Quality Assurance Project Plan

City of Moses Lake ASR Alternatives Evaluation and Cost Benefit Study

August 2024

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Each study conducted by the Washington State Department of Ecology (Ecology) must have an approved Quality Assurance Project Plan (QAPP). The QAPP describes the objectives of the study and the procedures to be followed to achieve those objectives.

This QAPP was prepared by a licensed hydrogeologist. A signed and stamped copy of the report is available upon request. This QAPP is available via Ecology's publication database and upon request. The Ecology publication number for this QAPP is 24-12-013. This QAPP is valid through August 2029.

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Quality Assurance Project Plan

City of Moses Lake ASR Alternatives Evaluation and Cost Benefit Study

July 2024

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2.0 Abstract

An Aquifer Storage and Recovery (ASR) program is being considered as a component of the City of Moses Lake's (City's) long-term water supply strategy of developing a surface water source to offset declining groundwater supplies.

An Alternatives Evaluation and Cost Benefit Study (referred to herein as the Study) will assess three alternatives for ASR source water, as well as the technical, operational, regulatory, and cost requirements to implement ASR within the City's municipal water system. Study tasks have been designed to address key components required in an ASR reservoir permit application as outlined in Washington Administrative Code (WAC) 173-157-110 and include:

1. Refine existing hydrogeologic conceptual model(s) detailing the target aquifer system;
2. Assess source water availability, legal framework, and water rights to implement project;
3. Evaluating existing water system infrastructure and considering system components for recharge, storage, and recovery;
4. Assessing water quality characteristics of potential source water (e.g., canal water) and the target aquifer to evaluate compliance with groundwater standards and the Antidegradation Policy in WAC 173-200.

Based on a review of past work, the State of Washington Department of Ecology (Ecology) and the City determined that additional information needs to be collected under this Study to better understand source water quality and water quality within the deeper basalt aquifer tapped by many City wells, which has exhibited water level declines. Key elements of the Study design can be found in this QAPP as follows:

- Section 3.2.3: Provides a description of the water quality constituents to be evaluated;
- Section 4.4: Presents the details of the tasks to be completed, in sequential order;
- Section 5: Outlines the project schedule and team;
- Section 6.2: Measurement Quality Objectives;
- Section 7.2: Describes water quality sampling locations and frequency (sampling schedule); and
- Section 8.2: Details the water quality sampling procedures.

3.0 Background

The Columbia River Basalt Aquifer System (Basalt Aquifer System) is the City's main potable water supply source and is tapped by 17 out of 18 of its currently active groundwater wells. As a component of its long-term water supply strategy, the City is evaluating development of an ASR program to offset declining water levels and well yields in the Basalt Aquifer System. Two potential source waters for City supply and ASR have been identified within the Study area: (1) Moses Lake and (2) the Bureau of Reclamation's Columbia Basin Irrigation Project water routed through the East Columbia Irrigation District (ECBID) canal system. A third major surface water, Crab Creek, is also located within the Study Area but is under a Surface Water Source Limitation, so is not considered as a source alternative for this study.

3.1 Introduction and Problem Statement

The goal of the Study is to support a decision regarding further pursuit of ASR program development and to address key components required in an ASR reservoir permit application, as outlined in WAC 173-157-110. Much of the information required for an ASR reservoir permit application has been documented through past efforts and publications by the City, the US Geological Survey (USGS), Ecology, and the Environmental Protection Agency (EPA). However, data gaps regarding source water availability and certain water quality considerations have been identified as needing to be addressed under this Study to support future decisions to implement ASR.

To support evaluation of ASR by the City, the Study must:

- Refine existing hydrogeologic conceptual model(s) to evaluate ASR feasibility and address informational requirements of Chapter 173-157-120 WAC;
- Assess source water availability, legal framework, and water rights to implement ASR in accordance with Chapter 173-157-130 and -140 WAC;
- Assess water quality in the target aquifer and source water to identify constituents of concern water quality compatibility with respect to:
    - Groundwater quality standards and antidegradation policy (Chapter 173-200 WAC);
    - Surface water treatment (Chapter 246-290 portions of Part 6);
    - Drinking water standards (Chapter 246-290-310); and
    - Drinking water Source Approval (Chapter 246-290-130).
- Identify the additional information requirements of WAC 173-157 that are not addressed in this Study.

The QAPP follows the recommended guidelines from Ecology's *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Ecology, 2004; updated 2016) to conduct water level and water quality analyses effectively and accurately as part of the Study and addresses the following items:

- Study design;
- Data and measurement quality objectives;
- Field and laboratory procedures;
- Quality control procedures;
- Data verification and validation protocols;
- Data management procedures; and
- Reporting.

The Study and development of this QAPP are funded under the Office of Columbia River (Agreement No. WROCR-2123-MoLaMS-00034) between the City and Ecology. Aspect is under contract to the City to prepare this QAPP and complete the Study.

3.2 Study Area and Surroundings

The Study Area is within the Quincy Basin, located in Grant County, Washington, as shown on Figure 1. The City lies within the Quincy Basin, an ancient glacial lake bounded by the Beezley Hills to the north, Frenchman Hills to the south, Evergreen and Babcock Ridges to the west and to the east by high lands east of Moses Lake (Schwennesen and Meinzer, 1918).

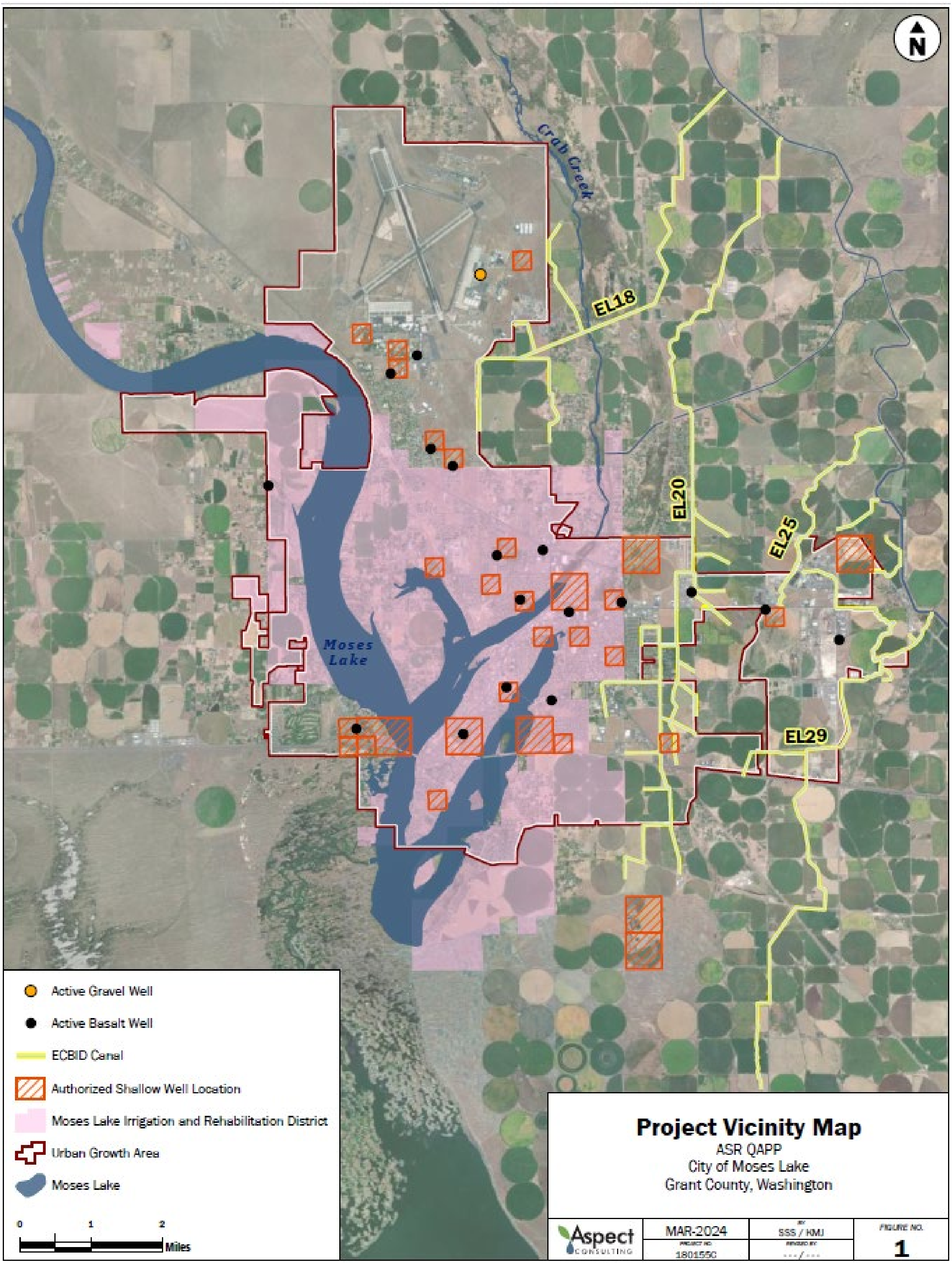

Figure 1. City of Moses Lake Project Vicinity Map

The City's potable water system is supplied by 18 groundwater wells, has approximately 12,000 connections, and serves a residential population of approximately 26,000 people. In the Study area, surface water is the primary source of irrigation water and groundwater serves as the primary source of drinking water. Figure 1 shows the City's Urban Growth Area, City water supply wells, and the surface waters being considered for new water supply under this Study (ECBID irrigation canals and Moses Lake).

Within the Quincy Basin there are two groundwater management zones recognized by the state; the shallow aquifer system, which is termed the Unconsolidated Zone and the deep aquifer system which is termed the Quincy Basalt Zone (both zones are defined by WAC 173-124-020). The City's water system is reliant on water rights and water supply infrastructure sourcing water from the Quincy Basalt Zone. Within the Study Area, the Quincy Basalt Zone is experiencing significant declines in yields due to decreasing water levels from overpumping and overuse (GWMA, 2012). As such, the Quincy Basalt Zone, specifically the Wanapum and Grande Ronde Formations are the two target aquifer units being evaluated for ASR (herein referred to as the target aquifers).

3.2.1 History of Study Area

The Study Area is located within the US Bureau of Reclamation Columbia Basin Project (CBP) boundary. The CBP diverts water from the Columbia River at Banks Lake. An extensive system of canals and wasteways distributes the Columbia River to the Quincy Basin, Pasco Basin and south of the Saddle Mountains to sustain over 600,000 acres of irrigated crops.

Following the construction of the CBP, the City experienced continued growth in agricultural related industries leading to growth in the residential, commercial, and industrial sectors. Today the City is the largest potable water purveyor in Grant County. The combined economic and population growth and associated water use has resulted in a decrease in the basalt groundwater supplies.

large volumes of irrigation imported from the Columbia River to the Study Area for over 70 years significantly increased recharge volumes to the shallow aquifer system. Increases in shallow groundwater levels were first documented by the Division of Water Resources in 1960 (Walters and Groilier, 1960) and was recently simulated for the Quincy Basin by the USGS (USGS, 2018).

With the increased water budget in the surface water system and shallow aquifer, ASR may be able to effectively use surface water to offset declines in basalt groundwater levels and provide additional supply to the City. The City is considering using water from Moses Lake or the ECBID canal system, which is likely to require treatment prior to supplying ASR.

3.2.2 Summary of Previous Studies and Existing Data

ASR was initially identified in the 2012 Columbia Basin Ground Water Management Area (GWMA) as a potential means to assure the City continues to have reliable water supply. Prior to the development of this QAPP a detailed review of background documents and data was conducted to understand existing geology, hydrology, and water chemistry in the area. Key findings from previous studies are included below.

Basalt Aquifer Parameters

Well testing documented on City Well logs and regional scientific investigations were used to estimate the aquifer parameters for the target aquifers . Results documented in these reports are summarized below in Table 1.

Table 1. Hydrogeologic Parameters of Basalt Aquifer System

Study Area	Study	Aquifer	Hydraulic Conductivity (ft/d)	Transmissivity[1] (ft^2/day)	Storativity (unitless)
Moses Lake Service Area	City Well Logs	Wanapum	-	7,200[2]	-
		Grande Ronde	-	3,300[3]	-
Quincy Basin	USGS (2018)	Wanapum	1 – 227	-	9.6×10^{-7} - 1×10^{-6}
		Grande Ronde	0.06 – 5,400	-	9.4×10^{-7} - 1×10^{-6}
North Moses Lake	USACE (2003)	Fractured Wanapum	28 – 2,800	-	-
Columbia Plateau	USGS (2000)	CRGB[4]	0.086 – 8.6	-	6×10^{-8}

Notes:

1. Specific capacity was used to estimate transmissivity using the empirical equation presented in Driscoll (1986): Specific Capacity (gpm/ft) = Transmissivity (gpd/ft) / 2,000
2. Pumping test data for City Well Nos. 10, 11, 18, 21, 23 and 24 were used to estimate transmissivity.3. Pumping test data for City Well Nos. 9, 19, 26, 31, and 33 were used to estimate transmissivity.
4. Columbia River Basalt Group

Groundwater Levels

As part of the ongoing maintenance and operation of its water system, the City has monitored and documented groundwater levels in a majority of their wells. Table 2 shows groundwater levels in the basalt aquifer consistently declining for the past few decades.

Table 2. Change in Groundwater Levels at City Wells

City Well No.	Well Depth (feet)	Source Aquifer	Summer Static Water level Declines (ft)	Average Decline Per Year (ft)	Measurement Span
4	1,000	Wanapum and Grande Ronde	210	4	1959-2009
7	950	Grande Ronde	270	5.4	1959-2009
8	1,045	Wanapum and Grande Ronde	45	1.5	1961-1992
9	1,100	Grande Ronde	320	7.3	1965-2009
10	692	Wanapum	155	3.7	1971-2013
11	805	Wanapum	333	9	1977-2013
12	568	Wanapum	5	0.2	1982-2006
14	1,027	Grande Ronde	13	0.9	1991-2006
17	1,240	Grande Ronde	105	6.6	1991-2013
18	585	Wanapum	189	18.9	2003-2013
19	755	Wanapum	78	11.1	2006-2013
21	712	Wanapum	170	4.5	1971-2009
23	791	Wanapum	270	7.1	1971-2009
24	725	Wanapum	124	4	1982-2013
28	750	Wanapum	142	3.4	1971-2013
29	134	Alluvial	2	0.1	1975-1992
31	970	Grande Ronde	37	7.4	2008-2013
33	909	Grande Ronde	100	19.8	2009-2013

Note: Information obtained from the City's 2015 Water System Plan

Groundwater Quality

The City conducts water quality sampling at each of its municipal water supply wells to comply with DOH drinking water source monitoring requirements. Although these water quality data are useful in characterizing ambient groundwater, the chemical analyses completed per DOH requirements do not include certain constituents and field parameters important for assessing geochemical compatibility with treated surface water (e.g., silica, sulfide, and oxidation-reduction potential [ORP]) and only report total metals concentrations rather than distinguishing total and dissolved fractions Additionally, water quality analyses completed under DOH requirements are reported only to the State Reporting Limit (SRL) as opposed to the Method Detection Limit (MDL) and, consequently, water quality results obtained from DOH records are often qualitatively reported as “less than” the SRL rather than reporting the measured concentration.

The DOH SENTRY database contains results for routine compliance sampling for each of the City’s wells. Table 3 identifies the periods of record of various analyte suites for the City’s wells from the DOH database.

Table 3. Water Quality Data Available from DOH SENTRY Database

Analyte Suite / Test Panel	Period of Record[1]	Note
Inorganic Constituents	1976 – 2022[2]	As, Ag, Ba, Be, Ca, Cd, Cl, Cr, Cu, Cyanide, Fe, Fl, Hg, Mg, Mn, Na, Ni, NO3, Pb, Sb, Se, SO4, Th, Zn, Color, Sp. Cond., Hardness, Turbidity
Synthetic Organic Compounds	1994 - 2022[3]	Analytical suites vary annually between insecticides, pesticides, and soil fumigants
Volatile Organic Compounds	1988 – 2022	Results for various temporal resolutions from each well
Radionuclides	2001 - 2021	Results for various temporal resolutions from each well

Notes:

1. Not all constituents span full periods of record
2. Not all constituents span whole record, full constituents list first recorded in 2003.

Table 4 presents Primary and Secondary Maximum Contaminant Level exceedances documented in each City well over the period of record.

Table 4. Water Quality Exceedances in City Wells

City Well No.	Well Depth (feet)	Source Aquifer	Parameter(s) Reported to Have Exceeded Primary or Secondary Drinking Water Standards[1]	Source Status
3	909	Basalt - Formation Unknown	Conductivity, Fluoride	Inactive
4	**1,000**	Wanapum and Grande Ronde	Iron, Manganese	Active
5	950	Basalt - Formation Unknown		Decommissioned
7	950	Grande Ronde	Fluoride	Active
8	1,045	Wanapum and Grande Ronde	Fluoride	Active
9	1,100	Grande Ronde	Fluoride, Iron	Active
10	692	Wanapum	Fluoride	Active
11	805	Wanapum	Fluoride	Active
12	568	Wanapum	Fluoride	Active
13	535	Wanapum		Decommissioned
14	1,027	Grande Ronde	Fluoride, Iron	Active
17	1,240	Grande Ronde	Fluoride	Active
18	**585**	Wanapum		Active
19	755	Wanapum	Iron	Active
21	712	Wanapum	Trichloroethylene[2], Manganese, Iron	Active
22	725	Wanapum	Trichloroethylene	Decommissioned
23	**791**	Wanapum	Trichloroethylene[2], Manganese	Active
24	**725**	Wanapum		Active
28	750	Wanapum	Trichloroethylene[2], Manganese	Active
29	134	Alluvial	Iron	Active
31	970	Grande Ronde	Iron	Decommissioned
32	919	Basalt - Formation Unknown	Fluoride, Iron	Decommissioned

City Well No.	Well Depth (feet)	Source Aquifer	Parameter(s) Reported to Have Exceeded Primary or Secondary Drinking Water Standards[1]	Source Status
33	**909**	Grande Ronde	Fluoride, Iron	Active

Notes: Bold cells indicate where well depths documented by the Department of Health Depths do not match those presented in the City's most recent Water System Plan.
[1]Iron, Manganese, Fluoride, Conductivity are all Secondary Contaminants. Secondary Contaminants are non-mandatory water quality standards for drinking water.
[2]Trichloroethylene (TCE) detected in Wanapum Well's located in the Larson Pressure Zone (Wells 21, 22, 23, 28). As a response the City deepened the well casing to cut off contamination in 2001. Since then, TCE has not been detected in any of the City's wells.

The USGS NWIS database includes water quality data for Moses Lake. Table 5 presents the existing water quality data for Moses Lake in relation to regulatory water quality standards.

Table 5. Moses Lake Water Quality

Parameter	Sample Date Range	Maximum Value	Units	WAC 173-200-040	Chapter 246-290 WAC Primary Drinking Water Standard	Chapter 246-290 WAC Secondary Drinking Water Standard
Alkalinity	3/28/2001 - 6/5/2012	184	mg/L	-	-	-
Ammonia	2/11/2001 - 6/5/2012	0.697	mg/L	-	-	-
Chloride	3/28/2001 - 9/26/2001	8.48	mg/L	250	-	250
Fecal Coliform	2/11/2001 - 9/9/2001	3	/100mL	-	-	-
Iron	9/26/2001	160	ug/L	300	-	300
Manganese	9/26/2001	21.2	ug/L	50	-	50
Nitrogen (NO2 + NO3)	3/2/2009 - 6/5/2012	0.385	mg/L	10	10	-
Ortho-Phosphate	2/11/2001 - 6/5/2012	0.127	mg/L	-	-	-
Phosphorus	2/11/2001 - 9/26/2001	0.17	mg/L	-	-	-
Total Phosphorus	3/2/1009 - 6/5/2012	0.0509	mg/L	-	-	-
Sulfate	8/1/2001	13	mg/L	250	-	250
pH[1]	2/11/2001 - 6/5/2012	9.42	pH	-	-	6.5 - 8.5
Temperature	2/11/2001 - 6/5/2012	28.22	deg C	-	-	-
Conductivity	2/11/2001 - 6/5/2012	404	uS/cm	-	-	700
Turbidity[1]	2/11/2001 - 6/5/2012	11	NTU	-	5*	-
Total Dissolved Solids	3/28/2001 - 9/26/2001	379	mg/L	500	-	500
Non-Volatile TSS	8/1/2001 - 9/6/2001	13	mg/L	-	-	-
TSS	2/11/2001 - 6/5/2012	18	mg/L	-	-	-
Total Organic Carbon	3/28/2001 - 9/26/2001	4.3	mg/L	-	-	-

Notes: ug/L – Micrograms per liter mg/L – Milligrams per liter uS/cm – microsiemens per centimeter
[1]Highlighted Cells indicate values exceeding regulatory drinking water standards.

[2]TSS = Total Suspended Solids.
* drinking water limit for turbidity is based on a treatment technique in lieu of a Maximum Contaminant Level, where unfiltered surface water cannot exceed 5 NTU (WAC 246-290-632).

A single sample was collected by the City from the ECBID canal system (the East Low Canal) on October 3, 2023, and tested for inorganics, metals, semivolatiles, and volatiles. All tested parameters were under their respective MCL. The water quality lab report is included as Appendix A. Additional data for the ECBID canal system may be obtained from ECBID and/or the US Bureau of Reclamation (Reclamation) during this study, if possible, and discussed in the project report.

3.2.3 Parameters of Interest

Water quality analytes were selected to evaluate the potential for water quality impacts related to ASR and compliance with Washington State Groundwater Quality Standards (Chapter 173-200 WAC) and Drinking Water Standards (Chapter 246-290 WAC), should a new source be intended to conjunctively supply ASR and potable use. The following sections describe the water quality analytes selected for this water quality assessment. The schedule for monitoring these constituents during the Study is presented in Section 7.2.

Field Parameters

Field parameters will be measured to provide independent corroboration of laboratory results, and to analyze constituents that have short hold times and can be reliably measured in the field. Field parameters include:

- Electrical conductivity
- Dissolved Oxygen (DO)
- Oxidation Reduction Potential (ORP)
- pH
- Temperature
- Turbidity
- Discrete groundwater depth-to-water
- Groundwater level measuring point elevation

General Chemistry

The General Chemistry suite includes inorganic constituents and conventional water quality parameters. Groundwater and surface water samples will be analyzed for this suite of constituents in both the dissolved (field-filtered to 45 microns) and total fractions. Geochemical analysis will evaluate chemical compatibility of native groundwater and surface water and monitor for potential chemical reactions of the recharge water with aquifer material (mineral dissolution and precipitation) during aquifer storage. This analytical suite will also inform source treatment requirements in the context of Chapter 173-200 WAC (Groundwater Quality Standards) and WAC 246-290-310 (Drinking Water standards). Constituents will include:

Alkalinity	Silica	Lead
Bicarbonate	Arsenic	Magnesium
Chloride	Antimony	Manganese
Total Dissolved Solids (TDS)	Aluminum	Mercury
Total Suspended Solids (TSS)	Barium	Nickel
Total and Dissolved (DOC) Organic Carbon (TOC)	Beryllium	Potassium
Phosphorus	Cadmium	Selenium
Bromide	Calcium	Silver
Fluoride	Chromium	Sodium
Nitrate-N	Copper	Thallium
Nitrite-N	Iron	Uranium
Sulfate	Zinc	Titanium

Volatile and Semivolatile Organic Compounds

As required by (DOH) and discussed in Section 3.2.2, the City has monitored both volatile organic compounds (VOCs) and synthetic organic compounds (SOCs). As summarized in Table 4, neither SOCs or VOCs have exceeded drinking water standards in any of the City's wells since 2001.

The Study will evaluate potential surface water sources (e.g., Moses Lake and Irrigation Canals) for both VOCs and SOCs. Therefore, measurement of VOCs and SOCs is necessary to accurately assess surface water quality. This will include the analytes specified in U.S. Environmental Protection Agency (EPA) Methods 524.2 (VOCs) and EPA Method 525.2 (SVOCs).

Herbicides and Pesticides

The City has analyzed for herbicides and pesticides for DOH drinking water compliance. Over the period of record (1994-present) neither herbicides or pesticides were detected in the City's water supply wells that are completed in the target aquifer.

The Study will evaluate potential surface water sources (Moses Lake and Irrigation Canals) for both herbicides and pesticides. Therefore, herbicides and pesticides will be measured at potential surface water sources as part of this Study. This will include the analytes specified in U.S. Environmental Protection Agency (EPA) Methods:

- Chlorinated Pesticides
- Chlorinated Acid Herbicides

- Pesticides as carbamates
- Herbicides – diquat, paraquat, endothall, and glyphosate

Bacteriological Constituents

The Study will evaluate bacteriological constituents (total coliform and E. Coli) in native groundwater and potential surface water sources (Moses Lake and Irrigation Canals) to determine baseline conditions. The Study will evaluate the following constituents:

- E. coli (presence/absence)
- Total coliforms (plate count)

Radionuclides

The City has monitored for radionuclides for DOH drinking water compliance. Over the period of record (2001-present) no radionuclides were detected above their respective MCL.

The Study will evaluate potential surface water sources (Moses Lake and Irrigation Canals) for the following radionuclides:

- Radium 226 + Radium 228
- Gross Alpha radiation
- Gross Beta radiation

3.2.4 Regulatory Criteria or Standards

The introduction of recharge water to groundwater is subject to the Antidegradation Policy and the numerical groundwater quality standards (GWQS) defined in Chapter 173-200 WAC. Table 6 presents the regulatory criteria by analyte method that will be considered during the Study.

Table 6. Regulatory Limits for General Chemistry, Field Parameters, and SVOCs and VOCs

Analyte	Unit	WAC 173-200-040	Chapter 246-290 WAC Primary Drinking Water Standard	Chapter 246-290 WAC Secondary Drinking Water Standard
EPA 200.8 (General Chemistry)				
Aluminum	ug/L			50
Barium	ug/L	1,000	2,000	
Calcium	ug/L			
Copper	ug/L	1,000	1,300	1,000
Iron	ug/L	300		300
Magnesium	ug/L			
Manganese	ug/L	50		50
Potassium	ug/L			
Silica (SiO2)	ug/L			
Sodium	ug/L			
Zinc	ug/L	5,000		5,000
Antimony	ug/L		6	
Arsenic	ug/L	0.05	10	
Beryllium	ug/L		4	
Cadmium	ug/L	10	5	
Chromium	ug/L	50	100	
Lead	ug/L	50	15	
Nickel	ug/L			
Selenium	ug/L	10	50	
Silver	ug/L	50		100
Thallium	ug/L		2	
Uranium	Ug/L		30	
EPA 300.0 (General Chemistry)				
Bromide	mg/L			
Chloride	mg/L	250		250
Fluoride	mg/L	4	4	2
Sulfate	mg/L	250		250
SM2320B (General Chemistry)				
Alkalinity as Carbonate	mg/L			
Bicarbonate Ion	mg/L			
SM2540C (General Chemistry)				
Total Dissolved Solids	mg/L	500		500
SM2540D (General Chemistry)				
Total Suspended Solids	mg/L			
SM4500NO3F (General Chemistry)				
Nitrate as Nitrogen	mg/L	10	10	
Nitrite as Nitrogen	mg/L		1	
SM5310C (General Chemistry)				
Total Organic Carbon	mg/L			
EPA 365.3 (General Chemistry)				
Phosphorus	mg/L			

Analyte	Unit	WAC 173-200-040	Chapter 246-290 WAC Primary Drinking Water Standard	Chapter 246-290 WAC Secondary Drinking Water Standard
EPA 515.4 (Pesticides and Herbicides)				
2,4-D	ug/L	100	70	
2,4-DB	ug/L			
3,5-Dichlorobenzoic acid	ug/L			
Acifluorfen	ug/L			
Chloramben	ug/L			
Chlorthal	ug/L			
Dalapon	ug/L		200	
Dicamba	ug/L			
Dichloroprop	ug/L			
Dinoseb	ug/L		7	
Pentachlorophenol	ug/L		1	
Picloram	ug/L		500	
Silvex	ug/L	10	50	
EPA 524.2 (VOCs and SVOCs)				
1,1,1,2-Tetrachloroethane	ug/L			
1,1,1-Trichloroethane	ug/L	200	200	
1,1,2,2-Tetrachloroethane	ug/L			
1,1,2-Trichloroethane	ug/L		5	
1,1-Dichloroethane	ug/L	1		
1,1-Dichloroethene	ug/L		7	
1,1-Dichloropropene	ug/L			
1,2,3-Trichlorobenzene	ug/L			
1,2,3-Trichloropropane	ug/L			
1,2,4-Trichlorobenzene	ug/L		70	
1,2,4-Trimethylbenzene	ug/L			
1,2-Dibromo-3-chloropropane	ug/L		0.2	
1,2-Dibromoethane (EDB)	ug/L	0.001	0.05	
1,2-Dichlorobenzene	ug/L		600	
1,2-Dichloroethane (EDC)	ug/L	0.5	5	
1,2-Dichloropropane	ug/L	0.6	5	
1,3,5-Trimethylbenzene	ug/L			
1,3-Dichlorobenzene	ug/L			
1,3-Dichloropropane	ug/L			
1,4-Dichlorobenzene	ug/L	4	75	
2,2-Dichloropropane	ug/L			
2-Chlorotoluene	ug/L			
4-Chlorotoluene	ug/L			
Benzene	ug/L	1	5	
Bromobenzene	ug/L			
Bromochloromethane	ug/L			
Bromodichloromethane	ug/L	0.3	80	
Bromoform	ug/L	5	80	
Bromomethane	ug/L			

Analyte	Unit	WAC 173-200-040	Chapter 246-290 WAC Primary Drinking Water Standard	Chapter 246-290 WAC Secondary Drinking Water Standard
Carbon Tetrachloride	ug/L	0.3	5	
Chlorobenzene	ug/L		100	
Chloroethane	ug/L			
Chloroform	ug/L	7	80	
Chloromethane	ug/L			
cis-1,2-Dichloroethene (DCE)	ug/L		7	
cis-1,3-Dichloropropene	ug/L			
Dibromochloromethane	ug/L	0.5	80	
Dibromomethane	ug/L			
Dichlorodifluoromethane	ug/L			
Ethylbenzene	ug/L		700	
Hexachlorobutadiene	ug/L			
Isopropylbenzene	ug/L			
m,p-Xylenes	ug/L		10,000	
Methyl tert-butyl ether (MTBE)	ug/L			
Methylene Chloride	ug/L	5	5	
Naphthalene	ug/L			
n-Butylbenzene	ug/L			
n-Propylbenzene	ug/L			
o-Xylene	ug/L		10,000	
p-Isopropyltoluene	ug/L			
sec-Butylbenzene	ug/L			
Styrene	ug/L		100	
tert-Butylbenzene	ug/L			
Tetrachloroethene (PCE)	ug/L	0.8	5	
Toluene	ug/L		1,000	
trans-1,2-Dichloroethene	ug/L		100	
trans-1,3-Dichloropropene	ug/L			
Trichloroethene (TCE)	ug/L	3	5	
Trichlorofluoromethane	ug/L			
Vinyl Chloride	ug/L	0.02	2	
EPA 525.2 (VOCs and SVOCs)				
Alachlor	ug/L		2	
Atrazine	ug/L		3	
Benzo(a)pyrene	ug/L	0.008	0.2	
Bis(2-ethylhexyl) adipate	ug/L		400	
Bis(2-ethylhexyl) phthalate	ug/L	6	6	
Bromacil	ug/L			
Butachlor	ug/L			
Fluorene	ug/L			
Hexachlorobenzene	ug/L	0.05	1	
Hexachlorocyclopentadiene	ug/L		50	
Metolachlor	ug/L			

Analyte	Unit	WAC 173-200-040	Chapter 246-290 WAC Primary Drinking Water Standard	Chapter 246-290 WAC Secondary Drinking Water Standard
Metribuzin	ug/L			
Propachlor	ug/L			
Simazine	ug/L		4	
EPA 531 (Pesticides and Herbicides)				
3-Hydroxycarbofuran	ug/L			
Aldicarb	ug/L			
Aldicarb Sulfoxide	ug/L			
Aldoxycarb	ug/L			
Carbaryl	ug/L			
Carbofuran	ug/L		40	
Methiocarb	ug/L			
Methomyl	ug/L			
Oxamyl	ug/L		200	
Propoxur	ug/L			
EPA 547 (Pesticides and Herbicides)				
Glyphosate	ug/L		700	
EPA 548.1 (Pesticides and Herbicides)				
Endothall	ug/L		100	
EPA 549.2 (Pesticides and Herbicides)				
Diquat	ug/L		20	
Paraquat	ug/L			
SM9221B (Bacteriological)				
Fecal Coliform	MPN/100mL			
SM9223B (Bacteriological)				
E. coli	MPN/100mL			
Total Coliform	MPN/100mL	1/100		
Field Parameters				
Specific conductance	uS/cm			700
Turbidity			5*	
pH	SU			6.5-8.5

Notes:
ug/L – Micrograms per liter
mg/L – Milligrams per liter
uS/cm – microsiemens per centimeter
SU. – standard units
* drinking water limit for turbidity is based on a treatment technique in lieu of a Maximum Contaminant Level, where unfiltered surface water cannot exceed 5 NTU (WAC 246-290-632).

3.3 Water quality impairment studies

Moses Lake Water Quality Impairment studies completed by Ecology are:

Washington State Department of Ecology (Ecology), 2000, Moses Lake Proposed Phosphorus Criterion and Preliminary Load Allocations Based on Historical Review, Publication No. 00-03-036, Prepared by James V. Carroll, Robert F. Cusimano, and William J. Ward, Environmental Assessment Program, Washington State Department of Ecology.

Washington State Department of Ecology (Ecology), 2002, Moses Lake Inflow-Outflow Balance: A Component of the Moses Lake Total Phosphorus Total Maximum Daily Load, Publication No. 02-03-029, June 2002, Prepared by Chris Evans and Art Larson, Environmental Assessment Program, Washington State Department of Ecology.

Washington State Department of Ecology (Ecology), 2003, Moses Lake Total Maximum Daily Load Groundwater Study, Publication No. 03-03-005, February 2003, prepared by Charles Pitz, Environmental Assessment Program, Washington State Department of Ecology.

Washington State Department of Ecology (Ecology), 2006, Moses Lake Phosphorus-Response Model and Recommendations to Reduce Phosphorus Loading, Publication No. 06-03-011, June 2006, Prepared by James V. Carroll, Environmental Assessment Program, Washington State Department of Ecology.

3.4 Effectiveness monitoring studies

Not applicable.

4.0 Project Description

4.1 Project Goals

The overall project (Study) goal is to assess the potential for ASR to augment existing water supplies and meet future water demands within the City's water service area. This Study focuses specifically on understanding the water quality conditions of the source water alternatives, the aquifer planned for reservoir storage and their compatibility. Tasks have been designed to determine water quality characteristics.

4.2 Project Objectives

The objectives of the Study include:

- Refine the hydrogeologic conceptual model to evaluate ASR feasibility and address informational requirements of Chapter 173-157-120 WAC;
- Assess source water quality and availability;

- Assess groundwater quality in the target aquifer and potential compatibility with source water alternatives;
- Populate geochemical reaction model simulations with site specific data
- Identify data gaps and additional information that may be needed in the future to further evaluate, design, and/or permit an ASR program.

4.3 Information Needed and Sources

Water quality data is needed from potential water sources and the target aquifer. Previous water quality data collected by the City (as part of DOH compliance) will be compiled, along with the data collected under this QAPP.

Additional details on field data collection for the Study are provided in Section 7.2.

4.4 Tasks Required

The objectives related to data collection under this Study require completing the following tasks.

