Water Source and Quality

6

INTRODUCTION

The two basic objectives of a water system are to provide a sufficient quantity of water to meet customer usage demands and to provide high quality water. **Chapter 7** discusses the City of Stanwood's (City) ability to supply a sufficient quantity of water and identifies future source requirements. This chapter discusses the City's existing water sources, water rights, water quality regulations, and water quality monitoring results.

EXISTING WATER SOURCES AND TREATMENT

Water Sources

All water supply to the City's water system is provided by a few groundwater wells in the East Stanwood Aquifer and one groundwater spring source. The City's oldest source of supply, the Hatt Slough Springs, is located south of the City limits on the south side of Hatt Slough and is currently offline due to a November 2011 landslide restricting access to the site. Bryant Well No. 1 is the City's largest single source of supply located near State Route (SR) 532 and 268th Street NW. Bryant Well No. 2, which is located adjacent to Bryant Well No. 1, is offline due to a decline in capacity and is considered an emergency source of supply. An emergency source is a source of supply that the Washington State Department of Health (DOH) has approved for use, but is not utilized for routine or seasonal demands. A replacement well, Bryant Well No. 3, was drilled in 2013 and is planned for connection to the water system in 2015. The Cedarhome Well was installed in 2008 to replace the Sill Well, which has been offline since 1985 and is disconnected from the water system. The Fure Well, which is located on the eastern edge of the City limits, is out of service and is considered an emergency source. Additional information on each of the City's existing sources is presented in **Chapter 2** and contained in **Appendix B**.

Water Treatment

The City transitioned to system-wide chlorination in 2008. The Cedarhome Well, Bryant Well No. 1, and Hatt Slough Springs, when in use, are all chlorinated. Historically, the City chlorinated its water only at the Hatt Slough Springs source as a precautionary measure, even though harmful bacteria have never been detected. However, in 2004, the DOH determined that a hydraulic connection exists between Bryant Well No. 1 and the nearby surface water source, Church Creek. As a result, the City is now required to provide disinfection at this source. The well is not classified as groundwater under the direct influence of surface water (referred to as a GWI source); therefore, it is not required to meet more stringent surface water treatment requirements. Following the classification of Bryant Well No. 1 as a source under hydraulic connection with surface water, the City constructed the Bryant Well Field Treatment Facility. The Bryant Well Field Treatment Facility chlorinates water produced from Bryant Well No. 1 after it is filtered with greensand media to reduce manganese and arsenic concentrations and is fed ferric chloride to assist with arsenic removal. The treatment facility will also treat Bryant Well No. 3 when it is online in 2015.

Groundwater is often fluoridated to assist in the prevention of tooth decay. The City has chosen not to fluoridate its water at this time.

WATER RIGHTS

Overview

A water right is a legal authorization to use a specified amount of public water for specific beneficial purposes. The water right amount is expressed in terms of instantaneous withdrawal rate and annual withdrawal volume. Washington State law requires users of public water to receive approval from the Washington State Department of Ecology (Ecology) prior to actual use of the water. This approval is granted in the form of a water right permit, which is developed into a certificate. However, a water right is not required for certain purposes (typically individual residences) that use 5,000 gallons per day (gpd) or less of groundwater from a well.

The process for obtaining a water right involves submitting a water right application that is reviewed by Ecology. If the request is approved, a water right is issued to allow for water use to commence. A water right permit provides permission to construct the necessary wells or diversions, pumps, and pipes to start using water. The water right permit remains in effect until the permit holder determines that their project is complete and they have used as much water as they will under the water right. At that time, the permit holder files a proof of appropriation form, which attests to the rate and volume of water used under the water right. A water right certificate is issued by Ecology following a proof of examination and determination that the amount of water put to beneficial use is consistent with the amount and conditions indicated on the water right permit.

A water right permit can only be issued by Ecology if the proposed use meets the following requirements.

- Water will be put to beneficial use.
- There will be no impairment to existing or senior rights.
- Water is physically and legally available for appropriation.
- Issuance of the requested water right will not be detrimental to the public interest.

During preparation of the report of examination, Ecology considers existing basin management plans, stream closures, instream flows, hydraulic continuity (surface water interconnected to groundwater), seawater intrusion, utilization of existing water sources, water conservation and availability of alternative water supplies, among other things. The water right decision process is increasingly becoming more complex and time consuming, due to the many competing interests for water, environmental issues, and regulatory requirements.

Existing Water Rights

The City currently holds one water right permit and three water right certificates for its sources of municipal water supply. A summary of these water rights is presented in **Table 6-1** and the principal water right documents are contained in **Appendix I**.

Table 6-1
Existing Water Rights

DOH No.	Source Name	WRTS Record Number	Certificate/Permit Number	Priority Date	Primary or Supplemental Right	Use	Existing Water Rights			
							Instantaneous		Annual	
							(gpm)	(cfs)	(acre-ft)	(gpm)
S01	Hatt Slough Springs	S1-*02432CWRIS	SWC 1164	9/28/1928	Primary	Permanent	1,122	2.5	1,810	1,122
S02	Bryant No. 1 [1]	G1-*00741CWRIS	GWC 615	2/20/1948	Primary	Permanent	2,000	4.5	2,400	1,487
S03	Bryant No. 2 [1]	G1-*00741CWRIS	GWC 615	2/20/1948	NA [1]	Emergency	2,000	4.5	2,400	1,487
NA [2]	Bryant No. 3 [1]	G1-*00741CWRIS	GWC 615	2/20/1948	NA [1]	Permanent [2]	2,000	4.5	2,400	1,487
S04	Fure Well	G1-*01067CWRIS	GWC 616	2/11/1949	Primary	Emergency	150	0.3	121	75
S07	Cedarhome Well [3]	G1-*04239	Superseding GWP 4111	3/6/1956	Primary	Permanent	600	1.3	960	595
					Water Right Total		3,872	8.6	5,291	3,279

1 = Bryant Well Nos. 1, 2, and 3 are authorized under the same water right. Quantities shown are for the entire right, not each individual well.
2 = Source approval not yet obtained
3 = Transferred from the Sill Well
DOH No. = Source Number
WRTS = Water Right Tracking System (Department of Ecology)
SWC = Surface Water Certificate
GWC = Groundwater Certificate
GWP = Groundwater Permit
gpm = gallons per minute
cfs = cubic feet per second
acre-ft = acre-feet per year

Surface Water Certificate 1164

Surface Water Certificate (SWC) 1164, with a priority date of September 28, 1928, currently authorizes the diversion of 2.5 cubic feet per second (cfs) from Hatt Slough Springs. The certificate contains no limitation on the annual volume that can be diverted, so it is shown in **Table 6-1** assuming continuous diversion at 2.5 cfs, year round. No changes have been made to this certificate since it was issued.

Groundwater Certificate 615

Groundwater Certificate (GWC) 615, with a priority date of February 20, 1948, currently authorizes the withdrawal of 2,000 gallons per minute (gpm) and 2,400 acre-feet per year (afy) from Bryant Well Nos. 1, 2, and 3, all located in the NW ¼, NE ¼, Section 29, Township 32 North, Range 4 East, W.M. The original certificate was issued in 1951 with Bryant Well No. 1 as the approved point of withdrawal. On September 21, 1992, the City applied to Ecology to include Bryant Well No. 2 as an additional point of withdrawal. The water right change was approved by Ecology in April 1996. Bryant Well No. 3 was included as an additional point of withdrawal in June 2014, when the City submitted a Showing of Compliance with the Revised Code of Washington (RCW) 90.44.100(3) form to Ecology. Passage of RCW 90.44.100(3) in 1997 allowed Bryant Well No. 3 to be added without having to go through the water right change process, as had been required for the addition of Bryant Well No. 2.

Groundwater Certificate 616

GWC 616, with a priority date of February 11, 1949, currently authorizes the withdrawal of 150 gpm and 121 afy from the Fure Well located in the NW ¼ SE ¼, Section 20, Township 32 North, Range 4 East, W.M. The original certificate was issued in 1951. No changes have been made to this certificate since it was issued.

Groundwater Permit 4111

Groundwater Permit (GWP) 4111, with a priority date of March 6, 1956, currently authorizes the withdrawal of 600 gpm and 960 afy from the Cedarhome Well located in the SW ¼ NE ¼, Section 20, Township 32 North, Range 4 East, W.M.

Since this water right is still in permit stage, the development schedule associated with it requires that water under this water right must be put to full beneficial use by October 2, 2022, unless an extension is requested and granted by Ecology. There are metering, water level, and water quality provisions on this permit that require the City to collect information and provide it to Ecology. Water use data is required to be recorded weekly and provided to Ecology by January 31st each year. Static water level measurements are required monthly and Ecology must be notified if a below normal seasonal water level drop is measured. Groundwater shall be collected and analyzed for chloride and conductivity in April and August with the results submitted to Ecology by October 15th each year.

GWP 4111 has a complex history. Originally, the water right was approved for withdrawal of 1,000 gpm and 1,600 afy from the Sill Well located in the SE ¼ NE ¼, Section 20, Township 32 North, Range 4 East, W.M. The report of examination listed all of the Stanwood Water Company's (prior operator of the City water system) water rights, which included GWC 509-D (no longer utilized by the City), GWC 615, GWC 616, GWP 487, SWC 1164, and SWP 4416 and then included the following statement, "The water requirements of the town are calculated at a continual pumping rate of 1000 gpm, or 1600 acre-feet annually, consistent with beneficial domestic and industrial use, less any amount diverted to this land under the above listed existing rights." This language was often used to limit the volume of water granted under a new water right when sufficient annual quantity had already been allocated for the applicant's need under existing water rights. The intent was to provide flexibility to the applicant by allowing the use of an additional source or sources without increasing the total amount of water available to them.

