has resulted in replacement of a large portion of the older distribution system. This has allowed the newly constructed pipelines to be brought up to current industry and City standards, resulting in a distribution system that meets most reliability criteria. A continuing allowance is included in the City's updated CIP for yearly water main replacement of the remaining older system piping, further fortifying system reliability.

Water Resource Evaluation

Distribution System Leakage (DSL)

DSL is water lost from the distribution system including both apparent losses and real losses. There are many sources of DSL in a typical water system including water system leaks, inaccurate supply metering, inaccurate customer metering, water service line and main breaks from construction, illegal water system connections or water use, and malfunctioning telemetry and control equipment resulting in an overflow of storage tanks. The current three-year rolling average for DSL is 8.5 percent, which meets the City's water conservation goals by having less than 10 percent DSL by 2017.

Water Use Efficiency (WUE)

The City updated their WUE program in 2011, according to Washington State Department of Health guidelines. The City's WUE program includes conservation measures that have resulted in a significant DSL reduction. Through these measures, the City's goal of attaining annual system leakage below 10 percent was first achieved in 2009 and continues to be maintained. Average customer demand per ERU has also decreased significantly, well in excess of the City's goal of 1 percent over six years established in 2011. With the program's success, there is limited additional conservation potential and no additional measures are currently planned for implementation.

Water Rights

An evaluation of the City's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands. The City has more than enough instantaneous and primary annual water rights to meet existing MDD and ADD respectively. Based on future demand projections, the City will need to expand both instantaneous and primary annual water rights or increase the amount of water supply from CPU before 2020.

Recommended CIP

The updated CIP presented in Table ES-2 summarizes water system improvements recommended for construction within the City's 20-year planning horizon. The water system improvements recommended in the CIP address the existing system deficiencies and provide for the future needs of the City. Implementing these improvements will help ensure that the City's customers continue to receive reliable, high-quality water service.

An estimated project cost has been developed for each improvement project presented in the CIP. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The cost estimates presented here are considered Class 4 by the Association for the Advancement of Cost Engineering International (AACE International) with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Estimated project costs include approximate construction costs and an allowance for administrative, engineering and other project related costs.

Table ES-2 Capital Improvement Program

Category	CIP No.	Project Description / Location	CIP Schedule and Project Cost Summary (2012 dollars)							Estimated Project Cost ^{1,2}	
			2013	2014	2015	2016	2017	2018	2019-2032		
Supply System Improvements	SS1	New Intertie/Pump Station on NE 219th	\$ 1,360,000								\$ 1,360,000
	SS2	NE 219th Intertie/Pump Station Upgrade (2021)								\$ 140,000	\$ 140,000
	SS3	Regional Source and Transmission Development			\$ 1,375,000	\$ 675,000	\$ 675,000	\$ 675,000	\$ 9,450,000	\$ 12,850,000	
		Well Replacement			\$ 800,000					\$ 800,000	
		<i>Sub-Total</i>	\$ 1,360,000	\$ -	\$ 2,175,000	\$ 675,000	\$ 675,000	\$ 675,000	\$ 9,590,000	\$ 15,150,000	
Storage Improvements	ST1	New 1.4 MG Reservoir (2023)							\$ 1,800,000	\$ 1,800,000	
		<i>Sub-Total</i>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,800,000	\$ 1,800,000	
Water Main Improvements	WM1	Annual Water Main Replacement Program	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 1,400,000	\$ 1,700,000	
	WM2	SW 2nd Court 8-inch Main							\$ 105,000	\$ 105,000	
	WM3	SW 3rd Street 8-inch Main to Hydrant							\$ 10,000	\$ 10,000	
	WM4	NE Grace Avenue 8-inch Main							\$ 475,000	\$ 475,000	
		SW 20th Avenue 12-inch Transmission						\$ 565,000		\$ 565,000	
		<i>Sub-Total</i>	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 615,000	\$ 1,990,000	\$ 2,855,000	
Capital Improvement Program (CIP) Total			\$ 1,410,000	\$ 50,000	\$ 2,225,000	\$ 725,000	\$ 725,000	\$ 1,290,000	\$ 13,380,000	\$ 19,805,000	

¹ Cost estimates are based on an Engineering (ENR) construction cost index of 9418 for Seattle, Washington (October 2012).

² Cost Estimates are in current dollars. (October 2012)

6 Year Total
\$6,425,000
Annual Avg
\$1,070,833

20 Year Total
\$19,805,000
Annual Avg
\$990,250

Financial Plan

The financial plan matches funding sources with the CIP presented in Table ES-2 and develops a multi-year water rate strategy to demonstrate financial viability in meeting the total costs of providing water service, which include:

- Financial policies
- Operating and maintenance (O&M) costs
- Administrative and overhead costs
- Capital related costs

The analysis considers the historical financial performance of the utility, the financial impact of executing the capital program, the sufficiency of current utility revenues, and the affordability of rates. The current water rate structure is also evaluated in terms of achieving revenue stability, efficiency of use and customer equity.

The results of this analysis indicate that inflationary level rate increases are necessary to fund ongoing operating needs and the identified capital program. Implementation of proposed rate increases should provide for continued financial viability.

Past Financial Performance Key Findings

- Charges for Services increased 11 percent over the historical period due to a combination of customer growth and rate increases, with a peak in revenue collection in 2009.

The Operating Ratio (total operating expenses divided by total operating revenues) remained at about 60 percent in all years, indicating operating revenues are sufficient to meet operating expenses. A ratio greater than 90 percent would indicate that there is little room for new debt service and capital replacement without additional rate increases. A ratio greater than 100 percent would indicate that operating expenses exceed operating revenues and would be indicative of an unsustainable financial condition. The utility had no outstanding debt, providing ample debt capacity to fund future capital.

- A Quick Ratio (current assets divided by current liabilities) increasing from 3:1 to 38:1 reflects the positive cash position of the water utility from 2006 to 2011. Current Assets, comprised of primarily cash and investments, grew by 141 percent during this period.

Capital Costs and Funding Strategy

The capital funding plan defines a strategy for funding the CIP presented in Table ES-2 considering available cash reserves, system development charges (SDCs), external contributions from grants / developers and new debt proceeds, if required.

Capital costs are stated in 2012 dollars and escalated annually at 3 percent construction cost inflation to the year of planned spending for financing projections. The CIP identifies \$6.4 million (\$7.1 million escalated) in project costs over the 6-year planning horizon and \$19.8 million (\$26.8 million escalated) over the 20-year period. Each year has varied capital obligations depending on construction schedules and infrastructure planning needs. About 27 percent of capital program costs are scheduled for the 6-year period.

The City water utility is projected to have sufficient cash to fund the total CIP as planned without borrowing, due to significant existing cash reserves, policy for ongoing rate-funding for system reinvestment and SDC revenue collections.

Revenue Requirements Forecast

The revenue requirement analysis forecasts the amount of operating and capital related costs to determine the annual revenue required from rates. The analysis incorporates operating revenues, O&M expenses, debt service payments, rate funded capital needs, and any other identified revenues or expenses related to water utility operations, and determines the sufficiency of the current level of rates.

The financial forecast is developed from the City's 2012 projected year-end performance, along with other key factors and assumptions listed below:

- Water rate revenues are forecasted based on projected year-end 2012 water rate revenue plus 1 percent annual customer growth.
- Interest earnings on cash balances are assumed at 0.2 percent in 2013 phasing up to 2 percent by the end of the 6-year forecast.
- Operating costs are based on the 2013-2014 Biennial Budget.
- O&M expenses are escalated at 2.5 percent per year for labor and general system costs and 7 percent for employee benefit costs. State taxes are calculated using prevailing tax rates.

Current and Projected Rates

The existing water rate structure consists of a monthly basic meter charge of \$11.80, which includes three hundred cubic feet (CCF) of water. Residential customers pay \$2.05 per CCF for use above the three (3) CCF and up to 15 CCF. Use above 15 CCF is charged at \$2.56

per CCF. All other customers pay a basic meter charge that increases with meter size and a volume charge of \$2.20 per CCF for all water use.

While the existing structure adequately encourages water conservation, further refinements could be made to improve efficiency of use and customer equity including:

- Eliminate the water usage allowance and charge for all use in volume rates
- Implement a third tier in the residential block rate to target highest water users and provide greater relief to low water users
- Consider seasonal rates for non-residential customers

Table ES-3 compares existing and proposed rates under the existing water rate structure.

**Table ES-3
Existing and Projected Water Rates**

Monthly Rates		Existing	Across-the-Board Increases					
		2012	2013	2014	2015	2016	2017	2018
Basic Meter Charge	Inside-City per month rate - includes 3 ccf	\$11.80	\$11.80	\$12.80	\$13.18	\$13.58	\$13.99	\$14.41
Residential Consumption	Inside-City per 100 cubic feet							
	4 - 15 ccf	\$2.05	\$2.05	\$2.05	\$2.11	\$2.17	\$2.24	\$2.31
	>15 ccf	\$2.56	\$2.56	\$2.56	\$2.64	\$2.72	\$2.80	\$2.88
Basic Meter Charge Commercial	5/8" meter	\$19.35	\$19.35	\$19.35	\$19.93	\$20.53	\$21.14	\$21.78
	3/4" meter	\$21.35	\$21.35	\$21.35	\$21.99	\$22.65	\$23.33	\$24.03
	1" meter	\$36.50	\$36.50	\$36.50	\$37.60	\$38.72	\$39.88	\$41.08
	1.5" meter	\$65.20	\$65.20	\$65.20	\$67.16	\$69.17	\$71.25	\$73.38
	2" meter	\$101.00	\$101.00	\$101.00	\$104.03	\$107.15	\$110.37	\$113.68
	3" meter	\$201.00	\$201.00	\$201.00	\$207.03	\$213.24	\$219.64	\$226.23
	4" meter	\$321.00	\$321.00	\$321.00	\$330.63	\$340.55	\$350.77	\$361.29
Commercial Consumption	Inside-City per 100 cubic feet	\$2.20	\$2.20	\$3.20	\$3.30	\$3.39	\$3.50	\$3.60
Commercial Irrigation	Annual connection	\$45.00	\$45.00	\$45.00	\$46.35	\$47.74	\$49.17	\$50.65
	De-activation charge	\$20.00	\$20.00	\$20.00	\$20.60	\$21.22	\$21.85	\$22.51
Outside the City	Rates and charges are all 1.5 times the in-City rates and charges							

Note: Table ES-3 reflects changes to basic residential meter charges and commercial consumption charges adopted in 2014.

System Development Charge

A SDC is a one-time charge imposed on new customers as a condition of connecting to the utility system. SDCs provide a mechanism for new customers to share in the capital costs incurred to support their addition to the system. The revenue from SDCs can only be used to fund water utility capital projects or pay debt service incurred to finance capital projects. In the absence of such charges, growth-related capital costs would be borne in large part by existing customers.

For the purposes of the financial analysis, the existing (2012) SDC is \$2,210 for new single family residential water customers. Based on projected infrastructure needs identified in the 20-year CIP presented in Table ES-2 and system capacity, an updated charge of \$3,074 per ERU was calculated for 2013. The updated SDC will be implemented in 2014 and adjusted for 2015 inflation. The proposed 2015 charge, incorporating inflation projected at 3 percent annually, is \$3,261 per ERU. The updated schedule of SDCs is summarized in Table ES-4.

**Table ES-4
SDC by Meter Size**

Existing Water SDCs		Planned 2014 SDC		Proposed 2015 SDCs	
Meter Size	Charge	Meter Size	Charge	Meter Size	Charge
5/8"	\$ 2,210	5/8"	\$ 3,074	5/8"	\$ 3,261
3/4"	\$ 3,315	3/4"	\$ 4,611	3/4"	\$ 4,892
1"	\$ 5,525	1"	\$ 7,685	1"	\$ 8,153
1.5"	\$ 13,260	1.5"	\$ 18,444	1.5"	\$ 19,568
2"	\$ 22,100	2"	\$ 30,741	2"	\$ 32,613
3"	\$ 50,830	3"	\$ 70,704	3"	\$ 75,010
4"	\$ 90,610	4"	\$ 126,037	4"	\$ 133,713

SECTION 1

EXISTING WATER SYSTEM AND POLICIES

Ownership and Management

The City of Battle Ground (City) Water Department is a city-owned water utility in Battle Ground, Washington. The City presently provides water service to approximately 5,300 homes and businesses.

Water System Contact Information:

Mailing Address: City of Battle Ground
109 SW 1st Street, Suite 122
Battle Ground, WA 98604

Phone Numbers: (360) 342-5000 – City Hall
(360) 342-5350 – Public Works Operations Center

FAX Numbers: (360) 342-5359 – Public Works Operations Center
WDOH ID#: 4700 5

The Water Department is managed by the Public Works Department of the City. The Public Works Director is in charge of the department and reports to the City Manager who reports to the City Council. A Public Works Foreman is in charge of operating the water system on a day to day basis. The Public Works Operations Manager and the Assistant City Engineer are also involved in decisions regarding the water system.

The current City's Organizational Table is presented at the end of this section.

System Background

History of Water System Development and Growth

The City was incorporated in 1951. The community stayed relatively small for a long time. In 1990, the population was less than 4,000. Rapid growth due to numerous housing developments, and addition of the Salmon Creek Interceptor for improved sewer capacity, has led to a population of 17,780 in 2011. The City has become an attractive city for commuters from Portland and Vancouver. Growth is expected to continue as the City fills out its Urban Growth Area (UGA) and incorporates more of the surrounding area into the city limits. Over the life of the prior Water System Plan, the number of City water service connections grew from 3,775 (2004 Water Facilities Inventory (WFI)) to 5,923 (2011 WFI). The population is projected to reach over 34,000 by 2031.

The City has relied exclusively on groundwater for its source of water. Wells 1 and 2 were the original wells for the City. As growth occurred Wells 4 and 5 were drilled, and within the

last 10 years Wells 6, 7, 8 and 9 were drilled and put into production. Due to the presence of high levels of iron in the aquifer source, the City does not intend to expand the groundwater source within the UGA. The City may consider replacing Wells 6 and 7 with a new well near Well 9 where iron concentration is limited. In the last 10 years the City's water supply from the wells has been supplemented by water from Clark Public Utilities (CPU) and the Battle Ground School District. The connection to the school well is now disconnected, and the City maintains its current intertie with CPU on NE 199th Street (Eaton Boulevard) at the Maple Grove School.

The City built its first five (5) reservoirs in the same location on Tukes Mountain at the eastern limits of the City's water service area. This location has resulted in high pressures in the majority of the distribution system, requiring most individual services to install private pressure reducing valves. In 2004 the City constructed a new two (2) million gallon (MG) welded steel reservoir west of SW 20th Avenue which has improved system operation with additional storage for times of high water demand.

Geography

The City is in Clark County, which is located in southwestern Washington. Clark County is bounded on the north by the Lewis River, on the east by the western slopes of the Cascade Mountains, and on the south and west by the Columbia River. Bottomland along the Columbia River transitions to plains and terraces. The terrain rises in the northeast to the foothills of the Cascades where elevations climb to 4,000 feet. The county covers approximately 633 square miles with forest covering more than 50 percent of the land areas. Major forested areas are in the north and northeast sections of the county.

Historically, the existing topography was influenced by geologic forces but more recently by surface water erosion. Down faulting has formed the Chelatchie Prairie and the Yacolt basin areas in the northeastern sections of the county. In general, glaciation, with subsequent erosion and deposition, has played a major part in forming the terraced landscape, which occurs in the Fourth Plain area and glacial outwash lowlands along the Columbia River.

Major bodies of water include Vancouver Lake in the southwest corner, Lacamas Lake in the southeast corner, and Lake Merwin and Yale reservoirs on the northern boundary. These latter two (2) bodies of water were created by dam construction for the generation of electrical power. Major rivers include the North Fork and East Fork of the Lewis River, the Washougal River, and the Columbia River. Stream systems include Salmon, Gee, Cedar, Burnt Bridger, Whipple and Lacamas Creeks.

The water utility's existing service area is within the city limits of the City. CPU service area surrounds the City, and also includes customers within the city limits. Features that present significant barriers to the development of the water transmission network include Weaver Creek, and the state highways SR 502 and SR 503.

The City works closely with the Washington State Department of Transportation to coordinate the installation of water facilities along new or upgraded highways that have increasingly restricted access.

Inventory of Existing Facilities

Existing City water facilities are illustrated on Plate 1 in Appendix A and on Figure 1-1, Existing Water System Schematic, at the end of this section.

Water Sources

The existing water system is supplied by eight (8) groundwater wells and two (2) active emergency interties with CPU. Table 1-1 summarizes the City’s existing supply sources and their capacities in gallons per minute (gpm). Additional detail on existing sources is provided in Section 3. All of these water sources are equipped with flow meters to measure and record production rate and volume. All water sources except Wells 4 and 5 have remote operation and monitoring capability provided by a Supervisory Control and Data Acquisition (SCADA) system that is managed for the City by CPU.

**Table 1-1
Water Supply Summary**

DOH Source No.	Well No. or Supply Source	Location	Water Right Qi (gpm)	Operating Q (gpm)
SO1	1	W Main Street (SR502) and SW 5th Avenue	350	280
SO2	2			
SO3	4	SW 10th Street dead end east of SR 503	250	150
SO4	5			
SO5	CPU Intertie	NE 199th Street (Eaton Blvd) at Maple Grove School	4-inch - 500 gpm	
SO6	School District Intertie		Abandoned	
SO7	CPU Intertie	NE Grace (142nd) Avenue and NE 10th St	6-inch for emergency use only	
SO8	6	SW 20th Street (112th) at SW 21st Court	350	200
SO9	7	Horsethief Reservoir Site on SW 11th Street	1,375	300
SO10	8			400
SO11	9			350

Water Treatment

All City wells are chlorinated and liquid sodium fluoride is added for dental benefits. Fluoride levels in the water system range from 0.8 to 1.3 mg/l with a goal of 1.0 mg/l. Residual chlorine disinfectant levels in the water system range from 0.4 to 0.8 mg/l. Table 1-2 summarizes water treatment facilities at each of the City's wells.

Chlorination

All of the City water utility's water production facilities include disinfection treatment to provide a residual throughout the distribution system. This treatment is achieved using 12.5 percent liquid sodium hypochlorite.

Iron and Manganese Removal

An iron and manganese removal facility is provided for Wells 7, 8 and 9. The facility uses manganese dioxide ore (AS-721 media) to adsorb dissolved iron and manganese. Chlorine is added prior to the adsorption units to provide continuous regeneration of the manganese dioxide media as well as for disinfection residual maintenance in the distribution system.

**Table 1-2
Groundwater Well Treatment Summary**

DOH Source No.	Well No.	Fluoridation	Chlorination Type	Iron & Manganese Treatment
SO1	1	Liquid	Liquid Hypochlorite	None
SO2	2	Liquid		
SO3	4	Liquid	Liquid Hypochlorite	None
SO4	5	Liquid		
SO8	6	Liquid	Liquid Hypochlorite	Sequestering w/Sodium Silicate
SO9	7	Liquid	Liquid Hypochlorite	Pyrolusite Adsorption
SO10	8	Liquid		
SO11	9	Liquid		

Water Storage Reservoirs

The existing water system contains a total of six (6) water storage reservoirs. Three (3) of these reservoirs are concrete and three (3) are steel. The total volume of the reservoirs is 3.84 MG with an effective volume of 3.54 MG due to dead storage in the Horsethief Reservoir. Five (5) of the reservoirs (three (3) concrete and two (2) steel) are located together on Tuke's Mountain. The sixth, a 2 MG steel reservoir, is located next to Wells 7, 8 and 9 in the Horsethief subdivision in the southwest part of town. Reservoirs on Tuke's Mountain serve the distribution system by gravity from an overflow elevation of 544 feet. The adjacent

Horsethief Pump Station supplies water to the distribution system from the Horsethief Reservoir. Table 1-3 provides a summary of the existing water storage facilities.

**Table 1-3
Water Storage Reservoir Summary**

Reservoir Name	Year Built	Height (ft)	Dia. (ft)	Total Volume (MG)	Effective Volume (MG)	Overflow Elevation (ft)
Tukes Mtn #1	1954	35	35	0.25	0.25	544
Tukes Mtn #2	1970s	50	25	0.18	0.18	544
Tukes Mtn #3	1980s	45	25	0.17	0.17	544
Tukes Mtn #4	1980s	40	25	0.15	0.15	544
Tukes Mtn #5	1999	38	68	1.03	1.03	544
Horsethief #6	2004	31	110	2.06	1.76	296
Totals:				3.84	3.54	

Pump Stations

The City’s water system has two (2) booster pump stations, one (1) at the Horsethief Reservoir and one (1) on Tukes Mountain.

The Horsethief Station pumps water through four (4) booster pumps from the Horsethief Reservoir up to the Tukes Mountain reservoirs. The pump station’s two (2) 50 horsepower (hp), 500 gpm pumps have variable frequency drives to match pump output with demand. The Horsethief Pump Station was designed such that 2,000 gpm could be provided with any one (1) pump out of service.

The Tuke’s Mountain Pump Station, at the intersection of NE 14th Street and NE 15th Avenues, has four (4) pumps. This station provides added pressure to serve homes that are too high to receive adequate service pressure by gravity from the Tuke’s Mountain reservoirs. Table 1-4 lists the capacities of each booster pump. All pumps are end suction centrifugal pumps.

**Table 1-4
Pump Station Summary**

Location	Horsepower (hp)	Elevation (ft)	Capacity (gpm)	Total Dynamic Head (TDH, ft)
Horsethief 1	50	269	500	270
Horsethief 2	50	269	500	270
Horsethief 3	100	269	1,000	270
Horsethief 4	100	269	1,000	270
Tukes 1	5	380	30	240
Tukes 2	30	380	300	240
Tukes 3	40	380	1,000	100
Tukes 4	40	380	1,000	100

Transmission and Distribution Mains

The City’s water system includes approximately 75 miles of transmission and distribution mains. Table 1-5 provides a summary of water mains by pipe diameter. All new water mains are ductile iron or PVC. The existing water system includes some steel mains in the central core of the City and a minimal amount of asbestos cement (AC) pipe. All steel pipe was installed before 1970 and is 6-inch diameter or smaller. AC pipe was installed in the 1970s.

Because of high static pressures in the system from the reservoirs on Tukes Mountain, most water services have individual pressure reducing valves. These are installed on the customer side of the meter and are customer maintained. See Section 3 for an evaluation of the existing water distribution facilities.

**Table 1-5
Water Main Summary**

Diameter (inches)	Length (miles)
4-inch or less	1.6
6	17.9
8	43.6
10	0.3
12	8.8
16	2.7
TOTAL	74.9

Related Plans

Coordinated Water System Plans

Clark County's *Coordinated Water System Plan Update (2012)* (CWSP). The most recent update was provided to update the 1999 plan, and to reflect new changes in service boundaries and service agreements, as required by the RCW. The 1999 update of the CWSP was developed to reflect the changes in zoning that resulted from implementation of growth management planning in Clark County. The 1999 plan completely replaced the 1991 and 1983 plans, which provided historical background and conceptual discussion of regional water supply system options.

Comprehensive Land Use Plans

Clark County's *20-Year Comprehensive Growth Management Plan*, adopted in 2007 and amended in 2008, 2009 and 2010. Among the measures to manage growth and development throughout the county, the plan identifies land uses and development densities appropriate for various areas of the county. It establishes UGAs and sets forth policies aimed at encouraging compact orderly development within these urban boundaries, and it defines level of service standards for public facilities.

Previous Battle Ground Water System Plans

Battle Ground Water System Plan (1994 and 2004) and *Water System Plan Update (1998)*. These plans serve as reference for this plan as well as documenting the history of the water system.

Clark Public Utilities Water System Plan

Clark Public Utilities Water System Plan (2004 and 2011). This plan is a comprehensive document detailing the operation, maintenance and future plans for CPU. Since CPU has interties with the City and has adjacent service area there is information that relates to the planning work for the City's water facilities.

Battle Ground Wellhead Protection Plan

Battle Ground Wellhead Protection Plan (2000, updated 2012). This plan documents the geology of the groundwater around the City and lists potential contaminants of the City's wells as well as determining the vulnerability of each well. The plan lays out a direction for the City to protect both the quantity and quality of their groundwater source. The Wellhead Protection Plan is included as Section 5 of this Water System Plan.

Existing and Retail Service Area

Figure 1-2 shows the City's existing, retail and future water service areas, city limits, UGA and CPU service area. The City's Water System services residential, commercial, industrial, and institutional customers within the city limits and less than 10 residences outside the city

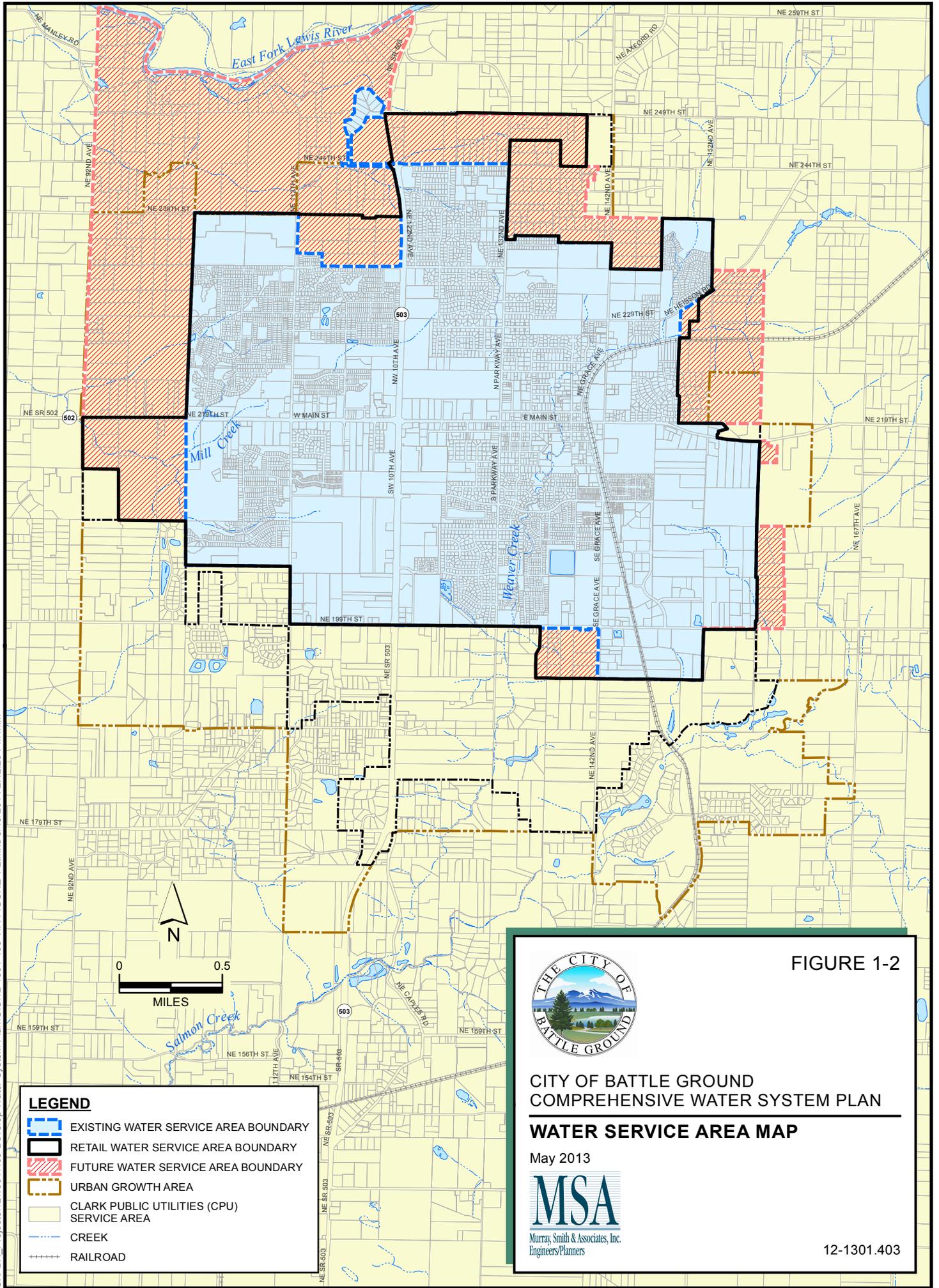


FIGURE 1-2



CITY OF BATTLE GROUND
COMPREHENSIVE WATER SYSTEM PLAN
WATER SERVICE AREA MAP

May 2013



limits. Some residents within the City's limits are served by CPU. The City's retail service area includes all area within the city limits that is not currently served by CPU.

Future Service Area

The City will continue to see extensions of distribution mains to ultimately serve any part of the City's UGA which is not served by CPU. CPU currently serves water to a large portion of customers inside the City's UGA. CPU will continue to serve those areas it already serves as agreed to under the terms of a service area interlocal agreement between the City and CPU. Expansion of the UGA is limited owing principally to controls on development imposed by Clark County's Comprehensive Plan and implementing land use regulations, consistent with the Growth Management Act (GMA). Currently CPU serves 97 connections within the City's service area and 725 connections outside City service area boundaries that are inside the City UGA.

Service Area Agreements

The City, CPU, and the other water purveyors within Clark County have recently updated the CWSP. As documented in the CWSP, all areas of the county fall within the designated service area of an existing water purveyor. The City and CPU have decided that CPU will continue to serve any of its existing service area that is annexed by the City. Consistent with the City's retail water service area, any area annexed that is not currently served by CPU will be served by the City.

Water Utility Service Area Policies

Wholesale Water and Wheeling of Water

The water utility will consider requests for wholesale water sales arrangements only with other major water purveyors. It would consider a request for wheeling water through the distribution system. Important considerations include monitoring and control, hydraulic evaluation of the potential impacts, water quality, and water rights changes.

Direct Connection

The water utility requires direct service from its main water system.

Design and Performance Standards

The City has prepared a comprehensive set of engineering and construction standards for all new utility projects. Water system standards are summarized in Section 7 of this plan.

Oversizing Policy

The water utility will provide financial assistance for oversizing of water facilities when the needs of the system exceed the development's requirements.

System Extension

All extensions to the water utility's system must meet its adopted engineering standards. Where desirable to meet long term system needs, the water utility will pay for oversizing facilities as appropriate.

Conditions of Service

Purveyor Responsibilities

The water utility is responsible for providing water that meets quality and quantity standards of the State of Washington and the utility's design standards. The water utility will attempt to minimize service interruptions during maintenance, repair, and construction activities.

Customer Responsibilities

The customer is responsible for payment of all charges incurred from their water service and for responding to the water utility's requests for water conservation during emergencies.

Connection Fees

The water utility will assess new or upgrading water customers' system development charges and fees. See the Financial Plan section of this report for additional detail.

Meter and Materials Requirements

The water utility will provide and install all water meters.

Consent

The customer must consent to access by the utility for inspection, maintenance, and repair of water facilities. All new facilities must be located within either the public right-of-way or within a dedicated utility easement.

Cross Connection

The water utility has a cross connection control program. When cross connections are identified or assemblies and/or plumbing are found defective, the utility will provide assistance to correct the problem, but will ultimately terminate service if left uncorrected. The customer is responsible for the purchase, installation, maintenance, and annual testing of cross connection control assemblies that meet the utility's standards.

Service Connection Responsibility

Service taps on new mains will be completed by the project proponent provided the water utility has been notified and a water utility inspector is onsite. A party acceptable to the water utility shall make all service taps on existing mains. All connections to existing water facilities require 48-hour notification.

Developer Extension Requirements

All developer extensions must meet the water utility's engineering and construction standards including design by a professional engineer. Financing of extensions is the developer's responsibility with the possible addition of utility oversizing by the water utility. Developer extensions involving booster pumps stations, reservoirs, new sources, or other facilities besides distribution mains must complete the Washington State Department of Health (DOH) project approval and review process, after approval by the City and before construction can begin.

Utility Easements

All piping, pumping, source, storage, and other facilities shall be located on public rights-of-way or dedicated utility easements. Utility easements must be a minimum of 15 feet in width and piping shall be installed no closer than five (5) feet from the easements edge.

Complaints

The water utility will evaluate all customer complaints to determine if they indicate a potential problem with the existing water treatment process, system facilities, or operational practices. The utility will be responsive to customer concerns and take appropriate action, as applicable; to address water quality or quantity concerns based on available resources and the significance the problem. Complaints may be made orally or in writing to the utility at any time through the utility contacts listed on water bills. The utility will maintain records of all complaints received and the actions taken to identify the source of the problem and to either resolve the problem or reduce the potential for future impacts.

In order to avoid unnecessary customer concerns, customers shall be informed of planned water service outages at least 24 hours in advance.

**The City of Battle Ground
2012 Organizational Table**

City Council

Mayor	Lisa Walters
Deputy Mayor	Shane Bowman
Council Members	William Ganley, Alex Reinhold, Philip Johnson, Mike Ciraulo, Adrian E. Cortes
City Manager	John M. Williams
City Clerk	Kay Kammer
Executive Assistant	Bonnie Gilberti

Police Department

Police Chief	Bob Richardson
Administrative Assistant	Margie Mendoza
Police Records Supervisor	Gail Truax
Police Records Clerks	Debi Knight-Gallino, Judy Teel
Police Lieutenant	Roy Butler
Police Sergeants	Jason Arrowsmith, Kim Armstrong, Simon Gellar, Aaron Kanooth, Jason Perdue
Police Officers	Philip Anderson, Brian Archer, Chris Crouch, Montie Elford, Michele Fox, Clint Fraser, John Graves, Shaun Holahan, Rick Kelly, Kyle Kinnan, Ed Michael, Brett Neilson, Joshua Phelps, Tim Wilson
Community Service Officer	Brent Gullickson
Community Service Crew Leaders	Gerald McBurney, Bob Powell

Community Development Department

Community Development Director	Robert Maul
Planning Supervisor	Sam Crummett
Building Inspector	Larry LaDuke
Plans Examiner	Mark Miller
Community Development Technician	Dorothy Harrington, Jessica Herceg
Customer Service Clerk	Alisha Smith

Finance Department

Finance and Information Services Director	Cathy Huber Nickerson
Senior Accountant	Brian Wolf
Information Technologies Manager	Dan Oehler
Accounts Payable Clerk	Chris Doerschuk
Payroll/Receivables Clerk	Sue Yeska
Utility Billing Clerk	Joy Lee

Customer Service Clerk	Tonya Brownlie
Fire Department	Fire and EMS – Fire District 27
Municipal Court Department	
Lead Court Clerk	Carol Landwehr
Court Clerks	Michelle Muir & Erin Danielson
Parks and Recreation	
Parks and Recreation	
Director	Debbi Hanson
Customer Service Clerk	vacant
Public Works Department	
Public Works Director/ City	
Engineer	Scott Sawyer
Assistant City Engineer	Mark Herceg
Associate Civil Engineer	Marit Ernst, and Ryan Jeynes
Engineering Technicians	Rick Adams, Joan Hall, Kelly Uhacz, Tommy Renner, Chris Smart
Customer Service Clerk	Darsie Slawson
Public Works Foreman	Cal Newton, Michael Venne
Maintenance Workers	Shawn Scott, Ron Buma, Chuck Kraus, Dave Petty, Don Risto, Wade Kinnan, Nick Grier, Kerry Hymas, Robert Miller, Crystal Springer, Dean Vandermeer, Mike Wilcock.

SECTION 2 POPULATION AND WATER DEMAND

This section summarizes the methodologies developed to project future water system demands using existing City of Battle Ground (City) water supply and consumption data. Projected water demands are used in Section 3 to analyze existing supply, transmission, and storage facilities and to form the basis for recommending future water system improvements that address deficiencies in Section 8.

Current Population, Service Connections, and Water Use

This section presents current and historical data for the City's water service area between 2005 and 2011. The data is used to establish existing baseline population, number of service connections, water production and consumption volumes.

Current Service Area Population

The current City water service area comprises a distinctly different boundary than the city limits and urban growth area, as illustrated in Figure 1-2. Due to this difference, water service area population is not available, as it is for city limits, through tracked census data from the Washington State Office of Financial Management (OFM). For the purposes of this plan, a 2011 water service area population is established by projecting actual City population data obtained through OFM and the most recent water service area population projections in Table 2-1.

**Table 2-1
Water Service Area Population Summary**

Year	BG City Limits Population¹	Water Service Area Population²
2005	14,730	11,048
2006	15,588	11,691
2007	16,048	12,036
2008	16,682	12,512
2009	17,201	12,900
2010	17,571	13,178
2011	17,780	13,335

Notes:

1. Data obtained from State OFM population database, year 2011 estimated.
2. Estimated water service area population based on City staff estimate of water service to approximately 75% of the City population.

Current Service Connections

The City implemented a new billing system software for 2011; in the process, service connection information pertaining to customer class prior to 2011 has become unavailable. Table 2-2 presents 2011 service connection data by customer class, as provided and calculated by the City. These numbers have some inconsistencies with those submitted in the 2011 Water Facilities Inventory form, but are believed to represent the most accurate tabulation of customer service data.

**Table 2-2
2011 Water Service Connections and Consumption by Customer Class**

Customer Class	Number of Connections	2011 Consumption (million gallons)	Percent of Total Consumption
Commercial Irrigation	20	4.85	1.1%
Commercial	24	75.60	17.5%
Churches	302	13.77	3.2%
Institutional	1	-	-
Multi-Family	14	9.18	2.1%
Residential	4,962	329.38	76.1%
Total	5,323	432.79	

Current Water Use

The City uses its own groundwater wells as the primary source of supply for the system, supplementing with water from interties with Clark Public Utilities (CPU) as necessary during peak usage periods. Monthly and yearly water production data by individual source of supply was obtained from City operational records. Monthly data for 2011 and annual totals for 2005 to 2010 are presented in Table 2-3.

The annual totals in Table 2-3 represent system supply. Daily supply to the system should not only consider source production, but also fluctuations in storage volume during the course of the day. Consumption is typically derived from billing records for individual service meters and is typically lower than the supply volume for the same time period. Differences between production and consumption are referred to as unaccounted for water use, which includes unmetered authorized and unauthorized uses. For a fully metered system like the City's, with limited authorized, unmetered usage unaccounted for water is primarily distribution system leakage (DSL) as discussed in Section 4.

**Table 2-3
Historical Monthly and Annual Water Production**

Month	Water Production (MG)							Total
	Wells 1&2	Wells 4&5	Well 6	Well 7	Well 8	Well 9	CPU Intertie	
January	7.13	5.17	2.35	5.44	8.82	4.08	-	32.98
February	7.16	4.67	5.50	0.74	12.21	-	-	30.28
March	8.76	5.11	6.83	-	14.11	-	-	34.81
April	8.80	2.89	6.33	-	13.46	1.17	-	32.65
May	7.21	4.58	-	-	13.29	8.71	-	33.79
June	8.95	5.19	-	6.42	2.33	8.97	0.08	41.94
July	11.09	5.23	-	12.12	12.64	10.32	0.46	51.86
August	11.48	5.20	-	11.43	11.41	17.86	0.39	57.77
September	10.43	4.98	-	10.83	10.91	10.41	0.10	47.66
October	6.83	5.19	-	4.08	10.37	8.41	-	34.88
November	6.01	5.19	-	-	8.50	12.40	-	32.09
December	7.79	5.46	-	-	8.38	10.82	-	32.45
2011 Total	101.63	58.83	21.01	51.07	136.42	93.15	1.04	463.15
2010	84.02	67.31	47.11	37.30	162.30	66.27	1.12	465.43
2009	81.14	76.17	47.01	50.89	179.00	79.14	5.79	519.14
2008	100.37	80.01	68.35	124.34	70.89	51.27	10.04	505.28
2007	85.37	83.07	70.95	62.32	145.32	79.66	6.20	532.88
2006	102.40	49.88	85.02	44.14	175.09	73.66	7.92	538.11
2005	89.87	20.87	59.64	83.83	90.90	144.72	0.57	490.40

Average, Maximum Day and Peak Hour Demand with Calculated Peaking Factors

Average Day Demand

Average Day Demand (ADD) is the total amount of water consumed and used in a year divided by the number of days in the year. The ADD is determined from historical water use patterns of the system and can be used to project future demand within the system. ADD data is typically used to determine standby storage and other requirements for water systems.

From the water production data presented in Table 2-3, an ADD for the years between 2005 and 2011 ranged between 1.27 and 1.47 million gallons per day (mgd).

Maximum Day Demand

Maximum day demand (MDD) is the maximum amount of water consumed and used throughout the system during any 24-hour period. MDD typically occurs on a hot summer day when a large volume of outdoor water use, such as lawn watering, is occurring.

Water supply records and reservoir telemetry reports are typically used to determine a system's MDD. Review of City water production, water purchase and reservoir data for the years between 2005 and 2011 determined that the MDD of 3.09 mgd (2,147 gallons per minute) occurred on July 31, 2007. A historical MDD:ADD peaking factor of 2.24 is established for demand forecasting.

Peak Hour Demand

Peak Hour Demand (PHD) is the maximum amount of water consumed and used throughout the system, excluding fire flow, during any one-hour time period.

The City does not have continuous system records that allow the calculation of PHD directly from operational data. Considering the residential land use and water demands that represent the vast majority of the City's service area, the *December 2009 DOH Water System Design Manual* is used to estimate the PHD for the purposes of this plan.

The calculated PHD, using current City MDD and equivalent residential units (ERUs) presented later in this section, is 3,298 gallons per minute (gpm). The calculated PHD:MDD peaking factor is 1.26.

Largest Water Users

Table 2-4 presents the City's top 10 water users in 2011. The water consumption of these 10 customers represents approximately 0.6 percent of the total consumption in 2011. The majority of large water users in the City are multi-family housing complexes, public facilities and commercial properties. While these users consume the largest amount per connection, single family residential customers account for vast majority of City consumption.

**Table 2-4
2011 Largest 10 Water Users**

Name	Address	Annual Consumption (1,000 gallons)
BG Mobile Estates	300 SW 7th Avenue	855
Old Castle Glass	1611 SE Commerce Ave	254
Mill Creek Apartments	518-520 NW 12th Ave	237
First Place Apartments	407 SW Eaton Blvd	192
Fred Meyer	401 NW 12th Ave	187
Victory Health & Rehab	510 N Parkway Ave	187
Devonwood Apartments	101 NE 1st Ave	167
Rivergrove Apartments	617 SE 4th Street	147
Mallard Landing	813 SE Clark Ave	137
BG Plaza Laundry	713 W Main St # 103	114
Total		2,478

Equivalent Residential Units (ERUs)

As required by Washington State Department of Health (DOH) for planning purposes, the demand of each customer class can be expressed in terms of ERUs for demand forecasting and establishing system capacities. One (1) ERU is equivalent to the average amount of water used by a single family residence. The number of ERUs represented by the demand of the other customer groups is determined from the total demand of the customer group and the demand per ERU calculated from the single family residential demand data.

Table 2-5 presents the computed ERU value and the number of ERUs for each customer class within the City's water service area, the total number of ERUs for all customers served by the City in 2011. The demands shown in the table are based on groundwater well production and CPU water purchasing data, which includes non-billed authorized consumption and DSL.

**Table 2-5
2011 Equivalent Residential Unit Summary**

Description	Customer Class			Totals
	Residential	Multi-Family	Commercial/Industrial	
Number of Service Connections	4,962	14	347	5,323
Annual Demand (MG) ¹	352.50	9.82	100.83	463.15
Demand per ERU (gal/day/ERU) ²	195	195	195	195
Total ERUs	4,962	138	1,419	6,520

Notes:

1. The Annual Demand is calculated by adding a proportional DSL component to the billed consumption data for each customer class. Total reflects overall system supply.
2. Demand per ERU is the amount of water used, including DSL, by one (1) residential unit.

Future Population and Water Demand Forecasting

Projected Population

Although the water service area population differs from the City's population, it is anticipated that city-wide growth will reflect growth within the service area. Based on recent population growth within the City, projected water service area population at the 6-year planning horizon in 2018 is estimated based on an annual average growth rate of 1.5 percent. Beyond 2018, through the 20-year planning horizon population growth is projected based on an annual average growth rate of 3.93 percent as presented in the City's *2004 Comprehensive Plan*. The smaller growth rate for the 6-year planning horizon is considered appropriate for the current development climate in the City. Table 2-6 presents the projected service area population for current 2012, 6-year and 20-year planning horizons.

**Table 2-6
Water Service Area Population Projection**

Projection Year	Projected Service Area Population
Current 2012 ¹	13,535
6-Year 2018 ¹	14,800
20-Year 2032 ²	25,390

Notes:

1. Population data for 2011-2018 is based on a 1.5 percent annual growth rate, representing a composite average of recent OFM, County and City data sources and near-term predicted growth trends.
2. Population data for 2018-2032 is based on a 3.93 percent annual growth rate, reflecting long-term predicted growth trends that are in concurrence with the currently adopted *2004 City of Battle Ground Comprehensive Plan*.

Projected Water Demands

Population and demand projections for the current, 6-year and 20-year planning horizons are summarized in Table 2-7. ERUs are projected using the annual average growth rates used to project population growth in Table 2-6. Future ADD was estimated based on an average water demand of 195 gallons per day (gpd) per ERU. Future MDD is estimated by multiplying projected ADD by the peaking factor 2.24. The *December 2009 DOH Water System Design Manual* calculation method is used to estimate future PHD. Table 2-7 also shows estimated future demands for the City’s two (2) pressure zones, Main and Tukes Mountain. Projected demand in the Tukes Mountain Pressure Zone is based on the estimated number of existing ERUs in this zone in 2011, approximately 104 ERUs which is approximately 1.6 percent of total system demand.

The City, through its Water Use Efficiency (WUE) program, has implemented conservation measures that have resulted in a significant DSL reduction in recent years as discussed in Section 4. Through these measures, the City’s goal of attaining annual system leakage below 10 percent was first achieved in 2009 and continues to be maintained. Average customer demand per ERU has also decreased considerably from 235 gpd/ERU in 2010, when the City’s current WUE goals were established, to 195 gpd/ERU as shown in Table 2-5. Although some customer water use efficiency may be due to variations in weather, this approximately 20 percent per ERU demand decrease far exceeds the City’s WUE program goal of a 1 percent reduction over 6 years. With the program’s success, no additional measures are currently planned for implementation. The methodologies employed in developing current planning data incorporate the results of the WUE program, thus future system demand projections based on this planning data implicitly include sufficient

conservation measures. Consistent with the goals of the ongoing WUE program, demand projections for the required planning period are presented in Table 2-7 with no demand reduction to reflect additional conservation potential.

**Table 2-7
Population and Demand Projections Summary**

Projection Year	Estimated Service Area Population	ERUs	Pressure Zone	Water Demands		
				ADD (mgd)	MDD (mgd)	PHD (gpm)
Current 2012	13,535	6,618	Main	1.27	2.84	3,245
			Tukes Mt.	0.02	0.05	53
			Total	1.29	2.89	3,298
6-Year 2018	14,800	7,236	Main	1.39	3.11	3,540
			Tukes Mt.	0.02	0.05	58
			Total	1.41	3.16	3,598
20-Year 2032	25,390	12,412	Main	2.38	5.33	6,012
			Tukes Mt.	0.04	0.09	98
			Total	2.42	5.42	6,110

Notes:

1. ERU projections are based on ERU growth rates equivalent to the population growth rates presented in Table 2-6.
2. 195 gpd/ERU was used to forecast future average daily demand based on historical demand per ERU.
3. MDD projections are calculated by multiplying the ADD by the peaking factor 2.24.
4. PHD is projected from MDD using the estimating method described in the *December 2009 DOH Water System Design Manual*.
5. Tukes Mountain Pressure Zone demand is estimated as 1.6 percent of total system demand.

SECTION 3
WATER SYSTEM ANALYSIS

This chapter presents an analysis of the City of Battle Ground’s (City’s) supply, pumping, storage, and distribution facilities based on industry standard criteria developed by the Washington State Department of Health (DOH). The water demand forecasts summarized in Section 2 are used in conjunction with these criteria to assess the adequacy of the water system to deliver sufficient quantities of water under peak or fire flow conditions at acceptable pipeline velocities and system pressures.

Water Supply Criteria and Analysis

The City’s water supply capacity was evaluated, based on the criteria shown in Table 3-1, to assess the current system’s ability to reliably supply existing and future demands.

Table 3-1
Water Supply Criteria

No.	Criteria Description	Reference	Necessity
1	Supply must be sufficient to provide, at a minimum, the maximum day demand (MDD)	WAC 246-290-222(4)	Required
2	Two (2) or more sources are capable of replenishing fire suppression storage within 72 hours while simultaneously supplying MDD	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
3	Total source capacity provides MDD with less than 18 hours of pumping	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
4	With largest source out of service, remaining sources can supply average day demand (ADD)	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
5	Backup power supply available (power receptacle for portable generator, two (2) public power sources or on-site auxiliary power)	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration

Water Supply Analysis

Supply capacity is evaluated by comparing existing and projected MDD for the City’s service area to the total available supply from all sources. Supply adequacy for individual pressure zones is evaluated later in this section through analysis of the booster pump stations serving each of the City’s two (2) pressure zones. Table 3-2 summarizes the supply evaluation including a brief evaluation of the maximum

instantaneous water rights to assess whether existing water rights are adequate to allow for expanded supply to meet future MDD. Further analysis of water rights is presented in Section 4.

**Table 3-2
Supply Evaluation Summary**

Year	MDD	Available Supply		Additional Supply Needed	
		Instantaneous Water Rights ¹	Operational Supply ²	Water Rights	Operational Capacity
	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
2012	2.89	3.35	2.85	-	0.04
2018	3.16	3.35	2.85	-	0.31
2032	5.42	3.35	2.85	2.07	2.57

Notes:

1. Sum of the allowable instantaneous withdrawal rates (Q_i) for Wells 1, 2 and 4 thru 9. Well 3 has been abandoned and the Well 3 water rights have been transferred to Clark Public Utilities.
2. Sum of the current maximum operating capacities for Wells 1, 2, 4, 5, 7, 8 and 9 as shown in Table 1-1, plus the 500 gpm maximum contractually allowable flow of the existing CPU intertie at Maple Grove School. Well 6 is excluded from total operational supply as it is currently offline due to customer complaints associated with iron bacteria.

Existing water rights are sufficient to support projected water system MDDs through 2018. If the City is able to drill additional wells and transfer the location of existing water rights there will still be a need for wholesale supply over the 20-year planning period. The City is currently coordinating with Clark Public Utilities (CPU) to participate in the development of regional water supply and transmission facilities to serve the north Clark County area. The City is currently negotiating water supply partnership and wholesale water purchase agreements with CPU. The City's capital investment in these facilities, and associated water supply capacity, is described further in Section 8.

The current maximum operational supply will be insufficient within the 6-year planning horizon due to the decline of existing well yields. To address this known operational deficiency, the City is moving forward with plans to construct a larger intertie with CPU that would initially provide a supply of 1,000 gallons per minute (gpm) or 1.44 million gallons per day (mgd). This new intertie would include provisions for an ultimate capacity of 3,000 gpm (4.32 mgd) as CPU develops new water sources. This intertie project is included in the capital improvement program (CIP) found in Section 8 of this plan.

Water Supply Reliability

The reliability of water supply to the City is enhanced through multiple supply facilities. There are four (4) wells that pump directly into the distribution system and three (3) wells

that pump into the Horsethief Reservoir. The pump station that supplies the Main Zone with water from the Horsethief Reservoir has four (4) pumps, two (2) have a 500 gpm capacity and two (2) have a 1,000 gpm capacity.

Table 3-3 summarizes an analysis of the City’s supply facilities ability to meet current and near-term reliability criteria both before and after addition of a new 1,000 gpm (1.44 mgd) intertie with CPU to replace the existing 500 gpm intertie at Maple Grove School which would be used only for emergencies.

**Table 3-3
Supply Reliability Analysis**

Criteria	Required Capacity (mgd)		Water System Capacity (mgd)	
	Current (2012)	2018	Existing	With New CPU Intertie
Two (2) or more sources are capable of replenishing fire suppression storage within 72 hours while simultaneously supplying MDD ¹	2.97	3.24	2.85	3.57
Total source capacity provides MDD with less than 18 hours of pumping	2.89	3.16	2.14	2.68
With largest source out of service, remaining sources can supply ADD	1.29	1.41	2.13	2.13
Backup power supply available ²	-	-	partial	partial

Notes:

1. Reliability capacity based on current and 2018 MDDs of 2.89 mgd and 3.16 mgd respectively, and replenishment of the largest 2,000 gpm, 2-hour fire within a 72 hour period. System capacities based on maximum current source operating yields as summarized in Table 3-2.
2. No well source facilities currently have backup power provisions. However, the Horsethief Pump Station, which pumps Wells 7, 8, and 9 source water into the distribution system from the 2.0 million gallon (MG) Horsethief Reservoir, maintains on-site emergency power.

Under existing conditions, supply reliability is deficient. However, with the planned addition of the 1,000 gpm (1.44 mgd) CPU intertie and its eventual expansion to 3,000 gpm (4.32 mgd), all reliability criteria will be met within the 20-year planning period. Backup power does not exist at all supply facilities. This deficiency is offset by the large pumping capacity of the Horsethief Pump Station which has on-site backup power. Additional capital improvements to the new intertie, for reliability purposes, are not considered necessary at this time and should be re-evaluated with the next Water System Plan update.

Pump Station Criteria and Analysis

The capacity requirements for booster pumping facilities vary based on whether the pump station is supplying constant pressure to an area, referred to as a “closed pressure zone”

or supplying a reservoir which then serves customers by gravity in an “open pressure zone”. In the City’s water system there are two (2) pump stations, the Horsethief and Tukes Mountain pump stations. The capacity evaluations of these facilities were based on two (2) different sets of requirements, due to the differing pressure zone configurations that they serve.

Horsethief Pump Station

The Horsethief Booster Pump Station supplies the Main Zone with water from the Horsethief Reservoir because the ground level reservoir cannot supply the system and maintain adequate system pressures with gravity flow. The Main Zone hydraulic grade line (HGL) is dictated by water levels in the Tukes Mountain Reservoirs, thus the Main Zone is an open pressure zone. Analysis of the Horsethief Pump Station is based on criteria for booster pumping to an open pressure zone as summarized in Table 3-4.

**Table 3-4
Open Zone Pump Station Criteria**

No.	Criteria Description	Reference	Necessity
1	Must be able to supply pressure zone MDD with all pumps in service.	WAC 246-290-222(4) and DOH 2009 <i>Water System Design Manual</i>	Required
2	Must have capacity to supply zone ADD with largest pump out of service	DOH 2009 <i>Water System Design Manual</i>	Required
3	Capacity to provide MDD with largest pump out of service	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
4	Minimum 30 psi at pump intake under peak hour demand (PHD) or fire flow plus MDD conditions	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
5	Automatic shut-off installed for pressures lower than 10 psi	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
6	Backup power supply available (power receptacle for portable generator, two (2) public power sources or on-site auxiliary power)	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration

Required criteria 1, supply Main Zone MDD with all pumps in service, can be met through 2018 with the existing Horsethief Pump Station capacity. Required criteria 2, supply Main Zone ADD with the largest pump out of service, can be met through the 20-year planning horizon with the current station capacity as shown in Table 3-5.

Although there is an apparent MDD deficiency at the Horsethief Pump Station in 2032, before recommending expanded station capacity, it is important to consider the contribution of supply sources simultaneously serving Main Zone customers. Wells 1, 2, 4 and 5 provide approximately 430 gpm to the Main Zone. 500 gpm can be supplied

from the CPU intertie at Maple Grove School with an additional 500 gpm to be constructed within the 6-year planning horizon. All of these existing sources offset the 705 gpm pump station deficiency in 2032. No additional capacity is recommended at the Horsethief Pump Station as part of this plan.

**Table 3-5
Horsethief Pump Station Required Capacity Evaluation**

Description	Current (2012)	2018	2032
	(gpm)	(gpm)	(gpm)
Required Criteria 1 – Supply Main Zone MDD with all pumps in service			
Main Zone MDD	1,975	2,160	3,705
Total Pump Station Capacity ¹	3,000	3,000	3,000
Additional Capacity Needed	-	-	705
Required Criteria 2 – Supply Main Zone ADD with the largest pump out of service			
Main Zone Average Day Demand (ADD)	882	964	1,654
Pump Station Capacity with Largest Pump Out of Service ¹	2,000	2,000	2,000
Additional Capacity Needed	-	-	-

Note:

1. Based on existing individual pump capacities of 500, 500, 1000 and 1000 gpm.

Horsethief Pump Station Reliability

The current configuration of the Horsethief Pump Station has the ability to meet most reliability criteria in combination with other existing or planned facilities:

- **Criteria 3** - The 2018 MDD can be met with the largest Horsethief pump out of service at which time the new 1,000 gpm CPU intertie is anticipated to be in service. This would allow the 2032 MDD to be met by a combination of the reduced pump station capacity, Wells 1, 2, 4 and 5 and the new CPU intertie without impacting service to the Main Zone.
- **Criteria 4 and 5** - Although the height of the Horsethief Reservoir that supplies the pump station does not permit 20 psi at the inlet, the normal operating suction pressures have not caused operational issues with the pumps and there are no existing or anticipated services on the suction side.
- **Criteria 6** - The Horsethief Pump Station has on-site emergency power.

