2020 Annual Water Quality Monitoring Report Spokane Valley-Rathdrum Prairie Aquifer Long Term Monitoring Program

Prepared by: Spokane County Water Resources

December 2020

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Introduction

The following report presents the field work, analytical results and findings from the Spokane Valley Rathdrum Prairie (SVRP) Aquifer Long Term Water Quality Monitoring Program. Spokane County Water Resources staff collected field data and groundwater samples from 29 dedicated monitoring wells, 17 public supply wells, and 5 springs.

Background

In 1978 the Environmental Protection Agency (EPA) designated the SVRP Aquifer as a "Sole Source Aquifer" under Section 1424(e) of the Safe Drinking Water Act. From May 1977 to June 1978 the Spokane County Water Quality Management Program conducted a one year study of the aquifer to determine if surface "recharge" is occurring to carry ground surface pollutants to the aquifer and, if so, the effect of such activities. The study concluded that domestic, municipal, commercial, agricultural, and industrial activities do impact aquifer water quality.

The 1978 Spokane Aquifer Cause and Effect Report determined that on-site sewage systems contribute to water quality degradation in the SVRP aquifer. As a result, the 1979 Spokane Aquifer Water Quality Management Plan included the following:

The recommendations for handling sanitary wastewater and mitigation of its pollution to the groundwater include the collection of all sewage from urbanized areas and treatment for discharge in such manner that the pollutants cannot enter the aquifer. Central sewer planning within the aquifer sensitive area should result in sewering of areas that have been urbanized or are to be urbanized.

The 1983 update to the Spokane Aquifer Cause and Effect Report found that there was an increasing trend in nitrate concentrations in the aquifer confirming the need to address on-site sewage disposal.

Spokane County Utilities began implementation of the Septic Tank Elimination Program (STEP) to address concerns that onsite sewage systems contribute to water quality degradation in the aquifer. STEP was completed in 2012, though additional areas not included in STEP are still being connected to sewer.

As a result of the 1983 study findings, the *Spokane Aquifer Water Quality Management Plan* was developed. One recommendation of the plan was to develop and implement a long-term ground water quality monitoring program to assess the effectiveness of the STEP. From 1980 to 2000 the Spokane Regional Health District (SRHD) conducted the aquifer monitoring program and in 2000 the Spokane County Water Resources section of the Division of Utilities (formerly the Spokane Water Quality Management Program) undertook the aquifer monitoring program.

The original study included 80 sample locations. Sixty locations were existing water supply wells, both water purveyor and private wells, and 20 locations were dedicated monitoring wells. From 1980 to 1996 all sampling locations were water supply wells. In 1996 dedicated monitoring wells were added to the monitoring network. In 2007, four spring/seep sampling locations were added. Currently the monitoring network is comprised of 29 dedicated monitoring wells, 17 public supply wells and 5 spring locations. Figure 1 shows the current sampling locations.



Figure 1. Map of the Spokane Valley Rathdrum Prairie Aquifer monitoring network with depth to water contours in feet.

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Program Objectives

The SVRP long term monitoring program has three objectives: 1) Asses the current aquifer water quality; 2) Identify spatial and temporal water quality trends; and 3) Evaluate water quality trends that are related to the Spokane County Septic Tank Elimination Program.

Study Area and Hydrogeologic Setting

Aquifer Hydrology

The SVRP aquifer underlies about 370 square miles of relatively flat, alluvial valley surrounded by bedrock highlands (Kahle and others, 2005). The aquifer consists primarily of coarse-grained sediments including sand, gravels, cobbles, and boulders. There is generally a greater percentage of finer material near the margins of the valley and becomes more coarse near the center throughout the Rathdrum Prairie and Spokane Valley. In the northwest portion of the aquifer, often referred to as the Hillyard Trough, the deposits are finer grained and the aquifer consists of sand with some gravel, silt, and boulders. The aquifer is highly productive. Aquifer wells yield as much as several thousand gallons per minute with relatively little drawdown. The hydraulic conductivity of the aquifer sediments is at the upper end of values measured in the natural environment (Kahle and others, 2005)

Spokane River SVRP Aquifer Interaction

The Spokane River is the largest source of recharge to the aquifer and receives the largest amount of discharge from the aquifer. A groundwater budget for the SVRP Aquifer developed by the USGS in 2007 estimates the Spokane River discharges 718 ft³/s to the aquifer, representing 49 percent of the total mean annual aquifer inflow of 1,417 ft³/s. The Spokane River receives an estimated 861 ft³/s from the aquifer representing 59 percent of the total mean annual outflow of 1,468 ft³/s. There are two distinct river reaches where the Spokane River receives water from the aquifer: 1) Flora Road to Greene Street; and 2) The Spokane Gage to Nine Mile Dam. These reaches are considered gaining reaches. There are also two distinct river reaches were the Spokane River discharges to the aquifer: 1) Coeur d'Alene Lake to Flora Road; and 2) Green Street to Monroe Street. These reaches are considered losing reaches. Aquifer water quality in the immediate vicinity of the river in the losing reaches is influenced by river water quality.

Monitoring Network

The current monitoring network includes 15 purveyor wells, 31 monitoring wells, and 5 natural springs for a total of 51 monitoring locations. The network is spatially distributed to provide information on water quality throughout the aquifer (Figure 1).

In addition to assessing general water quality, the monitoring network provides data for specific objectives. Four monitoring locations are at the Washington/Idaho border and provide a baseline to which water quality data from down gradient wells can be compared. At Barker Road, there are four monitoring locations that provide data to evaluate the water quality in the vicinity of a losing reach of the Spokane River. At Sullivan Road, there are three monitoring locations that provide data to evaluate water quality in the vicinity of a gaining reach of the Spokane River. The natural springs monitoring locations provide additional water quality information on aquifer water that enters surface water bodies, both the Spokane and Little Spokane Rivers.

Samples from the dedicated monitoring wells are taken from 1 to 1.5 feet below the static water level, or water table, and therefore provide data on water quality at the surface of the aquifer. The rational for this approach is that impacts to the aquifer will occur first at the surface. There are two locations that have "nested wells" that provide data at the same location but different depths. Many of the water supply wells also withdraw water from greater depths than the dedicated monitoring wells.

Summary of Field Activities

Monitoring Events

In 2020, sampling events occurred quarterly and included measurement of field parameters and sample collection for laboratory analysis. Monitoring locations and sample collection varies each quarter as summarized in Table 1.

There are 27 sites regularly monitored every quarter. Field parameters are collected regularly at every site each quarter. Samples are collected for four nutrient parameters (chloride, nitrate+nitrite, total phosphorus, and soluble reactive phosphorus) at every site each quarter, with Quarter 2 (Spring) sampling being the only exception.

During Quarter 2 (Spring) sampling, five additional monitoring wells are included in the sampling event for a total of 32 sites being sampled during Quarter 2. The samples collected from the five added sites are only analyzed for metals (no nutrient analyses). In addition, a sample for metals analysis is collected at only one of the regular monitoring locations, 5507A04; none of the other regular monitoring locations are sampled for metals during Quarter 2. The metals included in the Quarter 2 analysis are listed in Table 1.

During Quarter 3 (Summer) sampling, an additional eight purveyor wells, 15 monitoring wells, and one spring are included in the sampling event for a total of 51 sites being sampled for Quarter 3. During the Quarter 3 sampling event, fluoride and metals are added to the analyses (Table 1). Samples are collected for these and the regular nutrient analyses at all 51 monitoring locations.

For the 2020 sampling period, bromide was added to the regularly sampled nutrients to help determine potential source(s) of chloride in the aquifer.

	All Quarters	Added during	Added during
		Quarter 2 (Spring)	Quarter 3 (Summer)
Sites			
Purveyor Wells	5322F01		5308A02
	5324G01		5213B01
	5312H01		5408N01
	5407C01		5415E03
	5405K01		5518R01
	5427L01		5515C01
	5426L03		6328H01
			6320D01
Monitoring Wells	5417R02 5411R06	5312C01	*Quarter 2 Wells
	6631M07 5311J05	5507H01	6331M04
	6524R01 5322A01	5508M01	5307M01
	6525R01 5323E01	5508M02	5304G01
	5505D01 5315L01	5517D05	6330J01
	5507A04 5310Q01		6331J01
	6436N01 5308H01		6211K01
	5411R03 6327N04		6311J07
			5322A03
			5409C02
			5404A01
Springs	6306P01s		5411R05s
	6306P01s2		
	6211J01s		
	5212F01s		
Parameters			
Field Parameters	Water Temperature		
	рН		
	Dissolved Oxygen		
	Specific		
	Conductance		
Nutrients	Chloride		Fluoride
	Nitrate+Nitrite		
	Total Phosphorus		
	Soluble Reactive		
	Prosphorus		
NA-1-1-	Bromide (2020 only)		*O
ivietais		Arsenic (As)	Calcium (Ca)
			Calcium (Ca)
		Lood (Db)	Magnasium (Mar)
		Tine (7n)	
			Foldssium (K)
			Sodium (Na)

Table 1. Summary of SVRP monitoring locations and parameters by quarter.

Field Methods

Dedicated monitoring wells were sampled in the following manner. The depth to groundwater in the well was measured and recorded on field sheets. The pump intake was positioned at the top of the screened interval. If the water level was below the top of the screened interval the pump was set 1 to 1.5 feet below the water table surface. The monitoring wells were purged utilizing low-flow sampling techniques per EPA guidelines. Those techniques are described in the *Spokane County Water Resources Long Term Monitoring Program Quality Assurance Project Plan* (QAPP), August 2007. Water supply wells used for groundwater monitoring are run a minimum of five minutes before the sample is collected to obtain a representative sample. Groundwater samples are collected from spigots on the purveyor well discharge lines as close to the pump as possible. The field parameters such as depth-to-water, temperature, pH, and specific conductance are recorded on field sheets. Groundwater samples are delivered to the laboratory under Chain-of-Custody procedures. Copies of the Chain-of-Custody forms are available on request.

Analytical Methods

Analytical services were provided by SVL Analytical in Kellog, ID and IEH Aquatic Research in Seattle, WA as summarized in Table 2.

Lab	Parameter/Analyte	Method		
SVL Analytical	Chloride, Fluoride, Bromide	EPA 300		
	Nitrate+Nitrite	EPA 353.2		
	Mercury	EPA 245.1		
	Metals	EPA 200.8		
IEH Aquatic Research	Total Phosphorus	SM18 4500PF		
	Soluble Reactive Phosphorus (SRP)	SM18 4500PF		

Table 2. Analytical methods

Results

Data Quality

Analytical results were validated to ensure data quality objectives including precision, accuracy, representativeness, and completeness as outlined in the QAPP were met. No data anomalies were noted during the data validation process.

Water Quality

Quarterly analytical and field results are presented in Appendix A.

The following section summarizes the 2020 analytical results for all water quality parameters.