The total annual volume that had already been issued under the certificates and permits identified was equal to 6,285 afy when the report of examination issued in 1956 (GWC 509-D – 17 afy; GWC 615 – 2,400 afy; GWC 616 – 121 afy; GWP 487 – 1,720 afy; SWC 1164 – 1,810 afy; and SWP 4416 – 217 afy). Subsequent to the issuance of the report of examination, GWP 487 and SWP 4416 were cancelled. Cancellation of these two permits reduced the annual volume of water available to the Stanwood Water Company by 1,937 afy. Due to these circumstances, the restriction on the annual volume identified in the report of examination for GWP 4111 is interpreted to no longer be limiting on this water right, since the total use under all of the water rights to supply the City remains less than the 6,285 afy volume that the provision had identified as the cumulative limit. This interpretation makes the annual volume under this water right additive to the remaining active water rights, as depicted in **Table 6-1** and **Appendix I**.

On January 14, 1958, GWC 2986 (from GWP 4111) was issued for withdrawal from the Sill Well of 600 gpm and 960 afy, after the proof of appropriation form was filed indicating that 600 gpm was

the extent of the beneficial use. On October 2, 2001, the City submitted a change application to move the point of withdrawal from the Sill Well to the Cedarhome Well, which is located in the SW ¼ NE ¼, Section 20, Township 32 North, Range 4 East, W.M. As was Ecology's policy at the time with municipal water rights that were not being fully utilized, an order of rescission was issued on February 2, 2002, which rescinded GWC 2986 and reinstated GWP 4111, in order to allow even unused portions of the water right to carry through the change application process. When the Cedarhome Well was originally drilled it was only tested at a rate of 500 gpm, even though the water right was for 600 gpm. Based on Ecology's concerns regarding the potential for seawater intrusion, Ecology issued a report of examination for change on September 30, 2002, that restricted the Cedarhome Well to a pump rate of 500 gpm until further testing proved that 600 gpm could be withdrawn without causing seawater intrusion.

In September 2010, the City performed a test using the installed production pump while pumping into the City's distribution system. During the 24-hour, 600-gpm test, water quality and water level measurements were periodically taken. A report was provided to Ecology and on December 3, 2010, a superseding permit was issued that allowed the full 600 gpm and 960 afy authorized under the permit to be withdrawn from the Cedarhome Well.

Groundwater Application G1-26964

Groundwater application G1-26964, with a priority date of February 29, 1993, requests 1,000 gpm for municipal supply from a well in the SW ¼ NE ¼, Section 20, Township 32 North, Range 4 East, W.M., which is the same legal description as the Cedarhome Well. The application was submitted before the well was drilled. The application was made prior to the decision to transfer the water right from the Sill Well to Cedarhome Well. This groundwater application remains active and pending in Ecology's queue, although the City does not plan to expedite the processing of this application.

All water rights held by the City and described above are for municipal water supply purposes as described under the Municipal Water Law. The place of use for each water right held by the City is the same as the service area defined in the most recent water system plan (WSP) (**Figure 2-3**) and can be updated and changed through subsequent plans.

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. **Table 6-2** compares the combined maximum instantaneous water right amounts of the sources with the maximum day demand of the system and the combined maximum annual water right amounts of the sources with the average day demand of the system. As shown in the table, the City has sufficient water rights (both instantaneous and annual amounts) to meet the demands of its existing customers.

Table 6-2
Existing Water Rights Evaluation

Description	Instantaneous Rights/ Maximum Day Demand (gpm)	Annual Rights/ Average Day Demand (acre-feet)	Annual Rights/ Average Day Demand (gpm)
Total Water Rights	3,872	5,291	3,279
Existing (2013) Water Demand	974	928	575
Surplus (or Deficient) Rights	2,898	4,363	2,704

Table 6-3 summarizes the results of the future water rights evaluation, which compares the water rights of the existing sources with the system's future 6-year, 10-year, and 20-year demand projections. The analysis considered future demand projections with and without water use reductions from the City's planned water use efficiency efforts, as shown in the table. The results of the future water rights evaluation indicate the City has sufficient water rights to meet the demands through the year 2035.

Table 6-3
Future Water Rights Evaluation

Description	Instantaneous Rights/ Maximum Day Demand (gpm)	Annual Rights/ Average Day Demand (acre-ft)	Annual Rights/ Average Day Demand (gpm)
Year 2021 (+6 years) Without Conservation			
Total Water Rights	3,872	5,291	3,279
Projected (2021) Water Demand	1,160	1,106	685
Surplus (or Deficient) Rights	2,712	4,185	2,594
Year 2025 (+10 years) Without Conservation			
Total Water Rights	3,872	5,291	3,279
Projected (2025) Water Demand	1,258	1,199	744
Surplus (or Deficient) Rights	2,614	4,092	2,535
Year 2035 (+20 years) Without Conservation			
Total Water Rights	3,872	5,291	3,279
Projected (2035) Water Demand	1,503	1,433	888
Surplus (or Deficient) Rights	2,369	3,858	2,391
Year 2021 (+6 years) With Conservation			
Total Water Rights	3,872	5,291	3,279
Projected (2021) Water Demand	1,145	1,091	677
Surplus (or Deficient) Rights	2,727	4,200	2,602
Year 2025 (+10 years) With Conservation			
Total Water Rights	3,872	5,291	3,279
Projected (2025) Water Demand	1,233	1,175	729
Surplus (or Deficient) Rights	2,639	4,116	2,550
Year 2035 (+20 years) With Conservation			
Total Water Rights	3,872	5,291	3,279
Projected (2035) Water Demand	1,446	1,378	854
Surplus (or Deficient) Rights	2,426	3,913	2,425

Water Rights Planning

Although the City has sufficient water rights to supply the water system through 2035, and likely beyond, water right transfers and facility improvements are necessary to fully utilize the existing water rights. In the short-term, the City has the following plans for improving water right utilization:

- Equip Bryant Well No. 3 and bring the well into production under GWC 615;
- Change water right GWC 616 (i.e., Fure Well) to include the Bryant and Cedarhome Wells as additional points of withdrawal; and
- Either upgrade the Hatt Slough Springs infrastructure or file a water right change on SWC 1164 (i.e., Hatt Slough Springs) and utilize the water right at a new well location.

Infrastructure improvements to replace Bryant Well No. 2 with Bryant Well No. 3, which will allow full utilization of GWC 615 are in progress. Bryant Well No. 3 is scheduled to be online in 2015.

In response to decreased production from the Fure Well, the City initiated discussions with Ecology and the Stillaguamish Tribe to include the Bryant Wells and the Cedarhome Well as additional points of withdrawal under GWC 616, which is currently associated only with the Fure Well. The proposed change will provide the City with the operational flexibility to physically withdraw water under the Fure water right from the other wells as demand dictates. Ecology has agreed to consider allowing the City to proceed with a pilot water right process that will allow the City to directly hire a consultant from Ecology's list of qualified cost reimbursement contractors to not only provide background information, but also to prepare the report of examination for change for Ecology to review. The City has initiated stakeholder outreach and plans to complete the water right transfer by the end of 2014.

The City has also examined options for increasing the diversion of water from Hatt Slough Springs under SWC 1164 to improve utilization of its existing water right and provide additional redundancy within the system. Infrastructure upgrades at the springs will not require any changes to the existing water right. Through its history, the access road to Hatt Slough Springs has been impassable on a number of occasions due to movement of soil from the adjacent slope onto the road. The ongoing maintenance requirement and possibility that the access road could become permanently blocked, combined with the potential vulnerability of the springs to contamination, has caused the City to consider other alternatives, which currently include transferring the water right to wells either in the Lower Stillaguamish Valley, or on the Tulalip Plateau to the south of the springs. A copy of the alternative analyses memo and other related documentation is included in **Appendix O**.

Water well reports for wells completed in the Lower Stillaguamish Valley suggest that there is a sand and gravel aquifer at a depth of less than 100 feet that could be tapped by one or several wells. Concerns associated with building infrastructure in the valley include the threat of flooding, volcanic lahars, and potential for water quality issues (related both to land use and saltwater intrusion). Advantages of this alternative is the proximity of the new wells to existing water mains and the depth of the aquifer. Water well reports for wells completed on the northern Tulalip Plateau suggest that there is a sand and gravel aquifer at a depth of approximately 300 feet that is the source of the water emanating from Hatt Slough Springs. A water right transfer to a well or well field tapping the aquifer that is the source of Hatt Slough Springs would be a fairly straightforward water right change. The primary concerns with this alternative is that there is a very high density of individual domestic wells tapping the same aquifer in the vicinity and introduction of a large-scale production

well in the aquifer could cause neighboring wells to have reduced water levels to the point that they would need to lower their pump intakes or drill their wells deeper. Also, land would have to be acquired and a 1.25-mile-long pipeline would be necessary to connect the new well to the existing City system. Transfer of an inchoate portion of a surface water right to another location is severely constrained by the water code. It is estimated that Ecology would limit the transfer to the physically available rate and volume discharging from the springs, which has been estimated at 505 gpm and 815 afy based on historic records. The City will evaluate these options and work with Ecology as necessary to ensure that any actions are consistent with state law. The detailed analyses regarding a valley well is also included in **Appendix O**.

The City will strive to use its existing water sources efficiently by continuing to support the water use efficiency measures outlined in the City's Water Use Efficiency Program, which is included in **Appendix F**. In addition, the City will accomplish the proposed improvements identified in **Chapter 9** to improve the utilization of its water right capacity and to provide additional redundancy for the existing supply sources. Although no plans have been finalized, the City will continue to consider future water supply interties.

LONG-TERM WATER SUPPLY PLANNING

The City's water system does not currently have any interties with other water systems and all water used by the City is from local groundwater and spring sources. The 1991 *North Snohomish County Coordinated Water System Plan* (CWSP) discussed possible connections with the City of Arlington (Arlington) and Tatoosh water systems, although the connections were not mentioned in the 2010 CWSP. Arlington currently has an intertie with the City of Marysville (Marysville) and the Snohomish County Public Utility District (PUD), and Marysville has an intertie with the City of Everett. The City is exploring opportunities to increase its source diversity.

Source diversity is important primarily because it will provide the City with source redundancy as well as options in the event of groundwater contamination or productivity decline. The City has historically experienced a decline in supply rates and an increase in water quality concerns at wells including the Fure Well and Bryant Well No. 2. To date, the City has successfully replaced lost capacity with other groundwater supply sources. However, source diversity provides the City with additional options in the event of future source of supply issues.