Task 1: Assessment of Groundwater and ASR Source Water Quality

This task includes sampling of potential surface water sources (Moses Lake and Irrigation Canals) and groundwater wells. Source water quality data will be used to determine water treatment requirements for direct potable (municipal) supply and ASR uses. Water quality samples will be collected from four City wells, two points from Moses Lake and two different irrigation canals.

Groundwater wells will be sampled once within a single day to assess the spatial variability of water quality within the target aquifer. Surface water sampling will consist of two sampling events, one during the early irrigation season and one during the late irrigation season to assess the temporal variability of water quality for the surface water sources.

During both groundwater and surface water sampling, field water quality parameters will be collected. Additional specifics on sample locations and timing are included in Section 7.2.

This task will characterize potential source water quality and water quality in the target aquifers (the Wanapum Basalt Aquifer and the Grande Ronde Basalt Aquifer).

Task 2: Reporting and Analyses

This task includes the refinement of the hydrogeologic conceptual model and aquifer parameters, delineation of the target aquifer, and estimation of potential storage volumes and duration. Figures will be prepared, including hydrogeologic cross-sections, maps showing the extent of the target aquifer, water level hydrographs, and summary tables of aquifer parameters and calculations related to the target aquifer.

Also under this task, water quality and geochemical modeling results will be summarized and compared against regulatory standards, and full laboratory analytical data reports will be prepared.

4.5 Systematic planning process

Finalization of this QAPP is adequate systematic planning for the project.

5.0 Organization and Schedule

5.1 Key Individuals and Their Responsibilities

Table 7 shows the responsibilities of those who will be involved in this project.

Table 7. Organization of Project Staff and Responsibilities

Staff	Title	Responsibilities
Scott Tarbutton Office of Columbia River Phone: (509) 867-6534	OCR Quality Assurance Coordinator	Provides internal review of the QAPP and approves the final QAPP
Scott Tarbutton Office of Columbia River Phone: (509) 867-6534	OCR Project Manager	Provides oversight for the Study and Ecology Grant. Clarifies scope of the project. Provides review of the QAPP.
Patrick Cabbage Water Resources Program Phone: (509) 834-9985	Hydrogeologist	Provides technical oversight and review of the study, provides technical and permitting support
Brian Baltzell City of Moses Lake Phone: (509) 764-3786	Public Works Director	Reviews the draft and final QAPP and project deliverables, submittals for the Ecology Grant
Mark Beaulieu City of Moses Lake Phone: (509) 764-3782	City Engineer	Reviews the draft and final QAPP and project deliverables, submittals for the Ecology Grant
Andrew Austreng Aspect Consulting Phone: 206-838-5843	Principal Investigator and Project Manager	Co-author of QAPP, Aspect Project Manager, approach development, data analysis, QA/QC
Kelsey Mach Aspect Consulting Phone: (360) 483-0663	Permitting Specialist and Assistant Project Manager	Provides permitting technical assistance during development of the final report.
Silas Sleeper Aspect Consulting Phone: (206) 453-6058	Field Geologist	Co-author of QAPP, Plans/schedules field dates/logistics. Procures equipment. Collects data and records field information.
Stephen Bartlett Aspect Consulting Phone: (509) 831-7040	Field Geologist	Helps collect samples and records field information.
Lea Beard Aspect Consulting Phone (206) 780-7749	Data Scientist	Reviews and uploads EIM data.
Kathy Sattler Anatek Labs (509) 838-3999	Laboratory Manager	Prepares laboratory reports, conducts laboratory QA/QC.

5.2 Special Training and Certifications

A hydrogeologist licensed in the State of Washington will perform all analysis and interpretation of field data and provide oversight of hydrogeologic data collection. All field staff involved in this project will have either the relevant experience in the required standard operating procedures (SOPs) or be trained by the project manager or more senior field staff who have the required experience. The experienced staff will then lead the field data collection and oversee/mentor less-experienced staff.

5.3 Organization chart

Not applicable – See Table 7.

5.4 Proposed Project Schedule

Table 8 below provides the anticipated project schedule proposed under this project.

Table 8. Tentative Project Schedule

Task	Completion Date	Note
Final QAPP	Q2 2024	--
Groundwater and Surface Water Quality Testing	Q2-Q3 2024	Task will commence at the start of the irrigation season
Submit Draft Report	Q4 2024	--
Database uploaded to EIM	Q4 2024	--
Receive Ecology Comments	Q4 2024	--
Complete Final Report	Q4 2024	Following receipt and discussion of Ecology comments on the draft report.

5.5 Budget and Funding

The City has received funding from Ecology's Office of Columbia River (Agreement No. WROCR-2123-MoLaMS-00034) to conduct the Study and all tasks as described in Section 4.4. Aspect is under contract with the City to prepare this QAPP and complete the Study.

6.0 Quality Objectives

6.1 Data Quality Objectives [1]

The main data quality objective (DQO) for this Study is to collect representative water quality data from potential surface source water and groundwater sites for use in establishing background groundwater quality, and simulating potential geochemical reactions resulting during aquifer recharge, as well as measure (periodic and continuous) water levels from City wells shown on Figure 1 to characterize the hydrogeologic system and develop a conceptual site hydrogeologic model. These analyses will use common methodologies to evaluate water quality and groundwater flow direction that meet the measurement quality objectives (MQOs) described below.

6.2 Measurement Quality Objectives

Measurement Quality Objectives (MQOs) are statements of the precision, bias, and sensitivity necessary to meet the Study objectives. Precision and bias together express data accuracy. Representativeness, completeness, and comparability of the data define the suitability of the data for use in the study findings, and project design.

The field investigation will be conducted to measure water levels, collect representative water samples for analyses, and measure water quality field parameters. The MQOs for the field investigation are described by the analytical methods and field equipment used to collect measurements, and the standard operating procedures employed to make descriptions in the field.

6.2.1 Targets for Precision, Bias, and Sensitivity

The data collection instrumentation will meet the MQOs listed in Table 9, and the groundwater samples will be analyzed using standard methods that meet the MQOs listed in Table 10.

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[1] DQO can also refer to ***Decision*** Quality Objectives. The need to identify Decision Quality Objectives during the planning phase of a project is less common. For projects that do lead to important decisions, DQOs are often expressed as tolerable limits on the probability or chance (risk) of the collected data leading to an erroneous decision. And for projects that intend to estimate present or future conditions, DQOs are often expressed in terms of acceptable uncertainty (e.g., width of an uncertainty band or interval) associated with a point estimate at a desired level of statistical confidence.

Table 9. Field Method MQOs and Field Equipment Information

Parameter	Equipment/ Method	Bias (median)	Precision Field Duplicates (median)	Equipment Information			Expected Range
				Accuracy	Resolution	Range	
Groundwater Level Measurements							
Depth to Water Table	Waterline Electric Tape	--	--	0.05 ft	0.01 ft	--	250 to 750 ft
Wellhead Position (GPS)	Trimble R1 GNSS Receiver	--	--	><3.3 feet	0.01 ft	--	--
Field Water Quality Parameters							
pH	In-Situ AquaTroll 500 (with flow through cell)	--	--	0.1 SU	0.01 SU	0 to 14 SU	6.5 to 8.5 SU
Specific conductivity		--	--	±0.5% + 1 uS/cm	0. 1 uS/cm	0 to 350,000 uS/cm	150 to 500 uS/cm
Dissolved oxygen		--	--	± 0.1mg/L	0.01 mg/L	0 to 20 mg/L	0 to 10 mg/L
Oxidation-Reduction Potential		--	--	±5 mV	0.1 mV	-1400 to +1400 mV	-300 to +300 mV
Temperature		--	--	±0.1°C	0.01°C	-5 to 50°C	1 to 25°C
Turbidity	Hatch 2100Q Turbidimeter	--	--	±2%	0.01 NTU	0-1,000 NTU	0.1 to 100 NTU

Notes: mV = millivolts; ft H_2O = feet of water; SU = standard units; uS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °C = temperature in Celsius, NTU = nephelometric turbidity unit

Table 10. Laboratory MQOs of Water Samples

Analytical Suite and Method No.	Analyte	Method Detection Limit	Method Reporting Limit	Accuracy (LCS %Rec)	Matrix Spike (%Rec.)	Precision (RPD)
General Chemistry / Water Quality Parameters (all metals are *total and dissolved fractions)*						
SM 4500PF	Phosphorous, Total (mg/L)	0.0047	0.005	90-110	88.7-111	20
300	Chloride (mg/L)	0.078	0.1	90-110	85-115	15
300	Bromide (mg/L)	0.028	0.05	90-110	85-115	15
300	Fluoride (mg/L)	0.0127	0.05	90-110	85-115	15
300	Nitrate-N (mg/L)	0.0066	0.025	90-110	85-115	15
300	Nitrite-N (mg/L)	0.003	0.005	90-110	85-115	15
300	Sulfate (mg/L)	0.041	0.1	90-110	85-115	15
200.8	Mercury (ug/L)	0.09	0.1	90-110	70-130	20
200.8	Arsenic (µg/L)	0.0881	0.1	90-110	70-130	20
200.8	Antimony (µg/L)	0.162	0.3	90-110	70-130	20
200.8	Aluminum (µg/L)	2.65	5	90-110	70-130	20
200.8	Barium (µg/L)	0.273	0.3	90-110	70-130	20
200.8	Beryllium (µg/L)	0.0769	0.3	90-110	70-130	20
200.8	Cadmium (µg/L)	0.0336	0.1	90-110	70-130	20
200.8	Chromium (µg/L)	0.0946	0.5	90-110	70-130	20
200.8	Copper (µg/L)	0.172	0.5	90-110	70-130	20
200.8	Lead (µg/L)	0.181	0.2	90-110	70-130	20
200.8	Manganese (Total/Dissolved) (µg/L)	0.165	0.2	90-110	70-130	20
200.8	Nickel (µg/L)	0.176	0.2	90-110	70-130	20
200.8	Selenium (µg/L)	0.694	1.0	90-110	70-130	20
200.8	Silver (µg/L)	0.173	0.2	90-110	70-130	20
200.8	Thallium (µg/L)	0.0388	0.1	90-110	70-130	20
200.8	Uranium (ug/L)	0.18	1	85-115	70-130	20
200.8	Titanium (ug/L)	0.08	1	85-115	70-130	20
200.8	Zinc	0.5	0.446	85-115	70-130	20
200.7	Silica (silicon) (µg/L)	0.0714	0.2	90-110	70-130	20
200.7	Calcium (mg/L)	0.727	0.2	90-110	70-130	20
200.7	Iron (Total/Dissolved) (mg/L)	0.0281	0.03	90-110	70-130	20
200.7	Magnesium (mg/L)	0.0237	0.05	90-110	70-130	20
200.7	Potassium (mg/L)	0.703	1	90-110	70-130	20
200.7	Sodium (mg/L)	0.103	0.2	90-110	70-130	20
SM2320 B	Alkalinity (mg/L)	1	2	77-123	N/A	15
SM2320 B	Bicarbonate (mg/L)	1	2	77-123	N/A	15
SM2540 C	TDS (mg/L)	1	5	80-120	N/A	25
SM2540 D	TSS (mg/L)	1	1	75-125	N/A	70
SM5310 B	Total Organic Carbon (mg/L)	0.196	0.5	90-110	76-123	37
SM5310 B	Total Dissolved Carbon (mg/L)	0.243	0.5	83-117	78-121	28
Volatile Organic Compounds (VOCs)						
524.2	1,1,1,2-Tetrachloroethane (µg/L)	0.100	0.500	70-130	70-130	20
524.2	1,1,1-Trichloroethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,1,2,2-Tetrachloroethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,1,2-Trichloroethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,1-Dichloroethane (µg/L)	0.100	0.500	70-130	70-130	20

Analytical Suite and Method No.	Analyte	Method Detection Limit	Method Reporting Limit	Accuracy (LCS %Rec)	Matrix Spike (%Rec.)	Precision (RPD)
524.3	1,1-Dichloroethene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,1-Dichloropropene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2,3-Trichlorobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2,3-Trichloropropane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2,4-Trichlorobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2,4-Trimethylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2-Dibromo-3-chloropropane (DBCP) (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2-Dibromoethane (EDB) (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2-Dichlorobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2-Dichloroethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,2-Dichloropropane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,3,5-Trimethylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,3-Dichlorobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,3-Dichloropropane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	1,4-Dichlorobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	2,2-Dichloropropane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	2-Chlorotoluene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	4-Chlorotoluene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Benzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Bromobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Bromochloromethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Bromodichloromethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Bromoform (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Bromomethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Carbon Tetrachloride (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Chlorobenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Chloroethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Chloroform (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Chloromethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	cis-1,2-Dichloroethene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	cis-1,3-Dichloropropene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Dibromochloromethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Dibromomethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Dichlorodifluoromethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Ethylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Hexachlorobutadiene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Isopropylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	m+p-Xylene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Methyl-t-Butyl Ether (MTBE) (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Methylene Chloride (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Naphthalene (µg/L)	0.0840	0.200	20-130	20-130	25
524.3	n-Butylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	n-Propylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	o-Xylene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	p-Isopropyltoluene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	sec-Butylbenzene (µg/L)	0.100	0.500	70-130	70-130	20

Analytical Suite and Method No.	Analyte	Method Detection Limit	Method Reporting Limit	Accuracy (LCS %Rec)	Matrix Spike (%Rec.)	Precision (RPD)
524.3	Styrene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	tert-Butylbenzene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Tetrachloroethene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Toluene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	trans-1,2-Dichloroethene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	trans-1,3-Dichloropropene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Trichloroethene (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Trichlorofluoromethane (µg/L)	0.100	0.500	70-130	70-130	20
524.3	Vinyl Chloride (µg/L)	0.100	0.500	70-130	70-130	20
Synthetic Organic Compounds (SOCs)						
525.2	Acenaphthene (µg/L)	0.0300	0.200	20-130	20-130	25
525.2	Acenaphthylene (µg/L)	0.0240	0.200	20-130	20-130	25
525.2	Acetochlor (µg/L)	0.100	0.200	---	---	---
525.2	Alachlor (µg/L)	0.0550	0.200	20-130	20-130	25
525.2	Anthracene (µg/L)	0.0240	0.200	20-130	20-130	25
525.2	Atrazine (µg/L)	0.0670	0.100	20-130	20-130	25
525.2	Benzo[a]anthracene (µg/L)	0.0260	0.200	20-130	20-130	25
525.2	Benzo[a]pyrene (µg/L)	0.0100	0.0200	20-130	20-130	25
525.2	Benzo[b]fluoranthene (µg/L)	0.0550	0.200	20-130	20-130	25
525.2	Benzo[ghi]perylene (µg/L)	0.0530	0.200	20-130	20-130	25
525.2	Benzo[k]fluoranthene (µg/L)	0.0480	0.200	20-130	20-130	25
525.2	Bis(2-ethylhexyl)adipate (µg/L)	0.0690	0.600	20-150	20-150	25
525.2	Bis(2-ethylhexyl)phthalate (µg/L)	0.127	0.600	20-150	20-150	25
525.2	Bromacil (µg/L)	0.0500	0.100	20-130	20-130	25
525.2	Butachlor (µg/L)	0.0590	0.100	20-130	20-130	25
525.2	Butyl benzyl phthalate (µg/L)	0.0630	1.00	20-150	20-150	25
525.2	Chrysene (µg/L)	0.0280	0.200	20-130	20-130	25
525.2	Dibenz[a,h]anthracene (µg/L)	0.0540	0.200	20-130	20-130	25
525.2	Diethyl Phthalate (µg/L)	0.0550	1.00	20-150	20-150	25
525.2	Dimethyl Phthalate (µg/L)	0.0350	1.00	20-150	20-150	25
525.2	Di-n-butyl Phthalate (µg/L)	0.0470	1.00	20-150	20-150	25
525.2	EPTC (µg/L)	0.0560	0.100	20-130	20-130	25
525.2	Fluoranthene (µg/L)	0.0300	0.200	20-130	20-130	25
525.2	Fluorene (µg/L)	0.0350	0.200	20-130	20-130	25
525.2	Hexachlorobenzene (µg/L)	0.0370	0.100	20-130	20-130	25
525.2	Hexachlorocyclopentadiene (µg/L)	0.0410	0.100	20-130	20-130	25
525.2	Indeno[1,2,3-cd]pyrene	0.0510	0.200	20-130	20-130	25
525.2	Malathion (µg/L)	0.0690	0.200	20-130	20-130	25
525.2	Metolachlor (µg/L)	0.0550	0.100	20-130	20-130	25
525.2	Metribuzin (µg/L)	0.0570	0.100	20-130	20-130	25
525.2	Phenanthrene (µg/L)	0.0490	0.200	20-130	20-130	25
525.2	Prometon (µg/L)	0.0299	0.200	20-130	20-130	25
525.2	Pyrene (µg/L)	0.0430	0.200	20-130	20-130	25
525.2	Simazine (µg/L)	0.0630	0.0700	20-130	20-130	25
525.2	Terbacil (µg/L)	0.0790	0.100	20-130	20-130	25
Disinfection Byproducts						

Analytical Suite and Method No.	Analyte	Method Detection Limit	Method Reporting Limit	Accuracy (LCS %Rec)	Matrix Spike (%Rec.)	Precision (RPD)
sm6215B	Monochloroacetic acid (µg/L)	1.00	1.00	90-110	70-130	30
sm6215B	Dichloroacetic acid (µg/L)	1.00	1.00	90-110	70-130	30
552.2	Trichloroacetic acid (µg/L)	1.00	1.00	90-110	70-130	30
552.2	Monobromoacetic acid (µg/L)	1.00	1.00	90-110	70-130	30
552.2	Dibromoacetic acid (µg/L)	1.00	1.00	90-110	70-130	30
Herbicides and Pesticides						
505	4,4'-DDD (µg/L)	0.00190	0.100	65-135	70-130	20
505	4,4'-DDE (µg/L)	0.00180	0.100	65-135	70-130	20
505	4,4'-DDT (µg/L)	0.00150	0.100	65-135	70-130	20
505	Aldrin (µg/L)	0.00180	0.100	65-135	70-130	20
505	alpha-BHC (µg/L)	0.00180	0.100	65-135	70-130	20
505	beta-BHC (µg/L)	0.00240	0.100	65-135	70-130	20
505	Chlordane (µg/L)	0.0384	0.200	65-135	70-130	20
505	delta-BHC (µg/L)	0.00170	0.100	65-135	70-130	20
505	Dieldrin (µg/L)	0.00160	0.100	65-135	70-130	20
505	Endosulfan I (µg/L)	0.00230	0.100	65-135	70-130	20
505	Endosulfan II (µg/L)	0.00290	0.100	65-135	70-130	20
505	Endosulfan Sulfate (µg/L)	0.00130	0.100	65-135	70-130	20
505	Endrin (µg/L)	0.00490	0.0100	65-135	70-130	20
505	Endrin Aldehyde (µg/L)	0.00330	0.100	65-135	70-130	20
505	Endrin Ketone (µg/L)	0.00250	0.100	65-135	70-130	20
505	gamma-BHC (Lindane) (µg/L)	0.00260	0.0200	65-135	70-130	20
505	Heptachlor (µg/L)	0.00310	0.0400	65-135	70-130	20
505	Heptachlor Epoxide (µg/L)	0.00140	0.0200	65-135	70-130	20
505	Methoxychlor (µg/L)	0.00180	0.100	65-135	70-130	20
505	Toxaphene (µg/L)	0.385	1.00	65-135	70-130	20
505	Aroclor 1016 (PCB-1016)	0.0422	0.0800	65-135	70-130	20
505	Aroclor 1221 (PCB-1221)	0.500	20.0	65-135	70-130	20
505	Aroclor 1232 (µg/L)	0.100	0.100	65-135	70-130	20
505	Aroclor 1242 (µg/L)	0.100	0.100	65-135	70-130	20
505	Aroclor 1248 (µg/L)	0.100	0.100	65-135	70-130	20
505	Aroclor 1254 (µg/L)	0.100	0.100	65-135	70-130	20
505	Aroclor 1260 (µg/L)	0.0375	0.0375	65-135	70-130	20
505	2,4,5-T (ug/L)	0.0570	0.400	70-130	70-130	20
515.4	2,4,5-TP (Silvex) (ug/L)	0.0350	0.200	70-130	70-130	20
515.4	2,4-D (ug/L)	0.0330	0.100	70-130	70-130	20
515.4	2,4-DB (ug/L)	0.240	1.00	70-130	70-130	20
515.4	3,5-Dichlorobenzoic Acid (ug/L)	0.156	0.500	70-130	70-130	20
515.4	Acifluorofen	0.322	0.0200	70-130	70-130	20
515.4	Bentazon (ug/L)	0.105	0.500	70-130	70-130	20
515.4	Chloramben (ug/L)	0.0490	0.200	70-130	70-130	20
515.4	Dacthal	0.0110	0.0200	70-130	70-130	20
515.4	Dalapon (ug/L)	0.531	1.00	70-130	70-130	20
515.4	Dicamba (ug/L)	0.0710	0.200	70-130	70-130	20
515.4	Dichloroprop	0.260	0.0200	70-130	70-130	20
515.4	Dinoseb (ug/L)	0.0680	0.200	70-130	70-130	20
515.4	Pentachlorophenol (ug/L)	0.00900	0.0400	70-130	70-130	20

Analytical Suite and Method No.	Analyte	Method Detection Limit	Method Reporting Limit	Accuracy (LCS %Rec)	Matrix Spike (%Rec.)	Precision (RPD)
515.4	Picloram (ug/L)	0.0480	0.100	70-130	70-130	20
548.1	Endothall (ug/L)	2.92	9.00	65-105	70-110	20
549.2	Diquat (ug/L)	0.146	0.400	70-130	70-130	20
Bacteriological						
SM9223B	E. coli *(cfu/100mL)*	1 cfu/100 mL	--	--	--	--
SM 9223B	Total Coliform *(cfu/100mL)*	1 cfu/100 mL	--	--	--	--

Notes: RPD = relative percent difference, LCS = laboratory control sample, %Rec = percent recovered

Water Quality Analyses

The MQOs for the water quality analyses are summarized above in Table 10. Water quality sampling will be performed using industry-standard procedures to minimize bias and maximize precision. All sampling equipment will be decontaminated before and after completion of sampling activities.

Anatek Analytical (Anatek) is accredited by Ecology for all analytical procedures performed for this project and by the National Environmental Laboratory Accreditation Program (NELAP) for a comprehensive analytical laboratory accreditation. The laboratory is responsible for ensuring that all procedures performed comply with all requirements specified in the accreditation programs, laboratory quality assurance (QA) manuals, individual analytical methods, and this QAPP. Anatek's lab accreditation is included as Appendix B.

The quality and usability of data collected will be determined, based on the outcomes of data verification and validation, and expressed as data quality indicators measurement quality objectives (MQOs): precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity. The MQOs routinely obtained by the laboratory for the analytical procedures performed for this project are considered adequate. The definitions of the MQOs are presented as follows:

6.2.1.1 Precision

Precision is defined as the degree of agreement between or among independent, similar, or repeated measurements. Precision is a measure of variability in the results of replicate measurements due to random error. Precision is usually assessed by analyzing duplicate field measurements and random error is imparted by the variation in field procedures. Therefore, field sampling precision is addressed by collection of replicate measurements.

Precision is also expressed in terms of analytical variability. For this investigation, analytical variability will be measured as the relative percent difference (RPD) or coefficient of variation between analytical laboratory duplicates and between the matrix spike (MS) and matrix spike duplicate (MSD) analyses. Precision will be calculated as the RPD as follows:

$$RPD\ (\%) = 100 \times \frac{|S - D|}{(S + D)/2}$$

where:

S = analyte concentration in a sample

D = analyte concentration in a duplicate sample

The resultant RPD will be compared with criteria established by this QAPP in Table 10, and deviations from these criteria will be reported. If the QAPP criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. The RPD will be evaluated during data review and validation. The data reviewer will note deviations from the specified limits and deviations from the criteria will be flagged for further evaluation before being accepted for project use..

6.2.1.2 Bias

Bias is the difference between the sample mean (average value for a finite set of replicate measurements on a sample). and the true value. It will be measured as the percent recoveries of MS and MSD, organic surrogate compounds, and the laboratory control sample. Additional potential bias will be assessed using calibration standards and blank samples (e.g., method blanks). In cases where accuracy is determined from spiked samples, accuracy will be expressed as the percent recovery. The closer these values are to 100 percent, the more accurate the data.

Surrogate recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC}{SC} \times 100$$

Where:

SC = spiked concentration

MC= measured concentration

MS percent recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC - USC}{SC} \times 100$$

where:

SC = spiked concentration

MC = measured concentration

USC = unspiked sample concentration

MSD percent recovery will be calculated as follows:

$$\text{Recovery } (\%) = \frac{MDC - USC}{SC} \times 100$$

where:

SC	=	spiked concentration
MDC	=	measured duplicate spike concentration
USC	=	unspiked sample concentration

and

$$\text{RPD } (\%) = \frac{MC - MDC}{(MC+MDC)/2} \times 100,$$

where:

RPD = relative percent difference.

Field staff will minimize bias in the field measurements by strictly following equipment calibration and measurement protocols. Potential sources of field bias in measurements include measurement procedure, inability to measure all forms of the parameter of interest, and calibration problems. Table 10 presents the bias data quality objectives for pressure transducer and temperature sensor data for instrument QC checks.

The resultant percent recoveries will be compared with criteria established by this QAPP in Table 10 and deviations from these criteria will be reported (and in laboratory limits for RPD reported by the lab in individual reports). If the objective criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be evaluated during data review and validation, and the data reviewer will comment on the effect of the deviations on the reported data.

Groundwater Level Monitoring

The MQOs for the groundwater level monitoring of supply wells are as follows:

- Obtain horizontal well locations within 2-meter (6.5 feet) accuracy;
- Obtain the elevation (if not already obtained) of the wellhead or water level reference point relative to ground surface;
- Obtain ground surface elevations within a 3-foot accuracy (using GPS measurements, with elevations cross-referenced with a 10-meter digital elevation model available from the Washington State Department of Natural Resources);
- Obtain groundwater level measurements within a 0.01-foot accuracy. Measurements are recorded to ±0.01 foot and are accurate to ± 0.05 foot per 100 feet (Jelinski et al., 2015).

A description of the water level monitoring techniques that will be used to obtain the MQOs for the water level measurements and well locations is provided in the Field Procedures section (Section 8).

6.2.1.3 Sensitivity

Sensitivity will be determined by reviewing Method Reporting Limits (MRLs). MRLs are presented in Table 9 and account for matrix effects. The laboratory will be directed to report compounds detected above the Method Detection Limit (MDL) and positively identified below the MRL as estimated (J flag).

Sensitivity is also a measure of the capability of the field method and instrument used to detect a change. It is described by its range, accuracy, and resolution. This is usually reported for each instrument by the manufacturer. This information is provided in Table 9.

6.2.2 Targets for Comparability, Representativeness, and Completeness

6.2.2.1 Comparability

Comparability is the degree to which the data can be compared to historical data, reference values (such as background), and reference materials. This will be achieved through the use of standard operating procedures (SOPs) to collect field measurements and samples, training of field staff, field data-collection similarities (location, duration, time of year, weather conditions, etc.), instrumentation sensitivity, EPA-approved methods to analyze samples, and consistent units to report analytical results. Data comparability also depends on data quality. Data of unknown quality cannot be compared and will be flagged in project reporting, and evaluated for suitability for use in the project design.

6.2.2.2 Representativeness

Representativeness is the degree to which sample analyses results represent the conditions sampled. This component is generally considered during the design phase of a program. This program will use the results of all analyses to evaluate the suitability of the data for its intended use. Typically, a combination of continuous measurements, spot measurements, and historical data is needed to represent the expected variability of spatial and temporal conditions.

Representativeness of field measurements and samples will be ensured during the collection process by: (1) employing proper decontamination procedures, (2) thorough purging of the well and ensuring stability of field parameters prior to collecting groundwater samples (Section 8.2), and (3) the use of continuous monitoring equipment for groundwater level monitoring. The representativeness of analytical results will be determined by evaluating hold times, sample preservation, and blank contamination (e.g. trip blanks). Samples with expired hold times, improper preservation, or contamination may not be representative, and analytical results will be flagged for further evaluation before use in this project.

6.2.2.3 Completeness

Completeness will be calculated as follows:

$$Completeness\ (\%) = \frac{V}{P} \times 100$$

where:

V = number of valid measurements

P = number of planned measurements

Valid and invalid data (i.e., data qualified with the R flag [rejected]) will be identified during data validation. The completeness target for the Study is 100 percent of water quality samples. However, problems occasionally arise during data collection. A completeness of 95 percent is acceptable for discrete measurements. In general, the project is designed to accommodate some data loss and still meet project goals and objectives.

For continuous deployed measurements, additional variables can negatively impact completeness, including vandalism/theft/tampering, equipment failure, unacceptable fouling or drift, and unpredictable hydrologic events (steep drops in water level between visits). For these reasons, a completeness of 80 percent is acceptable for continuous measurements. Given these difficulties, redundancy is an important component when designing studies with continuous data collection, particularly at important boundary conditions and within the most critical areas. If completeness targets are not achieved, then a determination will be made as to whether the data that were successfully collected are sufficient to meet project needs. This will depend on a number of factors, such as the needs of the analysis framework, and the times and locations where data were lost. If successfully collected data are not sufficient, then one or a combination of the following approaches will be used:

1. Estimate missing data values from existing data, if this can be done with reasonable confidence;
2. Conduct targeted additional sampling to fill data gaps; and
3. Recollect all or a portion of data.

If completeness targets are not met, the study report will analyze the effect of the incomplete data on meeting the study objectives, account for data completeness (or incompleteness) in any data analyses, and document data completeness and its consequences in any study reports.

6.3 Acceptance Criteria for Quality of Existing Data

The City conducts water quality sampling at each of its groundwater wells to comply with DOH drinking water source requirements, but no Ecology-approved QAPP was prepared for this work.

6.4 Model Quality Objectives

The potential for physiochemical changes (mineral dissolution and/or precipitation) to occur because of recharge operations will be evaluated from the data collected during the water quality sampling events by developing a PHREEQC thermodynamic geochemical equilibrium model (Parkurst et al., 1980) for the target aquifer. The model will consider changes in Saturation Indices (SIs) for the primary minerals found in glacial and alluvial aquifer systems. The Lawrence Livermore National Lab dataset (LLNL) (Park, 2005) available from the U.S. Geological Survey will be used to estimate thermodynamic equilibrium and speciation data for aqueous and mineral compounds within the aquifer. This database has been peer reviewed and includes all the common mineral phases that have been previously documented within the regionally extensive glacial and alluvial materials that comprise the storage aquifer. A range of combinations for potential mineral assemblages will be evaluated by the model as part of a sensitivity analysis and quality evaluation (Section 13.4).

The model will evaluate potential changes in water quality that may occur due to mineral dissolution and precipitation. Predicted water quality constituent concentrations will be compared to measured water quality during pilot testing, if implemented.

The rate of reactions will not be explicitly modeled (a kinetic geochemical model will not be explicitly developed for this project). Therefore, no quantitative objectives are set for a comparison of the geochemical modeling results to observed water chemistry. Instead, the qualitative objective for the modeling is that the SIs calculated for water quality at various stages of future testing shall agree with the trends that model simulations predict using water quality data collected under this QAPP. The results of the model will be used to identify potential constituents and/or well performance trends to monitor during pilot testing. Model results will be used to inform regulatory considerations, planning, and for comparison to future water quality measurements associated with the ASR program.

7.0 Study Design

The Study design is a high-bias non-randomized study design. A narrative of the overall Study objective is provided in Section 4. This section provides the details of the data collection and analysis.

7.1 Study Boundaries

The Study area is shown on Figure 1 and will not extend beyond this footprint.

7.2 Field Data Collection

7.2.1 Sampling Locations and Frequency

Water quality sampling will occur according to the schedule shown in Tables 11 and 12. Proposed sampling locations are mapped on Figure 2 The sampling schedule has been tailored to the 2024 irrigation season and seeks to quantify the spatial and temporal variability of water quality in Moses Lake and the ECBID Canal System.

The analyte suite is described in Sections 3.2.3 and 6.2 and will be sampled according to the quality objectives described in Section 6. The sampling schedule is described below in Tables 12 and 13 and align with the proposed project schedule outlined in Section 5.4.

The groundwater sampling locations shown in Table 12 were identified based on proximity to potential surface water sources.

The surface water sampling locations are presented in Table 12based on a tentative priority (highest priority targets are in the first row of the table) and were identified based on their proximity to existing City wells completed in the target aquifer system. Alternative sample locations were identified in the event that sampling cannot be reliably completed (e.g., access or non-representative turbidity).

Surface water sampling will consist of two sampling events, one during the early irrigation season and one during the late irrigation season to assess the temporal variability of water quality for the surface water sources. Sampling will be completed after canals have been operating at capacity for at least two weeks to provide system flushing and after confirming with ECBID that aquatic weed control (herbicide) hasn’t occurred within the canals for at least a week.

Table 11. Groundwater Water Sampling Locations and Schedule

Wells Near Moses Lake							
Well No.	Year Drilled	Depth (feet)	Flow (gpm)	Unit	Status	Distance from surface water source (feet)	Anticipated Sampling Date
3	1970	909	1,000	Grande Ronde	Inactive	855	Summer 2024
Wells Near Canals							
18	2004	585	2,000	Wanapum	Active	200 feet from EL20 Canal	Summer 2024
12	1988	568	1,990			265 feet from EL25 Canal	

Notes:
All sampled wells will be tested for general chemistry.
Field parameters will be measured during every sampling event.

One field duplicate and data validation (DV) sample will be collected during each sampling event. The DV sample for a trip blank will include the VOC, general chemistry, and bacteria sample suites (note that no MS/MSD analyses will be completed for bacteria).

Table 12. Surface Water Sampling Locations and Schedule

Possible Surface Water Sampling Locations			
Surface Water Body	Nearby Well	Parameters to be Sampled	Anticipated Sampling Dates
Moses Lake	33 & 3 & 7	General chemistry, Bacteria, SVOC, Herbicides, Pesticides and Carbamates	August 2024 & October 2024
Moses Lake	10		
EL20 Canal	18		
EL25 Canal	12		
Moses Lake	4		
Moses Lake	31		

Notes:
Field parameters will be measured during every sampling event.

One field duplicate and data validation (DV) sample will be collected during each sampling event. The DV sample for a trip blank will include the VOC, general chemistry, and bacteria sample suites (note that no MS/MSD analyses will be completed for bacteria).
Highlighted cells represent alternative sampling locations in the case that sampling at the primary locations is not possible.
Well logs are included in Appendix D.