No capital improvements are recommended to the Horsethief Pump Station due to reliability considerations.

Tukes Mountain Pump Station

The purpose of the Tukes Mountain Pump Station is to supply the Tukes Mountain Pressure Zone with constant pressure water service. The service elevations within this zone cannot be supplied at the pressures furnished to the Main Zone by gravity from the Tukes Mountain Reservoirs. The criteria for evaluating the capacity and reliability of a pump station serving a closed pressure zone are summarized in Table 3-6.

**Table 3-6
Closed Zone Pump Station Criteria**

No.	Criteria Description	Reference	Necessity
1	Must have capacity to supply zone PHD at 30 psi	WAC 246-290-230(5) and DOH 2009 <i>Water System Design Manual</i>	Required
2	Must be able to supply zone MDD plus largest fire flow demand at 20 psi	WAC 246-290-230(6) and DOH 2009 <i>Water System Design Manual</i>	Required
3	Capacity to provide fire flow plus MDD with largest “routinely used” pump out of service	WAC 246-293-660(1) and DOH 2009 <i>Water System Design Manual</i>	Required
4	Capacity to provide PHD with largest pump out of service	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
5	At least 20 psi at intake under PHD or fire flow plus MDD conditions	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
6	Automatic shut-off installed for pressures lower than 10 psi	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
7	Backup power supply available (power receptacle for portable generator, two (2) public power sources or on-site auxiliary power)	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration

As shown in Table 3-7, the existing Tukes Mountain Pump Station meets PHD and MDD plus fire demand criteria through 2032, with or without the largest pump in service.

**Table 3-7
Tukes Mountain Pump Station Required Capacity Evaluation**

Description	Current (2012) (gpm)	2018 (gpm)	2032 (gpm)
Required Criteria 1 - Supply Tukes Mountain PHD at 30 psi			
Tukes Mountain PHD	53	58	98
Total Pump Station Capacity	2,330	2,330	2,330
Additional Capacity Needed	-	-	-
Required Criteria 2 - Supply Tukes Mountain MDD plus 1,000 gpm residential fire flow at 20 psi			
Tukes Mountain MDD	32	35	60
Tukes Mt Largest Fire Flow	1,000	1,000	1,000
Total Pump Station Capacity	2,330	2,330	2,330
Additional Capacity Needed	-	-	-
Required Criteria 3 - Supply Tukes Mountain MDD plus 1,000 gpm residential fire flow with largest "routinely used" pump out of service			
Tukes Mountain MDD	32	35	60
Tukes Mountain Largest Fire Flow	1,000	1,000	1,000
Pump Station Capacity with Largest Pump Out of Service	1,330	1,330	1,330
Additional Capacity Needed	-	-	-

Tukes Mountain Pump Station Reliability

The current configuration of the Tukes Mountain Pump Station meets all reliability criteria shown in Table 3-6:

- **Criteria 4** - The pump station capacity with the largest pump out of service exceeds peak hour demands through the 20-year planning horizon.
- **Criteria 5 and 6** - The water system hydraulic model was used to confirm adequate service pressures are provided from the Tukes Mountain Pump Station under PHD and MDD plus fire flow conditions. Pump station operation with Main Zone, suction side pressures below 20 psi does not occur and is not expected to occur in the future.
- **Criteria 7** - The Tukes Mountain Pump Station is equipped with a receptacle for a portable emergency power generator.

No capital improvements are recommended for the Tukes Mountain Pump Station due to reliability considerations.

Storage Criteria and Analysis

Storage Criteria

Water system storage is provided for different purposes which are represented by the following storage components: operational, equalizing, standby, fire, and dead storage. A description of each storage component and the criteria used to evaluate the capacity of the City's six (6) existing reservoirs is provided below.

Operational Storage: Operational storage is used to supply the water system under normal demand conditions. Operational storage is the average amount of draw down in the reservoir during normal operating conditions, which represents the volume of storage that is not available for other purposes. Operational storage in the City's reservoirs is calculated as the volume of storage between the water level when pumps are signaled to beginning re-filling the reservoirs and the maximum water level (i.e. overflow elevation) of the reservoirs.

Equalizing Storage: When source pumping capacity cannot meet the periodic peak demands placed on the water system, equalizing storage must be provided to meet these demands. The required volume of equalizing storage is calculated according to the *December 2009 DOH Water System Design Manual*. Equalizing storage is the amount of PHD in excess of all available, non-emergency supply sources for 2.5 hours.

Standby Storage: The purpose of standby, or emergency, storage is to provide a measure of reliability should supply sources fail or unusual conditions impose higher demands than anticipated. The volume of standby storage recommended for systems with one (1) supply source may be different than for systems, such as the City's, which are served by multiple sources. The required volume of standby storage for multiple source systems is calculated according to the *December 2009 DOH Water System Design Manual*. Standby storage is two (2) times ADD minus all but the largest available, non-emergency supply sources pumping for 24 hours.

Fire Storage: The purpose of fire suppression storage is to provide adequate volume to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement. The volume of fire storage is calculated as the product of the maximum required fire flow rate and duration.

Dead Storage: This type of storage is water that cannot be used because it is stored at an elevation that is too low to provide sufficient pressure by gravity within the service area. This unusable storage occupies the lower portion of many ground-level standpipe type reservoirs.

In addition to the storage volume requirements discussed above, reliability criteria used for storage facility analysis is summarized in Table 3-8.

**Table 3-8
Storage Analysis Criteria**

No.	Criteria Description	Reference	Necessity
1	Adequate operational, equalizing, fire, and standby storage volumes at minimum required pressures (30 psi at equalizing levels and 20 psi under fire flow conditions)	WAC 246-290-235 and DOH 2009 <i>Water System Design Manual</i>	Required
2	More than one gravity storage tank with the ability to isolate each tank	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
3	Sufficient storage to give standby capacity of at least 2 times ADD for all users with fire suppression available at minimum pressure requirements	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
4	A minimum standby storage of 200 gpd/ERU regardless of source capacity	DOH 2009 <i>Water System Design Manual</i>	Recommendation
5	An alarm system is installed that alerts operators to high and low operating levels in abnormal operating conditions	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration

Storage Analysis

As previously discussed, the City’s system is composed of two (2) pressure zones, Main and the constant pressure, closed, Tukes Mountain Zone. Although the Tukes Mountain Pressure Zone can only be supplied through pumping and not by gravity from City reservoirs, adequate storage capacity is required to provide suction supply to the Tukes Mountain Pump Station. Thus, the storage analysis will consider total, system-wide demands including the Main and Tukes Mountain Pressure Zones rather than a zone by zone analysis approach.

The entire volume of the Horsethief Reservoir is considered dead storage because it is not capable of supplying the water system by gravity but only through the Horsethief Pump Station. For the purposes of this storage analysis, the Horsethief Pump Station is considered a supply source just like the City’s Wells 1, 2, 4 and 5 and the CPU intertie. Storage analysis in 2018 and 2032 includes the replacement 1,000 gpm CPU intertie source capacity anticipated for construction prior to 2018. Well 6 is not included as a supply source as it is primarily operated for emergency purposes. Wells 7, 8 and 9 are not included as supply sources for the storage analysis because they pump directly to the Horsethief Reservoir which can only supply the system through the adjacent pump station.

Operational storage is calculated as the difference between the Horsethief Pump Station operational set points. Pumps at the Horsethief Station are signaled to turn on when the Tukes Mountain Reservoir No. 1 water level is at 88 percent and turn off when it is at 90 percent. This two (2) percent operational range equates to approximately 0.7 feet of water volume in each of the City’s five (5) Tukes Mountain Reservoirs.

Due to the number of supply sources serving the City’s Main Zone, standby storage calculated according to the *2009 Water System Design Manual* for systems with multiple sources, through 2018, is significantly less than the 200 gallons per day per equivalent residential unit (gpd/ERU) recommended for system reliability. Standby storage presented in Table 3-9 is calculated as 200 gpd/ERU through 2018 for reliability. Due to this conservatively high storage volume, fire storage is nested inside the required standby storage volume.

**Table 3-9
Storage Capacity Evaluation**

Year	Required Storage (MG)					Existing Storage (MG)			Additional Capacity Needed (MG)
	Operational	Equalizing	Standby	Fire ¹	Total Required	Total Existing	Dead	Effective	
Current (2012)	0.03	0.00	1.32	0.24	1.36	3.84	2.06	1.78	-
2018	0.03	0.00	1.45	0.24	1.48				-
2032	0.03	0.27	2.78	0.24	3.08				1.30

Note:

1. Fire storage is nested inside the required standby storage volume, thus total required storage is the sum of operational, equalizing and standby storage.

The results of this storage evaluation indicate that the system is meeting storage requirements through the 6-year planning period, but will become deficient before 2032. Interpolating the 6-year and 20-year projections, a new storage reservoir constructed within the Main Zone should be planned in approximately 2023, when existing storage is estimated to become deficient. For the purposes of this plan, a 1.4 MG reservoir is included in the CIP to meet storage requirements in 2032. Storage facility design should consider the reservoir’s expected life, thus it is recommended that the proposed 1.4 MG design capacity for this reservoir be revisited with the next Water System Plan update or as part of a preliminary design report. Current storage volume and operational features satisfy all reliability criteria presented in Table 3-8.

Distribution and Transmission System Criteria and Analysis

The City's existing distribution and transmission mains were evaluated using a hydraulic network analysis model to determine if the system is sized and looped adequately to provide the necessary flow rates and service pressures to meet existing and future demands. A hydraulic model of the system was developed using H2OMap, a GIS based modeling program developed by Innovyze. The model was used in a steady state mode to analyze existing and future system deficiencies. The process of creating and calibrating the model against field measurements is summarized in the following paragraphs.

Hydraulic Model Development

Facilities modeled for the City's distribution system analysis are illustrated on Plate 1 in Appendix A. Existing CAD mapping and record drawings obtained from the City were digitized to develop the initial model links (pipes) and nodes. This process included verification of pipeline physical parameters and modifications that were necessary to increase accuracy and create full system connectivity. Other sources of input used to establish the model base included:

- Clark County contour mapping was imported and interpolated to establish assigned node elevations.
- Source water pumping facilities were input based on available existing pump model information. When manufacturer's data was unavailable or dated, operational data was used to model the facility. Individual pumps within the City's two (2) pump stations were input to the model based on manufacturer's pump curves provided. For well pumping facilities, a constant supply was modeled based on current operational capacities.
- Storage facilities were modeled based on actual physical dimensions and volumes, as well as known operating parameters. The Horsethief Reservoir was input separately, whereas the five (5) individual tanks existing at the Tukes Mountain site were combined and modeled as one (1) facility, based on the composite storage volume per foot of height of the individual tanks. This adjustment was made to alleviate convergence issues that can develop when running model scenarios.
- The active CPU intertie at Maple Grove School was modeled as a fixed demand input, based on the flow control established by the intertie facilities and the HGL dictated by reservoir levels and operating supply facilities within the Main Pressure Zone.

- Wells 7, 8, and 9, which feed the Horsethief Reservoir, were not included in the model, since the booster pump flows are affected only by the water level of the reservoir, not by the flows into the reservoir.
- For future modeling scenarios, the planned CPU intertie at 219th Street, including a new pump station and transmission main in the vicinity of NE 219th Street between NW 92nd Avenue and 29th Avenue, was modeled. The pump station is required because CPU's system is at a lower HGL than the City's system. Proposed pumps, based on design documentation and an available project report, include an initial firm capacity of 1,000 gpm and an ultimate capacity of 3,000 gpm. This will be achieved with two (2) 1,000 gpm pumps in phase 1 and two (2) additional 1,000 gpm pumps in phase 2. These pumps and their associated curves were added to the model, with a fixed hydraulic grade anticipated from CPU set on the suction side.

Model Scenarios and Demand Input

Model scenarios were defined to analyze the performance of the system under multiple demand and fire flow conditions. Specifically, scenarios were created for ADD, MDD + FF, and PHD conditions for existing and projected 2018 and 2032 populations developed in Section 2.

Information for 2011 water service connections and consumption by customer class, which was discussed in Section 2, was used to estimate percentages of the total system demand associated with residential and commercial land uses. County zoning information was used to associate each model node with either a "Residential" or "Commercial" land use category. When assigning demands to the model, the total demand associated with each land use type was distributed evenly throughout all model nodes that belonged to each land use category.

Facility settings within the model differed for the various scenarios. Reservoir levels were set at the bottom of operational, standby, and fire volumes for the ADD, MDD+FF, and PHD scenarios, respectively. Source of supply facilities operating during each of the scenarios was determined by existing system operational protocol and set points, in many cases dictated by reservoir levels.

Calibration

Hydraulic model calibration is the process of using field pressure and flow data to modify model input parameters, resulting in simulations that more accurately replicate actual system operation. Hydrant flow testing was conducted at various locations within the City's distribution system on May 31, 2012. During testing, pressure gauges at a hydrant nearby to the opened hydrant measured both static and hydrant flow residual pressures. A flow gauge was used to measure flow out of the opened hydrant. Additionally,

boundary conditions, such as, reservoir levels and pumps operating (booster and well) were recorded. Results from the 10 individual flow tests were entered into the model as different scenarios under ADD conditions, with the following observations and modifications made before completion of calibration:

- Simulated pressures within the model under the same system boundary conditions were generally calculated to be higher than field measurements.
- Alteration of pipe friction factors, which were initially set at a Hazen-Williams “C” factor of 130 to reflect a large portion of newer ductile iron pipe within the system, did not result in significant reduction in the measured and modeled pressure discrepancies unless drastically decreased “C” factors were used. Implementing such changes to the model would not result in increased “real world” accuracy, and very limited changes were made to the friction factors during the calibration process.
- Much of the hydrant testing was performed during morning hours when higher diurnal demands are common. When increasing static demand conditions within the model by 25 percent over ADD levels, calculated and measured pressures calibrated within accuracy tolerances, given the relative accuracy of all measuring equipment employed during testing.
- Measured pressures within the Tukes Mountain Pressure Zone during field testing resulted in increased understanding of the operating set points for the Tukes Mountain Pump Station, and the discharge pressure band under which pumping to the closed zone is signaled “on” or “off”.

Distribution and Transmission Criteria

Criteria for evaluating the capacity and reliability of the distribution system piping network are summarized in Table 3-10.

**Table 3-10
Distribution and Transmission System Criteria**

No.	Criteria Description	Reference	Necessity
1	Capacity to deliver PHD at 30 psi measured at any existing water service meters	WAC-246-290-230(5)	Required
2	Provide MDD plus required fire flow while retaining a minimum 20 psi residual pressure at any point in the distribution system	WAC-246-290-230(6)	Required
3	Distribution system mains should be looped whenever feasible	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
4	Pipeline velocities should not be greater than 8 feet per second (fps) under PHD conditions	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
5	All pipelines can be flushed at a flow velocity of at least 2.5 fps	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
6	All mains should have appropriate internal and external corrosion protection	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration
7	Fire fighting demands should not create pressures below 30 psi in the distribution system to prevent cross-connection contamination	DOH 2009 <i>Water System Design Manual</i>	Reliability Consideration

Distribution and Transmission Analysis

The distribution and transmission analysis used the hydraulic model to test the existing system’s ability to provide PHD or MDD plus fire flow while maintaining minimum required system pressures. For the fire flow analysis, system adequacy was assessed using a 2,000 gpm fire flow to all non-single family residential areas within the Main Zone and a 1,000 gpm fire flow to the single family residential areas within both the Main and Tukes Zones. Model scenarios were developed to test the existing system with current 2012 and future 2018 and 2032 projected demands.

The results of the modeling analysis indicate that the existing and future system effectively maintains a minimum pressure of 30 psi to all customers under the PHD condition. However, for the MDD plus fire flow condition, three (3) existing piping deficiencies were identified:

- An estimated 550 linear foot (LF) section of existing 2-inch main along SW 2nd Court, north of SW 4th Street. This portion should be upgraded to an 8-inch waterline that can deliver fire flows under the MDD condition at the minimum required 20 psi residual pressure, as well as reduce pipeline velocities to acceptable levels.
- A portion of the existing 2-inch main along SW 3rd Street extending from S Parkway Avenue. It is recommended that approximately 50 LF of this main

between the 8-inch existing main on S Parkway Avenue and an existing fire hydrant on SW 3rd Street be upsized to meet fire flow, pressure and recommended pipeline velocity requirements. The remainder of the existing 2-inch main is located within private property and could continue to provide nominal residential demands.

- An estimated 1,190 LF of 6-inch main along NE Grace Avenue, between NE 6th Street and NE 10th Streets, should be upgraded to an 8-inch main to meet fire flow residual pressure requirements.

Distribution and Transmission Reliability

Within the last 15 years, the City has undertaken a rigorous CIP that has resulted in replacement of a large portion of the older distribution system. This has allowed the newly constructed pipelines to be brought up to current industry and City standards, resulting in a distribution system meeting almost all of the reliability considerations presented in Table 3-10. The recommended improvements discussed in the previous paragraph will result in the system meeting all reliability considerations almost system-wide. A continuing allowance is included in the CIP presented in Section 8 for yearly water main replacement of the remaining older system piping, further fortifying system reliability.

Valves, Telemetry and Intertie Evaluations

Valves

The City's distribution system includes valves installed at all intersections sufficient to allow isolation of all water main segments. Auxiliary valves are also installed on each hydrant branch. The number and placement of valves allows the City to isolate pipe sections in case of a main break or for maintenance and flushing. City design and construction standards for valves and hydrants are described in Section 7.

Telemetry

CPU currently operates the telemetry system for the City. Operators at CPU have the ability to turn booster pumps and wells on and off and monitor reservoir levels. This allows for continuous monitoring of the water system's pressure and flows.

Interties

As described in Section 1, the City has two (2) existing interties with CPU, one (1) of which is used for up to 500 gpm of supplemental supply during peak demand periods. The City does not have adequate supply capacity from other sources to meet MDDs without the use of this supplemental intertie. As discussed in the water supply analysis earlier in this section, the existing CPU intertie has insufficient capacity to supplement

projected future MDD in the City’s system. A new intertie with CPU is necessary to meet existing and future City demands, in lieu of any increases to the supply rate of the City’s existing wells.

Physical Capacity Summary

The physical capacity of Battle Ground’s water system is controlled by the City’s source capacity. A new, larger capacity supply intertie currently being developed with CPU will expand source capacity within the 6-year planning horizon. The City has taken additional steps to begin regional supply planning with CPU to meet anticipated future demands in the long-term. Battle Ground’s water system physical capacity is summarized in Table 3-11.

**Table 3-11
Physical Capacity Summary**

Water System Component	Operational Capacity	Required Performance Criteria	ERUs
Water Supply w/ 500 gpm CPU Intertie	2.85 mgd ¹	Sufficient to supply system-wide Max Day Demand (MDD) ³	6,522
Water Supply w/ 1,000 gpm CPU Intertie in development ⁶	3.57 mgd ¹		8,169
Water Supply w/ 3,000 gpm ultimate CPU Intertie capacity	6.45 mgd ¹		14,760
Capacity Related Storage	1.75 MG ⁴	Adequate system-wide equalization and standby storage volume, see Table 3-9 and notes 4 and 5	8,522

Notes:

1. Sum of the current maximum operating capacities for Wells 1, 2, 4, 5, 7, 8 and 9 as shown in Table 1-1, plus the existing or future CPU intertie capacity as noted.
2. Average Day Demand (ADD) per ERU = 195 gallons per day (gpd)/ERU, see Table 2-5.
3. MDD per ERU = 195*2.24 = 437 gpd/ERU, see page 2-7.
4. Capacity related storage = equalization (ES) and standby (SB) storage only, See Table 3-9.
 - a. Subtract operational (OS) and dead storage (DS) from total storage.
 - b. Fire storage (FSS) is nested inside SB storage so it is not subtracted.
 - c. 2.06 MG Horsethief Reservoir is all DS as this reservoir is too low in elevation to serve the Main Zone by gravity.
5. Number of ERUs calculated from capacity related storage using Equation 6-8 from the DOH 2009 *Water System Design Manual*.
6. Initial capacity of new intertie is 500 gpm, supplemented by existing 500 gpm CPU intertie capacity of 500 gpm – providing a total intertie capacity of 1,000 gpm. New intertie on-line and operating June 2014.

SECTION 4

WATER RESOURCE ANALYSIS

This section examines the City of Battle Ground's (City's) annual water loss, Water Use Efficiency (WUE) program, water rights and supply.

Distribution System Leakage

Distribution system leakage (DSL) is water lost from the distribution system including both apparent losses and real losses. There are many sources of DSL in a typical water system including water system leaks, inaccurate supply metering, inaccurate customer metering, water service line and main breaks from construction, illegal water system connections or water use, and malfunctioning telemetry and control equipment resulting in an overflow of storage tanks. Annual water supply, consumption and DSL in million gallons (MG) are summarized in Table 4-1. In lieu of billing data which became unavailable with a 2011 billing software transition, annual water production and consumption data reported through the City's WUE program was used to establish DSL levels prior to 2011.

The current three-year rolling average for DSL is 8.5 percent, which meets the City's water conservation goals by having less than 10 percent DSL by 2017.

Table 4-1
Historical Supply, Demand, and DSL Summary

Year	Water Produced and Purchased (MG)	Consumption (System Demand) ¹ (MG)	Water Loss (MG)	Percent DSL
2007 ²	526.00	450.00	76.00	14.4%
2008 ²	518.65	448.29	70.37	13.6%
2009 ²	520.51	471.86	48.65	9.3%
2010 ²	474.45	428.68	45.77	9.6%
2011 ³	463.15	432.79	30.37	6.6%
3-year rolling average (2009-2011)				8.5%

Notes:

1. Consumption data was not available for 2005 and 2006.
2. Total water produced and purchased and water consumption values between 2007 and 2010 are adopted from WUE Reports submitted to the DOH. The source of supply quantities within the WUE report differ from City operational records.
3. Total water produced and purchased and water consumption value for 2011 is based on City billing and operational records.

Water Use Efficiency

The City updated their WUE program in 2011, according to Washington State Department of Health (DOH) guidelines. The City's WUE program includes conservation measures that have resulted in a significant DSL reduction in recent years as shown in Table 4-1. Through these measures, the City's goal of attaining annual system leakage below 10 percent was first achieved in 2009 and continues to be maintained. Average customer demand per ERU has also decreased significantly, well in excess of the City's goal of 1 percent over six years established in 2011. With the program's success, there is limited additional conservation potential. For instance, many single family residences, the largest customer group served by Battle Ground, were constructed within the last 15 years in compliance with modern water fixture efficiency standards. It is not anticipated that conservation measures such as encouraging retrofitting of fixtures would result in significant gains in system-wide water use efficiency. No additional measures are currently planned for implementation. The City's updated WUE program is included as Appendix B of this plan.

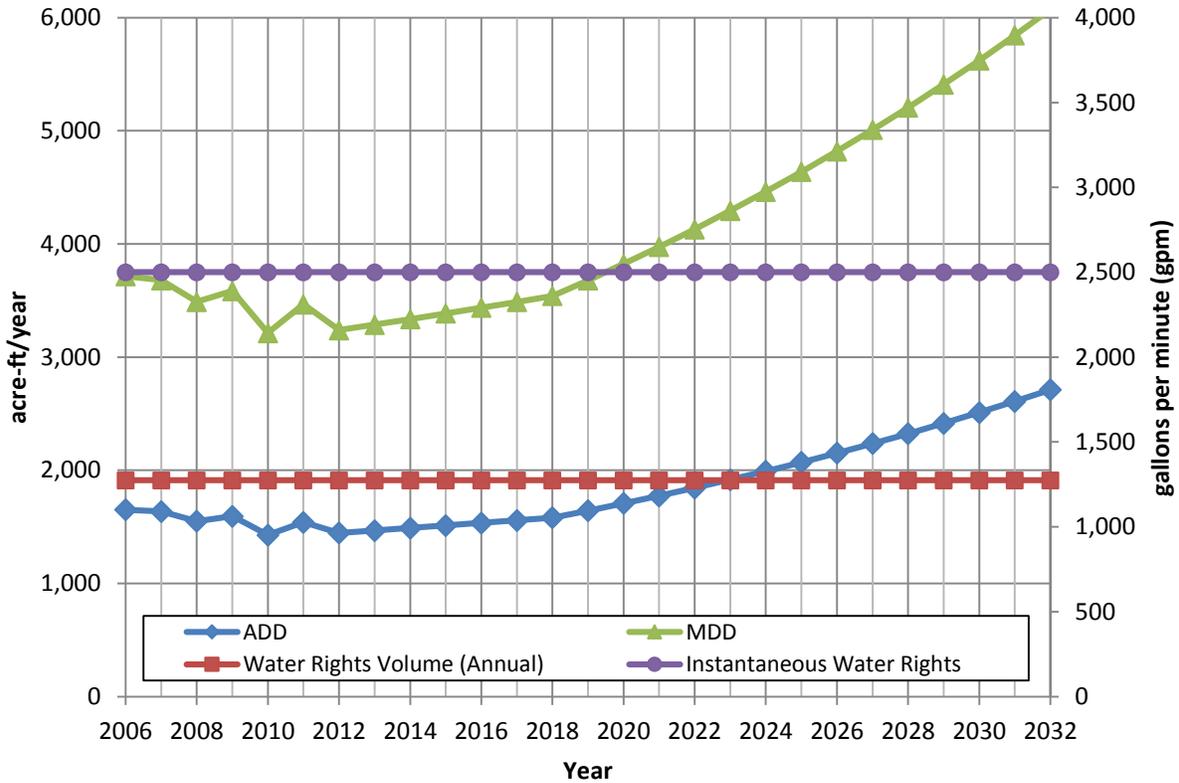
Reclaimed Water

The City currently has no plans for installing a reclaimed water distribution system. The City plans to participate in the County-wide program but it is not currently feasible to route water from the County facilities for use in the City.

Water Rights Evaluation

An evaluation of the City's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands. Figure 4-1 compares the City's maximum 2011 instantaneous (Q_i) water rights with the maximum day demand (MDD) and the 2011 primary annual (Q_a) water rights with the average day demand. As shown in the figure, the City has more than enough Q_i and Q_a water rights to meet the demands of the existing customers. According to future demand projections presented in Section 2, the City will need to expand both primary annual and instantaneous water rights or increase the amount of water supply from Clark Public Utilities (CPU).

**Figure 4-1
Demand vs. Water Rights Capacity**



Currently, the City cannot use their full water rights because existing wells do not have adequate operational capacity. Based on the City’s current understanding of the potential to expand the capacity of existing wells to utilize the full water rates and volumes, no further groundwater expansion is anticipated within the City. The City may consider replacing Wells 6 and 7 with a new well near Well 9. Table 4-2 lists all water right permits and certificates. Copies of the City’s water rights certificates are included in Appendix C. Water rights self-assessment forms for existing and projected 6-year and 20-year conditions are included at the end of this section.

**Table 4-2
City of Battle Ground Water Rights Summary**

Well No.	Location	Source Aquifer	Control No.	Priority Date	Instantaneous Quantity (Q _i) (gpm)	Annual Quantity (Q _a)	
						Primary (acre-ft)	Supplemental (acre-ft)
Wells 1&2	3N/2E-3B	UT	2605	6/3/1954	350	270	0
Well 3	3N/2E-3B	UT	2284	10/18/1954	transferred to CPU - 2006	0	transferred to CPU - 2006
Wells 4&5	3N/2E-3J	UT	G2-23122	8/30/1974	250	269	0
Well 6	3N/2E-4H	SGA	G2-29208	8/13/1986	350	430	0
Wells 7, 8 & 9	3N/2E-4K	SGA	G2-29477(A)	8/13/1986	1,375	943	207
Totals					2,325	1,912	207
Total (mgd)					3.35		

Interties

Water system interties are physical pipe and valve connections between two (2) adjacent water systems. Interties are normally separated by a closed isolation valve or a control valve. Emergency supply interties provide water from one (1) system to another during emergency events only. An emergency event may occur when a water system loses its main source of supply or a major transmission main and is unable to provide a sufficient quantity of water to its customers. Supply interties provide water from one (1) system to another during non-emergency events and are typically supplying water at all times.

The City currently has one (1) emergency and one (1) supply intertie as described below. The interlocal agreements governing these interties are included in Appendix D. The City has planned for potential supply interties in the future by pursuing a new intertie with CPU on the western border of the City’s water system at NE 219th Street.

Clark Public Utilities

The City currently has one (1) normally operated wholesale supply intertie with CPU, located on NE 199th Street (Eaton Blvd) at the Maple Grove School. Currently, this intertie provides up to 500 gallons per minute (gpm) of water directly into the City’s Main Pressure Zone. Historically, the City has relied entirely on the CPU intertie to meet peak demands in the summer. The City is currently pursuing a long term wholesale supply agreement with CPU to increase the amount of instantaneous water supply the City can receive. An agreement would increase the allowable amount of wholesale supply from CPU to 1,000 gpm in order to meet the City water system’s future demands. When the new intertie is built, the current 500 gpm intertie will only be used for emergency purposes. The terms of this supply agreement include transfer of 1,000 acre-ft of annual (Q_a) City water rights and 1,000

gpm of instantaneous (Q_i) City water rights under permit G2-29477(B) for Wells 7, 8, and 9 and certificate 2284 for Well 3 to CPU so that CPU can provide water for the City through current and future interties. After CPU develops new water sources the City may be able to draw up to 3,000 gpm instantaneously.

Water Supply Reliability Analysis

The CPU supply intertie and multiple system wells provide a reliable supply of water for the City. The capacity of some wells has decreased over time because of declining aquifer levels and clogging in Wells 7 and 8 due to high levels of iron. A Wellhead Protection Plan (WHPP) update, included as Section 5 of this plan, was completed in December 2012. In this WHPP Wells 1, 2, 4, 5 and 6 were identified as more vulnerable to contamination due to shallow well depths in the Upper Troutdale (UT) formation. However, the wells are located on several different sites decreasing the chances of all wells being contaminated at once. Wells 7, 8 and 9, near the Horsethief Reservoir, were determined to have low contamination vulnerability because they are located in the deeper Sand and Gravel Aquifer (SGA) with sand lenses between potential contamination from underground storage tanks and the aquifer. The City's current wells do not have adequate capacity to supply future demands. The capital improvement program in Section 8 identifies system improvements to increase supply capacity in order to meet future demands.

The existing CPU intertie provides a supplemental water supply to the City during peak conditions. CPU has very little excess water to provide to the City, but CPU is currently in the process of developing a large well field near Paradise Point that would provide a large long-term supply. Once this well field is completed CPU would have a more adequate supply of water to sell to the City.

Water Right Adequacy

The City's wells currently have adequate water rights and produce less water than is allowed by the water rights. To meet future demands water rights may be transferred to new wells or to CPU to increase the wholesale supply to the City. Due to reduced capacities in the City's existing wells it may not be feasible to use all of the existing water rights and it may be challenging to construct new wells with higher yields in the same aquifers as existing wells. The City is currently coordinating with CPU to participate in the development of regional water supply and transmission facilities to serve the north Clark County area. The City is currently negotiating water supply partnership and wholesale water purchase agreements with CPU.

Facility Reliability

Existing well facilities are in good condition and are expected to perform over the 20-year planning period. The City currently has adequate storage over the 6-year planning period, but will need to increase storage before 2032. Multiple well sites provide supply redundancy and system reliability in case of a failure at any of the reservoirs, booster pump stations, or supply lines to the distribution system. Older water distribution lines are being systematically replaced to upgrade the water system and reduce DSL.

Table 4-3

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – EXISTING STATUS

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates										
1. 2605	Town of Battle Ground	6/3/1954	Wells 1 & 2	NO	350	270	280	270	EXCEEDS	MEETS
2. G2-23122	Town of Battle Ground	8/30/1974	Wells 4 & 5	NO	250	269	150	180	EXCEEDS	EXCEEDS
3. G2-29208	City of Battle Ground	8/13/1986	Well 6	NO	350	430	200	65	EXCEEDS	EXCEEDS
4. G2-29477(A)	Town of Battle Ground	8/13/1986	Wells 7,8, & 9	NO	1,375	943 (additive) 207 (non-add)	1,050	861	EXCEEDS	EXCEEDS
5.										
Claims										
1.										
2.										
3.										
TOTAL	*****	*****	*****	*****	2,325	1,912	1,680	1,376	EXCEEDS	EXCEEDS
INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		EXISTING CONSUMPTION THROUGH INTERTIE		CURRENT INTERTIE SUPPLY STATUS (Excess/Deficiency)				
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)			
1. CPU Intertie	Clark Public Utilities	500	N/A	500	N/A	MEETS	N/A			
2.										
3.										
4.										
TOTAL	*****	500	N/A	500	N/A	MEETS	N/A			
PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS						
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested					
1.										
2.										
3.										
4.										

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Table 4-4

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 6 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (6-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates										
1. 2605	Town of Battle Ground	6/3/1954	Wells 1 & 2	NO	350	270	280	270	EXCEEDS	MEETS
2. G2-23122	Town of Battle Ground	8/30/1974	Wells 4 & 5	NO	250	269	150	240	EXCEEDS	EXCEEDS
3. G2-29208	City of Battle Ground	8/13/1986	Well 6	NO	350	430	200	220	EXCEEDS	EXCEEDS
4. G2-29477(A)	Town of Battle Ground	8/13/1986	Wells 7,8, & 9	NO	1,375	943 (additive) 207 (non-add)	1,050	943	EXCEEDS	MEETS
5.										
Claims										
1.										
2.										
3.										
TOTAL	*****	*****	*****	*****	2,325	1,912	1,680	1,673	EXCEEDS	EXCEEDS
INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)				
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)			
1. CPU Intertie	Clark Public Utilities	1,000	N/A	1,000	N/A	MEETS	N/A			
2.										
3.										
4.										
TOTAL	*****	1,000	N/A	1,000	N/A	MEETS	N/A			
PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS						
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested					
1.										
2.										
3.										
4.										

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Table 4-5

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 20 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (20-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates										
1. 2605	Town of Battle Ground	6/3/1954	Wells 1 & 2	NO	350	270	280	270	EXCEEDS	MEETS
2. G2-23122	Town of Battle Ground	8/30/1974	Wells 4 & 5	NO	250	269	150	269	EXCEEDS	MEETS
3. G2-29208	City of Battle Ground	8/13/1986	Well 6	NO	350	430	200	322	EXCEEDS	EXCEEDS
4. G2-29477(A)	Town of Battle Ground	8/13/1986	Wells 7,8, & 9	NO	1,375	943 (additive) 207 (non-add)	1,050	943	EXCEEDS	MEETS
5.										
Claims										
1.										
2.										
3.										
TOTAL	*****	*****	*****	*****	2,325	1,912	1,680	1,804	EXCEEDS	EXCEEDS
INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)				
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)			
1. CPU Intertie	Clark Public Utilities	3,000	N/A	3,000	N/A	MEETS	N/A			
2.										
3.										
4.										
TOTAL	*****	3,000	N/A	3,000	N/A	MEETS	N/A			
PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS						
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested					
1.										
2.										
3.										
4.										

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**CITY OF BATTLE GROUND
WELLHEAD PROTECTION PLAN
2012 UPDATE**

March, 2013

**CITY OF BATTLE GROUND
WELLHEAD PROTECTION PLAN
2012 UPDATE**

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March 18, 2013

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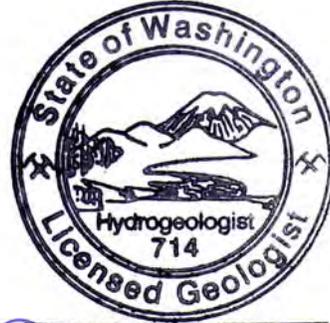
SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.



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1.0 EXECUTIVE SUMMARY

The City of Battle Ground has updated its wellhead protection plan (WHPP), which was originally issued in 2000. The purpose of the plan is to help prevent the City's groundwater supply sources from becoming contaminated, and to develop contingency and emergency response procedures in case one or more sources is lost because of contamination. The plan meets the requirements of Washington Administrative Code (WAC) 246-290-135(3). Work for this project included:

- Characterizing the hydrogeology of the Battle Ground area to identify aquifers that supply water to the City's wells and aquitards that protect water supplies from near-surface contamination;
- Updating groundwater quality characterization for the City's supply wells based on data managed by Washington Department of Health (WDOH);
- Updating delineation of wellhead protection area (WHPA) capture zones for select supply wells. WHPA capture zones were previously defined for some wells by the Clark County Water Quality Division;
- Updating inventories of confirmed and potential sources of contamination, particularly those that lie within the wellhead capture zones, and evaluating the risks associated with these sources;
- Updating contingency planning for provision of water supplies in case one or more wells are impacted by contamination and emergency response planning for spills that might affect the well sources; and,
- Updating implementation strategies to educate the public and manage the contaminant sources in the Battle Ground area.

The findings and recommendations of this work are discussed below.

1.1 FINDINGS

The City of Battle Ground currently owns eight wells that supply water to the municipality. Four of these (Wells 1, 2, 4, and 5) produce water from a shallow aquifer and four (Wells 6, 7, 8 and 9) produce water from a deeper aquifer. Groundwater withdrawals from the deep wells are emphasized because their yields are significantly higher than those of the shallow wells. In addition, the City also obtains backup supplies from an intertie with Clark Public Utilities (CPU). Intertie capacity will be increasing over the next 20 years.

1.1.1 Hydrogeology and Existing Water Quality

The major hydrogeologic units in the area include sediments deposited by modern rivers and by the ancient Columbia River. The Upper Troutdale and Sand and Gravel Aquifer (SGA) form the primary aquifers in the region. The SGA, a deep aquifer, is overlain by the fine-grained sediments of the Lower Confining Unit and, in some areas, the Upper Confining Unit. These two aquitards limit the movement of contaminants to the SGA from the surface and overlying aquifers. Consequently, wells completed in this unit are better protected from the threat of contamination.

Groundwater flows in the shallow Upper Troutdale Aquifer (QTu) is to the west-southwest in the study area, which covers 41 square miles surrounding Battle Ground. Groundwater discharges to features such as Salmon Creek and the East Fork of the Lewis River after traveling laterally from the upland areas, where much of the recharge occurs. The Columbia River serves as a primary discharge point for the deeper SGA system.

In general, the quality of groundwater from the City wells is good. In 1998, a few volatile organic compounds (VOCs) were detected in Wells 1 and 2, which are completed in the QTu. However, concentrations were well below drinking-water standards, and these compounds have not been detected in recent analyses. These historical detections may have been related to nearby contaminant sources along Main Street. The City monitors VOCs in these wells annually and biannually in all other wells.

In addition, iron and manganese exceedences have been noted in all of the City's wells, as is common for many areas of Clark County. Iron and manganese concentrations in the City's deeper (SGA) wells are sufficiently high to require treatment. Although these constituents do not threaten public health, they exceed secondary Maximum Contaminant Levels, which are based on aesthetic considerations.

1.1.2 Wellhead Protection Area Delineations

WHPA capture-zone delineations were prepared by Clark County and Pacific Groundwater Group for the City's wells. These delineations represent the extent of the capture zone for each well under average pumping conditions. Capture zones were defined for 0.5, 1, 5 and 10 year travel times within the groundwater flow system. The capture zones are represented in two-dimensions, and additional travel time is required for contaminants to travel from the land surface to the production aquifer, particularly for the City's SGA wells. PGG connected the capture zones for multiple wells to define "extended capture zones" and defined a 1000-foot buffer around the 10-year capture zone to compensate for possible inaccuracies in the locations of sites of potential groundwater contamination.

1.1.3 Contaminant Inventory

A range of potential contaminant sources was inventoried using a Geographic Information Systems (GIS) approach. Potential sources associated with land-use activities and septic system locations were identified based on data from Clark County, and potential sources associated with environmental sites and facilities using/storing hazardous materials were identified based on data from Washington Department of Ecology (Ecology). City staff also performed a windshield survey to identify possible activities on "parcels of concern" where land-use categories could include potential sources of contamination.

PGG ranked the priority of land-use parcels of concern based on contamination potential. The highest ranked parcels were associated with facilities with gasoline pumps and tanks, dry cleaners, car washes and auto parts dealers. Other facilities that could potentially contaminate groundwater but were outside the 5-year capture zone (e.g. car repair, gasoline pumps, etc) were assigned lower priorities. A few septic systems lie within the 1- and 5-year extended capture zones for the SGA wells. These septic systems should not pose a significant risk to these deep groundwater sources.

Ecology's database showed the occurrence of state cleanup sites under the State Model Toxics Control Act (MTCA), hazardous waste generators, underground storage tanks and leaky underground storage tanks (USTs and LUSTs), dairies, enforcement sites and stormwater generating operations within the capture zones. Within the capture zones there are 14 cleanup sites, 11 sites associated with hazardous materials, 14 sites associated with UST, 10 sites associated with LUST, and 1 stormwater site. PGG ranked cleanup sites as highest concern. Among the 14 cleanup sites, 3 are reported as requiring no further action and 2 are reported as cleaned up under MTCA, and 3 are located within defined 1-year capture zones.

Other potential sources of contamination include transportation-related spills along SR-502 and SR-503, and unused and improperly constructed wells.

The City will notify all owners/occupants of parcels and sites of concern that they are within WHPA capture zones and will notify the agencies regulating these parcels/sites of the potential contaminant inventory. Per WDOH wellhead protection guidance, the City should update its contaminant inventory every 2 years.

1.1.4 Source-Loss Analysis

A source-loss analysis completed for the Battle Ground wells indicates that the City has the ability to manage both short and long-term losses to the system. The system would be most impacted if Wells 7, 8 or 9 were taken off line, since they are the City's primary sources. Loss of these sources during high water demand months could lead to short-term rationing to achieve demand reductions of up to 23 percent, while the City either corrects an equipment failure or drills an additional well.

1.2 RECOMMENDATIONS

The following recommendations are based on the results of work completed for wellhead protection planning. These implementation strategies focus on public education, contaminant source management, monitoring, data management, and land use and regulatory controls. Wellhead protection can also be effected by coordination with other regional agencies and by emergency response and contingency planning, as discussed below.

1.2.1 Public Education and Technical Assistance

Strategies for public education include: increasing awareness and providing technical assistance for entities using hazardous materials within WHPAs, developing school programs and other educational materials for City residents (e.g. Annual Water Quality Report).

1.2.2 Contaminant Source Management

Businesses within designated WHPAs should be inventoried every two years to assess potential contaminant sources and waste handling practices. USTs that were not identified through this study should also be inventoried, including residential home heating oil USTs. Other strategies for managing possible contaminant sources include: encouraging Ecology to expedite cleanup actions; encouraging inspection of hazardous waste generators; reviewing stormwater management practices to identify areas of concern for groundwater quality; and encouraging residents to connect to sewer systems where possible. The City should request and/or encourage the cooperation of agencies such as Ecology and the Southwest Washington Health Department (SWWHD).

1.2.3 Monitoring and Data Management

Water-quality and other data that could assist in wellhead protection should be collected via cooperative programs with Clark County, CPU, and SWWHD and reviewed. These data should then be integrated into a database management system.

In addition to continuing with annual sampling for VOCs in Wells 1 and 2, the City may want to identify domestic wells for additional monitoring in high-risk areas.

1.2.4 Land Use and Regulatory Controls

Strategies related to land-use and regulatory controls include encouraging and supporting County ordinances related to wellhead protection and water quality, including Clark County's Critical Aquifer Recharge Areas (CARA) ordinance (Chapter 13.70) and Clark County's Water Quality ordinance (Chapter 13.26A).

1.2.5 Regional Coordination

The City should continue to communicate with other purveyors in Clark County to coordinate WHP planning activities and water-supply planning and development issues such as contingency planning and expansion of interties.

1.2.6 Planning Strategies

Developing strategies for emergency response and contingency planning is essential to wellhead protection. Such strategies include notifying emergency response organizations on the location of WHPAs, establishing communication protocols with first-responders, and preparing a contingency plan that covers short- and long-term responses if one or more sources are lost.

Given that source-loss analysis indicates that there will be times over the next 20 years when existing inerties are insufficient to offset impacts to total system capacity if certain well sources are lost, the City may want to consider planning for installation/development of backup wells. Should backup wells be constructed, we recommend targeting the (deep) SGA aquifer due to its greater degree of inherent protection from contamination introduced to the land surface, its consistently higher well yield, and because current capacity is 300 gpm less than existing water-right allocations

2.0 INTRODUCTION

This document provides an update to the City of Battle Ground's Wellhead Protection Plan (WHPP) which was prepared in 2000 (PGG, 2000). The updated WHPP has been prepared to meet requirements of Washington Administrative Code (WAC) 246-290-135, which mandates that purveyors of water systems using groundwater sources shall develop and implement a wellhead protection program. The goal of such a program is to prevent these sources from becoming contaminated. This updated WHPP was prepared according to the Washington State Department of Health's Wellhead Protection Program Guidance Document (WDOH, 2010). The WHPP must contain, at a minimum, the following elements:

- Wellhead capture zone delineations for the 6-month, 1-, 5-, and 10-year times-of-travel for each water-supply source based on a WDOH-approved method;
- An inventory of known and potential contaminant sources ranked for groundwater contamination hazard;
- Documentation that the City has notified owners and operators of known and potential contaminant sources/sites, as well as the regulatory agencies and local governments that regulate these sources/sites;
- Contingency plans for alternative sources of drinking water if any of the primary sources become threatened;
- Documentation that the City has coordinated with emergency spill responders regarding WHP areas, the contingency plans, and other results of this WHP investigation

2.1 SCOPE

This report covers wellhead protection measures for Wells 1, 2, 4, 5, 6, 7, 8 and 9, which supply water for the City of Battle Ground. Work for this WHP assessment included:

- Characterizing the hydrogeology of the Battle Ground area to identify aquifers that supply water to the City's wells and aquitards that protect water supplies from near-surface contamination;
- Updating groundwater quality characterization for the City's supply wells based on data managed by Washington Department of Health (WDOH);
- Updating delineation of wellhead protection area (WHPA) capture zones for select supply wells. WHPA capture zones were previously defined for some wells by the Clark County Water Quality Division;
- Updating inventories of confirmed and potential sources of contamination, particularly those that lie within the wellhead capture zones, and evaluating the risks associated with these sources;
- Updating contingency planning for provision of water supplies in case one or more wells are impacted by contamination and emergency response planning for spills that might affect the well sources; and,
- Updating implementation strategies to educate the public and manage the contaminant sources in the Battle Ground area.

In accordance with WDOH requirements, the City of Battle Ground has completed and submitted well-head susceptibility forms for all its water supply sources. Some of these forms will be updated in the near future.

2.2 STUDY AREA PHYSIOGRAPHIC FEATURES

The WHP study area is shown on **Figure 1**. It covers about 39 square miles surrounding the City of Battle Ground. The northern portion of the study area lies within the East Fork Lewis River basin and the southern portion lies within the Salmon Creek basin. The major population center is concentrated in Sections 34 and 35 of T.3 N., R.2 E., and Sections 1 and 2 of T.3 N., R.2 E. The study area extends as far south as the community of Meadow Glade.

The central part of the study area slopes gently to the southwest and ranges in elevation from about 260 to 310 feet above mean sea level (msl). Tukes Mountain lies directly to the northeast of the City and attains an elevation of more than 620 feet. Woodin (Weaver) Creek, a tributary of Salmon Creek, is the principal surface-water drainage in the Battle Ground area; its headwaters lie in the northern part of the City. The upper reaches of Mill Creek drain the western portion of the study area.

2.3 CLIMATE

Battle Ground lies in the central portion of Clark County, which has a marine warm-temperate climate, with relatively warm, dry summers, and typically mild, rainy winters. Approximately 75 percent of the total annual precipitation occurs from October through March; the remaining 25 percent occurs from April through September (Mundorff, 1964). Average annual precipitation at Battle Ground was about 52.6 inches for the 30-year period from 1981 through 2010 (<http://www.wrcc.dri.edu>).

2.4 WATER-SUPPLY SOURCES

The City of Battle Ground depends entirely on groundwater to meet the water demands of approximately 16,710 residential customers and 2,500 non-residential customers at 5,923 connections. Groundwater is withdrawn at an average rate of about 945 gpm (1.36 mgd) from eight water-supply wells based on historic 2004-2011 water use, and the rated capacity of these sources totals 1,660 gpm (2.39 mgd) (**Table 1**). The locations of these supply wells are shown on **Figure 1**. Construction details and other pertinent data for Wells 1, 2, 4, 5, 6, 7, 8, and 9 are presented on **Table 2**.

Wells 1, 2, 4, and 5, the “shallow wells”, are less than 150 feet deep. These wells were constructed in the 1950s and 1970s and have limited capacities — less than 200 gpm. Wells 6, 7, 8 and 9, the “deep wells”, were constructed between 1995 and 2004 and range from 299 to 438 feet deep. Original testing of the wells showed capacities ranging from 350 to 1000 gpm; however, current well capacities are somewhat lower due to partial clogging of the well screens with iron bacteria. The original well capacity estimates are summarized on **Table 2** whereas current operational capacities are summarized on **Table 1**.

Wells 7, 8 and 9 have the largest capacities and are used the most extensively. In addition to their production wells, the City of Battle Ground obtains water for peaking from a 500-gpm capacity intertie with Clark Public Utilities (CPU). The intertie also functions as an emergency source. The City is developing a new intertie with CPU that will replace the current intertie in 2013 and will have an initial capacity of 1,000 gpm. Improvements to this new intertie are available that would increase its capacity to 1,750 gpm (slated for 2017) and ultimately to 3,000 gpm (estimated for 2021). A summary of the City’s interties is presented on **Table 3**.

3.0 HYDROGEOLOGIC FRAMEWORK

The regional geology of Clark County is commonly divided into older rocks and younger sediments (which are semiconsolidated or unconsolidated). The older rocks crop out in the foothills and mountains in the north and east portions of the County but occur at depths greater than 600 feet in the Battle Ground area. The sediments crop out on the terraces and plains that cover most of the study area and contain the principal aquifers. The sedimentary units, from youngest to oldest, consist of:

- Recent alluvial deposits
- Pleistocene alluvial deposits
- Troutdale formation

These units are described below and shown on Hydrogeologic Cross Section A-A' (**Figure 2**). Surface outcrops for these units are shown on **Figure 1**, along with the location of the cross section. In addition to the sedimentary and older bedrock units, the Boring lava, a relatively young bedrock unit, crops out near Battle Ground.

All of the coarse-grained sedimentary units described below form the prevalent aquifers beneath Clark County.

3.1 RECENT ALLUVIAL DEPOSITS

Alluvial deposits occur in the study area along the rivers and streams. They include:

- Alluvial fans
- Terrace deposits
- Recent alluvium

The alluvial fans, terraces, and basin-fill deposits were deposited by tributaries of the Columbia River, which include the east Fork of the Lewis River and Salmon Creek. These sediments interfinger with the Pleistocene alluvium of the ancestral Columbia River.

The alluvial fans are coarse and gravelly in the terraces and at their apexes, but grade to fine sands and silts at their margins. One of the largest fans in Clark County occurs near Battle Ground.

Terraces occur along the stream channels upstream of the fans. The terraces north of Battle Ground along the East Fork of the Lewis River are generally much coarser than the alluvial fans, comprising very coarse gravel in a sandy matrix.

Within the Battle Ground study area, the Recent alluvium is confined to the floodplains of the East Fork of the Lewis River and Salmon Creek. It forms a thin veneer over the Troutdale formation and Pleistocene alluvial deposits. The alluvium typically consists of coarse sand and gravel along the lower portions of Salmon Creek and the East Fork of the Lewis River.

The Recent Alluvium contains a shallow, highly productive aquifer along streams such as the East Fork of the Lewis River and communicates hydraulically with these streams. Well yields from the aquifer can be relatively high, ranging between 500 and 1,000 gpm, although this aquifer is not a major supply source near Battle Ground.

3.2 PLEISTOCENE ALLUVIAL DEPOSITS

During Pleistocene time, the ancestral Columbia River deposited a great deltaic fan emanating from the Gorge because of a series of catastrophic events known as the “Missoula floods.” The resulting alluvium is exposed on broad plains and terraces in the southwestern part of Clark County. It crops out in the southern third of the study area. The deposits are only 20 to 40 feet thick in the Battle Ground area, where they comprise primarily silt and clay according to local driller’s logs.

The Pleistocene alluvial deposits form a highly permeable, productive aquifer in the southern part of Clark County, yielding more than 1,000 gpm to wells located in and near the cities of Vancouver, Camas, and Washougal. In the Battle Ground area, the deposits are too fine-grained and thin to yield significant quantities of water, and the aquifer is used solely for domestic purposes. In addition, only the lower few feet of the deposits are saturated in some areas, resulting in small well yields.

3.3 BORING LAVA

The Boring lava consists of fine-grained, vesicular basalt of Pliocene and early Pleistocene ages. The lava generally overlies the Troutdale formation, although evidence suggests simultaneous deposition. It crops out north and east of Battle Ground. Battle Ground Lake, a popular recreational site, lies in the crater of an old lava vent. The Boring lava forms a minor aquifer that can be productive within pyroclastic deposits and vesicular, scoriaceous interflow zones.

3.4 TROUTDALE FORMATION

The Troutdale formation underlies the Pleistocene alluvial deposits and comprises unconsolidated and semiconsolidated clay, silt, sand, and gravel. The unit crops out along the East Fork of the Lewis River, around Tukes Mountain, and in some areas west of town. The Troutdale formation contains three coarse-grained units that are separated by finer-grained confining units. The coarse units are:

- Upper Troutdale
- Lower Troutdale
- A deeper sand and gravel unit known as the “SGA”

These are the principal aquifers in the study area and their geologic characteristics are discussed below. The Upper Confining Unit separates the Upper and Lower Troutdale Aquifers, and the Lower Confining Unit separates the Lower Troutdale Aquifer and the SGA. The Upper Troutdale and SGA supply most of the groundwater in the Battle Ground area.

3.4.1 Upper Troutdale

The Upper Troutdale comprises the upper 100 feet of the Troutdale formation in the Battle Ground area. It consists of gravel in a matrix of coarse sand and silt, and includes sand lenses and stringers. The unit is often cemented. The Upper Troutdale appears to be continuous and underlie all of the study area.

The Upper Troutdale forms what has historically served as the most productive and important aquifer in the study area. The base of the aquifer lies between 80 to 150 feet msl in the Battle Ground vicinity. Despite its cementation, the Upper Troutdale Aquifer is permeable enough to produce high well yields in the

southern part of Clark County. In the Battle Ground area, however, yields from the Upper Troutdale are relatively low. Wells 1, 2, 4, and 5 only produce a few hundred gpm.

3.4.2 Upper Confining Unit

The Upper Confining Unit consists of fine sand, silt, and clay. It is typically about 50 feet thick and separates the Upper and Lower Troutdale in the western half of the study area. The unit may be absent in the eastern portion of the study area.

3.4.3 Lower Troutdale

Like the Upper Confining Unit, the Lower Troutdale is not continuous in the study area. The unit consists mostly of fine sand and typically attains thicknesses of about 50 to 80 feet where it has been penetrated by wells near Battle Ground. The Lower Troutdale occurs in the western portion of the study area but pinches out before reaching Well 6.

The Lower Troutdale Aquifer supplies many wells throughout Clark County, yielding from 300 to 1,000 gpm. The aquifer is not important in the Battle Ground area, however, because it does not contain sufficient coarse-grained zones and it is not continuous enough to produce significant quantities of water.

3.4.4 Lower Confining Unit

The Lower Confining Unit consists of fine sand, silt, and clay. It is typically on the order of about 50 feet thick in the study area, where it appears to be continuous between the Lower Troutdale and the SGA. The surface of the Lower Confining slopes to the west-southwest.

3.4.5 Sand and Gravel (SGA)

A deep sand and gravel unit (the “SGA”) lies beneath the Lower Confining Unit. It has been identified along the Sandy River in Oregon, at the City of Portland wellfield, at Ellsworth Springs, at Vancouver’s Well Station 7, and at the Vancouver fish hatchery. Logs for deep wells in the Meadow Glade and Pioneer vicinities indicate that the SGA probably extends continuously from the Portland wellfield to the East Fork of the Lewis River (Pacific Groundwater Group, 2008). The unit consists predominantly of fine- and fine-to-medium sand, with local lenses of silty sand and clay. It also contains sand and gravel horizons in the southern part of the county. This unit is on the order of 150 to 200 feet in thick in the Battle Ground vicinity.

The SGA supplies water to Wells 6, 7, 8 and 9, Battle Ground’s most productive sources, which have yielded up to 1,000 gpm of water. This aquifer dips to the west-southwest. Its base is estimated to lie at elevations between about 50 feet above msl and 300 feet below msl in the study area.

3.5 UNDIFFERENTIATED FINE-GRAINED UNIT

Undifferentiated fine-grained sediments underlie the SGA. These sediments consist mostly of silt and clay. In the Battle Ground area, the unit ranges in thickness from about 200 to more than 420 feet at Wells 7, 8, and the Keyser Nursery well. The undifferentiated fine-grained sediments overlie the older bedrock.

3.6 BEDROCK

Older bedrock crops out in the foothills and mountains in eastern and northern portions of Clark County and underlies the sedimentary deposits in the Battle Ground area. The rocks range from Miocene to Eocene age. They are primarily igneous in origin and include andesite, basalt, granodiorite, pyroclastics (breccia, tuff, and agglomerate), conglomerate, and shale. The rocks occur at depths of 500 feet or more in the study area and are generally hard and compact because of Miocene deformation.

