

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.

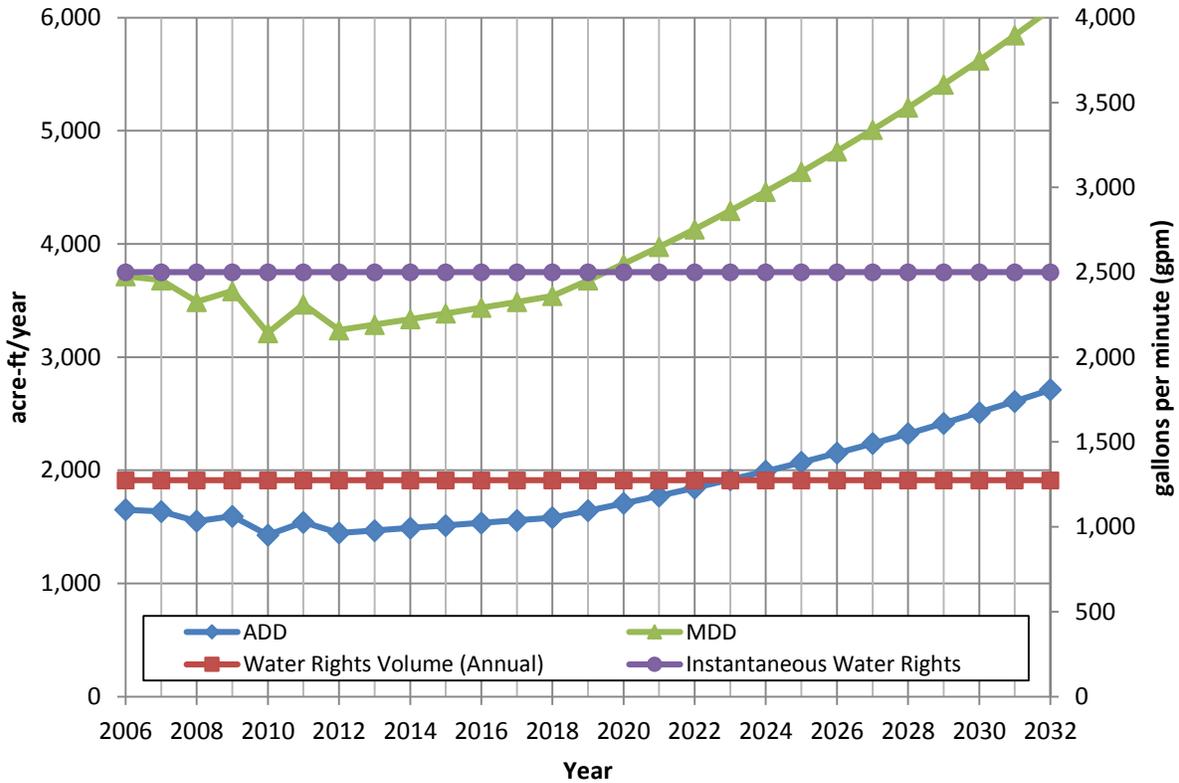
Reclaimed Water

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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