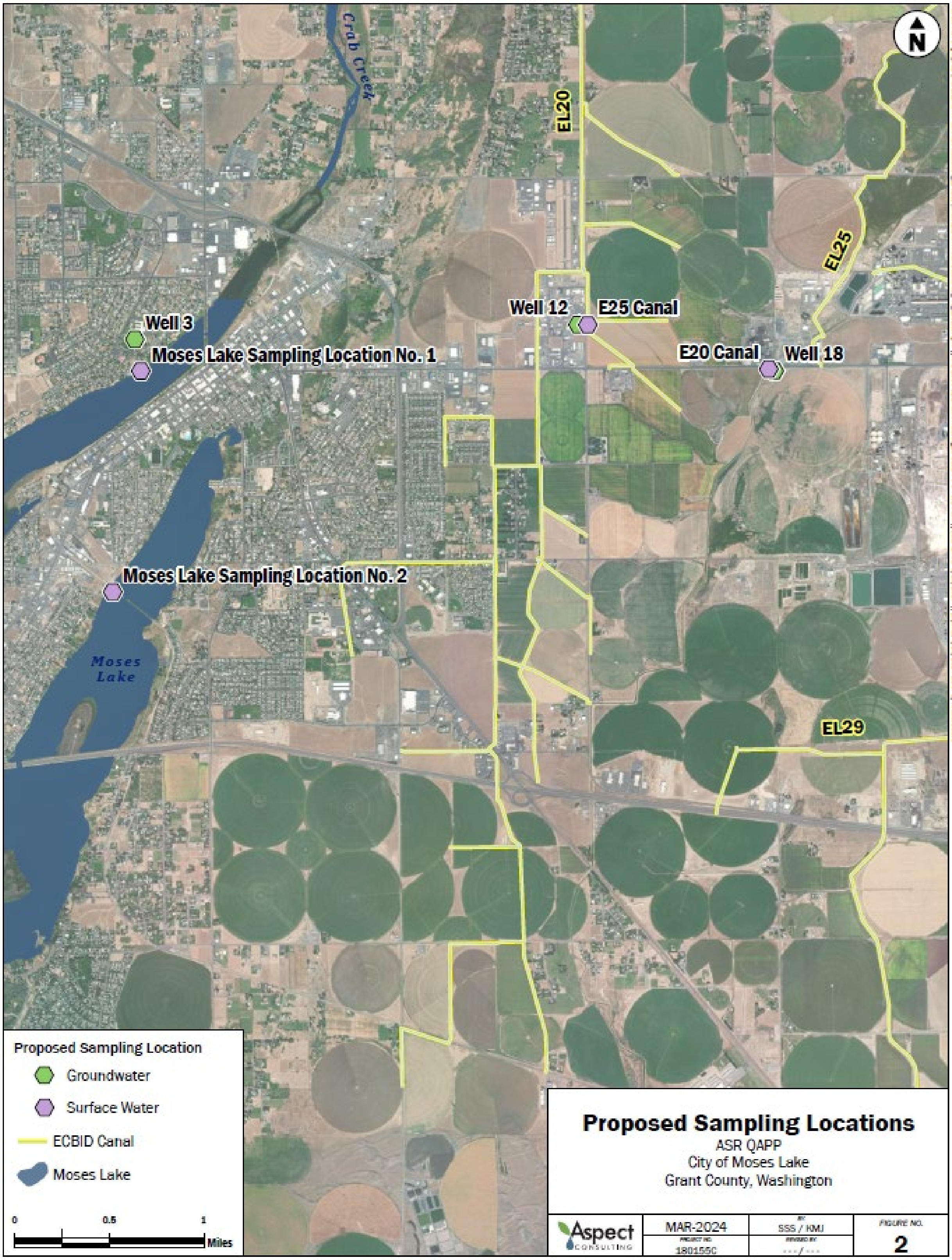

Figure 2. Proposed Sampling Locations

7.2.2 Field Parameters and Laboratory Analytes to be Measured

Field parameters will be measured using an AquaTroll 500 multimeter, and a Hatch 2100Q Portable Turbidimeter as described in Section 8.2, to provide independent corroboration of laboratory results, and to analyze constituents that have short hold times and can be reliably measured in the field. These include:

- Electrical conductivity
- Dissolved Oxygen
- ORP
- pH
- Temperature
- Turbidity

In addition to manual measurements of the above constituents during sampling events (measurements will be collected until values are stable, as described in Section 8.2. Groundwater depth-to-water measurements will be conducted using an electronic water level indicator as discussed in Section 8.2.

Laboratory analytes to be measured from water quality sampling throughout the Study are listed in Section 6.

7.3 Modeling and Analysis Design

Water quality modeling will be conducted using the PHREEQC geochemical software developed by the U.S. Geological Survey (USGS). The model simulations will incorporate water quality results for native groundwater in the target storage aquifer and the Source Water (from the Moses Lake and the Canal System).

The PHREEQC model will evaluate the potential for common primary and secondary minerals to dissolve or precipitate based on the predicted chemistry of mixed waters and calculated mineral saturation indices. Mixed water chemistry will be predicted by the model based on water quality data collected for City Wells and surface water sources as described in Section 7.2.1.

Geochemical modeling will begin by adding water from the potential sources to groundwater at assumed mixing ratios of 50/50 and 80/20 (source water / groundwater). The stored water will also be modeled in equilibrium with common basalt aquifer minerals (based on LLNL equilibrium and speciation data for aqueous and mineral compounds) to simulate potential water quality impacts from interaction with the target aquifer. Following mixing, saturation indices (SIs) for common basalt minerals deemed to have potentially applicable reaction kinetics (i.e., with potential to react within the timeframe considered for storage) will be calculated to assess the potential for mineral precipitation or dissolution.

The results of the model will be used to identify potential constituents and/or well performance trends to monitor for during future pilot testing.

7.3.2 Model setup and data needs

Model setup and model scenarios will be developed as described in Section 7.3. The only data needed for the model are representative water quality constituent profiles for the groundwater and prospective surface water sources, as indicated in Section 7.2.1.

7.4 Assumptions of Study Design

Existing water quality data for both sources through DOH is assumed to be representative of the current water quality conditions. Differences between the historical and sampled data will be evaluated in this study using the methods described in Section 6 to determine whether the differences are single-event outliers or representative of typical variability.

7.5 Possible Challenges and Contingencies

7.5.1 Logistical Problems

Logistical problems that interfere with measurement collection may occur during field work. These problems include:

1. Inability to access source water and groundwater measurement locations;
2. Inability to install pressure transducers into City wells;
3. Water quality samples meeting hold times and temperature criteria when shipping samples to laboratory for analysis.

7.5.2 Practical Constraints

Practical constraints that can interfere with a project include scheduling problems with personnel, equipment failure, or availability of adequate resources. Funding opportunities are typically the greatest limitation to collection of baseline data.

7.5.3 Schedule Limitations

No schedule limitations have been identified but could potentially arise from unforeseen circumstances.

8.0 Field Procedures

8.1 Invasive Species Evaluation

Field staff will follow Ecology SOP EAP070 (publicly available in digital format on Ecology's website), on minimizing the spread of invasive species (Ecology, 2023c). At the end of each field visit, field staff will clean field gear in accordance with the SOP for minimizing the spread of invasive species for areas of both moderate and extreme concern.

Field staff will minimize the spread of invasive species after conducting field work by:

- Inspecting and cleaning all equipment by removing any visible soil, vegetation, vertebrates, invertebrates, plants, algae, or sediment. If necessary, a scrub brush will be used and then rinsed with clean water either from the site or brought for that purpose. The process will be continued until all equipment is clean.
- Draining all water in samplers or other equipment that may harbor water from the site. This step will take place before leaving the sampling site or at an interim site. If cleaning after leaving the sampling site, field staff will ensure that no debris will leave the equipment and potentially spread invasive species during transit or cleaning.

Established Ecology procedures will be followed if an unexpected contamination incident occurs.

8.2 Measurement and Sampling Procedures

The procedures used in this Study are typical for hydrogeologic investigations. SOPs to be followed include the following:

- Standard Operating Procedure for Manually Obtaining Surface Water Samples (Ecology, 2021,
- Manual Well-Depth and Depth-to-Water Measurements (Ecology, 2023a),
- Standard Operating Procedures to Minimize the Spread of Invasive Species (Ecology, 2023b),
- Washington State Department of Health General Sampling Procedure (DOH, 2023),
- Collecting Groundwater Samples for Metals Analysis from Water Supply Wells (Ecology, 2019).

8.2.1 Well Location Survey

The horizontal location of the well will be determined using a Trimble GPS. Care will be taken to collect a GPS location with a horizontal accuracy of the less than 6.5 feet, as discussed in the *Quality Objectives* section (Section 6). The ground surface elevation will also be determined based on the Trimble GPS and shall have a vertical accuracy of equal to, or less than, 3 feet.

8.2.2 Groundwater Level Monitoring

Groundwater levels will be measured at least four City wells with an electronic water level indicator. The manual water level measurements will be compared to the static groundwater level documented post well completion to determine the amount of available head in the aquifer for storage.

Water levels should be collected using an electrical water level meter with engineer's scale accurate to a hundredth of a foot (0.01 feet). A permanent measuring point (MP) will be made from which all depth-to-water measurements are taken at each well to ensure data comparability. An MP will be established or the existing MP will be used if already established.

Establish a permanent measuring point (MP) via the method below:

1. MPs are normally established on the top rim of the actual well casing; this position is commonly referred to as “top of casing” (TOC). Locate the MP at a convenient place from which to measure the water level. If the TOC is level, collect the measurement from the north edge.
2. Clearly mark the MP. The MP must be as permanent as possible and be clearly visible and easily located. The MP may be marked using a permanent black marker, bright colored paint stick, or with a notch filed into the TOC.
3. Describe the position of the MP clearly in the field-data sheets.
4. The MP height is established in reference to a land surface datum (LSD). The LSD is generally chosen to be approximately equivalent to the average altitude of the ground surface around the well.
5. Measure the height of the MP in feet relative to the LSD. Generally, MPs are established to the nearest 0.1 feet using a pocket tape to measure the distance from the MP to the LSD. Note that values for measuring points that lie below land surface should be preceded by a minus sign (-). Record the height of the MP and the date it was established.
6. MPs and the LSD may change over time, the distance between the two should be checked whenever there have been activities, such as land development that could have affected either the MP or LSD at the site. Such changes must be measured as accurately as possible, documented and dated in field-data sheets, and in any database(s) into which the water-level data are entered.

All subsequent water level measurements should be referenced to the established MP. The MP value will be used to convert measurements into values that are relative to land surface.

After a permanent MP is established for each well, continue sampling using the following process:

1. Open the top of the well and note any popping sounds that would indicate pressure buildup, any odors, and the condition of the well head.
2. If there is a pressure transducer attached to the well cap carefully note the initial position of the cap (mark cap position on casing with permanent marker). If the well was airtight, wait a few minutes for the water level to return to equilibrium with atmospheric pressure.
3. Turn the water level meter on and slowly lower the probe into the well until it makes a tone indicating contact with the water level. To confirm contact with the distinct water boundary, slowly raise and lower the electric-tape probe in and out of the water column. If necessary, adjust the sensitivity setting of the meter to provide a “crisp” indication of the water surface. Measure the depth to water against the MP and mark down the date and time the reading was made.

4. At the precise location the indicator shows contact with the water surface, pinch the tape between your fingernails at the MP. Read the depth-to-water.
5. Repeat measurement to ensure that the water level is stable (not rising or falling over time).
6. When the probe is pulled back up, make a note of any mud, staining, or anything else on the tip. Before moving on to the next well, decontaminate the probe with a brush or paper towel, then rinse with distilled water and 10 percent bleach.

On occasion, condensation on the interior casing wall and probe can prematurely trigger the electric-tape indicator giving a false positive reading. In this situation it can help to center the tape in the well casing above the water level and lightly shake the tape to remove the excess water on the probe.

8.2.4 Groundwater and Surface Water Sampling

Groundwater quality samples from City Wells will be collected in general accordance with Ecology (2023dc); Ecology (2019b) and DOH (2023) standard procedures when using existing turbine pumps. Groundwater samples will be collected from the existing sample port at City Wells during operation of the existing pump, prior to any type of water storage or chlorine feed. The well will be purged until the water quality parameters stabilize. If necessary, groundwater quality samples will be collected using low-flow groundwater sampling techniques via a bladder pump.

Field water quality parameters (temperature, pH, specific conductivity, ORP, dissolved oxygen, and turbidity) will be monitored from each well at approximately 3- to 5-minute intervals throughout well purging using an Aqua Troll 500 and flow-through cell plumbed into the sampling port. Water quality parameters will be considered stable when three successive measurements indicate that the parameters fall within the stabilization criteria established in Standard Operating Procedure EAP098 and shown in Table 13 below. Once the water quality parameters have stabilized, the groundwater quality samples shall be collected from the respective sampling port.

Table 13. Field Parameter Stabilization Criteria

Parameter	Value	Units
pH	±0.1	SU
Specific Conductance	±10.0	uS/cm
Dissolved Oxygen	± 0.05 for values < 1 ± 0.2 for values > 1	mg/L
Temperature	±0.1	Degrees Celsius
ORP	±10	millivolts

Source water samples will be collected from the bank of the surface water body. Field water quality parameters (temperature, pH, specific conductivity, ORP, dissolved oxygen, and turbidity) will be obtained using an AquaTroll 500 water quality probe. Surface water samples will be collected as a grab sample either by directly dipping the laboratory-supplied sample bottle through the water column, or by pumping water with a peristaltic pump directly into the laboratory-supplied sample bottle.

All samples collected for dissolved metals will be field filtered with a 0.45-micron pore-size. Samples will be collected after pumping three filter volumes through the filter cartridge. A minimum of one surface water sample will be collected for each site and submitted to the laboratory for analysis.

8.3 Containers, Preservation Methods, Holding Times

The sample bottles and respective preservatives for each sample will be provided by the laboratory and filled accordingly. A description of the sample bottles, preservatives and analytical methods are provided in Table 14 and 15.

New latex gloves will be worn during the collection of the water quality parameters and samples. Samples for dissolved metal analyses shall be filtered prior to collection. All bottles shall be clearly labeled with a unique sample name, location name, date, time, and preservative. Samples shall be stored in a cooler at 4 degrees Celsius (°C) and delivered to the laboratory under standard chain-of-custody protocols, within the hold times provided in Table 14.

Table 14. Containers, Preservation Methods, and Holding Times

Parameter	Container	Preservative	Holding Time
General Chemistry / Water Quality Parameters (all metals and Dissolved fractions)			
Alkalinity (mg/L)	250 mL Plastic	Unpreserved	14 days
Bicarbonate (mg/L)	1 L Plastic	Unpreserved	14 days
Chloride (mg/L)	1 L Plastic	Unpreserved	28 days
TDS (mg/L)	1 L Plastic	Unpreserved	7 days
TSS (mg/L)			
Total Organic Carbon (mg/L)	1 L Plastic	H2SO4	28 days
Phosphorous, Total (mg/L)			
Bromide (mg/L)	1 L Plastic	Unpreserved	28 days
Fluoride (mg/L)			
Nitrate-N (mg/L)	1 L Plastic	Unpreserved	48 hours
Nitrite-N (mg/L)			

Parameter	Container	Preservative	Holding Time
Sulfate (mg/L)	1 L Plastic	Unpreserved	28 days
Silica (silicon) (µg/L)	1 L Plastic	HNO3	6 months
Arsenic (µg/L)	1 L Plastic	HNO3	6 months
Antimony (µg/L)	1 L Plastic	HNO3	6 months
Aluminum (µg/L)	1 L Plastic	HNO3	6 months
Barium (µg/L)	1 L Plastic	HNO3	6 months
Beryllium (µg/L)	1 L Plastic	HNO3	6 months
Cadmium (µg/L)	1 L Plastic	HNO3	6 months
Calcium (µg/L)	1 L Plastic	HNO3	6 months
Chromium (µg/L)	1 L Plastic	HNO3	6 months
Copper (µg/L)	1 L Plastic	HNO3	6 months
Iron (µg/L)	1 L Plastic	HNO3	6 months
Lead (µg/L)	1 L Plastic	HNO3	6 months
Magnesium (µg/L)	1 L Plastic	HNO3	6 months
Manganese (µg/L)	1 L Plastic	HNO3	6 months
Mercury (ug/L)	1 L Plastic	HNO3	28 days
Nickel (µg/L)	1 L Plastic	HNO3	6 months
Potassium (µg/L)	1 L Plastic	HNO3	6 months
Selenium (µg/L)	1 L Plastic	HNO3	6 months
Silver (µg/L)	1 L Plastic	HNO3	6 months
Sodium (µg/L)	1 L Plastic	HNO3	6 months
Thallium (µg/L)	1 L Plastic	HNO3	6 months
Titanium (ug/L)	1 L Plastic	HNO3	6 months
Zinc (ug/L)	1 L Plastic	HNO3	6 months
Volatile Organic Compounds (VOCs)			
All VOCs	40 mL VOA	Na2S203	14 Days
Synthetic Organic Compounds (SOCs)			
SOCs Measured Via EPA Methods 508.1 and 525.2	1 L Amber	HCl + Na2SO3	14 Days
SOCs Measured Via EPA Method 515.4	250 mL Amber	Na2SO3	14 Days
Herbicides and Pesticides			
Chlorinated Pesticides	1 L Amber	HCl + Na2SO3	14 Days
Chlorinated Acid Herbicides	G, Amber, Teflon-Lined Cap	<6ºC	14 days until extraction, 21 days after extraction

Parameter	Container	Preservative	Holding Time
Pesticides as carbamates	60 mL glass container	30mL/L of C2H3ClO2, 80mg/L of Na2S2O3.[1] Cool 4ºC	28 Days
Herbicides – diquat and paraquat	G, Amber, Teflon-Lined Cap	100mg/L of Na2S2O3, 4ºC	14 days until extraction, 21 days after extraction
Herbicides – endothall	G, Amber, Teflon-Lined Cap	4ºC	14 days until extraction, 21 days after extraction
Herbicides – glyphosate	Glass Container	100mg/L Na2S2O3, 4ºC	14 Days
Bacteriological (LabTest)			
E. coli	250 mL sterile plastic	Na2S2O3	30 hours
Total Coliform			

1. After the addition of C2H3ClO2 and Na2S2O3, seal and shake sample bottle for 1 min prior to storage.

8.4 Equipment Decontamination

Water samples are collected from dedicated sampling equipment or directly into laboratory provided containers to prevent cross-contamination. All sampling equipment will be decontaminated before and after completion of all sampling activities. Sampling equipment will be decontaminated with an industry standard, phosphorous-free detergent and brush or paper towel, then rinsed with distilled water.

8.5 Sample ID

All bottles shall be clearly labeled with a unique sample name, location name, date, time, and preservative. Samples shall be stored in a cooler at 4°C and delivered to the laboratory under standard chain-of-custody protocols, within the hold times provided in Table 14.

8.6 Chain of Custody

After collection, samples will be maintained in Aspect's custody until formally transferred to the analytical laboratory. For purposes of this work, custody of the samples will be defined as follows:

- In plain view of the field representatives
- Inside a cooler that is in plain view of the field representative
- Inside any locked space, such as a cooler, locker, car, or truck to which the field representative has the only immediately available key(s)

A chain-of-custody record provided by the laboratory will be initiated at the time of sampling for all samples collected. The record will be signed by the field representative and others who subsequently take custody of the samples. Couriers or other professional shipping representatives are not required to sign the chain-of-custody form; however, shipping receipts will be collected and maintained as a part of custody documentation in the project files. A copy of the chain-of-custody form with appropriate signatures will be maintained in Aspect's files and included as an appendix to the project report.

8.7 Field Log Requirements

During the collection of any field samples accompanying field documentation must be made clearly stating:

- Name and location of project
- Field personnel
- Sequence of events
- Any changes or deviations from the QAPP or SOPs
- Environmental conditions
- Date, time, location, ID, unique sample name, and description of each sample
- Field instrument calibration procedures
- Field measurement results
- Identity of QC samples collected
- Unusual circumstances that might affect interpretation of results

For this Study, data collected in the field will be contained in a field log (a binder backed by electronic scans of documents) that will consist of field notes (freehand notes) and Aspect field data sheets (Appendix C).

Field notes should be bound, waterproof notebooks with prenumbered pages (Rite in the Rain®). Permanent, waterproof ink should be used for all entries. Corrections should be made with single-line strikethroughs, initials, and date of correction. Use of white-out or correction fluid is not permitted.

While conducting field work, the field geologist or technician (Section 5) will document general pertinent observations and events in waterproof field notes and, when warranted, provide photographic documentation of specific sampling efforts. Data collected during the sample collection procedures will be recorded on standard Aspect field data sheets (Appendix C). Field notes will include a description of each field activity, sample descriptions, and associated details, such as the date, time, and field conditions. The laboratory chain-of-custody forms will be filled out before leaving the site. Upon completion of a field task, the field personnel will then scan field notes and Aspect field data sheets into computer files and provide the original versions to the Aspect Project Manager. Copies of Aspect field data sheet and laboratory chain of custody are provided in Appendix C.

8.8 Other Activities

Not Applicable.

9.0 Laboratory Procedures

9.1 Lab Procedures Table

Table 15 presents the lab procedures for each analyte including the sample matrix, number of samples, expected range of results, reporting limit, and analytical method.

Table 15. Lab Procedures

Analyte	Sample Matrix	Expected Range of Results	Minimum Reporting Limit	Analytical (Instrumental) Method
General Chemistry / Water Quality Parameters (all metals are total and Dissolved fractions)				
Alkalinity (mg/L)	Water	138-144	2	SM2320 B
Bicarbonate (mg/L)	Water	130-142	2	SM2320 B
Chloride (mg/L)	Water	12-19	0.2	EPA Method 300
TDS (mg/L)	Water	250-335	5	SM2540 C
TSS (mg/L)	Water	<5-5	5	SM2540 D
Total Organic Carbon (mg/L)	Water	0.5-0.61	0.5	SM5310 C
Phosphorous, Total (mg/L)	Water	0.01-1.75	0.01	EPA Method 365.3
Bromide (mg/L)	Water	0.02-0.2	0.1	EPA Method 300
Fluoride (mg/L)	Water	1.7-3.6	0.2	EPA Method 300
Nitrate-N (mg/L)	Water	0.02-2.3	0.1	EPA Method 300
Nitrite-N (mg/L)	Water	0.02-2.3	0.1	EPA Method 300
Sulfate (mg/L)	Water	26-32	0.2	EPA Method 300
Silica (silicon) (µg/L)	Water	55000-64000	200	EPA Method 200.7
Arsenic (µg/L)	Water	0.1-1.7	0.5	EPA Method 200.8
Antimony (µg/L)	Water	0.02-0.08	0.05	EPA Method 200.8
Aluminum (µg/L)	Water	3-17	2	EPA Method 200.8
Barium (µg/L)	Water	7.7-20	4	EPA Method 200.8
Beryllium (µg/L)	Water	<0.3	1	EPA Method 200.8
Cadmium (µg/L)	Water	<0.4	1	EPA Method 200.8
Calcium (µg/L)	Water	2400-9900	20	EPA Method 200.8
Chromium (µg/L)	Water	<2.1	4	EPA Method 200.8
Copper (µg/L)	Water	<2.1	4	EPA Method 200.8
Iron (µg/L)	Water	8-550	20	EPA Method 200.7
Lead (µg/L)	Water	2-50	10	EPA Method 200.8
Magnesium (µg/L)	Water	530-6230	5	EPA Method 200.7
Manganese (µg/L)	Water	0.9-21	1	EPA Method 200.8
Mercury (ug/L)	Water	Unknown	0.2	EPA Method 245.1
Nickel (µg/L)	Water	0.9-18	4	EPA Method 200.8
Potassium (µg/L)	Water	8200-12500	200	EPA Method 200.7
Selenium (µg/L)	Water	0.1-0.3	1	EPA Method 200.8
Silver (µg/L)	Water	56000-66300	4	EPA Method 200.8
Sodium (µg/L)	Water	59500-79800	200	EPA Method 200.7
Thallium (µg/L)	Water	0.009-0.07	0.02	EPA Method 200.8
Bacteriological (LabTest.)				
E. coli	Water	Unknown	--	SM 9223B

Analyte	Sample Matrix	Expected Range of Results	Minimum Reporting Limit	Analytical (Instrumental) Method
Total Coliform	Water	Unknown	--	SM 9223B
VOCs				
1,1,1,2-Tetrachloroethane	Water	<RL	0.5	EPA Method 524.2
1,1,1-Trichloroethane	Water	<RL	0.5	EPA Method 524.2
1,1,2,2-Tetrachloroethane	Water	<RL	0.5	EPA Method 524.2
1,1,2-Trichloroethane	Water	<RL	0.5	EPA Method 524.2
1,1-Dichloroethane	Water	<RL	0.5	EPA Method 524.2
1,1-Dichloroethene	Water	<RL	0.5	EPA Method 524.2
1,1-Dichloropropene	Water	<RL	0.5	EPA Method 524.2
1,2,3-Trichlorobenzene	Water	<RL	0.5	EPA Method 524.2
1,2,3-Trichloropropane	Water	<RL	0.5	EPA Method 524.2
1,2,4-Trichlorobenzene	Water	<RL	0.5	EPA Method 524.2
1,2,4-Trimethylbenzene	Water	<RL	0.5	EPA Method 524.2
1,2-Dibromo-3-chloropropane (DBCP)	Water	<RL	0.5	EPA Method 524.2
1,2-Dibromoethane (EDB)	Water	<RL	0.5	EPA Method 524.2
1,2-Dichlorobenzene	Water	<RL	0.5	EPA Method 524.2
1,2-Dichloroethane	Water	<RL	0.5	EPA Method 524.2
1,2-Dichloropropane	Water	<RL	0.5	EPA Method 524.2
1,3,5-Trimethylbenzene	Water	<RL	0.5	EPA Method 524.2
1,3-Dichlorobenzene	Water	<RL	0.5	EPA Method 524.2
1,3-Dichloropropane	Water	<RL	0.5	EPA Method 524.2
1,4-Dichlorobenzene	Water	<RL	0.5	EPA Method 524.2
2,2-Dichloropropane	Water	<RL	0.5	EPA Method 524.2
2-Chlorotoluene	Water	<RL	0.5	EPA Method 524.2
4-Chlorotoluene	Water	<RL	0.5	EPA Method 524.2
Benzene	Water	<RL	0.5	EPA Method 524.2
Bromobenzene	Water	<RL	0.5	EPA Method 524.2
Bromochloromethane	Water	<RL	0.5	EPA Method 524.2
Bromodichloromethane	Water	<RL	0.5	EPA Method 524.2
Bromoform	Water	<RL	0.5	EPA Method 524.2
Bromomethane	Water	<RL	0.5	EPA Method 524.2
Carbon Tetrachloride	Water	<RL	0.5	EPA Method 524.2
Chlorobenzene	Water	<RL	0.5	EPA Method 524.2
Chloroethane	Water	<RL	0.5	EPA Method 524.2
Chloroform	Water	<RL	0.5	EPA Method 524.2
Chloromethane	Water	<RL	0.5	EPA Method 524.2
cis-1,2-Dichloroethene	Water	<RL	0.5	EPA Method 524.2

Analyte	Sample Matrix	Expected Range of Results	Minimum Reporting Limit	Analytical (Instrumental) Method
cis-1,3-Dichloropropene	Water	<RL	0.5	EPA Method 524.2
Dibromochloromethane	Water	<RL	0.5	EPA Method 524.2
Dibromomethane	Water	<RL	0.5	EPA Method 524.2
Dichlorodifluoromethane	Water	<RL	0.5	EPA Method 524.2
Ethylbenzene	Water	<RL	0.5	EPA Method 524.2
Hexachlorobutadiene	Water	<RL	0.5	EPA Method 524.2
Isopropylbenzene	Water	<RL	0.5	EPA Method 524.2
m,p-Xylenes	Water	<RL	0.5	EPA Method 524.2
Methyl tert-Butyl Ether	Water	<RL	0.5	EPA Method 524.2
Methylene Chloride	Water	<RL	0.5	EPA Method 524.2
Naphthalene	Water	<RL	0.5	EPA Method 524.2
n-Butylbenzene	Water	<RL	0.5	EPA Method 524.2
n-Propylbenzene	Water	<RL	0.5	EPA Method 524.2
o-Xylene	Water	<RL	0.5	EPA Method 524.2
p-Isopropyltoluene	Water	<RL	0.5	EPA Method 524.2
sec-Butylbenzene	Water	<RL	0.5	EPA Method 524.2
Styrene	Water	<RL	0.5	EPA Method 524.2
tert-Butylbenzene	Water	<RL	0.5	EPA Method 524.2
Tetrachloroethene	Water	<RL	0.5	EPA Method 524.2
Toluene	Water	<RL	0.5	EPA Method 524.2
trans-1,2-Dichloroethene	Water	<RL	0.5	EPA Method 524.2
trans-1,3-Dichloropropene	Water	<RL	0.5	EPA Method 524.2
Trichloroethene	Water	<RL	0.5	EPA Method 524.2
Trichlorofluoromethane	Water	<RL	0.5	EPA Method 524.2
Vinyl Chloride	Water	<RL	0.5	EPA Method 524.2
SOCs				
Acenaphthene (µg/L)	Water	<RL	0.05	EPA Method 525.2
Acenaphthylene (µg/L)	Water	<RL	0.05	EPA Method 525.2
Acetochlor (µg/L)	Water	<RL	1	EPA Method 525.2
Alachlor (µg/L)	Water	<RL	0.072	EPA Method 525.2
Anthracene (µg/L)	Water	<RL	0.068	EPA Method 525.2
Atrazine (µg/L)	Water	<RL	0.1	EPA Method 525.2
Benz(a)anthracene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Benzo(a)pyrene (µg/L)	Water	<RL	0.02	EPA Method 525.2
Benzo(b)fluoranthene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Benzo(g,h,i)perylene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Benzo(k)fluoranthene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Benzyl butyl phthalate (µg/L)	Water	<RL	0.5	EPA Method 525.2

Analyte	Sample Matrix	Expected Range of Results	Minimum Reporting Limit	Analytical (Instrumental) Method
Bis(2-ethylhexyl) Adipate (µg/L)	Water	<RL	0.6	EPA Method 525.2
Bis(2-ethylhexyl) Phthalate (µg/L)	Water	<RL	0.6	EPA Method 525.2
Bromacil (µg/L)	Water	<RL	0.2	EPA Method 525.2
Butachlor (µg/L)	Water	<RL	0.052	EPA Method 525.2
Chrysene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Dibenz(a,h)anthracene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Diethyl Phthalate (µg/L)	Water	<RL	0.5	EPA Method 525.2
Dimethyl Phthalate (µg/L)	Water	<RL	0.5	EPA Method 525.2
Di-n-butyl Phthalate (µg/L)	Water	<RL	0.6	EPA Method 525.2
Di-n-octyl Phthalate (µg/L)	Water	<RL	0.2	EPA Method 525.2
EPTC (µg/L)	Water	<RL	0.052	EPA Method 525.2
Fluoranthene (µg/L)	Water	<RL	0.1	EPA Method 525.2
Fluorene (µg/L)	Water	<RL	0.05	EPA Method 525.2
Hexachlorobenzene (µg/L)	Water	<RL	0.1	EPA Method 525.2
Hexachlorocyclopentadiene (µg/L)	Water	<RL	0.1	EPA Method 525.2
Indeno(1,2,3-cd)pyrene (µg/L)	Water	<RL	0.2	EPA Method 525.2
Isophorone (µg/L)	Water	<RL	0.05	EPA Method 525.2
Malathion (µg/L)	Water	<RL	0.2	EPA Method 525.2
Metolachlor (µg/L)	Water	<RL	0.09	EPA Method 525.2
Metribuzin (µg/L)	Water	<RL	0.2	EPA Method 525.2
Parathion (µg/L)	Water	<RL	0.2	EPA Method 525.2
Phenanthrene (µg/L)	Water	<RL	0.05	EPA Method 525.2
Prometon (µg/L)	Water	<RL	0.05	EPA Method 525.2
Pyrene (µg/L)	Water	<RL	0.05	EPA Method 525.2
Simazine (µg/L)	Water	<RL	0.05	EPA Method 525.2
Terbacil (µg/L)	Water	<RL	0.2	EPA Method 525.2
Herbicides and Pesticides				
4,4'-DDD (µg/L)	Water	<RL	0.01	EPA Method 505
4,4'-DDE (µg/L)	Water	<RL	0.01	EPA Method 505
4,4'-DDT (µg/L)	Water	<RL	0.01	EPA Method 505
Aldrin (µg/L)	Water	<RL	0.01	EPA Method 505
alpha-BHC (µg/L)	Water	<RL	0.01	EPA Method 508.1
alpha-Chlordane (µg/L)	Water	<RL	0.01	EPA Method 508.1
beta-BHC (µg/L)	Water	<RL	0.01	EPA Method 508.1
Chlordane (µg/L)	Water	<RL	0.1	EPA Method 508.1
delta-BHC (µg/L)	Water	<RL	0.01	EPA Method 508.1
Dieldrin (µg/L)	Water	<RL	0.01	EPA Method 508.1
Endosulfan I (µg/L)	Water	<RL	0.01	EPA Method 508.1
Endosulfan II (µg/L)	Water	<RL	0.01	EPA Method 508.1
Endosulfan Sulfate (µg/L)	Water	<RL	0.01	EPA Method 508.1
Endrin (µg/L)	Water	<RL	0.01	EPA Method 508.1
Endrin Aldehyde (µg/L)	Water	<RL	0.01	EPA Method 508.1
Endrin Ketone (µg/L)	Water	<RL	0.01	EPA Method 508.1

Analyte	Sample Matrix	Expected Range of Results	Minimum Reporting Limit	Analytical (Instrumental) Method
gamma-BHC (Lindane) (µg/L)	Water	<RL	0.01	EPA Method 508.1
gamma-Chlordane (µg/L)	Water	<RL	0.01	EPA Method 508.1
Heptachlor (µg/L)	Water	<RL	0.01	EPA Method 508.1
Heptachlor Epoxide (µg/L)	Water	<RL	0.01	EPA Method 508.1
Heptachlor Epoxide (Isomer A) (µg/L)	Water	<RL	0.01	EPA Method 508.1
Methoxychlor (µg/L)	Water	<RL	0.01	EPA Method 508.1
Toxaphene (µg/L)	Water	<RL	0.1	EPA Method 508.1
Aroclor 1016 (µg/L)	Water	<RL	0.05	EPA Method 508.1
Aroclor 1221 (µg/L)	Water	<RL	0.1	EPA Method 508.1
Aroclor 1232 (µg/L)	Water	<RL	0.1	EPA Method 508.1
Aroclor 1242 (µg/L)	Water	<RL	0.1	EPA Method 508.1
Aroclor 1248 (µg/L)	Water	<RL	0.1	EPA Method 508.1
Aroclor 1254 (µg/L)	Water	<RL	0.1	EPA Method 508.1
Aroclor 1260 (µg/L)	Water	<RL	0.1	EPA Method 508.1
2,4,5-T (ug/L)	Water	<RL	0.2	EPA Method 515.4
2,4,5-TP (Silvex) (ug/L)	Water	<RL	0.05	EPA Method 515.4
2,4-D (ug/L)	Water	<RL	0.1	EPA Method 515.4
2,4-DB (ug/L)	Water	<RL	0.4	EPA Method 515.4
3,5-Dichlorobenzoic Acid (ug/L)	Water	<RL	0.2	EPA Method 515.4
4-Nitrophenol (ug/L)	Water	<RL	0.4	EPA Method 515.4
Acifluorfen (ug/L)	Water	<RL	0.2	EPA Method 515.4
Bentazon (ug/L)	Water	<RL	0.4	EPA Method 515.4
Chloramben (ug/L)	Water	<RL	0.3	EPA Method 515.4
Dacthal Diacid (ug/L)	Water	<RL	0.2	EPA Method 515.4
Dalapon (ug/L)	Water	<RL	1	EPA Method 515.4
Dicamba (ug/L)	Water	<RL	0.2	EPA Method 515.4
Dichlorprop (ug/L)	Water	<RL	0.4	EPA Method 515.4
Dinoseb (ug/L)	Water	<RL	0.2	EPA Method 515.4
Pentachlorophenol (ug/L)	Water	<RL	0.04	EPA Method 515.4
Picloram (ug/L)	Water	<RL	0.1	EPA Method 515.4
Endothall (ug/L)	Water	<RL	5	EPA Method 548.1
Diquat (ug/L)	Water	<RL	0.4	EPA Method 549.2
Paraquat (ug/L)	Water	<RL	0.8	EPA Method 549.2

Note:
1. See Section 7.2.1 and Table 11 and 12 for sampling schedule.