The older bedrock units generally form poor aquifers because their permeability is low. Small domestic yields can be obtained in many areas where wells intercept fractures. Reasonable yields are possible where fractures are abundant and unobstructed, although such yields are not common or expected.

3.7 GROUNDWATER FLOW

Groundwater in the study area occurs under unconfined, semiconfined, and confined conditions. Unconfined conditions are observed in shallow aquifers such as the Pleistocene and Recent Alluvium. Semiconfined conditions occur in the cemented portions of the Upper Troutdale Aquifer, and confined conditions occur in the Lower Troutdale Aquifer and the SGA.

Groundwater flow patterns in the shallow aquifers are reasonably well defined because water-level data are relatively abundant. Groundwater elevations in the study area range from about 300 feet msl in the eastern portion (along the foothills) to about 200 feet near Meadow Glade. Water-level contours for the Upper Troutdale are presented in **Figure 1**; these contours are based prior wellhead protection characterization performed by Swanson (1995). The illustration shows that groundwater in the aquifer generally flows from the northeast to southwest. Regional groundwater flow patterns are influenced by the major drainages in the area, which include Salmon Creek and the East Fork of the Lewis River.

Water levels and groundwater flow within the SGA are poorly defined since only a few wells are completed in this aquifer. Groundwater elevations within most of the SGA wells are typically around 75 feet msl in the study area, and flow is generally to the west-southwest, based on water levels measured in local wells. Groundwater movement is influenced by regional drainage features such as the Columbia River and the lower portions of the East Fork of the Lewis River. PGG estimated a southwestern groundwater flow direction (-160 degrees relative to east, as shown on **Figure 1**) and a hydraulic gradient of 0.018 ft/ft based on water-level data from Battle Ground Wells 7, 8, TW-1, and TW-2, CPU's Well 32 and the Keyser Nursery well.

4.0 WATER QUALITY

The City of Battle Ground collects samples from its supply wells to ensure compliance with WDOH drinking-water requirements. Sampling frequencies, exceedances, and treatment of water from these wells are discussed below.

4.1 SAMPLING FREQUENCIES

WDOH provides a water-quality monitoring report to the City in October of each year. This report identifies the City's requirements for compliance monitoring. WDOH requires that the City collect inorganic compound (IOC) samples annually. Volatile organic compound (VOC) sampling is required annually in Wells 1 and 2; and every two years in Wells 4, 5, 6, 7, 8, and 9.

The City must test annually for nitrate levels and once every 4 years for radionuclides. Battle Ground is currently operating under a sampling waiver for semivolatile organic compounds (SOCs) which expires in 2013.

4.2 EXCEEDANCES

Water from the City's wells is of good quality and that it meets all primary State and Federal drinking water standards. PGG reviewed reported water-quality standard exceedances reported on the WDOH database and water-quality data from other sources. Exceedances and detects are summarized below:

4.2.1 Iron and Manganese

The Sentry database indicates that Wells 1, 2, 4, 5, 6, 7 and 8 have exceeded the secondary MCL for iron (0.3 mg/l) and Wells 1, 2, 6, 7 and 8 have exceeded the secondary MCL for manganese (0.05 mg/l). The exceedances in Wells 1 and 2 were noted in 1995, were only slightly above MCL's, and have not continued in recent years. Although these metals do not pose a threat to public health, they are considered "nuisance constituents" since they tend to stain laundry and plumbing fixtures. Although not listed in the Sentry Database, Well 9 also exhibits elevated iron and manganese.

The City treats water from Wells 6, 7, 8 and 9 using a filtration method at Wells 7, 8 and 9 and a sequestering agent at Well 6. The filtration system at Wells 7, 8 and 9 features twelve 4-foot-diameter tanks that are configured into two separate filtration units of six tanks each. Each tank contains 3 feet of pyrolusite media. Depending on the demand for water, one or both of the filtration units may operate. Chlorinated water from Well 6 is treated with sodium silicate, a sequestering agent, to help reduce the effects of high levels of iron and manganese, which discolor water as they are oxidized by air or chlorine. Sequestering agents help prevent iron and manganese from precipitating in the water distribution system.

4.2.2 Volatile Organic Compounds

Annual and semi-annual sampling for VOC's have generally shown no detections; however, detections were encountered for a short duration approximately 15 years ago. Specifically, low concentrations of the following VOCs were detected in Well 1 in June 1998:

- Trichloroethylene (TCE) - 1.1 ppb
- Perchloroethylene (PCE) - 0.8 ppb
- 1,2,3-trichlorobenzene - 4.0 ppb

The Maximum Contaminant Level (MCL) for TCE and PCE is 5 ppb. Since 1,2,3-trichlorobenzene is unregulated, there is no MCL for this compound. These detections were believed to be related to nearby contamination sources along Main Street (PGG, 2000), which are now remediated.

5.0 WELLHEAD PROTECTION AREA DELINEATIONS

This section documents the methods used to delineate wellhead protection areas (WHPA's) and presents the results of the delineation analyses. Analytical modeling methods, developed based on PGG's understanding of the groundwater flow system, were used to delineate WHPA's. These methods are consistent with recommendations in WDOH's Wellhead Protection Guidance and with prior delineations based on existing susceptibility assessments of the City's wells. Also, as recommended in the WDOH Guidance, this section includes consideration of vertical components of potential contaminant transport pathways

WHPA delineations for Battle Ground's older wells (Wells 1, 2, 4 and 5) are based on analytical modeling work completed for a County-wide project by the Clark County Water Quality Division (Swanson, 1995). These delineations are considered to be conservative in that they likely overestimate WHPA sizes, since pumping at the older wells has reduced over recent years and is not expected to increase back to older rates. Analytical modeling was also used to generate new delineations for Wells 6, 7, 8 and 9.

Time-related "capture zones" were estimated for each supply well for 6-month and 1-, 5- and 10-year travel times. A capture zone is the area that supplies groundwater recharge to a pumping well—in other words, its "zone of contribution." In natural systems, capture zones are not circular but elongated, with most capture occurring from areas that lie upgradient of the wellhead. Each capture zone has a stagnation point—the maximum "point of capture" downgradient of the wellhead. A time-related capture zone is the area that supplies groundwater recharge to a pumping well within a specified period. The capture zone encompasses portions of the aquifer that surround the well.

Capture zones are defined in two dimensions within the aquifer in which the well is completed. Mapped capture zones are projections of capture areas defined within the completion aquifer up to the land surface. It should be recognized that additional travel time is often required for contaminants originating at the land surface to reach completion aquifers. This is particularly true for deep aquifers, where downward vertical transport can take decades or centuries.

Time-related capture zones provide a basis for developing monitoring plans, land-use inventories, and data collection plans. They are used in conjunction with the results of the aquifer vulnerability assessment.

5.1 CAPTURE ZONE ANALYSIS METHODS

Wells 1, 2, 4 and 5 are completed in the Upper Troutdale Aquifer. Swanson (1995) developed WHPA delineations with the EPA's "WHPA" model (EPA, 1991). The WHPA model is widely used for this purpose because it suits many hydrogeologic settings. The simpler WHPA module was used, which assumes a confined aquifer of infinite aerial extent, a uniform hydraulic gradient, and uniform transmissivity (i.e. the product of thickness and hydraulic conductivity). PGG updated the WHPA delineations prepared by Swanson by adding 6-month capture zones within the 1-year capture zones. The 6-month capture zones were assumed to have roughly the same shape and orientation as the 1-year capture zones, but were scaled to the volume of water captured over a 6-month pumping period using comparative fixed radius calculations. Given the close proximities between Wells 1 and 2 (60 feet apart) and between Wells 4 and 5 (50 feet apart), Swanson treated each well pair as a single pumping location (or wellfield).

Wells 6, 7, 8 and 9 are completed in the SGA. Capture zones for these wells were delineated using "GFLOW", a two-dimensional analytical element model (Haitjema, 2007). GFLOW also assumes steady-state conditions where flow rates, pumping stresses, and head gradients are in continuous equilibrium. It assumes an aquifer with constant thickness, infinite aerial extent, a uniform head gradient, and a uniform transmissivity. All wells were simulated as pumping simultaneously, such that capture zones are affected by pumping from neighboring wells. Given the close proximity of Wells 7 and 8 (25 feet), these wells were modeled as a single pumping location (wellfield).

Input to the models for the SGA wells included the following parameters:

- Pumping rate
- Aquifer transmissivity
- Aquifer porosity
- Hydraulic gradient and flow direction

Pumping rates modeled for the SGA wells were set to the 2004-2011 average withdrawals (Well 6: 112 gpm; Wells 7 and 8: 397 gpm, Well 9: 147 gpm).

Aquifer transmissivity was set to 10,600 ft²/day based on an aquifer thickness of 100 feet and a hydraulic conductivity of 106 ft/day. The hydraulic conductivity was derived from values obtained from testing Wells 6, 7, and 8. The aquifer thickness was derived from drillers and/or lithologic logs and hydrogeologic cross-sections, and generally includes all significant water-bearing media encountered in the well while drilling through the aquifer. A constant aquifer porosity of 0.20 was used for the entire modeling analysis.

Since reliable water level data for the SGA are limited, water-level contour maps have not been developed for this system (Section 3.7). Based on water levels in local wells, PGG estimated a flow direction of -160 degrees (relative to east) and a hydraulic gradient of 0.018 ft/ft as input to the model.

GFLOW simulates pumping water levels and drawdowns in the completion aquifer. Based on estimated groundwater flow patterns, GFLOW employs particle tracking routines to trace groundwater flow patterns upgradient from the pumping well. PGG delineated capture zones within GFLOW by plotting out particle traces associated with specified travel times within the aquifer (e.g. 0.5, 1, 5 and 10 years).

5.2 CAPTURE ZONE DELINEATIONS

The results of the capture-zone analysis are shown on **Figure 3** and discussed below. In addition to the calculated capture zones, PGG included supplemental buffers around the capture zones. These buffers add an additional factor of safety to the risk assessment presented in Section 6.

Figure 3 shows calculated capture zones for wells completed in both the Upper Troutdale Aquifer (1, 2, 4 and 5) and the SGA (6, 7, 8, 9). Capture zones for the Upper Troutdale Aquifer Wells were estimated by Swanson (1995), with supplemental 6-month capture zones developed by PGG. Capture zones for each Upper-Troutdale pumping center are mapped with solid fill. Capture zones for the SGA wells were estimated based on particle traces defined with GFLOW. Modeled particle traces are segregated by travel time by color on **Figure 3**.

Buffers were created between wells by expanding the boundaries of calculated capture zones where these capture zones approached one another. **Figure 3** shows how the various calculated 0.5-, 1-, 5- and 10-year capture zones were expanded to create “extended capture zones”. In addition, PGG added a 1000-foot buffer around the extended 10-year capture zone to compensate for possible inaccuracies in the locations of sites identified as having potential to contaminate groundwater, as described in Section 6.

It is again worth noting that the capture zones shown on **Figure 3** are defined for the aquifers in which the wells are completed. Actual travel times from the land surface to the capture zones associated with (deep) SGA wells will be significantly longer than travel times defined within the aquifer itself. Although wells completed in the Upper Troutdale Aquifer are shallower than SGA wells, additional travel time is also required for contaminants to migrate from the land surface through the silt/clay Pleistocene Alluvial Deposits to this aquifer.

6.0 RISK ASSESSMENT

Contaminant sources that overlay the capture zones for Battle Ground's wells were investigated and mapped using three databases that were imported into the project GIS. Data regarding land-use and septic system locations (per zoning parcel) were obtained from Clark County and data regarding environmental sites and facilities using/storing hazardous materials were obtained from Department of Ecology. The three databases were plotted in the project GIS was used to assess whether existing and potential contaminant sources were located within the capture zones for Battle Ground's wells.

Once parcels and sites of concern were mapped in the project GIS, PGG provided these maps and associated lookup tables to the City of Battle Ground. City staff performed a windshield survey to confirm the parcels/sites identified by PGG and look for other sites that may not have been included in the databases referenced above (none were identified). Finally, PGG assigned relative priority rankings to potential contamination sites/sources based on the types of activities/contaminants associated with each site and their possible effects on the City's drinking water sources.

6.1 LAND-USE DATABASE & WINDSHIELD SURVEY

Clark County's database contains a description of the current land use within each parcel in the study area. A GIS analysis was used to identify land uses that could pose a risk to groundwater within the capture zone for each supply well. Parcels where such land uses were identified were designated "parcels of concern." (POC's) This approach provides a way to assess potential sources of contamination. The POC's include those where the following activities are practiced:

- Bio-filtration swales/ponds within 6-mo capzone
- Botanical gardens and conservatories
- Convenience stores with pumps & tanks
- Drive through car washes
- Dry cleaners (free standing building)
- Farm buildings for equipment
- Fleet operation centers & storage
- Funeral services & crematories
- General repair & service garages
- Food Manufacturers
- Manufacturers of rubber & plastic products
- Railroad right of way
- Service repair shops
- Service stations with tanks, pumps, card locks
- Tires, batteries, parts & accessories dealers
- Health clinics (if using septic systems)

City staff reviewed health clinics (medical, dental, veterinary) and office buildings, and confirmed that all were on sewer. In addition, City staff assessed activities associated with office buildings, retail buildings, neighborhood "strip centers" (no anchor), community shopping centers (with anchors), and storage warehouses during their windshield survey and did not identify activities posing significant concern for groundwater contamination.

The identified POC's are shown on **Figure 4** and listed on **Table 4**. In addition, PGG reviewed POC's previously identified in the City's 2000 Wellhead Protection Plan (PGG, 2000) and found that all previously listed POC's are still included on **Table 4**; however, one parcel (1716 W Main St) was previously an automotive services site but is now a building supply store.

Clark County's zoning includes parcels zoned for agriculture, golf courses, and parks. These land uses may include the use of fertilizers, pesticides and herbicides; some of which are mobile in the subsurface and can potentially contaminate groundwater. Current zoning does not show any such categories within

the City's capture zones (**Figure 4**), although the City has a "Central Park" on 414 E Main St (listed in the land use database as "botanical gardens and conservatories") (**Table 4**). Zoning documented in the City's 2000 Wellhead Protection Plan shows several parcels in the "agricultural/forestry" category within the City's capture zones, but did not identify associated land uses. Current land uses for these parcels include RC ("regional center intended for commercial development) and mixed use residential. While the City's park was not identified in the 2000 parcel analysis, aerial photography from Google Earth suggests the park has been in existence since at least 1990.

Table 4 includes priority rankings for POC's based on associated land-use activities and capture zone locations. The ratings are relative within a low-medium-high continuum. Because no particularly high risk land uses were identified within the 1-year capture zones, only "medium" ratings were assigned to these POC's. "Medium" ratings were assigned to all the POC's within the 1-year capture zones of the Upper Troutdale wells and "low" ratings were assigned to all POC's within the 1-year capture zones of the (deeper) SGA wells. All POC's within 5-year capture zones were associated with Upper Troutdale wells and their moderate risk land-use activities yielded "medium" ratings. All POC's outside the 5-year capture zones were assigned low ratings due to the relatively high response time available should a spill occur.

The City will notify all owners of parcels of concern identified in **Table 4** that they are located in a well-head protection area. An example letter and a list of contact information for parcel owners is included in **Appendix A**.

6.2 FACILITY/SITE DATABASE

Ecology's Facility/Site Database (<http://www.ecy.wa.gov/fs/index.html>) includes information about the following environmental sites and activities of concern:

- State Cleanup sites
- Federal Superfund sites
- Hazardous Waste Generators
- Solid Waste Facilities
- Underground Storage Tanks (LUST & UST)
- Dairies
- Enforcement
- Stormwater (Industrial, Municipal & Construction)

The database includes site locations; however, PGG has found that locations can contain slight inaccuracies. Buffers added to the calculated capture zones, discussed above, may compensate for potential location inaccuracies. Information for cleanup sites located within the capture zones was supplemented with more detailed information from Ecology's Cleanup Site Search Database (fortress.wa.gov/ecy/gsp/SiteSearchPage.aspx) and its ISIS database (<https://fortress.wa.gov/ecy/tcpwebreporting/>). PGG also re-researched sites within the capture zones associated with the "enforcement" category of the Cleanup Site Search Database and found that all sites were labeled "Non Enforcement Final". PGG contacted Ecology to determine the nature of these sites, all of which pertained to filling of wetlands and were not considered to be pertinent to wellhead protection concerns. Finally, for stormwater sites listed in the Cleanup Site Search Database, only industrial sites and municipal sites within 1-year capture zones were included in the inventory. Construction sites were not included due to their short-term nature.

Figure 5 shows the locations of environmental sites identified by the Facility/Site Database. **Table 5** summarizes the sites identified within the capture zones and notes whether a site is associated with hazardous materials, underground storage tanks (UST), leaky-underground storage tanks (LUST), cleanup activities, or stormwater. **Table 6** provides supplemental information regarding cleanup sites.

Table 5 shows that within the capture zones there are 14 cleanup sites, 11 sites associated with hazardous materials, 14 sites associated with UST, 10 sites associated with LUST, and 1 stormwater site. Cleanup sites can be associated with LUST contamination or other sources of contamination and there is frequent duplication between UST and LUST sites. Cleanup sites are considered to be of highest concern. Among the 14 cleanup sites, 3 are reported as requiring no further action and 2 are reported as cleaned up under MTCA (**Table 6**). Three cleanup sites are located within defined 1-year capture zones:

- The Sholund Family Farm is a cleanup site that requires no further action on MTCA. Metals have been remediated from the soil and groundwater and petroleum product has been remediated from the soil. The site is located within the 6-month capture zone of Well 6.
- The CFM Site is awaiting cleanup under MTCA. LUST notifications were issued in 1991 and 1996, and an initial investigation was performed in 2005. Petroleum contamination is confirmed above cleanup levels in the soil and suspected in groundwater. The site is located within the 6-month capture zone of Wells 1 and 2.
- Battle Ground School District 119 is being cleaned up under MTCA. The cleanup is supervised/conducted by Ecology. A LUST was identified in 1990 with a number of reports received thereafter. A discovery/release report was filed in 2010. Petroleum contamination is confirmed above cleanup levels in the soil and groundwater. The site is located within the 1-year capture zone of Wells 1 and 2.

It should be noted that the WDOH guidance states that “chemicals capable of contaminating groundwater must not be stored or used in Zone 1” (i.e. the 1-year capture zone). Two additional cleanup sites are located within 5-year capture zones. Union 76 is a LUST site that requires no further action. Petroleum products were confirmed in the groundwater and soil. Grace Cleaners is currently being cleaned up under MTCA. Halogenated organics have been remediated from soils, but phenolic compounds have been confirmed above cleanup levels in soils. All other cleanup sites are within the 10-year capture zones or within the 1000-foot buffer to the 10-year capture zone.

Whereas cleanup sites and LUST sites have known or suspected contamination, a number of other site categories included in Ecology’s Facility/Site Database are included due to their potential to cause contamination.

- UST sites are associated with underground storage tanks; however, having such a tank does not provide evidence of a leak or contamination.
- Hazardous Materials sites are associated with the storage of hazardous materials; however, such storage does not provide evidence of a leak or contamination. The Williams Gas Northwest Pipeline crosses over the 0.5- and 1-year capture zone of Well 9, which is completed relatively deep in the SGA.
- Stormwater sites were limited in consideration to just industrial and municipal sites within 1-year capture zones. The single stormwater site located in the capture zones is also a dairy, designated in the industrial stormwater category.

PGG compared the environmental sites listed on **Table 5** with sites listed in the City’s 2000 Wellhead Protection Plan (PGG, 2000). We found that the sites listed in 2000 are all listed on **Table 5** except for two sites that appear to be incorrectly located¹.

Table 5 includes priority rankings for facilities/sites based on their categories described above and associated capture zone locations. The ratings are relative within a low-medium-high continuum. Of the 3 sites identified within 1-year capture zones, all were cleanup sites, and 2 were assigned “high” risk (due

¹ One site had an address that does not exist in Battle Ground the other is in Elma WA.

to ongoing cleanup) whereas the third was assigned “low” risk (due to “no further action” designation. Within the 5-year capture zones, the two cleanup sites were assigned “medium” and “low” ratings (the low rating associated with no further action), and the remaining 3 sites were assigned “low” ratings due to their association with storage rather than contamination. All facilities/sites outside the 5-year capture zones were assigned low ratings due to the relatively high response time available should a spill occur.

The City will notify all owners/occupants of environmental sites with the delineated capture zones along with the agencies administering cleanup and LUST sites that they are within WHP capture zones. An example letter and a list of contact information for parcel owners is included in **Appendix A**.

6.3 OTHER POTENTIAL SOURCES

A number of other land uses not mentioned above have the potential to contaminate groundwater:

- On-site septic systems
- Unused and improperly constructed wells
- Transportation corridors

On-Site Septic Systems

On-site septic systems pose a risk to a groundwater where they are relatively high in density and/or where hazardous wastes are discharged to them. Potential contaminants from septic systems include pathogenic organisms (bacteria and parasites), toxic substances, and nitrogen compounds. Clark County maintains a GIS coverage of on-site septic system locations based on information provided by the Southwest Washington Health Department. The locations of the septic systems are plotted on **Figures 4 and 5**. In general, very few septic systems are located within the City’s WHP capture zones. A few septic systems lie within the 1- and 5-year extended capture zones for the SGA wells. These septic systems should not pose a significant risk to these deep groundwater sources.

The extent to which pathogens are transported in the subsurface away from a septic drain field depends on the type of pathogen and the chemical and physical conditions in the subsurface. In general, if a septic system is properly sited, constructed, and maintained, the transport of microorganisms will be limited. Household hazardous chemicals such as cleaners, polishes, waxes, and paints can be transported to groundwater can via a septic system. Homeowners can improperly apply or dispose of chemicals because they do not understand the threat they pose to groundwater quality. In some areas, business and commercial facilities may still use on-site septic systems for sewage disposal. While businesses and commercial facilities associated with land uses potentially risky to groundwater were identified in Section 6.1, some categories (e.g. office buildings and medical clinics) were considered to be in the “gray zone” as they could pose a risk to groundwater via septic discharge. City staff reviewed associated office and clinic parcels, and confirmed that they are all connected to sewer lines.

Septic systems add nitrate to groundwater. Nitrate is regulated, since ingestion can result in methemoglobinemia, or “blue baby” syndrome. Other sources of nitrate include fertilizers, feedlots, and natural mineral deposits. Background concentrations of nitrates in groundwater are typically less than 1 milligram of nitrogen per liter (mg-N/L). The MCL for nitrate is 10 mg-N/L. In 1990, CPU conducted a nitrate study involving 4,200 private wells to assess the distribution of nitrates in Clark County. As discussed in the City’s 2000 Wellhead Protection Plan, nitrate concentrations in the vicinity of the City’s WHP capture zones are generally below 5 mg-N/L.

Unused and Improperly Constructed Wells

Well casings can provide a conduit between the ground surface and underlying aquifers. Improperly constructed or abandoned wells pose several potential problems. In wells with no surface seal, contaminants introduced near the wellhead can move downward outside the casing to underlying aquifers. Many older wells that were constructed before the implementation of WAC 173-160 have no surface seal. Unused wells that have not been properly abandoned are left uncapped in many cases, posing a special risk because contaminants can be introduced directly into the aquifer. Unused wells also pose a risk when they are damaged during site redevelopment. Any of these situations can provide a conduit for contaminant movement.

Clark County (1993) estimated that there may be more than 10,000 private wells in the county (Swanson & McCarley, 1993). Since many of these wells were constructed before drilling standards were adopted, the likelihood that some are improperly constructed is high. In addition, since there has been no inventory of the number or location of these wells, some of these wells may have been abandoned properly.

Transportation Corridors

Vehicles transporting hazardous material can be a source of groundwater contamination through accidents and resultant chemical spills. Hazardous materials are transported through Battle Ground on a daily basis via SR-502 (Main Street) and SR-503 (10th Avenue) (**Figure 3**). These routes are downgradient of the capture zones for the City's shallower wells (1, 2, 4, 5) and but occur within the mapped capture zones of the City's deeper SGA wells (6, 7, 8, 9). The depth of the SGA and overlying aquitards provides some measure of protection to these wells, including additional travel time from the land surface to the completion aquifer.

7.0 CONTINGENCY PLANNING

The purpose of this section is to develop a contingency plan identifying measures to be taken in case the City's largest production well is lost. This section is consistent with WDOH guidance on WHP planning and includes:

- An analysis of system capacity, water rights, and source loss
- Options for expansion within the City's existing sources of supply and water rights
- An analysis of existing and potential interties
- An analysis of potential future water supplies
- A description of emergency procedures to be taken if a source is lost
- A description of emergency notification procedures

7.1 ANALYSIS OF SYSTEM CAPACITY, WATER RIGHTS, AND SOURCE LOSS

7.1.1 System Capacity and Water Rights

In 1994, the City of Battle Ground's water sources consisted of four wells, three interties to CPU, and one supplemental well source from Battle Ground High School. Well 6 was installed in 1995, Wells 7 and 8 were installed in 1999, and Well 9 was installed in 2004. The City no longer receives water from the High School well and currently has only one active intertie with CPU. The rated capacity of all wells combined is currently 1,660 gpm (2.39 mgd), and the sum of water rights is 2,375 gpm (3.42 mgd) instantaneous (Qi) and 1,912 af/yr annual volume (Qa) (**Table 1**). The active intertie has a capacity of 500 gpm (0.72 mgd) (**Table 3**).

7.1.1.1 Wells 1 and 2

As originally constructed, Wells 1 and 2 had individual capacities of approximately 250 gpm. Over the years, the capacity of these wells diminished as water levels and well efficiencies declined. The current capacity of Well 1 is approximately 180 gpm and the current capacity of Well 2 is approximately 80 gpm, resulting in a combined capacity of 260 gpm or (0.37 mgd)^[1]. The aquifer is capable of supplying this capacity on a continuous basis.

Water rights for Wells 1 and 2 are 350 gpm Qi and 270 af/yr Qa (Groundwater Certificate 2605C, priority date June 3, 1954). A portion of Qa on this water right (207 af/yr) was listed as a supplemental (non-additive) allocation for Wells 7 and 8 under Permit G2-29477 (priority date August 13, 1986) which was later expanded to include the City's Well 9 and CPU's Well 35 when Permit G2-29477 was divided between Battle Ground (G2-29477(A)) and CPU (G2-29477(B)). The combined Qa for Wells 1 and 2 is subject to reduction if associated non-additive water rights are used at either CPU Well 35 or Battle Ground Wells 7, 8 and 9.

7.1.1.2 Wells 4 and 5

The combined capacity of Wells 4 and 5 is 125 gpm or 0.18 mgd. The aquifer is capable of supplying this capacity on a continuous basis.

Water rights for Wells 4 and 5 are 250 gpm (0.36 mgd) Qi and 269 af/yr Qa (Water Right Certificate G2-23122, dated August 30, 1974).

7.1.1.3 Well 6

The current capacity of the well is 200 gpm or 0.29 mgd. The aquifer is capable of supplying this capacity on a continuous basis. The water right for Well 6 provides 500 gpm (0.72 mgd) Qi and 430 af/yr Qa (Permit G2-29208, priority date August 13, 1986).

7.1.1.4 Wells 7, 8 and 9

The current combined capacity of Wells 7 and 8 is 650 gpm and the current capacity of Well 9 is 425 gpm, resulting in a combined capacity of 1,075 gpm (1.55 mgd). The City's water rights for Wells 7 and 8 were originally issued under water right permit G2-29477, and Well 9 was subsequently added to the permit as an additional point of withdrawal. Water-right permit G2-29477 originally had a Qi of 2,000 gpm and a Qa of 2,150 af/yr, of which 1,943 af/yr was primary and 207 af/yr was non-additive from Wells 1 and 2. The primary Qa was reduced to 943 af/yr (certificate 29477-A) when 1,000 af/yr was transferred to CPU (certificate 29477-B). The combined Qi was also reduced to 1,375 gpm (1.98 mgd) at this time.

7.1.1.5 Interties

A summary of the City's interties is presented on **Table 3**. The City currently uses its sole intertie with CPU as a source of peaking and emergency supply. The intertie was installed in 1995, is 4-inches in diameter and can supply up to 500 gpm. The City is developing a new intertie with CPU that will replace the current intertie in 2013 and will have an initial capacity of 1,000 gpm. Improvements to this new intertie are available that would increase its capacity over time. The source-loss analysis presented below assumes that intertie capacity will be increased to 1,750 gpm in 2017 and to 3,000 gpm in 2021.

7.1.2 Source-Loss Analysis

This source-loss analysis considers what would happen if the City lost supply from any of its wells due to contamination or well failure. The City currently relies on its intertie with CPU for peaking capacity, and as water demand increases, the City will become increasingly reliant on current and future interties. **Figure 6** presents:

- Preliminary estimates of the City's projected annual and maximum daily demand²;
- The total Qa water right for the City's wells (converted into an average daily pumping rate) and the total Qi water right;
- The City's projected instantaneous water-supply capacity over time based on its total well capacity plus capacity from existing and future interties; and,
- The City's instantaneous capacity with the loss of each of its key well sources (or source pairs, where two wells are located close together such that contamination would affect both)

While the City can meet the projected average daily demand (ADD) with its allocated Qa through 2017, comparison of projected maximum daily demand (MDD) to combined well capacity shows that the City cannot meet its current or future MDD without use of the interties. After 2017 the City will also need to rely on interties to meet portions of both its peaking demand *and* its ADD.

The combined source capacity curve (shown in cyan) can be compared to the projected MDD to evaluate the City's capability to meet MDD with all sources operating. **Figure 6** suggests that MDD can be met with the City's combination of wells and interties (although this comparison suggests a shortfall in 2012, this did not occur except when Well 9 was temporarily inoperable due to pump outage).

² These numbers are from a draft version of the City's 2012 Water System Plan, currently under preparation (personal communication, Ginter, 2012).

Comparison of projected MDD to the City's instantaneous capacity curves with loss of specific well sources suggests that prior to 2017, loss of Well 9 or Wells 7 and 8 (combined) could have a notable affect on the City's ability to meet its MDD. For instance, in 2016, loss of Well 9 would mean that the City could supply only 86 percent of its MDD, and loss of Wells 7 and 8 would mean that the City could supply only 77 percent of its MDD. Between 2017 and 2029, loss of any individual well source (or source pair) would have little or no affect on the City's ability to meet its MDD. This is largely due to the contribution of interties from CPU. After 2029, loss of Well 9 or Wells 7 and 8 would again have a notable affect on the City's ability to meet its MDD.

It should be noted that while Wells 7, 8 and 9 have the largest capacity of all the City's sources, these wells are less vulnerable to contamination than Wells 1, 2, 4, 5 and 6 (Section 6.4). The latter group of wells have shallower completions in the Upper Troutdale Formation (**Table 2**), and are therefore more vulnerable to contamination at the land surface than the deeper SGA wells. It should also be noted that due to the proximity between wells situated in pairs and completed in the same aquifer (i.e. Wells 1 & 2, 4 & 5, 7 & 8), if contamination were to reach one of the paired wells, it would likely affect both wells – either removing them from service or requiring treatment before distribution.

7.2 OPTIONS FOR INCREASED CAPACITY UNDER EXISTING WATER RIGHTS

Current well capacities are sufficient to exceed the City's water-right Qa. However, the rated capacities of all of the City's wells are less than associated water-right Qi allocations (**Table 1** and **Figure 6**). The disparity between well capacity and Qi has increased as many of the City's wells have experienced reduced capacities due to clogging by iron bacteria. Additional wells could be added to the vicinity of each of the City's sources (under Ecology's "Showing of Compliance") to support withdrawals up to the allocated water-right Qi's. This would increase the City's internal capacity to meet its MDD, thus reducing reliance on interties. Specifically:

- An additional 90 gpm could be developed in the vicinity of Wells 1 and 2;
- An additional 125 gpm could be developed in the vicinity of Wells 4 and 5;
- An additional 200 gpm could be developed in the vicinity of Well 6; and
- An additional 300 gpm could be developed in the vicinity of Wells 7, 8 and 9.

In all, the unused capacity of these wells would provide 715 gpm of additional instantaneous capacity. Furthermore, if the City were prepared to drill new wells, it could potentially target the SGA and transfer water rights from its shallow wells to new deeper wells, thus effectively increasing protection from contamination to its well sources. However, because both the Upper Troutdale Aquifer and the SGA have shown a history of clogging due to iron bacteria, the City may prefer to emphasize interties to meet its instantaneous demand requirements.

7.3 EMERGENCY PROCEDURES FOR LOSS OF A SOURCE

Over the 20-year projection period addressed in this Wellhead Protection Plan, the impact of losing a single source (where two wells immediately adjacent are also considered a single source) is unlikely to require reductions in supply of more than 25 percent of MDD. During significant portions of the 20-year time period (i.e. 2018 to 2028), loss of a single source would not impact to the City's ability to meet MDD. Were a source loss to occur during a time when the combined capacity of all the City's wells was needed to meet demand, the City would likely need to institute short-term rationing and pursue drilling additional wells.

As discussed above, the City's well capacity could be increased without exceeding existing water rights by drilling new wells. The decision as to where to drill a new well would depend on the reason for source

loss. If source loss is due to well failure, a replacement well could be drilled near to the original well under “showing of compliance”. Showing of compliance does not require water-right processing, and can be performed without significant administrative delay. It is reasonable to expect that several months (or longer) may be needed to contract and drill a new well, and connect the well to the distribution network.

If source loss is due to contamination, we would advise the City to either seek a new well location for the existing water right or increase groundwater development from an existing (different) location. In the first case, moving the point of withdrawal would require water-rights processing which would likely require months to years to complete³. However, because the City is not making full use of water rights from all of its sources, it could develop additional capacity at other source locations under showing of compliance and potentially offset lost capacity in a period of months. This is particularly relevant to loss of the City’s shallow well sources, where available additional capacity in the deep sources exceeds the current capacity of the shallow sources. However, if the City were to lose a deep source to contamination, available additional capacity from shallow sources is insufficient to replace deep source capacities. In this case, water rights processing would be required for a new well location. Fortunately, the potential for contamination of deep sources is significantly less than the potential for contamination of shallow sources.

Should contamination be detected in one of the City’s wells, emergency responses would be conducted, as described below.

7.3.1 Emergency Notification Procedures

In case of a spill of any magnitude within the WHPA, Ecology must be notified at (360) 407-6300. In addition, the following City Personnel should be notified:

- Scott Sawyer, City Engineer, (360) 342-5075
- Cal Newton, Public Works Superintendent, (360) 342-5365

7.3.2 City’s Chain-of-Command for Spill Response

The City’s Chain-of-Command response team is summarized in **Table 7**.

7.3.3 External Emergency Notification

In case of a spill that cannot be contained, Ecology’s should be contacted at its 24-hour number, (360) 407-6300. Safety Kleen, a cleanup contractor, should also be contacted at (503) 655-5798. If a spill can be contained, it should be pumped into a containment tank. If there is no containment tank on site, Baker Tanks should be contacted at (503) 775-7211 to provide one.

7.4 EMERGENCY PHONE NUMBERS

The following is a list of contacts and telephone numbers in case of an emergency:

Police:	911
Ambulance:	911
Fire:	911
Hospital:	(360) 256-2000 (Peace Health Southwest Center)

³ Months might be required under Ecology’s Cost Reimbursement program; otherwise, years are often required.

Fatal injuries and accidents in which two or more employees are hospitalized must be reported immediately to the Washington State Department of Labor and Industries, Division of Consultation and Compliance (800) 423-7233.

8.0 SPILL RESPONSE PLANNING

8.1 RESPONSIBILITIES FOR SPILL PREVENTION AND RESPONSE

Many organizations have responsibilities for spill prevention in Washington State. This section briefly summarizes those responsibilities.

8.1.1 The Responsible Party

The primary responsibility for assessing, responding to, and containing an oil spill or discharge falls upon the individual, agency, and/or company responsible for the spill incident. The Responsible Party (RP) is responsible for containing and cleaning up the spill, disposing of contaminated debris, restoring the environment, and paying damages regardless of whether there is an approved contingency plan. State and federal law specifically require that the removal of a discharge of oil or hazardous substance should be immediate.

If the spiller is unknown or fails to respond, or if the State or Federal On-Site Coordinator (OSC) considers the response inadequate, the agency with jurisdiction may take over the response and recover expenses from the spiller (RCW 90.48.335).

8.1.2 Environmental Protection Agency

The EPA has primary responsibility for land spills and spills that occur on inland U.S. waters that are not under US Coast Guard jurisdiction. In the past, EPA has delegated authority for certain spill-response activities to Ecology.

8.1.3 Department of Ecology

Ecology is the lead agency for environmental pollution response in Washington. As such, it has pre-designated the OSC and the Incident Commander (IC) for many spills occurring in the State's jurisdiction. If a spill occurs on a State highway, Ecology coordinates with the Washington State Patrol (WSP). The WSP then assumes responsibility as IC and leads the cleanup. The key responsibilities of Ecology include:

- Providing 24-hour emergency response to reported spill incidents
- Identifying the source, cause, and responsible party
- Assuming responsibilities of RP if a spiller cannot be located or is unresponsive
- Ensuring that containment, cleanup, and disposal are carried out in a timely and adequate manner

8.1.4 State Patrol

The Washington State Patrol (WSP) acts as the designated IC for incidents on Interstate and State highways and on other roads and jurisdictions as delegated. When a spill occurs on a State highway, Ecology joins the Unified Command and leads the cleanup response.

8.1.5 Emergency Management Division of the Washington Military Department

The Emergency Management Division of the Washington Military Department (<http://www.emd.wa.gov/>) provides disaster assistance for public agencies and recognizes hazards such as chemical (hazardous materials), pipelines, radiological, terrorism and transportation. Their assistance primarily addresses the repair and restoration of public facilities, infrastructure, or services which have been damaged or destroyed.

8.1.6 Local Emergency Planning and Emergency Management

The City of Battle Ground has developed a Local Emergency Planning Committee (LEPC) to facilitate planning efforts. LEPCs are responsible for creating emergency response plans. General requirements for local response plans are contained in Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). Generally, local agencies, particularly fire districts and law enforcement agencies, can be activated to provide emergency response services when there is a threat to life and property. Emergency response services may include:

- Investigating and documenting fire and explosion controls
- Establishing perimeter controls, evacuation routes, and traffic controls
- Containing or removing the spilled material, depending on the nature of the incident

The responsibilities of local government's Emergency Management Unit include:

- Developing and maintaining a hazardous material "annex" (supplement or appendix) to the State Comprehensive Emergency Management Plan. The responsibilities and actions of local, State, and Federal agencies should be defined.
- Assisting local agencies in preparing their standing operation procedures for hazardous materials incidents.
- Coordinating the various local emergency organizations and serving as the local liaison to Washington State EMD when that agency is involved.
- Contacting local landowners (may also be performed by local Health Department)
- Developing training programs and conducting exercises for local response agencies.
- Participating as a member of the Washington Wildlife Rescue Coalition.
- Establishing a Joint Information Center (JIC).
- Coordinating and interfacing with local governmental units (fire, medical, public works, sheriff, and law enforcement).
- Communicating with local government and industry.

8.2 SPILL ASSESSMENT AND RESPONSE PROCEDURES ON CITY PROPERTY

A spill of any magnitude that occurs within the WHPA and is not contained must be reported to Ecology and the City. After the spill is contained to the extent possible using on-site equipment, City personnel, Ecology, and a cleanup contractor should be notified.

8.3 SPILL CONTAINMENT/CLEANUP PROCEDURES ON CITY PROPERTY

If the spill can be contained, the following procedures should be followed:

1. Contain the spill with adsorbent materials. Neutralize with soda ash if the material is an acid.
2. Report the spill according to chain-of-command procedures.
3. Start the cleanup operation.

The spilled material should be pumped into an on-site tank for treatment, if possible. If it cannot be pumped into a tank, a cleanup contractor such as Safety Kleen should be contacted to contain the spill.

8.4 INSPECTIONS AND RECORDS

To the extent possible, the City should inspect the inventoried contaminants annually for proper containment. The facilities should also be checked to insure that the facility owners and operators are properly trained in spill prevention. The City staff should be responsible for inspection and record keeping for the spill prevention procedures. Records should be maintained for reference and recommendations should be made to correct deficiencies found by inspection.

Material Data Safety Sheets (MSDS) should be collected as part of the inspection process. These MSDS sheets must be available at each facility. The fire department also maintains copies of MSDS sheets for many facilities.

8.5 TRAINING

All City engineering, planning, and public works personnel should be trained in spill prevention at appropriate levels. For example:

- Engineering staff should be trained to identify proper spill containment and handling facilities when reviewing plans
- Planning staff should be trained to minimize potential contamination problems through changes in long-term zoning,
- Public works staff should be trained in spill response and field inspection procedures

City staff should be thoroughly familiar with the procedures outlined in this plan. City personnel can significantly impact spill prevention as part of their overall duties. This plan will be revised periodically to ensure that proper techniques are put to the best benefit.

Training should focus on safety, spill prevention, emergency response, evacuation, first aid, and hazardous waste first response.

9.0 IMPLEMENTATION STRATEGIES

Strategies for implementing the City of Battle Ground's WHP plan focus on several key issues:

- Public education and technical assistance
- Contaminant source management
- Monitoring and data management
- Land use and regulatory controls
- Regional coordination
- Planning

Each of these strategies is discussed below.

9.1 PUBLIC EDUCATION/TECHNICAL ASSISTANCE STRATEGIES

Public education and technical assistance strategies are required to teach City residents and businesses about practices that could impact the quality of groundwater in the WHPAs. These strategies include the following:

- Notifying all businesses that store and handle hazardous materials within the designated WHPAs about the importance of proper waste handling and disposal (addressed in **Appendix A**). Performing audits and making technical assistance available for small businesses within designated WHPAs.
- Developing educational materials that can be distributed to City residents to teach them how they can help protect groundwater. The Annual Water Quality Report can be used to inform customers about topics such as the location of WHPA boundaries and the importance of the proper use and disposal of lawn chemicals, household wastes, and other potential contaminants.
- Developing school programs to educate youth on groundwater protection.

9.2 CONTAMINANT SOURCE MANAGEMENT STRATEGIES

Strategies for managing contaminant sources are required to prevent contamination from point sources such as spills and USTs, as well as from regional sources such as septic systems. These strategies include the following:

- Regularly updating inventories of all businesses and potential contaminant sources within designated WHP capture areas. WDOH guidance states that inventories should be updated every two years (WDOH, 2010).
- Inventorying and locating USTs that were not identified through this study, including residential home heating oil USTs.
- Encouraging Ecology to expedite cleanup actions at confirmed contamination sites.
- Encouraging Ecology and the County to inspect the facilities of RCRA hazardous waste generators.
- Reviewing existing and proposed stormwater management practices to identify areas of concern for groundwater quality. The City should coordinate with Clark County as required.
- Requesting that the SWWHD focus its septic maintenance program on designated WHPAs.

- Encouraging residences that are currently served by septic drain fields within WHPAs to connect to the sewer system where possible. The City might consider financial incentives or other means of enticing residents to change.

9.3 MONITORING AND DATA MANAGEMENT STRATEGIES

Groundwater monitoring data provide a method for assessing trends in groundwater quality, on both regional and local scales. Regional data are available from sources such as the County, CPU, and SWWHD. Recommended strategies for monitoring and data management include:

- Collecting and analyzing water-quality, water-level, production, land-use, and other data that could assist in wellhead protection. This could be accomplished through cooperative programs with Clark County, CPU, and SWWHD.
- Integrating this data into a database management system to facilitate future analyses related to wellhead protection and water-resource issues.
- Applying a higher sampling intensity to the shallower, more vulnerable supply wells (wells 1, 2, 4 and 5).
- Reviewing logs for existing wells in high-risk areas to identify possible locations for monitoring.

9.4 LAND-USE CONTROLS AND REGULATION STRATEGIES

Wellhead Protection Guidance (WDOH, 2010) notes that public water systems owned and operated by local governments have clear authority to protect groundwater through zoning decisions, building and operating standards, land use controls, public health ordinances and other measures. The City can adopt zoning ordinances or codes that limit activities around water-supply sources, set design or operating standards for facilities in WHPA's, or other regulatory approaches. The following strategies related to land-use and regulatory controls could be implemented to protect water quality in WHPAs:

- Developing zoning overlays and adding performance standards to conditional use permits. However, because such strategies may be difficult and expensive to implement, it may be more practical to relocate the high-risk sources to areas where land-use conditions are not as critical.
- Encouraging and supporting the implementation of Clark County's Critical Aquifer Recharge Areas (CARA) ordinance (Chapter 13.70), which regulates activities within WHPAs and promotes the use of Best Management Practices (BMPs) to safeguard groundwater. Updated capture zone maps should be submitted periodically to the County for incorporation into the CARA process.
- Encouraging and supporting the implementation of Clark County's Water Quality ordinance (Chapter 13.26A), which is designed to reduce and control discharges of contamination to surface water and groundwater through BMPs and technical assistance programs.

9.5 REGIONAL COORDINATION STRATEGIES

Coordinating with other local purveyors in Clark County could enhance the effectiveness of wellhead protection efforts. Regional coordination strategies would include:

- Establishing a "steering group" with other local water purveyors and Clark County to coordinate WHP planning activities. This group should focus existing and future programs related to water quality and water resources on the designated WHPAs.

- Coordinating with other Clark County purveyors on water-supply planning and development issues. These issues include contingency planning and expansion of interties.

9.6 PLANNING STRATEGIES

Developing strategies for emergency response and contingency planning is essential to wellhead protection. Recommended action items related to such planning include:

- Notifying the appropriate emergency response organizations on the location of WHPAs and establishing formal communication protocols with the first-response emergency units.
- Preparing and distributing an emergency response contingency plan that covers short- and long-term responses if one or more sources is lost.
- Completing a hydraulic assessment of the distribution system to ensure that the contingency plans adequately address major losses of supply or storage capacity.

The City's Community Development Department should ensure that wellhead protection programs are integrated into overall community planning. Declaring a WHPA a critical aquifer recharge area, subject to local regulations and policies, is a useful part of a local Wellhead Protection Program.

Given that source-loss analysis indicates that there will be times over the next 20 years when existing interties are insufficient to offset impacts to total system capacity if certain well sources are lost, the City may want to consider planning for installation/development of backup wells. Should backup wells be constructed, we recommend targeting the (deep) SGA aquifer due to its greater degree of inherent protection from contamination introduced to the land surface and because current capacity is 300 gpm less than existing water-right allocations.

REFERENCES

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- WDOH (Washington Department of Health), 2010. Washington state wellhead protection program guidance document. DOH 331-018 (Revised). June 2010.

Table 1
Summary of Source Capacity and Water Rights

Well	Pumping Rate (gpm)			Annual Volume (acre-feet)		
	Historic Average ¹	Rated Capacity ²	Rights (Qi)	Historic Average	Capacity ⁴	Rights (Qa)
#1 and #2	171	260	350	276	420	270 ⁵
#4 and #5	118	125	250	190	202	269
#6	112	200	400	181	323	430
#7, #8, #9	544	1,075	1,375 ³	878	1,735	943 ⁶
Total	945	1,660	2,375	1,525	2,680	1,912

¹ Historic average from 2004-2011.

² Personal Communication, Cal Newton 2012.

³ Qi for wells 7, 8 and 9 (combined) was reduced from 2,000 gpm to 1,375 gpm due to a 625 gpm water-right transfer to Clark Public Utilities (CPU) as documented in Certificates 29477-A and 29477-B.

⁴ Instantaneous capacity pumped continuously over one year.

⁵ Qa for wells 1 and 2 is subject to reduction if associated non-additive water rights are used at either CPU Well 35 or Battle Ground wells 7, 8 and 9.

⁶ Original water-right certificate 29477 had a total Qa of 2,150 af/yr of which 1,943 af/yr was primary and 207 af/yr was non-additive from wells 1, 2, 4, 5 and 6. The primary Qa was reduced to 943 af/yr (certificate 29477-A) when 1,000 af/yr was transferred to CPU (certificate 29477-B).

Table 2 - Battle Ground Water Supply Wells

Battle Ground Well Number	WDOE Unique Well ID	WDOH Source ID	Local Number	Completed Aquifer	Well Diameter	Driller	Construct. Date	Altitude (ft-MSL)	Well Depth (ft)	Completion Interval Top (ft-bgs)	Bottom (ft bgs)	WL Depth (ft)	WL Date	Well Yield (gpm)	Specific Capacity (gpm/ft)	Estimated Transmissivity (gpd/ft)
WELL 1	AFP601	1	3N/2E-03AB	QTu	8	Bottner	3/30/1954	284	144	99	136	48.1	3/30/1954	180	7.9	
WELL 2	AFP603	2	3N/2E-03AB	QTu	12	Bottner	9/15/1954	284	152	116	144	54	9/15/1954	80	7.7	
WELL 4	AFP603	3	3N/2E-03DA	QTu	12	Hansen	6/25/1975	280	141	105	135	61.6	8/22/1975	75	3.3	
WELL 5	AFP604	4	3N/2E-03DA	QTu	12	Hansen	8/22/1975	280	140	105	135	59.7	8/22/1975	75	2.2	
WELL 6	ABT804	8	3N/2E-04AD	SGA	10	Hansen	9/17/1995	275	299	259	289	197.2	8/16/1995	350	9	46,000
WELL 7	ABB112	9	3N/2E-04-DB	SGA	12	Holt	1/15/1999	265	437	349	432	205	1/8/1999	1000	28.2	73,800
WELL 8	ABB118	10	3N/2E-04-DB	SGA	12	Holt	2/26/1999	265	438	350	435	202	2/22/1999	1000	23.8	73,800
WELL 9	AKW137	11	NW, SE, Sec 4, T3N/R2	SGA	12/8	Holt	2004	265	425	320	411	213.1	2004	500	21	70,000

NOTES:

Completion aquifers include Upper Troutdale aquifer (QTu) and sand and gravel aquifer (SGA).

Static water levels, well yields and specific capacity based on original driller's reports and represented well condition at time of drilling.

Transmissivity estimates referenced from hydrogeologic reports on file with City of Battle Ground.

Table 3
Battle Ground Interties

Location	Size (inches)	Maximum Capacity (gpm)	Status
NE 199 th Street at Maple Grove School	4	500	Installed in 1995. WDOH Source #6. Will be used for emergencies only when 1000 gpm becomes available at NE 219th St.
NE 219th St and NE 92nd Ave	16	1000	Available in 2013.
	16	1750	Likely available in 2017 with installation of additional booster pump.
	18 and 24	3000	Assumed available in 2021. Requires installation of larger diameter pipes and larger booster pumps.

Table 4 - Possible Parcels of Concern

Map ID	Owner	Land Use Description	Site Address*	Capture Zone Location	Septic	Priority Ranking
114	City Of Battle Ground	Bio-Filtration Swales/Ponds	n/r	6-Month Zone, Wells 7 & 8		low
115	City Of Battle Ground	Bio-Filtration Swales/Ponds	n/r	6-Month Zone, Wells 7 & 8		low
9	West Main Lic	Drive Through Car Wash	512 W Main St	6-Month Zone, Wells 1 & 2		medium
10	West Main Lic	Tires (includes retread tires), batteries, parts & acces, dealers	510 W Main St	6-Month Zone, Wells 1 & 2		medium
112	City Of Battle Ground	Bio-Filtration Swales/Ponds	2509 SW 11th Circle	6-Month Zone, Well 9		low
108	City Of Battle Ground	Bio-Filtration Swales/Ponds	n/r	6-Month Zone, Well 6		low
55	Song Simon S & Song Renee J	Convenience Store - w/ pumps & tanks	13 E Main St	5-Year Zone, Wells 1 & 2		medium
31	Patel Alkesh R & Patel Bindiya A	Dry Cleaners, laundries (single tenant - free standing bldg.)	100 E Main St	5-Year Zone, Wells 1 & 2		medium
61	Hussey Properties Inc	Tires (includes retread tires), batteries, parts & acces, dealers	213 W Main St	5-Year Zone, Wells 1 & 2		medium
27	Brown Robert P & Brown Ruth I	Convenience Store - w/ pumps & tanks	1912 W Main St	10-Year Zone, Wells 7 & 8		low
43	Washington State	Farm Bldgs for Equipment	2411 W Main St	10-Year Zone, Wells 7 & 8		low
45	Morse Properties Llc	General repair & service garages	1713 W Main St	10-Year Zone, Wells 7 & 8		low
130	Mcnair Richard S & McNair Jacquelin	SERVICE REPAIR SHOP	1806 W Main St	10-Year Zone, Wells 7 & 8	Yes	low
48	Les Schwab Tire Centers Wa	Tires (includes retread tires), batteries, parts & acces, dealers	1719 W Main St	10-Year Zone, Wells 7 & 8		low
89	Andersen Ronald A	Fleet Operation Centers & Storage	103 S 3rd Ave	10-Year Zone, Wells 1 & 2		low
66	Ferraro Miguel A	General repair & service garages	403 E Main St	10-Year Zone, Wells 1 & 2		low
64	Andersen Ronald	Mfg - Food	305 E Main St	10-Year Zone, Wells 1 & 2		low
105	Krause Steven R	SERVICE REPAIR SHOP	n/r	10-Year Zone, Wells 1 & 2		low
106	Krause Steven R	SERVICE REPAIR SHOP	303 S Parkway Ave	10-Year Zone, Wells 1 & 2		low
46	Morse Properties Llc	General repair & service garages	n/r	10-Year Zone, Well 9, Wells 7 & 8		low
15	Frontier Equities Llc	Convenience Store - w/ pumps & tanks	16 NW 13th Ave	10-Year Zone, Well 9		low
126	Levy Esther Trustee	Convenience Store - w/ pumps & tanks	907 W Main St	10-Year Zone (Smoothed)		low
3	Jmf Investments Iv Llc	Drive Through Car Wash	105 NW 12th Ave	10-Year Zone (Smoothed)		low
145	Fred Meyer Stores Inc	Service Station w/ Tanks & Pumps or Card Lock Station	1205 NW 1st St	10-Year Zone (Smoothed)		low
20	City Of Battle Ground	Botanical gardens and conservatories.	414 E Main St	1000-foot Buffer		low
35	City Of Battle Ground	Botanical gardens and conservatories.	n/r	1000-foot Buffer		low
141	Dickinson Daniel & Dickinson Annette	Convenience Store - w/ pumps & tanks	409 E Main St	1000-foot Buffer		low
24	Laynes Funeral Home Inc	Funeral services and crematories.	16 NE Clark Ave	1000-foot Buffer		low
29	Laynes Funeral Home Inc	Funeral services and crematories.	n/r	1000-foot Buffer		low
2	Punks Mufflers Llc	General repair & service garages	212 NE Grace Ave	1000-foot Buffer		low
86	Bertsch Robert G	General repair & service garages	715 SE 1st St	1000-foot Buffer		low
140	Ek Properties Llc	General repair & service garages	508 SE 1st St	1000-foot Buffer		low
142	Ek Properties Llc	General repair & service garages	n/r	1000-foot Buffer		low
16	Andersen Ronald A	Mfg - Rubber & Plastic Products	15 NE Grace Ave	1000-foot Buffer		low
146	Clark County General Services - Railroad	Railroad right-of-way	215 S Grace Ave	1000-foot Buffer		low
23	Laynes Funeral Home	Small retail building (<10,000 s.f.)	n/r	1000-foot Buffer		low

See Figure 4 for parcel locations. *All parcel addresses are in Battle Ground, WA 98604.