A review of water level information for Bryant Well No. 1 and the Fure Well does suggest that the aquifer water level has been declining over time as it adjusts to the City's withdrawals. Historic water depth measurements in Bryant Well No. 1 show that the water levels have declined by as much as 50 feet since the well field was made operational in the late 1940s, indicating that the aquifer tapped by this wellfield has not equilibrated to the pumping demands. The decline appears to be leveling off, but currently less than 40 percent of the water authorized to be withdrawn from the aquifer is pumped on an annual basis. Currently, the Bryant Well Field static water level is approximately 22 feet below sea level and has been below sea level since approximately 1966. While water quality has not diminished, there is a saltwater intrusion risk when the static water level is depressed below sea level in proximity to marine water.

The static water level elevation measured in the Cedarhome Well is less than 10 feet above sea level and the well taps an aquifer that is greater than 240 feet below sea level. While the water level in the well typically does recover above sea level between pumping events, the depth of the well, low static

water level elevation, and proximity to the shoreline suggest that it could also be susceptible to saltwater intrusion if over-pumped.

Currently, the City's sources do not show any signs of being compromised, but it is prudent for the City to consider supply alternatives to ensure supply redundancy and continuance in the future.

Feasibility of Obtaining New Water Rights

When considering supply redundancy, one option to investigate is the ability to obtain new water rights for municipal purposes. Water rights in Water Resources Inventory Area (WRIA) 5, which includes the City and surrounding areas, is managed by Chapter 173-505 Washington Administrative Code (WAC), Instream Resources Protection and Water Resources Program, Stillaguamish River Basin, which became effective on September 26, 2005. In this rule, Ecology created minimum instream flows for a number of streams, and also determined that no water is available for additional year-round appropriation from the streams and tributaries in WRIA 5. The findings severely limit where and if the City can obtain a new water right. For the City to obtain a new water right, the groundwater withdrawn would either not have an impact on any fresh surface water body, or a mitigation plan offsetting any impacts to the closed surface water bodies would be necessary.

Groundwater sources that may be subject to new appropriation, without the need for mitigation, are those sources where the withdrawal only intercepts groundwater destined to discharge directly to marine water. The most likely location for a well tapping this type of aquifer is on the west side of the Cedarhome Upland to the north of downtown, or on the west side of the Tulalip Plateau to the south of the Stillaguamish River.

A preliminary look at well logs in the Cedarhome Upland suggests that an aquifer does exist in this area below sea level and would be similar in nature to the aquifer tapped by the Cedarhome Well (i.e., fine sand). The static water level would be close to sea level (as it is in the Cedarhome Well), which is of concern due to the risk of saltwater intrusion into the aquifer with production level pumping, especially considering that this well would be closer to the shoreline. Conversely, the aquifer would be below sea level with a low static water level, which supports that pumping would not impact surface water bodies on the upland, such as Church Creek.

Beneath the northwestern Tulalip Plateau, the elevation of aquifer units and the static groundwater level is much higher than beneath the Cedarhome Upland. The higher static water level is beneficial in that it reduces the potential for saltwater intrusion into the aquifer. However, the configuration of the aquifers suggests that the aquifers might discharge as springs that are the headwaters of small streams as opposed to discharging directly to the marine water. Additional hydrogeologic study and consultation with Ecology and stakeholders would be needed before it could be determined if this area would be suitable for obtaining new water rights.

Given the forecast for excess water rights and the likely difficulty in obtaining new water rights in the Stillaguamish watershed, the City does not currently have any plans to pursue cost reimbursement processing of its pending new water right application (G1-26964), but instead will focus on expanding its ability to fully utilize its existing water rights.

Alternative Sources of Supply

To improve the City's supply redundancy and diversity, the City investigated alternative supply sources primarily related to connections with neighboring water systems. The City's current

infrastructure does not abut any water systems that obtain water from a non-local source of supply (i.e., Skagit PUD's Judy Reservoir System or the City of Everett Spada Lake). The closest nearby systems are dependent on local groundwater for their sources of supply. To provide the most water supply security, it would benefit the City to connect, either directly or indirectly, to a larger, regional source of supply.

Each potential neighboring water system was examined to determine if the systems have excess water rights for potential City use. If the system appears to have excess water rights, preliminary planning-level pipeline alignments are proposed along with the identification of potential planning, capital, and operational partners for each project.

Sources of Water

The water held or available to nearby water systems is discussed with a focus on excess water that could potentially be available to the City if the systems were connected.

City of Arlington Water Sources

Arlington is located to the southeast of the City's service area. Arlington currently has two well fields (i.e., Airport and Haller) with associated water rights GWC 5170, G1-24900C, SWC 194, G1-300889CL(A), and GWC 5169, plus an intertie with Snohomish PUD and the City of Marysville which are interpreted in its 2010 WSP to allow for a combined supply of up to 5,663 gpm and 5,628.19 afy. Water use efficiency reports from 2007 through 2012 show that the peak annual source production by Arlington was 1,601 afy in 2007. Arlington has an excess of 4,027.19 afy as compared with current demand. In Arlington's 2010 WSP it identifies that with conservation there will be a deficit of 818 gpm in the year 2058 and will only be 280 afy excess supply at that time. Since Arlington is connected to the regional system, where additional water may be available to meet future needs, and since it was identified in the CWSP, connection to this system will be explored in more detail in this chapter.

City of Marysville Water Sources

Marysville is located southeast of the City's service area. Marysville obtains water under its own water rights from Edward Springs and associated wells under water rights SWC 184, SWC 2180, GWC 286, GWC 1152, GWC 2096, and G1-25182P, from a Ranney well near the Stillaguamish River under G1-00675C, a well near Lake Goodwin under GWC 6890, a well field in the Sunnyside area under GWC 3100 and GWC 5469, a well near Highway 9 under G1-23487C, and a well referred to as the Cedar-crest LaJoy well under GWC 4155. The portion of the water rights available for municipal supply are interpreted by RH2 Engineering, Inc., (RH2) to add up to 8,248 gpm and 8,363.7 afy. In addition, Marysville partnered in construction of a 30-inch transmission main that delivers water from the City of Everett's system to Marysville, the Tulalip Tribes, and the Snohomish PUD. According to Marysville's 2009 WSP, Marysville obtains 13.15 million gallons per day (mgd) from the transmission main, which is equivalent to 9,132 gpm and 14,741 afy. Considering all combined sources, Marysville has a total available supply of 23,104.7 afy available. In 2007, Marysville used approximately 6,910 afy. In 2027, the forecasted demand is 18,569 afy. Thus, Marysville is expected to have an excess of 4,535.7 afy as compared to future demand estimates. Connection to this system will be explored in more detail in this chapter.

Seven Lakes Water Association Water Sources

Seven Lakes Water Association (Seven Lakes) is located to the south of the City's service area. Seven Lakes currently has six wells with associated water rights GWC 6997, G1-23373C, G1-23417C, G1-23805C, G1-24066C, G1-25311C, and G1-21526C, which are interpreted to allow for withdrawal of up to 572.6 afy. The water system currently serves 2,223 connections and its approved number of connections is unspecified. Water use efficiency reports from 2010 through 2012 show that the peak production by Seven Lakes was 474 afy. Thus, Seven Lakes has an excess of approximately 98.6 afy as compared with current demand, but the excess will likely be needed to meet future demands within the system's service area. Seven Lakes was previously intertied with Marysville, which is intertied with the City of Everett, but that intertie with Marysville was identified as inactive as of August 2011. Connection to this system will not be explored in more detail at this time due to the limited available excess water rights and lack of connection to the regional system.

Skagit PUD Water Sources

The Skagit PUD's Judy Reservoir system serves much of western Skagit County. The water system captures water from streams flowing off of Cultus Mountain (i.e., Mundt, Turner, Salmon, and Gilligan Creeks) and also pumps directly from the Skagit River. Skagit PUD's General Manager indicated that Skagit PUD is able to serve water outside of Skagit County, but that the Skagit PUD Board of Commissioners would need to vote to approve the connection before it could be allowed. According to the Skagit PUD's 2007 WSP update, Skagit PUD holds 18,755 afy of water rights for the Judy Reservoir system. Peak annual usage for the Judy Reservoir system from 2007 through 2012 was 9,392 afy. Thus, currently only half of the water right is utilized. According to the 2007 WSP, the 2027 forecasted water demand is 12,652 afy, which equates to an excess of 6,103 afy before the water right limit is reached. Connection to this system will be explored in more detail in this chapter.

Snohomish PUD Water Sources

The closest water systems to the City that are operated by Snohomish PUD are the Sunday Lake and Kayak water systems.

The Sunday Lake water system has one well with associated water rights GWC 7295 and G1-27418C that allow for a total withdrawal of 130 gpm and 100.5 afy. The Sunday Lake water system currently serves 156 connections and is authorized to serve up to 278 connections. Water use efficiency reports from 2008 through 2012 indicate that the peak annual withdrawal from the well was in 2009 when 34.4 afy was withdrawn, which is a per connection use of 0.22 afy. Based on this calculation, approximately 66.1 afy is not currently used. If the system grows to the authorized 278 connection, only 39.2 afy will be available under the water right limit.

The Kayak water system has two wells with associated water rights G1-23278C, G1-24415C, and G1-25989C that allow for a total withdrawal of 300 gpm and 156 afy. The Kayak water system which has a per connection use of 0.30 afy. Based on this calculation, approximately 44.1 afy is not currently used. If the system grows to the allowed 481 connection, only 9.3 afy will be available under the water right limit.

Connection to either of the Snohomish PUD systems will not be explored in more detail at this time due to the limited available excess water rights and lack of connection to the regional system.

Tatoosh Water Company Water Sources

The Tatoosh Water Company (Tatoosh) is a private water company that operates a water system serving land in both Snohomish and Skagit Counties. Tatoosh holds certificated water rights G1-00114C and G1-00115C that are interpreted by RH2 to allow for 1,550 gpm and 1,135 afy to be withdrawn from two wells located just south of Lake McMurray. These water rights were issued for a planned, 1,200 home, high-density residential/recreational development with a golf course. The wells, mainline, booster pump station, and reservoir (1.05-million gallon) were sized and constructed to serve this larger planned development and are underutilized based on the existing demand of 116 connections. Source metering data from 2000 through 2011 show the largest annual volume withdrawn from the wells occurred in 2007 when 112 afy was pumped. Distribution system leakage information obtained from DOH water use efficiency annual performance reports suggests that approximately half of the water withdrawn from the wells is lost before it reaches customers. In a 2013 feasibility study prepared for Ecology, RH2 estimated that if 2.5 times the existing use is reserved for future customers within the existing service area, the system will have excess water rights over 740 afy available for use outside of Tatoosh. Connection to this system will be explored in more detail in this chapter.

