

Technical Memorandum 5 Human Health Risk Assessment

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Subject: Human Health Risk Assessment
City of Longview
Design of Groundwater Source and Regional Water Treatment Facilities
K/J 0997003*00

Introduction and Objective

Kennedy/Jenks Consultants (Kennedy/Jenks) conducted a Human Health Risk Assessment (HHRA) as part of a more comprehensive Environmental Risk Assessment (ERA) for the City of Longview, Washington on use of groundwater in a deep aquifer below the Mint Farm Industrial Park (Mint Farm) as a raw drinking water source. The purpose of this memorandum is to document the objective, procedure and results of the HHRA.

Method and Procedures

The following discussion presents the methods and procedures used to conduct the HHRA on the deep aquifer raw water source and other local surface water sources.

Components of the Human Health Risk Assessment

The HHRA is comprised of the following component activities, conducted in the order presented:

- Water quality investigation and data collection
- Screening of data based on health-protective levels
- Analysis of impact to human health for water quality analyte concentrations found above the screening level; characterization of probability of risk to human health

The description of HHRA components, and method and procedures employed in completing these components, is discussed in more detail below.

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Definitions of Key Terms and Concepts used in this HHRA

In order to precisely and clearly communicate the procedures and findings of the HHRA this report defines key terms and concepts used throughout the work. The following are definitions of these key terms and concepts. Note that most laboratory analyses of these water quality analytes use electronic probe methods of detection – hence the occasional reference to “signal”.

Analyte – An element or a compound, either man-made or naturally occurring in a water quality sample, for the detection of which a known and approved laboratory analytical method was used.

Method Detection Limit (MDL) – The concentration of an analyte that, when processed through the complete analytical method, produces a signal with a 99 percent probability that it is different from the blank. The lowest concentration at which an analyte can be confirmed present in a sample.

Method Reporting Limit (MRL) – The lowest concentration normally reported by an analytical laboratory. It represents a conservative, nominal reporting limit designed to be representative of the minimum quantifiable concentration level for a particular analyte in a real environmental matrix as opposed to the statistically derived calculated MDL (method detection limit) as per 40 CFR 136 Appendix B, Procedure. This MRL defined by the laboratory must be greater than the statistically derived MDL and is typically the lowest calibration level used by the lab.

Primary Maximum Contaminant Level (MCL) – Enforceable state and federal drinking water quality standards developed for protection of human health under the Safe Drinking Water Act, promulgated by the EPA under authority of the Safe Drinking Water Act.

Screening Level – The concentration of an analyte used to assess the potential for human health risks; concentrations below the screening level are considered to not have adverse effects on human health. Concentrations above the screening level do not necessarily indicate the potential for adverse effects, but rather a need for further assessment. For the purposes of this HHRA, the MCL, where established, is used as the Screening Level. Where an MCL is not established, other appropriate sources for screening levels are cited.

Human Health Risk – The probability of adverse impact (chronic or acute disease, chronic or acute toxicity, carcinogenicity, or teratogenicity) to human health from exposure to analytes

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Water Quality Investigation and Data Gathering

Description. The ERA (as reflected in this specific HHRA) conducted water quality assessment based upon water samples collected and analyzed for a wide range of constituents that is much greater in number and diversity than the list of analytes currently regulated at state and federal levels for drinking water. This HHRA includes a number of organic chemicals based upon the historical and current industrial activities in the Mint Farm and adjacent areas. A number of contaminants of emerging concern (CECs), including endocrine-disrupting compounds (EDCs), candidates for potential future regulation, were also included. Thus, this HHRA was not only concerned with analytes in current drinking water regulations but was more stringent and mindful of public concern and public health in considering a wider range of analytes with potential to affect human health. Over 14,500 individual analyses were performed on soil and water samples taken between July and November of 2009.

Procedure. Samples were collected from the three potentially feasible raw water sources: the deep groundwater aquifer, the Cowlitz River (the City's current source of supply), and the Columbia River. For purposes of the HHRA, only water quality data were considered in evaluating the water sources. Other feasibility factors (e.g., water rights, costs, permitting) were not addressed in the HHRA.