Table 5 - Summary of Environmental Sites within Wellhead Protection Capture Zones

Map ID	Facility Site ID	Cleanup Site ID	Facility Name	Cleanup Site	Hazardous Materials	UST	LUST	Storm Water	Capture Zone Location	Priority Ranking
35	71217895	3703	Sholund Family Farm	Y					6-Month Zone. Well 6	low
36	73713224	7120	CFM Site	Y		Y	Y		6-Month Zone, Wells 1 & 2	high
37	81695495	10621	Battle Ground School District 119	Y		Y			1-Year Zone, Wells 1 & 2	high
39	86416754	578	Graces Cleaners	Y	Y				5-Year Zone, Wells 1 & 2 AND 10-Year Zone, Well 6	medium
1	1051	4980	Union 76	Y		Y	Y		5-Year Zone, Wells 1 & 2	low
25	7256537		Andersen Dairy Inc		Y			Y	5-Year Zone, Wells 1 & 2	low
32	37223232		Cenex Harvest States Old Station		Y	Y			5-Year Zone, Wells 1 & 2	low
43	99375277		QWEST Communications Battleground CDO		Y	Y			5-Year Zone, Wells 1 & 2	low
30	31157289		Village Mart			Y			10-Year Zone. Well 9	low
4	4282	11627	Vancouver Clinic Battle Ground	Y	Y				10-Year Zone, Wells 7 & 8	low
19	1577475		Williams Gas Pipelines Northwest Pipeline		Y				10-Year Zone, Wells 4 & 5	low
24	7134825		Battle Ground School District 119		Y		Y		10-Year Zone, Wells 1 & 2	low
31	32749129	5875	Battle Ground Farm & Home	Y		Y	Y		10-Year Zone, Wells 1 & 2	low
34	64531412		Parkway North Health Care Nurs		Y				10-Year Zone, Wells 1 & 2	low
38	82713854	10658	Draper Cf Dba Drapers City Cleaners	Y		Y	Y		10-Year Zone, Wells 1 & 2	low
33	58523474	9812	Jacksons Food Stores 500	Y	Y		Y		10-Year Zone (Smoothed)	low
17	23782	5228	Battle Ground Chevron	Y		Y	Y		1000-foot Buffer	low
21	3506334		Albertsons 592		Y				1000-foot Buffer	low
27	9977600	5509	Battle Ground Mini Mart 805	Y		Y	Y		1000-foot Buffer	low
28	15491331	5582	Battle Ground Utility Trench Scott Bros	Y		Y	Y		1000-foot Buffer	low
29	25875197		Lewis Rock & Redi Mix Inc Main St			Y			1000-foot Buffer	low
40	89645195	3708	WA DOT Battle Ground	Y					1000-foot Buffer	low
41	90426683	11004	Battle Ground Inn	Y		Y	Y		1000-foot Buffer	low
42	92132423		Dorsey Bus Service Inc Main St E		Y	Y			1000-foot Buffer	low

See **Figure 5** for site locations. See Table 6 for supplemental information about cleanup sites. "No further action" (NFA) cleanup sites receive low priority rankings for risk of contamination

Table 6 - Summary of Cleanup Sites within Wellhead Protection Capture Zones

Map ID	Facility Site ID	Cleanup Site ID	Facility Name	ISIS Site Summary Report
1	1051	4980	Union 76	This site requires no further action under MTCA. Petroleum products are reported as confirmed in the groundwater and soil.
4	4282	11627	Vancouver Clinic Battle Ground	This site requires no further action under MTCA based on an initial investigation. Petroleum products in the soil were remediated to below cleanup levels.
17	23782	5228	Battle Ground Chevron	The site is being cleaned up under MTCA, an Ecology supervised/conducted cleanup has been started. A routine cleanup was performed in 1995-96, but the site was reopened in 2000 due to LUST contamination. Halogenated organics and PAH's have been remediated in the soil, but petroleum products are currently confirmed above cleanup level in the soil and groundwater.
27	9977600	5509	Battle Ground Mini Mart 805	The site is being cleaned up under MTCA, an Ecology supervised/conducted cleanup has been started. A LUST was identified in 2001, a site characterization performed in 2003. Petroleum contamination is confirmed above cleanup levels in the soil and groundwater, and PAH contamination is confirmed in the groundwater and suspected in the soil.
28	15491331	5582	Battle Ground Utility Trench Scott Bros	The site is being cleaned up under MTCA, an Ecology supervised/conducted cleanup has been started. A LUST was identified in 1996 and notice of a cleanup site issued in 2005. Petroleum contamination is confirmed above cleanup levels in the soil and groundwater.
31	32749129	5875	Battle Ground Farm & Home	The site is being cleaned up under MTCA, an Ecology supervised/conducted cleanup has been started. Priority pollutant metals and petroleum products are currently confirmed above cleanup level in the soil and groundwater.
33	58523474	9812	Jacksons Food Stores 500	This site is reported cleaned up under MTCA. The site has a history of LUST reports received between 1993 and 2009. Ecology performed an initial investigation in late 2011. Petroleum products were detected below cleanup levels in groundwater and soil. Non-halogenated organics were confirmed above cleanup levels in groundwater. A no further action notice has not been issued for this site.
35	71217895	3703	Sholund Family Farm	This site requires no further action under MTCA. Metals have been remediated in the soil and groundwater, and petroleum product has been remediated from the soil.
36	73713224	7120	CFM Site	The site is awaiting cleanup under MTCA. LUST notifications were issued in 1991 and 1996, and an initial investigation was performed in 2005. Petroleum contamination is confirmed above cleanup levels in the soil and suspected in groundwater.
37	81695495	10621	Battle Ground School District 119	The site is being cleaned up under MTCA, an Ecology supervised/conducted cleanup has been started. A LUST was identified in 1990 with a number of reports received thereafter. A discovery/release report was filed in 2010. Petroleum contamination is confirmed above cleanup levels in the soil and groundwater.
38	82713854	10658	Draper CF DBA / Drapers City Cleaners	This site is reported as cleaned up under MTCA. Petroleum (gasoline and other) products are below cleanup levels in the soil, and diesel contamination is reported as suspected in the soil. A no further action notice has not been reported for this site.
39	86416754	578	Graces Cleaners	This site is being cleaned up under MTCA and the voluntary cleanup program. Contamination occurs in the soil. Halogenated organics are reported as remediated and phenolic compounds have been confirmed above cleanup levels.
40	89645195	3708	WA DOT Battle Ground	The site is being cleaned up under MTCA, an Ecology supervised/conducted cleanup has been started. Metals and petroleum products are confirmed above cleanup levels in the soil.
41	90426683	11004	Battle Ground Inn	This site is reported as cleaned up under MTCA. Diesel and other petroleum products were remediated below cleanup levels from the soil. A no further action notice has not been issued for this site.

Table 7
City's Chain-of-Command for Spill Response

Title	Name	Email	Phone	Cell/Pager
1. On Duty Battalion Chief (Clark Co. Fire & Rescue)	Variable	n/a	360-887-4609 (CCF&R)	360-607-3255
2. City Engineer & Public Works Director	Scott Sawyer	scott.sawyer@cityofbg.org	360-342-5075	360-608-0567
3. Public Works Foremen	Cal Newton	cal.newton@cityofbg.org	360-342-5365	360-798-7044
4. Maintenance Worker	Shawn Scott	shawn.scott@cityofbg.org	360-342-5364	360-798-7822

R 2 E

R 2 E

Figure 1
Surficial Geologic Map and
Cross Section Alignments

Prepared for
City of Battle Ground



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Pacific Groundwater
Group

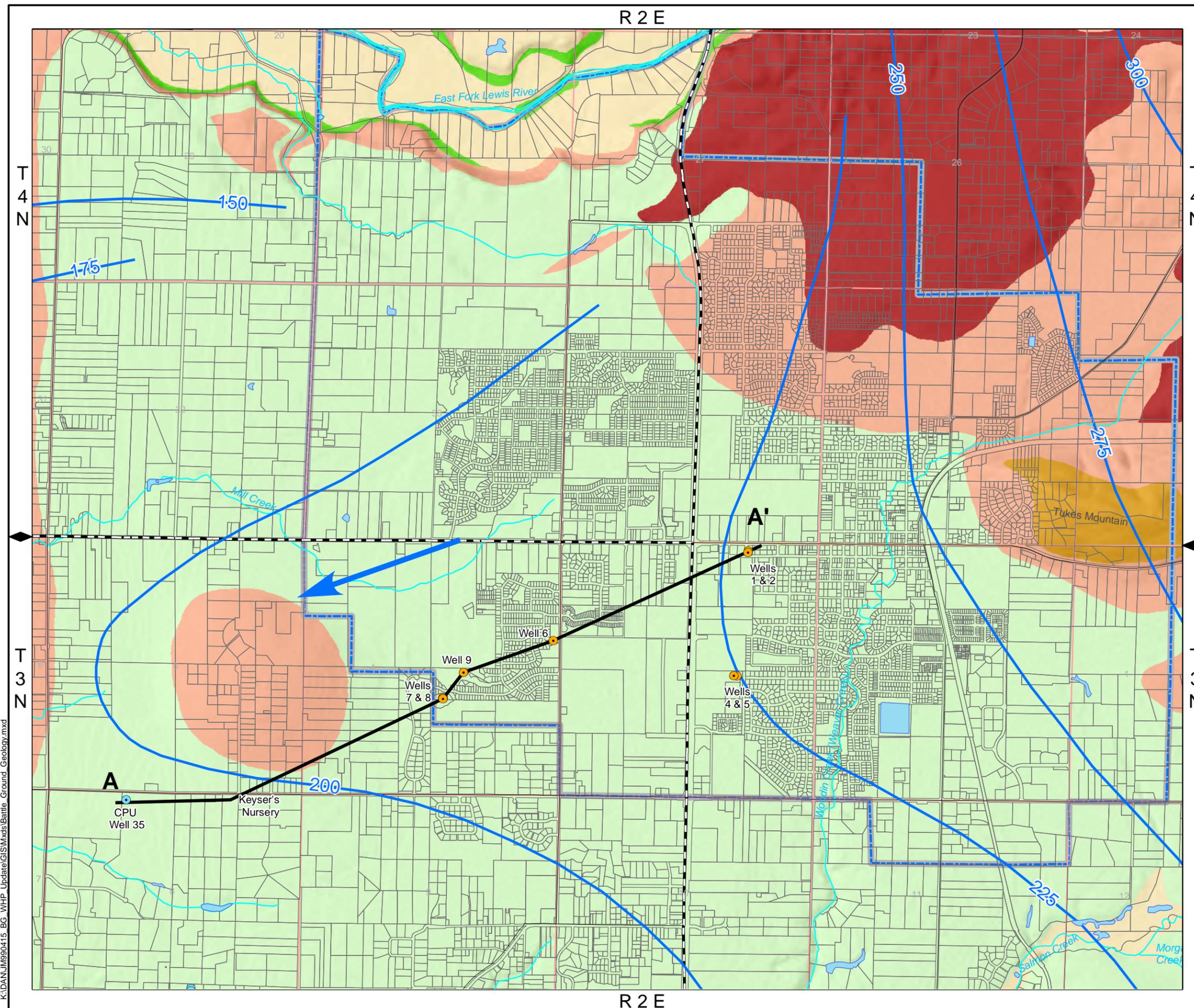
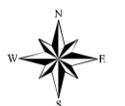


- Battle Ground Supply Well
- Other Wells
- Cross Section Alignment
- Water Service Area Boundary
- Taxlot Outlines
- Water Feature
- Groundwater Levels**
- Upper Troutdale Aquifer Water Level Contours*
- Estimated SGA Groundwater Flow Direction
- Surficial Geology****
- Recent Alluvial Deposits
- Pleistocene Alluvial Deposits
- Upper Troutdale Formation
- SGA (Sand & Gravel Aquifer)
- Boring Lava
- Bedrock

* From Swanson et al, 1993

**Modified from Howard 2002, Geologic Map of the Battle Ground Quadrangle, USGS MF-2395

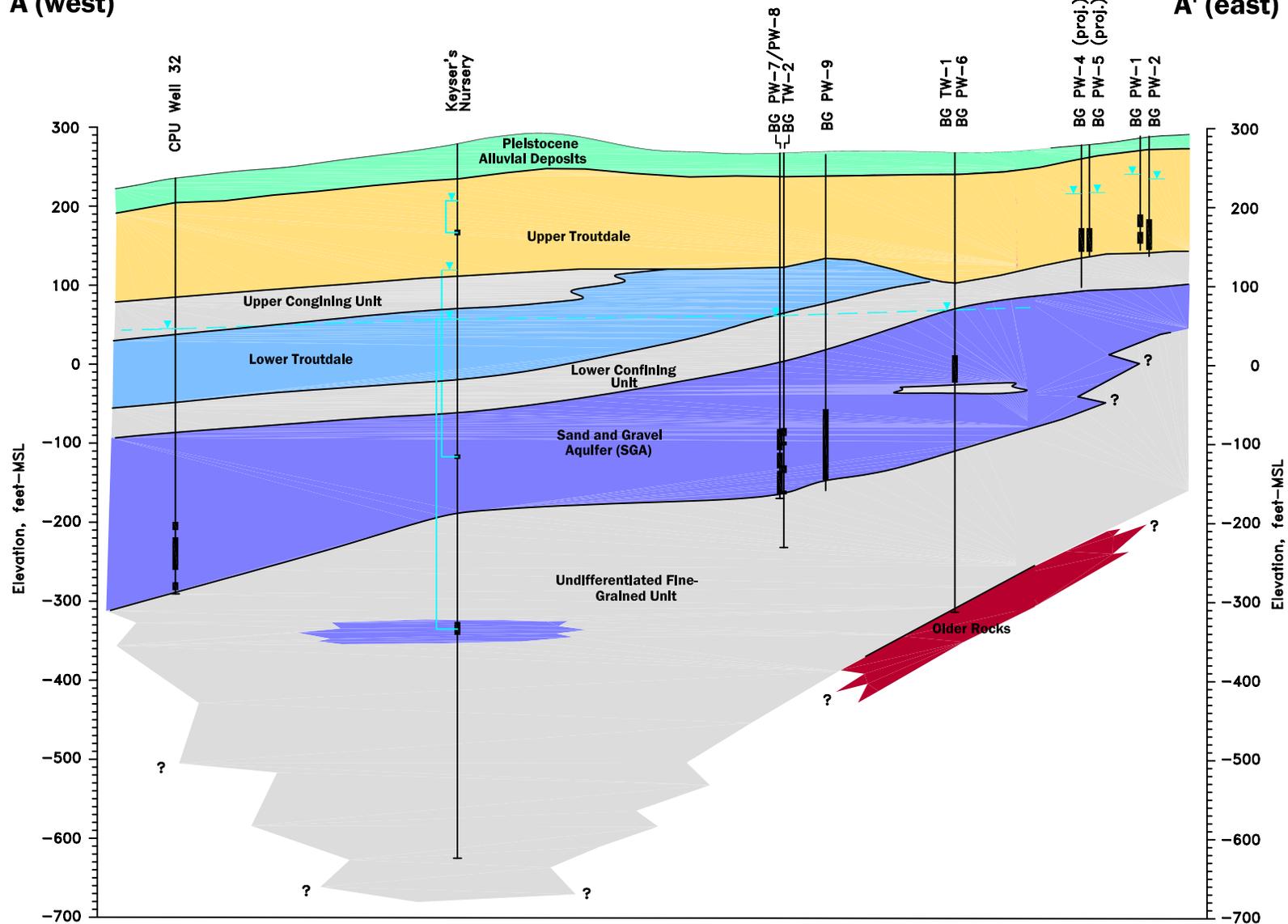
0 2,000 Feet
Map Projected in Washington State Plane, South Zone, NAD83 Datum



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A (west)

A' (east)



LEGEND

- Pleistocene Alluvial Deposits
- Upper Troutdale Aquifer
- Lower Troutdale Aquifer
- Sand and Gravel Aquifer (SGA)
- Confining Units
- Older Rocks

Well Completion Details

- Static Water Level
- Open Interval

Piezometric Surface for Sand and Gravel Aquifer

Vertical Scale in Feet
 0 100 200
 Horizontal Scale in Feet
 0 1000 2000

Figure 2
Hydrogeologic Profile A-A'

Battle Ground
 Wellhead Protection Plan - 2012



Figure 3
Wellhead Protection
Capture Zones

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 City of Battle Ground



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 Pacific Groundwater
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● Battle Ground Supply Well

□ Taxlots

SGA Capture Zone Modeling

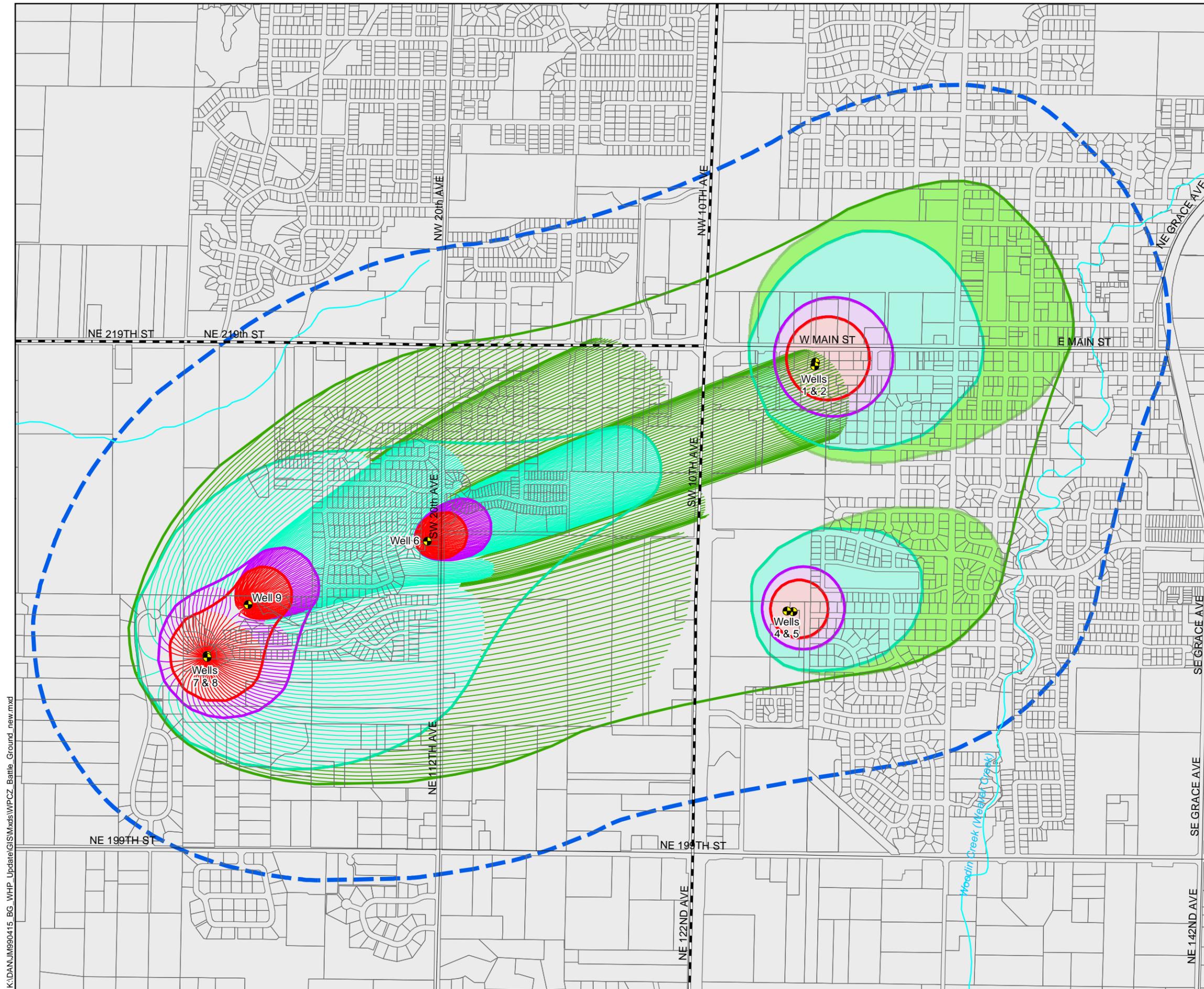
- 0 to 6 Month Particle Trace
- 6 to 12-Month Particle Trace
- 1 to 5-Year Particle Trace
- 5 to 10-Year Particle Trace

Upper Troutdale Aquifer Modeling (Swanson, 1993)

- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- 10 Year Capture Zone

Extended Wellhead Protection Capture Zones

- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- 10 Year Capture Zone
- 1000-foot Buffer



0 1,000
 Feet

Map Projected in Washington State Plane, South Zone, NAD83 Datum

Figure 4
Zoning and Parcels of Concern

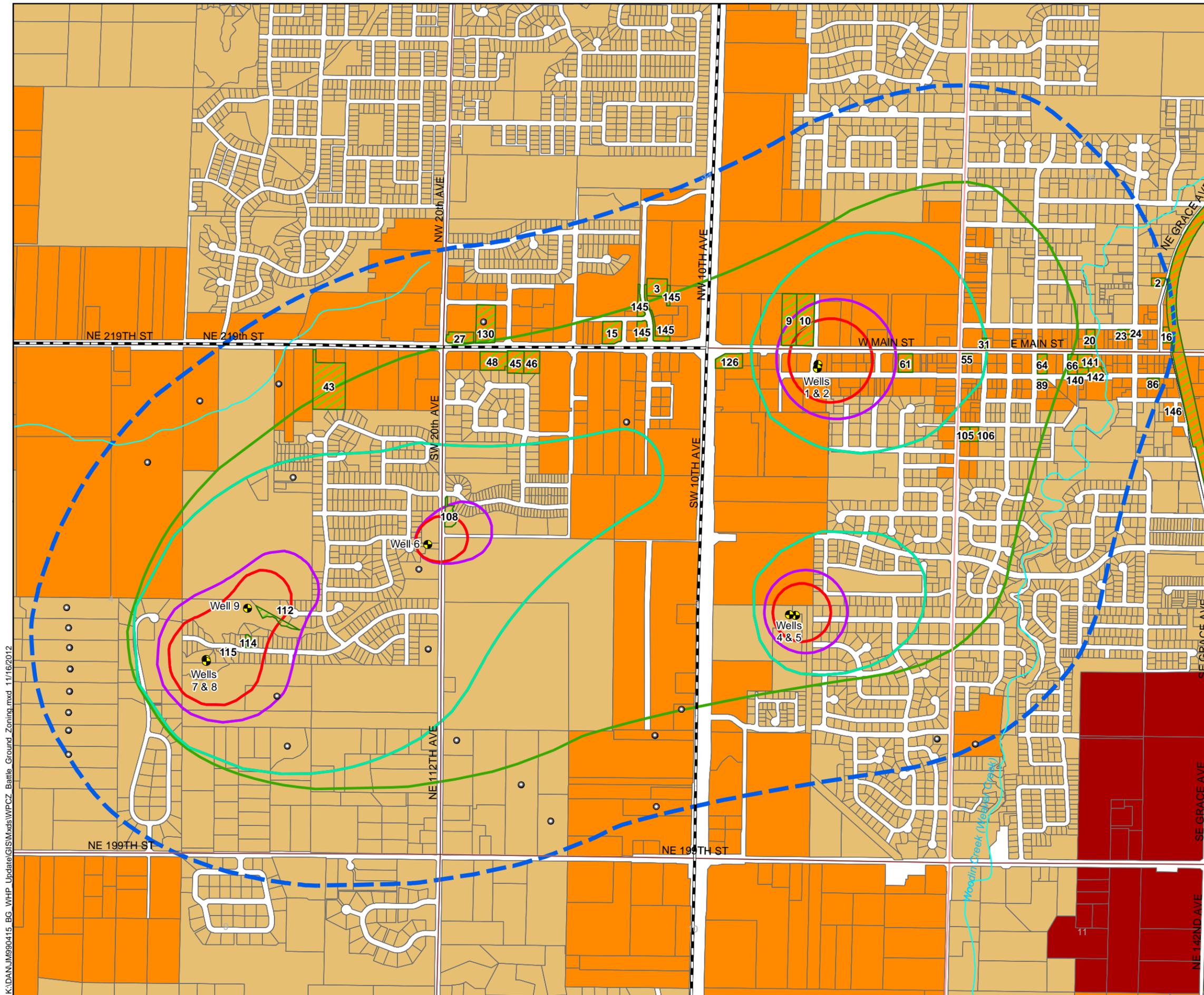
Prepared for
City of Battle Ground



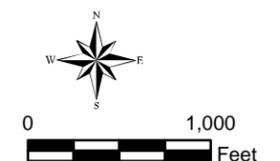
Prepared by
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Group



- Battle Ground Supply Well
 - 86 Parcels of Concern
 - Septic Systems (from County)
- Zoning Categories
- Industrial
 - Residential
 - Commercial
 - Park/OS/Public
- Extended Wellhead Protection Capture Zones
- 6 Month Capture Zone
 - 1 Year Capture Zone
 - 5 Year Capture Zone
 - 10 Year Capture Zone
 - 1000-foot Buffer



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Map Projected in Washington State Plane, South Zone, NAD83 Datum

Figure 5
Environmental Sites within
Wellhead Protection Capture Zones

Prepared for
 City of Battle Ground



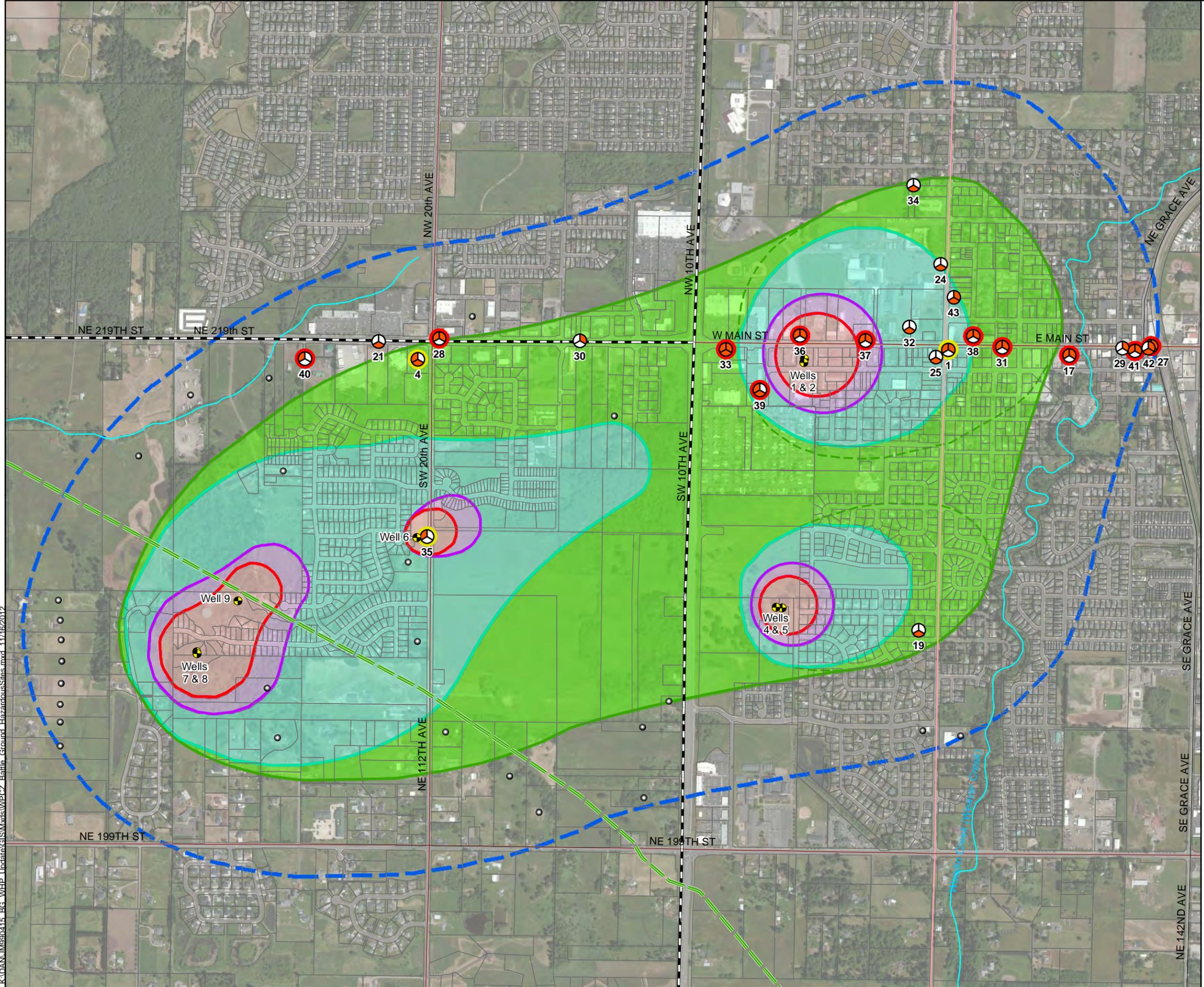
Prepared by
 Pacific Groundwater
 Group



- Battle Ground Supply Well
- DOE Sites of Concern**
 - Known Release
 - Known Release (No Further Action)
- Table 5 ID → → UST/LUST
- Cleanup Site → → Hazardous Materials

Refer to Section 4.3 and Table 5 for description.

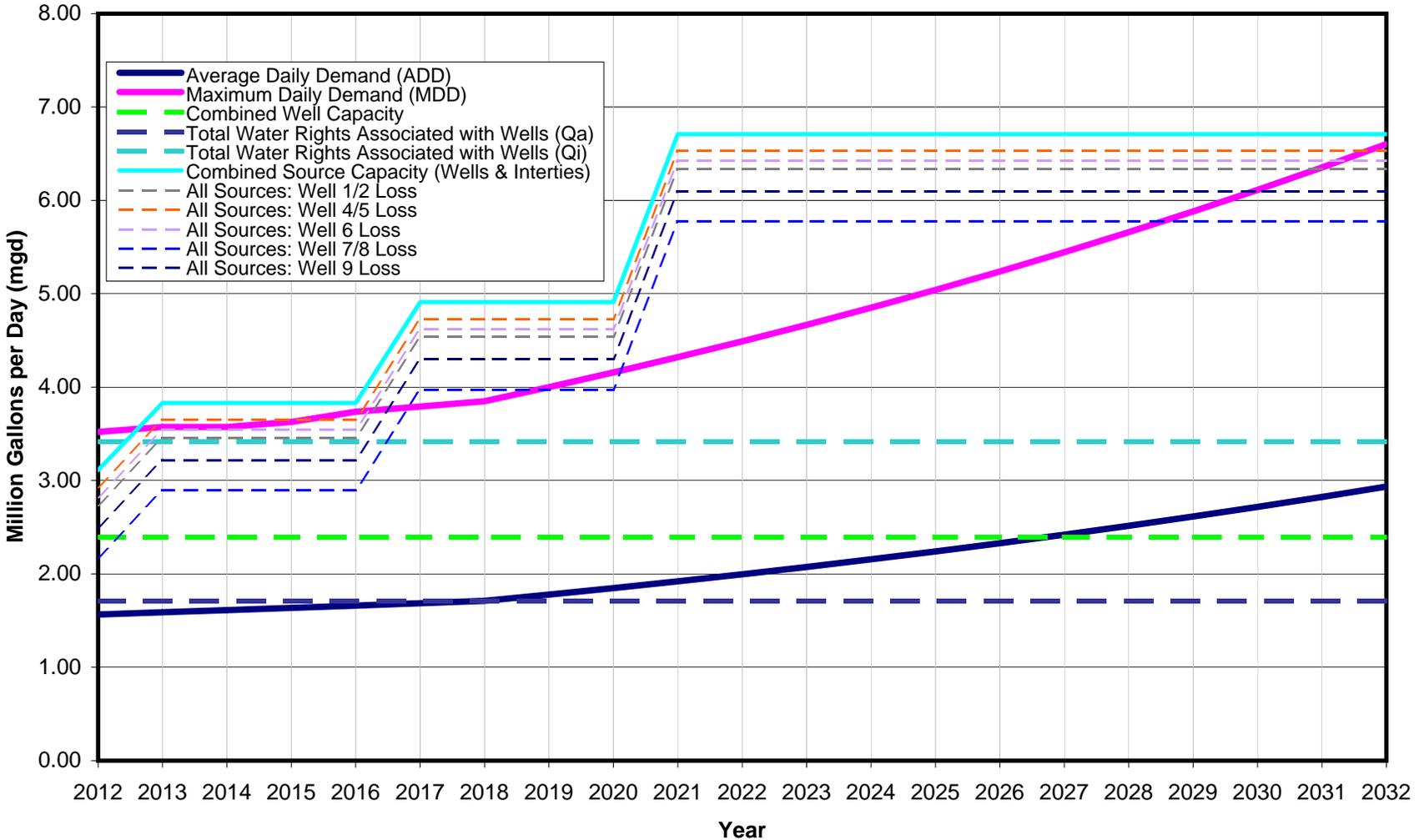
- Septic Systems (from County)
- Gas Transmission Pipelines
- Wellhead Protection Capture Zones**
 - 6 Month Capture Zone
 - 1 Year Capture Zone
 - 5 Year Capture Zone
 - 10 Year Capture Zone
 - 1000-foot Buffer



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Map Projected in Washington State Plane, South Zone, NAD83 Datum

Figure 6
City of Battle Ground
Source of Supply Scenarios vs. Demand



APPENDIX A

DOCUMENTATION OF WELLHEAD PROTECTION PROGRAM NOTIFICATIONS

Wellhead Protection Guidance (WDOH, 2010) states that within one year after defining the wellhead protection area boundaries, the water system must notify the identified potential contaminant sources—and the agencies or jurisdictions that regulate them—that they are in the wellhead protection area. Notification must be in writing. The water system must maintain documentation of the required notifications.

PGG recommends that the City send letters out to all “parcels of concern” listed on **Table 4** (addresses are included on the Table), all environmental sites listed on **Table 3** (addresses are listed on **Table A-1**), and relevant agencies. A sample letter for the parcels of concern and the environmental sites is included below, followed by sample letters for Ecology, the Police Department and the Fire Department. Letters to these three agencies should be accompanied by the map of environmental sites (**Figure A-1**). The letter to Ecology should also be accompanied by **Table A-1**.

Sample Letter to Potential Source Owners/Operators:

Date

Address of local business (*see Table 4 or Table A-1*)

Re: City of Battle Ground Wellhead Protection Plan

To Whom It May Concern:

The City of Battle Ground has developed a Wellhead Protection Plan to help maintain drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA). The Plan also requires an inventory of potential sources of groundwater contamination within these wellhead protection areas.

The primary purpose of this letter is to notify you that your facility is located within our WHPA. Since your business or the activities conducted at your facility may involve the use of chemicals (e.g., gasoline, underground storage tanks, hazardous waste, etc.), and the potential exists that a chemical spill from your facility may adversely impact the city drinking water supply, please notify the City of Battle Ground immediately if a chemical spill occurs at your facility. All spills should be reported by dialing 911 and requesting that the City of Battle Ground Fire Department and Southwest Washington Health Department be contacted.

Thank you for assisting us in protecting our water supply and groundwater resources. If you have any questions, please contact me at (360) 772-1283.

Sincerely,

Elaine Huber, P.E.
Operations Manager
City of Battle Ground

Sample Letter to Ecology:

Date

Department of Ecology
Southwest Regional Office
PO Box 47775
Olympia, WA 98504-7775

Re: City of Washougal Wellhead Protection Plan

Dear Department of Ecology:

The City of Battle Ground has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

The enclosed map depicts the WHPA boundary, source wells, and identified potential contaminant sources. Also enclosed is a table with names and location information for each site. Please review the map and use it as a reference when inspecting and permitting the storage, use, and disposal of hazardous material within our WHPA.

Please note that the City of Battle Ground has sent notices to each of these properties informing them of their location within the WHPA boundary. The City has also sent similar letters to properties with land uses that could contaminate groundwater quality.

Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 772-1283.

Sincerely,

Elaine Huber, P.E.
Operations Manager
City of Battle Ground

Sample Letter to Police Department:

Date

Bob Richardson, Police Chief
Battle Ground Police Department
507 S.W. 1st St.
Battle Ground, WA 98604

Re: City of Battle Ground Wellhead Protection Plan

Dear Chief Richardson:

The City of Battle Ground has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

As part of this Plan, the city must provide wellhead protection information to agencies responsible for incident/spill response procedures. It is important that you are aware of where potential contaminant releases could adversely impact the quality of our communities drinking water supply.

A map of the wellhead protection areas and adjacent transportation routes is enclosed for your review. An acknowledgement of receipt of this information or a response from your office as part of our wellhead protection plan documentation would be appreciated.

In the event of a spill or contaminant release, we would ask that you notify immediately us and the Department of Ecology, so that we can take appropriate measures to deal with the problem.

Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 772-1283.

Sincerely,

Elaine Huber, P.E.
Operations Manager
City of Battle Ground

Sample Letter to Fire Department:

Date

Chief Dennis Mason
Clark County Fire District No. 11
21609 NE 72 AVE
Battle Ground, WA

Re: City of Battle Ground Wellhead Protection Plan

Dear Chief Mason:

The City of Battle Ground has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

As part of this Plan, the city must provide wellhead protection information to agencies responsible for incident/spill response procedures. It is important that you are aware of where potential contaminant releases could adversely impact the quality of our communities drinking water supply.

A map of the wellhead protection areas and adjacent transportation routes is enclosed for your review. An acknowledgement of receipt of this information or a response from your office as part of our wellhead protection plan documentation would be appreciated.

In the event of a spill or contaminant release, we would ask that you notify immediately us and the Department of Ecology, so that we can take appropriate measures to deal with the problem.

Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 772-1283.

Sincerely,

Elaine Huber, P.E.
Operations Manager
City of Battle Ground

Table A-1: Environmental Site Mailing List for Wellhead Protection Area Notification

Map ID	Facility/Site ID	Cleanup Site ID	Facility/Site Name	Address	City	State	Zip Code	Latitude	Longitude
21	3506334		Albertsons 592	2108 W MAIN ST	BATTLE GROUND	WA	98604	45.780538	-122.560522
25	7256537		Andersen Dairy Inc	305 E MAIN ST	BATTLE GROUND	WA	98604-4501	45.780508	-122.537692
17	23782	5228	Battle Ground Chevron	409 E MAIN ST	BATTLE GROUND	WA	98604	45.780648	-122.53223
31	32749129	5875	Battle Ground Farm & Home	106 MAIN ST E	BATTLE GROUND	WA	98604-4516	45.78084	-122.53499
41	90426683	11004	Battle Ground Inn	711 E MAIN ST	BATTLE GROUND	WA	98604	45.78083	-122.52955
27	9977600	5509	Battle Ground Mini Mart 805	813 W MAIN ST	BATTLE GROUND	WA	98604	45.780972	-122.528889
24	7134825		Battle Ground School District 119	300 NORTH PARKWAY	BATTLE GROUND	WA	98604	45.783163	-122.537596
37	81695495	10621	Battle Ground School District 119	204 MAIN ST W	BATTLE GROUND	WA	98604-9109	45.78093	-122.54059
28	15491331	5582	Battle Ground Utility Trench Scott Bros	1912 W MAIN	BATTLE GROUND	WA	98604	45.78067	-122.55804
32	37223232		Cenex Harvest States Old Station	210 SE 1ST ST	BATTLE GROUND	WA	98604-8316	45.781343	-122.538806
36	73713224	7120	CFM Site	510 W MAIN	BATTLE GROUND	WA	98604-0458	45.78102	-122.54328
42	92132423		Dorsey Bus Service Inc Main St E	1017 MAIN ST E	BATTLE GROUND	WA	98604-4549	45.780917	-122.528998
38	82713854	10658	Draper Cf Dba Drapers City Cleaners	114 MAIN ST E	BATTLE GROUND	WA	98604-0417	45.78113	-122.53619
39	86416754	578	Graces Cleaners	717 W MAIN	BATTLE GROUND	WA	98604	45.780563	-122.545009
33	58523474	9812	Jacksons Food Stores 500	917 W MAIN	BATTLE GROUND	WA	98604	45.78057	-122.5463
29	25875197		Lewis Rock & Redi Mix Inc Main St	915 MAIN ST E	BATTLE GROUND	WA	98604-0100	45.780897	-122.530058
34	64531412		Parkway North Health Care Nurs	404 N PARKWAY	BATTLE GROUND	WA	98604	45.7854	-122.53879
43	99375277		QWEST Communications Battleground CDO	BEACH ST BTWN 1ST & MAIN	BATTLE GROUND	WA	98604	45.78223	-122.53702
35	71217895	3703	Sholund Family Farm	20806 NE 112TH AVE	BATTLE GROUND	WA	98604-7409	45.774999	-122.558333
1	1051	4980	Union 76	13 E MAIN ST	BATTLE GROUND	WA	98604-4522	45.78072	-122.53719
4	4282	11627	Vancouver Clinic Battle Ground	2005 W MAIN ST	BATTLE GROUND	WA	98604	45.780055	-122.558897
30	31157289		Village Mart	16 NW 13TH AVE	BATTLE GROUND	WA	98604-4379	45.780707	-122.552288
40	89645195	3708	WA DOT Battle Ground	10707 NE 219TH ST	BATTLE GROUND	WA	98604	45.77999	-122.56352
19	1577475		Williams Gas Pipelines Northwest Pipeline	2513 SW 11TH ST	BATTLE GROUND	WA	98604	45.77269	-122.53811

Figure A-1
Environmental Sites within
Wellhead Protection Capture Zones

Prepared for
 City of Battle Ground

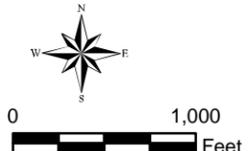
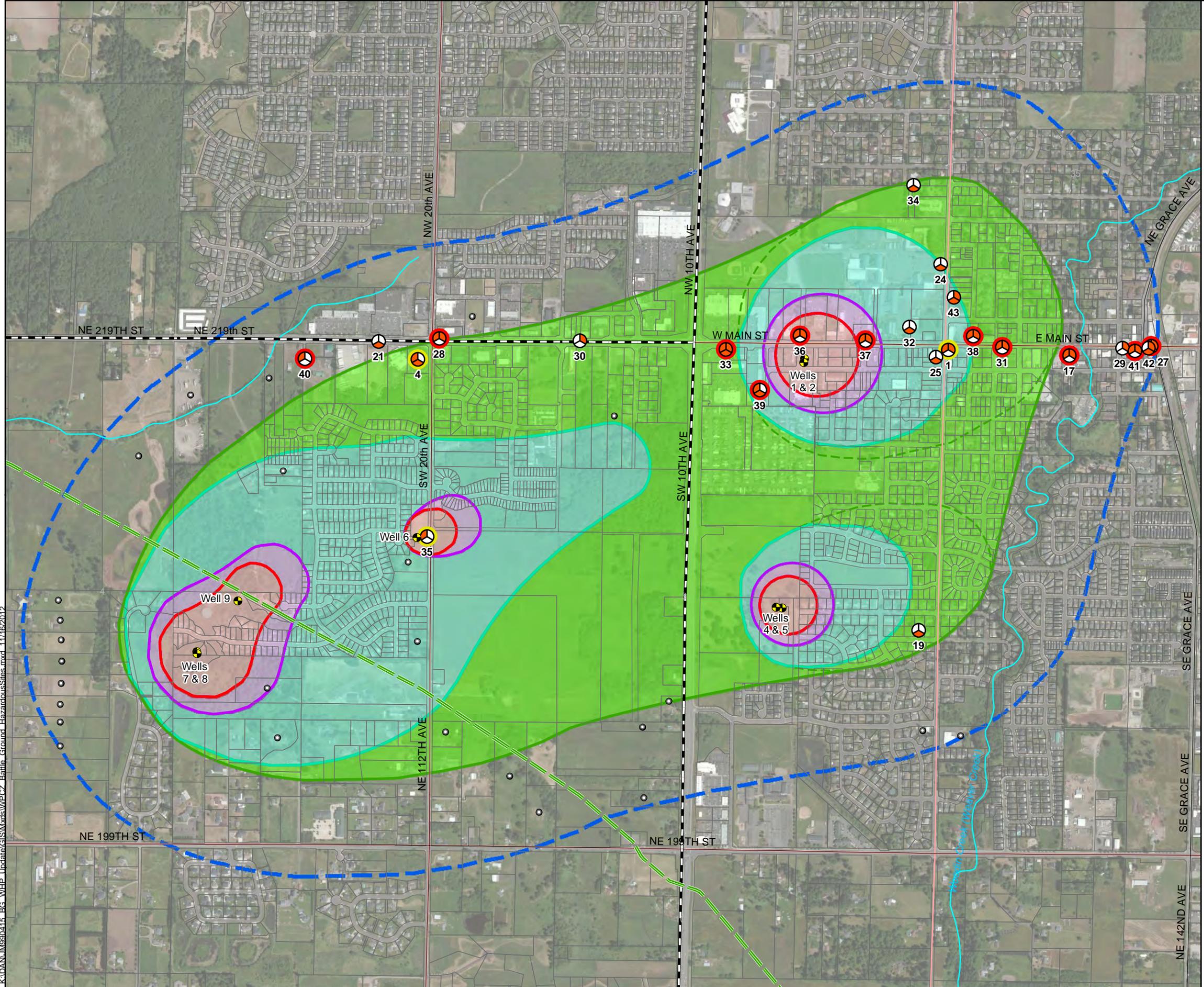


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 Pacific Groundwater
 Group



- Battle Ground Supply Well
 - DOE Sites of Concern**
 - Known Release
 - Known Release (No Further Action)
 - Table 5 ID → → UST/LUST
 - Cleanup Site → → Hazardous Materials
- Refer to Section 4.3 and Table 5 for description.

- Septic Systems (from County)
- Gas Transmission Pipelines
- Wellhead Protection Capture Zones**
 - 6 Month Capture Zone
 - 1 Year Capture Zone
 - 5 Year Capture Zone
 - 10 Year Capture Zone
 - 1000-foot Buffer



Map Projected in Washington State Plane, South Zone, NAD83 Datum

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SECTION 6

OPERATION AND MAINTENANCE PROGRAM

Water System Management and Personnel

Management of the City of Battle Ground's (City's) Water System is led by the City Council with each member serving staggered 4-year terms. The Public Works Director (Director) leads the public works department which includes the water system. The Director reports to the City Manager. Key public works personnel are as follows:

- Public Works Director
- City Engineer
- Associate Civil Engineer
- Engineering Technician II
- Operations Manager
- Public Works Supervisor

Public Works Director

The Public Works Director is ultimately responsible for all functions of the public works department including water, wastewater, streets, storm drainage, fleet, facilities and parks. The Director has the authority to implement both daily and long range water utility policy in a manner most beneficial to the water utility and its customers. The Public Works Director evaluates and selects long range water utility planning programs for conformance with the water utility goals, objectives, and budgetary constraints.

City Engineer, Associate Civil Engineer

The engineering positions are responsible for all system design as well as plan and specification review for customer and utility improvement projects. The engineers manage all capital improvement projects from planning to construction. The City Engineer handles requests for customer service, develops engineering drawings and coordinates construction of new services.

Engineering Technician II

The Engineering Technician coordinates and inspects the installation and repair of mains by contractors hired by the water utility. This individual oversees the laying of all new water mains, system tie-ins, installation of services, and pressure tests to ensure that all material and work conforms to the water utility's standard specifications.

Operations Manager

The Operations Manager is responsible for daily field operations, employee safety, and budget management for the Public Works Operations Center, including the water department. The Operations Manager oversees scheduling and dispatching of all crews, equipment, and material

for water utility operations. This position is also responsible for all Washington State Department of Health (DOH) water sampling and reporting, follow up on water system complaints, and implementation of maintenance and safety training programs for the water utility.

Public Works Supervisor

The Public Works Supervisor manages the operation and maintenance of all aspects of the water system. These duties include overseeing the water meter program, late shift duties, the cross connection control program, distribution system maintenance, water quality sampling, crew training, and customer inquiries. The supervisor is responsible for scheduling, monitoring, and testing of the distribution system and all sources of supply. This individual has an understanding of the DOH water testing regulations and reporting requirements for the system. This position is recognized by the DOH as being in charge of the daily operational activities of the water system and carries a Water Distribution Manager (WDM) III certification as required by DOH.

Waterworks Certification

In accordance with Chapter 246-290 WAC, Waterworks Operator Certification, all public water systems with more than 100 services are required to have a certified operator. Certified personnel are required for positions in charge of managing the water system and positions assigned to the lead responsibility for monitoring or improving water quality.

The City's water operations staff currently includes personnel with WDM, Water Distribution Specialist (WDS) and Cross Connection Control Specialist (CCS) certifications as summarized in Table 6-1. Battle Ground is working with DOH to identify the appropriate treatment plant operator certification level for the City's existing iron and manganese treatment and Wells 6, 7, 8 and 9. Once this determination is complete, Battle Ground will proceed with obtaining the required Water Treatment Plant Operator (WTPO) certification.

**Table 6-1
Water System Operator Certifications**

Operator Name	Certifications	Certificate Number
Cal Newton – Public Works Supervisor	WDM III, WDS II	3445
Shawn Scott	WDS, WDM I and CCS	5700
Don Risto	WDM II, CCS	10303
Chuck Kraus	WDS	7761
Ron Buma	WDS, CCS	7373
Bobby Miller	WDS	11621

System Operation

System Overview

As presented in Section 1, the City has eight (8) wells, six (6) reservoirs, and two (2) booster pump stations. Wells 1, 2, 4, 5 and 6 all pump to the Tukes Mountain Reservoirs which supply the Main Pressure Zone by gravity. Wells 7, 8 and 9 pump to the Horsethief Reservoir. The Horsethief Pump Station supplies water from the Horsethief Reservoir up to the Tukes Mountain Reservoirs. The Tukes Mountain Pump Station pumps water from the Main Pressure Zone to supply the homes on Tukes Mountain that are too close in elevation to the reservoirs to receive adequate pressure by gravity. Greater than 95 percent of all water system connections are in the Main Zone, served by gravity from the Tukes Mountain Reservoirs, which are operated at a nominal hydraulic grade of 544 feet. High service pressures in the Main Zone require individual pressure reducing valves (PRVs) on all service connections with pressure over 80 pounds per square inch (psi) at the meter.

The City maintains one (1) active supply connection to adjacent water provider Clark Public Utilities (CPU) at NE 199th Street (SW Eaton Boulevard) and SW 10th Avenue (SR503) at the Maple Grove School. This intertie has been used in recent years as an emergency source during periods of peak summertime demand. The City has a second emergency connection to CPU at NE Grace Avenue (142nd Avenue) and NE 10th Street. The City’s former connection to the City School District has been abandoned. The City is currently planning a new intertie with CPU on NE 219th Street at the water service area’s western boundary. The City has received DOH project review and approval for this improvement. This project is expected to begin construction as soon as other local permitting and access approvals have been completed.

Routine Operation

The City has an automated telemetry system that monitors and operates the water system, including signaling wells and booster pumps to turn on and off based on predetermined settings such as reservoir water levels. This telemetry system is monitored by CPU at their Operations

Center at 8600 NE 117th Avenue. Remote screens at the Battle Ground Operations Center allow City staff to monitor the telemetry system and intercept alarms or otherwise note water system operating conditions.

Well pumps are turned on as needed to maintain reservoir levels. The City uses Wells 7, 8 and 9 as the primary wells, followed by Wells 1 and 2 and then Wells 4 and 5. Well 6 is not operated due to high levels of iron bacteria, except for high demand periods in the summer. Wells 7, 8 and 9 fill the Horsethief Reservoir during the day. During normal operation the Horsethief Pump Station supplies water from the Horsethief Reservoir to the Tukes Mountain Reservoirs in the evening. The Tukes Mountain Pump Station is operated based on demand in the Tukes Mountain Pressure Zone. This pumping schedule allows the City to operate pumps during non-peak power times. During high water demands the wells and booster pumps operate as needed to keep the reservoirs as full as possible.

Operation and Maintenance Procedures

Table 6-2 lists the major water system components along with operation, maintenance, and equipment information about each component.

**Table 6-2
Operation and Maintenance Table**

Component	Operations	Maintenance	Equipment
Wells 1, 2 and 6	<ol style="list-style-type: none"> 1) Daily flowmeter readings 2) Daily inspection for leaks 3) Refill sodium hypochlorite tanks as needed 	<ol style="list-style-type: none"> 1) Repair leaks as needed 2) Repair any problems with sodium hypochlorite ASAP 3) Maintain well buildings 4) Maintain pumps per specs 	<ol style="list-style-type: none"> 1) Well Pumps 2) Disinfection system 3) Telemetry Equipment 4) Pipes and accessories 5) Sodium hypochlorite tanks
Wells 4, 5, 7, 8 and 9	<ol style="list-style-type: none"> 1) Daily flowmeter readings 2) Daily inspection for leaks 3) Add sodium hypochlorite as needed 	<ol style="list-style-type: none"> 1) Repair leaks as needed 2) Repair any problems with sodium hypochlorite ASAP 3) Maintain well buildings 4) Maintain pumps per specs 	<ol style="list-style-type: none"> 1) Well Pumps 2) Disinfection system 3) Telemetry Equipment 4) Pipes and accessories 5) Sodium hypochlorite tanks
Reservoirs	<ol style="list-style-type: none"> 1) Daily inspection for leaks, vandalism, intrusion, etc. 2) Daily recording of reservoir levels 	<ol style="list-style-type: none"> 1) Clean reservoir every 3-5 years. Use divers to eliminate the need to take reservoirs out of service. 2) maintain vents, overflows, and other components in proper working condition 	<ol style="list-style-type: none"> 1) Reservoir floats 2) Vent screens 3) Overflow and drainage systems 4) Telemetry equipment
Horsethief Booster Pumps	<ol style="list-style-type: none"> 1) Daily flowmeter reading. 2) Daily inspection for leaks, proper valve operation, etc. 	<ol style="list-style-type: none"> 1) Maintain pumps and valves per manufacturer specs 2) Repair any leaks or worn out piping, valves, ports, etc. 	<ol style="list-style-type: none"> 1) Booster Pumps 2) Control valves 3) Gate valves 4) Telemetry equipment 5) Flowmeter 6) Pressure transducer
Tukes Mountain Booster Pumps	<ol style="list-style-type: none"> 1) Daily flowmeter reading. 2) Daily inspection for leaks, proper valve operation, etc 	<ol style="list-style-type: none"> 1) Maintain pumps and valves per manufacturer specs 2) Repair any leaks or worn out piping, valves, ports, etc. 	<ol style="list-style-type: none"> 1) Booster Pumps 2) Control valves 3) Gate valves 4) Telemetry equipment 5) Flowmeter 6) Surge tanks

Comprehensive Water Quality Monitoring Plan

The City takes all necessary samples to comply with DOH and the Federal Safe Drinking Water Act (SDWA) and to ensure a safe supply of water for its customers. Water quality sampling requirements are outlined in Table 6-3.

**Table 6-3
Battle Ground Water System (ID#047005)
Water Monitoring Plan**

Parameter	Required	Battle Ground Monitoring	Comments
Inorganic Chemicals (IOC)	Monitor each well every three (3) years	Each well monitored every three (3) years	Monitor per DOH schedule
Volatile Organic Chemicals (VOCs)	Monitor each well every three (3) years or as required by DOH sampling schedule	Each well monitored every three (3) years except Wells 1 and 2 which are tested annually	Monitor per DOH schedule
Synthetic Organic Chemicals (SOCs)	Monitor each well once every nine (9) years with waiver	Currently on a waiver	Renew Waiver as indicated by DOH
Nitrate	Annual testing of each well	Each well monitored annually for nitrate	Monitor per DOH schedule
Lead and Copper	Every three (3) years	Done in 2011, retest in 2014	Monitor per DOH schedule
Disinfection By-Products (TTHM and HAA5)	Stage 2 Compliance Monitoring begins – Oct. 2013	4 samples taken quarterly	Monitor per DOH
Radionuclides	Monitor each well every three (3) years	Each well monitored every three (3) years	Monitor per DOH schedule
Coliform	Monitoring of 20 sites per month from the distribution system	Samples collected monthly according to the Coliform Monitoring Plan	See Appendix E

Water Quality Sampling Procedures

Coliform

The City takes routine monthly distribution samples along with investigative samples for newly constructed water mains. Samples are taken from interior faucets, if possible, which were identified according to a written coliform monitoring plan (See Appendix E). If present, remove strainers and washers from the faucet taps before taking the samples. The sample tap is sprayed with a sodium hypochlorite solution, then flushed for several minutes before taking samples.

Samples are collected in 100 milliliter (ml) bottles, as furnished by the testing lab. These bottles have been sterilized and care is taken not to contaminate the sample by touching either the underside of the cap or the top edge of the bottle or rinsing out the bottle prior to use.

Instructions for taking the sample are on the back of the form. With each sample collected, the person taking the sample completes a lab sample form and sends it to the testing lab within 12 to 24 hours. The sampler needs to fill out the lab form completely, and be sure to indicate the source of the sample, and the type of analysis requested.

Inorganic Chemicals

Samples are taken at the source, before treatment, in two (2) one-quart containers per source. Samples are taken while the well pumps are in operation. These sample containers are provided by the analytical laboratories. The samples are submitted to the lab with sampling forms that are completed at the time of sampling by the person doing the sample collection.

Disinfection By-Products

The water utility is required to collect four (4) trihalomethane (TTHM) and haloacetic acid (HAA5) samples each quarter beginning in October 2013, in compliance with the Stage 2 Disinfectants/ Disinfection By-Products Rule. The City currently collects four (4) samples per year in compliance with the Stage 1 Rule requirements.

Lead and Copper

One (1) round of lead and copper sampling is required every three (3) years, unless DOH provides a waiver. The City does not exceed the action level for these contaminants and has optimized the treatment system for corrosion control. The last round of samples was conducted in 2011, with the next set due in 2014. As with other sampling, the person collecting the sample is responsible for completing the lab form at the time of sample collection.

Organic Chemicals

Volatile organic chemical (VOC) sampling is required once every three (3) years for all wells except Wells 1 and 2 which are currently sampled each year. The City has a waiver from DOH requiring synthetic organic chemical (SOC) sampling once every nine (9) years. That waiver will soon expire and the City plans to retest in order to renew this 9-year waiver.

Radionuclides

Gross alpha chemical sampling is required once every three (3) years from each well, or as otherwise required by the DOH.

Reporting, Follow-up Action and Public Notification

The water utility is required to provide periodic reports to DOH which summarize the results of water quality testing. If a maximum contaminant level (MCL) or maximum residual disinfectant level (MRDL) standard is exceeded, follow-up action is required including consultation with DOH and possible public notification. Follow-up action after exceeding an MCL and procedures for DOH consultation and public notification are specified in WAC 246-290-320, WAC 246-290-480 and 40 CFR 141 Subpart Q respectively.