Only certain parameters have Primary Maximum Contaminant Levels (MCL) and Secondary drinking water standards defined by the EPA (40 CFR Chapter 1 Part 141) and State of Washington (WAC 246-290-310) (Table 3). Primary MCLs are standards set for the protection of human health. Secondary Drinking Water Regulations (secondary standards) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects

(such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. The State of Washington has also identified "trigger levels" for some contaminants (Table 3). Trigger levels are analyte concentrations that trigger additional sampling requirements for public water purveyors.

	Drinl	king Water Sta	ndards
Analytes		Trigger	
	MCL	Level	Secondary
Nitrate+Nitrite	10	5	-
Arsenic	0.01	0.005	-
Lead	0.015	-	-
Copper	1.3	-	-
Mercury	0.002	0.0004	-
Cadmium	0.005	0.005	-
Chromium	0.1	0.02	-
Fluoride	4	0.5	2
Chloride	-	250	250
Zinc	-	5	5
Manganese	-	0.05	0.05

Table 3. Washington State Drinking Water Standards

During 2020 there were no exceedances of the Primary MCLs; however, there were exceedances of the state trigger levels for two analytes: arsenic and manganese. In regulation, these standards apply to source sampling performed by public water purveyors as prescribed in State of Washington Drinking Water regulations. These standards provide a basis for comparison for the Long-Term Monitoring Program results and exceedances of these standards are noted in this report. However, such exceedances do not constitute a basis for regulatory action, as this is a non-regulatory monitoring program.

Several analytes (lead, copper, manganese, mercury, cadmium, chromium, zinc, fluoride, and bromide) are generally not detectable in samples, having more than 75 percent of samples reported as below the laboratory detection limits.

A detailed discussion regarding the results for each analyte follows.

Arsenic

Arsenic occurs naturally as a trace element in many types of rock and sediment. Therefore, it can enter groundwater through natural biogeochemical processes depending on conditions in the aquifer and the chemical form of the arsenic. Natural groundwater may contain trace levels (0.1 mg/L or less) of arsenic. Arsenic can also enter groundwater though discharges from agricultural and industrial practices.

Arsenic in drinking water is a health hazard. It is toxic at low levels and is a known carcinogen. Exposure can cause skin damage, circulatory system problems, and increased risk of cancer. For this reason, arsenic has a primary MCL of 0.010 mg/l and a trigger level of 0.005 mg/l.

2020 Annual Water Quality Monitoring Report SVRP Aquifer Long-term Monitoring Program During 2020, 63 samples were analyzed for arsenic. Arsenic levels detected across all samples range from below the analytical method reporting limit (0.001 mg/L) to 0.0083 mg/L. There were five samples with arsenic concentrations above the state trigger level. Eight samples (or approximately 13 percent) were non-detect.

Cadmium

Cadmium is a naturally occurring element often associated with lead, copper and zinc ores. Therefore, it can enter groundwater from erosion of natural deposits in the earth. Natural groundwater may contain trace levels (0.1 mg/L or less) of cadmium. Anthropogenic sources include discharges from metal refineries, corrosion of galvanized pipes, and runoff from wastes from batteries and paints.

Cadmium in drinking water is a health hazard. Exposure through consumption can adversely affect the kidneys and bone. Cadmium has a primary MCL of 0.005 mg/l, which is also the State trigger level.

During 2020, 63 samples were analyzed for cadmium. Cadmium levels for most samples (n = 62) were below the analytical method reporting limit (0.0002 mg/L). Only one sample collected from a site along Barker Rd. had a detectable concentration at 0.00023 mg/L. Therefore, the cadmium MCL was never reached or exceeded.

Calcium

Calcium is naturally very abundant, occurring in rocks, bones and shells. Natural sources of calcium include feldspars, gypsum, dolomite, aragonite, calcite, amphiboles, and pyroxenes. Calcium is major constituent in natural groundwater. Calcium, along with magnesium, can contribute to water hardness. Hardness is a characteristic of water which can enhance its palatability. Calcium is not a health hazard in drinking water and therefore no drinking water standards are established. During 2020, 55 samples were analyzed for calcium. Calcium levels detected across all samples range from 6.14 mg/L to 66.6 mg/L.

Chloride

Natural sources of chloride are primarily sedimentary rocks (e.g. halite or sylvite) with some igneous rocks. Chloride minerals from sedimentary rocks are highly soluble in water, resulting in chloride being present in all natural waters. Concentrations of chloride varies greatly, with sea water having the maximum level at ~35,000 mg/L. It is a major constituent of natural groundwater. Anthropogenic sources of chloride include sewage, some industrial effluents, and deicers.

Chloride does not pose a health hazard. Chloride is an aesthetic contaminant and has a secondary water quality of 250 mg/l to maintain palatability and use. The State trigger level is also 250 mg/L. Levels above 250 mg/L will cause water to taste salty. High chloride levels may also make water unsuitable for uses such as agriculture.

During 2020, 142 samples were analyzed for chloride. Chloride levels across all samples range from 1.83 mg/L to 32.00 mg/L. Therefore, the secondary water quality standard and State trigger level were not exceeded.

Chromium

Chromium is naturally occurring metal found in rocks and soil. Therefore, it can enter groundwater through erosion of natural deposits. Natural groundwater contains trace levels (0.1 mg/L or less) of

chromium. Anthropogenic sources include discharges from pulp and steel mills, and other industrial processes.

There are two forms of chromium that may be present in natural waters: trivalent chromium (chromium-3) and hexavalent chromium (chromium-6). Chromium-6 is the form that presents a health concern. Exposure to chromium-6 can cause allergic dermatitis. However, since chromium can change forms in water and in the body, the drinking water standards are set for total chromium. Chromium has a Primary MCL of 0.1 mg/L and a state trigger level of 0.02 mg/L.

In 2020, 55 samples were analyzed for total chromium. Chromium levels across all samples ranged from below the analytical method reporting limit (0.0015 mg/L) to 0.00885 mg/L. However, most samples (n = 51, or 93 percent) were non-detect. Therefore, the drinking water standards were met.

Copper

Copper is found naturally in rocks and soil. Copper can be found naturally as a pure metal as well as in copper sulfides, oxides, carbonates, and in complex copper minerals containing iron, nickel, cobalt, lead, zinc, silver or other elements. Natural groundwater contains trace levels of copper. Levels over 0.05 mg/L are not naturally encountered in groundwater, so levels about this may indicate pollution. Sources of contamination to groundwater are industrial discharges. Corrosion of household plumbing systems can lead to excess copper in drinking water, and cause metallic taste and blue-green staining.

While some copper intake is necessary for human health, exposure above certain levels can cause a variety of symptoms related to copper poisoning. Concentrations between 2.8 and 7.8 mg/L can cause signs of gastrointestinal distress such as vomiting or diarrhea. More severe cases of copper poisoning result in anemia, liver or kidney damage. To prevent adverse health effects associated with copper, the primary MCL is 1.3 mg/L and the secondary standard of 1.0 mg/L.

During 2020, 63 samples were analyzed for copper. Copper levels across all samples ranged from below the analytical method reporting limit (0.001 mg/L) to 0.0259 mg/L. Most samples (n = 49, or 78 percent) were non-detect. Therefore, the copper MCL and secondary standard was never reached or exceeded.

Fluoride

Fluoride is classified as any binary compound of another element bonded with fluorine. Fluorine is a natural trace element that exists in almost all soils. Natural sources of fluoride include amphiboles (hornblende), apatite, fluorite, fluorspar, cryolite, and mica. Fluoride is considered a secondary constituent of natural groundwater; secondary constituents are generally present in groundwater in concentrations between 0.01 to 10 mg/L.

Though fluoride salt is often added to drinking water at about 1 mg/L for the purposes of preventing tooth decay, fluoride in drinking water at higher concentrations is a health hazard. Fluoride at concentrations of more than 2 mg/L can result in a condition called mottling or discoloration of permanent teeth in children. Exposure to 4 mg/L or more for many years can cause skeletal fluorosis, where bones become extremely brittle. To prevent such adverse health effects, fluoride has a primary MCL of 4 mg/l and a State trigger level of 0.5 mg/L.

During 2020, 54 samples were analyzed for fluoride. Fluoride levels across all samples ranged from below the analytical method reporting limit (0.1 mg/L) to 0.27 mg/L. Most samples (n = 48, or 89 percent) were non-detect. Therefore, the MCL and secondary standard was never reached or exceeded.

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Lead

Lead is a naturally occurring metal found in rocks and soils. However, naturally occurring lead in a pure metallic form is rare and it is often found in combination with other minerals. The most common source of lead is sulphide, or galena. Lead tends to bind to soils and sediments which limits its presence in water. For this reason, natural groundwater only contains trace levels (0.1 mg/L or less) of lead. Levels above this may indicate pollution is occurring. Sources of contamination to groundwater may include industrial and mine discharges.

Any exposure to lead can cause adverse health effects including damage to the nervous system, kidneys, and bone marrow. In children, lead can cause delays in physical and mental developments leading to decreased attention span and learning disabilities. For this reason, lead has a federal action level of 0.015 mg/L.

During 2020, 63 samples were analyzed for lead. Lead levels for most samples (n = 62, or 98 percent) were below the analytical method reporting limit (0.001 mg/L). Only one sample collected from the springs at Sullivan Park had a detectable concentration at 0.00102 mg/L. Therefore, the federal action level was never reached or exceeded.

Manganese

Manganese is naturally found in soils, ores and rock, and is common in many groundwater sources. Natural sources of manganese include metamorphic and sedimentary rocks, mica biotite, amphibole hornblende. Natural groundwater contains trace levels of manganese (0.1 mg/L or less).

Manganese is not a health hazard in drinking water and therefore no primary MCL was established. Manganese is an aesthetic contaminant and has a secondary water quality standard of 0.05 mg/l. At this level and above, water may be cloudy, form black precipitates, contribute to mineral depositing in pipes or cause difficulty in sudsing and darkening of clothing during washing.

In 2020, 55 samples were analyzed for manganese. Manganese levels across all samples range from below the analytical method reporting limit (0.001 mg/L) to 0.329 mg/L. There were two exceedances of the secondary water quality standard: a sample from Plante's Ferry Park, which had the highest concentration measured (0.329 mg/L) and a sample from the monitoring well at Frederick and Bowdish which had 0.123 mg/L. All other samples were below 0.022 mg/L. Most samples (n = 43, or 78 percent) were non-detect.

Magnesium

Magnesium is naturally occurring mineral found in rocks and soils. Natural sources of magnesium include dolomite, magnesite, amphiboles, olivine, pyroxenes and clay minerals. It is a primary constituent of natural groundwater. Magnesium does not have applicable drinking water quality standards. Like calcium, magnesium contributes to water hardness. Hardness is a characteristic of water which can enhance its palatability. Magnesium is not a health hazard in drinking water and, therefore, there are no drinking water standards. In 2020, 55 samples were analyzed for magnesium. Magnesium levels across all samples range from 1.82 to 30.9 mg/L.