Tulalip Tribes Water Sources

The Tulalip Tribes are successors in interest to the Snohomish, Snoqualmie, Skykomish, and other allied tribes, and bands signatory to the 1855 Treaty of Point Elliot. The Tulalip Tribes operate a number of water systems serving land within the exterior boundaries of the Tulalip Reservation, in Snohomish County. The Tulalip Tribes has recently entered into a contract with the City of Everett to have access to a peak of 36 mgd (25,000 gpm) and 30 mgd annually (33,604 afy) from a new 48-inch pipeline running from Everett to the Tulalip Reservation. While the Tulalip Tribes have secured this water, in a July 2014 meeting with the City, the tribe expressed a willingness to consider partnering on expansion of the water system to the north, beyond the boundaries of the reservation. Connection to this system will be explored in more detail in this chapter.

Warm Beach Conference Grounds Water Sources

The Warm Beach Conference Grounds water system has four wells with associated water rights GWC 5108, G1-21305C, and G1-23659C that allow for a total withdrawal of 410 gpm and 156.4 afy of groundwater. The water system currently serves 551 connections and is authorized to serve that same number. Water use efficiency reports from 2010 through 2012 indicate that the peak annual withdrawal from the wells was 93.9 afy in 2011, which is a per connection use of 0.17 afy. Based on this calculation, approximately 62.5 afy is not currently used. Connection to this system will not be explored in more detail at this time due to the limited available excess water rights and lack of connection to the regional system.

Warm Beach Water Association Water Sources

The Warm Beach Water Association water system has three wells with associated water rights G1-00718C, G1-24266C, G1-24690C, and G1-25868P that allow for a total withdrawal of 318 gpm and 135 afy of groundwater. The water system also holds surface water rights from Lake Martha, but those are no longer used for potable supply. The water system currently serves 580 connections and is authorized to serve up to 785 connections. A water use efficiency report from 2010 indicates that the annual withdrawal from the wells was 85.9 afy, which is a per connection use of 0.15 afy. Based

on this calculation, approximately 49.1 afy is not currently used. If the system grows to the allowed 785 connections, only 17.2 afy will be available under the water right limit. Connection to this system will not be explored in more detail at this time due to the limited available excess water rights and lack of connection to the regional system.

Wilderness Ridge Water Association Water Sources

The Wilderness Ridge Water Association water system has two wells with associated water rights GWC 6709, G1-22415C, and G1-25596P that allow for a total withdrawal of 615 gpm and 150 afy of groundwater. The water system currently serves 284 connections and is authorized to serve up to 600 connections. Water use efficiency reports from 2010 through 2013 indicate that the peak annual withdrawal from the wells was in 2013 and was 49.6 afy, which is a per connection use of 0.18 afy. Based on this calculation, approximately 100.4 afy is not currently used. If the systems grows to the allowed 600 connections, only 42 afy will be available under the water right limit. Connection to this system will not be explored in more detail at this time due to the limited available excess water rights and lack of connection to the regional system.

Water Source Conclusions

Of the ten neighboring water systems examined, the Skagit PUD, Tatoosh, Marysville, Arlington, and Tulalip Tribes are the five systems that either hold sufficient excess water rights or have access to larger purveyors that could potentially supply additional wheeled water to the City. Potential pipeline alignments from each system and potential partners for each pipeline alignment are discussed in the following sections.

Alternatives

Six alternatives are identified for the City's water supply planning consideration. **Figure 6-1** shows the proposed pipeline alignment for each alternative and **Table 6-4** provides for a tabular comparison of each alternative.

Alternative 1 - Skagit PUD to City

Background

The City met with officials from Skagit PUD in late 2012 and discussed the possibility of the PUD delivering water to the City. The General Manager indicated that Skagit PUD is able to serve water outside of Skagit County, but that the Skagit PUD Board of Commissioners would need to vote to approve the connection before it could be allowed. If the City decides to pursue this alternative, the City should first request a decision by the Board of Commissioners as to whether they would allow water service outside of Skagit County.

Possible Route

The closest existing Skagit PUD water main is located in the vicinity of the community of Conway near Interstate 5 (I-5). From Conway, a proposed planning-level water main alignment would run generally south along Pioneer Highway and connect into the City's system just south of Douglas Creek. The pipeline may also be able to connect to the City's water system on Old Pacific Highway, although the City's existing water main is small in diameter. The Alternative 1 pipeline is approximately 6.7 miles in length (**Figure 6-1**). The City's future service area extends to the

Skagit/Snohomish county line and this pipeline would allow service to be provided to this portion of the water service area, which abuts 3.3 miles of the pipe alignment. The land use along Pioneer Highway is zoned by Snohomish County as Riverway Commercial Farmland and Local Commercial Farmland. After reaching the City's Urban Growth Area (UGA), the land use changes to Low Density Residential and Neighborhood Business. The intertie location could be at the county line, where the Skagit PUD and City service areas meet.

Partners

Potential partners in this project would be Skagit PUD and the City.

Alternative 2 - Tatoosh to City w*ith Fisher/Carpenter* Subbasin *Benefit*

Background

Tatoosh's excess water rights have been of interest to other parties in Snohomish County due to the system's location and the potential ability for it to serve piped water to the Fisher/Carpenter and Nookachamps Subbasins in the Skagit Watershed (WRIA 3). In a study commissioned by Ecology, RH2 provided cost estimates for extending Tatoosh water service to both the north and west. Multiple alternatives were presented, including a mainline extension between Tatoosh and the Wilderness Ridge Water Association, which is located just north of the City's future service area. Ecology is interested in an extension as a means to not only provide potable water to vacant lot owners, but also as a potential source of mitigation water that could be released into the many tributaries of Fisher Creek that the pipeline alignment would cross.

Route

The anticipated connection to the Tatoosh water system would be at the 14-inch-diameter asbestos cement (AC) pipe terminating on 316th Street NW, approximately 860 feet east of the intersection with 12th Avenue NW. From the pipe location, a proposed planning-level water main alignment would extend west on 316th Street NW, northwest on English Grade Road, west on 324th Street NW, south on 44th Avenue NW where it will cross I-5 at the existing underpass, northwest on Old 99 N, west on 324th Street NW, and south on 68th Avenue NW until it intersects the City's 12-inch main at the existing City limits. The total length of the Alternative 2 water main alignment is approximately 6.5 miles (**Figure 6-1**). The City's future service area extends to 308th Street NW and this pipeline alignment would allow service to be provided to this portion of the area along 68th Avenue NW (abuts 1.1 mile of the pipe alignment). The zoning within this portion of the future service area is Local Commercial Farmland.

Partners

Potential partners for Alternative 2 are Tatoosh, Snohomish PUD, Ecology, and the City.

Tatoosh does not have a current WSP and in order to qualify as an expanding system it will need a DOH-approved WSP. Based on water use efficiency reporting, Tatoosh would benefit from instituting an aggressive leak detection and correction program in order to reduce distribution system leakage. Tatoosh's participation in a regional water supply plan may be contingent on obtaining financial assistance for necessary planning and infrastructure upgrades to the existing system. Expanding Tatoosh's customer base will allow the system to have a larger rate-base to help spread the cost of future water system repairs and upgrades.

The CWSP identified the area between the existing Tatoosh service areas and the City as a part of the Snohomish PUD Remote Area. Snohomish PUD could be approached to determine its interest in owning and operating the pipeline within this remote area and providing water service to interested parties with Tatoosh water.

Ecology has been exploring ways of delivering piped water to rural areas within the Carpenter/Fisher Subbasin located in northern Snohomish County and southern Skagit County near the I-5 corridor since that area was closed to new permit-exempt well development under the 2006 revision to WAC 173-503. Even with the Washington State Supreme Court reinstatement of the original 2001 version of WAC 173-503, Ecology has remained interested in mitigation opportunities in this subbasin and the Washington State Legislature has provided money in the capital budget to fund this type of project. In a 2013 feasibility report, RH2 provided planning-level cost estimates for running pipe from Tatoosh west toward I-5 and across to tie into the Wilderness Ridge Water Association, which is adjacent to the City's future service area. If a water main was constructed from Tatoosh to the City, Ecology will be interested in the ability of a purveyor to use this pipeline to directly serve vacant lots near the pipeline alignment and as a source of streamflow augmentation water that could be released into the many tributaries of Fisher Creek along the pipeline alignment to mitigate for the impact of new permit-exempt wells in areas downstream that are too distant to be served piped water.

Alternative 3 - Tatoosh to City without Fisher/Carpenter Benefit

Background

The Alternative 2 pipeline alignment discussed previously is not the shortest route between the Tatoosh and City systems. A more direct route would be at least 1 mile shorter. However, this alignment does not run through the Carpenter/Fisher Subbasin and, therefore, Ecology would not be a potential partner for the Alterative 3 pipeline.

Route

The anticipated connection to the Tatoosh water system would be the 14-inch-diameter AC pipe on 316th Street NW, approximately a quarter mile east of 12th Avenue NW. From the pipe location, a proposed planning-level water main alignment would follow an existing smaller diameter pipeline alignment heading generally south to 300th Street NW, west on 300th Street NW across the I-5 overpass, northwest on Old 99 N, west on 300th Street NW, south on 68th Avenue NW until it intersects the City's 12-inch main at the City limits. The total length the Alternative 3 water main alignment is approximately 5.4 miles (**Figure 6-1**). The City's future service area extends to 308th Street NW in the north and 44th Avenue NW in the east and this pipeline alignment would allow service to be provided to the water service area along 300th Street NW and 68th Avenue NW, which abuts 2.1 miles of the pipe alignment. The zoning within this portion of the future service area includes both Rural Residential-5 and Local Commercial Farmland.