Contaminants are divided into three tiers of public notification requirements generally based on the potential for adverse effects on human health. Tier 1 public notices are required for contaminants which may cause adverse health effects with short term exposure including fecal coliform and nitrate. Tier 1 notices must be issued within 24 hours of a violation. Tier 2 and 3 public notices are applied to MCL violations whose potential for adverse health effects is more long term and for failure to comply with testing requirements. Tier 2 notices must be issued within 30 days of a violation and Tier 3 notices within one year.

The City will seek assistance and concurrence from DOH in developing appropriate public notifications. At a minimum each notification will state the sampling criteria, identify when the violation occurred, identify what corrective measures have been taken, and inform the customers what, if any, precautionary steps have been taken.

Coliform Monitoring

Groundwater Rule

Source water monitoring is required under the Groundwater Rule when any of the City's routine coliform samples is total coliform positive. Samples are taken at each of the City's wells, prior to treatment, and tested for E. coli within 24 hours of a total coliform positive. If one of these triggered source samples is E. coli positive, DOH will establish corrective action and additional sampling requirements. An E. coli positive source sample will require a Tier 1 public notification and inclusion in the City's annual consumer confidence report (CCR).

Acute Coliform Violation

An acute coliform violation occurs when a water system exceeds the MCL for fecal coliform or E. coli. This means at least one (1) positive routine sample and at least one (1) positive repeat sample, with one (1) of the samples being positive for fecal coliform or E. coli. If any sample is positive for fecal coliform or E. coli then DOH must be notified as soon as possible but no later than 24 hours after the violation is known. If an acute coliform violation occurs the following steps need to be taken:

1. Three (3) samples shall be taken at the following locations:
 - Site of previous sample with a coliform presence
 - Within five (5) active services upstream of site of sample with a coliform presence
 - Within five (5) active services downstream of site of sample with a coliform presence.
2. Notify DOH immediately at (360) 236-3030 during work hours or (877) 481-4901 at all other times. Notify the DOH Coliform Lead (Currently Sandy Brentlinger) at (360) 236-3044.
3. Notify system users within 24 hours using a boil water advisory with mandatory health effects language as shown in CFR 141 Subpart Q Appendix B.
4. Determine possible causes for the violation and correct the situation as soon as possible.

Non-Acute Coliform Violation

A non-acute coliform violation occurs when a water system exceeds the MCL for total coliform, calculated on a monthly basis. The City collects 20 routine samples each month. For systems with less than 40 routine samples monthly, a non-acute violation occurs if two or more routine or repeat samples have coliform present. If a non-acute coliform violation occurs the following steps need to be taken:

1. Notify DOH at (360) 236-3030, by the end of the next business day after determining that the violation occurred. Notify the DOH Coliform Lead (Currently Sandy Brentlinger) at (360) 236-3044.
2. Notify system users as soon as practical, no later than 30 days after the water system determines that a violation occurred.
3. Determine possible causes for the violation and correct the situation as soon as possible.

Inorganic Chemical and Physical Substances

Follow-up action for inorganic chemical and physical substances is dictated based on whether the substance is a primary or secondary contaminant. Primary contaminants generally present a greater risk to human health with a short-term exposure. Nitrate, a primary contaminant, has specific follow-up action outlined in *WAC 246-290-320*.

Primary inorganic chemicals for a groundwater system like Battle Ground's include:

- antimony
- arsenic
- asbestos
- barium
- beryllium
- cadmium
- chromium
- cyanide
- fluoride
- mercury
- nickel
- nitrate
- nitrite
- selenium
- sodium
- thallium

Secondary inorganic chemical and physical substances include:

- chloride
- color
- hardness
- zinc
- iron
- manganese
- specific conductivity
- silver
- sulfate
- total dissolved solids

Inorganic Substances Other Than Nitrate

If any routine sampling result for a primary inorganic chemical exceeds the MCL, a confirmation sample needs to be taken at the same sampling point as soon as possible but not to exceed two (2) weeks following the routine sample. Compliance will be based on an average for the routine and confirmation sample results. If an MCL is exceeded for a primary inorganic chemical, contact DOH within 48 hours and provide a Tier 2 public notification as soon as practical but no later than 30 days after the violation is known. DOH will provide guidance on additional sampling and/or repeat public notifications as needed for primary inorganic chemical MCL violations. If a secondary inorganic chemical or physical substance MCL violation occurs, the City will consult with DOH to determine what follow-up action is required.

The City has two (2) treatment systems for the secondary inorganic chemicals iron and manganese. Monthly testing is required for iron and manganese at each source, after treatment but before the water enters the distribution system. If iron and/or manganese levels exceed the secondary MCL four (4) months or more out of the year then DOH needs to be notified and follow up action may be needed.

Nitrate

If an annual nitrate sample result is five (5) milligrams per liter (mg/l) or greater, then quarterly sampling at that site will be required for at least one (1) year. Sampling can be reduced to annually by the state if four (4) consecutive quarterly samples are reliably below the MCL of 10 mg/l.

If a nitrate sample exceeds the MCL of 10 mg/l, then a confirmation sample needs to be taken within 24 hours. Compliance with the MCL will be based on the average of the two (2) results. If the MCL is exceeded the following steps need to be taken:

1. Begin consultation with DOH as soon as possible, but no later than 24 hours after the violation is known
2. Provide public notification within 24 hours by area radio and television stations
3. Develop a plan to either treat the contaminated water or discontinue use of the source
4. Provide additional public notification as established through consultation with DOH

Disinfection By-Products

When the annual running average for TTHMs is greater than 80 micrograms per liter (ug/l) or for HAA5s is greater than 60 ug/l, the system is in violation and a Tier 2 public notification is required within 30 days. The system will consult with DOH regarding follow up action, including public notification and additional monitoring as required.

Lead and Copper

The City is currently in compliance with the testing requirements of the Lead and Copper Rule, with a current 5-year testing waiver from the DOH.

The general public notification requirements of the SDWA also apply to the Lead and Copper Rule. Tier 2 notification is required for violations of treatment techniques. Tier 3 notification is triggered by failure to comply with testing and monitoring requirements.

Organic Chemicals

If any routine sample of a synthetic or volatile organic chemical (SOC or VOC) posts a detection exceeding 0.0005 mg/l, then quarterly sampling will be required for that sampling point. If one (1) or more of the two (2) carbon organic chemicals are detected (trichloroethylene, tetrachloroethylene, cis-1,2 dichloroethylene, trans-1, 2-dichloroethylene, and 1,1-dichloroethylene) then vinyl chloride sampling will be required for that source. Quarterly sampling may be reduced to annually by the state if a minimum of two quarterly samples show organic chemicals to be reliably and consistently below the MCLs. If the City has three (3) annual samples with no detections they will apply to the state for a waiver.

When sampling quarterly, an MCL violation is determined by the running annual average for each sampling point. When monitoring annually or less frequently, a detection of organic chemicals will trigger quarterly sampling, the system is then considered in violation if the running average for one year of sampling exceeds an MCL. With any routine sample organic chemical detection, DOH may require a confirmation sample. The average of the routine and confirmation sample are used to determine compliance.

DOH must be consulted within 48 hours of a detection exceeding 0.0005 mg/l to establish required follow-up monitoring. If an MCL violation occurs as described in the previous paragraph, a Tier 2 public notification is required as soon as practical but no later than 30 days after the violation is known. If the City does not follow required monitoring and testing procedures, a Tier 3 public notice is required within one year.

Radionuclides

If a gross alpha sample is greater than five (5) picocuries per liter (pCi/L) notify DOH and conduct follow up sampling as requested by DOH. An MCL exceedance will require a Tier 2 public notification.

Disinfection

The City doses the water at all their wells with sodium hypochlorite to disinfect and provide a chlorine residual in the water system. The City is required to monitor the residual in the water system every day, and to provide monthly reports to DOH. Measurable chlorine residual must be present in all parts of the distribution system.

Emergency Response Plan

The water utility has developed an Emergency Response Plan that is capable of reacting to major or catastrophic system malfunctions, in accordance with WAC 246-290 Emergency Measures. The development, publication, and wide distribution of standard operating procedures, emergency alert rosters, and contingency planning are essential elements of the overall Emergency Response Plan. The plan describes an organizational and communications network that has sufficient flexibility to respond to the wide range of emergency conditions.

Introduction

The Emergency Response Plan is intended to guide public works employees in restoring water service during a major emergency. A major emergency is an event that results in loss of water to a large service area or numerous small areas, and requires the total mobilization of the public works department and outside agencies and resources to restore service. Emergencies may result from natural causes of extreme intensity, duration, and extent or from man-made events, such as civil disorder or system contamination.

During a declared emergency condition, all the water system operations will be carried out through the Water Command Center, located within the Operations Center. The functions of the water staff and their locations during an emergency are summarized in the following paragraphs. Table 6-4 presents a list of contacts to be used during a City emergency. A summary of system components potentially impacted by various types of emergencies is shown in Table 6-5.

**Table 6-4
Water System Emergency Contact List**

Description	Contacts	Phone Number
City Hall	City Manager	(360) 342-5000
Public Works Department	Public Works Director	(360) 342-5075
On Call Cell Number (635-7076)	Public Works Operations Manager, Water Supervisor, Water Operations	(360) 342-5355
Clark County Health Water Program	County	(360) 397-8428
CPU Water Operations	CPU Water Staff	(360) 992-8022
ODW Southwest Region	Regional Engineer	(360) 236-3035
ODW Emergency Hotline	After Hours and Weekends	(877) 481-4901

**Table 6-5
Potential Disaster Effects**

Disaster Type	Wells	Storage	Transmission Network	Distribution System	Telemetry & Control	Power Supply Systems
Earthquake	x	x	x	x	x	x
Severe Windstorm	x	x			x	x
Ice/Snow Storm (Freezing Conditions)	x	x		x	x	x
Flooding	x		x	x		x
Fire	x	x			x	x
Volcanic Eruption	x	x	x	x	x	x
Drought	x					
Water Supply Contamination	x	x	x	x		
Water Main Break	x	x	x	x	x	x
Vandalism	x	x	x	x	x	x
Explosion/Bomb	x	x	x	x	x	x
Nuclear Warfare	x	x	x	x	x	x

Inventory status report and list of material suppliers are to be kept up-to-date and readily accessible to avoid unnecessary delay in restoration of service. Throughout the emergency, voice contact will be maintained between work crews, the Public Works Supervisor, the Public Works Operations Manager, and other key personnel to enhance coordination of work efforts. It is important that the Public Works Director and City Hall are kept apprised of the emergency to permit proper public notification.

Boil Water Advisories

Events Requiring Boil Water Advisory

Boil water advisories are established in response to a repeat positive sample for fecal coliform bacteria according to the sampling procedures described in the City's Coliform Monitoring Plan in Appendix E of this Water System Plan. Emergencies such as floods, earthquakes, and other disasters can result in damage to water system infrastructure, thereby also warranting a boil water advisory as a cautionary measure.

Initiating Advisory

Chain of Command

The Public Works Supervisor (Supervisor), upon receiving notice of a repeat positive coliform sample or qualifying emergency, is responsible for immediately contacting the Operations Manager and Public Works Director (Director) and consulting with the Washington State Department of Health Office of Drinking Water (DOH). The Director is responsible for issuing a boil water advisory based on the evidence presented by the Supervisor and direction provided by DOH. In the Director's absence, the City Engineer is responsible for issuing boil water advisories.

DOH contacts for Drinking Water Emergencies:

- During business hours: Southwest Regional office (360) 236-3030
- After hours emergency hotline: (877) 481-4901

Public Notification

DOH will be consulted prior to release of information to the public. A consensus will be reached with DOH regarding information to be released and actions to be taken. It is important not to release conflicting information so as not to confuse the public. Clark County Public Health will be notified of the boil water advisory prior to public notification so they may respond to potential public inquiries.

Clark County Public Health Contacts:

- During business hours: (360) 397-8428
- After hours emergency hotline: (888) 727-6230

As a courtesy, Clark Public Utilities (CPU) should also be informed of a boil water advisory from Battle Ground as some City residents receive their water from CPU and may be confused about what action they need to take.

Boil water advisories are issued to the public through radio, television and newspapers using the Flash Alert Assistance program for the local area.

- www.flashalert.net
- (360)834-1953

Public notification is also displayed prominently on the City's website. Citizens who have signed up for the City's emergency alert option will receive an automatic e-mail message. Door hangers with the advisory information may be provided to residents in the affected area at the Director's discretion.

An initial press release will be issued following initiation of a boil water advisory to inform the public of the situation, action being taken by the City to resolve it and action the public needs to take to protect their health. Consolidated press releases, announced on morning and evening television and radio news broadcasts, will also be used to keep the public informed of any updates. Press releases, public notification flyers and related document templates are available in the DOH's Coliform Public Health Advisory Packet:

<http://www.doh.wa.gov/ehp/dw/Coliform/coliform.htm>

Lifting Advisory

Criteria for Lifting Advisory

The City will repair any infrastructure damage identified as the possible source of contamination, disinfect the related facilities and/or flush distribution system piping as needed. Once repair and disinfection is complete, a boil water advisory will be rescinded following two consecutive days of no detection of coliform bacteria in the system.

Chain of Command

The Director is responsible for rescinding a boil water advisory. In the Director's absence, the City Engineer is responsible for lifting boil water advisories.

Public Notification

Once the boil water advisory is rescinded, a notice is developed to inform the public regarding appropriate measures for use of the water supply including flushing of pipes and fixtures as required.

Follow-up

A thorough investigation of the contamination source should be conducted and strategies developed to avoid similar future occurrences. The public should be informed and given updates regarding investigation findings in order to restore confidence in the quality of water provided by the City.

The City is required to submit a Public Notice Certification form to the DOH within 10 days of initiating the boil water advisory. The form is available from DOH as Form #331-264. It is also included in the DOH's Coliform Public Health Advisory Packet:

<http://www.doh.wa.gov/ehp/dw/Coliform/coliform.htm>

Major Emergency During Non-Working Hours

All water system staff will report and attend to their assigned trouble centers. Water system crews will report to work only upon notification. The notification can occur by phone, person, or media broadcasts.

Sequence of Events

1. Declaration of a major emergency by the City Manager
2. Dispatch notified of water outage and area
3. Dispatch notifies crew person on the on-call list
4. Crew person investigates and determines severity and extent of outage
5. Public Works Operations Manger or Public Works Supervisor notifies Public Works Director of emergency. If Public Works Director cannot be reached, Public Works Operations Manager or Public Works Supervisor notifies the City Engineer, who makes the decision on the declaration of an emergency. If the Public Works Director or City Engineer are not available then the Public Works Operations Manager or Public Works Supervisor may declare an emergency of the water utility.
6. Emergency stations are manned. Highest level staff member notifies City Hall and the City Manager.

Emergency Duties

Public Works Director

REPORTS TO – City Manager

1. RESPONSILBILITIES

- A. Receives and logs service outage calls.
- B. Ensures reported outages are on service restoration priority.
- C. Transmits information from office records to field crews as required.
- D. Provides message service to field crews and their families.

2. STAFF SUPPORT

Engineering and Customer Service Personnel

3. DIRECT CONTACTS

- A. Other Emergency Service Personnel, as required.
- B. Members of the general public or water system customers

4. LOCATION

Either at City Hall at 109 SE 1st Street, or the Public Works Operations Center at 1308 SE Grace Avenue, or alternatively as directed by the City Manager, at the Police Dept. EOC – 505 SW 1st Street.

Public Works Operations Manager

REPORTS TO – Public Works Director

1. RESPONSIBILITIES

- A. In charge of emergency operations of water, sewer, streets, and park services.
- B. Aids Public Works Director in setting restoration priorities.
- C. Dispatches crews to restore service in established order of priority.
- D. Advises City Hall of progress in restoration of water service.
- E. Monitors telemetry and control system in water command center.
- F. Makes field inspections of damage to water utility facilities and reports condition to Water Command Center.
- G. Ensures crews have necessary materials and equipment to restore service.
- H. Coordinates material and equipment purchases with suppliers.

2. STAFF SUPPORT

Operations Public Works Clerk
Public Works Supervisor

3. SUPERVISES

Water Utility Field Crews

4. DIRECT CONTACTS

Public Works Director
Public Works Supervisor
Clark Public Utilities (360) 992-8000

5. LOCATION

At Public Works Operations at 1308 SE Grace Avenue
Alternate Location: EOC at the Police Dept, at 505 SW 1st Street, or at City Hall – 109 SW 1st Street.

Public Works Supervisor (DOH Responsible Charge Person)

REPORTS TO – Public Works Operations Manager

1. RESPONSIBILITIES

- A. Has overall control of water utility resources.
- B. Assess damage to water system.
- C. Set priorities for restoration of water service.
- D. Coordinate efforts to restore water service.
- E. Make arrangements for mutual aid.
- F. Provide emergency status updates to public works operations and city hall.
- G. Contact DOH Engineer immediately if emergency may cause, or threatens to cause, water loss or threatens public health (WAC 246-290). DOH number is (360) 664-0768, or after hours number is (877) 481-4901.
- H. Contact Clark County Dept of Health (360) 397-8428.
- I. Advise local fire districts of emergency if water flow for firefighting is impaired.

2. SUPERVISES

Maintenance Crews

3. DIRECT CONTACTS

Public Works Operations Manager

Maintenance Workers

Clark Public Utilities (360) 992-8000

Members of the general public or water system customers

4. LOCATION

Public Works Operations at 1308 SE Grace Avenue

Alternate Location: City Hall – 109 SW 1st Street

Emergency Response Procedures

A series of potential disasters and other emergency conditions that could impact the City's water system as well as actions to be taken in the event of each emergency are presented below.

Emergency restoration priorities apply for all types of emergencies.

Emergency Restoration Priorities

Supply

Wells and booster pumps will be restored insofar as practicable, in the following order:

- 1. Wells 7 and 8 and Horsethief Pump Station
- 2. Well 9
- 3. Wells 1 and 2
- 4. Wells 4 and 5
- 5. Well 6

Emergency Services and Priority Customers

1. Transmission mains from wells to reservoirs
2. Life support system patients, such as, kidney dialysis and Vancouver Clinic
3. Major fire mains along SR502, Rasmussen, E Main, Onsdorff Boulevard, NE 10th Street, SW 20th Avenue and NW 20th Avenue, and Grace Avenue
4. Water Services to all lift stations, starting with Lift Station No.1 and Gardner
5. Individual customer water services

Identified Life Support Systems

A list needs to be developed of all the patients who currently have dialysis machines or respirators in the City's water system service area. In case of emergency situations, they will be instructed to call 911.

Emergency: Earthquake

Description

A major earthquake, with a magnitude of 5.0 or higher, and an intensity of 9 on the Modified Mercalli scale, could disrupt the source, transmission, pumping, storage, distribution, and telemetry components of the water system. In addition, power failures and interruption may occur to conventional communications such as the above ground fiber optic cable that links the Water Operations Center to the server at City Hall.

Response

Water personnel will anticipate critical water use needs for firefighting or medical facilities resulting from an earthquake. Since they are hidden from view and at least as susceptible to ground movement as aboveground structures, pipelines, wells, and other buried facilities require closer attention in the event of an earthquake. The system will be checked thoroughly for any unexplained drop in line pressure, reduction in flow rate, pump failure, leakage, or other signs of damage.

Emergency: Power Failure/Outage

Description

Short and long term interruptions in the power supply can occur for a variety of reasons. These can affect the water system and may or may not be associated with other emergencies. In addition, power outages may be localized to one (1) or more blocks or may affect the entire region. Facilities most affected by this type of emergency include source and booster pumping, telemetry equipment, and communication systems.

Response

In addition to their field response, water personnel will immediately contact the electric utility to determine the nature, extent, and expected duration of the power outage. Depending on the impact to the City's sources of supply, water utility staff may also contact CPU and investigate the possibility of opening the emergency intertie connection at NE 199th Street and Maple Grove School.

Available Back-up Generators

1. CPU – Auxiliary Generators may be available if not in use by CPU.
 - A. 180 kilowatt (kW)
 - B. 125 kW
 - C. 50 kW
 - D. 50 kW

2. Other Equipment – In addition to CPU's auxiliary generators, the following firms may have backup generators as noted:
 - A. Hanson Drilling – (1) 15 kW, (1) 30 kW
 - B. Mather & Sons – (1) 15 kW
 - C. Halton Tractor, Portland – up to 930 kW
 - D. E.C. Distributing, Portland – up to 75 kW
 - E. R.S.C. Rentals – up to 125 kW

Emergency Generator Start-up Procedures

Before leaving the yard:

- A. Unhook battery charger electric cord
- B. Turn battery charger on/off switch to off
- C. Check oil level
- D. Check fuel level

Notes: The Hand-Off-Auto switch is on the pump electric panel inside the pump house. Use the Man/Aux switch inside the pump house to switch all power from the CPU power system, to the backup generator, or vice versa.

Procedure at Well or Pump Station Site:

- A. Turn H/O/A switch to "OFF"
- B. Turn Man/Aux switch to "OFF"
- C. Plug in Power cord to panel, and lock into position
- D. Remove right front door panel
- E. Open the back door on the Pump Station generator
- F. Set and lock hand throttle to approximately one half throttle
- G. Switch engine control switch to manual; engine will start and automatically shut off starter
- H. Run at half throttle until engine is warmed up

- I. Adjust throttle to obtain 60 Hz on meter
- J. Switch MAN/AUX switch to AUX
- K. Start Pump by switching HOA switch to HAND

Procedure after using the generator:

- A. Top off and fill fuel tank
- B. Check the oil level
- C. Turn the battery charger on/off switch to ON
- D. Plug in the battery charger and make sure it is working

Emergency: Water Transmission Main Damage

Description

Rupture or leakage in the transmission lines from wells could be a result of earthquake, pressure surge, vandalism, bomb blast, construction, soil scour during a flood, corrosion, or material failure. A major break could drain connected storage facilities and present a flood and erosion threat to nearby areas. It is unlikely that the entire system would be affected.

Response

Such an event requires prompt action by the water utility personnel to isolate the damaged section and, thus, minimize the disruption of service for the rest of the system. If transmission paths from wells are shut down, the affected wells will be turned off manually, and a red tag placed on the telemetry system. The size and nature of the rupture must be evaluated promptly to ensure that adequate repair materials, excavation equipment, dewatering facilities, and trained personnel are deployed immediately. A field response will also address the need to re-route traffic and warn businesses and residences possibly affected by the break. Floods may also result in transmission main ruptures at the crossings with Mill Creek. All creek crossing will be checked if system damage is suspected. Ruptured pipeline crossings may be secured until flooding subsides and working conditions are safe.

When the water system loses positive pressure there is a heightened potential for water contamination. A boil water advisory will be needed until the safety of the water supply is verified through coliform sampling. DOH will be consulted to evaluate whether a water outage requires an advisory, the extent of the system that should be included in the advisory and when the advisory should be lifted.

Emergency water supplies can also be provided at strategic hydrants by installing hydrant meters within affected areas. For prolonged outages, arrangements may be made to haul water by tankers to impacted areas. Proceed with restoration of service in accordance with the service restoration priorities.

Emergency: Structural Damage to a Reservoir

Description

Reservoirs are designed to withstand earthquakes that can be expected within our seismic zone. Severe earthquakes may result in the buckling of steel plates, and possible cracks in reinforced concrete resulting in minor leaks in the tanks.

Response

In the event of an earthquake, each reservoir will be checked for signs of damage. If any damage is evident, the water level in the reservoir will be drawn down below the level of the damage. The tank will be taken out of service if necessary, until it can be inspected and repaired. A report of all repairs will be completed and sent to the Public Works Director and City Engineer. In addition to the field response, DOH and other applicable health agencies should be contacted to advise them of the situation.

Emergency: Contamination of Source of Supply

Description

Sources of contamination may occur in the aquifer or the wells, and can be the result of either manmade or natural occurrences. A partial list of possible sources for well contamination includes: effluent from septic tank drainfields, runoff from storm drainage facilities, leachate from pesticide use and/or landfills, spills from fuel storage tanks, other chemical or petroleum spills, contamination from animal wastes, vandalism, volcanic fallout, undesirable aquatic organisms.

Response

The initial response will be to isolate the contaminated facilities from the rest of the system. Other appropriate measures will be determined according to the type, location, nature, and entry path of the contaminant. In addition to field response, water system personnel must contact the appropriate health authorities. They need to determine, if possible, the extent of contamination in the system and prepare an appropriate public information program.

Emergency: High Water Demand

Description

Pumps and reservoirs are not keeping up with water demand. The water levels in all reservoirs are declining.

Response

During periods of high water demand, the City will purchase wholesale water supply through our approved interties with CPU, according to our wholesale water purchase agreements. The City will also continue to implement public education goals from the Water Use Efficiency program, including installing seasonal Conservameter signs, publishing water conservation advertising in the Reflector and on the City's web page, and making available to the public any other water conservation information that may be requested. Seasonal irrigation reduction will also be implemented at city parks, and other facilities, to emphasize the importance of conservation.

Safety Procedures

The City water system currently uses sodium hypochlorite for disinfection at all facilities, to eliminate the inherent problems with use and storage of chlorine gas. At this time most of the major water system hazards are prevented through the safe handling and storage of the sodium hypochlorite materials used in the disinfection process.

Other potential hazards are related to lifting out and reinstalling treatment or pumping equipment for repair. Each site has various pumps and pipeline components that, when removed for maintenance, require special lifting equipment and preparation for safe handling. Proper workplace lifting techniques are used during any water system maintenance project. The Horsethief Pump Station and the soon to be constructed CPU Intertie on NE 219th Street both include a portable lift capable of lifting any of the pumps and piping pieces inside the building. Journeyman electricians are hired in the event work is needed in the electrical control panel, and in the case of the telemetry system, CPU staff are contacted.

Additionally, the City ensures that operations staff are up to date in all their first aid training and provides each vehicle with a first aid kit. Each operator also gets annual training in Blood Borne Pathogens, Confined Space Entry, and other required training. The City is continuously working to bring in certified instructors, to provide required safety training and maintain currency for all the training requirements of each operations position.

Cross Connection Control Program

The City operates a cross connection control program to reduce the risk of backflow into the water system. City ordinance BMC 13.112.110 establishes the cross connection control program and the City currently employs three (3) certified CCS. There are over 1,086 double check valve backflow assemblies (DCVA) and over 146 reduced pressure backflow assemblies (RBPA) on the system. The City also requires DCVAs on all irrigation systems. During the building permit review process at City Hall, City staff check for new plumbing connections, to verify that there will not be any that are cross connected. The City also has a strong program to enforce the annual backflow testing requirement and regularly achieves good compliance through the use of three (3) successive reminder notices and eventually a lock-out notice. Table 6-6 below lists the status of the City's Cross Connection Control Program in regard to the minimum elements required by *WAC 246-290-490*.

**Table 6-6
Cross Connection Control Program Status**

Element	Status
Ordinance Establishing Authority	Ordinance now adopted, BMC 13.112
Procedures for evaluating new and existing connections	Within BMC 13.112.119 and written program, see Appendix F
Procedures for eliminating cross connections	Written program is attached in the Appendix F
Provide at least one (1) CCS on staff	City currently employs three (3) certified CCS
Procedures for Testing Requirements	All backflow assemblies are tracked in asset management database
Assembly Testing Quality Control	Local backflow testers are tracked in asset management database
Procedures for responding to backflow incidents	Included in Public Works Operations Procedures Manual
Cross Connection education program	Educational materials are provided with the annual testing notices
Database of cross-connection control records	Managed in the asset management database
Extra requirements for reclaimed water	Not applicable

Customer Complaint Response Program

All customer complaints are taken by the Public Works Department and written down. The complaint is then entered in the GBA asset management system through a work request form. With this form, the operator visits the site of the complaint and investigates as much as possible to determine the cause. If the operator is able to solve the problem he proceeds with a solution. If he is unable to determine the cause, or determine that the problem is not the City's to repair, then he will explain this to the customer and submit a short report to close out the work request record. If the operator needs assistance in resolving the complaint he will typically call in for additional help.

All complaints are recorded and kept on file at the Public Works office at 1308 Grace Avenue. Most of complaints related to the water system are related to either failed PRV, which are on the customer side of the meter, leaking services which are usually on the City side, and occasionally complaints of colored water related to the iron and manganese in the water supply.

Record Keeping and Reporting

The City meets at a minimum the record keeping requirements of the DOH Drinking Water Program, *WAC 246-290-480*. These record keeping requirements are:

- Coliform results are kept for five (5) years.
- Chemical analysis results are never discarded.
- Daily source meter readings are kept for 10 years.
- Other records of operation and analysis are kept for three (3) years, including records of action taken by the system to correct violations of primary drinking water standards.
- Copies of sanitary surveys and any record associated with a sanitary survey will be kept for 10 years.
- Project reports, construction documents, drawings, inspection reports, and approvals of water system facilities will be kept for the life of the facility.
- Daily chlorine residual readings are kept for a minimum of three (3) years.

Reporting requirements to DOH for the City include:

- Any failure to comply with monitoring requirements or the violation of a primary MCL.
- Copies of water quality monitoring results required by DOH.
- Copies of information relating to the status of monitoring waivers.
- The City shall submit an annual Water Facilities Inventory (WFI) form.
- The City shall submit an updated WFI to the department within thirty days of any change in the WFI.
- The City will notify DOH of any positive coliform sample. Reporting requirements are in the coliform monitoring plan included in Appendix E.

O&M Improvements

The City's capital improvement program in Section 8, does not include any improvements to the operation or maintenance of the system. Although some of the capital projects will change the operation and maintenance of the system, the projects will not necessarily improve the actual O&M costs of the system.

The City has previously considered the option of creating a pressure zone with a lower hydraulic grade than the Main Zone within the City, to reduce leakage in the Main Zone and save money on pumping costs. The option of splitting the Main Zone includes additional costs because a new intermediate pumping facility would be needed. Additionally, all private fire protection systems within the City would need to be re-designed to accommodate the lower supply pressure in order to continue to supply the fire flows that they were originally designed to provide. The impact on existing fire systems and costs for a new pump station have been determined to outweigh the savings from reduced pumping and leakage. The City has decided to maintain the existing established pressure zones.

No other O&M related enhancements have been considered with this updated water system plan, with the exception of facility upgrades related to security fencing at the Tukes Mountain Reservoirs.

SECTION 7

DESIGN AND CONSTRUCTION STANDARDS

There are five (5) elements of the City of Battle Ground's (City's) procedures for review of distribution facilities design:

- 1) Project Review Procedures
- 2) Policies and Requirements for Outside Parties
- 3) Design Standards (Performance Standards and Sizing Criteria)
- 4) Construction Standards (Materials and Methods)
- 5) Construction Certification and Follow Up Procedures

Project Review Procedures

All projects will be reviewed through approval by an Associate Civil Engineer. The Assistant City Engineer will provide oversight to ensure projects meet all City and State standards. The review will ensure that the project meets the needs of the City's Comprehensive Plans and all City zoning requirements. If a project meets all requirements for approval, then it is forwarded to the City Engineer for signature.

Following approval of the project, but before construction starts, a Pre-Construction Meeting is held between the Associate Civil Engineer, the Project Design Engineer, the Developer, and the Contractor. This meeting will allow the City staff to review the City's Construction Requirements with the Contractor, and to make sure that all necessary permits have been obtained.

Policies and Requirements for Outside Parties

Developers intending to install water lines need to fill out an application and receive approval from the City before beginning construction. Part of the permitting process is a review of the project as described above. Plans and specifications for any distribution system facility need to be stamped and signed by a Professional Engineer registered in the State of Washington who has experience in water system design. All fees need to be received by the City before approval is issued for construction.

Booster pumps, pressure reducing valves (PRVs), and storage tanks need to be submitted to the Washington State Department of Health (DOH) for plan review and approval. Approval from DOH is required for these facilities before the City will approve the project for construction. Projects that consist of waterline extensions only do not need separate approval from DOH.

Design Standards (Performance Standards and Sizing Criteria)

City of Battle Ground design and construction standards are consistent with standards agreed upon in the Clark County Coordinated Water System Plan.

In accordance with the City's Construction Standards, the minimum water main size shall be eight (8) inches in diameter. Mains less than eight (8) inches in diameter, but no smaller than four (4) inches in diameter, may be constructed subject to approval by the City Engineer in cul-de-sacs of not more than 400 feet in length where the water main can't be extended in the future, provided that the main is a minimum of eight (8) inches in diameter to the last hydrant.

In general, where the area is zoned for high-density residential, the minimum pipe diameter is eight (8) inches. Commercial and industrial area distribution systems are sized to meet the appropriate fire flow requirements, but no smaller than eight (8) inches in diameter. The City Engineer may reduce the minimum pipe size requirements only when a hydraulic and demand analysis indicates a smaller size will meet future needs. A larger size may also be required if fire protection requirements dictate. The minimum pressure requirement is 20 pounds per square inch during a fire flow event. Mains will be looped whenever practical. Dead end lines will have fire hydrants or blow-offs to flush out the water line. Water lines will be constructed of NSF (National Sanitation Foundation) approved ductile iron.

Booster pumps are designed to operate no more than 16 hours a day. Pump sizing is based on maximum capacity requirements over the 24-hour peak day period. PRV and pump stations will have redundant pumps and/or PRVs with isolation valves to allow for removal of valves or pumps for maintenance, repairs, or replacement. Facilities requiring electricity to operate shall have an outside electrical connection for a generator hook-up or their own emergency generator.

The maximum fire hydrant separation allowed is 700 feet in residential areas, with no residence more than 500 feet away. Hydrant spacing in commercial areas is a maximum of 300 feet. Valves are installed at all crosses and tees with all branches containing a valve. Auxiliary valves are installed on each hydrant branch.

Storage tank sizing will be based on Water System Plan design demands and accepted engineering practices. The City and the Developer will agree on the storage tank size prior to design of the storage tank.

Construction Standards (Materials and Methods)

American Water Works Association (AWWA) Standards need to be followed for the design and construction of distribution system facilities for the City. These AWWA standards include:

- Standard C104 – C153 (ANSI Standards for ductile iron pipe and fittings)
- Standard C500- C560 (Standards for valves and hydrants for waterworks)
- Standard C600 -99 (Installation of Ductile Iron Water Mains and their Appurtenances)

- Standard C605-94 (Underground Installation of PVC Pressure Pipe and Fittings for Water)
- Standard C606 -97 (Grooved and Shouldered Joints)
- Standard C651-99 (Disinfecting Water Mains)
- Standard C652-02 (Disinfection of Water Storage Facilities)
- Standard C800-01 (Underground Service Line Valves and Fittings)
- Standard C900-950 (Plastic Pipe)

Construction Certification and Follow-Up Procedures

During construction, the City's Engineering Technicians, or other Engineering personnel, will inspect construction on a regular basis to ensure it is meeting the City's Construction Standards. The Contractor is required to keep a record of all pressure and leak tests, disinfection procedures and results, and any changes made during construction from approved drawings.

Upon completion of the project the Contractor is required to submit copies of record drawings for the project, pressure and disinfection test results, and an operation and maintenance manual, if applicable, for the constructed facilities. The record drawings need to be stamped and signed by a Professional Engineer registered in the State of Washington. Along with these drawings and test results, where applicable, a DOH Construction Completion Report Form needs to be filled out, signed, and submitted to the State. This form needs to be stamped and signed by a Professional Engineer registered in the State of Washington.

SECTION 8

CAPITAL IMPROVEMENT PROGRAM

Introduction

This section presents proposed water system improvements recommended for construction or implementation within the City of Battle Ground's (City's) 20-year planning period under this plan. The water system improvements recommended in this section address the existing and anticipated future system deficiencies described in Section 3 and recommendations of the City's wellhead protection plan presented in Section 5. Implementing these improvements will help ensure that the City's customers will continue to receive reliable, high-quality water service.

This section also presents the planning-level Capital Improvement Program (CIP), planning-level project cost estimates, and an implementation schedule and budget. The information presented is intended to assist the City with its annual budgeting process, but more definitive project costs should be developed as the design for each recommended improvement is developed.

Cost Estimating Data

An estimated project cost has been developed for each improvement project presented in the CIP. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The Association for the Advancement of Cost Engineering International (AACE International) classifies cost estimates depending on project definition, end usage and other factors. The cost estimates presented here are considered Class 4 with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Estimated project costs include approximate construction costs and an allowance for administrative, engineering and other project related costs. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) CCI is a commonly used index for this purpose. For purposes of future cost estimate updating; the current ENR CCI for Seattle, Washington is 9418 (October 2012).

Water System Improvements

This section provides a description of the water system improvements proposed and recommended as a part of this Comprehensive Water System Plan. The proposed water system improvements are illustrated on Plate 1 in Appendix A. All proposed water system improvements are assigned a CIP number.

Wellhead Protection

The wellhead protection plan, presented in Section 5, recommended several protection strategies for the City's groundwater supply. Battle Ground has implemented the following wellhead protection measures:

- Contaminant source management
 - All customers within the City of Battle Ground are required to connect to the public sewer system thereby reducing the likelihood of groundwater contamination from private septic tanks.
- Regional coordination
 - Battle Ground is coordinating with the City of Ridgefield and Clark Public Utilities (CPU) to develop a long term regional supply.
- Planning and policy review
 - In the next five years, the City plans to enhance existing emergency response planning including:
 - Sharing wellhead protection area locations and establishing an emergency communication plan with first responders
 - Preparing a contingency plan for short and long term responses to the loss of a well

These wellhead protection strategies are not anticipated to require additional capital funds outside of the water system operating budget.

Proposed 2012 Water System Improvements

The proposed water system improvements presented in this section are grouped into categories representing improvement type. Each improvement type includes a range of project numbers assigned to individual projects.

1. System Supply Improvements (SS1 – SS3)
2. System Storage Improvement (ST1)
3. Water Main Improvements (WM1 – WM4)

The proposed water system improvements were identified from the results of distribution and transmission system hydraulic analyses presented in Section 3. Considerations were also given to the non-hydraulic issues related to repair, rehabilitation, operation, and maintenance while identifying the proposed water system improvements. The improvement types listed above are discussed in detail the following sections.

System Supply Improvements

Furnishing additional system supply to meet existing and projected demands associated with City growth is an urgent need. This issue was identified in the 2004 Water System Plan, with alternative new supply strategies evaluated. Since that period, the City has made the decision to maintain existing wells at their current operational production levels and seek additional water through new interties with Clark Public Utilities (CPU). The supply analysis in Table 3-2 shows the current sources to be sufficient under existing maximum day demand (MDD) conditions, and becoming deficient during the 6-year planning horizon. The City has already moved towards addressing this critical need, and has identified property and performed design engineering for a new intertie.

CIP SS1: New Intertie/Pump Station on NE 219th Street

Deficiency: Based on water billing and production data for the City over the last several years, the current City sources of supply cumulatively are not capable of fully meeting the projected MDD within the next six (6) years, as required by the State and evaluated within Section 3. This deficiency is due to operational constraints resulting from diminished well yields. Within the planning horizon the City's supply is deficient by existing water rights as well.

Improvement: A new intertie pump station, with an initial firm capacity of 1,000 gallons per minute (gpm), and space and facility provisions for an ultimate capacity of 3,000 gpm, has already been identified and much of the facility design completed. The pump station building will initially be equipped with two (2) 1,000 gpm pumps, but is designed with space provisions to ultimately install a total of four (4) 1,000 gpm pumps for a reliable source of supply with a firm capacity of 3,000 gpm. The facility is planned in the vicinity of NE 219th Street, between NW 92nd and 29th Avenues, and would also necessitate the construction of approximately 2,600 linear feet (LF) of 16-inch ductile iron discharge main along NE 219th Street in order to tie in to the western extent of the current distribution system.

Conceptual Cost: A planning level cost of \$1.4 million for this project is established using estimates developed and included within an August 2009 draft project report on the project. The cost estimate within the report was adjusted to increase the installed construction cost of the 16-inch ductile iron pipe to \$225 per LF to reflect conservative values recently observed within the industry, as well as including a 15 percent additive to the construction cost to account for remaining construction period engineering, legal, administrative, and other incurred project costs.

CIP SS2: 219th Street Intertie/Pump Station Upgrade

Deficiency: The initial 1,000 gpm intertie capacity will adequately sustain City supply requirements until approximately 2023. Two (2) additional pumps and associated mechanical/electrical appurtenances are recommended to be installed in 2021 to achieve the ultimate 3,000 gpm capacity. This ultimate capacity, without significant further

diminishment of current well production, will allow the City to meet supply requirements through the year 2032.

Improvement: The 219th Street Pump Station will be upgraded with two (2) additional 1,000 gpm capacity pumps to, with the existing two (2) pumps, bring the reliable pump station capacity up to 3,000 gpm. Associated manifolding, appurtenances, instrumentation, and programming is anticipated with this work, but no upgrading of initially constructed mechanical or site civil facilities is anticipated.

Conceptual Cost: A planning level cost for this project of \$60,000 is established based on quotations received for the installed pumps, with a \$35,000 allowance for associated mechanical and electrical appurtenances and programming. The total cost estimate of \$140,000 includes escalation by a 45 percent contingency to account for market fluctuation, engineering, legal, administrative, and other incurred costs.

CIP SS3: Regional Source and Transmission Development

Deficiency: The City's current agreements with CPU allow for the supply of up to 1,000 gpm from CPU to the City to meet water demands. Future water demands will exceed the combined capacity of the City's wells and the 1,000 gpm intertie capacity. The City must develop additional water supply to meet water demands beyond the 6-year planning horizon.

Improvement: Supply capacity in excess of 1,000 gpm from CPU required the development of expanded supply facilities and transmission piping from the CPU Paradise Point Wellfield and treatment facilities to the City's 219th Street Intertie and Pump Station. Preliminary planning and cost sharing agreements have been developed to support CPU's development of additional wells, expanded treatment facilities (iron and manganese removal) and a 24-inch and 16-inch diameter transmission main south from La Center (the location of the Paradise Point Wellfield) to the City.

Conceptual Cost: Planning level cost estimates for the City's \$12,850,000 share of the projected project cost have been developed by CPU to support development of necessary agreements and funding strategies. These cost estimates are very preliminary in nature but are intended to provide an appropriate level for long-range budgeting and revenue requirement analysis.

Well Replacement

Deficiency: The City has experienced declines in well capacity at Well No. 7 and 8. Based on the timing of regional supply development, loss of well capacity could result in a need to develop additional source capacity to meet peak demands prior to the development of regional supply sources.

Improvement: Based on hydrogeologic investigations recent efforts to rehabilitate Well No. 7 and 8, construction of a replacement well is recommended if well performance continues to decline.

Conceptual Cost: The planning level cost estimates for construction of a replacement well is \$800,000. It is anticipated that this CIP line item will serve as a placeholder for potential rehabilitation, or replacement, as may be needed to maintain adequate source capacity. This improvement is identified for completion in 2015 based on current investigations of well performance.

System Storage Improvement

The storage analysis performed in Section 3 indicates the need to increase storage capacity within the 20-year planning period to continue to provide adequate operational, equalizing, fire and standby storage to the system. Construction of a new reservoir within the Main Zone would also enhance the system's reliability in an abnormal future condition such as needing to take the Horsethief Reservoir off line for maintenance during a peak demand period.

CIP ST1: New 1.4 million gallon (MG) Reservoir

Deficiency: Analysis performed indicates that the City will become storage deficient under this document's growth projections in approximate year 2023. This deficiency occurs due to the increased recommended volumes for equalizing and standby storage, with the recommended requirements for each component being directly proportional to growth and the City's equivalent residential unit capacity. The analysis performed in Section 3 indicates the system to be in need of as much as 1.3 MG of additional system-wide storage by 2032. Without a site chosen and preliminary design work performed, a 1.4 MG reservoir is used for purposes of this planning document, which provides a small allowance for operational and dead storage components with the new facility.

Improvement: The planned storage facility is assumed to be a 1.4 MG ground level reservoir that will be located within the existing Main Zone service area such that additional pumping facilities will not need to accompany it for integration into the system. This might be achieved by either locating it such that the overflow elevation can match the existing hydraulic grade line within the zone, or by locating it such that the existing Horsethief Pump Station facilities might be used to transmit the volume to acceptable system pressures. For cost estimating, the reservoir is assumed to be steel construction.

Conceptual Cost: A planning level cost of \$1.8 million for this project is established after reviewing recent bidding information from other steel reservoir construction projects. The construction costs from this survey ranged from \$0.75 to \$2.00 per gallon, on average, with the higher range attributable to factors such as small tank size, required pumping or extensive reservoir mixing systems, and elevated tank construction. Assuming this reservoir to be constructed as a ground level tank, without pumping or extensive mixing systems, a

conceptual level cost of \$1.30 per gallon is assumed for this facility's project cost including an allowance for engineering, legal, administrative, and other incurred costs.

Water Main Improvements

Three (3) distribution system deficiencies were identified under this plan, and are itemized within the water main improvements below. Additionally, an item is allocated for an annual water main replacement program that will allow the City to continue replacing mains due to age, failure, or pipe material, such as, asbestos cement (AC) or steel.

CIP WM1: Annual Water Main Replacement Program

Deficiency: As inventoried in Section 1, the City's distribution system still contains several thousand LF of older AC and steel water lines remaining in service. These facilities are vulnerable to leaks and failures which will only increase over time as they continue to be in operation. A systematic replacement program should be continued on an annual basis, with individual yearly improvements identified through prioritization of the most vulnerable remaining facilities and input provided by operational staff.

Improvement: Locations and scope of water line replacement will be defined by the City on an annual basis. New waterlines will be designed of acceptable materials, coatings, and linings that meet current City standards. Replacement diameter will be of equal or greater diameter to the existing pipeline, with a minimum of eight (8) inches.

Conceptual Cost: A planning level cost for this project is established at \$50,000 per year through 2018 to allow the City to allocate more capital improvement funds to supply related projects. Beyond 2018 to the end of the planning period, water main replacement is estimated at \$100,000 annually which would likely allow the remainder of the City's older water mains to be replaced within the 20-year planning period.

CIP WM2: 8-inch Diameter Distribution Main on SW 2nd Court

Deficiency: The existing 2-inch main for this portion of the distribution system is old, does not meet current City standards, and does not provide minimum required pressures or acceptable velocity ranges under fire flow conditions. The main is in need of replacement as well as upsizing to improve the capacity and reliability of the City's distribution system.

Improvement: Replace approximately 550 LF of existing 2-inch steel distribution main along SW 2nd Court, north of SW 4th Street, with new 8-inch diameter pipe meeting City standards.

Conceptual Cost: A planning level cost for this project is established as \$105,000. Assumptions used in developing this cost include a conservative construction installation cost of \$130 per LF for 8-inch ductile iron pipe, and a 45 percent additive to escalate

construction cost to a total project cost, inclusive of engineering, legal, administrative, and other incurred project costs.

CIP WM3: 8-inch Diameter Distribution to Hydrant on SW 3rd Street

Deficiency: The existing 2-inch main for this portion of the distribution system is shown to be connected to a fire hydrant, does not meet current City standards, and does not provide minimum required pressures or acceptable velocity ranges under fire flow conditions. The main is in need of replacement as well as upsizing to improve the capacity and reliability of the City's distribution system.

Improvement: Replace approximately 50 LF of existing 2-inch steel distribution main, along SW 3rd Street between S Parkway Avenue and the existing hydrant, with new 8-inch pipe meeting City standards.

Conceptual Cost: A planning level cost for this project is established as \$10,000. Assumptions used in developing this cost include a conservative construction installation cost of \$130 per LF for 8-inch ductile iron pipe, and a 45 percent additive to escalate construction cost to a total project cost, inclusive of engineering, legal, administrative, and other incurred project costs.

CIP WM4: 8-inch Diameter Distribution on NE Grace Avenue

Deficiency: The existing 6-inch main for this portion of the distribution system, does not meet current City standards, and does not provide minimum required pressures under fire flow conditions. The main is in need of replacement as well as upsizing to improve the capacity and reliability of the City's distribution system.

Improvement: Replace approximately 2,520 LF of existing 6-inch distribution main, along NE Grace (142nd) Avenue between NE 1st Street and NE 10th Street, with new 8-inch diameter pipe meeting City standards.

Conceptual Cost: A planning level cost for this project is established as \$475,000. Assumptions used in developing this cost include a conservative construction installation cost of \$130 per LF for 8-inch ductile iron pipe, and a 45 percent additive to escalate construction cost to a total project cost, inclusive of engineering, legal, administrative, and other incurred project costs.

12-inch Diameter Transmission on SW 20th Street

Deficiency: Future transmission improvements to improve looping and fire service in the southwest corner of the City's service area are recommended for completion, and were originally anticipated to be completed as part of infrastructure improvements driven by development in this area. Upcoming City street improvements may present an opportunity to construct the transmission main improvements as part of the road project.

Improvement: Construct approximately 2,700 LF of 12-inch diameter transmission main extending west on SW 20th Avenue from SR 503 (SW 10th Avenue) to NE 112th Avenue.

Conceptual Cost: A planning level cost for this project is established as \$565,000. Assumptions used in developing this cost include a conservative construction installation cost of \$145 per LF for 12-inch ductile iron pipe, and a 45 percent additive to escalate construction cost to a total project cost, inclusive of engineering, legal, administrative, and other incurred project costs.

Capital Improvement Program

Based on the analysis and cost estimating discussed, a planning-level, phased CIP was prepared. The recommended CIP consists of the proposed water system improvements grouped by their respective improvement categories, planning-level project cost estimates, and an implementation schedule and budget. Table 8-1 summarizes the recommended CIP.

Table 8-1 Capital Improvement Program

Category	CIP No.	Project Description / Location	CIP Schedule and Project Cost Summary (2012 dollars)							Estimated Project Cost ^{1,2}
			2013	2014	2015	2016	2017	2018	2019-2032	
Supply System Improvements	SS1	New Intertie/Pump Station on NE 219th	\$ 1,360,000							\$ 1,360,000
	SS2	NE 219th Intertie/Pump Station Upgrade (2021)							\$ 140,000	\$ 140,000
	SS3	Regional Source and Transmission Development			\$ 1,375,000	\$ 675,000	\$ 675,000	\$ 675,000	\$ 9,450,000	\$ 12,850,000
		Well Replacement			\$ 800,000					\$ 800,000
		<i>Sub-Total</i>	\$ 1,360,000	\$ -	\$ 2,175,000	\$ 675,000	\$ 675,000	\$ 675,000	\$ 9,590,000	\$ 15,150,000
Storage Improvements	ST1	New 1.4 MG Reservoir (2023)							\$ 1,800,000	\$ 1,800,000
		<i>Sub-Total</i>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,800,000	\$ 1,800,000
Water Main Improvements	WM1	Annual Water Main Replacement Program	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 1,400,000	\$ 1,700,000
	WM2	SW 2nd Court 8-inch Main							\$ 105,000	\$ 105,000
	WM3	SW 3rd Street 8-inch Main to Hydrant							\$ 10,000	\$ 10,000
	WM4	NE Grace Avenue 8-inch Main							\$ 475,000	\$ 475,000
		SW 20th Avenue 12-inch Transmission						\$ 565,000		\$ 565,000
		<i>Sub-Total</i>	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 615,000	\$ 1,990,000	\$ 2,855,000
Capital Improvement Program (CIP) Total			\$ 1,410,000	\$ 50,000	\$ 2,225,000	\$ 725,000	\$ 725,000	\$ 1,290,000	\$ 13,380,000	\$ 19,805,000

¹ Cost estimates are based on an Engineering (ENR) construction cost index of 9418 for Seattle, Washington (October 2012).

² Cost Estimates are in current dollars. (October 2012)

6 Year Total
\$6,425,000
Annual Avg
\$1,070,833

20 Year Total
\$19,805,000
Annual Avg
\$990,250

SECTION 9

FINANCIAL PLAN

Introduction

The financial plan matches funding sources with the capital program identified in the Comprehensive Water System Plan (CWSP) and develops a multi-year rate strategy to demonstrate financial viability in meeting the total costs of providing water service, which include:

- Financial policies
- Operating and maintenance (O&M) costs
- Administrative and overhead costs
- Capital related costs

The analysis considers the historical financial performance of the utility, the financial impact of executing the capital program, the sufficiency of current utility revenues, and the affordability of rates. The current water rate structure is also evaluated in terms of achieving revenue stability, efficiency of use and customer equity.

Financial Structure

The City of Battleground (City) legally owns and operates a water utility fund. The water utility is responsible for funding all of its related costs through user fees. It does not depend on general fund resources. The primary source of funding for the water utility is monthly user rates, with additional revenues generated from water service fee penalties, meter installations and NSF check recovery fees. The City controls the level of user charges by ordinance and, subject to statutory authority, can adjust user charges as needed to meet financial objectives.

The City maintains a fund structure and implements financial policies that target management of a financially viable and fiscally responsible enterprise fund utility.

Financial Policies

This analysis is based on a framework of fiscal policies that promote the financial integrity and stability of the water utility. A brief summary of the key financial policies employed by the City, as well as those recommended and incorporated in the financial plan are discussed below.

Reserve Funds

Like any business, a municipal utility requires certain minimum levels of cash reserves to operate. These reserves address variability and timing of expenditures and receipts, as well as occasional disruptions in activities, costs or revenues. Given the City's responsibility to provide an essential service at a certain standard, protection against financial disruptions is even more important than it would be for a private sector or non-essential counterpart.

In addition to protecting the utility against financial disruption, a defined reserve structure serves to maintain appropriate segregation of funds and promote the use of resources for their intended purposes. The following reserve funds are evaluated.

The operating reserve is designated to provide a liquidity cushion to ensure that adequate cash working capital is maintained to deal with cash balance fluctuations from unanticipated cash expenses or lower than expected revenue collections.

The rate stabilization reserve maintains funds to cushion the impact of significantly lower than expected rate revenue collections caused by wet summers, loss of a large water user or other unexpected circumstances. Maintaining this reserve mitigates the impact of lower revenue collection and allows for rates to be less conservatively set.

The City's current policy is to maintain a minimum operating reserve target of 90 days of O&M expense and an additional 90 days of O&M for rate stabilization reserves. This target is within industry standards for a water utility. Based on 2013 O&M of \$1,138,977, a minimum target balance of \$280,844 is established for each reserve for a combined reserve of \$561,687, increasing with the O&M forecast to \$901,807 by the end of the study period (2032).

The capital contingency reserve is an amount of cash set aside in case of an emergency should a piece of equipment or a portion of the utility's infrastructure fail. The reserve could also be used for other unanticipated capital needs including capital project cost overruns. Industry practice ranges from maintaining a balance equal to 1 to 2 percent of fixed assets, an amount equal to a 5-year rolling average of capital improvement program (CIP) costs, or an amount determined sufficient to fund an equipment failure (other than catastrophic failure). The final target level should balance industry standards with the risk level of the City. A target of 2 percent of fixed assets has been used in this analysis, ranging from \$530,808 in 2013 to \$1,037,937 in 2032 as completed CIP projects increase the total cost of fixed assets.

The debt reserve fund is generally set by covenant requirements when debt is issued. The City has no outstanding debt.

System Reinvestment

The purpose of system reinvestment funding is to provide for the replacement of aging system facilities to ensure sustainability of the system for ongoing operation. Each year, the utility's assets lose value, and as they lose value they move toward eventual replacement. This accumulating loss in value and future liability is typically measured for reporting purposes through an annual depreciation expense, based on the original cost of the asset over its anticipated useful life. While this expense reflects the consumption of the existing asset and its original investment, the replacement of that asset will likely cost much more when factoring in inflation and construction conditions. Therefore, the added annual replacement liability is even greater than the annual depreciation expense.

The 2011 depreciation expense of \$605,964, plus estimated additional depreciation expense from new CIP projects as they are booked as assets through 2013, totals \$665,101. To maintain rate increases at about inflationary levels, this analysis assumed funding at about 65

percent of annual depreciation expense, ranging from \$432,316 to \$516,525 over the 6-year period. This level is projected to cash fund 92 percent of the 20-year CIP.

Past Financial Performance

This section includes a historical summary of financial performance as reported by the City on the water utility Statement of Revenues, Expenses and Changes in Fund Equity and Statement of Net Assets. Noteworthy findings and trends are discussed below to demonstrate the historical performance and condition of the utility.