Mercury

Mercury is a naturally occurring metal, but it is rare in pure metallic form. However, mercury can be found in inorganic and organic forms. Natural sources of inorganic mercury include cinnabar ore

2020 Annual Water Quality Monitoring Report SVRP Aquifer Long-term Monitoring Program (mercuric sulfide) and calomel. The most common organic form of mercury is methylmercury. Mercury has the highest solubility in water of any metal. Some microorganisms and natural processes can change mercury from one form to the other. Both organic and inorganic forms of mercury can be found in groundwater. Sources of contamination to groundwater may include discharge from refineries and factories and runoff from agricultural land and landfills.

Exposure to all forms of mercury at high levels can permanently damage the brain and kidneys. In pregnant women, mercury can also adversely affect the fetus. Methylmercury is more harmful than other forms, because it can bioaccumulate in tissues. To protect against adverse health effects, the primary MCL for mercury is 0.002 mg/L and the state trigger level is 0.0004 mg/L. This is for total mercury in water.

In 2020, 63 samples were analyzed for mercury. Mercury was not detected in any of the samples, as 100 percent of samples were below the analytical method reporting limit (0.0002 mg/L). Therefore, both the mercury MCL and the state trigger level were never reached or exceeded.

Nitrate

Nitrogen is a naturally occurring element that exists in many forms in the environment including nitrate, nitrite, and ammonia. Natural sources of nitrogen include atmospheric nitrogen, legumes, plant debris, decaying organic matter, animal excrement, and soils. Most nitrogenous materials are quickly converted to nitrate in natural waters, which is the final oxidation product of nitrogen. Nitrite is an intermediate form that occurs in the nitrogen cycle, and is not usually present in high concentrations. Past monitoring efforts confirmed this for the SVRP, which found that nitrite is typically negligible in groundwater samples. For this reason, the analytic method tests for both nitrate and nitrite (nitrate+nitrite), but is assumed to be and is reported as nitrate.

Nitrate is a secondary constituent of natural groundwater and may be present in concentrations between 0.1 to 10 mg/L. Concentrations higher than the local average may suggest pollution is occurring. Sources of nitrate contamination in groundwater include septic tanks, nitrogen-rich fertilizers, and agricultural processes.

Nitrate may present a health hazard in drinking water. Nitrate is especially harmful to infants, who consume a large quantity of water relative to their body weight. Nitrate concentrations above the MCL can lead to methemoglobinemia, a condition that reduces the oxygen carrying capacity of blood. To prevent such adverse health effects, nitrate has a primary MCL of 10 mg/L and a trigger level of 5 mg/L.

In 2020, 142 samples were analyzed for nitrates. Nitrate across all samples range from 0.08 to 4.99 mg/L. While the state trigger level was closely approached by the sample with the highest concentration, drinking water standards for nitrate were met.

Phosphorus

Phosphorus is a naturally occurring mineral that is rare in its pure elemental form. Phosphorus is usually found as organic and inorganic phosphate, and will change forms as it cycles through the environment. Natural groundwater usually contains trace levels (0.1 mg/L or less) of phosphate. Anthropogenic sources of phosphate to groundwater include septic systems, agricultural run-off, and run-off from fertilized lawns.

Phosphorus does not have applicable drinking water quality standards, but can be a concern for general surface water quality. Phosphorus is often limited in freshwater systems and excessive phosphorus can cause accelerated plant and algae growth, which can lead to low dissolved oxygen and fish kills.

Since different forms of phosphate may be present in groundwater, samples are analyzed for both total phosphorus and soluble reactive phosphorus (SRP). Analysis for total phosphorus, like it sounds, measures all forms of phosphorus present in the water sample. Analysis for SRP measures the dissolved portion of inorganic phosphorus within the water sample.

In 2020, 142 samples were analyzed for total phosphorus and for SRP. Total phosphorus levels across all samples ranged from below the analytical method reporting limit (0.002 mg/L) to 0.381 mg/L. SRP levels across all samples ranged from below the analytical method reporting limit (0.001 mg/L) to 0.042 mg/L. For total phosphorus and SRP respectively, there were 3 and 5 samples reported as non-detects.

Potassium

Potassium is a natural mineral found in feldspars (orthoclase and microcline), feldspathoids, some micas, and clay minerals. Potassium is considered a secondary constituent of groundwater, meaning it may be present in groundwater at concentrations between 0.1 and 10 mg/L. Potassium is not a health hazard for drinking water. Therefore, no drinking water standards have been set. In 2020, 55 samples were analyzed for potassium. Potassium levels across all samples ranged from 0.8 to 5.65 mg/L.

Sodium

Sodium is a naturally abundant mineral in rocks and soils such as feldspars (albite), clay minerals, and evaporates such as halite. Sodium is a primary constituent of natural groundwater. There are no applicable drinking water quality standards for sodium. In 2020, 55 samples were analyzed for sodium. Sodium levels across all samples ranged from 2.33 mg/L to 13.8 mg/L.

Zinc

Zinc is a naturally occurring metal that is often found with lead, copper, and silver ores. Zinc also forms salts and zinc compounds by combining with other elements such as chlorine, oxygen, and sulfur. Natural groundwater contains trace levels (0.1 mg/L or less) of zinc.

Zinc is an aesthetic contaminant and has a secondary water quality of 5 mg/l to maintain palatability and use. The State trigger level is also 5 mg/L. Above this concentration, zinc can cause metallic taste and can add to corrosion and staining of pipes and fixtures.

In 2020, 63 samples were analyzed for zinc. Zinc levels across all samples ranged from below the analytical method reporting limit (0.005 mg/L) to 0.132 mg/L. However, most samples (n = 49, or 78 percent) were non-detect.

Special Investigation: Chloride to Bromide (Cl/Br) Ratios to Determine Chloride Sources

In 2020, bromide was added to the suite of laboratory analysis for each quarter. Bromide is a naturally occurring anion of the element bromine that exists as a salt with sodium, potassium, and other cations. Because of their similar physical and chemical properties, bromide tends to occur in nature alongside sodium chloride (salt) but in smaller concentrations as it is less abundant in nature. However, bromide salts are very soluble in water, with a slightly higher solubility than chloride. This leads to different abundance of chloride and bromide in fluids and solids.

In groundwater, both chloride and bromide move conservatively, meaning they are less affected by physical and chemical processes such as adsorption to sediment and oxidation-reduction reactions. This allows the use of simple binary mixing curves to describe how chloride and bromide concentrations in dilute groundwater would change with increasing influence from another source. For this reason, chloride and bromide have been used to identify potential sources of groundwater contamination, including sources of chloride.

The method involves plotting the chloride to bromide (Cl/Br) ratio against the chloride concentrations of different sources, as well as binary mixing lines of those sources, and comparing where groundwater samples fall among these. Binary mixing lines can be calculated using the following equation from Jagucki and Darner 2001:

 $C_{mix} = (C_1 \times V) + (C_2 \times (1 - V))$

Where:

 C_{mix} is the concentration of chloride (or bromide) in the mixture C_1 is the concentration of chloride (or bromide) in the first end member C_2 is the concentration of chloride (or bromide) in the second end member V is the volume fraction of the first end member

Sources used as end members (start and stopping points of the mixing process) to calculate the binary mixing lines are listed in Table 4. Groundwater unaffected by anthropogenic sources will have a Cl/Br ratio of 200 or less and a chloride concentration of 10 mg/L or less (Figure 2). Outside of this range, there may be possible effects from anthropogenic sources. A Cl/Br ratio of 400 has been used as a threshold, where anthropogenic sources are considered to be influencing groundwater with Cl/Br ratios at this level and above and falling on or near the binary mixing curves. However, no definite claim can be made for groundwater with Cl/Br ratios between 200 and 400; other indicators and information may need to be assessed to determine whether there are potential anthropogenic influences (Jagucki and Darner 2001).

Source	Chloride (mg/L)	Bromide (mg/L)	Cl/Br Mass Ratio
Rain water	0.2	0.0045	44.44
Sea water	19,500	290	67.24
Septic tank leachate	91	0.1183	769
Halite (rock salt)	10,000	1.48	6,757

Table 4. Sources of chloride used as end members for calculating binary mixing lines. Chloride and bromide concentrations and chloride to bromide (Cl/Br) mass ratios of sources are from Katz et al 2011.

The County's interest in sources of chloride stems from unpublished analysis of past data, which indicates that chloride levels are increasing in the SVRP aquifer. It was suspected that this increase in chloride may be associated with the use of deicers [e.g. sodium chloride (NaCl), or magnesium chloride (MgCl)] in treating roads surfaces during the winter. Since the monitoring program already included quarterly sampling for chloride, the County could incorporate bromide for simultaneous measurement in groundwater samples to use the Cl/Br ratio to identify potential sources of chloride contamination within the SVRP aquifer.

In 2020, 143 samples were analyzed for bromide. Bromide levels across all samples ranged from below the analytical method reporting limit (0.1 mg/L) to 0.132 mg/L. However, almost all samples (n = 139, or 98 percent) were non-detect for bromide. Therefore, the Cl/Br ratios cannot be accurately calculated for most of the samples.

The two samples that had detectable concentrations of bromide were collected from the monitoring well located at the Fire Station on Houston and Regal in North Spokane (Well ID 6327N04). These two samples had a Cl/Br ratios of 332.98 and 456.95 with chloride concentrations of 19.5 and 22.3 mg/L respectively (Figure 2). These are at the low end of the range given for groundwater influenced by septic tank leachate, which has Cl/Br ratios between 400 and 1,100 with chloride concentrations between 20 and 100 mg/L (Katz et al 2011; Figure 2). The Fire Station well is located outside of the sewered area, so septic tank leachate is a possible source of contamination.



Figure 2. Plot of chloride to bromide (Cl/Br) ratios versus chloride concentrations in groundwater samples from Well ID 6327N04 as well as the rain water, sea water, septic tank leachate, and halite (road rock salt) end members (Katz et al 2011) and the binary mixing lines between rain water and halite, septic tank leachate, and seawater. The range for dilute groundwater and septic tank leachate are also shown.

The North Spokane Irrigation District Site 4 production well (Well ID 6328H01) offers a comparison to the Fire Station well. These wells are in an area where the SVRP aquifer has an upper and lower layer. The Fire Station well is in the upper aquifer, which is more susceptible to contamination whereas the North Spokane Irrigation District production well is in the lower, more protected layer. The sample collected from the North Spokane Irrigation District production District production well did not have detectable levels of bromide and had a much lower concentration of chloride as well as lower concentrations of other indicators of possible contamination from septic tank leachate (e.g. nitrate, sodium, calcium, and

potassium) (Katz et al 2011; Table 5). Unfortunately, the North Spokane Irrigation District well is sampled only during the summer/Quarter 3, so there is no concurrent comparison for the Fire Station sample from late October.