9.2 Sample Preparation Method(s)

Samples will be prepared and extracted by an accredited lab in accordance with industry standards and analytical methods. The selected laboratory is discussed in Section 9.4.

9.3 Special Method Requirements

Not applicable.

9.4 Laboratories Accredited for Methods

Analysis of water quality samples will be performed by Anatek of Spokane, Washington. Anatek is accredited by Ecology for analysis of all parameters included in this project (see Appendix B).

Contact information for the laboratory is:

Anatek Labs
504 E Sprague Ave
Suite D
Kelso, WA 98626

Project Manager: Kathy Sattler

Phone: (509) 838-3999
Fax: (509) 838-4433

10.0 Quality Control Procedures

Implementing QC procedures provides the information needed to assess the quality of the data that is collected. These procedures also help identify problems or issues associated with data collection or data analysis while the project is underway.

10.1 Field and Laboratory Quality Control

Standard EPA Level II procedures will be followed by the laboratory for one standard check, method blank, analytical duplicate, and matrix spike per laboratory batch (typically 10 to 20, as accommodated by laboratory autosampling equipment and sample backlog). Field procedures will follow standard guidelines and SOPs for the relevant field activity. As detailed below, data validation samples will be collected at a minimum of every 10 samples collected.

Data Validation Samples

Field quality control (QC) is accomplished through the analysis of controlled data validation (DV) samples that are introduced to the laboratory from the field. Field duplicates and trip blanks will be collected and submitted to the investigation laboratory to provide a means of assessing the quality of data resulting from the field sampling program.

Trip Blank

Trip blank samples will be used to monitor any possible cross-contamination that occurs during the transport of VOCs and samples. Trip blank samples are prepared by the laboratory using organic-free reagent-grade water into a VOA vial prior to the collection of field samples. Two vials per trip blank sample are placed with and accompany the VOCs samples through the entire transport process. Trip blank samples will be prepared and analyzed only for VOCs.

Field Duplicates

Field duplicate samples are used to check for sampling and analysis reproducibility. Field duplicate samples will be collected at a frequency of 10 percent of the field samples for every matrix and analytical method.

A set of DV samples will be collected for at least every 10 water samples collected. The DV sample set will include the following for calculation of DV parameters and acceptance criteria, and Section 9 for description of lab procedures):

- A MS/MSD
- A "blind" field duplicate (i.e., not indicated to the lab as a field duplicate)
- Trip blanks (for VOCs, bacteria, and inorganic constituent suites)
- Field blanks (for VOCs, anions and cations)

Except for the trip blank, the chemical analysis of DV samples will include the entire list of chemical analytes (Section 6). The trip blank will include only analysis of VOCs. The blind field duplicate will be labeled in a manner that does not indicate its true sample location, and the MS/MSD will be labeled, as such, for laboratory processing.

10.2 Corrective Action Processes

The laboratory will follow the analytical method for corrective action procedures when the sample results do not meet the QC acceptance criteria. The laboratory will notify the Aspect hydrogeologist that submitted the samples and include a narrative in the laboratory report when following the analytical method corrective action procedure results in a sample result not meeting the QC acceptance criteria. Findings will be reviewed by the Aspect project manager. QC results may indicate problems with data during the course of the project. Corrective action processes (such as recalibration) will be used if:

- Activities are inconsistent with the QAPP
- Field instruments yield unusual results
- Results do not meet MQOs or performance expectations
- If some other unforeseen problem arises

11.0 Data Management Procedures

11.1 Data Recording and Reporting Requirements

Field technicians will record all field data in a water-resistant field notebook, electronic data forms, or Aspect standard field data sheet. Before leaving each site, staff will check field notebooks, data sheets, or electronic data forms for missing or improbable measurements. Field technicians will enter field-generated data into spreadsheets or a project database as soon as practical after they return from the field. For data collected electronically, data will be backed up on servers when staff return from the field. Raw data files will be stored separate from processed data files.

The Aspect field hydrogeologist and field technician will check data entry against the field notebook data for errors and omissions following each sample event. The hydrogeologist will notify the Aspect project manager of missing or unusual data.

All final spreadsheet files, paper field notes, and final products created as part of the data collection and data QA process will be kept with the project data files.

Data will be uploaded to Ecology's EIM database as described in Section 11.4.

11.2 Laboratory Data Package Requirements

All continuous and laboratory data will be stored in a project database that includes station location information and data QA information. This database will facilitate summarization and graphical analysis of the data.

11.3 Electronic Transfer Requirements

The lab will provide an EPA Level II data package as a pdf and an electronic data deliverable (EDD) in the format of a csv or xls file (comma-separated value and Excel workbook). The data package will include the following sections: Case narrative; Chain-of-custody (COC) documentation; Summary of results for environmental samples; Summary of QA/QC results; and Raw data.

11.4 Data Upload Procedures

Following completion of the QC and DV procedures described in Section 10, all quality assured data will be formatted and uploaded to Ecology's EIM database by an Aspect data scientist using study ID: WROCR-2123-MoLaMS-00034

11.5 Model Information Management

Modeling will be completed using the PHREEQC code and existing peer-reviewed geochemical databases (Section 6.4). Aspect will maintain the final version of the model files, including input, output, and executables, for archiving at the completion of the task. Methods and results will be detailed in the project report. Electronic copies of the data and supporting documentation will be made available upon request. Aspect will maintain copies in a task subdirectory, subject to regular system backups, for a minimum period of 3 years after task termination, unless otherwise directed. The City will retain electronic copies of completed reports, including all data tables and figures. Maintenance of computer resources will be conducted by Aspect's in-house computer specialists.

12.0 Audits and Reports

12.1 Audits

Field technicians will be required to review this QAPP prior to each monitoring event and to maintain a copy of the QAPP and its appendices in the field. Field technicians may be audited at any time by the appropriate project manager or the Aspect data manager (Section 5) to ensure that field work is being completed according to this QAPP, work plan, and published SOPs.

12.2 Responsible Personnel

Personnel responsible for the audits are as follows:

- Field audit: Aspect Project Manager
- Field consistency review: experienced (at least 3 years) staff (senior hydrogeologist or project manager)
- Data analysis: Aspect hydrogeologists (field, senior, and principal, as required for specific analysis)

Personnel assigned to these roles are listed in Table 7.

12.3 Frequency and Distribution of Reports

Results of the field data collection, data quality assessment, and any data analysis will be documented in the final ASR Alternatives Evaluation Report. The final report will be distributed to all stakeholders involved or interested in the Study as determined by the City and Ecology.

Data analysis documentation may be accomplished in one document at the end of the project or in stages during different phases of the project. For complex projects, the project team may elect to write separate reports on the data collected, QA/QC, and model scenarios. For this project, the data analysis documentation will be included in the Water Quality Evaluation section (and appendices) of the final ASR Alternatives Evaluation Report.

Field and Laboratory Data will be entered into EIM when data collection is complete.

12.4 Responsibility for Reports

The Aspect Project Manager is responsible for verifying data completeness and usability before the data are used in the technical report and entered into Environmental Information Management (EIM) database. The Aspect Project Manager is also responsible for writing the final technical report, unless an alternate author is agreed upon and documented at the start of the project.

The Aspect Project Manager is responsible for assigning a peer reviewer with the appropriate expertise for the technical report. A draft report will be prepared and submitted to Ecology, then a final report will be prepared that addresses Ecology's comments. The peer reviewer is responsible for working with the report author to resolve or clarify any issues with the report.

13.0 Data Verification

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements.

13.1 Field Data Verification, Requirements, and Responsibilities

Field notebooks, data sheets, and electronic information storage will be checked for missing or improbable measurements, and initial data will be verified before leaving each site. This process involves checking the data sheet (written or electronic) for omissions or outliers. If measurement data are missing or a measurement is determined to be an outlier, the measurement will be flagged in the data sheet and repeated if possible. The field hydrogeologist or field technician is responsible for in-field data verification.

Upon returning from the field, data are either manually entered (data recorded on paper) or downloaded from instruments and then uploaded into the appropriate database or project folder (see Section 11: Data Management Procedures). Manually entered data will be verified/checked by a staff member who did not enter the data. Downloaded electronic data files will also be checked for completeness and appropriate metadata (such as file name, time code).

Following data entry verification, raw field measurement data will undergo a quality analysis verification process to evaluate the performance of the sensors. Field measurement data may be adjusted for bias or drift (increasing bias over time) based on the results of fouling, field, or standards checks following general USGS guidelines (Wagner, 2007) and this process:

Review Discrete Field QC Checks

The field check of instrumentation will consist of a manual measurement for water levels, and measurement of water quality standards in the field (checks with water quality standards will be completed separate from calibration events). Review of the field checks will consist of the following:

1. Review post check data for field QC instrument check (water quality and water level), reject data as appropriate.
2. Assign a quality rating to the field check values (pass or fail) based on the post-check.

Review/Adjust Time Series (Continuous) Data (where existing data is used in this Study)

1. Plot compensated pressure data converted to depth-to-water time series with field checks.

2. Reject data based on deployment/retrieval times, site visit disruption, blatant fouling events, and sensor/equipment failure.
3. Review sensor offsets for recalibration. Flag any potential chronic drift or bias issues specific to the instrument.
4. If applicable, review fouling check and make drift adjustment, if necessary. In some situations, an event fouling adjustment may be warranted based on abrupt changes in groundwater levels, barometric pressure, etc.
5. Review residuals from both field checks and post-checks, together referred to as QC checks. Adjust data, as appropriate, using a weight-of-evidence approach. Give the most weight to checks are accepted, rejected, or qualified. Potential data adjustments include:
    a. **Bias –** Data are adjusted by the average difference between the QC checks and deployed instrument. Majority of QC checks must show bias to use this method.
    b. **Regression –** Data adjusted using regression, typically linear, between QC checks and deployed instrument. This accounts for both a slope and bias adjustment. The regression must have at least five data points and an R^2 value of >0.95 to use for adjustment. Do not extrapolate regressions beyond the range of the QC checks.
    c. **Calibration/Sensor Drift –** Data adjusted using linear regression with time from calibration or deployment to post-check or retrieval. Majority of QC checks, particularly post-checks, must confirm pattern of drift.
6. Typically, choose the adjustment that results in the smallest residuals and bias between the adjusted values and QC checks. Best professional judgement and visual review are necessary to confirm adjustment.
7. If the evidence is weak, or inconclusive, do not adjust the data.

It will be noted in the final report if any data is adjusted. Data adjustment must be performed or reviewed by an Aspect Project Manager, or personnel, with the appropriate training and experience in processing raw sensor data.

13.2 Laboratory Data Verification

The lab will provide an EPA Level II data package. Additional laboratory data validation (check batch QC) will be conducted by Aspect’s project data scientist (Table 7). Laboratory validation results will be summarized on the laboratory reports, and Aspect’s validation results will be summarized in the final report. An Aspect hydrogeologist will verify the validated laboratory results.

13.3 Validation requirements, if necessary

Not applicable.

13.4 Model quality assessment

The geochemical model to be used in this project is a thermodynamic equilibrium model developed by the USGS. The model uses an existing database of mineral phase equilibria (Section 6.4) to evaluate the potential for reactions to occur without consideration for reaction kinetics. The model is intended to be used to “bookend” potential water quality changes that may occur through ASR and will be used primarily to identify potential trends to monitor for during pilot testing.

Quality assessment is defined as the process by which QC is implemented in the model development task. All modelers will conform to the following guidelines:

- All modeling activities including data interpretation are subject to audit or peer review. Thus, the modelers are instructed to maintain careful written and electronic records for all aspects of model development.
- If historical data are used, a written record on where the data were obtained and any information on their quality will be documented in the final report. A written record on where this information is on a computer or backup media will be maintained in the task files.
- If new theory is incorporated into the model framework, references for the theory and how it is implemented in any computer code will be documented and peer-reviewed.

Model results will be compared data obtained from other ASR projects operating under very similar conditions (e.g., the City of Yakima ASR program). The model quality assessment will be entirely qualitative.

A sensitivity analysis of input parameters and assumed mineral assemblages will be completed to assess the dependence of the geochemical model results on key input parameters. The resulting changes in mineral SI’s will be assessed and discussed in the final report.

14.0 Data Quality (Usability) Assessment

14.1 Process for Determining Project Objectives were Met

The Aspect Project Manager will assess all data (qualified and unqualified), results or verification, compliance with MQOs, and the overall quality of the data set to provide a final determination regarding usability in the context of the project-specific goals and objectives. The final report will document whether the final, acceptable-quality data set meets the needs of the project (allows desired conclusions/decisions to be made with the desired level of certainty).

14.2 Treatment of Nondetects

Nondetects will be reported as the MRL for that analyte with the appropriate flag (“<”) indicating it as a nondetect.

14.3 Data Analysis and Presentation Methods

Data found to be of acceptable quality for project objectives will be analyzed before being summarized. Any relevant and interesting data analysis will be presented in the final report using a combination of tables and plots of various kinds, such as time-series plots, histograms, and box plots.

The report will contain a summary table of field measurements and laboratory analytical results; figures of continuous data (water level hydrographs, potentiometric maps, etc.); discussion of results pertaining to each sample location; and a map of study area showing sampled locations. As discussed in Section 7.3, background water quality will be analyzed with the geochemical (PHREEQC) modeling results for rock water and mixing reactions.

Additionally, a conceptual hydrogeologic model will be included showing a cross section of the target aquifer in relation to the City Wells and adjacent surface water bodies (e.g., Moses Lake and Canals).

14.4 Sampling Design Evaluation

The Aspect Project Manager will decide whether the data package meets the MQOs and the criteria for completeness, representativeness, and comparability. If so, the sampling design will be considered effective. If the sampling design is found ineffective, the approach will be modified in accordance with Ecology, and/or the Study will be halted for redesign.

14.5 Documentation of Assessment

In the final report, the Aspect Project Manager will include a summary and detailed description of the data quality assessment and model quality evaluation findings. This summary is usually included in the Data Quality section of reports. The final report will also provide results of the data analysis, uncertainty analysis, and margin of safety.

15.0 References

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16.0 Appendices

Appendix A. East Low Canal Water Quality Report

Appendix B. Laboratory Accreditations

Appendix C. Aspect Field Data Sheets

Appendix D. City Well Logs

Appendix E. Glossaries, Acronyms, and Abbreviations

Glossary of General Terms

Ambient: Background or away from point sources of contamination. Surrounding environmental condition.

Clean Water Act: A federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the TMDL program.

Conductivity: A measure of water's ability to conduct an electrical current. Conductivity is related to the concentration and charge of dissolved ions in water.

Dissolved oxygen (DO): A measure of the amount of oxygen dissolved in water.

Dilution factor: The relative proportion of effluent to stream (receiving water) flows occurring at the edge of a mixing zone during critical discharge conditions as authorized in accordance with the state's mixing zone regulations at WAC 173-201A-100. http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-020

Effluent: An outflowing of water from a natural body of water or from a human-made structure. For example, the treated outflow from a wastewater treatment plant.

Fecal coliform (FC): That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius. Fecal coliform bacteria are "indicator" organisms that suggest the possible presence of disease-causing organisms. Concentrations are measured in colony forming units per 100 milliliters of water (cfu/100 mL).

Nutrient: Substance such as carbon, nitrogen, and phosphorus used by organisms to live and grow. Too many nutrients in the water can promote algal blooms and rob the water of oxygen vital to aquatic organisms.

pH: A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is considered to be neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands

Total suspended solids (TSS): Portion of solids retained by a filter.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Acronyms and Abbreviations

Aspect	Aspect Consulting, LLC
ASR	Aquifer Storage and Recovery
ALS	ALS Environmental Laboratory
City	City of Moses Lake
Commerce	State of Washington Department of Commerce
DBPs	Disinfection Byproducts
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DOH	Department of Health
DQI	data quality indicator
DQO	data quality objective
DV	data validation
ECBID	East Columbia Basin Irrigation District
EDD	Electronic Data Deliverable
e.g.	For example
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
et al.	And others
FC	Fecal coliform
GIS	Geographic Information System software
GPS	Global Positioning System
GWMA	Groundwater Management Area
GWQS	Groundwater Quality Standards
HAAs	Haloacetic Acids
i.e.	In other words
LCS	laboratory control sample
MDL	minimum detection limit
MQO	measurement quality objective
MRL	minimum reporting limit

MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NTR	National Toxics Rule
OCR	Office of Columbia River
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
Reclamation	U.S. Bureau of Reclamation
RPD	relative percent difference
RSD	relative standard deviation
SAP	Sampling Analysis Plain
SCADA	Supervisory Control and Data Acquisition
SOP	Standard operating procedures
Study	Alternatives Evaluation
THMs	Trihalomethanes
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
USFS	United States Forest Service
USGS	U.S. Geological Survey
VOA	volatile organic analysis
VOCs	volatile organic compounds
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area

Units of Measurement

°C	degrees centigrade
cfs	cubic feet per second
cfu	colony forming units
cms	cubic meters per second, a unit of flow
dw	dry weight

ft	feet
g	gram, a unit of mass
gpm	gallons per minute
kcfs	1,000 cubic feet per second
km	kilometer, a unit of length equal to 1,000 meters
L/s	liters per second (0.03531 cubic foot per second)
m	meter
mg	milligram
mgd	million gallons per day
mg/L	milligrams per liter (parts per million)
mL	milliliter
NTU	nephelometric turbidity units
s.u.	standard units
ug/L	micrograms per liter (parts per billion)
uS/cm	microsiemens per centimeter, a unit of conductivity

Quality Assurance Glossary

Accreditation: A certification process for laboratories, designed to evaluate and document a lab's ability to perform analytical methods and produce acceptable data (Kammin, 2010). For Ecology, it is defined according to WAC 173-50-040: "Formal recognition by [Ecology] that an environmental laboratory is capable of producing accurate and defensible analytical data."

Accuracy: The degree to which a measured value agrees with the true value of the measured property. USEPA recommends that this term not be used, and that the terms *precision* and *bias* be used to convey the information associated with the term *accuracy* (USEPA, 2014).

Analyte: An element, ion, compound, or chemical moiety (pH, alkalinity) which is to be determined. The definition can be expanded to include organisms, e.g., fecal coliform, Klebsiella (Kammin, 2010).

Bias: Discrepancy between the expected value of an estimator and the population parameter being estimated (Gilbert, 1987; USEPA, 2014).

Blank: A synthetic sample, free of the analyte(s) of interest. For example, in water analysis, pure water is used for the blank. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process (USGS, 1998).

Calibration: The process of establishing the relationship between the response of a measurement system and the concentration of the parameter being measured (Ecology, 2004).

Check standard: A substance or reference material obtained from a source independent from the source of the calibration standard; used to assess bias for an analytical method. This is an obsolete term, and its use is highly discouraged. See Calibration Verification Standards, Lab Control Samples (LCS), Certified Reference Materials (CRM), and/or spiked blanks. These are all check standards but should be referred to by their actual designator, e.g., CRM, LCS (Kammin, 2010; Ecology, 2004).

Comparability: The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator (USEPA, 2014; USEPA, 2020).

Completeness: The amount of valid data obtained from a project compared to the planned amount. Usually expressed as a percentage. A data quality indicator (USEPA, 2014; USEPA 2020).

Continuing Calibration Verification Standard (CCV): A quality control (QC) sample analyzed with samples to check for acceptable bias in the measurement system. The CCV is usually a midpoint calibration standard that is re-run at an established frequency during the course of an analytical run (Kammin, 2010).

Control chart: A graphical representation of quality control results demonstrating the performance of an aspect of a measurement system (Kammin, 2010; Ecology 2004).

Control limits: Statistical warning and action limits calculated based on control charts. Warning limits are generally set at +/- 2 standard deviations from the mean, action limits at +/- 3 standard deviations from the mean (Kammin, 2010).

Data integrity: A qualitative DQI that evaluates the extent to which a data set contains data that is misrepresented, falsified, or deliberately misleading (Kammin, 2010).

Data quality indicators (DQI): Commonly used measures of acceptability for environmental data. The principal DQIs are precision, bias, representativeness, comparability, completeness, sensitivity, and integrity (USEPA, 2006).

Data quality objectives (DQO): Qualitative and quantitative statements derived from systematic planning processes that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA, 2006).

Data set: A grouping of samples organized by date, time, analyte, etc. (Kammin, 2010).

Data validation: The process of determining that the data satisfy the requirements as defined by the data user (USEPA, 2020). There are various levels of data validation (USEPA, 2009).

Data verification: Examination of a data set for errors or omissions, and assessment of the Data Quality Indicators related to that data set for compliance with acceptance criteria (MQOs). Verification is a detailed quality review of a data set (Ecology, 2004).

Detection limit (limit of detection)**:** The concentration or amount of an analyte which can be determined to a specified level of certainty to be greater than zero (Ecology, 2004).

Duplicate samples: Two samples taken from and representative of the same population, and carried through and steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variability of all method activities including sampling and analysis (USEPA, 2014).

Field blank: A blank used to obtain information on contamination introduced during sample collection, storage, and transport (Ecology, 2004).

Initial Calibration Verification Standard (ICV): A QC sample prepared independently of calibration standards and analyzed along with the samples to check for acceptable bias in the measurement system. The ICV is analyzed prior to the analysis of any samples (Kammin, 2010).

Laboratory Control Sample (LCS)/LCS duplicate: A sample of known composition prepared using contaminant-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is prepared and analyzed in the same batch of regular samples using the same sample preparation method, reagents, and analytical methods employed for regular samples. Monitors a lab's performance for bias and precision (USEPA, 2014).

Matrix spike/Matrix spike duplicate: A QC sample prepared by adding a known amount of the target analyte(s) to an aliquot of a sample to check for bias and precision errors due to interference or matrix effects (Ecology, 2004).

Measurement Quality Objectives (MQOs)**:** Performance or acceptance criteria for individual data quality indicators, usually including precision, bias, sensitivity, completeness, comparability, and representativeness (USEPA, 2006).

Measurement result: A value obtained by performing the procedure described in a method (Ecology, 2004).

Method: A formalized group of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, data analysis), systematically presented in the order in which they are to be executed (USEPA, 2001).

Method blank: A blank prepared to represent the sample matrix, prepared and analyzed with a batch of samples. A method blank will contain all reagents used in the preparation of a sample, and the same preparation process is used for the method blank and samples (Ecology, 2004; Kammin, 2010).

Method Detection Limit (MDL): The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results (USEPA, 2016). MDL is a measure of the capability of an analytical method of distinguished samples that do not contain a specific analyte from a sample that contains a low concentration of the analyte (USEPA, 2020).

Minimum level: Either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL), whichever is higher. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: “quantitation limit,” “reporting limit,” and “minimum level” (40 CFR 136).

Parameter: A specified characteristic of a population or sample. Also, an analyte or grouping of analytes. Benzene and nitrate + nitrite are all parameters (Kammin, 2010; Ecology, 2004).

Population: The hypothetical set of all possible observations of the type being investigated (Ecology, 2004).

Precision: The extent of random variability among replicate measurements of the same property; a data quality indicator (USGS, 1998).

Quality assurance (QA): A set of activities designed to establish and document the reliability and usability of measurement data (Kammin, 2010).

Quality Assurance Project Plan (QAPP): A document that describes the objectives of a project, and the processes and activities necessary to develop data that will support those objectives (Kammin, 2010; Ecology, 2004).

Quality control (QC): The routine application of measurement and statistical procedures to assess the accuracy of measurement data (Ecology, 2004).

Relative Percent Difference (RPD): RPD is commonly used to evaluate precision. The following formula is used:

$$RPD = [Abs(a-b)/((a + b)/2)] * 100\%$$

where “Abs()” is absolute value and a and b are results for the two replicate samples. RPD can be used only with 2 values. Percent Relative Standard Deviation is (%RSD) is used if there are results for more than 2 replicate samples (Ecology, 2004).

Relative Standard Deviation (RSD): A statistic used to evaluate precision in environmental analysis. It is determined in the following manner:

$$RSD = (100\% * s)/x$$

where s is the sample standard deviation and x is the mean of results from more than two replicate samples (Kammin, 2010).

Replicate samples: Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled (USGS, 1998).

Reporting level: Unless specified otherwise by a regulatory authority or in a discharge permit, results for analytes that meet the identification criteria (i.e., rules for determining qualitative presence/absence of an analyte) are reported down to the concentration of the minimum level established by the laboratory through calibration of the instrument. EPA considers the terms "reporting limit," "quantitation limit," and "minimum level" to be synonymous (40 CFR 136).

Representativeness: The degree to which a sample reflects the population from which it is taken; a data quality indicator (USGS, 1998).

Sample (field): A portion of a population (environmental entity) that is measured and assumed to represent the entire population (USGS, 1998).

Sample (statistical): A finite part or subset of a statistical population (USEPA, 1992).

Sensitivity: In general, denotes the rate at which the analytical response (e.g., absorbance, volume, meter reading) varies with the concentration of the parameter being determined. In a specialized sense, it has the same meaning as the detection limit (Ecology, 2004).

Spiked blank: A specified amount of reagent blank fortified with a known mass of the target analyte(s); usually used to assess the recovery efficiency of the method (USEPA, 2014).

Spiked sample: A sample prepared by adding a known mass of target analyte(s) to a specified amount of matrix sample for which an independent estimate of target analyte(s) concentration is available. Spiked samples can be used to determine the effect of the matrix on a method's recovery efficiency (USEPA, 2014).

Split sample: A discrete sample subdivided into portions, usually duplicates (Kammin, 2010).

Standard Operating Procedure (SOP): A document which describes in detail a reproducible and repeatable organized activity (Kammin, 2010).

Surrogate: For environmental chemistry, a surrogate is a substance with properties similar to those of the target analyte(s). Surrogates are unlikely to be native to environmental samples. They are added to environmental samples for quality control purposes, to track extraction efficiency and/or measure analyte recovery. Deuterated organic compounds are examples of surrogates commonly used in organic compound analysis (Kammin, 2010).

Systematic planning: A step-wise process which develops a clear description of the goals and objectives of a project, and produces decisions on the type, quantity, and quality of data that will be needed to meet those goals and objectives. The DQO process is a specialized type of systematic planning (USEPA, 2006).

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16.0 Appendices

Appendix A. East Low Canal Water Quality Report

Appendix B. Laboratory Accreditations

Appendix C. Aspect Field Data Sheets

Appendix D. City Well Logs

Appendix E. Glossaries, Acronyms, and Abbreviations

Appendix A

East Low Canal Water Quality Report

Anatek Labs, Inc.

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Client:	Gray and Osborne, INC	Work Order:	WDJ0220
Address:	180 Iron Horse Court	Project:	Moses lake Canal Sampling
	Yakima, WA 98901	Reported:	11/16/2023 10:49
Attn:	Jared McMeen		

Analytical Results Report

Sample Location:	East Low Canal		
Lab/Sample Number:	WDJ0220-01	Collect Date:	10/03/23 11:15
Date Received:	10/03/23 15:30	Collected By:	Jared McMeen
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Chloride	3.26	mg/L	0.150	250	10/5/23 1:33	ELS	EPA 300.0	
Color	ND @pH 7.59	Color Units	5.00	15	10/4/23 9:58	ILG	SM 2120 B	
Conductivity	198	µmhos/cm	10.0	700	10/9/23 16:49	ILG	SM 2510 B	
Cyanide	ND	mg/L	0.0100	0.2	10/6/23 12:03	LED	EPA 335.4	
Fluoride	0.132	mg/L	0.100	4	10/5/23 1:33	ELS	EPA 300.0	
Hardness	76.5	mg CaCO3/L	6.00		10/5/23 15:30	ILG	SM 2340 C	
Nitrate/N	0.378	mg/L	0.100	10	10/5/23 1:33	ELS	EPA 300.0	
Nitrate/N + Nitrite/N	0.378	mg/L	0.100	10	10/5/23 1:33	ELS	EPA 300.0	
Nitrite/N	ND	mg/L	0.100	1	10/5/23 1:33	ELS	EPA 300.0	
Sulfate	15.9	mg/L	0.150	250	10/5/23 1:33	ELS	EPA 300.0	
TDS	116	mg/L			10/10/23 18:30	EAF	SM 2540 C	
Turbidity	3.05	NTU	0.100		10/4/23 19:55	ILG	EPA 180.1	
Metals by ICP-MS								
Silver	ND	mg/L	0.00100	0.1	10/5/23 14:56	JLG	EPA 200.8	
Arsenic	0.00197	mg/L	0.00100	0.01	10/5/23 14:56	JLG	EPA 200.8	
Barium	0.0299	mg/L	0.00100	2	10/5/23 14:56	JLG	EPA 200.8	
Beryllium	ND	mg/L	0.000300	0.004	10/5/23 14:56	JLG	EPA 200.8	
Cadmium	ND	mg/L	0.00100	0.005	10/5/23 14:56	JLG	EPA 200.8	
Chromium	ND	mg/L	0.00100	0.1	10/5/23 14:56	JLG	EPA 200.8	
Copper	0.00297	mg/L	0.00100	1.3	10/5/23 14:56	JLG	EPA 200.8	
Mercury	ND	mg/L	0.000100	0.002	10/5/23 14:56	JLG	EPA 200.8	
Manganese	0.00357	mg/L	0.00100	0.05	10/5/23 14:56	JLG	EPA 200.8	
Nickel	ND	mg/L	0.00100	0.1	10/5/23 14:56	JLG	EPA 200.8	
Lead	ND	mg/L	0.00100	0.015	10/5/23 14:56	JLG	EPA 200.8	
Antimony	ND	mg/L	0.00100	0.006	10/5/23 14:56	JLG	EPA 200.8	
Selenium	ND	mg/L	0.00100	0.05	10/5/23 14:56	JLG	EPA 200.8	
Thallium	ND	mg/L	0.00100	0.002	10/5/23 14:56	JLG	EPA 200.8	
Zinc	ND	mg/L	0.00100	5	10/5/23 14:56	JLG	EPA 200.8	
Metals by ICP								
Iron	0.0262	mg/L	0.0100	0.3	10/6/23 15:04	TEC	EPA 200.7	
Sodium	6.73	mg/L	0.100		10/6/23 15:04	TEC	EPA 200.7	
Semivolatiles								
3-Hydroxycarbofuran	ND	ug/L	2.00		10/10/23 6:09	BKP	EPA 531.2	
Aldicarb	ND	ug/L	0.500	3	10/10/23 6:09	BKP	EPA 531.2	
Aldicarb Sulfone	ND	ug/L	0.800	2	10/10/23 6:09	BKP	EPA 531.2	
Aldicarb Sulfoxide	ND	ug/L	0.500	4	10/10/23 6:09	BKP	EPA 531.2	
Carbaryl	ND	ug/L	2.00		10/10/23 6:09	BKP	EPA 531.2	

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Sample Location:	East Low Canal		
Lab/Sample Number:	WDJ0220-01	Collect Date:	10/03/23 11:15
Date Received:	10/03/23 15:30	Collected By:	Jared McMeen
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Semivolatiles (Continued)								
Carbofuran	ND	ug/L	0.900	40	10/10/23 6:09	BKP	EPA 531.2	
Methiocarb	ND	ug/L	1.00		10/10/23 6:09	BKP	EPA 531.2	
Methomyl	ND	ug/L	4.00		10/10/23 6:09	BKP	EPA 531.2	
Oxamyl	ND	ug/L	2.00	200	10/10/23 6:09	BKP	EPA 531.2	
Propoxur	ND	ug/L	1.00		10/10/23 6:09	BKP	EPA 531.2	
Surrogate: BDMC	*90.3%*		*70-130*		*10/10/23 6:09*	*BKP*	*EPA 531.2*	
1,2,3-Trichloropropane	ND	ug/L	0.500		10/10/23 2:20	TAZ	EPA 504.1	
DBCP (1,2-Dibromo-3-chloropropane)	ND	ug/L	0.0200	0.2	10/10/23 2:20	TAZ	EPA 504.1	
EDB (1,2-Dibromoethane)	ND	ug/L	0.0100	0.05	10/10/23 2:20	TAZ	EPA 504.1	
2,4,5-T	ND	ug/L	0.400		10/17/23 4:47	TGT	EPA 515.4	
2,4,5-TP (Silvex)	ND	ug/L	0.200	50	10/17/23 4:47	TGT	EPA 515.4	
2,4-D	ND	ug/L	0.100	70	10/17/23 4:47	TGT	EPA 515.4	
2,4-DB	ND	ug/L	1.00		10/17/23 4:47	TGT	EPA 515.4	
3,5-Dichlorobenzoic Acid	ND	ug/L	0.500		10/17/23 4:47	TGT	EPA 515.4	
Acifluorofen	ND	ug/L	1.00		10/17/23 4:47	TGT	EPA 515.4	
Bentazon	ND	ug/L	0.500		10/17/23 4:47	TGT	EPA 515.4	
Chloramben	ND	ug/L	0.200		10/17/23 4:47	TGT	EPA 515.4	
Dacthal	0.0783	ug/L	0.0200		10/17/23 4:47	TGT	EPA 515.4	
Dalapon	ND	ug/L	1.00	200	10/17/23 4:47	TGT	EPA 515.4	
Dicamba	ND	ug/L	0.200		10/17/23 4:47	TGT	EPA 515.4	
Dichloroprop	ND	ug/L	0.500		10/17/23 4:47	TGT	EPA 515.4	
Dinoseb	ND	ug/L	0.200	7	10/17/23 4:47	TGT	EPA 515.4	
Pentachlorophenol	ND	ug/L	0.0400	1	10/17/23 4:47	TGT	EPA 515.4	
Picloram	ND	ug/L	0.100	500	10/17/23 4:47	TGT	EPA 515.4	
4,4'-DDD	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
4,4'-DDE	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
4,4'-DDT	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Aldrin	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
alpha-BHC	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Aroclor 1016 (PCB-1016)	ND	ug/L	0.0800		10/9/23 23:46	GPB	EPA 505	
Aroclor 1221 (PCB-1221)	ND	ug/L	20.0		10/9/23 23:46	GPB	EPA 505	
Aroclor 1232 (PCB-1232)	ND	ug/L	0.500		10/9/23 23:46	GPB	EPA 505	
Aroclor 1242 (PCB-1242)	ND	ug/L	0.300		10/9/23 23:46	GPB	EPA 505	
Aroclor 1248 (PCB-1248)	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Aroclor 1254 (PCB-1254)	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Aroclor 1260 (PCB-1260)	ND	ug/L	0.200		10/9/23 23:46	GPB	EPA 505	
beta-BHC	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Chlordane	ND	ug/L	0.200	2	10/9/23 23:46	GPB	EPA 505	
delta-BHC	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Dieldrin	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Endosulfan I	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Endosulfan II	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Endosulfan sulfate	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Endrin	ND	ug/L	0.0100	2	10/9/23 23:46	GPB	EPA 505	
Endrin aldehyde	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
Endrin ketone	ND	ug/L	0.100		10/9/23 23:46	GPB	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.0200	0.2	10/9/23 23:46	GPB	EPA 505	