Partners

Potential partners in this project would be Tatoosh and Snohomish PUD for the area between the two service areas, and the City as described in Alternative 2. Ecology, as described in Alternative 2, would not be a potential partner for Alternative 3.

Alternative 4 - City of Marysville to City

Background

Marysville is well connected to the regional water system through interties with the Arlington, City of Everett, and Snohomish PUD Integrated System. Based on the City's 2009 WSP, an excess supply of 4,631 afy is forescast for 2028 when considering all of its water rights plus the water from the Joint Operating Agreement with the City of Everett and others.

Route

The closest existing Marysville mainline is located in the vicinity of Edward Springs. From Edward Springs, the planning-level pipeline alignment would generally extend west along Highway 531, then northwest on Frank Waters Road, then north on Marine Drive to where the water from Hatt Slough Springs enters the City's system. The total length of the Alternative 4 pipeline alignment is approximately 7.7 miles (**Figure 6-1**). If Seven Lakes has sufficient pipeline capacity along Highway 531, the length of pipe needed could be reduced. This pipeline alignment would allow the City to provide service to any of its future water service area along Marine Drive, which abuts 0.5 miles of the pipe alignment. However, the land use along Marine Drive is zoned by Snohomish County as Riverway Commercial Farmland and it is unlikely that there will be large demand for City water in this portion of the service area.

This pipeline route would also facilitate the future transfer of the City's Hatt Slough Springs water right from the spring source to a well or well field located on the northwestern Tulalip Plateau. The well or wells could then be tied into this pipeline to serve the City if abandonment of the Hatt Slough Springs source is pursued.

Partners

Potential partners in this project would be Marysville, Seven Lakes, Warm Beach Conference Grounds, Snohomish PUD for its declared Lake Goodwin service area and the area that is not currently within a declared future service area, and the City.

Alternative 5 - City of Arlington to City

Background

Arlington is well connected to the regional water system through interties with the Marysville and Snohomish PUD Integrated System. Based on the City's 2010 WSP, an excess supply of 1,727 afy is forecasted for 2028 when considering all of Marysville's water rights plus the wholesale agreement with Snohomish PUD. However, in 2058, Arlington forecasts a deficiency in instantaneous water rights and a surplus of 280 afy in annual water rights. However, access to the regional system might allow for additional water to be purchased through the interties and wheeled to the City. The community of Silvana, which lies between the two cities, is currently served by the Silvana Water Association from a spring source, but the system currently has a blue operating permit and cannot add additional connections.

Route

The closest existing Arlington mainline is located in the vicinity of the Highway 530 interchange with I-5. The potential planning-level pipeline alignment would extend west along Highway 530

(Pioneer Highway E), through the community of Silvana, then generally west on Norman Road as it winds through the Stillaguamish Valley until reaching the City mainline at Marine Drive. The total length of the Alternative 5 pipeline alignment would be approximately 8.5 miles (**Figure 6-1**). The City's future service area extends to 44th Avenue NW in the east and this pipeline alignment would allow service to be provided to this portion of the area along Norman Road (abuts 2.3 mile of the pipe alignment). However, the land use along Norman Road is zoned by Snohomish County as Riverway Commercial Farmland and it is unlikely that there will be large demand for City water in this portion of the service area.

Partners

Potential partners in this project would be Arlington, Silvana Water Association, Snohomish PUD for the area that is not currently within a declared future service area, and the City.

Alternative 6 – Tulalip Tribes to City

Background

The City met with representatives from the Tulalip Tribes in July 2014 and discussed the possibility of the Tulalip Tribes delivering water to the City. The representatives expressed a willingness to consider including the City as a partner on its new water connection with the City of Everett.

Possible Route

The terminus of the Tulalip Tribes new 48-inch main is located near the intersection of Quil Ceda Way and 27th Avenue NE, west of Interstate 5 (I-5). From there, a proposed planning-level water main alignment to serve the City would generally extend north along 27th Avenue, west on 116th Street NE, north at approximately 26th Avenue NE, west on 128th Street NE, north on 19th Avenue NE, east on 140th Street NE, north on 23rd Avenue NE, northwest on Forty Five Road, generally west along Highway 531, then northwest on Frank Waters Road, then north on Marine Drive to where the water from Hatt Slough Springs enters the City's system. The Alternative 6 pipeline is approximately 14.6 miles in length and approximately half of the alignment is shown on **Figure 6-1**. If Seven Lakes has sufficient pipeline capacity along Highway 531, the length of pipe needed could be reduced. This pipeline alignment would allow the City to provide service to any of its future water service area along Marine Drive, which abuts 0.5 miles of the pipe alignment. However, the land use along Marine Drive is zoned by Snohomish County as Riverway Commercial Farmland and it is unlikely that there will be large demand for City water in this portion of the service area.

This pipeline route would also facilitate the future transfer of the City's Hatt Slough Springs water right from the spring source to a well or well field located on the northwestern Tulalip Plateau. The well or wells could then be tied into this pipeline to serve the City if abandonment of the Hatt Slough Springs source is pursued.

Partners

Potential partners in this project would be Tulalip Tribes, Seven Lakes Water Association, Snohomish PUD, and the City.

Table 6-4 summarizes the potential alternative sources of supply.

Table 6-4
Potential Alternative Sources of Supply

Consideration	Alternative 1 Skagit PUD to City	Alternative 2 Tatoosh to City with Fisher/Carpenter Benefit	Alternative 3 Tatoosh to City without Fisher/Carpenter Benefit	Alternative 4 City of Marysville to City	Alternative 5 City of Arlington to City	Alternative 6 Tulalip Tribes to City
Intertie With	Skagit PUD	Tatoosh Water Company	Tatoosh Water Company	City of Marysville	City of Arlington	Tulalip Tribes
Forecast Excess Water Rights (afy)	6,103	740	740	4,535.7	280.0	TBD (E)
Year of Forecast	2027 (A)	Estimated (B)	Estimated (B)	2028 (C)	2058 (D)	TBD (E)
Approximate Total Pipeline Distance (miles)	6.7	6.5	5.4	7.7 (F)	8.5	14.6 (F)
Booster Pump Station(s) Needed	Yes	No	No	Yes	Yes	Yes
Pipeline Distance within Future Service Area (miles)	3.3	1.1	2.1	0.5	2.3	0.5
Zoning Adjacent to new pipeline witin Future Service Area (miles)	Riverway Commercial Farmland, Local Commercial Farmland, Low Density Residential, and Neighborhood Business	Local Commercial Farmland	Rural Residential-5 and Local Commercial Farmland	Riverway Commercial Farmland	Riverway Commercial Farmland	Riverway Commercial Farmland
Potential Partners with the City	Skagit PUD	Tatoosh, Snohomish PUD, Ecology	Tatoosh, Snohomish PUD	Marysville, Snohomish PUD, Seven Lakes Water Association	Arlington, Snohomish PUD, Silvana Water Association	Tulalip Tribes, Snohomish PUD, Seven Lakes Water Association
Possible to Wheel Water from Regional Everett System	No	No	No	Yes	Yes	Yes

(A) - 2007 Water System Plan (Skagit PUD, 2008)
(B) - Feasiblity Resport, Water System Evaluation Carpenter-Fisher, Upper Nookachamps, and East Nookachamps Subbasins (RH2, 2013)
(C) - City of Marysville Water Comprehensive Plan (HDR, 2009) combined with additional water right analysis
(D) - City of Arlington Comprehensive Water System Plan (RH2, 2010)
(E) - Excess water that could be made available would need to be determined through future negotiations.
(F) - Less if Seven Lakes Water Association pipe can be used across a portion of its service area

Alternative Source of Supply Conclusions

The City is currently fully dependent on local groundwater and spring sources. Declining groundwater levels over time and difficulty in accessing and maintaining Hatt Slough Springs suggests that seeking an intertie with a larger system that has different sources of supply is a potentially beneficial long-term strategy for the City. However, due to the City's location, there are currently no large water systems that have infrastructure directly adjacent to the City's water system allowing for an intertie. Each of the six alternatives identified involve installation of at least 5 miles of transmission main, which will be a substantial investment for a system the size of the City's.

Each of the alternatives does have the potential for multiple partners, which might help defray some of the transmission main capital costs. The City plans to continue or begin discussions with the identified potential partners. The discussion will determine if the other systems are interested in contracting to provide water to the City. Other next steps include identifying fatal flaws, preparing planning-level cost estimates, formulating an ownership and operation model for new pipelines, determining the optimal alternative, and developing a capital improvement plan to fund the design

and construction of the transmission main. **Chapter 9** includes additional feasibility studies associated with further alternative investigation.

DRINKING WATER REGULATIONS

Overview

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, the DOH is the agency responsible for implementing and enforcing the drinking water regulations. For the State of Washington to maintain primacy (delegated authority to implement requirements) under the SDWA, the state must adopt drinking water regulations that are at least as stringent as the federal regulations. In meeting these requirements, the DOH has published drinking water regulations that are contained in Chapter 246-290 WAC.

Existing Regulations

The Federal SDWA was enacted in 1974, as a result of public concern about water quality. The SDWA sets standards for the quality of drinking water and requires water treatment, if these standards are not met. The SDWA also sets water testing schedules and methods that water systems must follow. In 1986, the SDWA was amended as a result of additional public concern and frequent contamination of groundwater from industrial solvents and pesticides. The 1986 Amendments require water systems to monitor and treat for a continuously increasing number of water contaminants identified in the new federal regulations. EPA regulated approximately 20 contaminants between 1974 and 1986. The 1986 Amendments identified 83 contaminants that EPA was required to regulate by 1989. Implementation of the new regulations has been marginally successful due to the complexity of the regulations and the associated high costs. To rectify the slow implementation of the new regulations, the SDWA was amended again and re-authorized in August of 1996.

In response to the 1986 SDWA Amendments, EPA established six rules, known as the Phase I Rule, Phase II and IIb Rules, Phase V Rule, Surface Water Treatment Rule (SWTR), Total Coliform Rule, and Lead and Copper Rule. The EPA regulates most chemical contaminants through the Phase I, II, IIb, and V Rules. The City's active sources are affected by many of these rules.