Kennedy/Jenks collected samples from nine deep (DW-1 through DW-9) groundwater sentinel wells in addition to two existing water wells, Chinook Ventures and Puget Sound Energy Well #1 (RSW-2) to characterize the deep groundwater aquifer. The Columbia River water sample was taken at the Weyerhaeuser Company intake to be representative of the surface water quality of the Columbia River (RSW-1). The Cowlitz River (RSW-3) water sample was taken at the City of Longview Regional Water Treatment Plant, to represent the water quality for the current City raw water source. All sample locations are shown on Figure 1.

The sampling protocol for this water source investigation was organized into three tiers. These tiers were developed to meet the objectives of the different sample types. The sampling protocol (Technical Memorandum 2, May 5, 2009) is included in the Appendix to this report.

The three sample tiers are as follows:

- **Tier 1** – Analytes related to historic industrial and commercial activities in the area of the current industrial park. Results and data from the Tier 1 sampling are presented and evaluated in the *Phase I and Phase II ESA Report* and are not discussed further in this report.
- **Tier 2** – **(a)** Analytes regulated by the State of Washington Department of Health (DOH) Office of Drinking Water, and **(b)** Analytes related to historic industrial and

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commercial activities in the Mint Farm area, as determined by the Phase I ESA and public input.

- **Tier 3** – CECs and other analytes that are not currently regulated in drinking water but are being studied by the Federal EPA, and may be regulated in the future.

Screening of Water Quality Data

Description. The screening level evaluation is used as a health-protective approach to determine whether a more detailed risk assessment is required. In a screening level evaluation, detected concentrations (above the MRLs) are compared directly against health-based screening levels. The presence of a chemical at concentrations below its respective screening level can generally be assumed not to pose a significant, long-term (chronic) or short-term (acute) threat to human health. Concentrations above a screening level do not necessarily indicate an unacceptable risk to human health, but rather the need for further evaluation.

As the intended use of the deep aquifer groundwater is as a municipal water supply, screening levels for protection of drinking water were used in the HHRA. To evaluate the potential use of groundwater as a drinking water source, MCLs were used as screening levels in the HHRA. If a state or federal primary MCL was not listed for a detected chemical, then the following hierarchy was used to identify an appropriate screening level:

- Washington Administrative Code (WAC) 173-200-040 Table 1 Groundwater Quality Criteria. The purpose of WAC Groundwater Quality Criteria is to establish maximum contaminant concentrations for the protection of a variety of beneficial uses of Washington's groundwater. Drinking water is the beneficial use generally requiring the highest quality of groundwater.
- Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method B cleanup levels for groundwater. MTCA Method B cleanup levels were developed by Ecology's Toxic Cleanup Program for potable groundwater assessed for Cleanup Program sites. MTCA Method B cleanup levels are considered to be human health based screening levels and are not enforceable drinking water quality standards.
- United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Tap Water. The USEPA RSLs were developed for sites assessed under the Comprehensive Environmental Response, Compensation,

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and Liability Act (CERCLA). RSLs are considered to be human health based screening levels and are not enforceable drinking water quality standards.

All of the screening levels used in the HHRA are based on long-term exposure to water used as drinking water. Assumptions used in developing the screening levels, such as duration of exposure or amount of water consumed, are intended to be protective of human health. Margins of safety are also incorporated in the toxicity values used in developing the screening levels. Comparing all detected analyte concentrations to these screening levels, without consideration of treatment to reduce concentrations, results in a HHRA that provides a conservative assessment of human health risk.

Procedure. Kennedy/Jenks conducted a health-based screening of the water quality data, presented in Table A in the Appendix of this report, by comparing detected concentrations for each chemical against the respective health-based screening level.

The HHRA did not screen analytical data for general parameters, microbial parameters, and the majority of the naturally occurring minerals and salts. Naturally occurring minerals and salts are not of health concern and are common constituents in most groundwater supplies. Microbial parameters were not considered because the proposed future production wells will be disinfected and tested for microbial parameters guided by Washington State regulations.

Findings of Water Quality Investigation

Under the sampling protocol discussed above and included in the Appendix of this report, a total of over 300 analytes for the three raw water sources were tested for by Columbia Analytical Services (CAS) located in Kelso, Washington. Only analyte results that are greater than or equal to the MRL are reported. Table A in the Appendix presents water quality analytical results.