**Table 9-1a
Statement of Revenues, Expenses and Change in Fund Net Assets**

Statement Revenues Expenses and Change in Fund Net Assets	2006	2007	2008	2009	2010	2011
Operating Revenues						
Charges for Services	\$ 1,910,340	\$ 1,983,061	\$ 2,027,589	\$ 2,232,671	\$ 2,037,375	\$ 2,115,368
Miscellaneous	2,929	3,937	2,907	4,015	6,504	7,871
Total Operating Revenues	\$ 1,913,269	\$ 1,986,998	\$ 2,030,496	\$ 2,236,686	\$ 2,043,879	\$ 2,123,239
Operating Expenses						
Personnel Services	\$ 626,586	\$ 661,353	\$ 760,680	\$ 733,763	\$ 732,863	\$ 709,705
Supplies	105,772	85,568	78,796	74,861	87,250	87,621
Professional Services	75,807	87,067	71,368	71,893	76,688	84,009
Utilities	161,829	174,200	187,968	192,320	158,034	160,788
Miscellaneous	88,129	74,642	63,824	83,473	96,702	-
Repairs and Maintenance	52,213	50,672	77,473	34,143	53,944	45,030
Taxes	95,285	100,494	98,310	105,919	97,506	96,299
Intergovernmental Services	-	-	-	-	-	32,340
Insurance claims and expenses	-	-	-	-	-	-
Allocated expenses	-	-	-	-	-	-
Other	-	-	-	-	-	58,009
Depreciation	549,297	586,361	638,237	638,987	643,969	605,964
Total Operating Expenses	\$ 1,754,918	\$ 1,820,357	\$ 1,976,656	\$ 1,935,359	\$ 1,946,956	\$ 1,879,765
Operating Income/Loss	\$ 158,351	\$ 166,641	\$ 53,840	\$ 301,327	\$ 96,923	\$ 243,474
Nonoperating Revenues [Expenses]						
Interest Earnings	\$ 70,552	\$ 99,682	\$ 68,683	\$ 32,757	\$ 23,291	\$ 52,584
State and Federal Grants	-	-	-	-	-	-
Interest and Fiscal Charges	(34,978)	(18,312)	(4,154)	-	-	-
Gain [Loss] on Disposal of Capital Assets	(10,170)	-	-	-	-	-
Total Nonoperating Revenues [Expenses]	\$ 25,404	\$ 81,370	\$ 64,529	\$ 32,757	\$ 23,291	\$ 52,584
Income [Loss] Before Contributions and Transfers	\$ 183,755	\$ 248,011	\$ 118,369	\$ 334,084	\$ 120,214	\$ 296,058
Capital Contributions	\$ 712,637	\$ 1,392,073	\$ 1,599,666	\$ 596,648	\$ 205,168	\$ 175,117
Transfers Out	(167,252)	(184,414)	(192,195)	(151,412)	(172,589)	(178,975)
Increase [Decrease] in Net Assets	\$ 729,140	\$ 1,455,670	\$ 1,525,840	\$ 779,320	\$ 152,793	\$ 292,200
Total Net Assets at Beginning of Year	\$ 15,289,561	\$ 16,018,701	\$ 17,474,371	\$ 19,053,778	\$ 19,803,183	\$ 19,831,748
Prior Year Adjustments	-	-	53,567	(29,915)	(124,228)	-
Total Net Assets at End of Year	\$ 16,018,701	\$ 17,474,371	\$ 19,053,778	\$ 19,803,183	\$ 19,831,748	\$ 20,123,948

**Table 9-1b
Statement of Net Assets**

Statement of Net Assets	2006	2007	2008	2009	2010	2011
ASSETS						
Current Assets						
Cash and Cash Equivalents	\$ 1,297,647	\$ 2,021,170	\$ 1,951,385	\$ 1,752,260	\$ 1,431,955	\$ 1,359,523
Cash with Fiscal/Escrow Agent		-				
Investments	385,371	88,457	473,355	1,399,288	2,215,412	2,749,148
Receivables (net)						
Accounts	133,046	162,418	210,144	361,499	264,384	278,148
Interest	4,855	1,743	5,833	4,935	4,400	6,050
Restricted Assets	-	-	-	-	-	-
Prepaid Expenses	-	-	-	-	-	66
Interfund Advance Receivable	-	-	-	-	-	-
Total Current Assets	\$ 1,820,919	\$ 2,273,788	\$ 2,640,717	\$ 3,517,982	\$ 3,916,151	\$ 4,392,935
Noncurrent Assets						
Property, Plant and Equipment (Net)	15,135,223	15,637,261	16,648,218	16,531,404	16,163,688	15,926,639
Total Noncurrent Assets	\$ 15,135,223	\$ 15,637,261	\$ 16,648,218	\$ 16,531,404	\$ 16,163,688	\$ 15,926,639
TOTAL ASSETS	\$ 16,956,142	\$ 17,911,049	\$ 19,288,935	\$ 20,049,386	\$ 20,079,839	\$ 20,319,574
LIABILITIES						
Current Liabilities						
Accounts Payable	\$ 46,639	\$ 52,090	\$ 51,217	\$ 28,345	\$ 37,566	\$ 36,489
Advances from Other Funds	200,000	200,000	-	-	-	-
Accrued Interest Payable	5,906	2,008	35,507	34,613	34,741	34,034
Other Accrued Liabilities	46,692	50,711	90,595	120,510	105,040	44,122
Compensated Absences	812	845	1,446	1,569	1,769	2,025
Bonds, Notes and Loans Payable from Restricted Assets - Current	307,697	98,061	-	-	-	-
Total Current Liabilities	\$ 607,746	\$ 403,715	\$ 178,765	\$ 185,037	\$ 179,116	\$ 116,670
Noncurrent Liabilities						
Advances from Other Funds	200,000	-	-	-	-	-
Bonds, Notes and Loans Payable	98,021	-	-	-	-	-
Compensated Absences	31,674	32,963	56,392	61,166	68,975	78,956
Total Noncurrent Liabilities	\$ 329,695	\$ 32,963	\$ 56,392	\$ 61,166	\$ 68,975	\$ 78,956
TOTAL LIABILITIES	\$ 937,441	\$ 436,678	\$ 235,157	\$ 246,203	\$ 248,091	\$ 195,626
NET ASSETS						
Invested in Capital Assets, Net of Related Debt	14,729,505	15,539,200	16,648,218	16,531,404	16,163,688	15,926,639
Restricted for Capital Purposes	-	-	-	-	-	-
Restricted for Debt Service	-	-	-	-	-	-
Unrestricted	1,289,196	1,935,171	2,405,560	3,271,779	3,668,060	4,197,309
TOTAL NET ASSETS	\$ 16,018,701	\$ 17,474,371	\$ 19,053,778	\$ 19,803,183	\$ 19,831,748	\$ 20,123,948

Key findings include:

- Charges for Services increased 11 percent over the historical period due to a combination of customer growth and rate increases, with a peak in revenue collection in 2009.

- The Operating Ratio (total operating expenses divided by total operating revenues) remained at about 60 percent in all years, indicating operating revenues are sufficient to meet operating expenses. A ratio greater than 90 percent would indicate that there is little room for new debt service and capital replacement without additional rate increases. A ratio greater than 100 percent would indicate that operating expenses exceed operating revenues and would be indicative of an unsustainable financial condition. The utility had no outstanding debt, providing ample debt capacity to fund future capital.
- A Quick Ratio (current assets divided by current liabilities) increasing from 3:1 to 38:1 reflects the positive cash position of the water utility from 2006 to 2011. Current Assets, comprised of primarily cash and investments, grew by 141 percent during this period.

Capital Costs and Funding Strategy

The CIP developed for this CWSP identifies total capital obligations for a 6-year (2013-2018) and 20-year (2013-2032) planning period. The capital funding plan defines a strategy for funding the CIP considering available cash reserves, system development charges, external contributions from grants / developers and new debt proceeds, if required.

Capital costs are stated in 2012 dollars and escalated annually at 3 percent construction cost inflation to the year of planned spending for financing projections. The CIP identifies \$6.4 million (\$7.1 million escalated) in project costs over the 6-year planning horizon and \$19.8 million (\$26.8 million escalated) over the 20 year period.

Table 9-2 provides the detail CIP (escalated) and assumed funding sources. As shown, each year has varied capital obligations depending on construction schedules and infrastructure planning needs. About 27 percent of capital program costs are scheduled for the 6-year period.

**Table 9-2
Capital Financing Forecast**

Capital Funding	2013	2014	2015	2016	2017	2018	2013-2018 CIP	2013-2032 Total CIP
CIP 2013-2032 [1]								
New Intertie Booster Pump Station on Ne 219th St	\$ 1,400,800	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,400,800	\$ 1,400,800
New Intertie 219th St Booster Pump Station Upgrade	-	-	-	-	-	-	-	172,182
Regional Source Transmission Development	-	-	1,502,500	759,718	782,510	805,985	3,850,713	18,035,179
New 1.4 MG Reservoir	-	-	-	-	-	-	-	2,491,621
Annual Water Main Replacement Program	51,500	53,045	54,636	56,275	57,964	59,703	333,123	2,434,525
8" Diameter Distribution Main on SW 2nd Ct	-	-	-	-	-	-	-	129,137
8" Diameter Distribution to Hydrant on SW 3rd St	-	-	-	-	-	-	-	12,299
8" Diameter Distribution on NE Grace Ave	-	-	-	-	-	-	-	584,190
12" Main on SW 20th Street	-	-	-	-	-	674,640	674,640	674,640
Well Replacement	-	-	874,182	-	-	-	874,182	874,182
Total Capital Projects	\$ 1,452,300	\$ 53,045	\$ 2,431,318	\$ 815,994	\$ 840,474	\$ 1,540,327	\$ 7,133,458	\$ 26,808,755
Projected Capital Cash Flow								
Water SDC/Capital Fund Beginning Balance	\$ 87,302	\$ 1,013,750	\$ 3,189,472	\$ 1,407,444	\$ 1,260,844	\$ 1,117,207	\$ 87,302	\$ 87,302
Transfer from Water Fund (above reserve levels)	1,800,000	1,645,000	-	-	-	3,674	3,448,674	7,632,283
SDC Revenue	146,258	147,720	149,198	150,690	152,196	153,718	899,780	12,007,231
Rate-Funded System Reinvestment	432,316	433,005	484,145	504,629	525,728	516,525	2,896,348	14,608,900
Interest Earnings	175	3,041	15,947	14,074	18,913	22,344	74,494	1,805,144
Debt Proceeds	-	-	-	-	-	1,580,000	1,580,000	2,185,000
CIP Costs	(1,452,300)	(53,045)	(2,431,318)	(815,994)	(840,474)	(1,540,327)	(7,133,458)	(26,808,755)
Ending Balance	\$ 1,013,750	\$ 3,189,472	\$ 1,407,444	\$ 1,260,844	\$ 1,117,207	\$ 1,853,141	\$ 1,853,141	\$ 11,517,104

[1] Future Cost based on 3% annual inflation (conservative approximation of last 12 months ENR change).

The capital funding strategy assumes the following funding priority:

- Accumulated capital cash reserves
- Annual revenue collections for current connection charges (SDCs)
- Annual cash from rates earmarked for system reinvestment funding
- Annual transfers of excess cash (over minimum balance targets) from the operating fund, if any
- Debt issuance

The capital funding analysis demonstrates that the water utility is projected to have sufficient cash to fund 92 percent of the total CIP due to significant existing cash reserves, policy for ongoing rate-funding for system reinvestment, and SDC revenue collections. The remaining 8 percent is projected to be debt-funded. Projected borrowing totals \$2.2 million from issuances in 2018 and 2023.

Revenue Requirements Forecast

The revenue requirement analysis forecasts the amount of operating and capital related costs to determine the annual revenue required from rates. Although the capital funding plan is completed for the 20-year time horizon, the financial plan focuses on the 6-year planning period.

The analysis incorporates operating revenues, O&M expenses, debt service payments, rate funded capital needs, and any other identified revenues or expenses related to utility operations, and determines the sufficiency of the current level of rates. Revenue needs are

also impacted by debt covenants (typically applicable to revenue bonds) and specific fiscal policies and financial goals of the utility.

Typically, two (2) revenue sufficiency criteria are tested to determine the annual revenue need: 1) cash needs must be met and 2) debt coverage requirements must be realized.

The financial forecast is developed from the City's 2012 projected year-end performance, along with other key factors and assumptions listed below:

- Water rate revenues are forecasted based on projected year-end 2012 water rate revenue plus 1 percent annual customer growth.
- Interest earnings on cash balances are assumed at 0.2 percent in 2013 phasing up to 2 percent by the end of the 6-year forecast.
- Operating costs are based on the 2013-2014 Biennial Budget.
- O&M expenses are escalated at 2.5 percent per year for labor and general system costs and 7 percent for employee benefit costs. State taxes are calculated using prevailing tax rates.
- Revenue bond borrowing is projected at 3.5 percent interest and 1.5 percent issuance cost with a 20-year repayment term. The revenue bond coverage factor is 1.25 beginning in the first year of repayment.

Table 9-3 summarizes the annual revenue requirement for the 6-year horizon.

**Table 9-3
Revenue Requirement Forecast**

Revenue Requirements	Projected Y-E	Projected					
	2012	2013	2014	2015	2016	2017	2018
Revenues							
Rate Revenues Under Existing Rates	\$ 1,889,231	\$ 1,908,123	\$ 1,927,205	\$ 1,946,477	\$ 1,965,941	\$ 1,985,601	\$ 2,005,457
Non-Rate Revenues	247,845	251,412	251,939	250,925	256,709	262,841	276,608
Total Revenues	\$ 2,137,076	\$ 2,159,536	\$ 2,179,143	\$ 2,197,402	\$ 2,222,651	\$ 2,248,442	\$ 2,282,065
Expenses							
Cash Operating Expenses	\$ 1,487,023	\$ 1,668,954	\$ 1,733,195	\$ 1,774,984	\$ 1,817,803	\$ 1,861,676	\$ 1,906,739
Existing Debt Service	-	-	-	-	-	-	-
New Debt Service	-	-	-	-	-	-	121,546
Rate-Funded System Reinvestment	-	432,316	433,005	484,145	504,629	525,728	516,525
Total Expenses	\$ 1,487,023	\$ 2,101,269	\$ 2,166,200	\$ 2,259,129	\$ 2,322,432	\$ 2,387,405	\$ 2,544,810
Annual Surplus / (Deficiency)	\$ 650,053	\$ 58,266	\$ 12,943	\$ (61,727)	\$ (99,781)	\$ (138,963)	\$ (262,745)
Net Revenue from Rate Increases	\$ -	\$ -	\$ 40,679	\$ 83,405	\$ 128,263	\$ 175,344	\$ 224,741
Net Surplus / (Deficiency)	\$ 650,053	\$ 58,266	\$ 53,623	\$ 21,678	\$ 28,482	\$ 36,381	\$ (38,003)
Annual Rate Adjustment [1]		0.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Cumulative Rate Adjustment		0.00%	3.00%	6.09%	9.27%	12.55%	15.93%

[1]Rate increase for 2013 and 2014 adopted with the Biennial Budget.

The City has adopted the 2013-2014 biennial budget, which assumes no rate increase for 2013 and a 3 percent increase for 2014. Future annual increases of 3 percent are planned so that sufficient revenue is collected to meet rising costs and to make annual debt payments on the 2018 revenue bond. This rate strategy is projected to fund the financial obligations of the water utility including operating, capital, and reserve requirements through the forecast period.

Table 9-4 shows a summary of the projected operating and capital fund ending fund balances over the 6-year period. As previously discussed, the operating fund has a minimum operating reserve target of 90 days of O&M plus an additional 90 days of O&M for rate stabilization. The capital fund minimum balance is set at 2 percent of fixed assets. Minimums are met in each year of the planning period.

**Table 9-4
Ending Cash Balance Summary**

Ending Fund Balances	2012	2013	2014	2015	2016	2017	2018
Water Fund - Operating	\$ 3,925,641	\$ 2,183,907	\$ 592,530	\$ 614,208	\$ 642,689	\$ 679,071	\$ 637,394
Water SDC Fund - Capital	87,302	1,013,750	3,189,472	1,407,444	1,260,844	1,117,207	1,853,141
Debt Reserve	-	-	-	-	-	-	121,546
Total	\$ 4,012,943	\$ 3,197,657	\$ 3,782,002	\$ 2,021,652	\$ 1,903,533	\$ 1,796,278	\$ 2,612,081
Combined Minimum Target Balance		\$ 1,092,495	\$ 1,112,168	\$ 1,174,542	\$ 1,204,946	\$ 1,236,184	\$ 1,403,371

Current and Projected Rates

The existing water rate structure consists of a monthly basic meter charge of \$11.80, which includes three (3) ccf of water. Residential customers pay \$2.05 per ccf for use above the three (3) ccf and up to 15 ccf. Use above 15 ccf is charged at \$2.56 per ccf. All other customers pay a basic meter charge that increases with meter size and a volume charge of \$2.20 per ccf for all water use.

While the existing structure adequately encourages water conservation, further refinements could be made to improve efficiency of use and customer equity including:

- Eliminate the water usage allowance and charge for all use in volume rates
- Implement a third tier in the residential block rate to target highest water users and provide greater relief to low water users
- Consider seasonal rates for non-residential customers

The following table compares existing and proposed rates under the existing water rate structure.

**Table 9-5
Existing and Projected Water Rates**

Monthly Rates		Existing	Across-the-Board Increases					
		2012	2013	2014	2015	2016	2017	2018
Basic Meter Charge	Inside-City per month rate - includes 3 ccf	\$11.80	\$11.80	\$12.80	\$13.18	\$13.58	\$13.99	\$14.41
Residential Consumption	Inside-City per 100 cubic feet							
	4 - 15 ccf	\$2.05	\$2.05	\$2.05	\$2.11	\$2.17	\$2.24	\$2.31
	>15 ccf	\$2.56	\$2.56	\$2.56	\$2.64	\$2.72	\$2.80	\$2.88
Basic Meter Charge Commercial	5/8" meter	\$19.35	\$19.35	\$19.35	\$19.93	\$20.53	\$21.14	\$21.78
	3/4" meter	\$21.35	\$21.35	\$21.35	\$21.99	\$22.65	\$23.33	\$24.03
	1" meter	\$36.50	\$36.50	\$36.50	\$37.60	\$38.72	\$39.88	\$41.08
	1.5" meter	\$65.20	\$65.20	\$65.20	\$67.16	\$69.17	\$71.25	\$73.38
	2" meter	\$101.00	\$101.00	\$101.00	\$104.03	\$107.15	\$110.37	\$113.68
	3" meter	\$201.00	\$201.00	\$201.00	\$207.03	\$213.24	\$219.64	\$226.23
	4" meter	\$321.00	\$321.00	\$321.00	\$330.63	\$340.55	\$350.77	\$361.29
Commercial Consumption	Inside-City per 100 cubic feet	\$2.20	\$2.20	\$3.20	\$3.30	\$3.39	\$3.50	\$3.60
Commercial Irrigation	Annual connection	\$45.00	\$45.00	\$45.00	\$46.35	\$47.74	\$49.17	\$50.65
	De-activation charge	\$20.00	\$20.00	\$20.00	\$20.60	\$21.22	\$21.85	\$22.51
Outside the City	Rates and charges are all 1.5 times the in-City rates and charges							

Note: Table 9-5 reflects changes to basic residential meter charges and commercial consumption charges adopted in 2014.

Affordability

The Washington State Department of Health and Public Works Board use an affordability index to prioritize low-cost loan awards depending on whether utility bills exceed 2 percent of the median household income for the service area. This is a commonly used metric in the industry. If monthly bills are less than 2 percent of the median household income for the demographic area, rates are generally considered affordable. Table 9-6 presents the City’s estimated median income, affordability thresholds, and project water bills over the study period. As shown, the City’s projected water rates and corresponding customer bills are forecasted to remain well under the affordability threshold.

**Table 9-6
Affordability Benchmark**

	2012	With Projected Increases					
		2013	2014	2015	2016	2017	2018
Median Income	\$ 61,216	\$ 62,746	\$ 64,315	\$ 65,923	\$ 67,571	\$ 69,260	\$ 70,992
Affordability Threshold [1]	\$ 204.05	\$ 209.15	\$ 214.38	\$ 219.74	\$ 225.24	\$ 230.87	\$ 236.64
Projected Bi-Monthly Bill [2]	\$44.10	\$44.10	\$45.42	\$46.79	\$48.19	\$49.63	\$51.12

[1] Based on 2% of Median Household Income for a two-month period.

[2] Based on 16 ccf usage for a two-month period.

Available Funding Assistance and Financing Resources

Feasible long-term capital funding strategies must be defined to ensure that adequate resources are available to fund the identified CIP. In addition to cash reserves, capital revenues, and rate revenues designated for capital purposes, capital needs can be met from outside sources such as grants, low-interest loans, and bond financing. The following is a summary of potential resources.

Utility Resources

Water utility resources appropriate for funding capital needs include accumulated cash in the capital reserve, rate revenues designated for capital spending purposes, and capital-related connection charges and other connection fees. The first two (2) resources were discussed in the Financial Policies section (9.3). Capital related charges are discussed below.

Connection Charge

A connection charge (referred to as System Development Charge by the City), as provided for in RCW 35.92.025, refers to a one-time charge imposed on new customers as a condition of connecting to the utility system. The purpose of the connection charge is two-fold: 1) to promote equity between new and existing customers and 2) to provide a source of revenue to fund capital projects. Connection charges provide a mechanism for new customers to share in the capital costs incurred to support their addition to the system. Revenues from connection charges provide a source of cash flow that is used to support utility capital needs. The revenue can only be used to fund utility capital projects or pay debt service incurred to finance capital projects. In the absence of such charges, growth-related capital costs would be borne in large part by existing customers. In addition, the net investment in the utility already collected from existing customers, whether through rates, charges and/or assessments, would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments.

While connection charges commonly incorporate the cost of both existing system assets and future facilities based on the CIP, the City has elected to base the SDC exclusively on future system costs.

For the purposes of the financial analysis, the existing (2012) SDC is \$2,210 for new single family residential water customers. Based on projected infrastructure needs identified in the 20-year CIP presented in Section 8 and system capacity, an updated charge of \$3,074 per equivalent residential unit (ERU) was calculated for 2013. The updated SDC will be implemented in 2014 and adjusted for 2015 inflation. The proposed 2015 charge, incorporating inflation projected at 3 percent annually, is \$3,261 per ERU. The updated charge calculation and schedule of charges are as follows:

**Table 9-7a
2013 System Development Charge Calculation**

SDC UNIT COST	
Allocable Future Facilities Cost Basis	\$ 16,922,813
Incremental Future Capacity (ERUs)	5,505
Charge per ERU	\$ 3,074

**Table 9-7b
SDC by Meter Size**

Existing Water SDCs		Planned 2014 SDC		Proposed 2015 SDCs	
Meter Size	Charge	Meter Size	Charge	Meter Size	Charge
5/8"	\$ 2,210	5/8"	\$ 3,074	5/8"	\$ 3,261
3/4"	\$ 3,315	3/4"	\$ 4,611	3/4"	\$ 4,892
1"	\$ 5,525	1"	\$ 7,685	1"	\$ 8,153
1.5"	\$ 13,260	1.5"	\$ 18,444	1.5"	\$ 19,568
2"	\$ 22,100	2"	\$ 30,741	2"	\$ 32,613
3"	\$ 50,830	3"	\$ 70,704	3"	\$ 75,010
4"	\$ 90,610	4"	\$ 126,037	4"	\$ 133,713

Local Facilities Charge

While a connection charge is the manner in which new customers pay their share of general facilities costs, local facilities funding is used to pay the costs of local facilities that connect each property to the system's infrastructure. Local facilities funding is often overlooked in a rate forecast since it is funded upfront by either connecting customers and developers or through an assessment to properties, but typically not from rates. Although these funding mechanisms do not provide a capital revenue source toward funding CIP costs, the discussion of these charges is included because they impact the new system customers.

There are a number of mechanisms that can be considered toward funding local facilities. One (1) of the following scenarios typically occurs: a) the utility charges a connection fee based on the cost of the local facilities (under the same authority as the connection charge); b) a developer funds the extension of the system to their development and turns those facilities over to the utility (contributed capital); or c) a local assessment is set up called a Utility Local Improvement District (ULID/LID) that collects property assessments from benefited properties.

A Local Facilities Charge (LFC) is a variation of the connection charge authorized by RCW 35.92.025. It is a Utility-imposed charge to recover the cost related to extending service to local properties. Often called and applied as a front-footage charge imposed based on the length of water main footage “fronting” a particular property, it is usually implemented as a reimbursement mechanism to a utility for the cost of a local facility that directly serves a property. It is a form of connection charge and, as such, can accumulate up to ten years of interest. LFCs typically apply to instances where no developer-installed facilities are needed through developer extension due to the prior existence of available mains already serving the developing property.

A Developer Extension is a requirement that a developer install onsite and sometimes offsite improvements as a condition of extending service. These are in addition to the connection charge required and must be built to utility standards. Utilities are authorized to enter into developer extension agreements under RCW 35.91.020. Part of the developer extension agreement between a utility and developer might include a latecomer agreement, resulting in a latecomer charge to new connections to the developer extension.

Latecomer Charges are a variation of developer extensions whereby a new customer connecting to a developer-installed improvement makes a payment to a utility based on their share of the developer’s cost (RCW 35.91.020). The utility passes this payment to the developer who installed the facilities. This is part of the developer extension process, and defines the allocation of costs and records latecomer obligations on the title of affected properties. No interest is allowed, and the reimbursement agreement cannot exceed 15 years in duration.

A ULID/LID is another mechanism for funding infrastructure that assesses benefited properties based on the special benefit received by the construction of specific facilities (RCW 35.43.042). Most often used for local facilities, some ULIDs also recover related general facilities costs. Substantial legal and procedural requirements can make this a relatively expensive process, and there are mechanisms by which a ULID can be rejected by a majority of property ownership within the assessment district boundary.

Outside Funding Sources

Often utility resources from service revenue and connection charges are insufficient to cash-fund the cost of all CIP projects upfront. The City would look to external funding and financing options to complete the program. These include primarily state and federal low cost loan programs, grants, and revenue bonds.

Grants and low cost loans for Washington State utilities are available from the Departments of Ecology and the Department of Commerce. Each includes programs for which the City might be eligible, but are primarily targeted at sewer programs or low income and/or rural communities.

Washington State Department of Ecology

The Department of Ecology Water Quality Program administers three (3) major funding programs that provide low interest loans, grants or loans and grant combinations for projects that protect, preserve and enhance water quality in Washington State. These are primarily for wastewater projects and are not applicable to the City's water CIP. Further detail is available in the Funding Guidelines found at

<http://www.ecy.wa.gov/programs/wq/funding/funding.html>.

Washington State Department of Commerce

The Department of Commerce has four (4) grant and loan programs that the City could potentially be eligible for:

- Community Development Block Grants General Purpose Grant;
- Community Economic Revitalization Board Grant and Loan Program;
- Public Works Trust Fund Loan Program; and
- Drinking Water State Revolving Fund Loan Program.

Community Development Block Grants (CDBG) General Purpose Grants

CDBGs are made available to Washington State small cities, towns and counties in carrying out significant community and economic development projects that principally benefit low and moderate income persons. Eligible applicants are Washington State cities and towns with a population less than 50,000 and counties with a population less than 200,000 that are non-entitlement jurisdictions or are not participants in a HUD Urban County Entitlement Consortium. Eligible projects include public facilities for water, wastewater, storm sewer and streets. The application period is September through November annually.

Community Economic Revitalization Board (CERB)

CERB, a division of the Washington State Department of Commerce, primarily offers low cost loans; grants are made available only to the extent that a loan is not reasonably possible. The CERB targets public facility funding for economically disadvantaged communities, specifically for job creation and retention. Priority criteria include the unemployment rates, number of jobs created and/or retained, wage rates, projected private investment, and estimated state and local revenues generated by the project. Traditional construction projects are offered at a maximum dollar limit of \$1 million per project. A local match of 25 percent is targeted.

Eligible applicants include cities, towns, port districts, special purpose districts, federally recognized Indian tribes and municipal corporations.

The CERB's policy is that all loans will be secured by a general obligation pledge of the taxing power of the borrowing entity. Terms do not exceed 20 years, including available payment deferral of interest and principal for up to five (5) years. Interest rates match the

most current rate of Washington State bonds (not to exceed 10 percent). Application deadlines are 45 days prior to a CERB meeting, which are scheduled six (6) times per year. For more information, see

www.commerce.wa.gov/commissions/CommunityEconomicRevitalizationBoard/Pages/CERB-B-Traditional-Programs.aspx.

Public Works Trust Fund (PWTF)

While the PWTF has historically been a resource to cities, towns, counties and special purpose districts to fund water projects, it is not funded in the current biennium. In addition, the state legislature passed a statute with the intent of redirecting tax revenue from the Public Works Assistance Account for six (6) years to the state General Fund.

For more information, see: <http://www.pwb.wa.gov/Documents/Letter-to-2014-PWTF-Construction-Applicants.pdf>

Drinking Water State Revolving Loan Program (DWSRL)

The DWSRL is jointly administered by the Public Works Board and the Department of Health. The program is intended to improve drinking water systems and protect public health for publicly and privately owned systems.

There is no match required, terms are not to exceed 20 years and project completion time is 4 years after loan execution. The loan limit is \$12 million, with a loan fee of 1 percent, and interest rates range from 1 to 1.5 percent depending upon the income level of households in the water service area.

For more information, see: http://www.doh.wa.gov/ehp/dw/our_main_pages/dwsrf.htm

General Obligation Bonds

General obligation (GO) bonds are secured by the full faith and credit of the issuing agency, committing all available tax and revenue resources to debt repayment. With this high level of commitment, GO bonds have relatively low interest rates and few financial restrictions. However, the authority to issue GO bonds is restricted in terms of the amount and use of the funds, as defined by the Washington State Constitution and statute. Specifically, the amount of debt that can be issued is linked to assessed valuation.

RCW 39.36.020 states:

(ii) Counties, cities, and towns are limited to an indebtedness amount not exceeding one and one-half percent of the value of the taxable property in such counties, cities, or towns without the assent of three-fifths of the voters therein voting at an election held for that purpose.

(b) In cases requiring such assent counties, cities, towns, and public hospital districts are limited to a total indebtedness of two and one-half percent of the value of the taxable property therein.

While bonding capacity can limit availability of GO bonds for utility purposes, these can sometimes play a valuable role in project financing. A rate savings may be realized through two (2) avenues: 1) the lower interest rate and related bond costs; and 2) the extension of repayment obligation to all tax-paying properties (not just developed properties) through the authorization of an ad valorem property tax levy.

Revenue Bonds

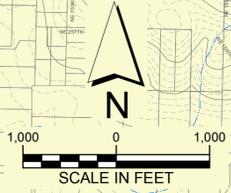
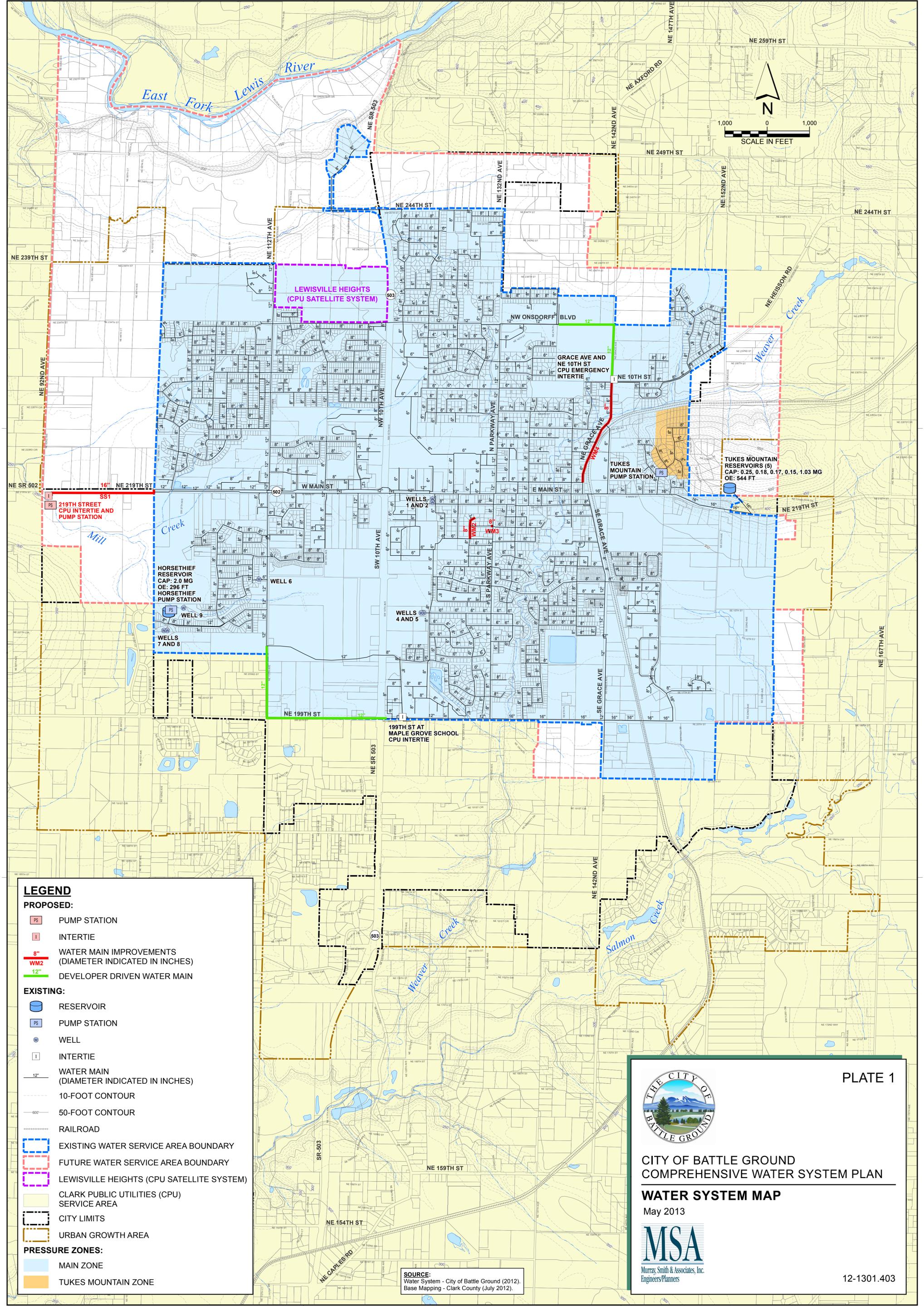
Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility and the debt obligation does not extend to a utility's other revenue sources. With this limited commitment, revenue bonds typically bear higher interest rates than GO bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (added bond debt service coverage). The utility agrees to satisfy these requirements by ordinance as a condition of the bond sale.

Revenue bonds can be issued in Washington State without a public vote. There is no bonding limit, except perhaps the practical limit of the utility's ability to generate sufficient revenue to repay the debt and provide coverage. In some cases, poor credit might make issuing bonds problematic.

Conclusion

The results of this analysis indicate that 3 percent annual rate increases are necessary to fund ongoing operating needs and projected debt associated with the identified capital program. Implementation of proposed rate increases should provide for continued financial viability.

It is recommended that the City regularly review and update the key underlying assumptions that serve as the foundation of the multi-year financial plan to ensure that adequate revenues are collected to meet the total water utility financial obligations.



LEGEND

PROPOSED:

- PS PUMP STATION
- I INTERTIE
- 8" WATER MAIN IMPROVEMENTS (DIAMETER INDICATED IN INCHES)
- WM2 DEVELOPER DRIVEN WATER MAIN

EXISTING:

- RES RESERVOIR
- PS PUMP STATION
- W WELL
- I INTERTIE
- 12" WATER MAIN (DIAMETER INDICATED IN INCHES)
- 10' 10-FOOT CONTOUR
- 50' 50-FOOT CONTOUR
- RR RAILROAD
- [] EXISTING WATER SERVICE AREA BOUNDARY
- [] FUTURE WATER SERVICE AREA BOUNDARY
- [] LEWISVILLE HEIGHTS (CPU SATELLITE SYSTEM)
- [] CLARK PUBLIC UTILITIES (CPU) SERVICE AREA
- [] CITY LIMITS
- [] URBAN GROWTH AREA

PRESSURE ZONES:

- [] MAIN ZONE
- [] TUKES MOUNTAIN ZONE



PLATE 1

**CITY OF BATTLE GROUND
COMPREHENSIVE WATER SYSTEM PLAN
WATER SYSTEM MAP**

May 2013



12-1301.403

SOURCE:
Water System - City of Battle Ground (2012),
Base Mapping - Clark County (July 2012).



City of Battle Ground

WATER USE EFFICIENCY PROGRAM

March 2011

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OBJECTIVE

The objectives of this document are to identify the conservation and water use efficiency requirements pertaining to the City of Battle Ground, evaluate past conservation efforts, and describe the City's Water Use Efficiency program.

INTRODUCTION

In 2003, the Washington State Legislature passed Engrossed Second Substitute House Bill 1338, also known as the Municipal Water Law (MWL), to address the increasing demand on the State's water resources. The law calls for all municipal water suppliers to use water more efficiently in exchange for water right certainty in meeting future demand for the resource. The legislature directed the Washington Department of Health (WDOH) to adopt an enforceable Water Use Efficiency (WUE) program. This WDOH program and its rules, which became effective on January 22, 2007, are designed to ensure the long term supply of drinking water, promote good stewardship of the water resources and ensure efficient operation and management of water systems.

The WUE rule affects all municipal water suppliers, including all Group A community water systems like the City of Battle Ground. As required by Washington Administrative Code (WAC) 246-290, the City must provide for data collection and analysis intended to track water consumption and water loss from leaks in the system. Our WUE program must evaluate alternative rate structures and determine the feasibility of adopting a structure that will encourage water conservation. The following report describes the City of Battle Ground's Water Use Efficiency program.

MUNICIPAL WATER LAW REQUIREMENTS

SECTION 1: WATER USE EFFICIENCY PROGRAM

As part of the Planning Requirements of the WUE, municipal water suppliers are required to collect data, forecast demand, evaluate WUE measures, calculate distribution leakage and implement a WUE program to meet their goals. As of January 1, 2007, water suppliers have been obligated to collect production and consumption data on a regular basis to include in planning documents and annual performance reporting. As part of this data collection, demand forecasting is also an essential component for determining future use and potential savings through a water use efficiency program. A description of the water supplier's water source and supply characteristics must also be provided.

SECTION 2: DISTRIBUTION LEAK STANDARDS

Prior to adoption of the MWL, the Department of Health did not have a set distribution leakage standard, but encouraged a figure of 20% or less. Municipal water suppliers must now meet a 10% or less distribution system leakage rate to comply with the new state standard. Leakage must be presented both as a percentage and as leakage volume, and based on a rolling three-year average. Compliance with the distribution leakage standard must be met by July 1, 2010; if unable to meet this standard, the supplier must develop and implement a Water Loss Control Action Plan that outlines the steps and timelines to achieve the desired leakage rate. Additionally, a meter installation schedule is also required for all service connections currently not metered.

SECTION 3: GOAL SETTING AND PERFORMANCE REPORTING

The WUE requires municipal water suppliers to establish water use efficiency goals. Establishing goals demonstrates commitment and support from the utility and its water customers to use water efficiently. Goals must be established through a public process and reported on annually to customers and DOH by July 1 of each year. The WUE goals established through a public process are for a six-year period, and should be re-evaluated each cycle. Goals must be measurable, address water supply and demand forecasting, and include an implementation schedule for each goal. Performance reports are required to be made available to the public: this requirement may be fulfilled by including the performance report information in the annual Consumer Confidence Report. Annual water system production total, distribution system leakage information, and a description of the WUE goals and progress of achieving them must also be included in this publication.

2011-2017 WATER USE EFFICIENCY PROGRAM

SECTION 4: *GENERAL DESCRIPTION OF THE CITY'S WATER SYSTEM*

The City of Battle Ground is a municipal corporation, formed by a vote of the people in 1951. Our water utility provides water within the City's Urban Growth Area, which currently covers about six square miles and serves about 17,310 people. The City's water system has 5,923 connections (as reported in the 2010 Water Facilities Inventory), which service approximately 6,596 Equivalent Residential Units (ERU's). An ERU is a term used in water system planning to represent the water use of average residential home.

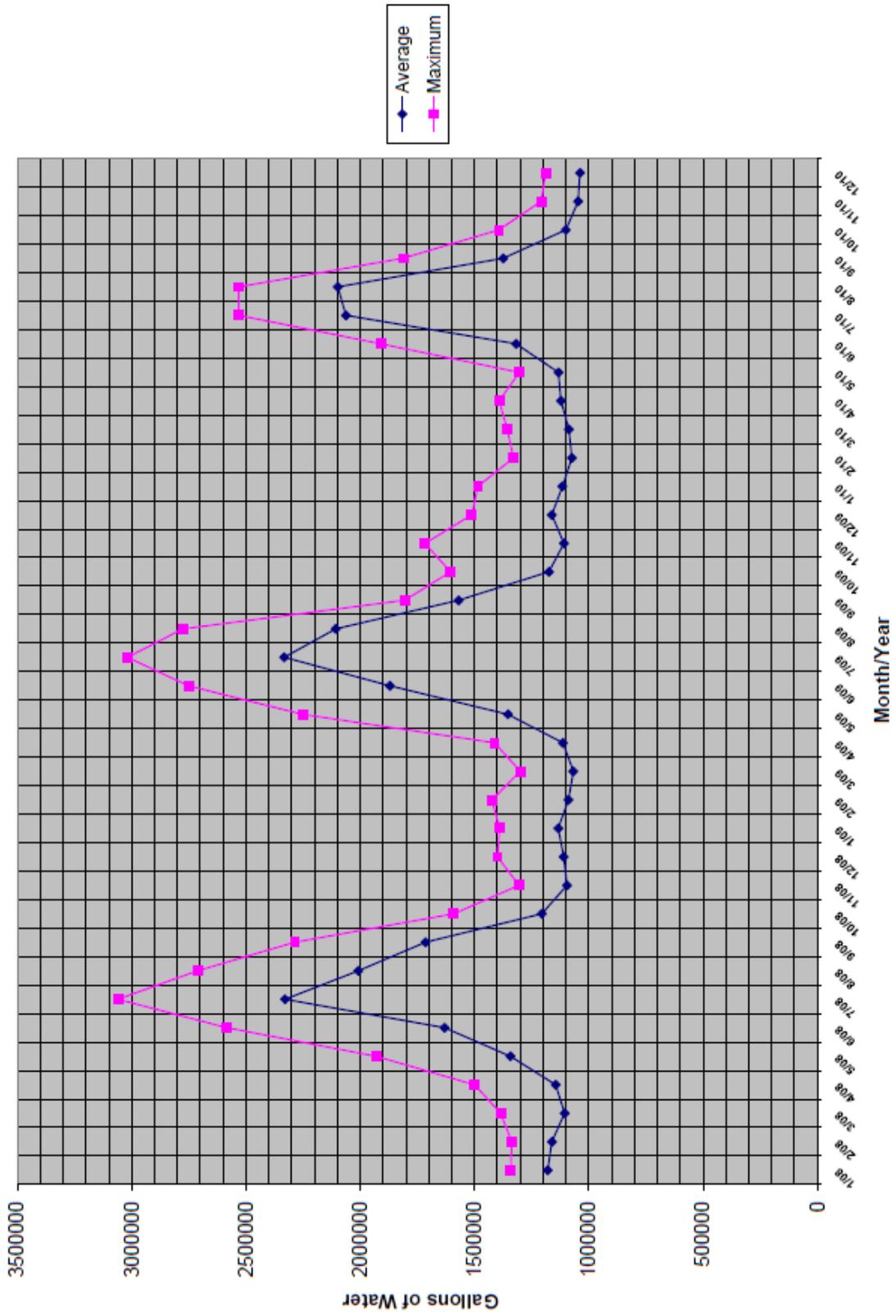
Single and multi-family residential customers total over 90% of our utilities accounts. The average residential customer consumes about 235 gallons of water per day, or about 91 gallons per person per day. This is a 26% decrease from 316 gallons/ERU as reported in our 1998 Water System Plan.

The City's water supply is produced by wells located in our regional aquifers. These wells produce an average daily flow totaling about 2.25 million gallons per day. The water is disinfected with sodium hypochlorite at each source well, and then treated with fluoride. Additional treatment measures are taken for iron removal at wells 7, 8 and 9. Our wells meet the water demand of the City, with the exception of emergency water needs. During peak usage periods, usually caused by high summer temperatures, we purchase water supplied by Clark Public Utilities (CPU). This water is supplied and metered through an existing intertie that is only opened on an emergency basis. Battle Ground's recent production history is summarized in the following chart, showing average monthly production rates and peak daily consumption for each month.

Additional information on our sources and water rights, along with future demand projections, can be found in the current City of Battle Ground Water System Plan; approved by the Washington State Department of Health.

TABLE 1:

Battle Ground Monthly Average/Peak Day Water Consumption (GPD) 2008-2010



SECTION 5: WATER CONSERVATION GOALS

The City of Battle Ground works to foster a conservation ethic among our consumers. One principal in achieving this goal is the reduction of the water demand in residential customers. Our staff has evaluated the effects of past activities aimed at water conservation and has established the following goals, to be adopted with this plan.

Supply - Conservation Goal:

Reduce annual distribution system leakage (DSL) from the current level of 12.1% to 10% or less within six years.

Demand - Conservation Goal:

Reduce the average equivalent residential unit annual water consumption by a minimum of 1% (2gpd) within six years.

SECTION 6: WATER CONSERVATION MEASURES

The City of Battle Ground is implementing water conservation measures as mandated under WAC 246-290-466. Water meters are in place at all sources and service connections. Meter data is collected and evaluated to determine trends in the consumption of water, and to generally account for the water in the system. The following is an outline of the measures that will be taken in an effort to achieve our water use efficiency goals.

Supply Side:

- 1. Leak Detection** – As leaks are discovered, they are repaired or mains are reconstructed as needed. One way we watch for system leaks is through our meter reading program. The City’s Finance Department uses software that tracks the consumption history of each meter. If a meter shows a higher than average consumption level during any given billing cycle a maintenance worker is sent to the site to verify the reading. If the reading is accurate, the location is then investigated for potential leaks to prevent further water loss.

Future work to decrease distribution system leaks will focus on service meter replacement and close monitoring of non-revenue water usage. Non-revenue water uses include, but are not limited to, water used in street sweeping, vacuum truck sewer cleaning, water line flushing and back washing at our treatment facility for wells 7, 8, and 9.

- 2. Source Metering** – The City has production meters on all water sources as well as a state of the art telemetry system to monitor these sites. The telemetry system monitors the operation of our water production system for possible pressure loss, pump function and water reservoir levels. Each component of the water supply system including the city’s meters, water mains, supply wells, reservoirs, booster stations, pressure reducing valves, and other facilities is inspected regularly and repairs are made when necessary.
- 3. Service Metering** – Industry standards for residential water meters state that these meters are expected to have a reasonable level of accuracy within their average service life of 10 to 12 years. The City’s Public Works staff has implemented a proactive meter replacement program with the goal to reduce system leakage and achieve a standard meter age of ten years or less.

A small percentage of our system’s DSL rate can be attributed to water theft related use. Historically, fire hydrants have been the primary source for water theft in our system. Our staff is diligent in identifying and discontinuing service when a violation is discovered. Violators can receive a misdemeanor charge and/or a related fine.

Demand Side –

- 1. Public Education** – The City provides informational materials aimed at water use efficiency for customers on the City’s website, www.cityofbg.org, and at several City offices. Documents like our “Every Drop Counts” brochure (*Appendix B*) and our annual water quality reports provide customers with information specific to the City’s water systems as well as tips that they can use to practice efficient water use in their daily lives. Additionally, the City utilizes the local newspaper to inform customers of the importance of water conservation (*Appendix C*) and to notify them of voluntary and/or regulatory restrictions whenever necessary.

Presumably, the most prominent component of our WUE public education efforts is our ‘Conservameter’ signs. These tools are usually implemented annually during our peak water usage months, late June through September. It allows our staff to communicate the state of the City’s water supply on a daily basis. During the drier seasons the production of water is significantly decreased, but due to the higher temperatures the demand for water increases. An assessment of the City’s water production and supply is taken daily, and staff will use these meters to express the need of conservation cooperation from our customers as necessary.



Conservameter – located on E Main Street and SW 5th Ave

2. **Building Code and Land Use Program** – The City’s building code includes several requirements for irrigation systems and low flow fixtures. Each new irrigation system requires a plumbing permit. Our inspectors make sure each system is installed correctly and is protected by a backflow device. They also make sure that each new residential and commercial development has low flow fixtures (faucets, toilets, showerheads, ect.) installed.

Additionally, the City’s land use code requires new developments to typically be denser than existing land uses resulting in decreased irrigation demands as parcels are developed. We anticipate that with continued growth the average water use by each ERU is expected to decrease as well.

3. **Customer Consumption History** - The monthly utility statements that the City sends out to its customers indicate water consumption history. By allowing customers to track and compare their usage, citizens can be informed of their own water use trends. The awareness can allow them to evaluate their individual water conservation needs and alert them of potential leaks.

4. **Irrigation Program and Watering for City Property** – During the drier months, the City may elect to suspend watering and irrigation operations at select City owned parks and facilities. Likewise, we encourage consumers to keep water conservation in mind when tending to their private landscapes by promoting the following water conservation ideas:

- Set sprinkler system timers to irrigate only when needed.
- Water lawns and plants in the early morning or late evening to limit water loss due to evaporation.
- Place a layer of mulch around plants and trees to avoid excessive evaporation.
- Monitor irrigation so to water only as rapidly as the soil can absorb the water.
- Install drip irrigation systems for a slow, steady supply of water to the plant roots.
- Position sprinklers or drip irrigation systems to water only the root areas of plants and not sidewalks, gutters, or streets.
- Consider native plants when landscaping.

5. **Inclined Block Rate Structure** – As the table below illustrates; the City’s Inclined Block Rate Structure establishes rates that will be applied to the customer based on their total usage. This rate schedule provides a financial incentive to reduce water demand, particularly during the peak summer period when the demand for water is more acute. It is estimated that our average residential customer will use no more than 3 units of water (748 gallons/unit, or CCF) per billing cycle. If that customer exceeds that estimate then the rate corresponding to their total usage in each billing cycle will be applied. (*See Table 2*)

**TABLE 2:
Historic Customer Water Rates**

Customer Class	2007	2008	2009	2010	2011
Residential - 3 units <i>(Inside City Limits)</i>	\$10.80	\$10.80	\$11.80	\$11.80	\$11.80
Residential - 4-15 units <i>(Inside City Limits)</i>	+ \$2.05/ ccf				
Residential - 16+ units <i>(Inside City Limits)</i>	+ \$3.08/ ccf	+ \$3.08/ ccf	+ \$2.56/ ccf	+ \$2.56/ ccf	+ \$2.56/ ccf
Residential - 3 units <i>(Outside City Limits)</i>	\$16.20	\$16.20	\$17.70	\$17.70	\$17.70
Residential - 4-15 units <i>(Outside City Limits)</i>	+ \$3.08/ ccf				
Residential - 16+ units <i>(Outside City Limits)</i>	+ \$3.84/ ccf				
Commercial - 5/8" meter	\$18.35*	\$18.35*	\$19.35*	\$19.35*	\$19.35*
Commercial - 3/4" meter	\$20.35*	\$20.35*	\$21.35*	\$21.35*	\$21.35*
Commercial - 1" meter	\$35.50*	\$35.50*	\$36.50*	\$36.50*	\$36.50*
Commercial - 1.5" meter	\$64.20*	\$64.20*	\$65.20*	\$65.20*	\$65.20*
Commercial - 2" meter	\$100.00*	\$100.00*	\$101.00*	\$101.00*	\$101.00*
Commercial - 3" meter	\$200.00*	\$200.00*	\$201.00*	\$201.00*	\$201.00*
Commercial - 4" meter	\$320.00*	\$320.00*	\$321.00*	\$321.00*	\$321.00*

* Plus \$2.20/ ccf

DISTRIBUTION SYSTEM LEAKAGE EVALUATION

Distribution system leakage (DSL) is defined as the difference between total water produced and all water consumed or purchased. We account for water within our system by examining supply and service meter data, and tracking water used for non-revenue producing purposes (maintenance and firefighting). Our records show that unaccounted for water losses in Battle Ground currently account for about 12.1% per year.

The 1994 *Conservation Planning Requirements* set the maximum allowable rate of lost and unaccounted for water, at 20% of total source production. We estimate our DSL rate was significantly higher in the mid 1990's, before Battle Ground experienced significant growth. Our current DSL average represents the significant improvement in our distribution system leak evaluation program. This is a direct result of continuous work to eliminate steel water mains, and directly respond to water system leaks as they are discovered.

The current WUE Rule mandates that we achieve an average DSL of 10 %, based on a three year rolling average. Table 3, below, summarizes the current three year rolling average.

TABLE 3
City of Battle Ground Historic Distribution System Leakage

Year	Metered Production	Metered Consumption	DSL		3 yr Rolling Average
			(MG)	(%)	
2007*	526 (MG)	450 (MG)	76 (MG)	14.4%*	N/A
2008	518 (MG)	448 (MG)	70 (MG)	13%	N/A
2009	520 (MG)	471 (MG)	48 (MG)	9.3%	12.1%
Average	519.6 (MG)	456.3 (MG)	63.2 (MG)	12.1%	12.1%

*Our original 2007 report was submitted with a lower value as shown in Appendix D.

WATER LOSS ACTION PLAN

Since the City does not meet the current WAC 246-290 DSL standard of 10%, we have developed a Water Loss Action Plan. This plan will be funded by the water utility and will include the following actions:

- Replace 10% of our water meters annually to eventually achieve an average water meter age of 10 years;
- Continue to perform scheduled calibration on all source flow meters;
- If DSL does not come below 10% after two years, implement system leak detection studies.

PROJECTED WATER SAVINGS

The 1994 and 1998 Water System Plan estimated consumption at 120gpcd (gallons per capita per day) or 316 gallons per ERU. Our current water system planning estimates our system demand rate at 97gpcd or 235 gallons per ERU. Therefore we estimate that the per capita use of water in Battle Ground has declined by approximately 26% since 1994. Existing and further conservation measures are expected to continue to reduce peak daily and seasonal water demands.

If our Water Use Efficiency goals are realized, the City is expected to see significant additional savings in water use and distribution system leakage (DSL). A 2% reduction in distribution system leakage combined with a 1% reduction in consumer usage over six years (2gpd per ERU) will result in an estimated savings of about 14.7 million gallons annually. This savings would allow our current system to adequately support an additional 442 people or 171 ERU's.

WATER USE EFFICIENCY PROGRAM EVALUATION

The WUE Program requires Battle Ground to set water use efficiency goals, and to evaluate each year's progress towards meeting these goals. Our goals must include a measurable outcome, address the water supply and demand characteristics, and include an implementation schedule to account of each facet of our program.

Many of the measures selected for the WUE program require little funding, such as including consumption history in bills and notifying customers of potential leaks. The City will track the finances associated with each measure and compare it to water saved to evaluate the effectiveness of each measure. If measures do not provide enough savings to meet their goals, additional or modified measures will be considered.

ANNUAL WUE REPORTING

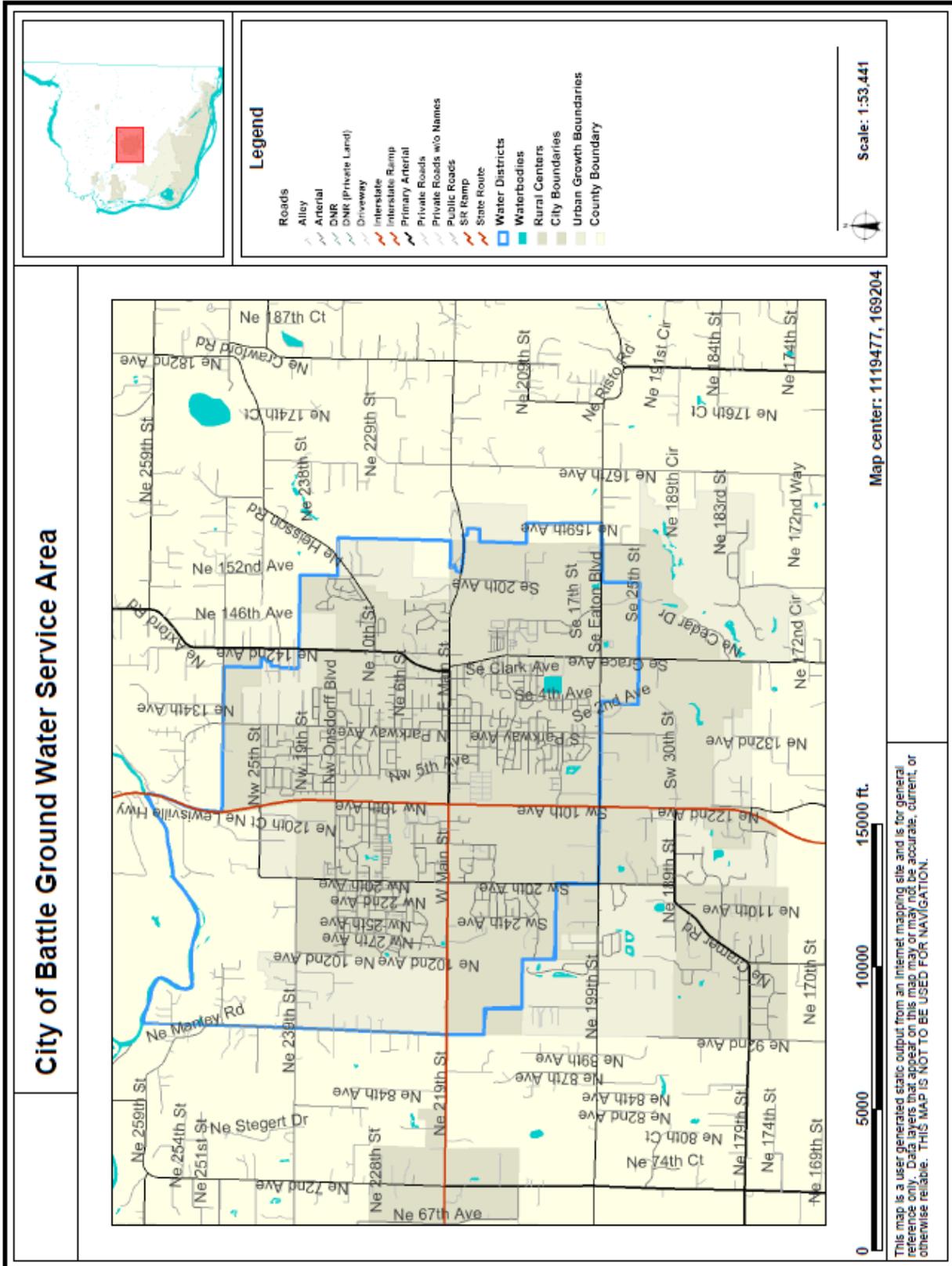
A WUE Report must be submitted to Washington Department of Health by July 1st of each year. The WDOH has developed a standard reporting form to help summarize the City's progress toward meeting their goals. The annual report must include:

- Total source production and system wide consumption
- Distribution system leakage in percentage and volume
- Goal description, schedule, and progress toward meeting goals

The City's WUE Reports for 2007, 2008 and 2009 are represented in Appendices D – F attached hereto.