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Sample Location:	East Low Canal		
Lab/Sample Number:	WDJ0220-01	Collect Date:	10/03/23 11:15
Date Received:	10/03/23 15:30	Collected By:	Jared McMeen
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Semivolatiles (Continued)								
Heptachlor	ND	ug/L	0.0400	0.4	10/9/23 23:46	GPB	EPA 505	
Heptachlor epoxide	ND	ug/L	0.0200	0.2	10/9/23 23:46	GPB	EPA 505	
Methoxychlor	ND	ug/L	0.100	40	10/9/23 23:46	GPB	EPA 505	
PCBs	ND	ug/L	0.500	0.5	10/9/23 23:46	GPB	EPA 505	
Toxaphene	ND	ug/L	1.00	3	10/9/23 23:46	GPB	EPA 505	
Surrogate: DCB	*79.6%*		*70-130*		*10/9/23 23:46*	*GPB*	*EPA 505*	
Acenaphthene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Acenaphthylene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Alachlor	ND	ug/L	0.200	2	10/17/23 3:22	BMM	EPA 525.2	
Anthracene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Atrazine	ND	ug/L	0.100	3	10/17/23 3:22	BMM	EPA 525.2	
Benzo[a]anthracene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.0200	0.2	10/17/23 3:22	BMM	EPA 525.2	
Benzo[b]fluoranthene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Benzo[ghi]perylene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Benzo[k]fluoranthene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.600	6	10/17/23 3:22	BMM	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.600	400	10/17/23 3:22	BMM	EPA 525.2	
Bromacil	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Butachlor	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Butyl benzyl phthalate	ND	ug/L	1.00		10/17/23 3:22	BMM	EPA 525.2	
Chlorpyrifos	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Chrysene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Cyanazine	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Diazinon	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Dibenz[a,h]anthracene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Diethyl phthalate	ND	ug/L	1.00		10/17/23 3:22	BMM	EPA 525.2	
Dimethyl phthalate	ND	ug/L	1.00		10/17/23 3:22	BMM	EPA 525.2	
Di-n-butyl phthalate	ND	ug/L	1.00		10/17/23 3:22	BMM	EPA 525.2	
EPTC	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Ethyl parathion	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Fluoranthene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Fluorene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.100	1	10/17/23 3:22	BMM	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.100	50	10/17/23 3:22	BMM	EPA 525.2	
Indeno[1,2,3-cd]pyrene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Malathion	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
MCPA	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Metolachlor	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Metribuzin	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Molinate	ND	ug/L	0.100	0.1	10/17/23 3:22	BMM	EPA 525.2	
Parathion ethyl	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Pendimethalin	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Permethrin	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Phenanthrene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Prometon	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Pronamide	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	

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Lab/Sample Number:	WDJ0220-01	Collect Date:	10/03/23 11:15
Date Received:	10/03/23 15:30	Collected By:	Jared McMeen
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Semivolatiles (Continued)								
Propachlor	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Pyrene	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Simazine	ND	ug/L	0.0700	4	10/17/23 3:22	BMM	EPA 525.2	
Terbacil	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Triadimefon	ND	ug/L	0.200		10/17/23 3:22	BMM	EPA 525.2	
Trifluralin	ND	ug/L	0.100		10/17/23 3:22	BMM	EPA 525.2	
Atrazine	ND	ug/L	0.107	3	10/17/23 3:22	BMM	EPA 525.2	
DEA (desethyl atrazine)	ND	ug/L	0.107		10/17/23 3:22	BMM	EPA 525.2	
Volatiles								
1,1,1,2-Tetrachloroethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,1,1-Trichloroethane	ND	ug/L	0.500	200	10/5/23 16:48	AAI	EPA 524.2	
1,1,2,2-Tetrachloroethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
1,1-Dichloroethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.500	7	10/5/23 16:48	AAI	EPA 524.2	
1,1-dichloropropene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,2,3-Trichlorobenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,2,3-Trichloropropane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.500	70	10/5/23 16:48	AAI	EPA 524.2	
1,2,4-Trimethylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,2-Dibromo-3-chloropropane (DBCP)	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.500	600	10/5/23 16:48	AAI	EPA 524.2	
1,2-Dichloroethane	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
1,3,5-Trimethylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,3-Dichlorobenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,3-Dichloropropane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.500	75	10/5/23 16:48	AAI	EPA 524.2	
2,2-Dichloropropane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
2-Chlorotoluene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
4-Chlorotoluene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Acrolein	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Acrylonitrile	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Benzene	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
Bromobenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Bromochloromethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Bromodichloromethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Bromoform	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Bromomethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Carbon disulfide	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
Chlorobenzene	ND	ug/L	0.500	100	10/5/23 16:48	AAI	EPA 524.2	
Chloroethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Chloroform	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Chloromethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.500	70	10/5/23 16:48	AAI	EPA 524.2	
cis-1,3-Dichloropropene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	

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504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Sample Location:	East Low Canal		
Lab/Sample Number:	WDJ0220-01	Collect Date:	10/03/23 11:15
Date Received:	10/03/23 15:30	Collected By:	Jared McMeen
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Volatiles (Continued)								
Dibromomethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Dichlorodifluoromethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
EDB (Screening)	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Ethylbenzene	ND	ug/L	0.500	700	10/5/23 16:48	AAI	EPA 524.2	
Hexachlorobutadiene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Isopropylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
m+p-Xylene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Methyl ethyl ketone (MEK)	ND	ug/L	2.50		10/5/23 16:48	AAI	EPA 524.2	
Methylene chloride	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
methyl-t-butyl ether (MTBE)	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Naphthalene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
n-Butylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
n-Propylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
o-Xylene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
p-isopropyltoluene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
sec-Butylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Styrene	ND	ug/L	0.500	100	10/5/23 16:48	AAI	EPA 524.2	
tert-Butylbenzene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
Toluene	ND	ug/L	0.500	1000	10/5/23 16:48	AAI	EPA 524.2	
Total Xylene	ND	ug/L	0.500	10000	10/5/23 16:48	AAI	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.500	100	10/5/23 16:48	AAI	EPA 524.2	
trans-1,3-Dichloropropene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
trans-1-4-Dichloro-2-butene	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Trichloroethene	ND	ug/L	0.500	5	10/5/23 16:48	AAI	EPA 524.2	
Trichlorofluoromethane	ND	ug/L	0.500		10/5/23 16:48	AAI	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.500	2	10/5/23 16:48	AAI	EPA 524.2	
Surrogate: 1,2-Dichlorobenzene-d4	*102%*		*70-130*		*10/5/23 16:48*	*AAI*	*EPA 524.2*	
Surrogate: 4-Bromofluorobenzene	*92.2%*		*70-130*		*10/5/23 16:48*	*AAI*	*EPA 524.2*	
Surrogate: Toluene-d8	*99.2%*		*70-130*		*10/5/23 16:48*	*AAI*	*EPA 524.2*	

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Sample Location:	Trip Blanks		
Lab/Sample Number:	WDJ0220-02	Collect Date:	09/29/23 08:00
Date Received:	10/03/23 15:30	Collected By:	
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Volatiles								
1,1,1,2-Tetrachloroethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,1,1-Trichloroethane	ND	ug/L	0.500	200	10/5/23 17:21	AAI	EPA 524.2	
1,1,2,2-Tetrachloroethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
1,1-Dichloroethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.500	7	10/5/23 17:21	AAI	EPA 524.2	
1,1-dichloropropene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,2,3-Trichlorobenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,2,3-Trichloropropane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.500	70	10/5/23 17:21	AAI	EPA 524.2	
1,2,4-Trimethylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,2-Dibromo-3-chloropropane (DBCP)	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.500	600	10/5/23 17:21	AAI	EPA 524.2	
1,2-Dichloroethane	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
1,3,5-Trimethylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,3-Dichlorobenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,3-Dichloropropane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.500	75	10/5/23 17:21	AAI	EPA 524.2	
2,2-Dichloropropane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
2-Chlorotoluene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
4-Chlorotoluene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Acrolein	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Acrylonitrile	3.66	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	W1
Benzene	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
Bromobenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Bromochloromethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Bromodichloromethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Bromoform	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Bromomethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Carbon disulfide	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
Chlorobenzene	ND	ug/L	0.500	100	10/5/23 17:21	AAI	EPA 524.2	
Chloroethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Chloroform	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Chloromethane	0.830	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	W1
cis-1,2-dichloroethene	ND	ug/L	0.500	70	10/5/23 17:21	AAI	EPA 524.2	
cis-1,3-Dichloropropene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Dibromomethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Dichlorodifluoromethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Ethylbenzene	ND	ug/L	0.500	700	10/5/23 17:21	AAI	EPA 524.2	
Hexachlorobutadiene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Isopropylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
m+p-Xylene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Methyl ethyl ketone (MEK)	ND	ug/L	2.50		10/5/23 17:21	AAI	EPA 524.2	
Methylene chloride	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
methyl-t-butyl ether (MTBE)	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	

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Sample Location:	Trip Blanks		
Lab/Sample Number:	WDJ0220-02	Collect Date:	09/29/23 08:00
Date Received:	10/03/23 15:30	Collected By:	
Matrix:	Drinking Water		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Volatiles (Continued)								
Naphthalene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
n-Butylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
n-Propylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
o-Xylene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
p-isopropyltoluene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
sec-Butylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Styrene	ND	ug/L	0.500	100	10/5/23 17:21	AAI	EPA 524.2	
tert-Butylbenzene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
Toluene	ND	ug/L	0.500	1000	10/5/23 17:21	AAI	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.500	100	10/5/23 17:21	AAI	EPA 524.2	
trans-1,3-Dichloropropene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
trans-1-4-Dichloro-2-butene	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Trichloroethene	ND	ug/L	0.500	5	10/5/23 17:21	AAI	EPA 524.2	
Trichlorofluoromethane	ND	ug/L	0.500		10/5/23 17:21	AAI	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.500	2	10/5/23 17:21	AAI	EPA 524.2	
Surrogate: 1,2-Dichlorobenzene-d4	*104%*		*70-130*		*10/5/23 17:21*	*AAI*	*EPA 524.2*	
Surrogate: 4-Bromofluorobenzene	*92.4%*		*70-130*		*10/5/23 17:21*	*AAI*	*EPA 524.2*	
Surrogate: Toluene-d8	*99.4%*		*70-130*		*10/5/23 17:21*	*AAI*	*EPA 524.2*	

Authorized Signature,

Brock Gerger For Kathleen Sattler, Laboratory Manager

L4	The associated blank spike recovery was below method acceptance limits. This analyte was not detected in the sample.
M1	Matrix spike recovery was high; the associated blank spike recovery was acceptable. Potential matrix effect
W1	Analyte was not detected in the sample but was detected in the associated trip blank.
PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte

RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was spiked or duplicated.

This report shall not be reproduced except in full, without the written approval of the laboratory
The results reported related only to the samples indicated.

ANATEK LABS

Chain of Custody Record

1282 Alturas Drive, Mo
504 E Sprague Ste D, Spo
3019 Gs Center Rd. Wena
1008 W Ahtanum Rd. Ya

WDJ0220

Due: 10/18/23

Turn

Please ref

www.

Company Name: Gray & Osborne	Project Manager: Russ Porter Contact Jared McMeen w/ questions
Address: 180 Iron Horse Court	Project Name & #: Moses Lake Water Quality Sampling 23507 / Moses Lake Canal Sampling - Job# TBD
City: Yakima State: WA Zip: 98901	Purchase Order #: Blue Heron Park: 23507 Canal: ~~Please call to ask~~
Phone: (509) 453-4833	Sampler Name & Phone: Jared McMeen (509) 453-4833 (253) 732-2208
Email Address(es): jmcmeen@g-o.com rporter@g-o.com invoice: ap@g-o.com	

X Normal
__Next Day*
__2nd Day*
__Other*________

__Phone
__Email

*All rush order requests must have prior approval

PO Moses Lake: 23507
PO East Canal: 23599

List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	WA IOC	VOC 524.2	Pest-525.2	Pest-505	Herb 515.4	Fum 504.1	Carb 531.1			
	Moses Lake Blue Heron Park	10/3 9:45 AM				X	X	X	X	X					
	East Low Canal	10/3 11:15 AM				X	X	X	X	X	X	X			

Preservative:

Note Special Instructions/Comments

Inspection Checklist

Received Intact?	(Y)	N
Labels & Chains Agree?	(Y)	N
Containers Sealed?	(Y)	N
No VOC Head Space?	(Y)	N
Cooler?	(Y)	N
Ice/Ice Packs Present?	(Y)	N

Temperature (°C): 16°C RH 103
Number of Containers: ~~15~~ 19
Shipped Via: Hand
Preservative: Na Sulfite, M-HNO3, HCl, Na Thio, Na OH
Date & Time: 10-3-23 15:30
Inspected By: [signature]

	Printed Name	Signature	Company	Date	Time
Relinquished by	Jared McMeen	[signature]	Gray & Osborne	10-3	15:30
Received by	Richie H.	[signature]	Anatek	10-3-23	15:30
Relinquished by					
Received by					
Relinquished by					
Received by					

Samples submitted to Anatek Labs may be subcontacted to other accredited labs if necessary. This message serves as notice of this possibility. Subcontracted analyses will be clearly noted on the analytical report.

Appendix B

Laboratory Accreditations

The State of Washington
Department of Ecology

Anatek Labs, Inc - Spokane
Spokane, WA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation.

This certificate is effective November 16, 2023 and shall expire November 15, 2024.

Witnessed under my hand on December 26, 2023.

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C585

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Anatek Labs, Inc - Spokane

Spokane, WA

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." SM refers to EPA approved method versions. ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Turbidity	EPA 180.1_2_1993	
Chloride	EPA 300.0_2.1_1993	
Fluoride	EPA 300.0_2.1_1993	
Nitrate	EPA 300.0_2.1_1993	
Nitrate + Nitrite	EPA 300.0_2.1_1993	
Nitrite	EPA 300.0_2.1_1993	
Orthophosphate	EPA 300.0_2.1_1993	
Sulfate	EPA 300.0_2.1_1993	
Cyanide, Total	EPA 335.4_1_1993	
Color	SM 2120 B-2011	
Alkalinity	SM 2320 B-2011	
Hardness (calc.)	SM 2340 B-2011	
Hardness, Total (as CaCO3)	SM 2340 C-2011	
Specific Conductance	SM 2510 B-2011	
Solids, Total Dissolved	SM 2540 C-2011	
Cyanide, Total	SM 4500-CN¯ E-2011	
pH	SM 4500-H+ B-2011	
Nitrate (calc.)	SM 4500-NO3¯ F-2011	
Nitrate + Nitrite	SM 4500-NO3¯ F-2011	
Nitrite	SM 4500-NO3¯ F-2011	
Orthophosphate	SM 4500-P F-2011	
UV Absorbing Organics	SM 5910 B-2011	3
Aluminum	EPA 200.8_5.4_1994	
Antimony	EPA 200.8_5.4_1994	
Arsenic	EPA 200.8_5.4_1994	
Barium	EPA 200.8_5.4_1994	

Matrix/Analyte	Method	Notes
Drinking Water		
Beryllium	EPA 200.8_5.4_1994	
Cadmium	EPA 200.8_5.4_1994	
Chromium	EPA 200.8_5.4_1994	
Copper	EPA 200.8_5.4_1994	
Lead	EPA 200.8_5.4_1994	
Manganese	EPA 200.8_5.4_1994	
Mercury	EPA 200.8_5.4_1994	
Nickel	EPA 200.8_5.4_1994	
Selenium	EPA 200.8_5.4_1994	
Silver	EPA 200.8_5.4_1994	
Thallium	EPA 200.8_5.4_1994	
Total Uranium	EPA 200.8_5.4_1994	
Zinc	EPA 200.8_5.4_1994	
1,1,1,2-Tetrachloroethane	EPA 524.2_4.1_1995	
1,1,1-Trichloroethane	EPA 524.2_4.1_1995	
1,1,2,2-Tetrachloroethane	EPA 524.2_4.1_1995	
1,1,2-Trichloroethane	EPA 524.2_4.1_1995	
1,1-Dichloroethane	EPA 524.2_4.1_1995	
1,1-Dichloroethylene	EPA 524.2_4.1_1995	
1,1-Dichloropropene	EPA 524.2_4.1_1995	
1,2,3-Trichlorobenzene	EPA 524.2_4.1_1995	
1,2,3-Trichloropropane	EPA 524.2_4.1_1995	2
1,2,4-Trichlorobenzene	EPA 524.2_4.1_1995	
1,2,4-Trimethylbenzene	EPA 524.2_4.1_1995	2
1,2-Dichlorobenzene	EPA 524.2_4.1_1995	
1,2-Dichloroethane (Ethylene dichloride)	EPA 524.2_4.1_1995	
1,2-Dichloropropane	EPA 524.2_4.1_1995	
1,3,5-Trimethylbenzene	EPA 524.2_4.1_1995	
1,3-Dichlorobenzene	EPA 524.2_4.1_1995	
1,3-Dichloropropane	EPA 524.2_4.1_1995	
1,4-Dichlorobenzene	EPA 524.2_4.1_1995	
2,2-Dichloropropane	EPA 524.2_4.1_1995	
2-Butanone (Methyl ethyl ketone, MEK)	EPA 524.2_4.1_1995	
2-Chlorotoluene	EPA 524.2_4.1_1995	
2-Hexanone	EPA 524.2_4.1_1995	
4-Chlorotoluene	EPA 524.2_4.1_1995	
4-Isopropyltoluene (p-Cymene)	EPA 524.2_4.1_1995	

Matrix/Analyte	Method	Notes
Drinking Water		
4-Methyl-2-pentanone (MIBK)	EPA 524.2_4.1_1995	
Acetone	EPA 524.2_4.1_1995	
Acrolein (Propenal)	EPA 524.2_4.1_1995	
Acrylonitrile	EPA 524.2_4.1_1995	
Benzene	EPA 524.2_4.1_1995	
Bromobenzene	EPA 524.2_4.1_1995	2
Bromochloromethane	EPA 524.2_4.1_1995	
Bromodichloromethane	EPA 524.2_4.1_1995	
Bromoform	EPA 524.2_4.1_1995	
Carbon disulfide	EPA 524.2_4.1_1995	
Carbon tetrachloride	EPA 524.2_4.1_1995	
Chlorobenzene	EPA 524.2_4.1_1995	
Chlorodibromomethane	EPA 524.2_4.1_1995	
Chloroethane (Ethyl chloride)	EPA 524.2_4.1_1995	
Chloroform	EPA 524.2_4.1_1995	2
cis-1,2-Dichloroethylene	EPA 524.2_4.1_1995	
cis-1,3-Dichloropropene	EPA 524.2_4.1_1995	
Dibromomethane	EPA 524.2_4.1_1995	
Dichlorodifluoromethane (Freon-12)	EPA 524.2_4.1_1995	
Dichloromethane (DCM, Methylene chloride)	EPA 524.2_4.1_1995	2
Ethylbenzene	EPA 524.2_4.1_1995	
Hexachlorobutadiene	EPA 524.2_4.1_1995	
Isopropylbenzene	EPA 524.2_4.1_1995	
Methyl bromide (Bromomethane)	EPA 524.2_4.1_1995	
Methyl chloride (Chloromethane)	EPA 524.2_4.1_1995	
Methyl tert-butyl ether (MTBE)	EPA 524.2_4.1_1995	
m-Xylene	EPA 524.2_4.1_1995	
Naphthalene	EPA 524.2_4.1_1995	
n-Butylbenzene	EPA 524.2_4.1_1995	2
n-Propylbenzene	EPA 524.2_4.1_1995	2
o-Xylene	EPA 524.2_4.1_1995	
p-Xylene	EPA 524.2_4.1_1995	
sec-Butylbenzene	EPA 524.2_4.1_1995	2
Styrene	EPA 524.2_4.1_1995	
tert-Butylbenzene	EPA 524.2_4.1_1995	
Tetrachloroethylene (Perchloroethylene)	EPA 524.2_4.1_1995	
Toluene	EPA 524.2_4.1_1995	

Matrix/Analyte	Method	Notes
Drinking Water		
Total Trihalomethanes	EPA 524.2_4.1_1995	
trans-1,2-Dichloroethylene	EPA 524.2_4.1_1995	
trans-1,3-Dichloropropylene	EPA 524.2_4.1_1995	
trans-1,4-Dichloro-2-butene	EPA 524.2_4.1_1995	
Trichloroethene (Trichloroethylene)	EPA 524.2_4.1_1995	
Trichlorofluoromethane (Freon 11)	EPA 524.2_4.1_1995	
Vinyl chloride	EPA 524.2_4.1_1995	
Xylene (total)	EPA 524.2_4.1_1995	
Gross Alpha	EPA 900.0-80	1
Gross Beta	EPA 900.0-80	1
Radium-228	EPA 904.0-80	1
Heterotrophic Bacteria	SM 9215 B (PCA)	2,6
Heterotrophic Bacteria	SM 9215 E SimPlate®	
Fecal coliform-count	SM 9221 B+E1+C (LTB/BGB/EC-MPN)	
Total coliforms-count	SM 9221 B+E1+C (LTB/BGB/EC-MPN)	
E.coli-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	
Total coliforms-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	
Total coli/E.coli - detect	SM 9221 D+F (PA Broth/BGB/EC Mug-PA)	2
Fecal coliform-count	SM 9222 D (mFC)-06	
Total coli/E.coli - detect	SM 9223 B Colilert 18® (PA)	
E.coli-count	SM 9223 B Colilert 18® QTray®	
Total coliforms-count	SM 9223 B Colilert 18® QTray®	
Non-Potable Water		
non-Polar Extractable Material (TPH)	EPA 1664B (SGT-HEM)	3
n-Hexane Extractable Material (O&G)	EPA 1664B -10 (HEM)	3
Turbidity	EPA 180.1_2_1993	
Mercury	EPA 245.1_3_1994	3
Chloride	EPA 300.0_2.1_1993	
Fluoride	EPA 300.0_2.1_1993	
Nitrate	EPA 300.0_2.1_1993	
Nitrate + Nitrite	EPA 300.0_2.1_1993	
Nitrite	EPA 300.0_2.1_1993	
Orthophosphate	EPA 300.0_2.1_1993	2
Sulfate	EPA 300.0_2.1_1993	
Cyanide, Total	EPA 335.4_1_1993	
Chemical Oxygen Demand (COD)	EPA 410.4_2_1993	
Total Organic Halides (TOX)	EPA 9020B_2_1994	

Matrix/Analyte	Method	Notes
Non-Potable Water		
Alkalinity	SM 2320 B-2011	
Hardness, Total (as CaCO3)	SM 2340 C-2011	
Specific Conductance	SM 2510 B-2011	
Solids, Total	SM 2540 B-2011	
Solids, Total Dissolved	SM 2540 C-2011	
Solids, Total Suspended	SM 2540 D-2011	
Solids, Total Volatile	SM 2540 E-2011	
Chromium, Hexavalent	SM 3500-Cr B-2011	3,5
Cyanide, Total	SM 4500-CN¯ E-2011	
pH	SM 4500-H+ B-2011	
Ammonia	SM 4500-NH3 H-2011	
Nitrate	SM 4500-NO3¯ F-2011	
Nitrate + Nitrite	SM 4500-NO3¯ F-2011	
Nitrite	SM 4500-NO3¯ F-2011	
Nitrogen, Total Kjeldahl	SM 4500-Norg C-2011	
Orthophosphate	SM 4500-P G-2011	2
Phosphorus, Total	SM 4500-P H-2011	2,6
Biochemical Oxygen Demand (BOD)	SM 5210 B-2011	
Carbonaceous BOD (CBOD)	SM 5210 B-2011	
UV Absorbing Organics	SM 5910 B-2011	3
Aluminum	EPA 200.8_5.4_1994	1
Antimony	EPA 200.8_5.4_1994	1
Arsenic	EPA 200.8_5.4_1994	1
Barium	EPA 200.8_5.4_1994	1
Beryllium	EPA 200.8_5.4_1994	1
Cadmium	EPA 200.8_5.4_1994	1
Calcium	EPA 200.8_5.4_1994	
Chromium	EPA 200.8_5.4_1994	1
Cobalt	EPA 200.8_5.4_1994	1
Copper	EPA 200.8_5.4_1994	1
Iron	EPA 200.8_5.4_1994	
Lead	EPA 200.8_5.4_1994	1
Magnesium	EPA 200.8_5.4_1994	
Manganese	EPA 200.8_5.4_1994	1
Mercury	EPA 200.8_5.4_1994	1
Molybdenum	EPA 200.8_5.4_1994	1
Nickel	EPA 200.8_5.4_1994	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
Potassium	EPA 200.8_5.4_1994	
Selenium	EPA 200.8_5.4_1994	1
Silver	EPA 200.8_5.4_1994	1
Sodium	EPA 200.8_5.4_1994	
Thallium	EPA 200.8_5.4_1994	1
Total Uranium	EPA 200.8_5.4_1994	1
Vanadium	EPA 200.8_5.4_1994	1
Zinc	EPA 200.8_5.4_1994	1
1,1,1,2-Tetrachloroethane	EPA 624.1	3
1,1,1-Trichloroethane	EPA 624.1	3
1,1,2,2-Tetrachloroethane	EPA 624.1	3
1,1,2-Trichloroethane	EPA 624.1	3
1,1-Dichloroethane	EPA 624.1	3
1,1-Dichloroethylene	EPA 624.1	3
1,2,3-Trichlorobenzene	EPA 624.1	3
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 624.1	3
1,2-Dichlorobenzene	EPA 624.1	3
1,2-Dichloroethane (Ethylene dichloride)	EPA 624.1	3
1,2-Dichloropropane	EPA 624.1	3
1,3-Dichlorobenzene	EPA 624.1	3
1,4-Dichlorobenzene	EPA 624.1	3
2-Butanone (Methyl ethyl ketone, MEK)	EPA 624.1	3
4-Isopropyltoluene (p-Cymene)	EPA 624.1	3
Acetone	EPA 624.1	3
Acrolein (Propenal)	EPA 624.1	3
Acrylonitrile	EPA 624.1	3
Benzene	EPA 624.1	3
Bromodichloromethane	EPA 624.1	3
Bromoform	EPA 624.1	3
Carbon tetrachloride	EPA 624.1	2,3
Chlorobenzene	EPA 624.1	3
Chlorodibromomethane	EPA 624.1	3
Chloroethane (Ethyl chloride)	EPA 624.1	3
Chloroform	EPA 624.1	3
cis-1,3-Dichloropropene	EPA 624.1	3
Dibromochloropropane	EPA 624.1	3
Dichloromethane (DCM, Methylene chloride)	EPA 624.1	3

Matrix/Analyte	Method	Notes
Non-Potable Water		
Ethylbenzene	EPA 624.1	3
Methyl bromide (Bromomethane)	EPA 624.1	3
Methyl chloride (Chloromethane)	EPA 624.1	3
Methyl tert-butyl ether (MTBE)	EPA 624.1	3
Methylene chloride (Dichloromethane)	EPA 624.1	3
Styrene	EPA 624.1	3
Tetrachloroethylene (Perchloroethylene)	EPA 624.1	3
Toluene	EPA 624.1	3
trans-1,2-Dichloroethylene	EPA 624.1	3
trans-1,3-Dichloropropylene	EPA 624.1	3
Trichloroethene (Trichloroethylene)	EPA 624.1	3
Trichlorofluoromethane (Freon 11)	EPA 624.1	3
Vinyl chloride	EPA 624.1	3
Gross Alpha	EPA 900.0-80	1
Gross Beta	EPA 900.0-80	1
Radium-228	EPA 904.0-80	1
Heterotrophic Bacteria	SM 9215 B (PCA)	2,6
Heterotrophic Bacteria	SM 9215 E SimPlate®	
E.coli-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	
Total coliforms-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	
Fecal coliform-count	SM 9221 E2+C (A1-MPN)	
Fecal coliform-count	SM 9222 D (mFC)-06	
E.coli-count	SM 9223 B Colilert 18® QTray®	
Total coliforms-count	SM 9223 B Colilert 18® QTray®	
Salmonella	SM 9260 D (MF-counts)	
Solid and Chemical Materials		
Chloride	EPA 300.0_2.1_1993	
Fluoride	EPA 300.0_2.1_1993	
Nitrate	EPA 300.0_2.1_1993	
Nitrite	EPA 300.0_2.1_1993	
Sulfate	EPA 300.0_2.1_1993	
Cyanide, Total	EPA 335.4_1_1993	
Extractable Organic Halides	EPA 9023-96	
pH	EPA 9045D_2002	
Chlorine	EPA 9076	
Solids, Total Volatile	SM 2540 G-2011	
Cyanide, Total	SM 4500-CN$^-$ E-2011	

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Ammonia	SM 4500-NH3 H-2011	
Nitrate + Nitrite	SM 4500-NO3¯ F-2011	
Nitrogen, Total Kjeldahl	SM 4500-Norg C-2011	
Orthophosphate	SM 4500-P F-2011	
Phosphorus, Total	SM 4500-P F-2011	
Aluminum	EPA 6020B_(7/14)	3
Antimony	EPA 6020B_(7/14)	3
Arsenic	EPA 6020B_(7/14)	3
Barium	EPA 6020B_(7/14)	3
Beryllium	EPA 6020B_(7/14)	3
Boron	EPA 6020B_(7/14)	
Cadmium	EPA 6020B_(7/14)	3
Calcium	EPA 6020B_(7/14)	3
Chromium	EPA 6020B_(7/14)	3
Cobalt	EPA 6020B_(7/14)	3
Copper	EPA 6020B_(7/14)	3
Iron	EPA 6020B_(7/14)	
Lead	EPA 6020B_(7/14)	3
Magnesium	EPA 6020B_(7/14)	3
Manganese	EPA 6020B_(7/14)	3
Mercury	EPA 6020B_(7/14)	3
Molybdenum	EPA 6020B_(7/14)	3
Nickel	EPA 6020B_(7/14)	3
Potassium	EPA 6020B_(7/14)	3
Selenium	EPA 6020B_(7/14)	3
Silver	EPA 6020B_(7/14)	3
Sodium	EPA 6020B_(7/14)	3
Strontium	EPA 6020B_(7/14)	
Thallium	EPA 6020B_(7/14)	3
Tin	EPA 6020B_(7/14)	
Titanium	EPA 6020B_(7/14)	
Total Uranium	EPA 6020B_(7/14)	3
Vanadium	EPA 6020B_(7/14)	3
Zinc	EPA 6020B_(7/14)	3
Mercury	EPA 7471B_(2/07)	
Benzene	EPA 8021B_2_(12/96)	
Ethylbenzene	EPA 8021B_2_(12/96)	

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
m+p-xylene	EPA 8021B_2_(12/96)	
o-Xylene	EPA 8021B_2_(12/96)	
Toluene	EPA 8021B_2_(12/96)	
Xylene (total)	EPA 8021B_2_(12/96)	
Aroclor-1016 (PCB-1016)	EPA 8082A_(2/07)	2
Aroclor-1221 (PCB-1221)	EPA 8082A_(2/07)	2
Aroclor-1232 (PCB-1232)	EPA 8082A_(2/07)	2
Aroclor-1242 (PCB-1242)	EPA 8082A_(2/07)	
Aroclor-1248 (PCB-1248)	EPA 8082A_(2/07)	2
Aroclor-1254 (PCB-1254)	EPA 8082A_(2/07)	2
Aroclor-1260 (PCB-1260)	EPA 8082A_(2/07)	2
Diesel range organics (DRO)	WDOE NWTPH-Dx_(1997)	
1,1,1,2-Tetrachloroethane	EPA 8260D_4_(6/18)	3
1,1,1-Trichloro-2,2,2-trifluoroethane	EPA 8260D_4_(6/18)	3
1,1,1-Trichloro-2-propanone	EPA 8260D_4_(6/18)	3
1,1,1-Trichloroethane	EPA 8260D_4_(6/18)	3
1,1,2,2-Tetrachloroethane	EPA 8260D_4_(6/18)	3
1,1,2-Trichloroethane	EPA 8260D_4_(6/18)	3
1,1,2-Trichlorofluoroethane	EPA 8260D_4_(6/18)	3
1,1-Dichloroethane	EPA 8260D_4_(6/18)	3
1,1-Dichloroethylene	EPA 8260D_4_(6/18)	3
1,1-Dichloropropene	EPA 8260D_4_(6/18)	3
1,2,3-Trichlorobenzene	EPA 8260D_4_(6/18)	3
1,2,3-Trichloropropane	EPA 8260D_4_(6/18)	3
1,2,3-Trimethylbenzene	EPA 8260D_4_(6/18)	3
1,2,4-Trichlorobenzene	EPA 8260D_4_(6/18)	3
1,2,4-Trimethylbenzene	EPA 8260D_4_(6/18)	3
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260D_4_(6/18)	3
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260D_4_(6/18)	3
1,2-Dichlorobenzene	EPA 8260D_4_(6/18)	3
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260D_4_(6/18)	3
1,2-Dichloropropane	EPA 8260D_4_(6/18)	3
1,3,5-Trimethylbenzene	EPA 8260D_4_(6/18)	3
1,3-Dichlorobenzene	EPA 8260D_4_(6/18)	3
1,3-Dichloropropane	EPA 8260D_4_(6/18)	3
1,3-Dichloropropene	EPA 8260D_4_(6/18)	3
1,4-Dichlorobenzene	EPA 8260D_4_(6/18)	3

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
2,2-Dichloropropane	EPA 8260D_4_(6/18)	3
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260D_4_(6/18)	3
2-Chlorotoluene	EPA 8260D_4_(6/18)	3
2-Hexanone	EPA 8260D_4_(6/18)	3
2-Hexene	EPA 8260D_4_(6/18)	3
4-Bromofluorobenzene	EPA 8260D_4_(6/18)	3
4-Chlorotoluene	EPA 8260D_4_(6/18)	3
4-Isopropyltoluene (p-Cymene)	EPA 8260D_4_(6/18)	3
4-Methyl-2-pentanone (MIBK)	EPA 8260D_4_(6/18)	3
Acetone	EPA 8260D_4_(6/18)	3
Acrolein (Propenal)	EPA 8260D_4_(6/18)	3
Acrylonitrile	EPA 8260D_4_(6/18)	3
Benzene	EPA 8260D_4_(6/18)	3
Bromobenzene	EPA 8260D_4_(6/18)	3
Bromochloromethane	EPA 8260D_4_(6/18)	3
Bromodichloromethane	EPA 8260D_4_(6/18)	3
Bromoethane (Ethyl Bromide)	EPA 8260D_4_(6/18)	3
Bromoethene	EPA 8260D_4_(6/18)	3
Bromoform	EPA 8260D_4_(6/18)	3
Carbon disulfide	EPA 8260D_4_(6/18)	3
Carbon tetrachloride	EPA 8260D_4_(6/18)	3
Chlorobenzene	EPA 8260D_4_(6/18)	3
Chlorodibromomethane	EPA 8260D_4_(6/18)	3
Chloroethane (Ethyl chloride)	EPA 8260D_4_(6/18)	3
Chloroform	EPA 8260D_4_(6/18)	3
cis & trans-1,2-Dichloroethene	EPA 8260D_4_(6/18)	3
cis-1,2-Dichloroethylene	EPA 8260D_4_(6/18)	3
cis-1,3-Dichloropropene	EPA 8260D_4_(6/18)	3
Dibromomethane	EPA 8260D_4_(6/18)	3
Ethylbenzene	EPA 8260D_4_(6/18)	3
Hexachlorobutadiene	EPA 8260D_4_(6/18)	3
Iodomethane (Methyl iodide)	EPA 8260D_4_(6/18)	3
Isopropylbenzene	EPA 8260D_4_(6/18)	3
m+p-xylene	EPA 8260D_4_(6/18)	3
Methyl bromide (Bromomethane)	EPA 8260D_4_(6/18)	3
Methyl chloride (Chloromethane)	EPA 8260D_4_(6/18)	3
Methyl tert-butyl ether (MTBE)	EPA 8260D_4_(6/18)	3

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Methylene chloride (Dichloromethane)	EPA 8260D_4_(6/18)	3
Naphthalene	EPA 8260D_4_(6/18)	3
n-Butylbenzene	EPA 8260D_4_(6/18)	3
n-Propylbenzene	EPA 8260D_4_(6/18)	3
o-Xylene	EPA 8260D_4_(6/18)	3
sec-Butylbenzene	EPA 8260D_4_(6/18)	3
Styrene	EPA 8260D_4_(6/18)	3
tert-Butylbenzene	EPA 8260D_4_(6/18)	3
Tetrachloroethylene (Perchloroethylene)	EPA 8260D_4_(6/18)	3
Toluene	EPA 8260D_4_(6/18)	3
trans-1,2-Dichloroethylene	EPA 8260D_4_(6/18)	3
trans-1,3-Dichloropropylene	EPA 8260D_4_(6/18)	3
trans-1,4-Dichloro-2-butene	EPA 8260D_4_(6/18)	3
Trichloroethene (Trichloroethylene)	EPA 8260D_4_(6/18)	3
Trichlorofluoromethane (Freon 11)	EPA 8260D_4_(6/18)	3
Vinyl acetate	EPA 8260D_4_(6/18)	3
Vinyl chloride	EPA 8260D_4_(6/18)	3
Xylene (total)	EPA 8260D_4_(6/18)	3
Fecal coliform-count	EPA 1680 Biosolids (LTB/EC-MPN)	
Salmonella	EPA 1682 Biosolids (MSRV)	
Fecal coliform-count	SM 9221 E2+C (A1-MPN)	

Accredited Parameter Note Detail

1) Accreditation based in part on recognition of Florida NELAP accreditation. 2) Provisional accreditation pending acceptable PT completion. 3) Interim accreditation pending the successful completion of an on-site audit to verify method capabilities (WAC 173-50-100). 4) Accreditation is limited to liquid matrix. 5) Provisional accreditation pending an acceptable response to the technical report. (6) Provisional accreditation pending submittal of acceptable corrective action report.