The EPA set two limits for each contaminant that is regulated under the rules. The first limit is a health goal, referred to as the Maximum Contaminant Level Goal (MCLG). The MCLG is zero for many contaminants, especially known cancer-causing agents (carcinogens). The second limit is a legal limit, referred to as the Maximum Contaminant Level (MCL). The MCLs are equal to or higher than the MCLGs; however, most MCLs and MCLGs are the same, except for contaminants that are regulated as carcinogens. The health goals (MCLGs) for carcinogens are typically zero, because they cause cancer and it is assumed that any amount of exposure may pose some risk of cancer. A summary of each rule follows.

To fully understand the discussion that follows, a brief definition of several key terms is provided below.

- Organic Chemicals – Animal or plant produced substances containing carbon and other elements such as hydrogen and oxygen.
- Synthetic Organic Chemicals (SOCs) – Man-made organic substances including herbicides, pesticides, and various industrial chemicals and solvents.
- Volatile Organic Chemicals (VOCs) – Chemicals, as liquids, that evaporate easily into the air.
- Inorganic Chemicals (IOCs) – Chemicals of mineral origin that are naturally occurring elements. These include metals such as lead and cadmium.

Phase I Rule

The Phase I Rule, which was the EPA's first response to the 1986 amendments, was published in the Federal Register on July 8, 1987, and became effective on January 9, 1989. This rule provided limits for eight VOCs that may be present in drinking water. VOCs are used by industries in the manufacturing of rubber, pesticides, deodorants, solvents, plastics and other chemicals. VOCs are found in everyday items such as gasoline, paints, thinners, lighter fluid, mothballs and glue, and are typically encountered at dry cleaners, automotive service stations and elsewhere in industrial processes. The City currently complies with all contaminant monitoring requirements under this rule.

Phase II and IIb Rules

The Phase II and IIb Rules were published in the Federal Register on January 30, 1991, and July 1, 1991, and became effective on July 30, 1992, and January 1, 1993, respectively. These rules updated and created limits for 38 contaminants (organics and inorganics), of which 27 were newly regulated. Some of the contaminants are frequently applied agricultural chemicals (nitrate), while others are more obscure industrial chemicals. The City currently complies with all contaminant monitoring requirements under this rule.

Phase V Rule

The Phase V Rule was published in the Federal Register on July 17, 1992, and became effective on January 17, 1994. This rule set standards for 23 additional contaminants, of which 18 are organic chemicals (mostly pesticides and herbicides) and 5 are IOCs (such as cyanide). The City currently complies with all contaminant monitoring requirements under this rule.

Surface Water Treatment Rule

The SWTR was published in the Federal Register on June 29, 1989, and became effective on December 31, 1990. Surface water sources, such as rivers, lakes, and reservoirs (which are open to the atmosphere and subject to surface runoff), and GWI sources are governed by this rule. The SWTR seeks to prevent waterborne diseases caused by the microbes *Cryptosporidium, Legionella* and *Giardia lamblia*, which are present in most surface waters. The rule requires disinfection of all surface water sources and GWI sources. All surface water sources and GWI sources must also be filtered, unless a filtration waiver is granted. A filtration waiver may be granted to systems with pristine sources that continuously meet stringent source water quality and protection requirements. The City does not currently have any sources that are classified as surface water or GWI; therefore, this rule does not currently affect the City.

Interim Enhanced Surface Water Treatment Rule

The EPA proposed the Interim Enhanced Surface Water Treatment Rule (IESWTR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became effective on February 16, 1999, concurrent with the Stage 1 Disinfectants/Disinfection By-products Rule. The rule primarily applies to public water systems that serve 10,000 or more people and use surface water or GWI sources. The rule also requires primacy agencies (i.e., DOH in Washington State) to conduct sanitary surveys of all surface water and GWI systems, regardless of size. The rule is the first to directly regulate the protozoan Cryptosporidium and has set the MCLG for Cryptosporidium at zero. Water systems affected by this rule needed to comply with it by December 16, 2001. The City does not currently have any sources that are classified as surface water or GWI; therefore, this rule does not currently affect the City.

Long Term 1 Enhanced Surface Water Treatment Rule

This is the follow-up rule to the IESWTR and became effective in December of 1998. The final Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was published on January 14, 2002, and became effective February 13, 2002. The rule addresses water systems using surface water or GWI sources serving fewer than 10,000 people. The rule extends protections against Cryptosporidium for smaller water systems. The City does not currently have any sources that are classified as surface water or GWI; therefore, this rule does not currently affect the City.

Total Coliform Rule

The Total Coliform Rule was published in the Federal Register on June 29, 1989, and became effective on December 31, 1990. The rule set both health goals (MCLGs) and legal limits (MCLs) for total coliform levels in drinking water, and the type and frequency of testing that is required for water systems. The rule requires more monitoring than prior requirements, especially for small systems. In addition, every public water system is required to develop a coliform monitoring plan, subject to approval by DOH.

Coliform is a group of bacteria, some of which live in the digestive tract of humans and many animals, and are excreted in large numbers with feces. Coliform can be found in sewage, soils, surface waters and vegetation. The presence of any coliform in drinking water indicates a potential health risk and potential waterborne disease outbreak, which may include gastroenteric infections, dysentery, hepatitis, typhoid fever, cholera and other infectious diseases.

The rule established the health goal for total coliform at zero. To comply with the legal limit, systems may not find coliform in more than 5 percent of the samples taken each month. For systems like the City that must take ten samples per month (eight in July and August), one sample that contains coliform would exceed the legal limit and trigger the follow-up sampling requirements. A copy of the City's Water Quality Monitoring Plan, including the coliform monitoring program, is contained in **Appendix J**.

Lead and Copper Rule

The Lead and Copper Rule was published in the Federal Register on June 7, 1991, and became effective on December 7, 1992. On January 12, 2000, the EPA published minor revisions to the rule in the Federal Register, which primarily improved the implementation of the rule. On June 29, 2004, additional minor revisions and clarifications on several requirements of the Lead and Copper Rule

were published by the EPA. The rule identifies action levels for both lead and copper. An action level is different than an MCL. An MCL is a legal limit for a contaminant, and an action level is a trigger for additional prevention or removal steps. The action level for lead is greater than 0.015 milligrams per liter (mg/L). The action level for copper is greater than 1.3 mg/L. If the 90th percentile concentration of either lead or copper from the group of samples exceeds these action levels, a corrosion control study must be undertaken to evaluate strategies and make recommendations for reducing the lead or copper concentration below the action levels. The rule requires systems that exceed the lead level to educate the affected public about reducing its lead intake. Systems that continue to exceed the lead action level after implementing corrosion control and source water treatment may be required to replace piping in the system that contains lead sources. Corrosion control is typically accomplished by increasing the pH of the water to make it less corrosive, which reduces its ability to break down water pipes and absorb lead or copper.

Lead is a common metal found throughout the environment in lead-based paint, air, soil, household dust, food, certain types of pottery, porcelain, pewter, brass and water. Lead can pose a significant health risk if too much of it enters the body. Lead builds up in the body over many years and can cause damage to the brain, red blood cells and kidneys. The greatest risk is to young children and pregnant women. Lead can slow normal mental and physical development of growing bodies.

Copper is a common, natural and useful metal found in our environment. It is also a trace element needed in most human diets. The primary impact of elevated copper levels in water systems is stained plumbing fixtures. At certain levels (well above the action levels), copper may cause nausea, vomiting, and diarrhea. It can also lead to serious health problems in people with Wilson's disease. Long-term exposure to elevated levels of copper in drinking water could also increase the risk of liver and kidney damage. The City currently complies with all contaminant monitoring and treatment requirements under this rule.

Radionuclides Rule

The EPA established interim drinking water regulations for radionuclides in 1976 under the SDWA. MCLs were established for alpha, beta and photon emitters, and radium 226/228. Radionuclides are elements that undergo a process of natural decay and emit radiation in the form of alpha or beta particles and gamma photons. The radiation can cause various kinds of cancers, depending on the type of radionuclide exposure from drinking water. The regulations address both man-made and naturally occurring radionuclides in drinking water.

The 1986 amendments to the SDWA finalized the regulations for radionuclides by eliminating the term "interim." The amendments also directed the EPA to promulgate health-based MCLGs, as well as MCLs. The EPA failed to meet the statutory schedules for promulgating the radionuclide regulations, which resulted in a lawsuit. In 1991, the EPA proposed revisions to the regulations but a final regulation based on the proposal was never promulgated. The 1996 amendments to the SDWA directed the EPA to revise a portion of the earlier proposed revisions, adopt a schedule, and review and revise the regulations every six years, as appropriate, to maintain or improve public health protection. Subsequent to the 1996 amendments, a 1996 court order required the EPA to either finalize the 1991 proposal for radionuclides or to ratify the existing standards by November 2000.

The final rule was published in the Federal Register on December 7, 2000, and became effective on December 8, 2003. The rule established an MCLG of zero for the four regulated contaminates and MCLs of 5 pCi/L for combined radium-226 and radium-228, 15 pCi/L for gross alpha (excluding

radon and uranium), 4 mrem/year for beta particle and photon radioactivity and 30 ug/L for uranium. The City currently complies with all contaminant monitoring requirements under this rule.

Wellhead Protection Program

Section 1428 of the 1986 SDWA amendments mandates that each state develop a wellhead protection program. The Washington State mandate for wellhead protection and the required elements of a wellhead protection program are contained in WAC 246-290-135, Source Protection, which became effective in July of 1994. In Washington State, DOH is the lead agency for the development and administration of the State's wellhead protection program.

A wellhead protection program is a proactive and ongoing effort of a water purveyor to protect the health of its customers by preventing contamination of the groundwater that it supplies for drinking water. All federally defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection program. All required elements of a local wellhead protection program must be documented and included in either the Comprehensive Water System Plan (applicable to the City) or a Small Water System Management Program document (not applicable to the City). A copy of the City's Wellhead Protection Program is contained in **Appendix K**.