Table 5. Comparison of the Fire Station at Houston and Regal monitoring well (ID 6327N04) and the North Spokane Irrigation District Site 4 production well (ID 6328H01) using analytes that could be indicative of septic tank leachate contamination in groundwater.

Analyte (mg/L)	Fire	Station	North Spokane
	(632	27N04)	Irrigation District
			(6328H01)
	8/4/2020	10/28/2020	8/4/2020
Chloride	22.30	19.50	3.73
Bromide	0.11	0.13	<0.10
Cl/Br	456.95	332.98	
Nitrate + Nitrite	3.640	3.790	1.740
Total Phosphorus	0.004	<0.002	0.005
Soluble Reactive Phosphorus	0.002	0.001	0.003
Sodium	13.80	13.60	3.61
Calcium	44.70	43.90	25.80
Potassium	4.25	4.18	1.83

While the prevalence of non-detects of bromide seemingly confounds the overall analysis, the nondetect bromide data along with a median chloride concentration of 7.45 mg/L and a maximum chloride concentration of 32 mg/L in samples can still be informative. Together, this is an indication that the SVRP groundwater is typically within the range of dilute groundwater and that slightly higher concentrations of chloride (e.g. those above 10 mg/L) may or may not be a result of anthropogenic sources.

If road runoff or road salt (halite) was influencing the SVRP aquifer groundwater quality as suspected, more samples would have chloride and bromide concentrations resulting in high Cl/Br ratios. Studies suggest that groundwater dominated by halite sources would have Cl/Br ratios of at least 1,000 with chloride concentrations of at least 100 mg/L. In addition, it has been demonstrated that groundwater samples affected by road salt come from wells in close proximity to roads, usually within 100 feet (Katz et al, 2011; Jagucki and Darner 2001; and Mullaney et al 2009). Yet, even though most SVRP aquifer monitoring locations are within 100 feet of a road or parking lot, chloride concentrations are not indicative of halite influence and samples could not have Cl/Br ratios calculated due to non-detect bromide concentrations. For comparison, the Fire Station well is over 300 feet from any nearby road. Therefore, it appears that road deicing is not affecting the SVRP aquifer groundwater quality. However, given the sampling schedule, it is possible that the influence of road runoff on groundwater was missed by the quarterly snap-shot.

Given that the analysis using the Cl/Br ratios seems to indicate chloride levels in the SVRP aquifer are generally within the range for dilute groundwater with some potential for slightly elevated levels, two

other factors were briefly considered for determining potential effects on chloride levels: well depth and location type.

Plotting chloride concentrations against well depth does not show a correlation between well depth and levels of chloride (Figure 3). However, looking at chloride concentrations by type of monitoring location (monitoring well, purveyor well, and natural springs) shows that monitoring wells have lower chloride concentrations than purveyor wells and natural springs (Figure 4). In fact, a Mann-Whitney test conducted on the data indicates that chloride levels at monitoring wells are significantly different from chloride levels at purveyor wells (z = 3.407, p < 0.05). However, the same test indicates there is no significant difference between chloride levels at purveyor wells and chloride levels at the natural springs (z = 1.35, p > 0.05).



Figure 4. Scatter plot of well depth versus chloride concentrations.



Figure 5. Boxplots showing chloride concentrations by type of monitoring location: monitoring wells (n = 84), purveyor wells (n = 40), and natural springs (n = 17).

Though the purveyor wells tend to have higher chloride concentrations than the monitoring wells, this (theoretically) should not be due to any treatment since sampling protocols were set to collect samples prior to treatment. The County is currently conducting a more thorough analysis of SVRP aquifer data for the 20-year period from 1999 to 2019, and will follow-up to see if these patterns emerge in long-term data.

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APPENDIX A Spokane County Water Resources - Spokane Valley Rathdrum Prairie Aquifer Monitoring

	2020 Quarterly Results													
			Well Name	NE Community Center, City monitoring well	Trinity School, Adams & Carlisle, City monitoring well	Trinity School, Adams & Carlisle, City monitoring well					Hale's Ale Nested Site, east			
		WC	MP Well ID	5304G01	5307M01	07M01 5308H01				5311J07		531	1J05	
		Samplel	D/Comment	5304G01	5307M01	5308H01	5308H01	5308H01	5308H01	5311J07	5311J05	5311J05	5311J05	5311J05
Quarte				3	3	1	2	3	4	3	1	2	3	4
		S	ample Date	8/4/20	8/3/20	2/5/20	5/5/20	8/3/20	10/28/20	8/7/20	2/5/20	5/5/20	8/7/20	10/28/20
		Static Wat	ter Level (ft)	179.59	139.22	82.08	79.55	86.21	84.45	68.03	63.23	59.15	67.82	66.49
		Samp	le Depth (ft)	182	148	87	87	88	87	105	65	63	69	68
		Conducti	vity (µS/cm)	256.20	225.60	208.70	220.60	157.60	213.60	297.90	285.10	350.00	300.60	311.80
		Water Tempe	erature (C°)	13.50	16.40	13.40	13.00	14.50	13.70	11.90	10.70	11.80	11.60	11.50
pH				7.98	8.14	7.87	6.95	7.94	7.78	7.87	7.79	7.68	7.84	7.80
Ausslates	Washingto	n Drinking Wat	ter Standards											
Analytes	MCL ¹	Trigger Level ²	Secondary											
Phosphorus	-	-	-	0.005	0.008	0.006	0.004	0.008	0.003	0.006	0.013	0.007	0.006	<0.002
SRP ³	-	-	-	0.002	0.002	0.002	0.004	0.002	0.002	0.003	0.013	0.004	0.002	0.002
Nitrate+Nitrite	10	5	-	1.260	1.130	1.040	1.050	0.790	1.020	1.490	1.600	1.870	1.510	1.520
Arsenic	0.01	0.005	-	0.00264	0.00254	-	-	0.00243	-	0.00316	-	-	0.00323	-
Lead ⁴	0.015	-	-	<0.0010	<0.0010	-	-	<0.0010	-	<0.0010	-	-	<0.0010	-
Copper ⁴	1.3	-	-	<0.00100	<0.00100	-	-	<0.00100	-	<0.00100	-	-	<0.00100	-
Mercury	0.002	0.0004	-	<0.00020	<0.00020	-	-	<0.00020	-	<0.00020	-	-	<0.00020	-
Cadmium	0.005	0.005	-	<0.0002	<0.0002	-	-	<0.0002	-	<0.0002	-	-	<0.0002	-
Chromium	0.1	0.02	-	<0.0015	<0.0015	-	-	<0.0015	-	<0.0015	-	-	<0.0015	-
Fluoride	4	0.5	2	<0.10	<0.10	-	-	<0.10	-	<0.10	-	-	<0.10	-
Chloride	-	250	250	8.04	7.92	5.84	5.96	5.75	6.40	8.87	7.70	8.09	9.20	8.35
Sodium	-	-	-	5.04	4.14	-	-	3.17	-	4.98	-	-	5.09	-
Zinc	-	5	5	<0.005	<0.005	-	-	<0.005	-	0.012	-	-	<0.005	-
Magnesium	-	-	-	14.70	10.50	-	-	6.84	-	17.30	-	-	16.90	-
Potassium	-	-	-	1.99	1.84	-	-	1.39	-	2.11	-	-	2.09	-
Manganese	-	0.05	0.05	<0.001	<0.001	-	-	<0.001	-	<0.001	-	-	<0.001	-
Calcium	-	-	-	31.40	30.30	-	-	19.90	-	37.10	-	-	37.50	-
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

All results reported in mg/l (ppm)