[signature]

Authentication Signature
Rebecca Wood, Lab Accreditation Unit Supervisor

01/09/2024

Date

The State of Washington
Department of Ecology

Anatek Labs, Inc - Moscow
Moscow, ID

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective March 21, 2023 and shall expire March 20, 2024.

Witnessed under my hand on June 27, 2023

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C595

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Anatek Labs, Inc - Moscow

Moscow, ID

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." SM refers to EPA approved method versions. ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Turbidity	EPA 180.1_2_1993	1,8
Chloride	EPA 300.0_2.1_1993	1
Fluoride	EPA 300.0_2.1_1993	1,8
Nitrate	EPA 300.0_2.1_1993	1,8
Nitrate + Nitrite	EPA 300.0_2.1_1993	1
Nitrite	EPA 300.0_2.1_1993	1,8,9
Orthophosphate	EPA 300.0_2.1_1993	1
Sulfate	EPA 300.0_2.1_1993	1
Perchlorate	EPA 331.0_1.0_2005	1
Cyanide, Total	EPA 335.4_1_1993	1,8
Color	SM 2120 B-2011	1,9
Alkalinity	SM 2320 B-2011	1
Hardness (calc.)	SM 2340 B-2011	1
Specific Conductance	SM 2510 B-2011	1
Solids, Total Dissolved	SM 2540 C-2011	1
pH	SM 4500-H+ B-2011	1,6
Nitrate	SM 4500-NO3¯ F-2011	1,8
Nitrate + Nitrite	SM 4500-NO3¯ F-2011	1
Nitrite	SM 4500-NO3¯ F-2011	1,8
Total Organic Carbon	SM 5310 B-2011	1
Anionic Surfactants (MBAS)	SM 5540 C-2011	1
Aluminum	EPA 200.7_4.4_1994	1
Barium	EPA 200.7_4.4_1994	1
Beryllium	EPA 200.7_4.4_1994	1
Cadmium	EPA 200.7_4.4_1994	1
Calcium	EPA 200.7_4.4_1994	1

Matrix/Analyte	Method	Notes
Drinking Water		
Chromium	EPA 200.7_4.4_1994	1
Copper	EPA 200.7_4.4_1994	1
Iron	EPA 200.7_4.4_1994	1
Magnesium	EPA 200.7_4.4_1994	1
Manganese	EPA 200.7_4.4_1994	1
Nickel	EPA 200.7_4.4_1994	1,8
Potassium	EPA 200.7_4.4_1994	1
Sodium	EPA 200.7_4.4_1994	1,8
Aluminum	EPA 200.8_5.4_1994	1
Antimony	EPA 200.8_5.4_1994	1,8
Arsenic	EPA 200.8_5.4_1994	1,8
Barium	EPA 200.8_5.4_1994	1,8
Beryllium	EPA 200.8_5.4_1994	1,8
Cadmium	EPA 200.8_5.4_1994	1,8
Chromium	EPA 200.8_5.4_1994	1,8
Copper	EPA 200.8_5.4_1994	1,8
Lead	EPA 200.8_5.4_1994	1,8
Manganese	EPA 200.8_5.4_1994	1
Mercury	EPA 200.8_5.4_1994	1,8
Nickel	EPA 200.8_5.4_1994	1,8
Selenium	EPA 200.8_5.4_1994	1,8
Silver	EPA 200.8_5.4_1994	1
Thallium	EPA 200.8_5.4_1994	1,8
Total Uranium	EPA 200.8_5.4_1994	1,8
Zinc	EPA 200.8_5.4_1994	1
1,2,3-Trichloropropane	EPA 504.1_1.1_1995	1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1_1.1_1995	1,8
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1_1.1_1995	1,8
Aldrin	EPA 505_2.1_1995	1
Aroclor-1016 (PCB-1016)	EPA 505_2.1_1995	1,8
Aroclor-1221 (PCB-1221)	EPA 505_2.1_1995	1,8
Aroclor-1232 (PCB-1232)	EPA 505_2.1_1995	1,8
Aroclor-1242 (PCB-1242)	EPA 505_2.1_1995	1,8
Aroclor-1248 (PCB-1248)	EPA 505_2.1_1995	1,8
Aroclor-1254 (PCB-1254)	EPA 505_2.1_1995	1,8
Aroclor-1260 (PCB-1260)	EPA 505_2.1_1995	1,8
Chlordane (tech.)	EPA 505_2.1_1995	1,8

Matrix/Analyte	Method	Notes
Drinking Water		
Dieldrin	EPA 505_2.1_1995	1
Endrin	EPA 505_2.1_1995	1,8
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 505_2.1_1995	1,8
Heptachlor	EPA 505_2.1_1995	1,8
Heptachlor epoxide	EPA 505_2.1_1995	1,8
Methoxychlor	EPA 505_2.1_1995	1,8
Toxaphene (Chlorinated camphene)	EPA 505_2.1_1995	1,8
2,4,5-T	EPA 515.4_1_2000	1
2,4-D	EPA 515.4_1_2000	1,8
2,4-DB	EPA 515.4_1_2000	1
3,5-Dichlorobenzoic acid	EPA 515.4_1_2000	
Acifluorfen	EPA 515.4_1_2000	1
Bentazon	EPA 515.4_1_2000	
Chloramben	EPA 515.4_1_2000	
Dacthal Acid Metabolites	EPA 515.4_1_2000	1
Dalapon	EPA 515.4_1_2000	1,8
Dicamba	EPA 515.4_1_2000	1
Dichloroprop (Dichlorprop)	EPA 515.4_1_2000	1
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 515.4_1_2000	1,8
Pentachlorophenol	EPA 515.4_1_2000	1,8
Picloram	EPA 515.4_1_2000	1,8
Silvex (2,4,5-TP)	EPA 515.4_1_2000	1,8
3-Hydroxycarbofuran	EPA 531.2_1_2001	1
Aldicarb (Temik)	EPA 531.2_1_2001	1
Aldicarb sulfone	EPA 531.2_1_2001	1
Aldicarb sulfoxide	EPA 531.2_1_2001	1
Carbaryl (Sevin)	EPA 531.2_1_2001	1
Carbofuran (Furaden)	EPA 531.2_1_2001	1,8
Methiocarb (Mesurol)	EPA 531.2_1_2001	1
Methomyl (Lannate)	EPA 531.2_1_2001	1
Oxamyl	EPA 531.2_1_2001	1,8
Propoxur (Baygon)	EPA 531.2_1_2001	1
Glyphosate	EPA 547_1990	1,8
Diquat	EPA 549.2_1_1997	1,8
Bromoacetic acid (MBAA, BAA)	SM 6251 B-05	1,8
Bromochloroacetic acid (BCAA)	SM 6251 B-05	1
Chloroacetic acid (MCAA, CAA)	SM 6251 B-05	1,8

Matrix/Analyte	Method	Notes
Drinking Water		
Dibromoacetic acid (DBAA)	SM 6251 B-05	1,8
Dichloroacetic acid (DCAA)	SM 6251 B-05	1,8
Total haloacetic acids (HAA5)	SM 6251 B-05	1,8
Trichloroacetic acid (TCAA)	SM 6251 B-05	1,8
1,1,1,2-Tetrachloroethane	EPA 524.3_1.0_2009	1
1,1,1-Trichloroethane	EPA 524.3_1.0_2009	1
1,1,2,2-Tetrachloroethane	EPA 524.3_1.0_2009	1
1,1,2-Trichloroethane	EPA 524.3_1.0_2009	1
1,1-Dichloroethylene	EPA 524.3_1.0_2009	1
1,1-Dichloropropene	EPA 524.3_1.0_2009	1
1,2,3-Trichlorobenzene	EPA 524.3_1.0_2009	1
1,2,3-Trichloropropane	EPA 524.3_1.0_2009	1
1,2,4-Trichlorobenzene	EPA 524.3_1.0_2009	1
1,2,4-Trimethylbenzene	EPA 524.3_1.0_2009	1
1,2-Dichlorobenzene	EPA 524.3_1.0_2009	1
1,2-Dichloroethane (Ethylene dichloride)	EPA 524.3_1.0_2009	1
1,2-Dichloropropane	EPA 524.3_1.0_2009	1
1,3,5-Trimethylbenzene	EPA 524.3_1.0_2009	1
1,3-Dichlorobenzene	EPA 524.3_1.0_2009	1
1,3-Dichloropropane	EPA 524.3_1.0_2009	1
1,4-Dichlorobenzene	EPA 524.3_1.0_2009	1
2,2-Dichloropropane	EPA 524.3_1.0_2009	
2-Chlorotoluene	EPA 524.3_1.0_2009	1
4-Chlorotoluene	EPA 524.3_1.0_2009	1
4-Isopropyltoluene (p-Cymene)	EPA 524.3_1.0_2009	1
Benzene	EPA 524.3_1.0_2009	1
Bromobenzene	EPA 524.3_1.0_2009	1
Bromochloromethane	EPA 524.3_1.0_2009	1
Bromodichloromethane	EPA 524.3_1.0_2009	1,8
Bromoform	EPA 524.3_1.0_2009	1,8
Carbon disulfide	EPA 524.3_1.0_2009	1
Carbon tetrachloride	EPA 524.3_1.0_2009	1
Chlorobenzene	EPA 524.3_1.0_2009	1
Chlorodibromomethane	EPA 524.3_1.0_2009	1,8
Chloroethane (Ethyl chloride)	EPA 524.3_1.0_2009	
Chloroform	EPA 524.3_1.0_2009	1,8
cis-1,2-Dichloroethylene	EPA 524.3_1.0_2009	1

Matrix/Analyte	Method	Notes
Drinking Water		
cis-1,3-Dichloropropene	EPA 524.3_1.0_2009	1
Dibromomethane	EPA 524.3_1.0_2009	1
Dichlorodifluoromethane (Freon-12)	EPA 524.3_1.0_2009	1
Diethyl ether	EPA 524.3_1.0_2009	1
Ethylbenzene	EPA 524.3_1.0_2009	1
Hexachlorobutadiene	EPA 524.3_1.0_2009	1
Iodomethane (Methyl iodide)	EPA 524.3_1.0_2009	1
Isopropylbenzene	EPA 524.3_1.0_2009	1
m+p-xylene	EPA 524.3_1.0_2009	1
Methyl bromide (Bromomethane)	EPA 524.3_1.0_2009	1
Methyl chloride (Chloromethane)	EPA 524.3_1.0_2009	1
Methyl tert-butyl ether (MTBE)	EPA 524.3_1.0_2009	1
Methylene chloride (Dichloromethane)	EPA 524.3_1.0_2009	1
Naphthalene	EPA 524.3_1.0_2009	1
n-Butylbenzene	EPA 524.3_1.0_2009	1
n-Propylbenzene	EPA 524.3_1.0_2009	1
o-Xylene	EPA 524.3_1.0_2009	1
sec-Butylbenzene	EPA 524.3_1.0_2009	1
Styrene	EPA 524.3_1.0_2009	1
tert-Butylbenzene	EPA 524.3_1.0_2009	1
Tetrachloroethylene (Perchloroethylene)	EPA 524.3_1.0_2009	1
Toluene	EPA 524.3_1.0_2009	1
Total Trihalomethanes	EPA 524.3_1.0_2009	1,8
trans-1,2-Dichloroethylene	EPA 524 3 1 0 2009	1
trans-1,3-Dichloropropylene	EPA 524.3_1.0_2009	1
Trichloroethene (Trichloroethylene)	EPA 524.3_1.0_2009	1
Trichlorofluoromethane (Freon 11)	EPA 524.3_1.0_2009	1
Vinyl chloride	EPA 524.3_1.0_2009	1,8
Xylene (total)	EPA 524.3_1.0_2009	1
2,4-Dinitrotoluene (2,4-DNT)	EPA 525.2_2_1995	1
2,6-Dinitrotoluene (2,6-DNT)	EPA 525.2_2_1995	1
4,4'-DDD	EPA 525.2_2_1995	1
4,4'-DDE	EPA 525.2_2_1995	1
4,4'-DDT	EPA 525.2_2_1995	1
Acenaphthylene	EPA 525.2_2_1995	1
Acetochlor	EPA 525.2_2_1995	1
Alachlor	EPA 525.2_2_1995	1,8

Matrix/Analyte	Method	Notes
Drinking Water		
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 525.2_2_1995	1
alpha-Chlordane	EPA 525.2_2_1995	1
Anthracene	EPA 525.2_2_1995	1
Atrazine	EPA 525.2_2_1995	1,8
Benzo(a)anthracene	EPA 525.2_2_1995	1
Benzo(a)pyrene	EPA 525.2_2_1995	1
Benzo(g,h,i)perylene	EPA 525.2_2_1995	1
Benzo(k)fluoranthene	EPA 525.2_2_1995	1
Benzo[b]fluoranthene	EPA 525.2_2_1995	1
beta-BHC (beta-Hexachlorocyclohexane)	EPA 525.2_2_1995	1
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 525.2_2_1995	1,8
Bromacil	EPA 525.2_2_1995	1
Butachlor	EPA 525.2_2_1995	1
Butyl benzyl phthalate	EPA 525.2_2_1995	1,8
Chrysene	EPA 525.2_2_1995	1
Cyanazine	EPA 525.2_2_1995	1
delta-BHC	EPA 525.2_2_1995	1
Di(2-ethylhexyl)adipate	EPA 525.2_2_1995	1,8
Diazinon	EPA 525.2_2_1995	1
Dibenz(a,h) anthracene	EPA 525.2_2_1995	1
Diethyl phthalate	EPA 525.2_2_1995	1,8
Dimethyl phthalate	EPA 525.2_2_1995	1,8
Di-n-butyl phthalate	EPA 525.2_2_1995	1,8
EPTC (Eptam, s-ethyl-dipropyl thio carbamate)	EPA 525.2_2_1995	1
Fluorene	EPA 525.2_2_1995	1
gamma-Chlordane	EPA 525.2_2_1995	1
Hexachlorobenzene	EPA 525.2_2_1995	1,8
Hexachlorocyclopentadiene	EPA 525.2_2_1995	1,8
Indeno(1,2,3-cd) pyrene	EPA 525.2_2_1995	1
Metolachlor	EPA 525.2_2_1995	1
Metribuzin	EPA 525.2_2_1995	1
Molinate	EPA 525.2_2_1995	1
Phenanthrene	EPA 525.2_2_1995	1
Prometon	EPA 525.2_2_1995	1
Propachlor (Ramrod)	EPA 525.2_2_1995	1
Pyrene	EPA 525.2_2_1995	1
Simazine	EPA 525.2_2_1995	1,8

Matrix/Analyte	Method	Notes
Drinking Water		
Terbacil	EPA 525.2_2_1995	1
trans-Nonachlor	EPA 525.2_2_1995	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS)	EPA 533	1
1H,1H,2H,2H,-Perfluorodecanesulfonic acid (8:2 FTS)	EPA 533	1
1H,1H,2H,2H,-Perfluorooctanesulfonic acid (6:2 FTS)	EPA 533	1
1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	EPA 533	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	EPA 533	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS)	EPA 533	1
Hexafluoropropylene oxide dimer acid (HFPO-DA)	EPA 533	1
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	EPA 533	1
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	EPA 533	1
Perfluoro-3-methoxypropanoic acid (PFMPA)	EPA 533	1
Perfluoro-4-methoxybutanoic acid (PFMBA)	EPA 533	1
Perfluorobutane sulfonic acid (PFBS)	EPA 533	1
Perfluorobutanoic acid (PFBA)	EPA 533	1
Perfluorodecanoic acid (PFDA)	EPA 533	1
Perfluorododecanoic acid (PFDoA)	EPA 533	1
Perfluoroheptane sulfonic acid (PFHpS)	EPA 533	1
Perfluoroheptanoic acid (PFHpA)	EPA 533	1
Perfluorohexane sulfonic acid (PFHxS)	EPA 533	1
Perfluorohexanoic acid (PFHxA)	EPA 533	1
Perfluorononanoic acid (PFNA)	EPA 533	1
Perfluorooctane sulfonic acid (PFOS)	EPA 533	1
Perfluorooctanoic acid (PFOA)	EPA 533	1
Perfluoropentane sulfonic acid (PFPeS)	EPA 533	1
Perfluoropentanoic acid (PFPeA)	EPA 533	1
Perfluoroundecanoic acid (PFUnA)	EPA 533	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS)	EPA 537.1 revison 2 (3/20)	10
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	EPA 537.1 revison 2 (3/20)	10
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS)	EPA 537.1 revison 2 (3/20)	10
Hexafluoropropylene oxide dimer acid (HFPO-DA)	EPA 537.1 revison 2 (3/20)	10
N-Ethylperfluorooctane sulfonamido acetic acid (NEtFOSAA)	EPA 537.1 revison 2 (3/20)	10
N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	EPA 537.1 revison 2 (3/20)	10
Perfluorobutane sulfonic acid (PFBS)	EPA 537.1 revison 2 (3/20)	10
Perfluorodecanoic acid (PFDA)	EPA 537.1 revison 2 (3/20)	10
Perfluorododecanoic acid (PFDoA)	EPA 537.1 revison 2 (3/20)	10
Perfluoroheptanoic acid (PFHpA)	EPA 537.1 revison 2 (3/20)	10

Matrix/Analyte	Method	Notes
Drinking Water		
Perfluorohexane sulfonic acid (PFHxS)	EPA 537.1 revison 2 (3/20)	10
Perfluorohexanoic acid (PFHxA)	EPA 537.1 revison 2 (3/20)	10
Perfluorononanoic acid (PFNA)	EPA 537.1 revison 2 (3/20)	10
Perfluorooctane sulfonic acid (PFOS)	EPA 537.1 revison 2 (3/20)	10
Perfluorooctanoic acid (PFOA)	EPA 537.1 revison 2 (3/20)	10
Perfluorotetradecanoic acid (PFTeDA)	EPA 537.1 revison 2 (3/20)	10
Perfluorotridecanoic acid (PFTrDA)	EPA 537.1 revison 2 (3/20)	10
Perfluoroundecanoic acid (PFUnA)	EPA 537.1 revison 2 (3/20)	10
N-Ethylperfluorooctane sulfonamido acetic acid (NEtFOSAA)	EPA 537_1.1_2009	1
N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	EPA 537_1.1_2009	1
Perfluorobutane sulfonic acid (PFBS)	EPA 537_1.1_2009	1
Perfluorodecanoic acid (PFDA)	EPA 537_1.1_2009	1
Perfluorododecanoic acid (PFDoA)	EPA 537_1.1_2009	1
Perfluoroheptanoic acid (PFHPA)	EPA 537_1.1_2009	1
Perfluorohexane sulfonic acid (PFHxS)	EPA 537_1.1_2009	1
Perfluorohexanoic acid (PFHxA)	EPA 537_1.1_2009	1
Perfluorononanoic acid (PFNA)	EPA 537_1.1_2009	1
Perfluorooctane sulfonic acid (PFOS)	EPA 537_1.1_2009	1
Perfluorooctanoic acid (PFOA)	EPA 537_1.1_2009	1
Perfluorotetradecanoic acid (PFTeDA)	EPA 537_1.1_2009	1
Perfluorotridecanoic acid (PFTrDA)	EPA 537_1.1_2009	1
Perfluoroundecanoic acid (PFUnA)	EPA 537_1.1_2009	1
Endothall	EPA 548.1_1_1992	1,8
Total coli/E.coli - detect	SM 9223 B Colilert 18® (PA)	8,9
Non-Potable Water		
n-Hexane Extractable Material (O&G)	EPA 1664B -10 (HEM)	1
Turbidity	EPA 180.1_2_1993	1
Chloride	EPA 300.0_2.1_1993	1
Fluoride	EPA 300.0_2.1_1993	1
Nitrate	EPA 300.0_2.1_1993	1
Nitrate + Nitrite	EPA 300.0_2.1_1993	1
Nitrite	EPA 300.0_2.1_1993	1
Orthophosphate	EPA 300.0_2.1_1993	1
Sulfate	EPA 300.0_2.1_1993	1
Perchlorate	EPA 331.0_1.0_2005	7
Cyanide, Total	EPA 335.4_1_1993	1
Phenolics, Total	EPA 420.1_1978	1,9