Consumer Confidence Report

The final rule for the Consumer Confidence Report (CCR) was published in the Federal Register on August 19, 1998 and became effective on September 18, 1998. Minor revisions were posted in the Federal Register on May 4, 2000. The CCR is the centerpiece of the right-to-know provisions of the 1996 amendments to the SDWA. All community water systems, like the City, were required to issue the first report to customers by October 19, 1999. The annual report must be updated and re-issued to all customers by July 1st of each year thereafter.

The CCR is a report on the quality of water that was delivered to the system during the previous calendar year. The reports must contain certain specific elements but may also contain other information that the purveyor deems appropriate for public education. Some, but not all, of the information that is required in the reports includes the source and type of the drinking water, type of treatment, contaminants that have been detected in the water, potential health effects of the contaminants, identification of the likely source of contamination, violations of monitoring and reporting, and variances or exemptions to the drinking water regulations. A copy of the City's latest CCR is contained in **Appendix L**.

Stage 1 Disinfectants/Disinfection By-products Rule

Disinfection by-products (DBPs) are formed when free chlorine reacts with organic substances, most of which occur naturally. These organic substances (called precursors) are a complex and variable mixture of compounds. The DBPs themselves may pose health risks. Trihalomethanes (THM) are a category of DBPs that had been regulated previous to this rule. However, systems with groundwater sources that serve a population of less than 10,000 were not previously required to monitor for THM.

The EPA proposed the Stage 1 Disinfectants/Disinfection By-products Rule (D/DBPR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became effective on February 16, 1999. The rule applies to the City and most other water systems, including

systems serving fewer than 10,000 people that add a chemical disinfectant to the drinking water during any part of the treatment process. The rule reduced the MCL for total THM, which are a composite measure of four individual THM, from the previous interim level of 0.10 mg/L to 0.08 mg/L. The rule established MCLs and requires monitoring of three additional categories of DBPs (0.06 mg/L for five haloacetic acids (HAA5), 0.01 mg/L for bromate and 1.0 mg/L for chlorite). The rule established maximum residual disinfectant levels for chlorine (4.0 mg/L), chloramines (4.0 mg/L) and chlorine dioxide (0.8 mg/L). The rule also requires systems using surface water or groundwater directly influenced by surface water to implement enhanced coagulation or softening to remove DBP precursors, unless alternative criteria are met. Compliance with this rule must have been satisfied by December 16, 2001 for large surface water systems (those serving over 10,000 people) and by December 16, 2003 for smaller surface water systems and all groundwater systems (i.e., the City). The City currently complies with all contaminant monitoring requirements under this rule.

Unregulated Contaminant Monitoring Regulation

The EPA established the Unregulated Contaminant Monitoring Regulation (UCMR) to generate data on contaminants that are being considered for inclusion in new drinking water standards. The information collected by select public water systems will ensure that future regulations established by the EPA are based on sound science. The rule was first published in the Federal Register on September 17, 1999, and was subsequently amended on March 2, 2000, and January 11, 2001. The UCMR became effective on January 1, 2001.

Three separate lists of unregulated contaminants are maintained under the UCMR: List 1, List 2 and List 3. Contaminants are organized on the tiered lists based on the availability of standard testing procedures and the known occurrence of each contaminant, with List 1 containing contaminants that have established standard testing procedures and some, but insufficient, information on their occurrence in drinking water. Monitoring for contaminants on the three lists is limited to a maximum of 30 contaminants within a 5-year monitoring cycle, and the EPA is required to publish new contaminant monitoring lists every 5 years. As new lists are published, contaminants will be moved up in the lists if adequate information is found to support additional monitoring. All public water systems serving more than 10,000 people and a randomly selected group of smaller water systems are required to monitor for contaminants. The City currently monitors for some unregulated contaminants.

Arsenic

The EPA established interim drinking water regulations for arsenic in 1976 under the SDWA. Arsenic is highly toxic, affects the skin and nervous system, and may cause cancer. The 1996 SDWA amendments require the EPA to conduct research to assess health risks associated with exposure to low levels of arsenic. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90-day public review period. The final rule, which was published in the Federal Register on January 22, 2001, was to become effective on March 23, 2001, except for certain amendments to several sections of the rule. Because of the national debate regarding the science and costs related to the rule however, the EPA announced on May 22, 2001, that it was delaying the effective date for the rule to allow time to reassess the rule and to afford the public a full opportunity to provide further input. On October 31, 2001, the EPA reaffirmed the final rule as published on January 22, 2001. The Arsenic Rule subsequently became effective on February 22, 2002.

The rule sets the MCLG of arsenic at zero and reduces the MCL from the previous standard of 0.05 mg/L to 0.01 mg/L. Arsenic's monitoring requirements will be consistent with the existing requirements for other inorganic contaminants. The regulation required the City to begin monitoring by January 23, 2006. The results of this monitoring have indicated elevated levels of arsenic in the source water from Bryant Well Nos. 1 and 2. The City complies with this rule by removing arsenic at the Bryant Well Field Treatment Facility prior to distribution to the City's customers.

Filter Backwash Recycling Rule

The 1996 SDWA amendments required the EPA to promulgate a regulation governing the recycling of filter backwash water within public water system's treatment processes. Public water systems using surface water or groundwater under the direct influence of surface water that utilize filtration processes and recycling must comply with this rule. The rule aims to reduce risks associated with recycling contaminants removed during filtration. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90-day public review period. The final rule was published in the Federal Register on June 8, 2001 and became effective on August 7, 2001.

The rule requires filter backwash water be returned to a location that allows complete treatment. In addition, filtration systems must provide detailed information regarding the treatment and recycling process to the state. The regulation requires water systems to have complied with the rule starting December 8, 2003, if filter backwash water was recycled. The Bryant Well Field Treatment Facility backwash recycle method meets the requirements of this rule.

Stage 2 Disinfectants/Disinfection By-products Rule

This rule is the second part of the D/DBPR, of which Stage 1 D/DBPR became effective in February 1999. The Stage 2 D/DBPR was published on January 4, 2006, in the Federal Register and became effective on March 6, 2006. The EPA implemented this rule simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule.

Similar to the Stage 1 D/DBPR, this rule applies to most water systems that add a disinfectant to the drinking water other than ultraviolet light or those systems which deliver such water. The Stage 2 D/DBPR changes the calculation procedure requirement of the MCLs for two groups of disinfection by-products, total THM (TTHM) and HAA5. The rule requires each sampling location to determine compliance with MCLs based on their individual annual average DBP levels (termed the Locational Running Annual Average), rather than utilizing a system-wide annual average. The rule also proposes new MCLGs for chloroform (0.07 mg/L), trichloroacetic acid (0.02 mg/L) and monochloroacetic acid (0.03 mg/L).

Additionally, the rule requires systems to document peak DBP levels and prepare an Initial Distribution System Evaluation (IDSE) to identify Stage 2 D/DBPR compliance monitoring sites. IDSEs require each water system to prepare a separate IDSE plan and report, with the exception of those systems who obtain a 40/30 Certification or a Very Small System Waiver. In order to qualify for the 40/30 Certification, all samples collected during Stage 1 monitoring must have TTHM and HAA5 levels less than or equal to 0.040 mg/L and 0.030 mg/L, respectively. The first stage of the IDSE schedule required systems serving 100,000 or more people to submit IDSE plans by October 1, 2006. Systems serving 50,000 to 99,999 people had to submit IDSE plans by April 1, 2007, while systems serving 10,000 to 49,999 people had to submit plans by October 1, 2007. Systems serving fewer than 10,000 people must submit an IDSE plan by April 1, 2008, if they did not qualify for

40/30 Certification or a Very Small System Waiver. The City currently complies with all contaminant monitoring requirements under this rule and has completed its IDSE plan, which is included in **Appendix J**.

Long Term 2 Enhanced Surface Water Treatment Rule

Following the publishing of the IESWTR, the EPA introduced the LT1ESWTR to supplement the preceding regulations. The second part of the regulations of the LT1ESWTR, which became effective in February 2002, are mandated in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The final rule was published in the Federal Register on January 5, 2006, and became effective on March 6, 2006. The final rule was implemented simultaneously with the Stage 2 D/DBPR described in the previous section. This rule applies to all systems that use surface water or GWI sources.

This rule establishes treatment technique requirements for filtered systems based on their risk level for contamination, calculated from the system's average Cryptosporidium concentration. Requirements include up to 2.5-log Cryptosporidium treatment in addition to existing requirements under the IESWTR and LT1ESWTR. Filtered systems that demonstrate low levels of risk will not be required to provide additional treatment. Unfiltered systems under this rule must achieve at least a 2-log inactivation of Cryptosporidium if the mean level in the source water remains below 0.01 oocysts/L. If an unfiltered system's mean level of Cryptosporidium exceeds 0.01 oocysts/L, the LT2ESWTR requires the system to provide a minimum 3-log inactivation of Cryptosporidium. All unfiltered systems are also required to utilize a minimum of two disinfectants in their treatment process.

The LT2ESWTR also addresses systems with unfinished water storage facilities. Under this rule, systems must either cover their storage facilities or achieve inactivation and/or removal of 4-log virus, 3-log *Giardia lamblia* and 2-log Cryptosporidium on a state-approved schedule. Lastly, the rule extends the requirement of the disinfection profiles mandated under the LT1ESWTR to the proposed Stage 2 D/DBPR. Since this rule applies only to systems that use surface water or GWI sources, it does not impact the City.

Groundwater Rule

The EPA promulgated the Groundwater Rule (GWR) to reduce the risk of exposure to fecal contamination that may be present in public water systems that use groundwater sources. The GWR also specifies when corrective action (which may include disinfection) is required to protect consumers who receive water from groundwater systems from bacteria and viruses. The GWR applies to public water systems that use groundwater and to any system that mixes surface and groundwater if the groundwater is added directly to the distribution system and provided to consumers without treatment equivalent to surface water treatment. The final rule was published in the Federal Register on November 8, 2006, and became effective on January 8, 2007.

The rule targets risks through an approach that relies on the four following major components.

1. Periodic sanitary surveys of groundwater systems that require the evaluation of eight critical elements and the identification of significant deficiencies (such as a well located near a leaking septic system). States must complete the initial survey for most community water systems by December 31, 2012, and for community water systems with outstanding performance and all non-community water systems by December 31, 2014. DOH conducted

its most recent sanitary survey of the City's water system in July 2012, under the state's existing sanitary survey program.