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Felts Fi monitor	eld City ing well	Plantes Ferry Park monitoring well	monitoring well Frederick & Bowdish			moni	itoring well at	SCC		
		WC	MP Well ID	5312	2C01	5404A01	5409C02				5310Q01			
		Samplel	D/Comment	5312C01	5312C01	5404A01	5409C02	5310Q01	5310Q01a	5310Q01	5310Q01a	5310Q01	5310Q01a	5310Q01
Quarter			Quarter	2	3	3	3	1	1	2	2	3	3	4
		S	ample Date	5/5/20	8/3/20	8/7/20	8/13/20	2/5/20	2/5/20	5/5/20	5/5/20	8/3/20	8/3/20	10/28/20
		Static Wat	ter Level (ft)	56.34	63.29	48.13	92.60	34.95	-	30.79	-	40.05	-	38.38
		Samp	le Depth (ft)	58	68	110	94	42	-	41	-	41	-	41
		Conducti	vity (µS/cm)	228.80	-	266.8	275.90	191.20	-	236.6	-	183.60	-	185.9
		Water Tempe	erature (C°)	14.00	-	13.40	11.20	13.00	-	13.3	-	14.80	-	13.7
			pН	7.12	-	7.07	7.75	8.17	-	7.72	-	8.31	-	8.07
Analytes	Washingto	<mark>n Drinking Wat</mark>	ter Standards											
Analytes	MCL ¹	Trigger Level ²	Secondary											
Phosphorus	-	-	-	-	0.015	0.381	-	0.005	0.005	0.004	0.004	0.005	0.005	0.003
SRP ³	-	-	-	-	0.015	0.019	-	0.002	0.002	0.003	0.003	0.004	0.003	<0.001
Nitrate+Nitrite	10	5	-	-	0.950	0.090	-	0.859	0.824	1.050	1.020	0.760	0.790	0.721
Arsenic	0.01	0.005	-	0.00586	0.00629	<0.00100	0.00830	-	-	-	-	0.00338	0.00345	-
Lead ⁴	0.015	-	-	<0.0010	<0.0010	<0.0010	<0.0010	-	-	-	-	<0.0010	<0.0010	-
Copper ⁴	1.3	-	-	<0.00100	<0.00100	0.02590	<0.00100	-	-	-	-	<0.00100	<0.00100	-
Mercury	0.002	0.0004	-	<0.00020	<0.00020	<0.00020	<0.00020	-	-	-	-	<0.00020	<0.00020	-
Cadmium	0.005	0.005	-	<0.0002	<0.0002	<0.0002	<0.0002	-	-	-	-	<0.0002	<0.0002	-
Chromium	0.1	0.02	-	-	<0.0015	<0.0015	0.00215	-	-	-	-	<0.0015	<0.0015	-
Fluoride	4	0.5	2	-	<0.10	0.27	-	-	-	-	-	<0.10	<0.10	-
Chloride	-	250	250	-	3.60	1.92	-	4.97	4.98	6.28	6.29	5.70	5.60	4.60
Sodium	-	-	-	-	3.42	11.00	4.24	-	-	-	-	3.08	3.13	-
Zinc	-	5	5	<0.005	<0.005	0.132	<0.005	-	-	-	-	<0.005	<0.005	-
Magnesium	-	-	-	-	6.60	14.60	14.60	-	-	-	-	8.08	8.08	-
Potassium	-	-	-	-	1.41	5.65	1.95	-	-	-	-	1.51	1.52	-
Manganese	-	0.05	0.05	-	<0.001	0.329	0.123	-	-	-	-	0.022	0.020	-
Calcium	-	-	-	-	24.40	25.40	37.00	-	-	-	-	24.60	24.40	-
Bromide	-	-	-	-	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	monitoring well at SCC	Oli	ve & Fiske	monitoring v	vell	Thirc	, east	Third & Havana Nested Site, mid		
		WC	MP Well ID	5310Q01		531	5L01			532	5322A03		
		Samplel	D/Comment	5310Q01a	5315L01	5315L01	5315L01	5315L01	5322A01	5322A01	5322A01	5322A01	5322A03
			Quarter	4	1	2	3	4	1	2	3	4	3
		S	Sample Date	10/28/20	2/5/20	5/5/20	8/3/20	10/28/20	2/5/20	5/5/20	8/3/20	10/28/20	8/3/20
		Static Wa	ter Level (ft)	-	65.51	61.87	69.69	68.29	48.19	44.44	52.37	50.90	52.51
		Samp	le Depth (ft)	-	69	68	71	70	49	47	54	52	90
		Conducti	vity (µS/cm)	-	237.40	267.30	209.00	218.60	273.60	327.90	343.10	267.70	246.70
		erature (C°)	-	12.60	14.00	14.90	13.20	12.50	14.00	15.40	13.00	14.60	
			pН	-	8.09	7.77	7.93	7.90	8.30	7.61	7.85	7.62	7.93
Analytaa	Analytos Washington Drinking Water Standard												
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	0.003	0.007	0.005	0.009	0.004	0.009	0.009	0.007	0.007	0.008
SRP ³	-	-	-	<0.001	0.004	0.003	0.004	0.004	0.009	0.009	0.006	0.006	0.006
Nitrate+Nitrite	10	5	-	0.702	1.110	1.210	0.970	0.913	1.590	1.850	1.410	1.300	1.500
Arsenic	0.01	0.005	-	-	-	-	0.00245	-	-	-	0.00260	-	0.00276
Lead ⁴	0.015	-	-	-	-	-	<0.0010	-	-	-	<0.0010	-	<0.0010
Copper ⁴	1.3	-	-	-	-	-	< 0.00100	-	-	-	< 0.00100	-	< 0.00100
Mercury	0.002	0.0004	-	-	-	-	<0.00020	-	-	-	<0.00020	-	<0.00020
Cadmium	0.005	0.005	-	-	-	-	< 0.0002	-	-	-	<0.0002	-	<0.0002
Chromium	0.1	0.02	-	-	-	-	<0.0015	-	-	-	<0.0015	-	<0.0015
Fluoride	4	0.5	2	-	-	-	<0.10	-	-	-	<0.10	-	<0.10
Chloride	-	250	250	4.61	9.89	9.46	7.50	5.91	14.40	17.50	8.75	9.45	9.24
Sodium	-	-	-	-	-	-	3.36	-	-	-	4.83	-	5.07
Zinc	-	5	5	-	-	-	< 0.005	-	-	-	< 0.005	-	< 0.005
Magnesium	-	-	-	-	-	-	9.60	-	-	-	11.20	-	11.00
Potassium	-	-	-	-	-	-	1.65	-	-	-	1.97	-	1.93
Manganese	-	0.05	0.05	-	-	-	<0.001	-	-	-	<0.001	-	<0.001
Calcium	-	-	-	-	-	-	28.10	-	-	-	34.10	-	33.60
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

All results reported in mg/l (ppm)

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	6th & Ha	ivana monit (MW-2)	oring well	6th & Havana monitoring well (MW-2)	na CITY of SPOKANE-Ray)				CITY of SPOKANE- Nevada	Sullivan I Krispy monitor	Road and Kreme, ing well
		WC	MP Well ID		5323E01		5323E01		5322	2F01		5308A02	5411	IR06
	SampleID/Commen				5323E01	5323E01	5323E01	5322F01	5322F01	5322F01	5322F01	5308A02	5411R06	5411R06
			Quarter	1	2	3	4	1	2	3	4	3	1	2
		S	Sample Date	2/5/20	5/5/20	8/3/20	10/28/20	1/21/20	4/21/20	7/28/20	10/27/20	7/28/20	2/4/20	5/5/20
		Static Wa	ter Level (ft)	48.84	45.11	52.94	51.49	-	-	-	-	-	46.05	42.24
		Samp	le Depth (ft)	50	46	54	53	-	-	-	-	-	47	44
		Conducti	vity (µS/cm)	358.00	364.10	350.00	376.80	440.30	432.00	376.90	440.60	179.90	222.20	83.10
Water Temperature (C°)				12.20	13.30	15.30	13.1	11.80	11.90	12.10	11.70	17.30	10.10	10.90
pH				7.97	7.53	7.54	7.52	8.60	8.33	7.98	8.10	8.22	8.29	8.09
Ausslates	Analytos Washington Drinking Water Standard													
Analytes	MCL ¹	Trigger Level ²	Secondary											
Phosphorus	-	-	-	0.011	0.015	0.012	0.014	0.021	0.022	0.016	0.020	0.004	0.006	0.007
SRP ³	-	-	-	0.011	0.015	0.011	0.010	0.020	0.018	0.015	0.018	0.003	0.003	0.006
Nitrate+Nitrite	10	5	-	2.510	2.250	2.570	2.380	3.900	3.430	2.960	3.140	0.850	0.819	0.080
Arsenic	0.01	0.005	-	-	-	0.00359	-	-	-	0.00385	-	0.00275	-	-
Lead ⁴	0.015	-	-	-	-	<0.0010	-	-	-	<0.0010	-	<0.0010	-	-
Copper ⁴	1.3	-	-	-	-	< 0.00100	-	-	-	0.00850	-	0.00190	-	-
Mercury	0.002	0.0004	-	-	-	< 0.00020	-	-	-	<0.00020	-	<0.00020	-	-
Cadmium	0.005	0.005	-	-	-	< 0.0002	-	-	-	< 0.0002	-	<0.0002	-	-
Chromium	0.1	0.02	-	-	-	<0.0015	-	-	-	<0.0015	-	<0.0015	-	-
Fluoride	4	0.5	2	-	-	<0.10	-	-	-	<0.10	-	<0.10	-	-
Chloride	-	250	250	16.20	13.10	17.00	15.80	25.80	23.60	19.20	24.10	4.95	2.69	2.44
Sodium	-	-	-	-	-	8.10	-	-	-	9.78	-	3.07	-	-
Zinc	-	5	5	-	-	<0.005	-	-	-	< 0.005	-	< 0.005	-	-
Magnesium	-	-	-	-	-	16.50	-	-	-	16.80	-	7.75	-	-
Potassium	-	-	-	-	-	2.72	-	-	-	2.83	-	1.41	-	-
Manganese	-	0.05	0.05	-	-	<0.001	-	-	-	<0.001	-	<0.001	-	-
Calcium	-	-	-	-	-	48.80	-	-	-	53.50	-	23.90	-	-
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

All results reported in mg/l (ppm)

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Sullivan F Krispy I monitor	Road and Kreme, ing well	Mission a monitorir CII	& Barker ng well at D 4	I.E. COLD STORAGE	Trent &	& Barker Ro	ad, monitori	ng well	Barker Road north of river, monitoring well
		WC	MP Well ID	5411	R06	5517	D05	5213B01		550	5D01		5507H01
		Samplel	D/Comment	5411R06	5411R06	5517D05	5517D05	5213B01	5505D01	5505D01	5505D01	5505D01	5507H01
			Quarter	3	4	2	3	3	1	2	3	4	2
		S	Sample Date	8/7/20	10/29/20	5/7/20	8/6/20	7/28/20	2/4/20	5/7/20	8/6/20	10/29/20	5/7/20
	Static Water Level (ft)				49.96	79.96	85.91	-	91.89	88.68	94.02	92.72	43.10
		Samp	le Depth (ft)	53	51	85	87	-	93	90	95	94	45
		Conducti	vity (µS/cm)	220.20	259.50	112.50	89.10	36.10	359.20	413.10	346.90	365.90	98.10
		Water Tempe	erature (C°)	11.90	12.00	14.70	13.20	12.20	10.60	11.30	11.80	12.70	9.00
			pН	7.95	7.52	7.51	7.75	7.82	8.03	7.83	7.92	7.58	7.50
Analytas	Analytos Washington Drinking Water Standards		ter Standards										
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	0.006	0.005	-	0.006	0.008	0.010	0.014	0.011	0.011	-
SRP ³	-	-	-	0.002	0.004	-	0.003	0.007	0.009	0.010	0.010	0.010	-
Nitrate+Nitrite	10	5	-	0.950	1.110	-	0.370	2.030	3.020	3.680	3.440	3.130	-
Arsenic	0.01	0.005	-	0.00231	-	<0.00100	< 0.00100	0.00240	-	-	0.00527	-	<0.00100
Lead ⁴	0.015	-	-	<0.0010	-	<0.0010	<0.0010	<0.0010	-	-	<0.0010	-	<0.0010
Copper ⁴	1.3	-	-	<0.00100	-	<0.00100	< 0.00100	0.00250	-	-	<0.00100	-	<0.00100
Mercury	0.002	0.0004	-	<0.00020	-	<0.00020	< 0.00020	<0.00020	-	-	<0.00020	-	<0.00020
Cadmium	0.005	0.005	-	< 0.0002	-	< 0.0002	< 0.0002	<0.0002	-	-	< 0.0002	-	<0.0002
Chromium	0.1	0.02	-	<0.0015	-	-	<0.0015	<0.0015	-	-	<0.0015	-	-
Fluoride	4	0.5	2	<0.10	-	-	<0.10	<0.10	-	-	<0.10	-	-
Chloride	-	250	250	3.34	3.03	-	2.46	32.00	6.64	7.52	7.52	7.45	-
Sodium	-	-	-	3.03	-	-	2.33	10.70	-	-	6.33	-	-
Zinc	-	5	5	<0.005	-	0.014	< 0.005	< 0.005	-	-	<0.005	-	0.008
Magnesium	-	-	-	13.50	-	-	3.82	13.80	-	-	14.60	-	-
Potassium	-	-	-	1.67	-	-	0.98	2.66	-	-	2.44	-	-
Manganese	-	0.05	0.05	<0.001	-	-	<0.001	<0.001	-	-	<0.001	-	-
Calcium	-	-	-	29.40	-	-	11.20	42.40	-	-	50.30	-	-
Bromide	-	-	-	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-

All results reported in mg/l (ppm)