Matrix/Analyte	Method	Notes
Non-Potable Water		
Perchlorate	EPA 6850-07	1
Alkalinity	SM 2320 B-2011	1
Hardness (calc.)	SM 2340 B-2011	1
Specific Conductance	SM 2510 B-2011	1
Solids, Total Dissolved	SM 2540 C-2011	1
Solids, Total Suspended	SM 2540 D-2011	1,9
Cyanide, Weak Acid Dissociable	SM 4500 CN^- I-2011	
Cyanides, Amenable to Chlorination	SM 4500-CN^- G-2011	9
pH	SM 4500-H+ B-2011	1,6
Ammonia	SM 4500-NH3 G-2011	1
Nitrate	SM 4500-NO_3^- F-2011	1
Nitrate + Nitrite	SM 4500-NO_3^- F-2011	1
Nitrite	SM 4500-NO_3^- F-2011	1
Nitrogen, Total Kjeldahl	SM 4500-Norg C-2011	1
Orthophosphate	SM 4500-P F-2011	1
Phosphorus, total	SM 4500-P F-2011	1
Total Organic Carbon	SM 5310 B-2011	1
Phenolics, Total	SM 5530 D-2010	1,9
Mercury	EPA 1631 E-02	1
Aluminum	EPA 200.7_4.4_1994	1
Barium	EPA 200.7_4.4_1994	1
Beryllium	EPA 200.7_4.4_1994	1
Boron	EPA 200.7_4.4_1994	1
Cadmium	EPA 200.7_4.4_1994	1
Calcium	EPA 200.7_4.4_1994	1
Chromium		1
Cobalt	EPA 200.7_4.4_1994	1
Copper	EPA 200.7_4.4_1994	1
Iron	EPA 200.7_4.4_1994	1
Lead	EPA 200.7_4.4_1994	1
Magnesium	EPA 200.7_4.4_1994	1
Manganese	EPA 200.7_4.4_1994	1
Molybdenum	EPA 200.7_4.4_1994	1
Nickel	EPA 200.7_4.4_1994	1
Sodium	EPA 200.7_4.4_1994	1
Titanium	EPA 200.7_4.4_1994	1
Vanadium	EPA 200.7_4.4_1994	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
Zinc	EPA 200.7_4.4_1994	1
Aluminum	EPA 200.8_5.4_1994	1
Antimony	EPA 200.8_5.4_1994	1
Arsenic	EPA 200.8_5.4_1994	1
Barium	EPA 200.8_5.4_1994	1
Beryllium	EPA 200.8_5.4_1994	1,9
Cadmium	EPA 200.8_5.4_1994	1
Chromium	EPA 200.8_5.4_1994	1
Cobalt	EPA 200.8_5.4_1994	1
Copper	EPA 200.8_5.4_1994	1
Lead	EPA 200.8_5.4_1994	1
Manganese	EPA 200.8_5.4_1994	1
Molybdenum	EPA 200.8_5.4_1994	1
Nickel	EPA 200.8_5.4_1994	1
Selenium	EPA 200.8_5.4_1994	1
Silver	EPA 200.8_5.4_1994	1
Strontium	EPA 200.8_5.4_1994	
Thallium	EPA 200.8_5.4_1994	1
Tin	EPA 200.8_5.4_1994	1
Titanium	EPA 200.8_5.4_1994	1
Total Uranium	EPA 200.8_5.4_1994	1
Vanadium	EPA 200.8_5.4_1994	1
Zinc	EPA 200.8_5.4_1994	1
Mercury	EPA 245.7_2005	1
4,4'-DDD	EPA 608.3	1
4,4'-DDE	EPA 608.3	1
4,4'-DDT	EPA 608.3	1
Aldrin	EPA 608.3	1
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608.3	1
Aroclor-1016 (PCB-1016)	EPA 608.3	1
Aroclor-1221 (PCB-1221)	EPA 608.3	1
Aroclor-1232 (PCB-1232)	EPA 608.3	1
Aroclor-1242 (PCB-1242)	EPA 608.3	1
Aroclor-1248 (PCB-1248)	EPA 608.3	1
Aroclor-1254 (PCB-1254)	EPA 608.3	1
Aroclor-1260 (PCB-1260)	EPA 608.3	1
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608.3	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
Chlordane (tech.)	EPA 608.3	1
delta-BHC	EPA 608.3	1
Dieldrin	EPA 608.3	1
Endosulfan I	EPA 608.3	1
Endosulfan II	EPA 608.3	1
Endosulfan sulfate	EPA 608.3	1
Endrin	EPA 608.3	1
Endrin aldehyde	EPA 608.3	1
Endrin ketone	EPA 608.3	1
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608.3	1
Heptachlor	EPA 608.3	1
Heptachlor epoxide	EPA 608.3	1
Methoxychlor	EPA 608.3	1
Toxaphene (Chlorinated camphene)	EPA 608.3	1
1,1,1,2-Tetrachloroethane	EPA 624.1	1
1,1,1-Trichloroethane	EPA 624.1	1
1,1,2,2-Tetrachloroethane	EPA 624.1	
1,1,2-Trichloroethane	EPA 624.1	1
1,1-Dichloroethane	EPA 624.1	1
1,1-Dichloroethylene	EPA 624.1	1
1,1-Dichloropropene	EPA 624.1	1
1,2,3-Trichlorobenzene	EPA 624.1	1
1,2,3-Trichloropropane	EPA 624.1	1
1,2,4-Trimethylbenzene	EPA 624.1	1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 624.1	1
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 624.1	1
1,2-Dichlorobenzene	EPA 624.1	1
1,2-Dichloroethane (Ethylene dichloride)	EPA 624.1	1
1,2-Dichloropropane	EPA 624.1	1
1,3,5-Trimethylbenzene	EPA 624.1	1
1,3-Dichlorobenzene	EPA 624.1	1
1,3-Dichloropropane	EPA 624.1	1
1,4-Dichlorobenzene	EPA 624.1	1
2,2-Dichloropropane	EPA 624.1	1
2-Butanone (Methyl ethyl ketone, MEK)	EPA 624.1	
2-Chloroethyl vinyl ether	EPA 624.1	1
2-Chlorotoluene	EPA 624.1	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
2-Hexanone	EPA 624.1	
4-Chlorotoluene	EPA 624.1	1
4-Isopropyltoluene (p-Cymene)	EPA 624.1	1
4-Methyl-2-pentanone (MIBK)	EPA 624.1	
Acrolein (Propenal)	EPA 624.1	1
Acrylonitrile	EPA 624.1	1
Benzene	EPA 624.1	1
Bromobenzene	EPA 624.1	1
Bromochloromethane	EPA 624.1	1
Bromodichloromethane	EPA 624.1	1
Bromoform	EPA 624.1	1
Carbon disulfide	EPA 624.1	
Carbon tetrachloride	EPA 624.1	1
Chlorobenzene	EPA 624.1	1
Chlorodibromomethane	EPA 624.1	1
Chloroethane (Ethyl chloride)	EPA 624.1	1
Chloroform	EPA 624.1	1
cis-1,2-Dichloroethylene	EPA 624.1	1
cis-1,3-Dichloropropene	EPA 624.1	1
Dibromomethane	EPA 624.1	1
Diethyl ether	EPA 624.1	1
Ethylbenzene	EPA 624.1	1
Iodomethane (Methyl iodide)	EPA 624.1	1
Isopropylbenzene	EPA 624.1	1
m+p-xylene	EPA 624.1	1
Methyl bromide (Bromomethane)	EPA 624.1	1
Methyl chloride (Chloromethane)	EPA 624.1	1
Methyl tert-butyl ether (MTBE)	EPA 624.1	1
Methylene chloride (Dichloromethane)	EPA 624.1	1
n-Butylbenzene	EPA 624.1	1
n-Propylbenzene	EPA 624.1	1
o-Xylene	EPA 624.1	1
sec-Butylbenzene	EPA 624.1	1
Styrene	EPA 624.1	1
tert-Butylbenzene	EPA 624.1	
Tetrachloroethylene (Perchloroethylene)	EPA 624.1	1
Toluene	EPA 624.1	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
trans-1,2-Dichloroethylene	EPA 624.1	1
trans-1,3-Dichloropropylene	EPA 624.1	1
trans-1,4-Dichloro-2-butene	EPA 624.1	1
Trichloroethene (Trichloroethylene)	EPA 624.1	1
Trichlorofluoromethane (Freon 11)	EPA 624.1	1
Vinyl chloride	EPA 624.1	1
Xylene (total)	EPA 624.1	1
1,2,4-Trichlorobenzene	EPA 625.1	1
1,2-Dinitrobenzene	EPA 625.1	
1,2-Diphenylhydrazine	EPA 625.1	1
1,3-Dinitrobenzene (1,3-DNB)	EPA 625.1	
1-Methylnaphthalene	EPA 625.1	
2,2'-Oxybis(1-chloropropane)	EPA 625.1	1
2,3,4,6-Tetrachlorophenol	EPA 625.1	1
2,3,5,6-Tetrachlorophenol	EPA 625.1	
2,4,5-Trichlorophenol	EPA 625.1	1
2,4,6-Trichlorophenol	EPA 625.1	1
2,4-Dichlorophenol	EPA 625.1	1
2,4-Dimethylphenol	EPA 625.1	1
2,4-Dinitrophenol	EPA 625.1	1
2,4-Dinitrotoluene (2,4-DNT)	EPA 625.1	1
2,6-Dinitrotoluene (2,6-DNT)	EPA 625.1	1
2-Chloronaphthalene	EPA 625.1	1
2-Chlorophenol	EPA 625.1	1
2-Methylnaphthalene	EPA 625.1	1
2-Methylphenol (o-Cresol)	EPA 625.1	
2-Nitroaniline	EPA 625.1	1
2-Nitrophenol	EPA 625.1	1
3,3'-Dichlorobenzidine	EPA 625.1	1
3-Nitroaniline	EPA 625.1	1
4,6-Dinitro-2-methylphenol	EPA 625.1	1
4-Bromophenyl phenyl ether (BDE-3)	EPA 625.1	1
4-Chloro-3-methylphenol	EPA 625.1	1
4-Chloroaniline	EPA 625.1	1
4-Chlorophenyl phenylether	EPA 625.1	1
4-Methylphenol (p-Cresol)	EPA 625.1	
4-Nitroaniline	EPA 625.1	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
4-Nitrophenol	EPA 625.1	1
Acenaphthene	EPA 625.1	1
Acenaphthylene	EPA 625.1	1
Aniline	EPA 625.1	
Anthracene	EPA 625.1	1
Benzidine	EPA 625.1	1
Benzo(a)anthracene	EPA 625.1	1
Benzo(a)pyrene	EPA 625.1	1
Benzo(g,h,i)perylene	EPA 625.1	1
Benzo(k)fluoranthene	EPA 625.1	1
Benzo[b]fluoranthene	EPA 625.1	1
Benzyl alcohol	EPA 625.1	1
bis(2-Chloroethoxy)methane	EPA 625.1	1
bis(2-Chloroethyl) ether	EPA 625.1	1
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625.1	1
Butyl benzyl phthalate	EPA 625.1	1
Carbazole	EPA 625.1	
Chrysene	EPA 625.1	1
Dibenz(a,h) anthracene	EPA 625.1	1
Diethyl phthalate	EPA 625.1	1
Dimethyl phthalate	EPA 625.1	1
Di-n-butyl phthalate	EPA 625.1	1
Di-n-octyl phthalate	EPA 625.1	1
Fluoranthene	EPA 625.1	1
Fluorene	EPA 625.1	1
Hexachlorobenzene	EPA 625.1	1
Hexachlorobutadiene	EPA 625.1	1
Hexachlorocyclopentadiene	EPA 625.1	1
Hexachloroethane	EPA 625.1	1
Indeno(1,2,3-cd) pyrene	EPA 625.1	1
Isophorone	EPA 625.1	1
m+p Cresol	EPA 625.1	
Naphthalene	EPA 625.1	1
n-Decane	EPA 625.1	1
Nitrobenzene	EPA 625.1	1
N-Nitrosodimethylamine	EPA 625.1	1
N-Nitroso-di-n-propylamine	EPA 625.1	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
N-Nitrosodiphenylamine	EPA 625.1	1
n-Octadecane	EPA 625.1	1
Pentachlorophenol	EPA 625.1	1
Phenanthrene	EPA 625.1	1
Phenol	EPA 625.1	1
Pyrene	EPA 625.1	1
Pyridine	EPA 625.1	
Fecal coliform-count	SM 9221 B+E1+C (LTB/BGB/EC-MPN)	
Total coliforms-count	SM 9221 B+E1+C (LTB/BGB/EC-MPN)	
E.coli-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	
Total coliforms-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	
Solid and Chemical Materials		
Chloride	EPA 300.0_2.1_1993	1
Fluoride	EPA 300.0_2.1_1993	1
Nitrate	EPA 300.0_2.1_1993	1
Nitrite	EPA 300.0_2.1_1993	1
Orthophosphate	EPA 300.0_2.1_1993	1
Sulfate	EPA 300.0_2.1_1993	1
Cyanide, Total	EPA 335.4_1_1993	
Cyanide, Total	EPA 9012 B-04	1
pH	EPA 9045 D_2004	1
Cyanide, Total	SM 4500-CN¯ E-2011	1
Cyanides, Amenable to Chlorination	SM 4500-CN¯ G-2011	4
Ammonia	SM 4500-NH3 G-2011	1,9
Nitrate (calc.)	SM 4500-NO3¯ F-2011	1
Nitrogen, Total Kjeldahl	SM 4500-Norg C-2011	1
Phosphorus, total	SM 4500-P F-2011	1,4
Aluminum	EPA 6010D_(7/14)	1
Barium	EPA 6010D_(7/14)	1
Beryllium	EPA 6010D_(7/14)	1
Boron	EPA 6010D_(7/14)	1,4
Cadmium	EPA 6010D_(7/14)	1
Calcium	EPA 6010D_(7/14)	1
Chromium	EPA 6010D_(7/14)	1
Cobalt	EPA 6010D_(7/14)	1,4
Copper	EPA 6010D_(7/14)	1
Iron	EPA 6010D_(7/14)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Magnesium	EPA 6010D_(7/14)	1
Manganese	EPA 6010D_(7/14)	1
Molybdenum	EPA 6010D_(7/14)	1
Nickel	EPA 6010D_(7/14)	1
Sodium	EPA 6010D_(7/14)	1
Vanadium	EPA 6010D_(7/14)	1
Zinc	EPA 6010D_(7/14)	1
Aluminum	EPA 6020B_(7/14)	1
Antimony	EPA 6020B_(7/14)	1
Arsenic	EPA 6020B_(7/14)	1
Barium	EPA 6020B_(7/14)	1
Beryllium	EPA 6020B_(7/14)	1
Boron	EPA 6020B_(7/14)	1
Cadmium	EPA 6020B_(7/14)	1
Chromium	EPA 6020B_(7/14)	1
Cobalt	EPA 6020B_(7/14)	1
Copper	EPA 6020B_(7/14)	1
Iron	EPA 6020B_(7/14)	1
Lead	EPA 6020B_(7/14)	1
Magnesium	EPA 6020B_(7/14)	1
Manganese	EPA 6020B_(7/14)	1
Mercury	EPA 6020B_(7/14)	1
Molybdenum	EPA 6020B_(7/14)	1
Nickel	EPA 6020B_(7/14)	1
Potassium	EPA 6020B_(7/14)	1,4
Selenium	EPA 6020B_(7/14)	1
Sodium	EPA 6020B_(7/14)	1
Strontium	EPA 6020B_(7/14)	1
Thallium	EPA 6020B_(7/14)	1
Tin	EPA 6020B_(7/14)	1,4
Titanium	EPA 6020B_(7/14)	1
Vanadium	EPA 6020B_(7/14)	1
Zinc	EPA 6020B_(7/14)	1
Methamphetamine	ALI SOP 602	1,5
4,4'-DDD	EPA 8081B_(2/07)	1
4,4'-DDE	EPA 8081B_(2/07)	1
4,4'-DDT	EPA 8081B_(2/07)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Aldrin	EPA 8081B_(2/07)	1
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B_(2/07)	1
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B_(2/07)	1
Chlordane (tech.)	EPA 8081B_(2/07)	1
Dacthal (DCPA)	EPA 8081B_(2/07)	1
delta-BHC	EPA 8081B_(2/07)	1
Dieldrin	EPA 8081B_(2/07)	1
Endosulfan I	EPA 8081B_(2/07)	1
Endosulfan II	EPA 8081B_(2/07)	1
Endosulfan sulfate	EPA 8081B_(2/07)	1
Endrin	EPA 8081B_(2/07)	1
Endrin aldehyde	EPA 8081B_(2/07)	1
Endrin ketone	EPA 8081B_(2/07)	1
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B_(2/07)	1
Heptachlor	EPA 8081B_(2/07)	1
Heptachlor epoxide	EPA 8081B_(2/07)	1
Methoxychlor	EPA 8081B_(2/07)	1
Toxaphene (Chlorinated camphene)	EPA 8081B_(2/07)	1
Aroclor-1016 (PCB-1016)	EPA 8082A_(2/07)	1
Aroclor-1221 (PCB-1221)	EPA 8082A_(2/07)	1
Aroclor-1232 (PCB-1232)	EPA 8082A_(2/07)	1
Aroclor-1242 (PCB-1242)	EPA 8082A_(2/07)	1
Aroclor-1248 (PCB-1248)	EPA 8082A_(2/07)	1
Aroclor-1254 (PCB-1254)	EPA 8082A_(2/07)	1
Aroclor-1260 (PCB-1260)	EPA 8082A_(2/07)	1
Azinphos-ethyl (Ethyl guthion)	EPA 8141B_2_(2/07)	1,4
Azinphos-methyl (Guthion)	EPA 8141B_2_(2/07)	1
Bolstar (Sulprofos)	EPA 8141B_2_(2/07)	1,4
Carbophenothion	EPA 8141B_2_(2/07)	1
Chlorfenvinphos	EPA 8141B_2_(2/07)	1
Chlorpyrifos	EPA 8141B_2_(2/07)	1
Coumaphos	EPA 8141B_2_(2/07)	1,4
Demeton	EPA 8141B_2_(2/07)	
Demeton-o	EPA 8141B_2_(2/07)	1
Demeton-s	EPA 8141B_2_(2/07)	1,4
Diazinon	EPA 8141B_2_(2/07)	1,4
Dichlorovos (DDVP, Dichlorvos)	EPA 8141B_2_(2/07)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Dimethoate	EPA 8141B_2_(2/07)	1
Dioxathion	EPA 8141B_2_(2/07)	
Disulfoton	EPA 8141B_2_(2/07)	1
EPN	EPA 8141B_2_(2/07)	1
Ethion	EPA 8141B_2_(2/07)	1,4
Ethoprop	EPA 8141B_2_(2/07)	1
Famphur	EPA 8141B_2_(2/07)	1
Fensulfothion	EPA 8141B_2_(2/07)	1,4
Fenthion	EPA 8141B_2_(2/07)	1
Malathion	EPA 8141B_2_(2/07)	1
Merphos	EPA 8141B_2_(2/07)	1,4
Methyl parathion (Parathion, methyl)	EPA 8141B_2_(2/07)	1
Mevinphos	EPA 8141B_2_(2/07)	1,4
Monocrotophos	EPA 8141B_2_(2/07)	1,4
Naled	EPA 8141B_2_(2/07)	1
Parathion, ethyl	EPA 8141B_2_(2/07)	1
Phorate	EPA 8141B_2_(2/07)	1
Phosmet (Imidan)	EPA 8141B_2_(2/07)	1,4
Ronnel	EPA 8141B_2_(2/07)	1
Sulfotepp	EPA 8141B_2_(2/07)	1
Terbufos	EPA 8141B_2_(2/07)	1
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8141B_2_(2/07)	1
Tetraethyl pyrophosphate (TEPP)	EPA 8141B_2_(2/07)	1
Thionazin (Zinophos)	EPA 8141B_2_(2/07)	1,4
Tokuthion (Prothiophos)	EPA 8141B_2_(2/07)	1,4
Trichloronate	EPA 8141B_2_(2/07)	1,4
2,4,5-T	EPA 8151A_(1/98)	1
2,4-D	EPA 8151A_(1/98)	1
2,4-DB	EPA 8151A_(1/98)	1
Acifluorfen	EPA 8151A_(1/98)	
Bentazon	EPA 8151A_(1/98)	
Chloramben	EPA 8151A_(1/98)	
Dacthal (DCPA)	EPA 8151A_(1/98)	
Dalapon	EPA 8151A_(1/98)	1
DCPA di acid degradate	EPA 8151A_(1/98)	
Dicamba	EPA 8151A_(1/98)	1
Dichloroprop (Dichlorprop)	EPA 8151A_(1/98)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151A_(1/98)	1
MCPA	EPA 8151A_(1/98)	1
MCPP	EPA 8151A_(1/98)	
Pentachlorophenol	EPA 8151A_(1/98)	1
Picloram	EPA 8151A_(1/98)	
Silvex (2,4,5-TP)	EPA 8151A_(1/98)	1
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330B_(10/06)	4
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330B_(10/06)	4
2,4,6-Trinitrobenzene	EPA 8330B_(10/06)	4
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330B_(10/06)	4
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330B_(10/06)	4
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330B_(10/06)	4
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330B_(10/06)	4
2-Nitrotoluene	EPA 8330B_(10/06)	4
3-Nitrotoluene	EPA 8330B_(10/06)	4
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330B_(10/06)	4
4-Nitrotoluene	EPA 8330B_(10/06)	4
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330B_(10/06)	4
Nitrobenzene	EPA 8330B_(10/06)	4
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330B_(10/06)	4
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330B_(10/06)	4
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330B_(10/06)	4
1,1,1,2-Tetrachloroethane	EPA 8260D_4_(6/18)	1
1,1,1-Trichloroethane	EPA 8260D_4_(6/18)	1
1,1,2,2-Tetrachloroethane	EPA 8260D_4_(6/18)	1
1,1,2-Trichloroethane	EPA 8260D_4_(6/18)	1
1,1-Dichloroethane	EPA 8260D_4_(6/18)	1
1,1-Dichloroethylene	EPA 8260D_4_(6/18)	1
1,1-Dichloropropene	EPA 8260D_4_(6/18)	1
1,2,3-Trichlorobenzene	EPA 8260D_4_(6/18)	1
1,2,3-Trichloropropane	EPA 8260D_4_(6/18)	1
1,2,4-Trichlorobenzene	EPA 8260D_4_(6/18)	1
1,2,4-Trimethylbenzene	EPA 8260D_4_(6/18)	1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260D_4_(6/18)	1
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260D_4_(6/18)	1
1,2-Dichlorobenzene	EPA 8260D_4_(6/18)	1
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260D_4_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
1,2-Dichloropropane	EPA 8260D_4_(6/18)	1
1,3,5-Trimethylbenzene	EPA 8260D_4_(6/18)	1
1,3-Dichlorobenzene	EPA 8260D_4_(6/18)	1
1,3-Dichloropropane	EPA 8260D_4_(6/18)	1
1,4-Dichlorobenzene	EPA 8260D_4_(6/18)	1
2,2-Dichloropropane	EPA 8260D_4_(6/18)	1
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260D_4_(6/18)	1
2-Chlorotoluene	EPA 8260D_4_(6/18)	1
2-Hexanone	EPA 8260D_4_(6/18)	1
4-Chlorotoluene	EPA 8260D_4_(6/18)	1
4-Isopropyltoluene (p-Cymene)	EPA 8260D_4_(6/18)	1,4
4-Methyl-2-pentanone (MIBK)	EPA 8260D_4_(6/18)	1
Acetone	EPA 8260D_4_(6/18)	1
Acrylonitrile	EPA 8260D_4_(6/18)	1
Benzene	EPA 8260D_4_(6/18)	1
Bromobenzene	EPA 8260D_4_(6/18)	1
Bromochloromethane	EPA 8260D_4_(6/18)	1
Bromodichloromethane	EPA 8260D_4_(6/18)	1
Bromoform	EPA 8260D_4_(6/18)	1
Carbon disulfide	EPA 8260D_4_(6/18)	1
Carbon tetrachloride	EPA 8260D_4_(6/18)	1
Chlorobenzene	EPA 8260D_4_(6/18)	1
Chlorodibromomethane	EPA 8260D_4_(6/18)	1,4
Chlorodifluoromethane (Freon-22)	EPA 8260D_4_(6/18)	
Chloroethane (Ethyl chloride)	EPA 8260D_4_(6/18)	1
Chloroform	EPA 8260D_4_(6/18)	1
cis-1,2-Dichloroethylene	EPA 8260D_4_(6/18)	1
cis-1,3-Dichloropropene	EPA 8260D_4_(6/18)	1
Dibromochloropropane	EPA 8260D_4_(6/18)	
Dibromomethane	EPA 8260D_4_(6/18)	1
Dichlorodifluoromethane (Freon-12)	EPA 8260D_4_(6/18)	1
Diethyl ether	EPA 8260D_4_(6/18)	1,4
Ethylbenzene	EPA 8260D_4_(6/18)	1
Hexachlorobutadiene	EPA 8260D_4_(6/18)	1
Iodomethane (Methyl iodide)	EPA 8260D_4_(6/18)	1,4
Isopropylbenzene	EPA 8260D_4_(6/18)	1
m+p-xylene	EPA 8260D_4_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Methyl bromide (Bromomethane)	EPA 8260D_4_(6/18)	1
Methyl chloride (Chloromethane)	EPA 8260D_4_(6/18)	1
Methyl tert-butyl ether (MTBE)	EPA 8260D_4_(6/18)	1
Methylene chloride (Dichloromethane)	EPA 8260D_4_(6/18)	1
Naphthalene	EPA 8260D_4_(6/18)	1
n-Butylbenzene	EPA 8260D_4_(6/18)	1
n-Propylbenzene	EPA 8260D_4_(6/18)	1
o-Xylene	EPA 8260D_4_(6/18)	1
p-Xylene	EPA 8260D_4_(6/18)	1
sec-Butylbenzene	EPA 8260D_4_(6/18)	1
Styrene	EPA 8260D_4_(6/18)	1
tert-Butylbenzene	EPA 8260D_4_(6/18)	1
Tetrachloroethylene (Perchloroethylene)	EPA 8260D_4_(6/18)	1
Toluene	EPA 8260D_4_(6/18)	1
trans-1,2-Dichloroethylene	EPA 8260D_4_(6/18)	1
trans-1,3-Dichloropropylene	EPA 8260D_4_(6/18)	1
trans-1,4-Dichloro-2-butene	EPA 8260D_4_(6/18)	1,4
Trichloroethene (Trichloroethylene)	EPA 8260D_4_(6/18)	1
Trichlorofluoromethane (Freon 11)	EPA 8260D_4_(6/18)	1
Vinyl chloride	EPA 8260D_4_(6/18)	1
Xylene (total)	EPA 8260D_4_(6/18)	1
1,2,4-Trichlorobenzene	EPA 8270E_6_(6/18)	1
1,2-Dichlorobenzene	EPA 8270E_6_(6/18)	1
1,2-Dinitrobenzene	EPA 8270E_6_(6/18)	
1,2-Diphenylhydrazine	EPA 8270E_6_(6/18)	1,4
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270E_6_(6/18)	
1,3-Dichlorobenzene	EPA 8270E_6_(6/18)	1
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270E_6_(6/18)	
1,4-Dichlorobenzene	EPA 8270E_6_(6/18)	
1,4-Dinitrobenzene	EPA 8270E_6_(6/18)	1
1-Methylnaphthalene	EPA 8270E_6_(6/18)	
2,2'-Oxybis(1-chloropropane)	EPA 8270E_6_(6/18)	
2,3,4,6-Tetrachlorophenol	EPA 8270E_6_(6/18)	1
2,3,5,6-Tetrachlorophenol	EPA 8270E_6_(6/18)	
2,4,5-Trichlorophenol	EPA 8270E_6_(6/18)	1
2,4,6-Trichlorophenol	EPA 8270E_6_(6/18)	1
2,4-Dichlorophenol	EPA 8270E_6_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
2,4-Dimethylphenol	EPA 8270E_6_(6/18)	1
2,4-Dinitrophenol	EPA 8270E_6_(6/18)	1
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270E_6_(6/18)	1
2-Chloronaphthalene	EPA 8270E_6_(6/18)	1
2-Chlorophenol	EPA 8270E_6_(6/18)	1
2-Methylnaphthalene	EPA 8270E_6_(6/18)	1
2-Methylphenol (o-Cresol)	EPA 8270E_6_(6/18)	1
2-Naphthylamine	EPA 8270E_6_(6/18)	
2-Nitroaniline	EPA 8270E_6_(6/18)	1
2-Nitrophenol	EPA 8270E_6_(6/18)	1
3,3'-Dichlorobenzidine	EPA 8270E_6_(6/18)	1
3-Nitroaniline	EPA 8270E_6_(6/18)	1
4,6-Dinitro-2-methylphenol	EPA 8270E_6_(6/18)	1
4-Bromophenyl phenyl ether (BDE-3)	EPA 8270E_6_(6/18)	1
4-Chloro-3-methylphenol	EPA 8270E_6_(6/18)	1
4-Chloroaniline	EPA 8270E_6_(6/18)	1
4-Chlorophenyl phenylether	EPA 8270E_6_(6/18)	1
4-Methylphenol (p-Cresol)	EPA 8270E_6_(6/18)	1,4
4-Nitroaniline	EPA 8270E_6_(6/18)	1
4-Nitrophenol	EPA 8270E_6_(6/18)	1
Acenaphthene	EPA 8270E_6_(6/18)	1
Acenaphthylene	EPA 8270E_6_(6/18)	1
Aniline	EPA 8270E_6_(6/18)	1
Anthracene	EPA 8270E_6_(6/18)	1
Azinphos-methyl (Guthion)	EPA 8270E_6_(6/18)	1,3,4
Benzidine	EPA 8270E_6_(6/18)	1
Benzo(a)anthracene	EPA 8270E_6_(6/18)	1
Benzo(a)pyrene	EPA 8270E_6_(6/18)	1
Benzo(g,h,i)perylene	EPA 8270E_6_(6/18)	1
Benzo(k)fluoranthene	EPA 8270E_6_(6/18)	1
Benzo[b]fluoranthene	EPA 8270E_6_(6/18)	1
Benzyl alcohol	EPA 8270E_6_(6/18)	1
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8270E_6_(6/18)	3
bis(2-Chloroethoxy)methane	EPA 8270E_6_(6/18)	1
bis(2-Chloroethyl) ether	EPA 8270E_6_(6/18)	1
Butyl benzyl phthalate	EPA 8270E_6_(6/18)	1
Carbazole	EPA 8270E_6_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Carbophenothion	EPA 8270E_6_(6/18)	1
Chlorpyrifos	EPA 8270E_6_(6/18)	1,3
Chrysene	EPA 8270E_6_(6/18)	1
Demeton-s	EPA 8270E_6_(6/18)	1
Di(2-ethylhexyl)adipate	EPA 8270E_6_(6/18)	
Di(2-ethylhexyl)phthalate	EPA 8270E_6_(6/18)	1
Dibenz(a,h) anthracene	EPA 8270E_6_(6/18)	1
Dibenzofuran	EPA 8270E_6_(6/18)	1
Diethyl phthalate	EPA 8270E_6_(6/18)	1
Dimethoate	EPA 8270E_6_(6/18)	1,3
Dimethyl phthalate	EPA 8270E_6_(6/18)	1
Di-n-butyl phthalate	EPA 8270E_6_(6/18)	1
Di-n-octyl phthalate	EPA 8270E_6_(6/18)	1
Disulfoton	EPA 8270E_6_(6/18)	1,3
EPN	EPA 8270E_6_(6/18)	1
Famphur	EPA 8270E_6_(6/18)	1
Fenthion	EPA 8270E_6_(6/18)	1,3
Fluoranthene	EPA 8270E_6_(6/18)	1
Fluorene	EPA 8270E_6_(6/18)	1
Hexachlorobenzene	EPA 8270E_6_(6/18)	1
Hexachlorobutadiene	EPA 8270E_6_(6/18)	1
Hexachlorocyclopentadiene	EPA 8270E_6_(6/18)	1
Hexachloroethane	EPA 8270E_6_(6/18)	1
Indeno(1,2,3-cd) pyrene	EPA 8270E_6_(6/18)	1
Isophorone	EPA 8270E_6_(6/18)	1
m,p Cresol	EPA 8270E_6_(6/18)	1
Malathion	EPA 8270E_6_(6/18)	1,3
Methyl parathion (Parathion, methyl)	EPA 8270E_6_(6/18)	1,3
Mevinphos	EPA 8270E_6_(6/18)	1,3
Naled	EPA 8270E_6_(6/18)	1,3
Naphthalene	EPA 8270E_6_(6/18)	1
Nitrobenzene	EPA 8270E_6_(6/18)	1
n-Nitrosodimethylamine	EPA 8270E_6_(6/18)	1
N-Nitroso-di-n-propylamine	EPA 8270E_6_(6/18)	1
n-Nitrosodiphenylamine	EPA 8270E_6_(6/18)	1
Parathion	EPA 8270E_6_(6/18)	3
Pentachlorophenol	EPA 8270E_6_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Phenanthrene	EPA 8270E_6_(6/18)	1
Phenol	EPA 8270E_6_(6/18)	1
Phorate	EPA 8270E_6_(6/18)	1,3
Pyrene	EPA 8270E_6_(6/18)	1
Pyridine	EPA 8270E_6_(6/18)	1
Sulfotepp	EPA 8270E_6_(6/18)	1,3
Terbufos	EPA 8270E_6_(6/18)	1,3
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8270E_6_(6/18)	1,3
Diesel range organics (DRO)	WDOE NWTPH-Dx_(1997)	1,2
Gasoline range organics (GRO)	WDOE NWTPH-Gx_(1997)	1,2

Accredited Parameter Note Detail

(1) Accreditation is based in part on recognition of Florida Department of Health NELAP accreditation. (2) Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June 1997. (3) Tributyl phosphate used for internal standard and normal 8270 surrogates used. (4) Accreditation is limited to water only. (5) Anatek Labs, Inc. SOP for determination of methamphetamine by HPLC-MS. (6) Approved for compliance testing only when holding time is met.(7) Method not approved for NPDES testing. (8)Accreditation based in part on recognition of Idaho Department of Health and Welfare accreditation. (9) Provisional accreditation pending submittal of acceptable Proficiency Testing (PT) results (WAC 173-50-110).(10) Interim accreditation pending the successful completion of an on-site audit to verify method capabilities (WAC 173-50-100).

Rebecca Wood

07/03/2023

Authentication Signature
Rebecca Wood, Lab Accreditation Unit Supervisor

Date

Appendix C

Aspect Field Data Sheets

Chain of Custody Record

Anatek Labs, Inc.
1282 Alturas Drive, Moscow ID 83843 (208) 883-2839
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999

Company Name:	Project Manager:
Address:	Project Name & # :
City: State: Zip:	Purchase Order #:
Phone:	Sampler Name & Phone:
Email Address(es):	

Turn Around Time & Reporting

Please refer to our normal turn around times at www.anateklabs.com/pricing-lists

__Normal
__Next Day*
__2nd Day*
__Other*________

__Phone
__Email

*All rush order requests must have prior approval

List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume										
				Preservative:											

Note Special Instructions/Comments

	Printed Name	Signature	Company	Date	Time
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
No VOC Head Space?	Y	N
Cooler?	Y	N
Ice/Ice Packs Present?	Y	N

Temperature (°C):________________________
Number of Containers:____________________
Shipped Via:____________________________
Preservative:____________________________
____
Date & Time:____________________________
Inspected By:___________________________

Samples submitted to Anatek Labs may be subcontacted to other accredited labs if necessary. This message serves as notice of this possibility. Subcontracted analyses will be clearly noted on the analytical report.

Aspect CONSULTING

DAILY REPORT

350 Madison Avenue North
Bainbridge Island, Washington 98110
(206) 780-9370

710 Second Avenue, Suite 550
Seattle, Washington 98104
(206) 328-7443

DATE:	**PROJECT NO.**	**WEATHER:**
PROJECT NAME:	**CLIENT:**	
EQUIPMENT USED:	**PROJECT LOCATION:**	

THE FOLLOWING WAS NOTED:

COPIES TO:	**Aspect Consulting PROJECT MANAGER:**
Page 1 of 1	**FIELD REP.:**

Sample number ______________________

GROUNDWATER SAMPLING RECORD

WELL NUMBER: _______ **Page:**____ **of** ____

Project Name: ______________________
Project Number: ______________________
Date: ______________________
Sampled by: ______________________
Measuring Point of Well: TOC
Screened Interval (ft. TOC) ______________________
Filter Pack Interval (ft. TOC) ______________________

Starting Water Level (ft TOC): ______________
Casing Stickup (ft): ______________
Total Depth (ft TOC): ______________
Casing Diameter (inches): ______________

Casing Volume ___________ (ft Water) x ___________ (Lpfv)(gpf) = ___________ (L)(gal)

Casing volumes: 3/4"= 0.02 gpf 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf
3/4"= 0.09 Lpf 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf

Sample Intake Depth (ft TOC): ___________

PURGING MEASUREMENTS

Time	Cumul. Volume (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (°C)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mv)	Turbidity (NTU)	Comments
Criteria:		Typical 0.1-0.5 Lpm	Stable	na	± 3%	± 10%	± 0.1	± 10 mV	± 10%	

Total Gallons Purged: ______________________
Total Casing Volumes Removed: ______________

Ending Water Level (ft TOC): ______________________
Ending Total Depth (ft TOC): ______________

SAMPLE INVENTORY

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance		Remarks
						Color	Turbidity & Sediment	

METHODS

Parameters measured with (instrument model & serial number): ______________________
Purging Equipment: ______________________
Decon Equipment: ______________________
Disposal of Discharged Water: ______________________
Observations/Comments: ______________________

X:\Aspect Forms\Field Forms\Groundwater Sampling Form.xlsx

Aspect CONSULTING

Appendix D

City Well Logs

The Dep. The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

well No. 3

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. Appli./ 1521
Cert. 876-A

Date August 10, 1951
Record by Don E. Gray
Source Driller's Record

Location: State of WASHINGTON
County Grant
Area
Map
SW ¼ SE ¼ sec. 15 T. 19 N., R. 28 E.

DIAGRAM OF SECTION

Drilling Co. G. D. Hall & Associates
Address
Method of Drilling Date Jan. 15 1951
Owner City of Moses Lake
Address
Land surface, datum 1070 ft. above / below

Correlation	Material	Thickness (feet)	Depth (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Over burden	2	2
	Coarse gravel	8	10
	Gravel & boulders	4	14
	Boulders	4	18
	Boulders & coarse gravel	3	21
	Coarse gravel	3	24
	Gravel-dry	8	32
	Sand & gravel	10	42
	Basalt, blue & boulders	11	53
	Clay, yellow & sandy	11	64
	Loose gravel	1	65
	Sand & gravel	9	74
	Gravel & broken rock	6	80
	Brown rock (caving)	22	102
	Basalt, blue & broken	8	110
	Blue basalt	5	115

Turn up

(over)

Sheet ___ of ___ sheets

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued No. ____/____-____

Correlation	Material	Thickness (feet)	Depth (feet)
	Depth forward	———	
	Blue basalt (caving)	7	122
	Blue basalt (creviced)	10	132
	Blue basalt, hard	11	143
	Black basalt	15	158
↑	Dark basalt, creviced	28	186
	Blue basalt	14	200
	Blue shale	5	205
	Blue basalt, creviced	20	225
Wanapum	Blue basalt, hard	36	261
	Blue shale	4	265
	Blue basalt, broken	27	292
	Blue basalt, hard	14	306
	Gray basalt	42	348
	Blue basalt broken	16	364
	Gray basalt	23	387
↓	Blue basalt	56	443
	Blue clay	7	450
	Brown shale	8	458
	Blue basalt, broken	18	476
↑	Gray basalt, hard	122	598
	Blue basalt, broken	7	605
Grande Ronde	Black basalt	51	656
	Black basalt, creviced	14	670
	Black basalt, broken	84	754
	Blue basalt, hard	8	762
	Dark basalt, hard	61	823
	Dark basalt, caving	4	827
↓	Dark basalt, hard	19	846
	Dark basalt, caving	4	850
	Dark basalt, hard	23	873
	Gray basalt, hard	36	909

Pump Test:
Dim: 909' x 16" Drilled
SWL: 25'
DD: 92'
Yield: 1420 g.p.m.
Casing: 20" dia. St. Wt. from 0 to 86'
16" dia. St. Wt. from 0 to 132'

Perforations: no information

Meter 38033 gallons
12/16/75 338 770 000
11/31/74 466 217 000

S F. 7449-46 REMINGTON INC-20 20 743-24

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

WELL LOG

Record by....................

Source....................

Location: State of WASHINGTON

County....................

Area....................

Map....................

......¼ Q ¼ sec. 15 T. 19 N., R. 28 E./W.

Diagram of Section: 15

Drilling Co.....................

Address....................

Method of Drilling.................... Date...................., 19......

Owner....................

Address....................

Land surface, datum.................... ft. above/below

SWL:.................... Date...................., 19...... Dims.:....................

19/28-15Q1. City of Moses Lake. Altitude, 1,070 ft.
Drilled 1950. Casing, 16-in. to 132 ft.

Holocene:	
Soil	2
Pleistocene:	
Fluvial and lacustrine deposits:	
Fluvial gravel:	
Gravel, coarse	10
Gravel and boulders	14
Boulders	18
Boulders and coarse gravel	21
Gravel, coarse	24
Gravel, dry	32
Sand and gravel	42
Boulders	53
Ringold Formation:	
Lacustrine clay:	
Clay, sandy, yellow	64
Tuffaceous sand and conglomerate:	
Gravel, loose	65
Sand and gravel	74
Gravel and broken basalt	80

Turn up

Sheet......of......sheets

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued No................/..........-...............

Pliocene-Miocene:	
Yakima Basalt:	
Roza Member:	
Basalt, brown (caving)	102
Basalt, broken, blue	110
Basalt, blue	115
Basalt, blue (caving)	122
Basalt, creviced, blue	132
Basalt, hard, blue	143
Basalt, black	158
Basalt, creviced, dark	186
Basalt, blue	200
Squaw Creek Diatomite Bed:	
Shale, blue	205
Frenchman Springs Member:	
Basalt, creviced, blue	225
Basalt, hard, blue	261
Shale, blue	265
Basalt, broken, blue	292
Basalt, hard, blue	301
Basalt, gray	348
Basalt, broken, blue	364
Basalt, gray	387
Basalt, blue	443
Vantage Sandstone Member:	
Clay, blue	450
Shale, brown	458
Lower basalt, undifferentiated:	
Basalt, broken, blue	476
Basalt, hard, gray	598
Basalt, broken, blue	605
Basalt, black	656
Basalt, creviced, black	670
Basalt, broken, black	754
Basalt, hard, blue	762
Basalt, hard, dark	823
Basalt, dark (caving)	827
Basalt, hard, dark	846
Basalt, dark (caving)	850
Basalt, hard, dark	873
Basalt, hard, gray	909

[illegible]

The Dep The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG Well #4 No. Appli. #2848 Cer. 2099-A

Date March, 19 54

Record by A.A. Durand & Son

Source Driller's Record

Location: State of WASHINGTON

County Grant

Area

Tr. 73, Battery Orchard

Tr. sec. 28 T. 19 N., R. 28 E.

Diagram of Section

Drilling Co. A. A. Durand & Son

Address 115 Reese, Walla Walla

Method of Drilling Date 1-27, 19 54

Owner City of Moses Lake, Wash.

Address

Land surface, datum ft. above / below

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	Top Soil	1	1
	Sand & gravel boulders	2	3
	Gravel & boulders	3	6
	Boulders	6	12
	Sandy clay	26	38
	Boulders & sand	6	44
	Boulders, gravel & sand	15	59
	Broken basalt	3	62
	Broken rock with brown mud	9	71
	Very hard gray basalt	19	90
	Broken rock with some sand	3	93
	Gray hard basalt	4	97
	Broken brown rock	5	102
	Brown basalt	30	132
	Broken basalt	2	134
	Hard brown basalt	2	136

Turn up

Sheet 1 of 2 sheets

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued

No. ..../.........-..........

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	——	136
	Broken basalt	6	142
	Brown rock	2	144
	Hard gray basalt	56	200
	Medium soft, brown broken basalt	40	240
	Medium dark basalt	18	258
	Med. Hard black basalt	15	273
	Med. hard gray basalt	10	283
	Med. soft, brown broken basalt	22	305
	Med. soft, dark basalt	74	379
	Hard, gray basalt	28	407
	Med. soft dark basalt	20	427
	Med. hard gray basalt	26	453
	Med. soft dark basalt	9	462
	Med. hard gray basalt	13	475
	Med. dark basalt	25	500
	Hard dark basalt	4	504
	Hard gray basalt	21	525
	Medium dark basalt	61	586
	Hard gray basalt	10	596
	Medium dark basalt	21	617
	Hard gray basalt	14	631
	Med. hard gray basalt	7	638
	Med. hard dark basalt	5	643
	Hard gray basalt	15	658
	Open cave	1	659
	Medium broken basalt	5	664
	Blue shale or clay, trace of mica	10	674
	Blue clay	16	690
	Med. dark basalt	21	711

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION AND DEVELOPMENT

WELL LOG Well #4 No. Appli. #2848 Cert. 2099-A

Date March, 1954

Record by A.A. Durand & Son

Source Driller's Record

Location: State of WASHINGTON

County Grant

Area

~~Map~~ Tr. 73, Battery Orchard

~~XXXXXXXX~~ sec. 28 T. 19 N., R. 28 E.

Diagram of Section

Drilling Co. A.A. Durand & Son

Address 115 Reese, Walla Walla

Method of Drilling Date 1-27, 1954

Owner City of Moses Lake, Wash.

Address

Land surface, datum ft. above / below

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	Depth Forward		711
	Hard dark basalt	6	717
	Med. dark basalt	33	750
	Broken basalt with broken red rock	25	775
	Med. dark basalt	2	777
	Hard dark basalt	98	875
Gr. Ronde	Black basalt with layers of shale	7	882
	Hard dark basalt	41	923
	Med. hard basalt	14	937
	Hard gray basalt	23	960
	Broken soft rock	3	963
	Med. hard, dark basalt	20	983
	Med. dark basalt	15	998
	Hard ark basalt	2	1000

Turn up Sheet 2 of 2 sheets

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued No. 2 / 2 -

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	———	
	PUMP TEST:		
	Dim. 1000' x 12"x8'		
	SWL: 33 ft.		
	Dd. 65 ft.		
	Yield: 1510 g.p.m.		
	Casing:		
	12" diam. st. wt. 0 to 395 ft.		
	8" " " " 362 to 711 ft.		
	Meter 46828 gallons		
	12/10/75 204 460 000		
	11/30/76 279 027 000		

S. F. No. [illegible]-12-54—3M. [illegible]08.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Well Tagging Form

Unique Well Tag No: ABS 792

56300X SrcNum 02 (well 4)

RECORD VERIFICATION (check ✓ one)

- [ ] Well Report available *(please attach this form to the well report and submit it to the Ecology Regional Office near you)*
- [ ] Verification inconclusive
- [x] Well Report not available

WELL OWNERSHIP, IF DIFFERENT FROM WELL REPORT

First Name: Moses Lake Last Name:

Street Address:

City: Moses Lake State: WA

LOCATION OF WELL, IF DIFFERENT FROM WELL REPORT

Well Address: 2430 Texas Street.

City: Moses Lake County:

T. 19 N. R. 28 E W.M. Sec. 28 NW 1/4 of the SE

FOR AGENCY USE ONLY

Latitude 47 06 ' 22 . 02517N "

Longitude 119 18 ' 19 . 67535W "

- [x] GPS
- [ ] Topographic Map
- [ ] Survey
- [ ] Computer generated

Elevation at land surface 341 feet/meters (circle one)

- [ ] Digital Altimeter
- [ ] Topographic Map
- [x] Other Gyle

Additional information, if available:

- [ ] Location marked on topographic map *(please attach)*
- [ ] Location marked on air photo *(please attach)*

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

35115

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W044646
UNIQUE WELL I.D. # #7
Water Right Permit No.

(1) **OWNER:** Name City of Moses Lake Address 321. S. Balsam Moses Lake, WA 98837

(2) **LOCATION OF WELL:** County Grant - ____ 1/4 ____ 1/4 Sec 23 T. 19 N., R 28 W.M.

(2a) **STREET ADDRESS OF WELL** (or nearest address)

(3) **PROPOSED USE:** ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (If more than one)
Abandoned ☐ New well ☐ Deepened ☐ Reconditioned ☒ Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well ____ inches.
Drilled ____ feet. Depth of completed well ____ ft.

(6) **CONSTRUCTION DETAILS:**
Casing Installed: ____" Diam. from ____ ft. to ____ ft.
Welded ☐ ____" Diam. from ____ ft. to ____ ft.
Liner installed ☐
Threaded ☐ ____" Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☐
Type of perforator used
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☐
Manufacturer's Name
Type ____ Model No.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☐ Size of gravel
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☐ No ☐ To what depth? ____ ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ____ Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name
Type: ____ H.P.