2. Source water monitoring to test for the presence of E. coli, enterococci or coliphage in the sample. There are two monitoring provisions.
    - Triggered monitoring for systems that do not already provide treatment that achieves at least 99.99 percent (4-log) inactivation or removal of viruses and that have a total coliform positive routine sample under the Total Coliform Rule sampling in the distribution system.
    - Assessment monitoring is a complement to triggered monitoring. A state has the option to require systems to conduct source water assessment monitoring at any time to help identify high risk systems.
3. Corrective actions required for any system with a significant deficiency or source water fecal contamination. The system must implement one or more of the following corrective action options: correct all significant deficiencies; eliminate the source of contamination; provide an alternate source of water; or provide treatment that reliably achieves 99.99 percent inactivation or removal of viruses.
4. Compliance monitoring to ensure that treatment technology installed to treat drinking water reliably achieves at least 99.99 percent inactivation or removal of viruses.

The compliance date for requirements of this rule other than the sanitary survey was December 1, 2009. The City's last sanitary survey was completed in July 2012. The City is currently addressing deficiencies identified in this sanitary survey, mainly pertaining to sanitary maintenance and inspection of storage tanks and complies with all other requirements of the rule.

Future Regulations

Drinking water regulations are continuously changing in an effort to provide higher quality and safer drinking water. Modifications to the existing rules described above and implementation of new rules are planned for the near future. A summary of upcoming drinking water regulations that will most likely affect the City is presented in the following sections.

Radon

In July of 1991, the EPA proposed a regulation for radon, as well as three other radionuclides. The 1996 SDWA amendments required the EPA to withdraw the 1991 proposal due to several concerns that were raised during the comment period. A new proposed regulation was published in the Federal Register on November 2, 1999. Comments on the proposed rule were due to the EPA by February 4, 2000. Final federal requirements for addressing radon are delayed until 2008 but have not yet been published. The rule proposes a 300 pCi/L MCL for community water systems that use groundwater or an alternative, less stringent MCL of 4,000 pCi/L for water systems where their state implements an EPA-approved program to reduce radon risks in household indoor air and tap water. It is not currently known when or what a radon regulation may require as adopted by the EPA or what the implementation schedule for the rule will be. Because the final radon rule requirements are uncertain, the impact of this rule on the City is unknown at this time.

Unregulated Contaminant Monitoring Regulation Revisions

In accordance with the original UCMR, the EPA is proposing an updated contaminant monitoring list for the next five-year monitoring cycle, in addition to other minor revisions to the UCMR. The proposed rule was published August 22, 2005, in the Federal Register, and the comment period for the proposed revisions closed on October 21, 2005. The proposed revisions include a list of 26 chemicals that will be monitored during the 2007 through 2011 monitoring cycle, and approves several new testing methods to conduct the monitoring. For this upcoming cycle, all systems serving more than 100,000 people and a larger representative sample of smaller water systems than mandated under the original rule will be required to monitor for contaminants. The rule also requires additional water system data to be reported with the monitoring results, establishes a procedure for determining minimum reporting levels and proposes several revisions to the implementation of the monitoring program.

SOURCE WATER QUALITY

This section presents the current water quality standards for groundwater sources and the results of the City's recent source water quality monitoring efforts. A discussion of the water quality requirements and monitoring results for the City's distribution system is presented in the section that follows.

Drinking Water Standards

Drinking water quality is regulated at the federal level by the EPA and at the state level by DOH. Drinking water standards have been established to maintain high quality drinking water by limiting the levels of specific contaminants (i.e., regulated contaminants) that can adversely affect public health and are known or likely to occur in public water systems. Non-regulated contaminants do not have established water quality standards and are generally monitored at the discretion of the water purveyor and in the interest of customers.

The regulated contaminants are grouped into two categories of standards – primary and secondary. Primary standards are drinking water standards for contaminants that could affect health. Water purveyors are required by law to monitor and comply with these standards and notify the public if water quality does not meet any one of the standards. Secondary standards are drinking water standards for contaminants that have aesthetic effects, such as unpleasant taste, odor or color (staining). The national secondary standards are unenforceable federal guidelines or goals where federal law does not require water systems to comply with them. However, states may adopt their own enforceable regulations governing these contaminants. The State of Washington has adopted regulations that require compliance with some of the secondary standards. Water purveyors are not required to notify the public if water quality does not meet the secondary standards.

Source Monitoring Requirements and Waivers

The City is required to perform water quality monitoring at each of its active sources for inorganic chemical and physical substances, organic chemicals and radionuclides. The monitoring requirements that the City must comply with are specified in WAC 246-290-300. A description of the source water quality monitoring requirements and procedures for each group of substances is contained in the City's Water Quality Monitoring Plan, which is included as **Appendix J**.

In 1994, DOH developed the Susceptibility Assessment Survey Form for water purveyors to complete for use in determining a drinking water source's potential for contamination. The results of the susceptibility assessment may provide monitoring waivers that allow reduced source water quality monitoring. Based on the results of the susceptibility assessment survey for each source, DOH assigned a moderate susceptibility rating to Bryant Well No. 1, a low susceptibility rating to Bryant Well No. 2, and a high susceptibility rating for Hatt Slough Springs. The susceptibility rating for the more recently completed Cedarhome Well is low according to DOH's Water Quality Monitoring Schedule. The sources have historically been granted susceptibility waivers that allow the City to avoid monitoring of ethylene dibromide and other soil fumigants, dioxin, endothall, diquat and glyphosphate.

Source Monitoring Results

The quality of the City's groundwater sources has been good and meets or exceeds all drinking water standards, except for slightly higher than allowable levels of manganese and arsenic at Bryant Well No. 1. The City monitored each source for VOCs and IOCs and physical substances once during each of the two past compliance periods. Nitrate monitoring has been performed annually since 2000. As required by DOH, monitoring for radionuclides was completed once in 2010. The next radionuclides sample is due in June 2016 in order to fall within the January 2014 through December 2019 6-year compliance period.

The results of inorganic chemical (including nitrate) and VOC monitoring for the City's sources indicate that all primary standards were met. All secondary standards were also met at the sources, except for high arsenic and manganese levels at the Bryant Well No. 1. The Bryant Well Field Treatment Facility meets these secondary water quality standards at the Bryant Wells.

DISTRIBUTION SYSTEM WATER QUALITY

Monitoring Requirements and Results

The City is required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, DBPs, lead and copper, and asbestos in accordance with Chapter 246-290 WAC. A description of the distribution system water quality monitoring requirements and procedures are contained in the City's Water Quality Monitoring Plan that is included in **Appendix J**.

The City has been in compliance with all monitoring requirements for the past several years. A summary of the results of the distribution system water quality monitoring within the City's system is also presented.

Coliform Monitoring

In 2008, the City transitioned to a fully chlorinated water system through the addition of the Cedarhome Well and the Bryant Well Field Treatment Facility. The City now has a permanent disinfecting residual to ensure the absence of coliform bacteria at all times. From 2010 to 2013, all coliform monitoring samples were satisfactory with no violations. Based on the City's current population, a minimum of ten coliform samples per month (eight in July and August) from different locations throughout the system are required to be collected.

Disinfectant Residual Concentration Monitoring

Disinfection requirements applicable to the City are contained in WAC 246-290-310, which states that a disinfectant residual concentration shall be detectable in all active parts of the distribution system and that the maximum residual disinfectant level shall be 4.0 mg/L for chlorine and chloramines. The City's chlorination target is to maintain a residual disinfectant concentration of at least 0.2 mg/L in the distribution system. Since Bryant Well No. 1 was found to be in hydraulic connection with surface water, a CT of six is required at this source. This is equivalent to a free chlorine residual of 0.14 mg/L after the plant's contact loop; however, the free chlorine residual is typically maintained at a higher level. From 2010 through 2013, the average free chlorine residual throughout the City was 0.38 mg/L. The water samples collected by the City for coliform analysis are also tested for residual disinfectant concentration. The results of residual disinfectant concentration tests indicate that the City is in compliance with the regulations.

Disinfectants/Disinfection By-products Monitoring

THM and HAA5 are disinfection by-products that are formed when free chlorine reacts with organic substances (i.e., precursors), most of which occur naturally. Formation of THM and HAA5 are dependent on such factors as amount and type of chlorine used, water temperature, concentration of precursors, pH, and chlorine contact time. THM have been found to cause cancer in laboratory animals and are suspected to be human carcinogens. The City's most recent samples for THM and HAA5 in 2010, 2011, 2012, and 2013 revealed concentrations lower than their MCLs. Therefore, the City is in compliance with this regulation.

In response to the Stage 1 and Stage 2 D/DBPR, the City expanded their distribution system monitoring to include THM and HAA5. The City also completed an IDSE standard monitoring plan, which was submitted to the EPA for compliance. The IDSE standard monitoring plan is included in **Appendix J**.

Lead and Copper Monitoring

The Lead and Copper Rule identifies the action level for lead as being greater than 0.015 mg/L and the action level for copper as being greater than 1.3 mg/L. The results of the tests from 2012, which included 30 sample sites, indicated a range of less than 0.001 mg/L to 0.004 mg/L for lead and a range of less than 0.005 mg/L to 0.134 mg/L for copper. These results have all been satisfactory, since the 90th percentile concentration of either lead or copper from each group of samples has not exceeded the action levels.

Asbestos

Asbestos monitoring is required if the sources are vulnerable to asbestos contamination or if the distribution system contains more than 10 percent of asbestos cement pipe. Although none of the City's sources are susceptible to asbestos contamination, AC pipe comprises approximately 19 percent of the City's distribution system. Therefore, the City must monitor for asbestos in the distribution system. The current MCL for asbestos is 7 million fibers per liter and greater than 10 microns in length. Monitoring must be accomplished during the first three-year compliance period of each nine-year compliance cycle. The water sample must be taken at a tap that is served by an asbestos cement pipe under conditions where asbestos contamination is most likely to occur. The City's most recent samples in 2010 and 2013 did not contain asbestos contamination.