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Barker Road Trail North, m	d Centennial conitoring well	VERA V	VATER & P	OWER, Nev	v Well 4	E. SPOKANE WTR DIST, Site 1			
		WG	QMP Well ID	5508	BM01		542	6L03			5324	4G01	
		Samplel	D/Comment	5508M01	5508M01	5426L03	5426L03	5426L03	5426L03	5324G01	5324G01	5324G01	5324G01
			Quarter	2	3	1	2	3	4	1	2	3	4
		S	Sample Date	5/7/20	8/6/20	1/21/20	4/21/20	7/28/20	10/27/20	1/21/20	4/21/20	7/28/20	10/29/20
		Static Wa	ter Level (ft)	62.02	68.34	-	-	-	-	-	-	-	-
		Samp	le Depth (ft)	64	70	-	-	-	-	-	-	-	-
		Conducti	vity (µS/cm)	62.80	56.3	352.30	389.10	385.00	423.00	421.40	462.00	433.80	451.40
		Water Tempe	erature (C°)	8.90	18.80	10.60	11.10	10.07	10.90	10.80	11.30	11.30	11.10
			pН	7.46	7.34	7.94	7.97	7.55	7.70	7.84	8.03	7.65	7.37
Analytaa	Washingto	n Drinking Wa	ter Standards										
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	-	0.010	0.008	0.009	0.007	0.007	0.020	0.018	0.018	0.019
SRP ³	-	-	-	-	0.009	0.008	0.008	0.006	0.007	0.019	0.018	0.017	0.019
Nitrate+Nitrite	10	5	-	-	0.280	2.690	2.580	2.980	2.850	3.490	3.510	3.560	2.960
Arsenic	0.01	0.005	-	<0.00100	<0.00100	-	-	0.00418	-	-	-	0.00477	-
Lead ⁴	0.015	-	-	<0.0010	<0.0010	-	-	<0.0010	-	-	-	<0.0010	-
Copper ⁴	1.3	-	-	<0.00100	<0.00100	-	-	<0.00100	-	-	-	0.00220	-
Mercury	0.002	0.0004	-	<0.00020	<0.00020	-	-	<0.00020	-	-	-	<0.00020	-
Cadmium	0.005	0.005	-	<0.0002	<0.0002	-	-	<0.0002	-	-	-	<0.0002	-
Chromium	0.1	0.02	-	-	<0.0015	-	-	<0.0015	-	-	-	<0.0015	-
Fluoride	4	0.5	2	-	<0.10	-	-	<0.10	-	-	-	<0.10	-
Chloride	-	250	250	-	1.90	11.70	12.30	11.70	12.70	19.50	22.10	19.70	20.00
Sodium	-	-	-	-	2.63	-	-	8.70	-	-	-	10.60	-
Zinc	-	5	5	0.028	0.022	-	-	0.006	-	-	-	0.006	-
Magnesium	-	-	-	-	1.82	-	-	15.70	-	-	-	19.30	-
Potassium	-	-	-	-	0.90	-	-	3.11	-	-	-	3.25	-
Manganese	-	0.05	0.05	-	<0.001	-	-	<0.001	-	-	-	<0.001	-
Calcium	-	-	-	-	6.20	-	-	55.80	-	-	-	59.10	-
Bromide	-	-	-	_	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Euclid & Barker monitoring well at CID5								MODERN ELECT WATER, Site 11	New Bal monitor	four Park ing well
		WC	MP Well ID			1	5507A04				5408N01	5415E03	5417	7R02
		Samplel	D/Comment	5507A04	5507A04a	5507A04	5507A04a	5507A04	5507A04	5507A04a	5408N01	5415E03	5417R02	5417R02
			Quarter	1	1	2	2	3	4	4	3	3	1	2
		S	Sample Date	2/4/20	2/4/20	5/7/20	5/7/20	8/6/20	10/29/20	10/29/20	7/28/20	7/28/20	2/5/20	5/7/20
		Static Wa	ter Level (ft)	68.80	-	65.46	-	71.34	69.92	-	-	-	70.31	66.82
		Samp	le Depth (ft)	71	-	70	-	73	71	-	-	-	72	68
		Conducti	vity (µS/cm)	337.80	-	378.80	-	316.30	335.40	-	229.30	198.30	206.60	211.30
		Water Tempe	erature (C°)	9.80	-	10.40	-	11.10	11.70	-	11.90	11.70	13.10	13.90
		-	pH	8.00	-	7.85	-	7.43	7.50	-	7.89	7.98	8.19	7.85
	Washingto	n Drinking Wat	ter Standards											
Analytes	MCL ¹	Trigger Level ²	Secondary											
Phosphorus	-	-	-	0.003	0.004	0.005	0.005	0.006	<0.002	< 0.002	0.003	0.003	0.008	0.007
SRP ³	-	-	-	< 0.001	<0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	0.007	0.006
Nitrate+Nitrite	10	5	-	1.440	1.410	1.800	1.790	1.610	1.490	1.470	1.320	1.080	1.130	1.010
Arsenic	0.01	0.005	-	-	-	0.00199	0.00199	0.00202	-	-	0.00298	0.00347	-	-
Lead ⁴	0.015	-	-	-	-	<0.0010	<0.0010	<0.0010	-	-	<0.0010	<0.0010	-	-
Copper ⁴	1.3	-	-	-	-	< 0.00100	<0.00100	<0.00100	-	-	< 0.00100	<0.00100	-	-
Mercury	0.002	0.0004	-	-	-	<0.00020	<0.00020	<0.00020	-	-	<0.00020	<0.00020	-	-
Cadmium	0.005	0.005	-	-	-	< 0.0002	< 0.0002	<0.0002	-	-	< 0.0002	< 0.0002	-	-
Chromium	0.1	0.02	-	-	-	-	-	<0.0015	-	-	<0.0015	<0.0015	-	-
Fluoride	4	0.5	2	-	-	-	-	<0.10	-	-	<0.10	<0.10	-	-
Chloride	-	250	250	2.72	2.73	2.86	2.85	2.76	2.92	2.91	4.49	4.01	7.33	5.77
Sodium	-	-	-	-	-	-	-	3.27	-	-	3.05	2.81	-	-
Zinc	-	5	5	-	-	< 0.005	< 0.005	<0.005	-	-	<0.005	<0.005	-	-
Magnesium	-	-	-	-	-	-	-	18.90	-	-	12.40	10.40	-	-
Potassium	-	-	-	-	-	-	-	2.12	-	-	1.82	1.62	-	-
Manganese	-	0.05	0.05	-	-	-	-	<0.001	-	-	<0.001	<0.001	-	-
Calcium	-	-	-	-	-	-	-	41.70	-	-	30.40	25.50	-	-
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

												-			
			Well Name	New Balfour Park monitoring well		Holy Cross, Rhoades & Washington monitoring well	Franklin Park, City monitoring well	East Valley High School monitoring well				ORCHARD AVE IRRIG DIST, Site 1			
		WG	MP Well ID	5417	'R02	6330.J01	6331,101		6436	6N01			5312H01		
		Samplel	D/Comment	5417R02	5417R02	6330J01	6331J01	6436N01	6436N01	6436N01	6436N01	5312H01	5312H01	5312H01	
			Quarter	3	4	3	3	1	2	3	4	1	2	3	
		S	ample Date	8/7/20	10/29/20	8/4/20	8/4/20	2/4/20	5/5/20	8/7/20	10/29/20	1/21/20	4/21/20	7/28/20	
	Static Water Level (ft				72.27	210.24	206.31	114.20	110.62	117.77	116.02	-	-	-	
	Sample Depth (ft				74	212	208.5	116	112	119	117	-	-	-	
	Conductivity (µS/cm				205.00	232.70	229.90	582.40	531.60	495.10	602.10	264.00	304.40	292.90	
	Water Temperature (C°			14.70	14.60	15.60	13.90	12.90	14.30	14.10	13.80	10.50	10.40	10.90	
pl			pH	7.97	7.50	7.86	8.02	7.86	7.35	7.33	7.15	8.17	8.06	7.74	
Ausslates	Analytes Washington Drinking Water Standa														
Analytes	MCL ¹	Trigger Level ²	Secondary												
Phosphorus	-	-	-	0.009	0.025	0.005	0.006	0.034	0.042	0.056	0.043	0.014	0.017	0.013	
SRP ³	-	-	-	0.007	<0.001	0.002	0.002	0.033	0.039	0.042	0.041	0.014	0.014	0.011	
Nitrate+Nitrite	10	5	-	0.790	0.840	1.010	0.990	3.160	4.990	4.650	3.880	1.760	2.010	2.240	
Arsenic	0.01	0.005	-	0.00272	-	0.00337	0.00394	-	-	0.00277	-	-	0.00498	0.00490	
Lead ⁴	0.015	-	-	<0.0010	-	<0.0010	<0.0010	-	-	<0.0010	-	-	<0.0010	<0.0010	
Copper ⁴	1.3	-	-	< 0.00100	-	<0.00100	<0.00100	-	-	0.00120	-	-	< 0.00100	<0.00100	
Mercury	0.002	0.0004	-	<0.00020	-	<0.00020	<0.00020	-	-	<0.00020	-	-	<0.00020	<0.00020	
Cadmium	0.005	0.005	-	< 0.0002	-	<0.0002	< 0.0002	-	-	< 0.0002	-	-	< 0.0002	< 0.0002	
Chromium	0.1	0.02	-	0.0020	-	<0.0015	0.0030	-	-	0.0089	-	-	-	<0.0015	
Fluoride	4	0.5	2	<0.10	-	<0.10	<0.10	-	-	<0.10	-	-	-	<0.10	
Chloride	-	250	250	5.58	6.54	4.76	7.61	28.40	16.90	7.18	28.50	5.29	6.63	6.84	
Sodium	-	-	-	2.93	-	3.65	3.26	-	-	10.20	-	-	-	4.68	
Zinc	-	5	5	<0.005	-	< 0.005	<0.005	-	-	< 0.005	-	-	0.009	0.015	
Magnesium	-	-	-	8.02	-	15.10	13.70	-	-	27.70	-	-	-	14.10	
Potassium	-	-	-	1.50	-	1.89	1.79	-	-	3.98	-	-	-	2.20	
Manganese	-	0.05	0.05	0.002	-	<0.001	0.002	-	-	0.012	-	-	-	<0.001	
Calcium	-	-	-	25.60	-	27.60	27.90	-	-	66.60	-	-	-	40.50	
Bromide	Calcium Bromide			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	

All results reported in mg/l (ppm)