APPENDICES

APPENDIX A: City of Battle Ground's Water Service Area Ma



APPENDIX B: Water Conservation Brochure “Every Drop Counts”



Landscaping and Water - Getting the Most out of Both

Sometimes it's hard to believe with our rainy weather here in the Pacific Northwest, that we need to conserve water. Water consumption skyrockets during the summer months, which in turn, depletes our water resources making water conservation a necessity.

You can help save water and your landscaping at the same time by following these practical guidelines.

1. Best time - Water in the early morning or evening. You lose a lot of water due to evaporation when watering after temperatures have reached their peak.
2. Get a timer - These \$10 items are so handy and help you to not forget that sprinkler running outside when you get busy inside.
3. Use soaker hoses when possible and drip systems in pots.
4. Make sure valves are not leaking outside. Sometimes just slightly tightening can stop the drip at your outside nozzle.
5. Adjust your sprinkler before you turn it on. The street, driveway and sidewalks get plenty of water during the winter months!
6. Use mulch around shrubs and plants to reduce evaporation and cut down on weed growth.
7. Consider installing new landscaping at the end of the season when the weather is cooler and water usage is tapering off.
8. Landscape with grasses, plants and trees that are native to the Pacific Northwest. Group plants together based on similar watering needs.



City of Battle Ground

109 S.W. 1st Street, Ste. 122
Battle Ground, WA 98604
Phone: 360-342-5070
Fax: 360-342-5057

Email: Joan.Hall@ci.battle-ground.wa.us

For More Information on
Water Conservation log onto:
www.cityofbg.org
www.bewatersmart.net
www.awwwa.org
www.h2ouse.org



**“When the well is dry,
we know the worth of water”
Benjamin Franklin**

WATER

Every Drop Counts!



Your Guide to Water Conservation



Water saving tips for you.....

In the Kitchen.

- Never run the dishwasher without a full load. This will save water, energy, detergent and money.
- Fill a pan of water or put a stopper in the sink for washing and rinsing pots, pans, dishes and cooking implements rather than turning on the water faucet each time a rinse is needed.
- Scrape the dishes clean instead of rinsing them before placing them in the dishwasher.
- Keep a container of drinking water in the refrigerator. Running water from the tap until it is cool enough to drink is wasteful.
- Use a small pan of cold water when cleaning vegetables rather than letting the water run over them. Use this to water potted plants.
- Always keep water conservation in mind. Avoid doing wasteful things like making a huge pot of coffee if you're only going to drink a cup or two.

.....In the Bathroom.

- When building a new home or remodeling a bathroom, install a new low-volume flush toilet that uses only 1.6 gallons per flush.
- You save a lot of water by installing low-flow shower heads. Using these low flow devices you can save as much as 5½ gallons of water per minute.
- Test toilets for leaks. Add a few drops of food coloring to the water in the toilet tank, but do not flush the toilet. Watch to see if the coloring appears in the bowl within a few minutes. If it does, the toilet has a leak that needs to be repaired.
- In older high-volume flush toilets use some type of toilet tank displacement device to reduce the volume of water in the tank, but still provides enough for flushing. You can find these devices at most home improvement centers.
- Check faucets for leaks. A slow drip can waste as much as 170 gallons of water each day, or 5000 gallons of water each month. This adds a lot of money to your water bill.

.....In the Laundry.

- Wash only full loads of clothes when using your washing machine. It can take as much as 59 gallons of water to wash one load of clothes.
- Pay attention to your load size. Use the lowest possible water level setting on the washing machine according to the amount of clothes being washed.
- Use cold water whenever possible. This saves energy too, and conserves the hot water for others uses. It's also better for most types of fabrics.
- When purchasing new appliances, check the requirements of various models and brands. Some use less water than others.
- If possible, replace old washer and dryers with new energy saving models. You may even be able to receive a tax credit for these purchases.

.....And your Plumbing.

- Check water line connections and faucets for leaks.
- Repair leaky faucets promptly. It is easy to do, it costs very little and can make a substantial savings in your water bills.
- Make sure that the line from the water meter to your house is free of leaks. To check, turn off all indoor and outdoor faucets and water-using appliances. The water meter should be read at 10 to 20 minute intervals. If it continues to run or turn, a leak probably exists and needs to be located and repaired.
- Some estimate that about 75% of the water used at home is used in the bathroom. Taking a shower instead of a bath will usually save water, and a low-flow shower head may well be the single most effective water conservation measure you can take.

The water we conserve today can serve us tomorrow.

**APPENDIX C:
Public Information Announcement**

8 Easy Ways to Save Water

Saving Water Outdoors

Up to half of residential water use occurs outdoors. Watering wisely protects the home, preserves beautiful lawns and landscapes and will save some folks up to **50%** of the water they use outdoors.

1 Water your lawn early & use time care

Watering your lawn in the early morning or early evening reduces evaporation and waste. Lawns only need watering every three to five days in the summer. It only needs about 1/2 to 3/4 inch of water at a time. Place time care around your yard & measure the water collected in half an hour. Spread several cans around your yard to test for even distribution.



2 Sprinkle your yard with care

Install soaker hoses or drip irrigation systems for planting beds with shrubs and flowers. Make sure you are watering your plants and not the street or driveway.

3 Organize your surroundings

Landscapes with drought-tolerant ornamental grasses, plants and trees. Group plants together based on similar water needs. Mulch to retain moisture and reduce weeds.

4 Buy a nozzle for the nose of your hose

Place a shutoff nozzle on your hose to control the flow of water so you only use what you need. Remember to turn the water off at the faucet to prevent leaks.



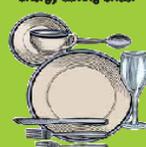
5 Save time, water and money

If you don't have an automatic timer on your sprinkler, use a kitchen timer to remind you to turn off the water. Left unattended, a garden hose can waste as much as 600 gallons of water in just one hour and cost you a lot of money.



6 Delay household chores

Run automatic dishwashers only when fully loaded. Set clothes washers to the appropriate level for the size of load you are washing. If possible, replace old appliances with new energy saving ones.



Saving Water Indoors

Fixing leaks and replacing old plumbing fixtures with water-saving ones could save a family of four 30,000 gallons of water each year.

7 Help your toilet and faucet save water

Replace any worn, corroded or bent parts in your toilet. A leaky tank can waste 200 gallons of water each day. Repair dripping faucets by replacing washers. If your faucet is dripping at the rate of one drop per second, you can waste 20 gallons of water each day.



8 Shower yourself with savings

By keeping your showers under five minutes and installing low-flow showerheads, you can save a lot of water. Older fixtures can deliver as much as 8 gallons per minute. New showerheads deliver 2 1/2 gallons of water per minute. That adds up to a lot of water and money saved.

Remember:
Always turn water off while brushing your teeth and shaving.



WATER
Conserve It.



For more information on water conservation, visit our website www.cityofbg.org or contact Public Works at 342-5070.
This message brought to you by the City of Battle Ground.

APPENDIX D:

City of Battle Ground's 2007 WUE Report



**Annual Water Use Efficiency
Performance Report Form**

Please refer to the *Getting Started – Water Use Efficiency Guidebook*,
DOH Pub. 331-375, http://www.doh.wa.gov/ehp/dw/municipal_water/331-375_7-24-07.pdf for help in filling out this form.

General System Information:

System Name: City of Battle Ground

System ID #: 047004

County: Clark

Your Name: Cal Newton

Your Title: Operations Foreman

Your Phone Number: (360) 342-5365

Today's Date: 09/25/08

Production and Distribution System Leakage Information:

12-Month Performance Reporting Period:

1 / 2007 to 12 / 2007 (Month/Year)

Distribution System Leakage Summary:	
Total Water Produced and Purchased – Annual Volume	526 <input checked="" type="checkbox"/> millions of gallons* <input type="checkbox"/> gallons*
Distribution System Leakage – Volume	76 <input checked="" type="checkbox"/> millions of gallons* <input type="checkbox"/> gallons*
Distribution System Leakage – Percent	8 %

**Report volume in millions of gallons or gallons: 1 cubic foot = 7.48 gallons*

<p>DSL = [(TP - AC) / TP] x 100 Percent of Distribution System Leakage (DSL) Total Water Produced and Purchased (TP) Authorized Consumption (AC)</p>

Goal Setting Information:

Date of Public Forum: (Month/ Date/Year)

Note: Goals must be established through a public process.

Has goal been changed since last performance report? Yes No

In the following section, provide a narrative on progress in reaching your goals. Include the following information:

1. Identify water savings goals.
 2. Identify the time schedule for achieving goals.
 3. Describe progress made toward achieving goals, such as:
 - Estimate how much water you have saved.
 - Report progress toward meeting goals within your established timeframe.
 - If you are not on track to reach your goals, identify any adjustments or changes to your WUE measures.
 - Include any other information that helps you tell your story.
1. Public education,
Informational brochures at City Hall and Public Works
Installed water conservation signs at City well sites
2. We are also keeping track of water used for flushing, street sweeping and sewer line cleaning, this will give us a better idea of actual water loss

Note: If you cannot complete electronically, attach separate pages with general system information at the top.

Meter Installation Information:

Is your system fully metered? Yes No

If yes, / (Month/Year) If no, complete the rest of this section.

Date for completing installation on all existing connections and interties:

/ (Month/Year) Due by January 22, 2017

Describe your progress in metering and any efforts taken to minimize leakage:

Note: If you cannot complete electronically, attach separate pages with general system information at the top.

Return this completed form to:

E-mail: wue@doh.wa.gov

Mail: WUE Program, Office of Drinking Water

PO Box 47822, Olympia, WA 98504-7822

FAX: (360) 236-2252

For more information, contact a regional planner:

Eastern Regional Office – Spokane – Main Office: 509-456-3115

Southwest Regional Office – Tumwater – Main Office: 360-236-3030

Northwest Regional Office – Kent – Main Office: 253-395-6750

The Department of Health is an equal opportunity agency. For persons with disabilities, this form is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388).

APPENDIX E:
City of Battle Ground 2008 WUE Report

Annual Water Use Efficiency Performance Report Form



You must submit this report by email.
Save the completed form with your water system's name
and email it to WUE@doh.wa.gov by July 1.

General Water System Information

System Name: City Of Battle Ground

System ID #: 047005

County: Clark

Your Name: Cal Newton

Your Title: Operations Foreman

Your email address: cal.newton@ci.battle-ground.wa.us

Your Phone Number: (360) 342-5365 Enter without dashes. Example: 3601234567

Today's Date: 07/23/09 Enter as mm/dd/yy. Example: 01/01/09

Who should we contact if we have questions about this report?

Name: Elain Huber

Phone Number: (360) 342-5355 Enter without dashes. Example: 3601234567

Water Metering Information

Is your water system fully metered? Yes

If Yes, continue to next page.

If not fully metered:

Current status of meter installation:

Describe efforts to minimize leakage:

Production, Authorized Consumption, and Distribution System Leakage Information:

Reporting Year: 2008

12-Month WUE Reporting Period:

01/01/08 to 12/31/08 Enter as mm/dd/yy. Example: 07/01/08

Incomplete or missing data for the year? No

If yes, explain:

Distribution System Leakage Summary:	
Total Water Produced and Purchased (TP) – Annual Volume	518,653,306 gallons
Authorized Consumption (AC) – Annual Volume	448,286,512 gallons
Distribution System Leakage – Annual Volume TP - AC	70,366,794 gallons
Distribution System Leakage – Percent DSL = [(TP - AC) / TP] x 100	13.0 %

Goal Setting Information:

Date of Most Recent Public Forum: _____ Enter as mm/dd/yy.
Example: 10/01/08

Goals must be established through a public process.

Has goal been changed since last annual WUE report? No

Each goal must identify the measurable water savings that will be achieved at a specific time in the future. Identify all water saving goals established by elected governing board.

WUE Goals:

<p>Supply Side Goal (if applicable):</p> <p>Formal adoption still in progress</p> <p>Demand Side Goal (required):</p>

I don't have this information

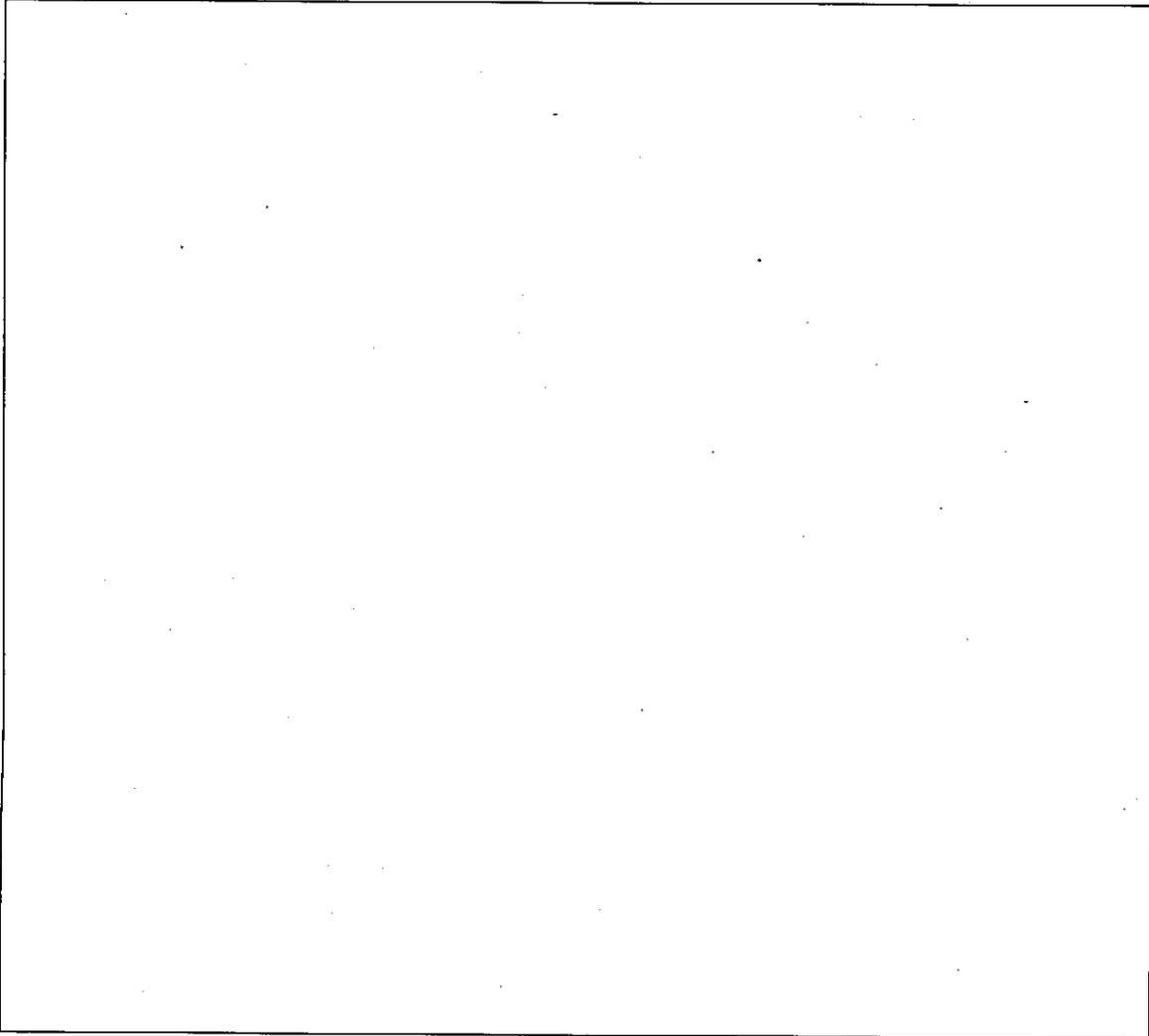
Describe Progress in Reaching Goals:

- Estimate how much water you have saved.
- Report progress toward meeting goals within your established timeframe.
- Identify any WUE measures you are currently implementing.

<p>Supply Side Goal Progress:</p> <p>consulting engineering under way for an additional 500 gpm intertie to Clark Public utilities for whole sale water supply Construction scheduled for 4th Qtr of 09</p> <p>Demand Side Goal Progress:</p> <p>Landscape management water curtailing on peak days Meter program consistently repairs and replaces leaking meters Hang door hangers for accounts that are leaking on consumer side</p>

Additional Information Regarding Supply and Demand Side WUE Efforts

- If you established a goal to maintain a historic level (such as maintaining daily consumption at 65 gallons per person per day), you must explain why you are unable to reduce water use below that level.
- Include any other information that describes how you and your customers use water efficiently.



For more information, visit our Web at <http://www.doh.wa.gov/ehp/dw/programs/wue.htm> or contact a regional planner:

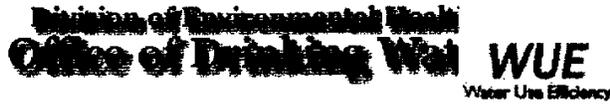
Eastern Regional Office—Spokane—Main Office: (509) 456-3115

Southwest Regional Office—Tumwater—Main Office: (360) 236-3030

Northwest Regional Office—Kent—Main Office: (253) 395-6750

The Department of Health is an equal opportunity agency. For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY: 1-800-833-6388).

**APPENDIX F:
City of Battle Ground 2009 WUE Report**



You are here: [DOH Home](#) » [EH](#) » [ODW](#) » [Water System Data](#) » [Water Use Efficiency Report Form](#)

Annual Water Use Efficiency Performance Report Form

Please refer to the [Getting Started: Water Use Efficiency Guidebook](#) Today's Date: 10/4/2010

General System Information

System Name: BATTLE GROUND WATER DEPT, CITY OF
 System ID #: 04700
 County: CLARK
 Your Name: Cal Newton
 Your Title: Operations Foreman
 Your Email Address: cal.newton@ci.battle-ground.wa.us
 Your Phone Number: (360) 342-5365

Meter Installation Information

Is your water system fully metered? Yes
 Current status of meter installation: Fully metered

Production, Authorized Consumption, and Distribution System Leakage Information

Reporting Year: 2009
 12-Month WUE Reporting Period: 1/1/2009 to 12/31/2009
 Incomplete or missing data for the year? No
 If yes, explain:

Distribution System Leakage Summary	
Total Water Produced and Purchased (TP) - Annual Volume	520,507,310 Gallons
Authorized Consumption (AC) - Annual Volume	471,858,827 Gallons
Distribution System Leakage - Annual Volume TP - AC	48,648,483 Gallons
Distribution System Leakage - Percent DSL = [(TP - AC) / TP] x 100	9.3 %
3-Year Annual Average - Percent	-- %

Goal-Setting Information

Date of most recent public forum:
 Has goal been changed since last WUE report? No
 Demand Side Goal: Formal Adoption still in progress
 Demand Side Goal Progress: Landscape irrigation management with water curtailment on peak days; Meter program to replace meters on a set schedule; hanging of door hangers to notify customers of leaks on customer (Demand) side

Additional Information:


 Please click 'Back' if you need to make changes.
 



RESOLUTION NO. 11-07

A RESOLUTION ESTABLISHING WATER USE EFFICIENCY GOALS FOR THE CITY OF BATTLE GROUND WATER SYSTEM AS REQUIRED UNDER THE STATE MUNICIPAL WATER LAW AND REGULATIONS

WHEREAS, the Washington State Legislature adopted the Municipal Water Law (House Bill 1338) requiring that the Washington State Department of Health establish water use efficiency requirements designed to ensure efficient use of water; and

WHEREAS, the Washington State Department of Health has developed Water Use Efficiency Requirements that are now codified within WAC Chapter 246-290; and

WHEREAS, WAC 246-290-830 institutes a process for the local water purveyor to establish Water Use Efficiency Goals including that a public forum must occur at least two weeks after a public notice and the elected governing board of the public water system shall review and consider all comments received, and that various materials be available for the public fully documenting the basis for the goal; and

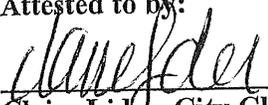
WHEREAS, the City of Battle Ground held a public forum on Monday, June 6th, 2011, for which notice was provided at least two weeks prior to the forum. The public was given an opportunity to participate and provide comment, and comments were received, reviewed and considered by the Council.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Battle Ground, of Battle Ground, Washington, hereby adopts the attached Water Use Efficiency Program.

DONE IN OPEN MEETING OF THE CITY COUNCIL OF THE CITY OF BATTLE GROUND, WASHINGTON THIS 10th DAY OF June, 2011.

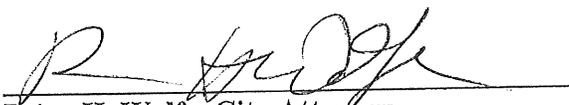

Michael J. Ciraulo, Mayor

Attested to by:



Claire Lider, City Clerk

Approved as to form:



Brian H. Wolfe, City Attorney

PUBLIC NOTICE OF PROPOSED PUBLIC FORUM
FOR THE CITY OF BATTLE GROUND'S
WATER CONSERVATION GOALS
&
"WATER USE EFFICIENCY PROGRAM"

DATE: Monday, June 6th, 2011

TIME: 7:00 p.m.

LOCATION: CITY OF BATTLE GROUND CITY COUNCIL CHAMBERS
109 S.W. 1st St.
BATTLE GROUND, WA 98604

SUBJECT: "WATER USE EFFICIENCY PROGRAM"

PURPOSE OF FORUM: The Battle Ground City Council will conduct a public forum on the proposed adoption of water conservation goals through a proposed "Water Use Efficiency Program" as required by the Washington State Dept. of Health and WAC 246-290-800(2). This program proposes water conservation goals for the City of Battle Ground community drinking water system, Wash. State ID # 47005.

HEARING DATE: The City Council will conduct the forum on Monday June 6th, 2011, during the regularly scheduled council meeting starting at 7:00 p.m. This meeting will be held in the City of Battle Ground City Council Chambers, located at 109 S.W. 1st St, Battle Ground, Washington, 98604. The public and interested parties are invited to testify orally or by written statement.

INFORMATION AVAILABLE: Information regarding the proposed water conservation goals and a copy of the proposed Water Use Efficiency Plan, are available on request at Battle Ground City Hall, 109 S.E. 1st St, Battle Ground, during normal business hours of 8:00 a.m. to 5 p.m.

CITY CONTACT PERSON: The primary contact person for this action is

Elaine Huber,
Operations Manager, Public Works Dept.
City of Battle Ground
1308 SE Grace Ave.

Battle Ground, WA 98604
360-342-5355
Elaine.huber@ci.battle-ground.wa.us

COMMENTS: Direct written comments to the City of Battle Ground City Clerk, 109
S.E. 1st St, Battle Ground, WA 98604, no later than 5:00 p.m. on June 6th, 2011.
Or submit comments into the record during the public hearing.

DATE ISSUED: May 9th, 2011

DATE PUBLISHED: May 18th, 2011



**BATTLE GROUND CITY COUNCIL MEETING MINUTES
JUNE 6, 2011**

The regular meeting of the Battle Ground City Council was called to order at 7:02 p.m. by Deputy Mayor Phil Haberthur in the Council Chambers of City Hall, 109 SW 1st Street, Battle Ground, Washington.

City Clerk Claire Lider called the roll. The following were:

- PRESENT:** Mayor Michael J. Ciraulo (arrived at 7:43 p.m.), Deputy Mayor Phil Haberthur, Councilmembers Zandamela, Reinhold, Walters, Ganley and Regan.
- ABSENT:** None.
- ALSO PRESENT:** City Manager John M. Williams, Public Works Director / City Engineer Scott Sawyer, Finance and Information Services Director Catherine Huber Nickerson, Chief of Police Bob Richardson, Community Development Director Robert Maul, Parks and Recreation Director Debbi Hanson, Executive Assistant Bonnie Gilberti, Associate Civil Engineer Ryan Jeynes, Community Development Technician Dorothy Harrington and City Clerk Claire Lider.
- PRESS:** Joanna Michaud, The Reflector.

Moved by Councilmember Zandamela and seconded by Councilmember Ganley to excuse Mayor Ciraulo as he is attending the Vancouver City Council meeting as part of his work responsibilities. Motion carried.

SUMMARY REPORTS

7:06:53 PM **Council Liaison Summary Reports**

Councilmember Walters stated that she had contacted Community Development Director Robert Maul with regards to a closure by Daybreak School that she felt created a traffic issue. She stated that she felt that this matter is something that the City Council should look into further.

Councilmember Reinhold stated that the Portland Rose Parade is this weekend. He added that the Battle Ground Rose Float was tested on Memorial Day and wondered if it would be possible

to have a mini-parade for the Rose Float next year on Memorial Day. He said that, during this year's test run, many people gathered to watch the Rose Float.

Councilmember Zandamela said that, on May 21, 2011, he and Mayor Ciraulo attended the Clark County Youth Achievement Awards, he noted that the Battle Ground students would be recognized at the June 20, 2011 City Council meeting.

Councilmember Ganley said that he attended Clark County's First Citizen Award Ceremony, last Wednesday, which honored Washington State University Chancellor Hal Dengerink. He noted that he felt that the close proximity of Washington State University makes Battle Ground an appealing location.

Deputy Mayor Phil Haberthur reported on the following meetings that he had attended:

- On May 23, 2011, he met with representatives with Citizens Against Bigger Trucks. He said that they would like people to write to the Congresswoman with regards to semis driving down freeways.
- On May 25, 2011, he visited the Battle Ground Rose Float.
- On May 26, 2011, he attended the Rachel's Challenge event and thanked the Battle Ground School District for putting on this event.
- On May 31, 2011, he met with a citizen with regards to the potential C-TRAN maintenance and operations ballot measure.
- On June 1, 2011, he met with a representative from Save Our Busses, which was in regards to this year's C-TRAN ballot measure.
- On June 2, 2011, he attended the North County Leadership Group meeting and the employment land survey was discussed, SR-502 access issues and economic development strategies.
- On June 3, 2011, he had a discussion with the regional sewer consultant regarding the rate findings and level of service issues. He said that there is a Regional Sewer Group meeting on July 8, 2011 and he would like Council's input prior to that meeting.

Moved by Councilmember Reinhold and seconded by Councilmember Regan to have a special meeting with regards to sewer on Monday, June 27, 2011 at 6:00 p.m.

There was discussion on the time of the meeting.

Moved by Councilmember Reinhold and seconded by Councilmember Regan to amend the original motion to have a special meeting with regards to sewer on Monday, June 27, 2011 at 7:00 p.m. instead of 6:00 p.m. Motion carried.

Mayor's Report

No report submitted.

Additional Business

No items submitted.

7:16:42 PM City Manager's Report

City Manager John Williams stated that he felt that the City Council should consider adding an agenda item with regards to the City's potential sponsorship of Harvest Days.

There was discussion on information that the City Council would like to know with regards to the City's potential sponsorship of Harvest Days:

- Staff time.
- Police pay.
- Future police staffing.

7:20:23 PM CITIZEN COMMUNICATIONS

Stephen Hee, 17714 NE Homestead Drive, Brush Prairie, Washington

Mr. Hee spoke against the proposed Cedars Annexation and provided the City Council with a document entitled, "Cedar Annexation Proposal", dated June 6, 2011, and noted that there was a revised petition included against the potential Cedars Annexation (attached). He also submitted his remarks in the document entitled, "June 6 Battle Ground City Council Meeting" (attached).

Deputy Mayor Haberthur explained the annexation process and noted what stage the proposed Cedars Annexation is in.

Councilmembers Reinhold and Walters left the meeting at 7:27 p.m.

Councilmembers Reinhold and Walters returned to the meeting at 7:29 p.m.

Mark Gawecki, 17706 NE Homestead Drive, Brush Prairie, Washington

Mr. Gawecki spoke against the proposed Cedars Annexation and submitted his remarks in a document entitled, "Citizens Communication Speech", dated June 5, 2011 (attached).

Keith Mathison, 20517 NE 182nd Avenue, Battle Ground, Washington

Mr. Mathison stated that September 17 – 23, 2011 is Constitution Week and suggested that the City Council work with the school district with regards to this. He then cited various reasons as to why he felt that the City Council should help to make sure that the school districts are held to what he believed to be a higher standard.

Norm Klamm, 11001 NE 189th Street, Battle Ground, Washington

Mr. Klamm thanked Deputy Mayor Haberthur for keeping his composure during the high-level of emotion that was heard during this evening's Citizen Communications.

With no further comments, Deputy Mayor Haberthur closed the Citizen's Communications portion of the meeting.

7:39:56 PM **CONSENT AGENDA**

All items listed below are considered to be routine and will be enacted by one motion. There will be no separate discussion of these items unless a Councilmember requests specific items to be removed from the Consent Agenda for discussion prior to the time council votes on the motion to adopt the Consent Agenda.

- A. Payroll Vouchers dated 05/20/2011, #27092 to #27106, in the amount of \$18,173.22 and Direct Deposits in the amount of \$144,643.50
- B. Claim Vouchers dated 04/22/2011, #65358 to #65411, in the amount of \$230,977.88
- C. Claim Vouchers dated 04/29/2011, #65412 to #65449, in the amount of \$356,730.42
- D. Claim Vouchers dated 05/06/2011, #65450 to #65527, in the amount of \$312,345.82
- E. Claim Vouchers dated 05/13/2011, #65528 to #65573, in the amount of \$140,458.28
- F. Minutes of the May 16, 2011 City Council Study Session
- G. Minutes of the May 16, 2011 City Council Meeting
- H. Ballot Deposit Site Lease with Clark County
- I. Interlocal Service Agreement with the City of Ridgefield for Summer Playground Program
- J. Professional Services Agreement with Recreation Instructor

Deputy Mayor Haberthur asked if there were any agenda items that the Council would like to have removed from the consent agenda.

Moved by Councilmember Reinhold and seconded by Councilmember Regan to approve the consent agenda as presented. Motion carried.

OLD BUSINESS

7:40:19 PM **Water Use Efficiency Resolution: Public Hearing / Motion**

City Manager John Williams stated that the water use efficiency resolution that is before the City Council tonight essentially memorializes the City's current practice. He said that it is before the City Council specifically due to a regulatory agency's rules that state that the Council must pass a resolution with regards to water use efficiency.

Deputy Mayor Haberthur opened the public hearing on Resolution No. 11-07, a resolution establishing water use efficiency goals for the City of Battle Ground's water system as required under the state municipal water law and regulations.

With no citizen testimony given, Deputy Mayor Haberthur closed the public hearing on Resolution No. 11-07.

Moved by Councilmember Regan and seconded by Councilmember Reinhold to approve Resolution No. 11-07 as presented. Motion carried.

7:42:06 PM **Cedars Annexation AX: 01-11: Presentation**

City Manager John Williams stated that, the last time that the City Council had discussed the proposed Cedars Annexation 10% Notice of Intent, the Council had decided to postpone taking action on the notice as they wanted additional information with regards to fire service for the area.

Mayor Ciraulo arrived to the meeting at 7:43 p.m.

Community Development Director Robert Maul reviewed the process, thus far. He then distributed a revised annexation map that the applicant submitted (attached). He noted that the City had created a map based on the revised map submitted that has additional detail (attached).

Mr. Williams explained that, if the Council were to move forward with the proposed Cedars Annexation 10% Notice of Intent, the petitioner would still need to achieve a petition signed by property owners that represent 60% of the annexation area's assessed value.

There was discussion on the new proposed boundaries.

Councilmember Regan noted that he would accept the original annexation proposal, but not the [updated] one with holes.

There was discussion on:

- Service continuity in the area.
- Fire services.
- Police services.

Councilmember Zandamela stated that he would vote against the annexation, as he felt that many people did not want to be included in the annexation and he did not approve of the boundaries.

Moved by Councilmember Walters and seconded by Councilmember Ganley to accept the 10% petition to annex land, with modifications, with the Cedars Annexation, illustrated in Figure 1 of the City Council Agenda memo, dated June 6, 2011; and require the simultaneous adoption of proposed zoning regulations; and require the assumption of all or any portion of existing City indebtedness by the area to be annexed. Call for the vote: Ayes; Councilmembers Walters and Ganley, Deputy Mayor Haberthur and Mayor Ciraulo. Nays; Councilmembers Zandamela, Reinhold and Regan. Motion carried.

NEW BUSINESS

7:59:01 PM **Six-Year Transportation Improvement Plan: Presentation**

Public Works Director / City Engineer Scott Sawyer stated that the City is required by law to annually update the City's Six-Year Transportation Improvement Plan.

Mr. Sawyer then reviewed the Six-Year Transportation Improvement Plan as presented in the City Council packet.

There was discussion on item #8, the SR 502 / SR 503 Right Turn Lanes Project, with regards to funding.

Deputy Mayor Haberthur left the meeting at 8:05 p.m.

Councilmember Reinhold noted that these projects are not listed in priority order.

There was discussion on Item #5, the SW 3rd Street Connection, with regards to adding additional access points, but not sidewalks.

Moved by Councilmember Regan and seconded by Councilmember Ganley to set a public hearing on the Six-Year Transportation Improvement Plan during the June 20, 2011 City Council meeting. Motion carried.

City Manager John Williams noted that a public hearing date would need to be set to consider the Cedars Annexation's 60% petition.

Moved by Councilmember Walters and seconded by Councilmember Ganley to hold a public hearing on the 60% petition for the Cedars Annexation on July 18, 2011. Motion carried.

Deputy Mayor Haberthur returned to the meeting at 8:09 p.m.

8:09:36 PM **ADMINISTRATIVE REPORTS**

Parks and Recreation Department

Parks and Recreation Director Debbi Hanson stated that she is working with Rock Solid Teen Center to develop an agreement for rental use of their shuttle bus and van. She then said that, at the June 20, 2011 Council meeting, staff would be presenting a Park Advisory Board recommendation regarding the youth member position.

Community Development Department

Community Development Director Robert Maul stated that Papparazzi Restaurant is under new ownership and would have a soft opening on June 14, 2011. He then spoke to the City Council with regards to the Commerce East Development Agreement.

City Manager John Williams noted that Burgerville is currently under construction.

Public Works Department

Public Works Director / City Engineer Scott Sawyer said that City Staff would be returning at an upcoming City Council meeting to request approval for the City Manager to sign a contract with the Clark County Community Development Block Grant program to accept funding to complete the construction of the SW 3rd Street Road Project.

Finance Department

Finance and Information Services Director Catherine Huber Nickerson said that, June 13, 2011, at 9:00 a.m., the State Auditor's would be presenting their Exit Conference. She invited Councilmembers to attend this meeting.

Executive Department

City Manager John Williams announced that Parks and Recreation Director Debbi Hanson had been selected as the Clark County Parks Foundation's 2011 Florence B. Wager "Tributary" Award winner. He added that the formal presentation of the award to Ms. Hanson would take place at the Foundation's Annual Lunch Meeting on June 14, 2011.

Mr. Williams added that he had spoken with the Government & Politics classes at Battle Ground High School on Friday.

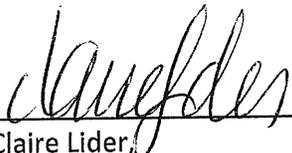
Mayor Ciraulo announced that the next meeting of the City Council would be on Monday, June 20, 2011, with a Study Session beginning at 6:00 p.m. and the Regular Meeting beginning at 7:00 p.m. at Battle Ground City Hall, 109 SW 1st Street in Battle Ground, Washington.

ADJOURNMENT

The meeting adjourned at 8:18 p.m.

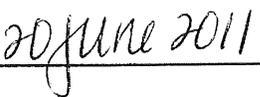


Michael J. Ciraulo,
Mayor



Claire Lider,
City Clerk

Date of Approval by the City Council:



Meetings of the Battle Ground City Council are recorded digitally. These recordings are kept on file in the office of the City Clerk for a period of six (6) years.

City of Battle Ground
 PO Box 37
 Battle Ground, Washington 98604-0037



**STATE OF WASHINGTON
 CERTIFICATE OF WATER RIGHT**

Document Title: Certificate of Water Right

Agency: Department of Ecology
 Southwest Regional Office
 P.O. Box 47775
 Olympia, WA 98504-7775

Applicant: City of Battle Ground
 PO Box 37
 Battle Ground, WA 98604-0037

Reference Number:

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 13, 1986	G2-29208	G2-29208	G2-29208

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown, but is limited to an amount actually beneficially used.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE	TRIBUTARY OF (IF SURFACE WATERS)	
Well #6		
MAX. CUBIC FEET PER SECOND	MAX. GALLONS PER MINUTE	MAX. ACRE-FEET PER YEAR
	350	430

QUANTITY/TYPE OF USE/PERIOD OF USE

430 Acre-feet per year Municipal supply Year-round, as needed

LEGAL DESCRIPTION OF LOCATION OF DIVERSION/WITHDRAWAL

1/4 1/4	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R.I.A.	COUNTY
SE 1/4 NE 1/4	4	3	2E	28	Clark

PARCEL # 192683472

ADDITIONAL LEGAL IS ON PAGE 2

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

1/4 1/4	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R.I.A.	COUNTY
N/A	N/A	N/A	N/A	28	Clark

PARCEL # N/A

ADDITIONAL LEGAL IS ON PAGE 2

CONTINUED LEGAL DESCRIPTION FOR LOCATION OF DIVERSION/WITHDRAWAL

2000 feet South and 50 feet West of the Northeast corner of Section 4.

CONTINUED LEGAL DESCRIPTION FOR PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Battle Ground.

PROVISIONS

All conditions and requirements contained in reports of examination or permits previously issued apply to this certificate unless specifically noted below.

An approved measuring device shall be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC. Water use data shall be recorded *monthly* and maintained by the property owner for a minimum of five years, and shall be promptly submitted to Ecology upon request.

The well access port shall be maintained at all times.

Issuance of this water right is subject to the implementation of the minimum requirements established in the Conservation Planning Requirements, Guideline and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs, July 1994, and as revised.

Under RCW 90.03.005 and 90.54.020(6), conservation and improved water use efficiency must be emphasized in the management of the State's water resources, and must be considered as a potential new source of water. Accordingly, as part of the terms of this water right, the applicant shall prepare and implement a water conservation plan approved by Department of Health. The standards for such a plan may be obtained from either the Department of Health or the Department of Ecology.

The quantity authorized by this document for appropriation is considered to be a portion of the amount reserved by the adoption of Chapter 173-592, Reservation of Future Public Water Supply For Clark County. The priority date of this permit is August 13, 1986.

"This certificate is issued with the understanding that the City of Battle Ground has agreed to participate in the June 1995 Salmon Creek Basin Monitoring and Management Plan. Participation in this Plan, will provide the City of Battle Ground guidance, assistance, and acceptable criteria to meet the need for data

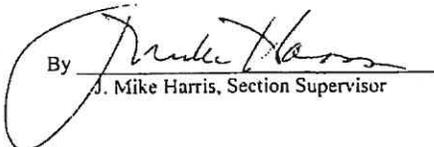
(continued on page 3)

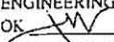
The right to use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.100.

This certificate of water right is specifically subject to relinquishment for non-use of water as provided in Chapter 90.14 RCW.

Given under my hand and the seal of this office at Olympia, Washington,
this 11th day of July, 2002.

Tom Fitzsimmons, Director
Department of Ecology

By 
J. Mike Harris, Section Supervisor

ENGINEERING DATA
OK 
ECY 040-1-2 (Rev. 8-97)

LEGAL DESCRIPTION AND/OR PROVISIONS CONTINUED

Provisions Continued

collection, analysis, resource management including the protection of senior water rights or of game fish and/or food fish populations of the stream, and data submittal. If future monitoring and evaluation show that the flow of Salmon Creek has fallen below a threshold level, as defined under the Monitoring and Management Plan, the permittee and Ecology shall take corrective action as prescribed in the Monitoring and Management Plan through water rights enforcement, curtailment of pumping, or otherwise, to further identify cause(s) and alleviate the adverse effects. This permit is not subject to future formal establishment of minimum or base flows pursuant to chapter 90.22 and 90.54 Revised Code of Washington."

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
SUPERSEDING

PERMIT
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

- Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)
- Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE August 13, 1986	APPLICATION NUMBER G2-29477 (A)	PERMIT NUMBER G2-29477 (A)	CERTIFICATE NUMBER
----------------------------------	------------------------------------	-------------------------------	--------------------

NAME
City of Battle Ground

ADDRESS (STREET) (CITY) (STATE) (ZIP CODE)
109 SW 1st Street Ste 122 Battle Ground Washington 98604

The applicant is pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following public waters of the State of Washington, subject to existing rights and to the limitations and provisions set herein.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE:
Wells 7, 8 & 9

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE 1375	MAXIMUM ACRE FEET PER YEAR 943 (additive) 207 (non-additive)
-------------------------------	------------------------------------	--------------------------------------------------------------------

QUANTITY, TYPE OF USE, PERIOD OF USE 943 Acre-feet per year (additive) 207 Acre-feet per year (non-additive)	Municipal supply Municipal supply	Year-round, as needed Year-round, as needed
--------------------------------------------------------------------------------------------------------------------	--------------------------------------	------------------------------------------------

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION-WITHDRAWAL
Well 7: 2360 feet West and 2070 feet North of the Southeast corner of Section 4.
Well 8: 2360 feet West and 2096 feet North of the Southeast corner of Section 4.
Well 9: 1964 feet West and 2547 feet North of the Southeast corner of Section 4.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) NW¼ SE¼	SECTION 4	TOWNSHIP N. 3	RANGE, (E. OR W.) W.M. 2E	W.R.I.A. 28	COUNTY Clark
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RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)
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LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

The area served by the City of Battle Ground. The place of use of this water right is the service area described in the most recent Water System Plan approved by the Washington State Department of Health, so long as the City of Battle Ground is and remains in compliance with the criteria in RCW 90.03.386(2). RCW 90.03.386 may have the effect of revising the place of use of this water right.

If the criteria in section 90.03.386(2) are not met, the place of use of this water right reverts to the last place of use described by Ecology in a water right authorization.

DESCRIPTION OF PROPOSED WORKS

Well 7: 12-inch casing completed at 432 feet below ground surface (bgs).
Well 8: 12-inch casing to 438 feet bgs
Well 9: 12-inch casing to 425 feet bgs

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE: Started	COMPLETE PROJECT BY THIS DATE: Completed	WATER PUT TO FULL USE BY THIS DATE: April 1, 2020
----------------------------------------	---------------------------------------------	------------------------------------------------------

PROVISIONS

"This permit supersedes permit of same number issued on July 8, 1999."

"This is a 2-way split of the original ground water permit G2-29477 issued to the City of Battle Ground on July 8, 1999. The City of Battle Ground transferred 625 gpm and 1000 af/yr additive quantities from this permit to Clark Public Utilities Well 35 under permit G2-29477(B). As a result of the transfer the City of Battle Ground shall be issued Superseding Permit G2-29477(A) in the amount of 1,375 gpm and 943 af/yr additive and 207 af/yr non-additive to reflect the transfer of water rights authorized under G2-29477(B). The total amounts authorized under G2-29477(A) and G2-29477(B) shall not exceed 2,000 gpm and 2,150 acre-feet per year (1,943 additive and 207 non-additive)."

"This permit is issued subject to the provisions of the January 1992, Memorandum of Understanding (MOU) between Clark County, Clark Public Utilities, and the Departments of Health and Ecology. The MOU provides that water availability and impact to senior rights will be reassessed for this permit, based on study findings from the Water Resources Plan to be completed under the MOU."

"This permit is issued with the understanding that the City of Battle Ground is an active participant in the Salmon Creek Management Plan, and that continued monitoring and evaluation of Salmon Creek and aquifers in continuity thereto will be conducted by affected parties according to a Monitoring and Management Plan, the provisions of which have been agreed to and approved by the parties to this agreement. If future monitoring and evaluation show that the flow of Salmon Creek has fallen below a threshold level, as defined under the Monitoring and Management Plan, the permittee and Ecology shall take corrective action as prescribed in the Monitoring and Management Plan through water rights enforcement, curtailment of pumping, or otherwise as required to alleviate the adverse effects."

"If future monitoring and evaluation of Salmon Creek and aquifer in continuity thereto, as determined by the Management Team, show that the appropriation of ground water under this permit is adversely affecting the flow of Salmon Creek to the detriment of senior water rights or fishery resources of the stream, Battle Ground has agreed and shall take corrective actions by curtailment of pumping, or otherwise, to alleviate the flow interference. Battle Ground's agreement to this provision, is consistent with the Salmon Creek Basin Water Resources Management Plan identified in the January 15, 1992, MOU between the County, CPU, Ecology and Health."

The quantity authorized by this document for appropriation is considered to be a portion of the amount reserved by the adoption of Chapter 173-592, Reservation of Future Public Water Supply for Clark County. The priority date of this permit is August 13, 1986.

The water appropriated under this application will be used for public water supply. The State Board of Health rules require public water supply owners to obtain written approval from the Office of Water Supply, Department of Health, 1112 SE Quince Street, PO Box 47890, Olympia, Washington 98504-7890, prior to any new construction or alterations of a public water supply system.

"The applicant is advised that the quantity of water allocated by this permit may be reduced at the time of final certification to reflect system capacity and actual usage. This permit specifically authorizes withdrawals from a deep aquifer system. All production wells must be completed within this aquifer system. The applicant is advised that completing these wells at shallower depths will likely require re-application to Ecology, and issuance of a permit prior to use."

(continued on page)

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Olympia, Washington,

this _____ day of _____, 2005.

OK MD

Department of Ecology
by Thomas Loranger
Thomas Loranger, Section Manager

Provisions Continued

The permittee is advised that notice of Proof of Appropriation of water (under which the final certificate of water right is issued) should not be filed until the permanent distribution system has been constructed and that quantity of water allocated by the permit to the extent water is required, has been put to full beneficial use.

An approved measuring device shall be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC.

Water use data shall be recorded daily. The maximum monthly rate of diversion/withdrawal and the monthly total volume shall be submitted to Ecology by January 31st of each calendar year. Ecology is requiring submittal of daily meter readings to collect seasonal information for water resource planning, management and compliance.

The following information shall be included with each submittal of water use data: owner, contact name if different, mailing address, daytime phone number, WRIA, Permit/Certificate/Claim No., source name, annual quantity used including units, maximum rate of diversion including units, monthly meter readings including units, peak monthly flow including units, Department of Health WFI water system number and source number(s), purpose of use, well tag number, open channel flow or pressurized diversion and period of use. In the future, Ecology may require additional parameters to be reported or more frequent reporting. Ecology prefers web based data entry, but does accept hard copies. Ecology will provide forms and electronic data entry information.

Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements".

Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

All wells constructed in the State shall meet the construction requirements of Chapter 173-160 WAC entitled "Minimum Standards for the Construction and Maintenance of Wells" and Chapter 18-104 RCW entitled "Water Well Construction, Act (1971)."

Installation and maintenance of an access port as described in Chapter 173-160 is required. An air line and gauge may be installed in addition to the access port.

In order to maintain a sustainable supply of water, pumping must be managed so that static water levels do not progressively decline from year to year. Water levels shall be measured and recorded monthly, using a consistent methodology. The length of the pumping period or recovery period prior to each measurement shall be constant, and shall be included in the record. Data shall be submitted annually, in the month of February, to the Department of Ecology.

Issuance of this water right is subject to the implementation of the minimum requirements established in the Conservation Planning Requirements, Guideline and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs, July 1994, and as revised.

Under RCW 90.03.005 and 90.54.020(6), conservation and improved water use efficiency must be emphasized in the management of the states water resources, and must be considered as a potential new source of water. Accordingly, as part of the terms of this water right, the applicant shall prepare and implement a water conservation plan approved by Department of Health. The standards for such a plan may be obtained from either the Department of Health or the Department of Ecology.

CERTIFICATE RECORD No. 5 PAGE No. 2284-A

STATE OF WASHINGTON, COUNTY OF Clark

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY That TOWN OF BATTLE GROUND, WASHINGTON

has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well located within the NW 1/4 of NE 1/4 of Sec. 3, Twp. 3 N., Rge. 2 E.W.M.

for the purpose of municipal water supply under and subject to provisions contained in Ground Water Permit No. 3596 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 5 at page 2284-A that the right hereby confirmed dates from October 18, 1954; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 375 gallons per minute; 270 acre-feet per year for municipal water supply.

A description of the lands to which such ground water right is appurtenant, and the place where such water is put to beneficial use, is as follows:

Town of Battle Ground, Clark County, Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this

12th day of July, 1955.

WITNESSES

[Signature]

[Signature] State Supervisor of Water Resources.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

G 757615

1065834

CERTIFICATE OF WATER RIGHT

- Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)
- Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

CERTIFICATE NUMBER G 2-23122 C	PERMIT NUMBER G 2-23122 P	APPLICATION NUMBER G2-23122	PRIORITY DATE August 30, 1974
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NAME TOWN OF BATTLE GROUND			
ADDRESS (STREET) P. O. BOX 233	(CITY) Battle Ground	(STATE) Washington	(ZIP CODE) 98604

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown.

PUBLIC WATER TO BE APPROPRIATED

SOURCE 2 wells	TRIBUTARY OF (IF SURFACE WATERS)		
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MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE 250	MAXIMUM ACRE-FEET PER YEAR 269
QUANTITY, TYPE OF USE, PERIOD OF USE 269 acre-feet per year	municipal supply	continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION/WITHDRAWAL
1000 feet east and 120 feet south of the center of Sec. 3

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) NW $\frac{1}{4}$ SE $\frac{1}{4}$	SECTION 3	TOWNSHIP N. 3	RANGE, (E. OR W.) W.M. 2 E	W.R.I.A. 28	COUNTY Clark
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RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)
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LEGAL DESCRIPTION OF PROPERTY WATER TO BE USED ON

Area served by Town of Battle Ground.

1065835

The Water Resources Act of 1971 specifies certain criteria regarding utilization and management of the waters of the State in the best public interest. Issuance of this certificate was based on sufficient waters available, at least during portions of the year. However, it is pointed out to the certificate holder that his use of the water may be subject to regulation at certain times, based on the necessity to maintain water quantities sufficient preservation of the natural environment.

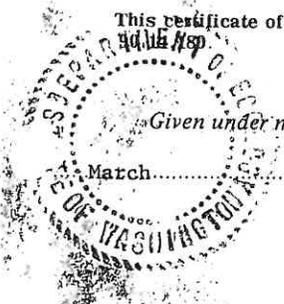
The access port as required on your permit shall be maintained at all times.

Owing to the proximity of neighboring wells, the certificate holder is reminded of his responsibility towards same and advised that he may be required to regulate his withdrawal pumping rate if existing rights are injuriously affected.

A suitable measuring device shall be installed and maintained in accordance with WAC 508-64-020 through WAC 508-64-040.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020.

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.03.380, 90.03.390, and 90.44.020.



Given under my hand and the seal of this office at Olympia, Washington, this25th..... day
March....., 19..77.....

WESLEY A. HUNTER, ACTING DIRECTOR
~~JOHN A. BROWN, DIRECTOR~~
Department of Ecology

by E. W. Assestine
E. W. ASSELSTINE, Regional Manager

ENGINEERING DATA
OK.....

FOR COUNTY USE ONLY

mu
Town of Battle Ground
P O Box 233
Battle Ground WA 98604

FILED FOR RECORD
CLARK CO. WASH.
State Wash
APR 4 1 38 PM '77
AUDITOR
RON DOTZAUER 300



Short-Term Agreement for Wholesale Supply, for Calendar Year 2005

**Regional Water Supply Agreement for Implementing Water System Interties
Under Clark County Coordinated Water System Plan**

The authority for this agreement is granted by the Public Water System Coordination Act of 1977, Chapter 70.116 RCW.

WHEREAS, Such an agreement promotes efficient water resource management within the Salmon Creek Basin by utilizing existing water rights permits; and,

WHEREAS, such an agreement is consistent with the Clark County Coordinated Water System Plan (CWSP) to meet regional supply needs; and,

WHEREAS, Water service areas for each party and responsibilities for water supply service are designated in the CWSP to help assure that time, effort, and money are best used by avoiding unnecessary duplication of service to properly manage the area's valuable resources; and,

WHEREAS, Water system interties are mutually beneficial as part of a cooperative effort to provide safe and adequate water supply to North Clark County; and,

WHEREAS, the following administrative procedures and management system will enable all of the water purveyors to participate in a regional program;

NOW THEREFORE, Clark Public Utilities and the City of Battle Ground having entered into this Agreement by their signature, concur with the following:

GENERAL TERMS AND OBJECTIVES

1. Clark Public Utilities and the City of Battle Ground are committed to providing potable water on a cost-of-service basis for those areas located within their respective service areas. Clark Public Utilities and the City of Battle Ground are therefore committed to water service policies consistent with recommendations of the CWSP and their Water System Plans.
2. A new intertie will be constructed by the Receiving Party (the City of Battle Ground) and water supply improvements will be implemented by the Supplying Party (Clark Public Utilities) to allow water supply, estimated at 500 gpm or more to be supplied through the intertie.

**COPY-ORIG TO
CENTRAL FILES**

3. The intertie between Clark Public Utilities and the City of Battle Ground will be implemented under the same terms and conditions as existing intertie except for appropriate unit cost adjustments that reflect actual cost of service.
4. The existing intertie between the Parties will be closed upon completion of a new intertie. The motor-operated valve from the existing intertie will be relocated to the new intertie location, and SCADA will be installed to allow both parties to monitor the flow through the intertie.

CONDITIONS OF SERVICE

1. Interties must be metered and water utilized subject to conservation objectives and programs outlined in the CWSP and each Utility's Water System Plan. Initially a meter will be installed capable of measuring 500 gallons per minute (gpm) at the intertie service conditions.
2. Extension of service, as well as resale to other water purveyors, must be consistent with the approved CWSP and this agreement.
3. No service will be permitted that will result in a degradation of water quality. The Supplying Party (Clark Public Utilities) will be responsible for monitoring water quality at the Intertie. The Receiving Party (City of Battle Ground) will be responsible for monitoring distribution system water quality, adding fluoride (if needed) and maintaining a backflow prevention program.
4. The Intertie Constructing Party (City of Battle Ground) will be responsible for maintaining the main extension, Intertie, and metering equipment. Construction and maintenance costs will not be included in the rates charged to the Receiving Party (City of Battle Ground).
5. Requests for water will be at the direction of the Receiving Party (City of Battle Ground).
6. Operation of the Intertie for will be at the direction of the Supplying Party (Clark Public Utilities). The Supplying Party will supply water whenever water is available, and a request is made by the receiving party.

WATER RIGHTS

With the Department of Ecology's approval, the Receiving Party (City of Battle Ground) will transfer approximately 1,000 AF of annual, excess water rights to the Supplying Party (Clark Public Utilities) to ensure that the Supplying Party's annual quantity is not exceeded by providing water supply through the Intertie. The following water rights will be transferred:

Well No.	Location	Source Aquifer***	Control No.	Status	Priority Date	Transferring Instantaneous Quantity (Qi) gpm	Remaining Instantaneous Quantity (Qi) gpm	Transferring Primary Annual Quantity (Qa) af/yr	Remaining Primary Annual Quantity (Qa) af/yr	Current Well Capacity gpm	2004 Water Use af/yr
Well 3*	3N/2 E-3B	UT	2284	Certificate	10/18/1954	375	0		0	0	0.0
Wells 7, 8 & 9**	3N/2 E-4K	SGA	G2-29477	Permit	8/13/1986	625	1,375	1000 (943 remaining)	943	1,200	726.8
Totals						1,000	1,375	1,000	943	1,200	726.8

Notes:

- * Well 3 has been decommissioned as per the provisions of G2-29208.
- ** Capacity of Wells 7 and 8 have been diminished due to clogging by iron bacteria.
- *** Source aquifers include Upper Troutdale aquifer (UT) and Sand and Gravel aquifer (SGA)

A yearly water resources use estimate will be prepared by both parties and shared among them. The water resource use estimate will include:

- 1 Water demand forecast, average use,
- 2 Water demand forecast, peak day use,
- 3 Water rights permits and certificates, instantaneous capacity,
- 4 Water rights permits and certificates, annual capacity,
- 5 Installed pumping capacities.

If this agreement is terminated by either party, for any reason, the Supplying Party (Clark Public Utilities) agrees to Transfer the following water rights to the Receiving Party, unless otherwise agreed to by both parties.