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ____ ft.
Static level ____ ft. below top of well Date
Artesian pressure ____ lbs. per square inch Date
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☐

(10) **WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Fished Out 280' PVC 3/4 Pipe		
Cleaned Out		
Back to Bottom		950'

RECEIVED NOV 13 1995 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

Work Started 8/9/95, 19. Completed 10/9, 1995

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Irrigators, Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address PO Box 449 Moses Lake, WA 98837
(Signed) [signature] (WELL DRILLER) License No. 2292
Contractor's Registration No. IRRIGI*1160J Date November 8, 1995

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Well Tagging Form

Unique Well Tag No: ABS 793

56300X SrNum 04 ABS 793 (well 7)

RECORD VERIFICATION (check ✓ one)

☐ Well Report available *(please attach this form to the well report and submit it to the Ecology Regional Office near you)*

☐ Verification inconclusive

☐ Well Report not available

WELL OWNERSHIP, IF DIFFERENT FROM WELL REPORT

First Name: Moses Lake Last Name:

Street Address:

City: Moses Lake State: WA

LOCATION OF WELL, IF DIFFERENT FROM WELL REPORT

Well Address: 324 E Fifth Avenue

City: Moses Lake County:

T. 19 N. R. 28 ~~~~E W.M. Sec. ~~~~ 23 NW 1/4 of the NW

FOR AGENCY USE ONLY

Latitude 47 07 ' 50 . 41562 N "

Longitude 119 16 ' 23 . 77908 W "

☐ GPS

☐ Topographic Map

☐ Survey

☐ Computer generated

Elevation at land surface 344 feet/meters (circle one)

☐ Digital Altimeter

☐ Topographic Map

☐ Other

Additional information, if available:

☐ Location marked on topographic map *(please attach)*

☐ Location marked on air photo *(please attach)*

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

FOR AGENCY USE ONLY

WELL CHARACTERISTICS

Physical Description of well (size of casing, type of well, housing, etc.)

Location of Well identification Tag: wellhead/base in well house

Was supplemental tag needed for ease of identifying well? ☐ Yes ☒ No

If yes, where was tag placed?

(D)	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Scale 1:24,000 (1"=2,000')

Indicate the location of the well within the Section by drawing a dot at that point.

SECTION 23

COMMENTS:

FOR ECOLOGY WATER RESOURCES PROGRAM ONLY

Water Right # ______ Date Issued ______

Circle One: Application Permit Certificate Claim Exempt

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. G300842P

Permit No. 11779

(1) OWNER: Name City of Moses Lake Address Drawer 940, Moses Lake, WA 98837

(2) LOCATION OF WELL: County Grant WELL 5 — NE ¼ SE ¼ Sec. 23 T. 19 N., R. 28 W.M.

Bearing and distance from section or subdivision corner 350 feet South and 90 feet West of E¼ corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 5
New well ☐ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☒ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 12-24" inches.
Drilled 950 ft. Depth of completed well 950 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0.0 ft. to 113 ft.
Threaded ☐ 20" Diam. from 63 ft. to 194 ft.
Welded ☐ 12" Diam. from 655 ft. to 786 ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations ... in. by ... in.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type ... Model No.
Diam. ... Slot size ... from ... ft. to ... ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ... ft. to ... ft.

Surface seal: Yes ☒ No ☐ To what depth? 113 ft.
Material used in seal Grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ... Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Peerless
Type: Turbine 6 stage 10" Bowls H.P. 100

(8) WATER LEVELS: Land-surface elevation above mean sea level 1,176 ft.
Static level 100 ft. below top of well Date 11-7-56
Artesian pressure ... lbs. per square inch Date
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom?
Yield: 1120 gal./min. with 111 ft. drawdown after 1½ hrs.
" 899 " 111 " 9 "
" 956 " 118 " 20½ "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test ... gal./min. with ... ft. drawdown after ... hrs.
Artesian flow ... g.p.m. Date
Temperature of water 68°F Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Brown Soft Top Soil	0	2
Grey Hard Sand & Gravel	2	34
Grey Medium Sand & Gravel	34	53
Brown Soft Sandy Clay	53	64
Brown Soft Caliche	64	99
Hard Grey Basalt	99	111
Brown Med. Brkn. Basalt&Clay	111	132
Hard Brown Basalt	132	134
Brown Medium Broken Basalt	134	136
Brown Medium Coarse Basalt	136	140
Brown Hard Basalt	140	144
Brown Medium Porous Basalt	144	161
Porous Med. Basalt & Clay	161	163
Grey Med/Hard Por.Bas.&Clay	163	178
Brown Medium Basalt	178	190
Hard Basalt	190	195
Grey Extra Hard Basalt	195	214
Grey Hard Basalt	214	254
Grey Medium Basalt & Clay	254	274
Grey Medium Basalt	274	304
Grey Hard Basalt	304	363
Brn. Med. Por. Basalt&Clay	363	367
Grey Hard Basalt	367	372
Grey Medium Hard Basalt	372	404
Grey Hard Basalt	404	459
Grey Medium Porous Basalt	459	464
Grey Hard Basalt	464	467
Grey Medium Basalt	467	477
Grey Medium Porous Basalt	477	507
Grey Hard Basalt	507	563
Black Med. Brkn. Por. Bas.	563	567
Black Medium Basalt	567	582
Black Medium Porous Basalt	582	585
Black Hard Basalt	585	612
Grey Hard Basalt	612	625
(See Attached Sheet)		

Work started ..., 19... Completed ..., 19...

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME ... (Person, firm, or corporation) (Type or print)

Address

[Signed] ... (Well Driller)

License No. ... Date ..., 19...

OK 1210 1270-73

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

19/28 -23 K

City of Moses Lake

WELL LOG: Continued

Material	From	To
Grey Extra Hard Basalt	625	643
Gray Hard Basalt	643	703
Gray Medium Basalt	703	723
Black Medium Broken Basalt	723	726
Green Medium Clay	726	737
Green Soft Clay	737	743
Gray Soft Clay	743	749
Brown Soft Clay	749	760
Brown Medium Broken Basalt	760	807
Grey Medium Broken Basalt	807	816
Brown Medium Broken Basalt	816	846
Grey Hard Basalt	846	950

Wanapum

Grande Ronde

Cased

970 gpm
1500 af/yr
Mun.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

The Dep The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appli. 10233
Permit 9488
#10

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

WELL LOG

Record by: Driller
Source: Driller's record

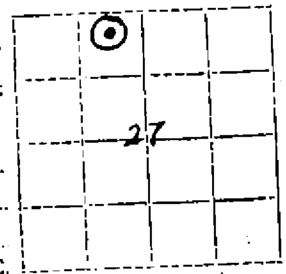

Diagram of Section

Location: State of WASHINGTON
County: Grant
Area:
Map:
NE¼ NW¼ sec. 27 T. 19N., R. 28 E.

Drilling Co. Frank L. Zimmerman, Well Drilling Contra.
Address 2004 S. Belair Dr., Moses Lake, WA
Method of Drilling cable Date Jan. 13, 1970
Owner City of Moses Lake, Washington
Address 321 South Balsam St., Moses Lake, WA
Land surface, datum 1232 ft. above / below
SWL: +4 ft. Date Dec. 30, 1970 Dims.: 20" x 692'

Correlation	Material	From (feet)	To (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Municipal supply		
	Top soil	0	5
	Boulders	5	10
	Hardpan	10	25
	Clay, sand & small gravel	25	59
	Basalt, broken (water)	59	61
	Basalt, medium hard	61	86
	Basalt, broken (water)	86	101
	Basalt, hard	101	183
	Basalt, broken black (little water)	183	231
	Basalt, hard black	231	511
	Basalt, broken (water)	511	522
	Basalt, hard	522	642

Sheet......of......sheets

Turn up

The Dep The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued No. 19 / 28E-27C

Correlation	Material	From (feet)	To (feet)
	Depth forward	——	642
	Basalt, broken (water)	642	658
	Basalt, hard	658	682
	Rock, broken and clay	682	692
	Basalt, black	692	
Flowing 200 gpm			
	Casing: 24" from 0' to 65'6"		
	20" from 0' to 236'		
	16" from 229' to 269'		
	Pump test 2200 gpm with 147' ft. DD		
	after 20 hrs.		
	Surface seal: Grout to 236'		
	Water Temp. 69		
	Meter 85366 gallons		
	12/10/75 539747000		
	11/30/76 839990000		

S. F. No. 7449—OS—12-68.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

mi

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Well Tagging Form

Unique Well Tag No: ABS 794 ✓

56300X Svc Nun 07 (well ID).

RECORD VERIFICATION (check ✓ one)

☐ Well Report available *(please attach this form to the well report and submit it to the Ecology Regional Office near you)*

☐ Verification inconclusive

☒ Well Report not available

WELL OWNERSHIP, IF DIFFERENT FROM WELL REPORT

First Name: Moses Lake Last Name:

Street Address:

City: Moses Lake State: WA

LOCATION OF WELL, IF DIFFERENT FROM WELL REPORT

Well Address: 1501 W. Peninsula Drive

City: County:

T. 19 N. R. 28 E W.M. Sec. 27 NE 1/4 of the NW ✓

FOR AGENCY USE ONLY

Latitude 47 06 ' 55 . 98662 N "

Longitude 119 17 ' 32 . 68616 W "

☒ GPS
☐ Topographic Map
☐ Survey
☐ Computer generated

Elevation at land surface 339 feet/meters (circle one)

☐ Digital Altimeter
☐ Topographic Map
☒ Other GPS

Additional information, if available:

☐ Location marked on topographic map *(please attach)*

☐ Location marked on air photo *(please attach)*

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

FOR AGENCY USE ONLY

WELL CHARACTERISTICS

Physical Description of well (size of casing, type of well, housing, etc.)

Location of Well identification Tag: well head/Base in well house

Was supplemental tag needed for ease of identifying well? ☐ Yes ☒ No

If yes, where was tag placed?

D	(C)	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Scale 1:24,000 (1"=2,000')

Indicate the location of the well within the Section by drawing a dot at that point.

SECTION 27

COMMENTS:

FOR ECOLOGY WATER RESOURCES PROGRAM ONLY

Water Right # ____________ Date Issued ____________

Circle One: Application Permit Certificate Claim Exempt

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. Applt. 285
Cert. 372-A

Date May 23, 1947
Record by Allen E. Hosack
Source Driller's Record

Location: State of WASHINGTON
County Grant
Area
Map
SE¼ SE¼ sec. 13 T. 19 N., R. 28 E.

DIAGRAM OF SECTION

Drilling Co. Allen E. Hosack
Address Nampa, Idaho
Method of Drilling Date May 16, 17, 18, 1947
Owner U.S. Bureau of Reclamation
Address P.O. Box 937; Boise, Idaho
Land surface, datum [illegible] ft. above / below

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	Soil	2	2
	Gravel & boulders	13	15
	Small gravel & sand	9	24
	Light hard pan	6	30
	Brown clay	33	63
	Red clay	9	72
	Brown basalt	12	84
	Black basalt	6	90
	Black basalt, medium hard	26	116
	Brown basalt	12	128
	Black basalt, hard	1	129
	Brown basalt, firm	8	137
	Calcium rock, very hard & creviced	13	150
	Grey basalt, hard	2	152
	Black basalt, hard	8	160
	Black & red basalt, cavey water	3	163

Turn up (over) Sheet ___ of ___ sheets

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued No.____/____-____

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	——	
	Light blue & grey basalt, hard	19	182
	Black basalt, hard	13	195
	Brown basalt, cavey	15	210
	Black basalt	5	215
	Brown basalt, water	4	219
	Black basalt small crevice water	7	226
	Grey basalt, small crevice	22	248
	Soft brown basalt, water	2	250
	Hard brown basalt	8	258
	Hard grey basalt	2	260
	Soft brown basalt	2	262
	Hard grey basalt	2	264
	Porous loose basalt	2	266
	Hard black basalt	4	270
	Soft black basalt	1	271
	Hard Black basalt	2	273
	Crevice, no cuttings, water	1	274
	Grey basalt, springy	3	277
	Blue clay, water	3	280
	Blue & grey basalt, hard	9	289
	Blue clay seams	1	290
	Blue loose basalt, cavey	5	295
	Grey basalt, crevice	3	298
	Blue basalt, hard	18	316
	Grey basalt, hard	13	329
	Grey basalt, springy	6	335
	Brown basalt, water	2	337
	Grey basalt, hard	35	372
	Grey basalt, crevice	2	374
	Grey basalt, hard	4	378
	Brown basalt, water	10	388
	Grey basalt, hard	12	400

(continued)

The Dep. The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

No. Cert./ 372-A
(CONTINUED)

WELL LOG

Date ______, 19__

Record by ______

Source ______

Location: State of WASHINGTON

County ______

Area ______

Map ______

___ ¼ ___ ¼ sec. ___ T. ___ N., R. ___ E./W.

DIAGRAM OF SECTION

Drilling Co. ______

Address ______

Method of Drilling ______ Date ______ 19__

Owner ______

Address ______

Land surface, datum ______ ft. above/below ______

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Correlation	Material	Thickness (feet)	Depth (feet)
	Black basalt, firm	13	413
	Grey basalt, cavey & hard streak	13	426
	Grey basalt, hard	31	457
	Black basalt, hard	4	461
	Blue clay, water	1	462
	Black casalt, firm	13	475
	Brown conglomerate, possibly big flow of water	13	488
	Black & brown basalt	4	492
	Grey basalt, hard	7	499
	Black basalt	13	512
	Grey basalt, hard	17	529
	Blue basalt, soft water	11	540
	Blue basalt, hard	8	548
	Black basalt, not too hard	13	561
	(over)		

Turn up

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL LOG.—Continued No.____/____-____

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	——	
	Black basalt, no cuttings small crevice, possible some water	7	568
	Pump Test:		
	Dim: 568' x 15"		
	SWL: 145'		
	DD: 51'		
	Yield: 1050 g.p.m.		
	Casing: 20" diameter O.D., 65 lbs. per ft. from 0 to 45'7"		
	16" diameter O.D., 52 lbs. per foot from 0 to 107'8"		
	Perforations:		
	None		
	Meter none		

The Dept. The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WATER WELL REPORT

ECOLOGY Original & 1st copy Ecology 2nd copy owner 3rd copy driller

Construction/Decommission (x in circle) 126436

O Construction

O Decommission *ORIGINAL CONSTRUCTION Notice of Intent Number*

CURRENT Notice of Intent No W150719

Unique Ecology Well ID Tag No AAN 874

Water Right Permit No

Property Owner Name City of Moses Lake

Well Street Address P O Box 1579

City Moses Lake County GRANT

Location NW 1/4 1/4 NW 1/4 Sec 20 Twn 19N R 29 EWM circle or one WWM

Lat/Long (s t,r still REQUIRED) Lat Deg ___ Lat Min/Sec ___ Long Deg ___ Long Min/Sec ___

Tax Parcel No

PROPOSED USE ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other

TYPE OF WORK Owner's number of well (if more than one) ___

☒ New Well ☐ Reconditioned *Method* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS Diameter of well 16" inches drilled 585' ft Depth of completed well 525' ft

CONSTRUCTION DETAILS

Casing Installed ☒ Welded 24 Diam from +1 ft to 44 ft

☐ Liner installed 16 Diam from +1 ft to 280 ft

☐ Threaded ___ Diam from ___ ft to ___ ft

Perforations ☐ Yes ☒ No

Type of perforator used ___

SIZE of perfs ___ in by ___ in and no of perfs ___ from ___ ft to ___ ft

Screens ☐ Yes ☒ No ☐ K Pac Location ___

Manufacturer's Name ___

Type ___ Model No ___

Diam ___ Slot Size ___ from ___ ft to ___ ft

Diam ___ Slot Size ___ from ___ ft to ___ ft

Gravel/Filter packed ☐ Yes ☒ No ☐ Size of gravel/sand ___

Materials placed from ___ ft to ___ ft

Surface Seal ☒ Yes ☐ No To what depth? 280' ft

Materials used in seal ___

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? ___ Depth of strata ___

Method of sealing strata off ___

PUMP Manufacturer's Name ___

Type ___ H P ___

WATER LEVELS Land surface elevation above mean sea level ___ ft

Static level 51 ft below top of well Date ___

Artesian pressure ___ lbs per square inch Date ___

Artesian water is controlled by ___ (cap valve etc)

WELL TESTS Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes by whom? Irrigators

Yield 2200 gal /min with 150' ft drawdown after 8 hrs

Yield ___ gal /min with ___ ft drawdown after ___ hrs

Yield ___ gal /min with ___ ft drawdown after ___ hrs

Recovery data (time taken as zero when pump turned off)(water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ___

Bailer test ___ gal /min with ___ ft drawdown after ___ hrs

Airtest 2500 gal /min with stem set at 525 ft for 2 hrs

Artesian flow ___ g p m Date ___

Temperature of water ___ Was a chemical analysis made? ☐ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation Describe by color character size of material and structure and the kind and nature of the material in each stratum penetrated with at least one entry for each change of information Indicate all water encountered (USE ADDITIONAL SHEETS IF NECESSARY)

MATERIAL	FROM	TO
Brown Silt	0	2
Black Sand & gravel	2	25
Broken Brown Basalt		
some Tan Clay Silt	25	34
Hard Gray Basalt	34	117
Med soft Brown & Black	117	128
Hard Dark gray	128	162
Soft Brown Visicular		
& Gray water	162	168
Hard gray basalt	168	196
Soft Dark gray	196	203
Hard light gray	203	221
Soft Broken gray &		
brown basalt some		
gray & brown clay	221	243
Med hard dark gray	243	270
Very hard gray basalt	270	305
Soft Brown Visicular		
Basalt,broken gray		
Brown silt water		
1000 GPM Aprox	305	322
Hard gray basalt	322	375
Soft broken brown		
Basalt	375	379
Med hard dark gray		
Basalt 240psi 2Airpks	379	390
Hard dark gray Basalt	390	432

Start Date 11-01-02 Completed Date 12/23/03

RECEIVED FEB - 6 2003 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

RECEIVED JAN 24 2003 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

WELL CONSTRUCTION CERTIFICATION I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Larry McLanahan

Driller/Engineer/Trainee Signature Larry McL

Driller or Trainee License No 0337

If trainee, licensed driller's Signature and License no ___

Drilling Company BJExploration Co Inc

Address 404 N Conway St

City State Zip Kennewick, WA 99336

Contractor's Registration No BJEXPCI132QK Date 12/23/03

The Dept. The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WATER WELL REPORT

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - driller

Construction/Decommission ("x" in circle)
○ Construction
○ Decommission *ORIGINAL CONSTRUCTION Notice of Intent Number* ______

CURRENT Notice of Intent No. W150719
Unique Ecology Well ID Tag No. AAN874
Water Right Permit No. ______
Property Owner Name City of Moses Lake
Well Street Address P.O. Box 1579
City Moses Lake County: GRANT
Location NW 1/4- 1/4 NW 1/4 Sec 20 Twn 19N R 29 EWM or WWM (circle one)
Lat/Long: (s,t,r still REQUIRED) Lat Deg ______ Lat Min/Sec ______ Long Deg ______ Long Min/Sec ______
Tax Parcel No. ______

PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______
☒ New Well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well ______ inches, drilled ______ ft
Depth of completed well ______ ft

CONSTRUCTION DETAILS
Casing Installed: ☒ Welded 24" Diam from +1 ft to 44 ft
☐ Liner installed 16" Diam. from +1 ft to 280 ft
☐ Threaded ______" Diam from ______ ft. to ______ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used ______
SIZE of perfs ______ in by ______ in and no of perfs ______ from ______ ft. to ______ ft

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______
Manufacturer's Name ______
Type ______ Model No ______
Diam ______ Slot Size ______ from ______ ft to ______ ft
Diam ______ Slot Size ______ from ______ ft to ______ ft

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand ______
Materials placed from ______ ft. to ______ ft

Surface Seal: ☒ Yes ☐ No To what depth? 280' ft
Materials used in seal ______
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

PUMP: Manufacturer's Name ______
Type ______ HP ______

WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 51' ft below top of well Date ______
Artesian pressure ______ lbs per square inch Date ______
Artesian water is controlled by ______ (cap,valve, etc)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Irrigators
Yield 2200 gal./min with 150' ft. drawdown after 8 hrs.
Yield ______ gal./min with ______ ft drawdown after ______ hrs
Yield ______ gal./min with ______ ft drawdown after ______ hrs
Recovery data (time taken as zero when pump turned off)(water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______
Bailer test ______ gal./min with ______ ft drawdown after ______ hrs
Airtest 2500 gal./min with stem set at 525 ft for 2 hrs
Artesian flow ______ g p m Date ______
Temperature of water ______ Was a chemical analysis made? ☐ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information Indicate all water encountered (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Soft broken brown &		
Gray Basalt Trace of		
brown clay	432	435
Med. Hard Porus basalt	435	500
Broken gray basalt &		
Brown siltstone	500	518
Hard gray basalt	518	582
Fractured Basalt		
Loss Circulation	582	585
16" Casing to 280		
280-525 19" hole		
525-585 Hole full of		
caving material		
Placed 5/5gallon buckets		
of 1/2" Benonite pellets		
in hole.		

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Start Date 11-01-02 Completed Date 12/23/03

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Larry McLanahan
Driller/Engineer/Trainee Signature [signature]
Driller or Trainee License No. 0337

If trainee, licensed driller's Signature and License no. ______

Drilling Company BJ ExplorationCo., Inc.
Address 404 N. Conway Street
City, State, Zip Kennewick, WA 99336
Contractor's Registration No. BJEXPCI132QK Date 12/23/03

316389

Please print, sign and return to the Department of Ecology

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

Construction/Decommission
☒ Construction
☐ Decommission ORIGINAL INSTALLATION Notice of Intent Number ______

Current Notice of Intent No. W242662
Unique Ecology Well ID Tag No. ALF 728
Water Right Permit No. 4138
Property Owner Name City of Moses Lake
Well Street Address 500 Montana St.
City Moses Lake County 13-Grant
Location NE 1/4-1/4 SW 1/4 Sec 29 Twn 19N R 28E EWM (circle one) or WWM
Lat/Long (s, t, r still REQUIRED) Lat Deg ______ Lat Min/Sec ______ Long Deg ______ Long Min/Sec ______
Tax Parcel No. 110346001

PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______
☒ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 16 inches, drilled 970 ft.
Depth of completed well 970 ft.

CONSTRUCTION DETAILS
Casing Installed: ☒ Welded 20" Diam. from 0 ft. to 67 ft.
☐ Liner installed 16" Diam. from +2 ft. to 743 ft.
☐ Threaded ______" Diam. from ______ ft. to ______ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used ______
SIZE of perfs ______ in. by ______ in. and no. of perfs ______ from ______ ft. to ______ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand ______
Materials placed from ______ ft. to ______ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 750 ft.
Material used in seal Portland cement
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level ______ ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Layne of WA.
Yield: 1500 gal./min. with 169 ft. drawdown after 10 hrs.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 2-19-08
Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water 74 Was a chemical analysis made? ☒ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Sand	0	12
Sand + Gravel	12	67
Broken Brown basalt	67	105
Porous brown basalt	105	161
Soft black basalt	161	237
Broken brown basalt	237	248
Fractured black basalt	248	251
Soft brown basalt	251	256
Med black basalt	256	304
Broken brown basalt	304	341
Med black basalt	341	443
Broken black green + brown clay	443	460
Med black basalt	460	505
Soft black basalt	505	515
Med black basalt	515	554
Fractured black basalt	554	581
Hard grey basalt	581	703
Green clay	703	723
Fractured black basalt	723	726
Solid black basalt	726	756
Fractured black basalt	756	763
Hard black basalt	763	795
Broken brown basalt	795	823
Fractured black basalt	823	863
Broken brown basalt	863	872
Hard brown basalt	872	890
Hard black basalt	890	970

Start Date 10-16-07 Completed Date 1-31-08

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) David Smith
Driller/Engineer/Trainee Signature [signature]
Driller or trainee License No. 2844
Drilling Company Blue Star Enterprises NW Inc
Address 2010 Butler Loop
City, State, Zip Richland WA. 99354

If TRAINEE,
Driller's Licensed No. ______
Driller's Signature ______

Contractor's Registration No. Bluesen 942RM Date 3-17-08

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Appendix E. Glossaries, Acronyms, and Abbreviations

Glossary of General Terms

Ambient: Background or away from point sources of contamination. Surrounding environmental condition.

Clean Water Act: A federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the TMDL program.

Conductivity: A measure of water's ability to conduct an electrical current. Conductivity is related to the concentration and charge of dissolved ions in water.

Dissolved oxygen (DO): A measure of the amount of oxygen dissolved in water.

Dilution factor: The relative proportion of effluent to stream (receiving water) flows occurring at the edge of a mixing zone during critical discharge conditions as authorized in accordance with the state's mixing zone regulations at WAC 173-201A-100. http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-020

Effluent: An outflowing of water from a natural body of water or from a human-made structure. For example, the treated outflow from a wastewater treatment plant.

Fecal coliform (FC): That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius. Fecal coliform bacteria are "indicator" organisms that suggest the possible presence of disease-causing organisms. Concentrations are measured in colony forming units per 100 milliliters of water (cfu/100 mL).

Nutrient: Substance such as carbon, nitrogen, and phosphorus used by organisms to live and grow. Too many nutrients in the water can promote algal blooms and rob the water of oxygen vital to aquatic organisms.

pH: A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is considered to be neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands

Total suspended solids (TSS): Portion of solids retained by a filter.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Acronyms and Abbreviations

Aspect	Aspect Consulting, LLC
ASR	Aquifer Storage and Recovery
ALS	ALS Environmental Laboratory
City	City of Moses Lake
Commerce	State of Washington Department of Commerce
DBPs	Disinfection Byproducts
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DOH	Department of Health
DQI	data quality indicator
DQO	data quality objective
DV	data validation
ECBID	East Columbia Basin Irrigation District
EDD	Electronic Data Deliverable
e.g.	For example
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
et al.	And others
FC	Fecal coliform
GIS	Geographic Information System software
GPS	Global Positioning System
GWMA	Groundwater Management Area
GWQS	Groundwater Quality Standards
HAAs	Haloacetic Acids
i.e.	In other words
LCS	laboratory control sample
MDL	minimum detection limit
MQO	measurement quality objective
MRL	minimum reporting limit

MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NTR	National Toxics Rule
OCR	Office of Columbia River
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
Reclamation	U.S. Bureau of Reclamation
RPD	relative percent difference
RSD	relative standard deviation
SAP	Sampling Analysis Plain
SCADA	Supervisory Control and Data Acquisition
SOP	Standard operating procedures
Study	Alternatives Evaluation
THMs	Trihalomethanes
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
USFS	United States Forest Service
USGS	U.S. Geological Survey
VOA	volatile organic analysis
VOCs	volatile organic compounds
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area

Units of Measurement

°C	degrees centigrade
cfs	cubic feet per second
cfu	colony forming units
cms	cubic meters per second, a unit of flow
dw	dry weight

ft	feet
g	gram, a unit of mass
gpm	gallons per minute
kcfs	1,000 cubic feet per second
km	kilometer, a unit of length equal to 1,000 meters
L/s	liters per second (0.03531 cubic foot per second)
m	meter
mg	milligram
mgd	million gallons per day
mg/L	milligrams per liter (parts per million)
mL	milliliter
NTU	nephelometric turbidity units
s.u.	standard units
ug/L	micrograms per liter (parts per billion)
uS/cm	microsiemens per centimeter, a unit of conductivity

Quality Assurance Glossary

Accreditation: A certification process for laboratories, designed to evaluate and document a lab's ability to perform analytical methods and produce acceptable data (Kammin, 2010). For Ecology, it is defined according to WAC 173-50-040: "Formal recognition by [Ecology] that an environmental laboratory is capable of producing accurate and defensible analytical data."

Accuracy: The degree to which a measured value agrees with the true value of the measured property. USEPA recommends that this term not be used, and that the terms *precision* and *bias* be used to convey the information associated with the term *accuracy* (USEPA, 2014).

Analyte: An element, ion, compound, or chemical moiety (pH, alkalinity) which is to be determined. The definition can be expanded to include organisms, e.g., fecal coliform, Klebsiella (Kammin, 2010).

Bias: Discrepancy between the expected value of an estimator and the population parameter being estimated (Gilbert, 1987; USEPA, 2014).

Blank: A synthetic sample, free of the analyte(s) of interest. For example, in water analysis, pure water is used for the blank. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process (USGS, 1998).

Calibration: The process of establishing the relationship between the response of a measurement system and the concentration of the parameter being measured (Ecology, 2004).

Check standard: A substance or reference material obtained from a source independent from the source of the calibration standard; used to assess bias for an analytical method. This is an obsolete term, and its use is highly discouraged. See Calibration Verification Standards, Lab Control Samples (LCS), Certified Reference Materials (CRM), and/or spiked blanks. These are all check standards but should be referred to by their actual designator, e.g., CRM, LCS (Kammin, 2010; Ecology, 2004).

Comparability: The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator (USEPA, 2014; USEPA, 2020).

Completeness: The amount of valid data obtained from a project compared to the planned amount. Usually expressed as a percentage. A data quality indicator (USEPA, 2014; USEPA 2020).

Continuing Calibration Verification Standard (CCV): A quality control (QC) sample analyzed with samples to check for acceptable bias in the measurement system. The CCV is usually a midpoint calibration standard that is re-run at an established frequency during the course of an analytical run (Kammin, 2010).

Control chart: A graphical representation of quality control results demonstrating the performance of an aspect of a measurement system (Kammin, 2010; Ecology 2004).

Control limits: Statistical warning and action limits calculated based on control charts. Warning limits are generally set at +/- 2 standard deviations from the mean, action limits at +/- 3 standard deviations from the mean (Kammin, 2010).

Data integrity: A qualitative DQI that evaluates the extent to which a data set contains data that is misrepresented, falsified, or deliberately misleading (Kammin, 2010).

Data quality indicators (DQI): Commonly used measures of acceptability for environmental data. The principal DQIs are precision, bias, representativeness, comparability, completeness, sensitivity, and integrity (USEPA, 2006).

Data quality objectives (DQO): Qualitative and quantitative statements derived from systematic planning processes that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA, 2006).

Data set: A grouping of samples organized by date, time, analyte, etc. (Kammin, 2010).

Data validation: The process of determining that the data satisfy the requirements as defined by the data user (USEPA, 2020). There are various levels of data validation (USEPA, 2009).

Data verification: Examination of a data set for errors or omissions, and assessment of the Data Quality Indicators related to that data set for compliance with acceptance criteria (MQOs). Verification is a detailed quality review of a data set (Ecology, 2004).

Detection limit (limit of detection)**:** The concentration or amount of an analyte which can be determined to a specified level of certainty to be greater than zero (Ecology, 2004).

Duplicate samples: Two samples taken from and representative of the same population, and carried through and steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variability of all method activities including sampling and analysis (USEPA, 2014).

Field blank: A blank used to obtain information on contamination introduced during sample collection, storage, and transport (Ecology, 2004).

Initial Calibration Verification Standard (ICV): A QC sample prepared independently of calibration standards and analyzed along with the samples to check for acceptable bias in the measurement system. The ICV is analyzed prior to the analysis of any samples (Kammin, 2010).

Laboratory Control Sample (LCS)/LCS duplicate: A sample of known composition prepared using contaminant-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is prepared and analyzed in the same batch of regular samples using the same sample preparation method, reagents, and analytical methods employed for regular samples. Monitors a lab's performance for bias and precision (USEPA, 2014).

Matrix spike/Matrix spike duplicate: A QC sample prepared by adding a known amount of the target analyte(s) to an aliquot of a sample to check for bias and precision errors due to interference or matrix effects (Ecology, 2004).

Measurement Quality Objectives (MQOs)**:** Performance or acceptance criteria for individual data quality indicators, usually including precision, bias, sensitivity, completeness, comparability, and representativeness (USEPA, 2006).

Measurement result: A value obtained by performing the procedure described in a method (Ecology, 2004).

Method: A formalized group of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, data analysis), systematically presented in the order in which they are to be executed (USEPA, 2001).

Method blank: A blank prepared to represent the sample matrix, prepared and analyzed with a batch of samples. A method blank will contain all reagents used in the preparation of a sample, and the same preparation process is used for the method blank and samples (Ecology, 2004; Kammin, 2010).

Method Detection Limit (MDL): The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results (USEPA, 2016). MDL is a measure of the capability of an analytical method of distinguished samples that do not contain a specific analyte from a sample that contains a low concentration of the analyte (USEPA, 2020).

Minimum level: Either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL), whichever is higher. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: "quantitation limit," "reporting limit," and "minimum level" (40 CFR 136).

Parameter: A specified characteristic of a population or sample. Also, an analyte or grouping of analytes. Benzene and nitrate + nitrite are all parameters (Kammin, 2010; Ecology, 2004).

Population: The hypothetical set of all possible observations of the type being investigated (Ecology, 2004).

Precision: The extent of random variability among replicate measurements of the same property; a data quality indicator (USGS, 1998).

Quality assurance (QA): A set of activities designed to establish and document the reliability and usability of measurement data (Kammin, 2010).

Quality Assurance Project Plan (QAPP): A document that describes the objectives of a project, and the processes and activities necessary to develop data that will support those objectives (Kammin, 2010; Ecology, 2004).

Quality control (QC): The routine application of measurement and statistical procedures to assess the accuracy of measurement data (Ecology, 2004).

Relative Percent Difference (RPD): RPD is commonly used to evaluate precision. The following formula is used:

$$RPD = [Abs(a-b)/((a + b)/2)] * 100\%$$

where "Abs()" is absolute value and a and b are results for the two replicate samples. RPD can be used only with 2 values. Percent Relative Standard Deviation is (%RSD) is used if there are results for more than 2 replicate samples (Ecology, 2004).

Relative Standard Deviation (RSD): A statistic used to evaluate precision in environmental analysis. It is determined in the following manner:

$$RSD = (100\% * s)/x$$

where s is the sample standard deviation and x is the mean of results from more than two replicate samples (Kammin, 2010).

Replicate samples: Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled (USGS, 1998).

Reporting level: Unless specified otherwise by a regulatory authority or in a discharge permit, results for analytes that meet the identification criteria (i.e., rules for determining qualitative presence/absence of an analyte) are reported down to the concentration of the minimum level established by the laboratory through calibration of the instrument. EPA considers the terms "reporting limit," "quantitation limit," and "minimum level" to be synonymous (40 CFR 136).

Representativeness: The degree to which a sample reflects the population from which it is taken; a data quality indicator (USGS, 1998).

Sample (field): A portion of a population (environmental entity) that is measured and assumed to represent the entire population (USGS, 1998).

Sample (statistical): A finite part or subset of a statistical population (USEPA, 1992).

Sensitivity: In general, denotes the rate at which the analytical response (e.g., absorbance, volume, meter reading) varies with the concentration of the parameter being determined. In a specialized sense, it has the same meaning as the detection limit (Ecology, 2004).

Spiked blank: A specified amount of reagent blank fortified with a known mass of the target analyte(s); usually used to assess the recovery efficiency of the method (USEPA, 2014).

Spiked sample: A sample prepared by adding a known mass of target analyte(s) to a specified amount of matrix sample for which an independent estimate of target analyte(s) concentration is available. Spiked samples can be used to determine the effect of the matrix on a method's recovery efficiency (USEPA, 2014).

Split sample: A discrete sample subdivided into portions, usually duplicates (Kammin, 2010).

Standard Operating Procedure (SOP): A document which describes in detail a reproducible and repeatable organized activity (Kammin, 2010).

Surrogate: For environmental chemistry, a surrogate is a substance with properties similar to those of the target analyte(s). Surrogates are unlikely to be native to environmental samples. They are added to environmental samples for quality control purposes, to track extraction efficiency and/or measure analyte recovery. Deuterated organic compounds are examples of surrogates commonly used in organic compound analysis (Kammin, 2010).

Systematic planning: A step-wise process which develops a clear description of the goals and objectives of a project, and produces decisions on the type, quantity, and quality of data that will be needed to meet those goals and objectives. The DQO process is a specialized type of systematic planning (USEPA, 2006).

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