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	ORCHARD AVE IRRIG DIST, Site 1		S	pokane Co	Water Dist #	3, Site 2-5, 2	26th & Vercl	er		WHITWORTH WATER DIST. #2, Well 2A
		WC	QMP Well ID	5312H01				542	7L01				6320D01
		Samplel	D/Comment	5312H01	5427L01	5427L01a	5427L01	5427L01a	5427L01	5427L01a	5427L01	5427L01a	6320D01
			Quarter	4	1	1	2	2	3	3	4	4	3
		S	Sample Date	10/27/20	1/21/20	1/21/20	4/21/20	4/21/20	7/28/20	7/28/20	10/27/20	10/27/20	8/4/20
		Static Wa	ter Level (ft)	-	-	-	-	-	-	-	-	-	-
		Samp	le Depth (ft)	-	-	-	-	-	-	-	-	-	-
		Conducti	vity (µS/cm)	269.00	357.20	-	381.6	-	365.40	-	376.90	-	253.20
		Water Tempe	erature (C°)	10.40	11.5	-	12.1	-	12.80	-	11.60	-	14.50
			рН	7.95	8.02	-	7.94	-	7.70	-	7.79	-	8.07
Analytaa	Analytes Washington Drinking Water Standards												
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	0.012	0.007	0.007	0.008	0.007	0.007	0.006	0.005	0.005	0.004
SRP ³	-	-	-	0.011	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.001
Nitrate+Nitrite	10	5	-	1.400	2.440	2.460	2.360	2.340	2.430	2.480	2.150	2.150	1.570
Arsenic	0.01	0.005	-	-	-	-	-	-	0.00414	0.00412	-	-	0.00313
Lead ⁴	0.015	-	-	-	-	-	-	-	<0.0010	<0.0010	-	-	<0.0010
Copper ⁴	1.3	-	-	-	-	-	-	-	0.00220	0.00210	-	-	<0.00100
Mercury	0.002	0.0004	-	-	-	-	-	-	<0.00020	<0.00020	-	-	<0.00020
Cadmium	0.005	0.005	-	-	-	-	-	-	<0.0002	<0.0002	-	-	<0.0002
Chromium	0.1	0.02	-	-	-	-	ŀ	-	<0.0015	<0.0015	-	-	<0.0015
Fluoride	4	0.5	2	-	-	-	-	-	<0.10	<0.10	-	-	<0.10
Chloride	-	250	250	5.33	11.10	11.10	10.80	10.20	11.10	10.70	11.40	11.40	8.19
Sodium	-	-	-	-	-	-	-	-	6.93	7.00	-	-	3.85
Zinc	-	5	5	-	-	-	-	-	<0.005	<0.005	-	-	<0.005
Magnesium	-	-	-	-	-	-	-	-	17.90	18.00	-	-	16.40
Potassium	-	-	-	-	-	-	-	-	2.75	2.78	-	-	1.99
Manganese	-	0.05	0.05	-	-	-	-	-	<0.001	<0.001	-	-	<0.001
Calcium	-	-	-	-	-	-	-	-	50.20	50.60	-	-	30.60
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Fire S	tation Hous	ton & Regal	, No. Spokar	ne WD	NORTH SPOKANE IRRIG. DIST. # 4, Site 4	Idaho Roa	ing well at		
		WC	QMP Well ID			6327N04			6328H01		663 <i>°</i>	1M07	
		Samplel	D/Comment	6327N04	6327N04	6327N04	6327N04a	6327N04	6328H01	6631M07	6631M07	6631M07	6331M07
			Quarter	1	2	3	3	4	3	1	2	3	4
		S	Sample Date	2/5/20	5/5/20	8/4/20	8/4/20	10/28/20	8/4/20	2/4/20	5/7/20	8/6/20	10/29/20
		Static Wa	ter Level (ft)	188.72	186.32	187.52	-	189.63	-	114.49	112.72	115.55	114.44
Sample Depth (ft)				190	187	189	-	191	-	116	114	117	116
		Conducti	vity (µS/cm)	370.1	407.60	443.10	-	440.00	197.70	264.40	297.50	250.80	260.60
	Water Temperature (C°			12.7	13.20	14.80	-	12.10	12.00	13.90	14.10	15.00	14.60
pł				7.87	7.31	7.75	-	7.55	7.94	8.18	8.23	8.08	7.83
Analytaa	Analytes Washington Drinking Water Standar												
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	0.005	0.003	0.003	0.004	<0.002	0.005	0.005	0.005	0.004	0.004
SRP ³	-	-	-	0.002	0.002	0.002	0.002	0.001	0.003	0.003	0.003	0.003	0.004
Nitrate+Nitrite	10	5	-	2.880	2.860	3.860	3.640	3.790	0.940	1.360	1.740	1.700	1.480
Arsenic	0.01	0.005	-	-	-	0.00156	0.00150	-	0.00292	-	-	0.00499	-
Lead ⁴	0.015	-	-	-	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010	-
Copper ⁴	1.3	-	-	-	-	< 0.00100	<0.00100	-	0.00140	-	-	< 0.00100	-
Mercury	0.002	0.0004	-	-	-	<0.00020	<0.00020	-	<0.00020	-	-	<0.00020	-
Cadmium	0.005	0.005	-	-	-	<0.0002	<0.0002	-	<0.0002	-	-	< 0.0002	-
Chromium	0.1	0.02	-	-	-	<0.0015	<0.0015	-	<0.0015	-	-	<0.0015	-
Fluoride	4	0.5	2	-	-	<0.10	<0.10	-	0.12	-	-	<0.10	-
Chloride	-	250	250	11.40	9.86	22.20	22.30	19.50	3.73	5.52	5.44	5.37	5.63
Sodium	-	-	-	-	-	13.80	13.60	-	3.61	-	-	3.18	-
Zinc	-	5	5	-	-	<0.005	<0.005	-	<0.005	-	-	<0.005	-
Magnesium	-	-	-	-	-	30.90	30.40	-	10.60	-	-	14.10	-
Potassium	-	-	-	-	-	4.25	4.18	-	1.83	-	-	2.13	-
Manganese	-	0.05	0.05	-	-	<0.001	<0.001	-	<0.001	-	-	<0.001	-
Calcium	-	-	-	-	-	44.70	43.90	-	25.80	-	-	31.40	-
Bromide	-	-	-	<0.10	<0.10	<0.10	0.11	0.13	<0.10	<0.10	<0.10	<0.10	<0.10

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	ldaho	Road 300 f monito	t south of pij ring well	beline,	Idaho I	Road 1000 f	ing well	Orchard Ave Irrig Dist Site 2			
		WG	MP Well ID		652	5R01				6524R01			5407	7C01
		Samplel	D/Comment	6525R01	6525R01	6525R01	6525R01	6524R01	6524R01	6524R01	6524R01a	6524R01	5407C01	5407C01
			Quarter	1	2	3	4	1	2	3	3	4	3	4
		S	Sample Date	2/4/20	5/7/20	8/6/20	10/29/20	2/4/20	5/7/20	8/6/20	8/6/20	10/29/20	7/28/20	10/27/20
		Static Wa	ter Level (ft)	103.62	102.09	104.59	103.69	125.29	124.22	126.46	-	125.71	-	-
		Samp	le Depth (ft)	105	103	106	105	127	125	128	-	127	-	-
		Conducti	vity (µS/cm)	315.30	351.60	290.9	303.9	325.2	364.50	293.60	-	301.40	295.70	277.70
		Water Tempe	erature (C°)	9.90	10.40	11.2	11.2	10.30	10.70	11.70	-	11.20	22.30	17.00
		-	pH	8.09	8.02	7.86	7.64	8.01	7.85	7.86	-	7.58	7.91	8.16
Ameliates	Washingto	n Drinking Wa	ter Standards											
Analytes	MCL ¹	Trigger Level ²	Secondary											
Phosphorus	-	-	-	0.004	< 0.002	0.004	0.004	0.005	0.003	0.005	0.005	< 0.002	0.008	0.009
SRP ³	-	-	-	0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.006	0.007
Nitrate+Nitrite	10	5	-	1.130	1.340	1.100	0.949	2.300	2.770	1.940	2.080	1.930	1.620	1.450
Arsenic	0.01	0.005	-	-	-	0.00221	-	-	-	0.00286	0.00278	-	0.00265	-
Lead ⁴	0.015	-	-	-	-	<0.0010	-	-	-	<0.0010	<0.0010	-	<0.0010	-
Copper ⁴	1.3	-	-	-	-	< 0.00100	-	-	-	<0.00100	<0.00100	-	0.00340	-
Mercury	0.002	0.0004	-	-	-	<0.00020	-	-	-	<0.00020	<0.00020	-	< 0.00020	-
Cadmium	0.005	0.005	-	-	-	<0.0002	-	-	-	< 0.0002	<0.0002	-	< 0.0002	-
Chromium	0.1	0.02	-	-	-	<0.0015	-	-	-	<0.0015	<0.0015	-	<0.0015	-
Fluoride	4	0.5	2	-	-	<0.10	-	-	-	<0.10	<0.10	-	<0.10	-
Chloride	-	250	250	3.11	2.90	2.16	2.38	4.67	4.66	4.01	4.02	4.37	7.52	5.55
Sodium	-	-	-	-	-	3.22	-	-	-	3.73	3.61	-	4.94	-
Zinc	-	5	5	-	-	< 0.005	-	-	-	< 0.005	< 0.005	-	0.008	-
Magnesium	-	-	-	-	-	18.10	-	-	-	16.60	16.00	-	14.80	-
Potassium	-	-	-	-	-	1.96	-	-	-	2.21	2.15	-	2.21	-
Manganese	-	0.05	0.05	-	-	<0.001	-	-	-	<0.001	<0.001	-	<0.001	-
Calcium	-	-	-	-	-	36.50	-	-	-	41.40	40.20	-	39.40	-
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

All results reported in mg/l (ppm)