Well No.	Location	Source Aquifer***	Control No.	Status	Priority Date	Transferring Instantaneous Quantity (Qi) gpm	Remaining Instantaneous Quantity (Qi) gpm	Transferring Primary Annual Quantity (Qa) af/yr	Remaining Primary Annual Quantity (Qa) af/yr	Current Well Capacity gpm	2004 Water Use af/yr
Well 3*	3N/2 E-3B	UT	2284	Certificate	10/18/1954	375	0		0	0	0.0
Wells 7, 8 & 9**	3N/2 E-4K	SGA	G2-29477	Permit	8/13/1986	625	1,375	1000 (943 remaining)	943	1,200	726.8
Totals						1,000	1,375	1,000	943	1,200	726.8

Notes:

- * Well 3 has been decommissioned as per the provisions of G2-29208.
- ** Capacity of Wells 7 and 8 have been diminished due to clogging by iron bacteria.
- *** Source aquifers include Upper Troutdale aquifer (UT) and Sand and Gravel aquifer (SGA)

By transferring water rights to the Supplying Party, the Receiving Party does not forfeit its rights to future financial consideration for this permanent transfer of its excess water rights, under a future agreement.

By receiving these water rights for this agreement, the Supplying Party agrees to waive the system development charge for the new intertie to be constructed by the Receiving Party.

By waiving the system development charge for the intertie for this agreement, the Supplying Party does not forfeit its right to charge a system development charge, or capital contributions under a future agreement.

COST OF WATER SUPPLY

1. Rates charged for water service will be cost-of-service based. Rates will remain in effect until a new cost-of-service study has been completed and adopted by Clark Public Utilities Commissioners. Rates will be set by resolution of the Supplying Party and will go into effect in accordance with the enacting document. The Receiving Party will be notified when an update of the Cost of Service Analysis is being initiated by the Supplying Party and prior to public review of the proposed rates.
2. Rates for Service will include the monthly customer service charge, and monthly rate volume charge identified in the Public Authority service class of the current cost-of-service study.
3. In the event the intertie meter is upsized, the Receiving Party will be responsible for the differential cost between sizes. Upsizing of intertie meters will be required when the meters exceed their rated capacity more than 50% of the time they register flow.

SUPPLY AND SERVICE TYPE

The type of service and amount of flow available for this agreement is summarized in the table below.

Service Summary for Clark Public Utilities – City of Battle Ground Short-Term Intertie Agreement	
Type of Service	Amount
The amount of flow available during peak hours is:	As available, limited by intertie design.
The amount of flow available during off-peak hours is:	As available, limited by intertie design.
The amount of non-guaranteed service flow is:	As available, limited by intertie design.
The Initial cost of service Rate for service is:	\$1.25*
The capital contribution for guaranteed service is	Not applicable in this agreement.

* - current volume rate for Clark Public Utilities, 2005

Either Party may terminate this agreement by delivering a signed letter (Termination Letter) to the other Party stating the intent to terminate the agreement. The agreement will terminate not less than 120 days after receipt of the signed Termination Letter is received.

The undersigned Parties agree to all of the terms and conditions contained in this agreement.

Supplying Agency
Clark Public Utilities

By: *Douglas L. Quinn*
Title: *Director of Water Services*
Date: *5-2-05*

Receiving Agency
City of Battle Ground

By: *[Signature]*
Title: *CITY MGR*
Date: *4-26-05*

EXPIRES 2029

**Water Supply Agreement between
Clark Public Utilities and the City of Battle Ground
for Calendar Years 2009 - 2029**

THIS AGREEMENT is made and entered into this 7th day of August, 2009, by and between Clark Public Utilities ("Clark") and the City of Battle Ground (the "City").

WHEREAS, the authority for this Agreement is granted by the Public Water System Coordination Act of 1977, Chapter 70.116 RCW.

WHEREAS, such an agreement promotes efficient water resource management within the Salmon Creek Basin by utilizing existing water rights permits; and

WHEREAS, such an agreement is consistent with the Clark County Coordinated Water System Plan (CWSP) to meet regional supply needs; and

WHEREAS, water service areas for each party and responsibilities for water supply service are designated in the CWSP to help assure that time, effort, and money are best used by avoiding unnecessary duplication of infrastructure to properly manage the areas' valuable resources; and

WHEREAS, water system interties are mutually beneficial as part of a cooperative effort to better manage groundwater resources and to provide safe and adequate water supply to North Clark County; and

WHEREAS, Clark currently anticipates that it has the ability to provide excess water from its system to the City to help the City meet its water supply needs for next twenty years; and

WHEREAS, the City has requested water service from Clark and Clark has agreed to provide such water service subject to the terms of this Agreement.

NOW THEREFORE, the City, having entered into this Agreement by its signature, concurs with the following:

GENERAL TERMS AND OBJECTIVES

1. This Agreement shall supersede and replace the Short-Term Water Supply Agreement signed by the parties on May 2, 2005.
2. The City shall construct and maintain ownership, at its expense, a new intertie along NE 219th Street (SR 502) east of NE 92nd Avenue. Clark shall perform water supply improvements west of the current water service boundary (NE 92nd Avenue) to allow an initial water supply of 1,000 gpm. As additional water supply is developed by Clark, and future pumps are added to the system at the intertie by the City, such volume is expected to allow a maximum of 3,000 gpm to be supplied through the new intertie. The new intertie

between Clark and the City will be operated by Clark using Clark's Supervisory Control and Data Acquisition (SCADA) system to maintain mutually agreed upon set points for the City's reservoirs. During times of emergencies or high demand Clark and the City will communicate their water needs and will manage the system to provide a minimum level of service for both purveyors. If the parties observe that demand for water exceeds the available supply and there is clear evidence that, unless limitations are imposed, water use at normal levels will lead to a rapid depletion of water source reserves, such as drought situations or when significant facility failures occur, the City agrees to impose conservation and emergency measures concurrently with Clark. The existing intertie (Maple Grove, Flow 9) between the parties will remain as an emergency backup upon completion of the new intertie and until the City no longer needs this point of connection.

3. Clark and the City will continue to serve, within their respective water service boundaries, as designated through the CWSP and as shown on the Clark County GIS mapping system. Subject to approval by both parties, minor service modifications are allowed to ensure efficient service delivery.
4. SCADA will be installed in the new booster building (intertie) to allow both parties to monitor the status of the facility in real time. Clark will oversee control of the intertie regarding ON/OFF settings and flow needs based on requests from the City and the capacity status of Clark's water system. The City will grant access for installation of intertie appurtenances in the intertie building.

CONDITIONS OF SERVICE

Interties will be metered and the water utilized is subject to conservation objectives and programs outlined in the CWSP and each party's Water System Plan. Initially, a meter will be installed capable of measuring 1,000 gallons per minute (gpm) at the intertie service location.

No service will be permitted that will result in a degradation of Clark's water quality. Clark will be responsible for monitoring water quality to the intertie and maintaining the metering equipment. The City will be responsible for monitoring its distribution system water quality and adding fluoride at the intertie location (if needed).

The City will be responsible for maintaining the main extension within the city limits, the intertie, and its metering equipment.

Either party may terminate this Agreement with six (6) months prior notice to the other party of its election to terminate the Agreement, subject to approval by the Department of Health.

WATER RIGHTS

The City previously transferred excess water rights of 1,000 AF of annual and 1,000 gpm instantaneous flow to Clark in 2005. This was to facilitate Clark's installation of a water supply well capable of meeting the City's first stage demand and to ensure that Clark's annual quantity limit was not exceeded by supplying water through the intertie.

A yearly water resources use estimate will be prepared by both parties and shared among them. The water resources use estimate will include:

1. Water demand forecast, average use
2. Water demand forecast, peak day use
3. Water rights permits and certificates, instantaneous capacity
4. Water rights permits and certificates, annual capacity
5. Installed pumping capacities

COST OF WATER SUPPLY

1. Clark will charge its prevailing rate for water service (Public Authority Service class). Rates are subject to periodic updates reflecting Clark's cost-of-service.
2. Rates, fees, and system development charges for service will be applied in accordance with the Public Authority Service class of Clark's rate schedules for water service.
3. The intertie water meter shall be upsized at the City's expense when the flow requested by the City exceeds the accuracy limits established by the manufacturer of the meter installed. An additional system development charge shall be paid by the City to Clark for the added capacity.

CURRENT CHARGES

The current system development charge for a 6-inch meter that can measure the 1,000 gpm flow is \$211,970.

The monthly charge is the sum of the basic charge per meter and the volume charge for water used.

MONTHLY VOLUME CHARGE

\$1.60 per 100 cubic feet (ccf) – Block 1

\$2.08 per 100 cubic feet (ccf) – Block 2

\$2.56 per 100 cubic feet (ccf) – Block 3

These rates will be applied on a daily basis using a 30-day average.

MONTHLY BASIC CHARGE AND VOLUME PER BLOCK

Schedule (Suffix)	Meter	Basic Charge (Monthly)	Block 1 (Cubic Feet)	Block 2 (Cubic Feet)	Block 3 (Cubic Feet)
59 (G Meter)	6-inch	\$509.15	0 – 165,600	165,601 – 331,200	Over 331,200

The City will construct and maintain ownership of an intertie at its expense, which will be comprised of a booster station and pipe gallery, prior to the booster station that will be used to meter flows. Initial construction will allow 500 to 1,000 gpm flow through the booster station. As the water demand increases and water supply facilities are developed, additional pumps can be added by the City to give a maximum flow of 3,000 gpm over a 20-year time frame.

To assist Clark in the development of future supplies, the City will support Clark's efforts in acquiring water right applications, grants, and loans.

The undersigned parties agree to all of the terms and conditions contained in this Agreement.

Clark Public Utilities

By: [Signature]
Title: CEO / General Manager
Date: 8-4-09

City of Battle Ground

By: [Signature]
Title: DENNIS OSBORN, CITY MANAGER
Date: July 21 09

City of Battle Ground – Coliform Monitoring Plan Summary

Section 1 – Monitoring Requirements

Washington Department of Health (DOH) administrative code Chapter 246-290 WAC regarding Public Water Supplies sets water quality monitoring requirements for water sources used for public supply in compliance with federal Safe Drinking Water Act (SDWA) regulations. Monitoring requirements for coliform bacteria, fecal coliform bacteria and E. coli are based on the water source and population served. Coliform bacteria and E. coli are tested because their presence indicates a potential threat to human health.

The Battle Ground Water Department is required to collect 20 routine coliform samples each month. The City has 42 sample sites which are rotated every third month and 6 sites at local schools which are tested every month. Coliform sampling sites and the monthly testing schedule for each site are summarized in Table 1 at the end of this Coliform Monitoring Plan. A sampling site map is also included at the end of this Plan.

Section 2 - Coliform Sampling Procedures

Battle Ground takes routine monthly distribution samples along with investigative samples for newly constructed water mains. Routine samples are taken from faucets at sampling sites identified in this Coliform Monitoring Plan. All sources can be sampled directly as necessary as well as the Horsethief Reservoir.

To take samples remove strainers and washers from faucet taps beforehand. Spray the tap with a solution of sodium hypochlorite. The sample tap should be flushed several minutes before taking the sample.

Samples are collected in 100 milliliter (ml) bottles, as furnished by the testing lab. These bottles have been sterilized and sealed. Care must be taken that neither the underside of the cap nor the top edge of the bottle is touched to avoid contamination. Do not rinse out the sample bottle.

The lab sample form, including the source of water and type of sample being submitted, is filled out by the person taking the sample and sent with the sample to the testing lab as soon as possible. The lab needs to receive the sample within 30 hours for the sample to be valid. Instructions for taking samples are on the back of the form.

Battle Ground chlorinates the water at each supply well to maintain a free chlorine residual of 0.3 to 0.8 parts per million (ppm) in the water distribution system. Battle Ground is required to monitor the chlorine residual in the system on a daily basis and provide monthly reports to DOH. A minimum measurable free chlorine residual of 0.2 ppm should be present

in all parts of the distribution system. The chlorine residual of the water at the tap should be tested and noted on the sample form.

Sample sites for the monitoring program are plotted on a map of the system to ensure that sampling efforts are not overly concentrated in any one area. Sample sites should be reviewed at least annually to ensure representative sampling of all areas of the water system. A map of the sample sites is included at the end of this Coliform Monitoring Plan. Sites are tested monthly.

Section 3 – Re-sampling Requirements for Positive Samples

If coliform bacteria are present in any routine sample that has not been invalidated, the water utility must collect repeat samples at the following locations:

- Each source as required by the Groundwater Rule
- Site of previous sample with a coliform presence
- Within five active services upstream of site of sample with a coliform presence
- Within five active services downstream of site of sample with a coliform presence

A non-acute maximum contaminant level (MCL) violation occurs if two or more of the routine or repeat coliform samples in a month are positive for total coliforms. If a repeat sample is positive DOH needs to be contacted and additional repeat samples are needed.

An acute MCL violation occurs if either the routine or repeat sample is positive for fecal coliform or E. coli.

Reporting and Public Notification

The water utility is required to provide periodic reports to DOH, summarizing the results of water quality testing. If any MCLs are exceeded, both DOH and the public must be notified in accordance with procedures specified in WAC 246-290-310, WAC 246-290-320 and WAC 246-290-480. DOH has developed public notices, press releases and certifications for water systems to use.

Although each public notification should be developed with the assistance and concurrence of the DOH* Coliform Program Manager and/or Regional Engineer, at a minimum the notification should:

- Contain a clear explanation of the violation including when it occurred
- Discuss potential adverse health effects and any segments of the population that may be at higher risk
- Mandatory health effects information
- A list of actions taken to remedy the situation

- A list of steps the consumer should take including whether alternative water sources should be used (boiled/bottled)
- Provide telephone number and contact person at Battle Ground
- When a return to compliance is expected
- Standard distribution language
- If appropriate, notice would be multilingual
- Certification required for acute and non-acute public notices. Certification must be sent to DOH within 10 days of notification.

In all cases the DOH* Coliform Program Manager and/or Regional Engineer should be consulted before issuing public notices.

Acute MCL

An acute MCL violation occurs when a water system exceeds the MCL for fecal coliform or E. coli. For all water systems an acute violation occurs when two or more samples are positive for total coliform and at least one sample is positive for fecal coliform or E. coli. If any sample is positive for fecal coliform or E. coli notify DOH* as soon as possible. If an acute coliform MCL violation occurs the following steps need to be taken:

- Notify DOH* immediately.
- Notify system users within 24 hours using mandatory health effects language. A boil water advisory will be required. The notification will go out through television, radio stations, hand delivery, mailings, and other methods deemed appropriate by DOH.
- Determine possible causes for violation and correct the situation as soon as possible.

Non-Acute MCL

A non-acute coliform MCL violation occurs when a water system exceeds the MCL for total coliform. This means two or more of the routine or repeat samples in a month are positive for total coliform bacteria. If a non-acute coliform MCL violation occurs the following steps need to be taken.

- Notify DOH* as soon as possible after determining a violation occurred
- Notify system users as soon as practical, within 30 days after the violation is known.
- Determine possible causes for violation and correct the situation as soon as possible.

Customer Complaints

It is recommended that a systematic approach be developed to handling customer complaints concerning the water system. Staff members familiar with system and operating conditions should handle calls. A record should be kept of all customer complaints and should include follow-up work undertaken to correct the problem. If a coliform sample is taken in response to a customer complaint the results should be recorded and kept in a file or database. This

file should contain all customer complaint results. Results can then be plotted on a map to locate areas of water quality concerns.

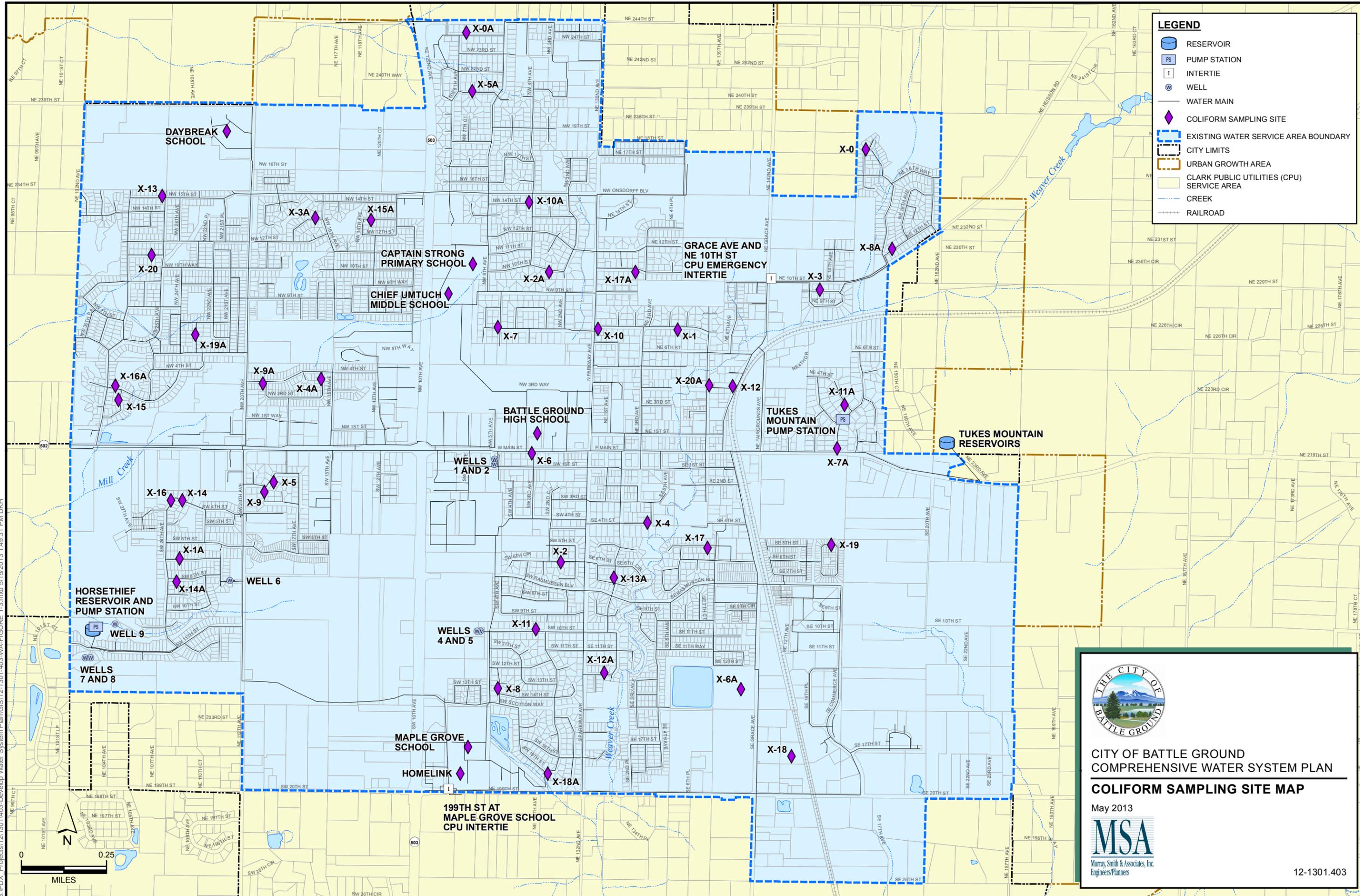
* DOH - Department of Health, S.W. Drinking Water Operations, Regional Engineer or Water Quality Specialist, PO Box 47823, Olympia, WA 98504-7823; (360) 664-0768. Coliform Program Manager number is (360) 753-5090. The after hours, holidays, and weekend emergency number is (877) 481-4901.

Table 1
City of Battle Ground - Coliform Sampling Sites

Sample Site	Location	Months Sampled Annually											
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	Maple Grove School	X	X	X	X	X	X	X	X	X	X	X	X
	Chief Umtuch Middle School	X	X	X	X	X	X	X	X	X	X	X	X
	Captain Strong Primary School	X	X	X	X	X	X	X	X	X	X	X	X
	Battle Ground High School	X	X	X	X	X	X	X	X	X	X	X	X
	Daybreak School	X	X	X	X	X	X	X	X	X	X	X	X
	HomeLink	X	X	X	X	X	X	X	X	X	X	X	X
X-0	1720 NE 16th Loop	X			X			X			X		
X-0A	720 NW 24th Street	X			X			X			X		
X-1	415 NE 7th Street	X			X			X			X		
X-1A	2306 SW 7th Street	X			X			X			X		
X-2	111 SW 6th Street	X			X			X			X		
X-2A	215 NW 10th Street	X			X			X			X		
X-3	1204 NE 9th Way	X			X			X			X		
X-3A	1604 NW 13th Street	X			X			X			X		
X-4	306 SE 4th Street	X			X			X			X		
X-4A	312 NW 16th Avenue	X			X			X			X		
X-5	121 SW 19th Avenue		X			X			X			X	
X-5A	712 NW 21st Street		X			X			X			X	
X-6	301 W Main Street #101		X			X			X			X	
X-6A	1308 SE Grace Avenue		X			X			X			X	
X-7	708 NW 5th Avenue		X			X			X			X	
X-7A	11 NE 15th Avenue		X			X			X			X	
X-8	1314 SW 5th Avenue		X			X			X			X	
X-8A	1708 NE 12th Street		X			X			X			X	
X-9	212 SW 19th Avenue			X			X			X			X
X-9A	1901 NW 4th Street			X			X			X			X
X-10	619 N Parkway Avenue			X			X			X			X
X-10A	400 NW 14th Street			X			X			X			X
X-11	208 SW 10th Street			X			X			X			X
X-11A	216 NE 16th Avenue			X			X			X			X
X-12	312 NE Grace Avenue			X			X			X			X
X-12A	104 SE 13th Street			X			X			X			X
X-13	2502 NW 15th Street	X			X			X			X		
X-13A	604 SE 2nd Avenue	X			X			X			X		
X-14	2304 SW 4th Street		X			X			X			X	
X-14A	2307 SW 8th Street		X			X			X			X	
X-15	208 NW 28th Avenue		X			X			X			X	
X-15A	1305 NW 13th Street		X			X			X			X	
X-16	402 SW 24th Avenue			X			X			X			X
X-16A	2812 NW 3rd Way			X			X			X			X
X-17	605 SE 5th Street			X			X			X			X
X-17A	219 NE 10th Street			X			X			X			X
X-18	14444 NE 199th Street- Bus Barn			X			X			X			X
X-18A	201 SW 19th Street- David Reeves			X			X			X			X
X-19	1416 SE 5th Way- Corey's	X			X			X			X		
X-19A	609 NW 23rd Avenue	X			X			X			X		
X-20	2510 NW 11th Street		X			X			X			X	
X-20A	315 NE Clark Avenue		X			X			X			X	

LEGEND

- RESERVOIR
- PS PUMP STATION
- I INTERTIE
- W WELL
- WATER MAIN
- COLIFORM SAMPLING SITE
- EXISTING WATER SERVICE AREA BOUNDARY
- CITY LIMITS
- URBAN GROWTH AREA
- CLARK PUBLIC UTILITIES (CPU) SERVICE AREA
- CREEK
- RAILROAD



**CITY OF BATTLE GROUND
COMPREHENSIVE WATER SYSTEM PLAN
COLIFORM SAMPLING SITE MAP**

May 2013
MSA
Murray, Smith & Associates, Inc.
Engineers/Planners

“CROSS CONNECTION CONTROL PROGRAM”

(a) INTRODUCTION

The purpose of this Cross Connection Control Ordinance is to define the authority Of the City of Battle Ground as the water purveyor in the elimination of all cross Connections within its public potable water supply.

This Ordinance shall apply to all users connected to the City of Battle Ground public potable water supply regardless of whether the user is located within the city limits or outside of the city limits.

This Ordinance will comply with the Federal Safe Drinking Water Act (P.L. 93-523), the Washington Administrative Code (Chapter 246-290 WAC) The rules set forth are adopted under Chapter 19.27 and 70.92 RCW and The Uniform Plumbing Code (Chapters 51-56 and 51-77 WAC) adopted by the Washington State Building Code Council as they pertain to cross connections with the public water supply.

(b) OBJECTIVES OF ORDINANCE

The specific objectives of the Cross Connection Control Ordinance for the City of Battle Ground are as follows:

- (1) To protect the public potable water supply of the City of Battle Ground against actual or potential contamination by isolating within the consumer*s water system contaminants or pollutants which could, under adverse conditions backflow through uncontrolled cross connections into the public water system.
- (2) To eliminate or control existing cross connections, actual or potential, between the consumer*s potable water system(s) and non-potable or industrial piping system(s).
- (3) To provide a continuing inspection program of cross connection control which will systematically and effectively control all actual or potential cross connections which may be installed in the future.

(c) RESPONSIBILITY: HEALTH AGENCY

The Washington State Department of Health / Division of Environmental Health Office of Drinking Water has the responsibility for promulgating and enforcing laws, rules, regulations, and policies to be followed in carrying out an effective Cross Connection Control Program.

The Washington State Department of Health / Division of Environmental Health Office of Drinking Water also has the primary responsibility of insuring that the water purveyor operates the public potable water system free of actual or potential sanitary hazards, including unprotected cross connections.

They have the further responsibility of insuring that the water purveyor provides an approved water supply at the service connection to the consumer*s water system and, further, that he requires the installation, testing, and maintenance of an approved backflow prevention assembly on the service connection when required.

(d) RESPONSIBILITY: WATER PURVEYOR

Except as otherwise provided herein, the water purveyor*s (City of Battle Ground) responsibility to ensure a safe water supply, begins at the source and includes all of the public water distribution system, including the service connection, and ends at the point of delivery to the consumer*s water system(s). In addition, the water

purveyor shall exercise reasonable vigilance to insure that the consumer has taken the proper steps to protect the public potable water system. To insure that the proper precautions are taken, the City of Battle Ground is required to determine the degree of hazard or potential hazard to the public potable water system; to determine the degree of protection required; and to ensure proper containment protection through an on-going inspection program.

When it is determined that a backflow prevention assembly is required for the protection of the public system, the City of Battle Ground shall require the consumer, at the consumer's expense, to install an approved backflow prevention assembly at each service connection, to test immediately upon installation and thereafter annually or at a frequency as determined by the City of Battle Ground; to properly repair and maintain such assembly or assemblies and to keep adequate records of each test and subsequent maintenance and repair, including materials and/or replacement parts.

(e) RESPONSIBILITY: CONSUMER

The consumer has the primary responsibility of preventing pollutants and contaminants from entering his potable water system(s) or the public potable water system. The consumer's responsibility starts at the point of delivery from the public potable water system and includes all of his water system(s). Upon notification from the city, the consumer, at his own expense, shall install, operate, test annually, and maintain an approved backflow prevention assembly as directed by the City of Battle Ground. The consumer shall maintain accurate records of tests and repairs made to the backflow prevention assembly and provide the City of Battle Ground with copies of such records. The records shall be on forms approved by the City of Battle Ground and shall include the list of materials or replacement parts used. Following any repair, overhaul, re-piping or relocation of an assembly, the consumer shall have it tested to insure that it is in good operating condition and will prevent backflow. Tests, maintenance and repairs of backflow prevention assemblies shall be made by a certified backflow prevention assembly tester. A list of those who are certified can be obtained from the City of Battle Ground.

(f) RESPONSIBILITY: CERTIFIED BACKFLOW ASSEMBLY TESTER

When employed by the consumer to test, repair, overhaul, or maintain backflow prevention assemblies, a Backflow Prevention Assembly Tester will have the following responsibilities:

The Backflow Prevention Assembly Tester must be State Certified and will be responsible for making competent inspections, for repairing or overhauling backflow prevention assemblies and for making reports of such repair to the consumer and responsible authorities on forms approved by the City of Battle Ground. The tester shall include the list of materials or replacement parts used. The tester shall be equipped with and be competent to use all the necessary tools, gauges, manometers and other equipment necessary to properly test, repair, and maintain backflow prevention assemblies. It will be the tester's responsibility to insure that original manufactured parts are used in the repair of or replacement of parts in a backflow prevention assembly. It will be the tester's further responsibility not to change the design, material or operational characteristics of an assembly during repair or maintenance without prior approval of the City of Battle Ground. A certified

tester shall perform the work and be responsible for the competency and accuracy of all tests and reports. A certified tester shall provide a copy of all test and repair reports to the consumer and to the City of Battle Ground within ten (10) business days of any completed test or repair work. A certified tester shall maintain such records for a minimum period of three (3) years.

All certified backflow prevention assembly testers must obtain and employ backflow prevention assembly test equipment which has been evaluated and/or approved by the City of Battle Ground. All test equipment shall be registered with the City of Battle Ground and the Washington Department of Health. All test equipment shall be checked for accuracy annually (at a minimum), calibrated, if necessary, and certified to the City of Battle Ground as to such calibration, employing an accuracy calibration method acceptable to the City of Battle Ground.

All certified backflow prevention assembly testers must become re-certified every two (2) years through an approved backflow prevention certification program.

(g) DEFINITIONS

This Ordinance is gender neutral and the masculine gender shall include the feminine and vice versa. Shall is mandatory, may is permissive and discretionary. The use of the singular shall be construed to include the plural and the plural shall include the singular as indicated by the context of its use.

(1) Air-Gap Separation

The term "air-gap separation" shall mean a physical separation between the free flowing discharge end of a potable water supply pipeline and an open or nonpressure receiving vessel. An "approved air-gap separation" shall be at least double the diameter of the supply pipe measured vertically above the overflow rim of the receiving vessel - in no case less than 1 inch (2.54 cm).

(2) Approved

The term "approved" as herein used in reference to a water supply shall mean a water supply that has been approved by the Washington State Department of Health (Division of Environmental Health Office of Drinking Water).

The term "approved" as herein used in reference to air-gap separation, a pressure vacuum breaker, a double check valve assembly, a double check detector assembly, a reduced pressure principle backflow prevention assembly, a reduced pressure principle detector assembly, or other backflow prevention assemblies or methods shall mean an approval by the City of Battle Ground.

(3) Backflow

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The term "backflow shall mean the undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into the distribution pipes of the consumer or public potable water system from any source or sources.

(4) Backflow Prevention Assembly-Approved

The term "approved backflow prevention assembly" shall mean an assembly used for containment and/or isolation purposes that has been investigated and approved by the City of Battle Ground and has been shown to meet the design and performance standards of the American Society of Sanitary Engineers (ASSE), the American

Water Works Association (AWWA), or the Foundation for Cross Connection Control and Hydraulic Research of the University of Southern California. The approval of backflow prevention assemblies by the City of Battle Ground is based on a favorable report by the Foundation for Cross Connection Control and Hydraulic Research of the University of Southern California, recommending such an approval. (To be approved, an assembly must be readily accessible for in-line testing and maintenance, and shall successfully complete a one year field evaluation within the City of Battle Ground's water system).

(5) Backflow Prevention Device Approved

The term "approved backflow prevention device shall mean a device used for isolation purposes that has been shown to meet the design and performance standards of the American Society of Sanitary Engineers (ASSE) and the American Water Works Association (AWWA).

(6) Backflow Prevention Assembly - Unapproved

The term unapproved backflow prevention assembly" shall mean an assembly that has been investigated by the City of Battle Ground and has been determined to be unacceptable for installation within the City of Battle Ground water system. Consideration for disapproval and removal from the "Approved List" shall be based upon, but not limited to, the following criteria: a) due to poor performance standards (i.e., significant failure rate); b) lack of or unavailability of repair parts; and/or, c) poor service or response from assembly*s factory representative(s).

(7) Backflow Prevention Assembly Type

A "backflow prevention assembly" shall mean an assembly used to prevent backflow into a consumer or public potable water system. The type of assembly used should be based on the degree of hazard either existing or potential (as defined herein). The types are:

- a. Double Check Valve Assembly (DCVA)
- b. Double Check Detector Assembly (Fire System) (DCDA)
- c. Pressure Vacuum Breaker (PVB)
- d. Reduced Pressure Principle Assembly (RP)
- e. Reduced Pressure Principle-Detector Assembly (Fire System) (RPDA)

(8) Backflow Prevention Assembly Tester-Certified

The term "certified backflow prevention assembly tester" shall mean a person who has proven their competency to the satisfaction of the Washington State Department of Health.

Each person who is certified to make competent tests, or to repair, overhaul, and make reports on backflow prevention assemblies shall be knowledgeable of applicable laws, rules, and regulations, shall be a licensed plumber or have at least two (2) years experience under and be employed by a Washington State licensed plumber or plumbing contractor, or have equivalent qualifications acceptable to the City of Battle Ground and must hold a certificate of completion from an approved training program in the testing and repair of backflow prevention assemblies. Backflow assembly testers who hold a certificate of completion from an approved training program shall be required to successfully complete a practical examination

administered by the State of Washington Department of Health, prior to conducting test and repair work on backflow prevention assemblies in the City of Battle Ground's water system.

(9) Back-Pressure Backflow

"Back-Pressure backflow" shall mean any elevation in the consumer water system (by pump, elevation of piping, or steam and/or air pressure) above the supply pressure at the point of delivery which would cause or tend to cause a reversal of the normal direction of flow.

(10) Back-Siphonage Backflow

"Back-siphonage backflow" shall mean a reversal of the normal direction of flow in the pipeline due to a negative pressure (vacuum) being created in the supply line with the backflow source subject to atmospheric pressure.

(11) Check Valve - Approved

The term "approved check valve" shall mean a check valve that is drip-tight in the normal direction of flow when the inlet pressure is at least one (1) psi and the outlet pressure is zero. The check valve shall permit no leakage in a direction reversed to the normal flow. The closure element (e.g. clapper, poppet, or other design) shall be internally loaded to promote rapid and positive closure. An approved check valve is only one component of an approved backflow prevention assembly - i.e., pressure vacuum breaker, double check valve assembly, double check detector assembly, reduced pressure principle assembly, or reduced pressure detector assembly.

(12) Consumer

The term "consumer" shall mean any person, firm, or corporation using or receiving water from the City of Battle Ground's water system.

(13) Consumer's Water System

The term "consumer's water system" shall include any water system commencing at the point of delivery and continuing throughout the consumer's plumbing system, located on the consumer's premises, whether supplied by a public potable water or an auxiliary water supply. The system or systems may be either a potable water system or an industrial piping system.

(14) Consumer's Potable Water System

The term "consumer's potable water system" shall mean that portion of the privately owned potable water system lying between the point of delivery and point of use and/or isolation protection. This system will include all pipes, conduits, tanks, receptacles, fixtures, equipment, and appurtenances used to produce, convey, store, or use potable water.

(15) Containment

The term "containment" shall mean preventing the impairment of the public potable water supply by installing an approved backflow prevention assembly at the service connection.

(16) Contamination

The term "contamination" shall mean an impairment of the quality of the water which creates a potential or actual hazard to the public health through the

introduction of hazardous or toxic substances or through the spread of disease by sewage, industrial fluids, or waste.

(17) Cross Connection

A "cross connection" shall mean any unprotected actual or potential connection or structural arrangement between a public or a consumer's water system and any other source or system through which it is possible to introduce any contamination or pollution, other than the intended potable water with which the system is supplied. By-pass arrangements, jumper connections, removable sections, swivel or change-over devices, and other temporary or permanent devices through which or because of which "backflow" can or may occur are considered to be cross connections.

(18) Double Check Valve Assembly

The term "double check valve assembly" shall mean an assembly composed of two (2) independently acting, approved check valves, including tightly closing shut-off valves attached at each end of the assembly and fitted with properly located test cocks. This assembly shall only be used to protect against a non-health hazard (i.e., pollutant).

(19) Double Check-Detector Assembly

The term "double check-detector assembly" shall mean a specially designed assembly composed of a line-size approved double check valve assembly with a specific bypass water meter and a meter-sized approved double check valve assembly. The meter shall register (in U.S. gallons) accurately for only very low rates of flow and shall show a registration for all rates of flow. This assembly shall only be used to protect against a non-health hazard (i.e., pollutant).

(20) Hazard - Degree Of

The term "degree of hazard" shall be derived from the evaluation of conditions within a system which can be classified as either a "pollutant" (non-health) or a "contamination" (health) hazard.

(21) Hazard-Health

The term "health hazard" shall mean an actual or potential threat of contamination of a physical, hazardous or toxic nature to the public or consumer's potable water system to such a degree or intensity that there would be a danger to health.

(22) Hazard - Non-Health

The term "non-health hazard" shall mean an actual or potential threat to the quality of the public or the consumer's potable water system. A non-health hazard is one that, if introduced into the public water supply system could be a nuisance to water customers, but would not adversely affect human health.

(23) Hazard - Pollutant

The term "pollutant hazard" shall mean an actual or potential threat to the quality or the potability of the public or the consumer's potable water system but which would not constitute a health or a system hazard, as defined. The maximum degree or intensity of pollution to which the potable water system could be degraded under this definition would cause a nuisance or be aesthetically objectionable or could cause minor damage to the system or its appurtenances.

(24) Health Agency

The term "health agency" shall mean the State of Washington Department of Health (Division of Environmental Health Office of Drinking Water)

(25) Industrial Fluids

The term "industrial fluids" shall mean any fluid or solution which may be chemically, biologically, or otherwise contaminated or polluted in a form or concentration such as would constitute a health, or non-health hazard if introduced into a public or consumer potable water system. Such fluids may include, but are not limited to: process waters; chemicals in fluid form; acids and alkalis; oils, gases; etc.

(26) Industrial Piping System - Consumer*s

The term "consumer*s industrial piping system" shall mean any system used by the consumer for transmission of or to confine or store any fluid, solid or gaseous substance other than an approved water supply. Such a system would include all pipes, conduits, tanks; receptacles, fixtures, equipment, and appurtenances used to produce, convey, or store substances which are or may be polluted or contaminated.

(27) Isolation

"Isolation" is the act of confining a localized hazard within a consumer*s water system by installing approved backflow prevention assemblies. (Disclaimer): The City of Battle Ground may make recommendations, upon facility inspection, as to the usages of isolation devices/assemblies, but does not assume or have responsibility whatsoever for such installations.

(28) Point Of Delivery

"Point of delivery" shall generally be at the property line of the customer, adjacent to the public street where the City of Battle Ground's mains are located, or at a point on the customer*s property where the meter is located. The customer shall be responsible for all water piping and control devices located on the customer*s side of the point of delivery.

(29) Pollution

The term "pollution" shall mean an impairment of the quality of the water to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably affect the aesthetic qualities of such waters for domestic use.

(30) Potable Water

The term "potable water" shall mean water from any source which has been investigated by the Washington State Department of Health (Department of Environmental Health Office of Drinking Water) and which has been approved for human consumption.

(31) Public Potable Water System

The term public potable water system shall mean any publicly or privately owned water system operated as a public utility, under a current Washington State Department of Health permit, to supply water for public consumption or use. This system will include all sources, facilities, and appurtenances between the source and the point of delivery such as valves, pumps, pipes, conduits, tanks, receptacles, fixtures,

equipment, and appurtenances used to produce, convey, treat, or store a potable water for public consumption or use.

(32) Reduced Pressure Principle Backflow Prevention Assembly

The term "reduced pressure principle backflow prevention assembly" shall mean an assembly containing within its structure a minimum of two (2) independently acting, approved check valves, together with a hydraulically operating, mechanically independent, pressure differential relief valve located between the check valves and at the same time below the first check valve. The first check valve reduces the supply pressure a predetermined amount so that during normal flow and at cessation of normal flow, the pressure between the checks shall be less than the supply pressure. In case of leakage of either check valve, the pressure differential relief valve, by discharge to atmosphere, shall operate to maintain the pressure between the checks less than the supply pressure. The unit shall include tightly closing shut-off valves located at each end of the assembly and each assembly shall be fitted with properly located test cocks. The assembly is designed to protect against a health hazard (i.e., contaminant).

(33) Reduced Pressure Principle-Detector Assembly

The term "reduced pressure principle-detector assembly" shall mean a specially designed assembly composed of a line-size approved reduced pressure principle backflow prevention assembly with a specific bypass water meter and a meter sized approved reduced pressure principle backflow prevention assembly. The meter shall register (in U.S. gallons) accurately for only very low rates of flow and shall show a registration for all rates of flow. This assembly shall be used to protect against health hazard (i.e., contaminant).

(34) Service Connections

The term "service connection" shall mean the terminal end of a service connection from the public potable water system, i.e., where the City of Battle Ground loses jurisdiction and sanitary control over the water at its point of delivery to the consumer's water system.

(35) Vacuum Breaker Atmospheric Type

The term "atmospheric vacuum breaker" (also known as the "non-pressure type vacuum breaker") shall mean a device containing a float-check; a check seat, and an air inlet port. The flow of water into the body causes the float to close the air inlet port. When the flow of water stops the float falls and forms a check valve against back-siphonage and at the same time opens the air inlet port to allow air to enter and satisfy the vacuum. A shut-off valve immediately upstream may be an integral part of the device. An atmospheric vacuum breaker is designed to protect against a non-health hazard (isolation protection only) under a back-siphonage condition only.

(36) Vacuum Breaker Pressure Type

The term "pressure vacuum breaker" shall mean an assembly containing an independently operating internally loaded check valve and an independently operating loaded air inlet valve located on the discharge side of the check valve. The assembly is to be equipped with properly located test cocks and tightly closing shut-off valves attached at each end of the assembly. This assembly is designed to protect against a health hazard (i.e., contaminant) under a backsiphonage

condition only.

(37) Water Purveyor

The term “water purveyor” shall mean the owner or operator of a public potable water system, providing an approved water supply to the public.

(38) Water Supply - Approved

The term “approved water supply” shall mean any public potable water supply which has been investigated and approved by the Washington State Department of Health (Division of Environmental Health, Office of Drinking Water.) The system must be operating under a valid health permit. In determining what constitutes an approved water supply, The Washington State Department of Health (Division of Environmental Health Office of Drinking Water) has reserved the final judgment as to its safety and potability.

(39) Water Supply - Auxiliary

The term “auxiliary water supply” shall mean any water supply on or available to the premises other than the purveyor*s approved public potable water supply. These auxiliary waters may include water from another purveyors public potable water supply or any natural source such as a well, spring, river, stream, etc., “used water”, or industrial fluids. These waters may be polluted, contaminated, or objectionable and constitute an unacceptable water source over which the water purveyor does not have sanitary control.

(40) Water Supply - Unapproved

The term “unapproved water supply” shall mean a water supply which has not been approved for human consumption by the Washington State Department of Health

(41) Water - Used

The term “used water” shall mean any water supplied by a water purveyor from a public water system to a consumer*s water system after it has passed through the point of delivery and is no longer under the control of the water purveyor.

(h) RIGHT OF ENTRY

Authorized representative(s) from the City of Battle Ground shall have the right to enter, upon presentation of proper credentials and identification, any building, structure, or premises during normal business hours, or at any time during the event of an emergency, to perform any duty imposed by this Ordinance. Those duties may include sampling and testing of water, or inspections and observations of all piping systems connected to the public water supply. Where a user has security measures in force which would require proper identification and clearance before entry into their premises, the user shall make necessary arrangements with the security guards so that upon presentation of suitable identification, the City of Battle Ground personnel will be permitted to enter, without delay, for the purposes of performing their specific responsibilities. Refusal to allow entry for these purposes may result in discontinuance of water service.

On request, the consumer shall furnish to the City of Battle Ground any pertinent information regarding the water supply system on such property where cross connections and backflow are deemed possible.

(I) ELIMINATION OF CROSS CONNECTIONS: DEGREE OF HAZARD

When cross connections are found to exist, the owner, his agent, occupant, or tenant will be notified in writing to disconnect the same within the time limit established by the City of Battle Ground. Degree of protection required and maximum time allowed for compliance will be based upon the potential degree of hazard to the public water supply system. The maximum time limits are as follows:

- (1) Cross connections with private wells or other auxiliary water supplies require immediate disconnection from City of Battle Ground's potable water system until an approved backflow prevention device is installed.
- (2) All facilities which pose a health hazard to the potable water system must have a containment assembly in the form of a reduced pressure principle backflow prevention assembly within 60 days.
- (3) All industrial and commercial facilities not identified as a "health hazard" shall be considered non-health hazard facilities. All non-health hazard facilities must install, as a minimum containment assembly, a double check valve assembly within 90 days.
- (4) If, in the judgment of the City of Battle Ground, an imminent health hazard exists, water service to the building or premises where a cross connection exists may be terminated unless an air gap is immediately provided, or the cross connection is immediately eliminated.
- (5) The consumer is responsible for installing sufficient internal isolation backflow prevention assemblies and/or methods (i.e., air gap, pressure vacuum breakers, reduced pressure principle backflow prevention assembly, double check valve assembly).
- (6) Water mains served by the City of Battle Ground but not maintained by the City of Battle Ground should be considered cross connections, with degree of hazard to be determined by the City of Battle Ground. Degree of protection shall be based upon, the degree of hazard.
- (7) In the event that the City of Battle Ground Cross Connection Control Coordinator or Inspector does not have sufficient access to every portion of a private water system (i.e., classified research and development facilities; federal government property) to allow a complete evaluation of the degree of hazard associated with such private water systems, an approved reduced pressure principle assembly shall be required as a minimum of protection.
- (8) No person shall fill special use tanks or tankers containing pesticides, fertilizers, other toxic chemicals or their residues from the public water system except at a location equipped with an air gap or an approved reduced pressure principle backflow prevention assembly properly installed on the public water supply.

(J) INSTALLATION OF ASSEMBLIES

- (1) All backflow prevention assemblies shall be installed in accordance with the specifications furnished by the City of Battle Ground and/or the manufacturer's installation instructions and/or in the latest edition of the Uniform Plumbing Code as adopted by the Washington State Building Code Council, whichever is most restrictive.
- (2) All new construction plans and specifications, when required by the International Building Code as adopted by the Washington State Code Council and the Washington

State Department of Health / Division of Environmental Health Office of Drinking Water, shall be made available to the City of Battle Ground for review and approval, and to determine the degree of hazard.

(3) Ownership, testing, and maintenance of the assembly shall be the responsibility of the customer.

(4) All double check valve assemblies must be installed in drainable pits wherever below ground installation is necessary, in accordance with detailed specifications provided by the City of Battle Ground.

(5) Reduced pressure principle assemblies must be installed in a horizontal position and in a location in which no portion of the assembly can become submerged in any substance under any circumstances (pit and/or below grade installations are prohibited).

Double check valve assemblies may be installed in a vertical position with prior approval from the City of Battle Ground, provided the flow of water is in an upward direction.

(6) The installation of a backflow prevention assembly which is not approved must be replaced with an approved backflow prevention assembly.

(7) The installer is responsible to make sure a backflow prevention assembly is working properly upon installation and is required to furnish the following information to the City of Battle Ground within fifteen (15) days after a reduced pressure principle backflow preventer (RP), double-check valve assembly (DCVA), pressure vacuum breaker (PVB), double check-detector assembly (DCDA), or reduced pressure principle detector assembly (RPDA) is installed:

- a. service address where assembly is located
- b. owner (and address, if different from service address)
- c. description of assembly*s location
- d. date of installation
- e. installer (include name, contractor/plumbing company represented, contractor*s/plumber*s license number, and project permit number)
- f. type of assembly, size of assembly
- g. manufacturer, model number, serial number
- h. test results/report

(8) When it is not possible to interrupt water service, provisions shall be made for a "parallel installation" of backflow prevention assemblies. The City of Battle Ground will not accept an unprotected bypass around a backflow preventer when the assembly is in need of testing, repair, or replacement.

(9) The consumer shall, upon notification, install the appropriate containment assembly not to exceed the following time frame:

Health Hazard 60 days

Non-Health Hazard 90 days

(10) Following installation, all RP, DCVA, PVB, DCDA, and RPDA are required to be tested by a certified backflow prevention assembly tester within ten (10) days.

(k) TESTING AND REPAIR OF ASSEMBLIES

(1) Testing of backflow prevention assemblies shall be made by a certified backflow prevention assembly tester at the customer*s expense. Such tests are to be conducted upon installation and annually thereafter or at a frequency established by

the City of Battle Ground's regulations. A record of all testing and repairs is to be retained by the customer. Copies of the records must be provided to the City of Battle Ground within ten (10) business days after the completion of any testing and/or repair work.

(2) Any time that repairs to backflow prevention assemblies are deemed necessary, whether through annual or required testing or routine inspection by the owner or by the City of Battle Ground, these repairs must be completed within a specified time in accordance with the degree of hazard. In no case shall this time period exceed:

- a. Health Hazard Facilities - 14 days
- b. Non-Health Hazard Facilities - 21 days

(3) All backflow prevention assemblies with test cocks are required to be tested annually or at frequency established by the City of Battle Ground's regulations. Testing requires a water shutdown usually lasting five (5) to twenty (20) minutes. For facilities that require an uninterrupted supply of water, and when it is not possible to provide water service from two separate meters, provisions shall be made for a "parallel installation" of backflow prevention assemblies.

(4) All certified backflow prevention assembly testers must obtain and employ backflow prevention assembly test equipment which has been evaluated and/or approved by the City of Battle Ground. All test equipment shall be registered with the City of Battle Ground. All test equipment shall be checked for accuracy annually (at a minimum), calibrated, if necessary, and certified to the City of Battle Ground to such accuracy/calibration, employing a calibration method acceptable to City of Battle Ground.

(5) It shall be unlawful for any customer or certified tester to submit any record to the City of Battle Ground which is false or incomplete in any material respect. It shall be unlawful for any customer or certified tester to fail to submit to the City of Battle Ground of any record which is required by this Ordinance. Such violations may result in any of the enforcement actions outlined in Section (O) of this Ordinance.

(I) FACILITIES REQUIRING PROTECTION

Approved backflow prevention assemblies shall be installed on the service line to any premises that the City of Battle Ground has identified as having a potential for backflow. The following types of facilities or services have been identified by the City of Battle Ground as having a potential for backflow of non-potable water into the public water supply system.

Therefore, an approved backflow prevention assembly will be required on all such services according to the degree of hazard present. Other types of facilities or services not listed below may also be required to install approved backflow prevention assemblies if determined necessary by the City of Battle ground. As a minimum requirement, all commercial services will be required to install a Double Check Valve Assembly, unless otherwise listed below.

DCVA = Double check valve Assembly

RP = Reduced Pressure Principle Assembly

DCDA = Double Check Detector Assembly

RPDA = Reduced Pressure Detector Assembly

AG = Air Gap

PVB = Pressure vacuum Breaker

- (1) Aircraft and Missile Plants: RP
 - (2) Automotive Services Stations, Dealerships, etc.
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
 - (3) Automotive Plants: RP
 - (4) Auxiliary Water Systems:
 - a. Approved Public/Private Water Supply: DCVA
 - b. Unapproved Public/Private Water Supply: AG
 - c. Used Water and Industrial Fluids: RP
 - (5) Bakeries:
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
 - (6) Beauty Shops/Barber Shops
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
 - (7) Beverage Bottling Plants: RP
 - (8) Breweries: RP
 - (9) Buildings - Hotels, apartment houses, public and private buildings, or other structures having unprotected cross connections.
 - a. (Under five stories) No Health Hazard: DCVA
 - b. (Under five stories) Health Hazard: RP
 - c. (Over five stories) All: RP
 - (10) Canneries, packing houses, and rendering plants: RP
 - (11) Chemical plants - Manufacturing, processing, compounding or treatment: RP
 - (12) Chemically contaminated water systems: RP
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- (13) Commercial car-wash facilities: RP
 - (14) Commercial greenhouses: RP
 - (15) Commercial sales establishments (department stores, malls, etc.)
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
 - (16) Concrete/asphalt plants: RP
 - (17) Dairies and cold storage plants: RP
 - (18) Dye works: RP
 - (19) Film laboratories: RP
 - (20) Fire systems
 - a. Systems 3/4"(inch) to 2"(inch)
 - 1. No Health Hazard: DCDA
 - 2. Health Hazard: (Booster Pumps, Foam, Antifreeze Solution, etc.): RP
 - b. Systems 2 1/2"(inch) to 10"(inch) (or larger)
 - 1. No Health Hazard: DCDA
 - 2. Health Hazard: (Booster Pumps, Foam, Antifreeze Solution etc.): RPDA
 - (21) Hospitals, medical buildings, sanitariums, morgues, mortuaries, autopsy facilities, nursing and convalescent homes, medical clinics, and veterinary hospitals: RP

- (22) Industrial facilities:
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
- (23) Laundries:
 - a. No Health Hazard: DCVA
 - b. Health Hazard: (i.e., Dry Cleaners): RP
- (24) Lawn irrigation systems (split taps):
 - a. No Health Hazard: RP
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- b. Health Hazard: (Booster Pumps, Chemical Systems): RP
- (25) Metal manufacturing, cleaning, processing, and fabricating plants: RP
- (26) Mobile home parks:
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
- (27) Oil and gas production, storage or transmission properties: RP
- (28) Paper and paper products plants: RP
- (29) Pest control (exterminating and fumigating): RP
- (30) Plating plants: RP
- (31) Power plants: RP
- (32) Radioactive materials or substances - plants or facilities handling: RP
- (33) Restaurants:
 - a. No Health Hazard: DCVA
 - b. Health Hazard: RP
- (34) Restricted, classified, or other closed facilities: RP
- (35) Rubber plants (natural or synthetic): RP
- (36) Sand and gravel plants: RP
- (37) Schools and colleges: RP
- (38) Sewage and storm drain facilities: RP
- (39) Swimming Pools: RP
- (40) Waterfront facilities and industries: RP
- (41) Residential:
 - a. No Health Hazard DCVA
 - b. Health Hazard RP

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All assemblies and installations shall be subject to inspection and approval by the City of Battle Ground.

(m) CONNECTIONS WITH UNAPPROVED SOURCES OF SUPPLY

(1) No person shall connect or cause to be connected any supply of water not approved by the Washington State Department of Health / Division of Environmental Health Office of Drinking Water to the water system supplied by the City of Battle Ground. Any such connections allowed by the City of Battle Ground must be in conformance with the backflow prevention requirements of this Ordinance.

(2) In the event of contamination or pollution of a public or consumer potable water system, the consumer shall notify the City of Battle Ground immediately in order that appropriate measures may be taken to overcome and eliminate the contamination or pollution.

(n) FIRE PROTECTION SYSTEMS

(1) All connections for fire protection systems connected with the public water system, two (2) inches and smaller, shall be protected with an approved double check valve assembly as a minimum requirement. All fire systems using toxic additives or booster pumps shall be protected by an approved reduced pressure principle assembly at the main service connection.

(2) All connections for fire protection systems connected with the public water system greater than two (2) inches, shall be protected with an approved double check detector assembly as a minimum requirement. All fire protection systems using toxic or hazardous additives or booster pumps shall be protected by an approved reduced pressure principle detector assembly at the main service connection.

(3) All existing backflow prevention assemblies two and one-half (2 ½) inches and larger installed on fire protection systems (that were initially approved by the City of Battle Ground shall be allowed to remain on the premises, as long as they are being properly maintained, tested and repaired as required by this Ordinance. If, however, the existing assembly must be replaced (once it can no longer be repaired), or in the event of proven water theft through an un-metered source, the consumer shall be required to install an approved double check detector assembly or reduced pressure principle detector assembly as required by this provision.

(o) ENFORCEMENT

(1) The owner, manager, supervisor, or person in charge of any installation found not to be in compliance with the provisions of this Ordinance shall be notified in writing with regard to the corrective action(s) to be taken. The time for compliance shall be in accordance with paragraph (j).

(2) The owner, manager, supervisor, or person in charge of any installation which remains in non-compliance after the time prescribed in the initial notification, as outlined in paragraph (j) shall be considered in violation of this Ordinance, and may be issued a civil citation by the City of Battle Ground. Said citation shall specify the nature of the violation and the provision(s) of this Ordinance violated, and further notify the offender that the civil penalty for said violation is as set forth in paragraph (3) below and is to be paid to the City of Battle Ground at the office of the City of Battle Ground, 109 SW 1st Street, Suite 220 Battle Ground, WA 98604, within thirty (30) days. If the penalty prescribed herein is not paid within the time allowed, the City of Battle Ground may initiate a civil action in the nature of a debt and recover the sums set for in paragraph (3) below plus the cost of action.

(3) Any offender who shall continue any violation beyond the time limit provided for in the aforementioned notification shall be subject to a civil penalty of up to \$1000 per violation. Each day in which a violation of any provision of this Ordinance shall occur or continue shall constitute a separate and distinct offense.

(4) If, in the judgement of the City of Battle Ground, any owner, manager, supervisor, or person in charge of any installation found to be in non-compliance with the provisions of this Ordinance, neglects their responsibility to correct any violation, it may result in discontinuance of water service until compliance is achieved.

(5) Failure of a customer or certified tester to submit any record required by this Ordinance, or the submission of falsified reports/records may result in a civil

penalty of up to **\$1000** per violation. If a certified backflow prevention assembly tester submits falsified records to the City of Battle Ground, the City of Battle Ground shall take the necessary actions to revoke certification to test backflow prevention assemblies within the potable water system for a time period not to exceed one (1) Year.

The tester will then be required to complete an approved certification course to acquire a new certification. Falsification made to records/reports after becoming re-certified shall result in the permanent revocation of backflow testing certification, in addition to a civil penalty (as stated herein).

(6) Enforcement of this program shall be administered by the City of Battle Ground or their authorized representative.

(7) Requests for extension of time shall be made in writing to the City of Battle Ground or their authorized representative. All other appeals will be made to the Backflow Prevention Advisory Board through the Washington State Department of Health / Division of Environmental Health Office of Drinking Water.

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