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Mission Well, LIBERTY LAKE SEWER DIST		PASADEN	A PARK #2		CONSOLIDATED IRRIG DIST 19, Site 2A	CONSOLIDATED IRRIG DIST 19, Site 11B	SPOKAI	NE FISH HA BRIFFITH SF	TCHERY, PR
		WC	MP Well ID	5515C01		540	5K01		5518R01	6631M04		6211J01s	
		Samplel	D/Comment	5515C01	5405K01	5405K01	5405K01	5405K01	5518R01	6631M04	6211J01s	6211J01S	6211J01S
	Quart		Quarter	3	1	2	3	4	3	3	1	2	3
		S	Sample Date	7/28/20	1/21/20	4/21/20	7/28/20	10/27/20	7/28/20	8/6/20	1/21/20	4/21/20	8/4/20
		Static Wa	ter Level (ft)	-	-	-	-	-	-	-	-	-	-
		Samp	le Depth (ft)	-	-	-	-	-	-	-	-	-	-
		Conducti	vity (µS/cm)	281.00	193.40	196.50	176.80	194.40	140.60	232.70	305.60	327.30	302.90
		Water Tempe	erature (C°)	12.40	11.00	10.20	10.30	11.00	14.00	13.10	11.10	11.30	12.50
	p		pН	7.71	8.03	8.14	7.76	8.03	8.13	7.80	8.21	8.19	7.99
Analutaa	Washington Drinking Water Standa		ter Standards										
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	0.010	0.008	0.007	0.006	0.006	0.004	0.005	0.006	0.006	0.007
SRP ³	-	-	-	0.008	0.007	0.007	0.005	0.004	<0.001	0.003	0.004	0.005	0.004
Nitrate+Nitrite	10	5	-	1.480	1.840	1.320	1.300	0.874	0.680	1.340	1.920	1.810	1.760
Arsenic	0.01	0.005	-	0.00310	-	-	0.00145	-	0.00135	0.00541	-	-	0.00302
Lead ⁴	0.015	-	-	<0.0010	-	-	<0.0010	-	<0.0010	<0.0010	-	-	<0.0010
Copper ⁴	1.3	-	-	<0.00100	-	-	<0.00100	-	0.00110	0.00240	-	-	<0.00100
Mercury	0.002	0.0004	-	<0.00020	-	-	<0.00020	-	<0.00020	<0.00020	-	-	<0.00020
Cadmium	0.005	0.005	-	<0.0002	-	-	< 0.0002	-	<0.0002	<0.0002	-	-	<0.0002
Chromium	0.1	0.02	-	<0.0015	-	-	<0.0015	-	<0.0015	<0.0015	-	-	<0.0015
Fluoride	4	0.5	2	<0.10	-	-	<0.10	-	<0.10	<0.10	-	-	<0.10
Chloride	-	250	250	6.01	5.08	4.52	4.53	3.50	5.01	5.12	10.50	10.90	11.70
Sodium	-	-	-	5.33	-	-	3.75	-	2.69	3.03	-	-	4.88
Zinc	-	5	5	<0.005	-	-	< 0.005	-	< 0.005	<0.005	-	-	<0.005
Magnesium	-	-	-	13.10	-	-	7.54	-	5.41	13.00	-	-	19.50
Potassium	-	-	-	2.18	-	-	2.04	-	1.24	1.98	-	-	2.42
Manganese	-	0.05	0.05	<0.001	-	-	<0.001	-	<0.001	<0.001	-	-	<0.001
Calcium	-	-	-	39.00	-	-	23.50	-	21.00	28.30	-	-	35.40
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	SPOKANE FISH HATCHERY, GRIFFITH SPR SPR SPR SPR SPR SPR Spokane Fish Spokane Fish Spokane Fish Sullivan Spring Sullivan Spring							Waikiki Springs			
		WC	MP Well ID	6211J01s	6211K01	5411R05s		5212	F01s			6306P01s		
		Samplel	D/Comment	6211J01s	6211K01	5411R05S	5212F01S	5212F01S	5212F01S	5212F01s	6306P01s	6306P01s	6306P01s	
			Quarter	4	3	3	1	2	3	4	1	2	3	
		S	Sample Date	10/27/20	8/4/20	8/7/20	2/5/20	4/21/20	8/3/20	10/27/20	1/21/20	4/21/20	8/4/20	
		Static Wa	ter Level (ft)	-	-	-	-	-	-	-	-	-	-	
		Samp	le Depth (ft)	-	-	-	-	-	-	-	-	-	-	
		Conducti	vity (µS/cm)	324.90	277.70	211.40	319.6	301.4	285.10	333.90	334.00	423.90	373.10	
		Water Tempe	erature (C°)	11.20	13.30	12.60	11.3	11.7	12.30	11.40	10.70	10.90	11.10	
	pF			7.90	8.05	7.84	8.12	8.15	7.95	7.96	8.08	8.15	7.93	
Analytaa	halytes Washington Drinking Water Stand													
Analytes	MCL ¹	Trigger Level ²	Secondary											
Phosphorus	-	-	-	0.004	0.005	0.005	0.006	0.006	0.009	0.004	0.005	0.004	0.003	
SRP ³	-	-	-	0.004	0.004	0.002	0.004	0.005	0.004	0.003	0.002	0.004	0.002	
Nitrate+Nitrite	10	5	-	1.570	1.510	0.850	2.450	2.010	1.860	2.430	3.570	3.230	3.430	
Arsenic	0.01	0.005	-	-	0.00348	0.00317	-	-	0.00328	-	-	-	0.00222	
Lead ⁴	0.015	-	-	-	<0.0010	<0.0010	-	-	<0.0010	-	-	-	<0.0010	
Copper ⁴	1.3	-	-	-	0.00420	<0.00100	-	-	<0.00100	-	-	-	<0.00100	
Mercury	0.002	0.0004	-	-	0.0002	<0.00020	-	-	<0.00020	-	-	-	<0.00020	
Cadmium	0.005	0.005	-	-	0.0002	<0.0002	-	-	<0.0002	-	-	-	<0.0002	
Chromium	0.1	0.02	-	-	0.0015	<0.0015	-	-	<0.0015	-	-	-	<0.0015	
Fluoride	4	0.5	2	-	0.10	<0.10	-	-	<0.10	-	-	-	<0.10	
Chloride	-	250	250	11.40	9.12	2.87	12.90	13.10	16.00	16.60	15.10	19.00	16.30	
Sodium	-	-	-	-	4.29	2.87	-	-	6.32	-	-	-	7.11	
Zinc	-	5	5	-	0.012	<0.005	-	-	<0.005	-	-	-	<0.005	
Magnesium	-	-	-	-	18.10	11.60	-	-	13.30	-	-	-	24.50	
Potassium	-	-	-	-	2.24	1.77	-	-	2.19	-	-	-	2.73	
Manganese	-	0.05	0.05	-	<0.001	0.004	-	-	<0.001	-	-	-	<0.001	
Calcium	-	-	-	-	32.70	26.30	-	-	37.10	-	-	-	38.30	
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name	Waikiki Springs	V	Vaikiki Spring	s-new locatio	n		Bla	ank		
		WG	MP Well ID	6306P01s		6306F	P01s2			Bla	ank		
		Samplel	D/Comment	6306P01s	6306P01s2	6306P01s2	6306P01s2	6306P01s2	BLANK	BLANK	BLANK	BLANK	
			Quarter	4	1	2	3	4	1	2	3	4	
		S	Sample Date	10/27/20	1/21/20	4/21/20	8/4/20	10/27/20	2/5/20	5/7/20	8/4/20	10/28/20	
		Static Wa	ter Level (ft)	-	-	-	-	-	-	-	-	-	
		Samp	le Depth (ft)	-	-	-	-	-	-	-	-	-	
		Conducti	vity (µS/cm)	344.70	293.50	317.90	296.80	320.80	-	-	-	-	
		Water Tempe	erature (C°)	10.70	10.30	11.00	11.30	10.60	-	-	-	-	
			pН	7.95	8.31	8.29	8.08	7.95	-				
Analytaa	Washingto	n Drinking Wa	ter Standards										
Analytes	MCL ¹	Trigger Level ²	Secondary										
Phosphorus	-	-	-	0.003	0.005	0.006	0.003	0.003	<0.002	<0.002	<0.002	<0.002	
SRP ³	-	-	-	0.002	0.002	0.006	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	
Nitrate+Nitrite	10	5	-	3.220	2.120	2.080	2.180	2.050	<0.05	<0.05	<0.05	<0.05	
Arsenic	0.01	0.005	-	-	-	-	0.00254	-	-	<0.00100	<0.00100	-	
Lead ⁴	0.015	-	-	-	-	-	<0.0010	-	-	<0.0010	<0.0010	-	
Copper ⁴	1.3	-	-	-	-	-	<0.00100	-	-	<0.00100	<0.00100	-	
Mercury	0.002	0.0004	-	-	-	-	<0.00020	-	-	<0.00020	<0.00020	-	
Cadmium	0.005	0.005	-	-	-	-	<0.0002	-	-	<0.0002	<0.0002	-	
Chromium	0.1	0.02	-	-	-	-	<0.0015	-	-	-	<0.0015	-	
Fluoride	4	0.5	2	-	-	-	<0.10	-	-	-	<0.10	-	
Chloride	-	250	250	17.40	7.66	9.54	9.23	9.23	<0.2	<0.2	<0.2	<0.2	
Sodium	-	-	-	-	-	-	4.77	-	-	-	0.50	-	
Zinc	-	5	5	-	-	-	< 0.005	-	-	<0.005	< 0.005	-	
Magnesium	-	-	-	-	-	-	20.60	-	-	-	<0.5	-	
Potassium	-	-	-	-	-	-	2.47	-	-	-	<0.5	-	
Manganese	-	0.05	0.05	-	-	-	0.002	-	-	-	<0.001	-	
Calcium	-	-	-	-	-	-	33.70	-	-	-	<0.1	-	
Bromide	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	-	-	<0.1	-	

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus

			Well Name		Equipme	ent Blank				
		WC	MP Well ID	Equipment Blank						
		Samplel	D/Comment	EQUIP BLANK	EQUIP BLANK	EQUIP BLANK	EQUIP BLANK			
			Quarter	1	2	3	4			
		S	ample Date	2/5/20	5/7/20	8/4/20	10/28/20			
		Static Wa	ter Level (ft)	-	-	-	-			
		Samp	le Depth (ft)	-	-	-	-			
		Conducti	vity (µS/cm)	-	-	-	-			
		Water Tempe	erature (C°)	-	-	-	-			
			pН	-	-	-	-			
Analytos	Washingto	n Drinking Wat	ter Standards							
Analytes	MCL ¹	Trigger Level ²	Secondary							
Phosphorus	-	-	-	<0.002	<0.002	<0.002	<0.002			
SRP ³	-	-	-	<0.001	<0.001	<0.001	<0.001			
Nitrate+Nitrite	10	5	-	<0.05	<0.05	0.958	<0.05			
Arsenic	0.01	0.005	-	-	<0.00100	<0.00100	-			
Lead ⁴	0.015	-	-	-	<0.0010	<0.0010	-			
Copper ⁴	1.3	-	-	-	<0.00100	<0.00100	-			
Mercury	0.002	0.0004	-	-	<0.00020	<0.00020	-			
Cadmium	0.005	0.005	-	-	<0.0002	<0.0002	-			
Chromium	0.1	0.02	-	-	-	<0.0015	-			
Fluoride	4	0.5	2	-	-	<0.10	-			
Chloride	-	250	250	<0.2	<0.2	<0.2	<0.2			
Sodium	-	-	-	-	-	0.50	-			
Zinc	-	5	5	-	<0.005	<0.005	-			
Magnesium	-	-	-	-	-	<0.5	-			
Potassium	-	-	-	-	-	<0.5	-			
Manganese	-	0.05	0.05	-	-	<0.001	-			
Calcium	-	-	-	-	-	<0.1	-			
Bromide	-	-	-	-	-	<0.1	-			

1 Maximum Contaminent Levels

2 Trigger level identified on WA Dept of Health analytical results forms.

Results above the trigger level are in red.

3 Soluble Reactive Phosphorus