Findings of Water Quality Screening

There were no analytes detected above the respective screening levels. Additional information on the results of the water quality screening is provided below.

Detections of Tier 2(a) Analytes - Regulated Raw Water Constituents

There were no exceedances of respective health-based screening levels for the deep groundwater samples. There also were no exceedances of respective screening levels for surface water samples collected from either the Columbia or Cowlitz Rivers.

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While iron and manganese are not of a health concern, these metals can cause objectionable color and odor, and staining of plumbing fixtures. The City will provide a groundwater treatment plant as part of this groundwater project. The treatment will address iron and manganese such that the iron levels are below 0.05 milligrams per liter (mg/L) and the manganese levels are below 0.02 mg/L in the distributed water. Treatment will also ensure that arsenic levels remain below 5 micrograms per liter ($\mu\text{g/L}$) in the distributed water.

Detection of Tier 2(b) Analytes – Constituents of Local Historical Concern

No Tier 2(b) analytes were detected above screening levels.

Detections of Tier 3 Analytes – CECs and Other Compounds of Concern

Several unregulated Tier 3 chemicals including pharmaceuticals, personal care products, and a plastic additive, were detected above the MRL in the deep groundwater and surface water samples. See Table A for analyte concentrations. With the exception of bisphenol A, State or Federal health-based screening levels do not exist for the detected analytes because they have only recently emerged as being of potential concern. Recent research studies have reviewed the toxicological effects of various unregulated chemicals and proposed acceptable daily intakes (ADIs). The ADIs were converted to drinking water equivalent levels (DWELs) for use as screening levels following the methodology used by the USEPA in developing maximum contaminant level goals, as presented in Table 1 below. None of the analytes was detected at a concentration above their respective screening levels and they are not considered a significant human health risk.

Table 1. Screening Levels for Unregulated Analytes

| Analyte | ADI ¹ ($\mu\text{g/kg-day}$) | DWEL ² ($\mu\text{g/L}$) | Source |
|---------------------------------|---|---------------------------------------|-------------|
| 2-Hydroxy-4-Methoxybenzophenone | 133 ³ | 4655 | NTP 1992 |
| Bisphenol A | -- ⁴ | -- | -- |
| Caffeine | 2500 | 87500 | Nawrot 2003 |
| Fluoxetine | 0.097 | 3.4 | Snyder 2009 |
| N,N-Diethyl-3-Methyl Benzamide | 2.3 | 81 | Nellor 2009 |
| Sulfamethoxazole | 4.3 | 151 | Snyder 2009 |

¹ Acceptable daily intake

² Drinking water equivalent level

³ ADI calculated using a no observed adverse effects level of 400 milligrams per kilogram per day and an uncertainty factor of 3000.

⁴ The MTCA Method B cleanup level for groundwater was used as the screening level for bisphenol A.

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Note that in Table 1, only analytes detected at concentrations greater than or equal to the MRL are listed and that the DWEL, calculated from the ADI, is consistent with USEPA methodology for MCL goals, where

$$DWEL = (ADI * 70 \text{ kg}) / 2 \text{ L/day, where ADI is in } \mu\text{g/kg-day}$$

Conclusions on Human Health Risk of Analyzed Raw Water Sources

Of the more than 300 analytes evaluated in the HHRA, no analytes were found above their screening levels in the potential raw water source samples. Specific conclusions that have been developed based upon the analysis presented in this Technical Memorandum are as follows:

- The sampling and analysis yields no evidence of contamination due to the previous use of various chemicals associated with the historical farming and industrial activities in or near the Mint Farm. For example, the industrial and agricultural chemicals PCBs, dioxins and furans, cyanide, perchlorate, atrazine and mercury were not detected in the deep groundwater samples.
- Iron and manganese were detected at levels that are not of health concern in the deep groundwater samples, however, these metals can cause objectionable color and odor, and staining of plumbing fixtures. Although the EPA does not regulate these metals, the DOH regulates them in drinking water due to their aesthetic problems. Treatment will be provided to prevent such aesthetic problems by removing iron and manganese from the water to meet specific treated water quality goals (0.05 mg/l and 0.02 mg/l, respectively) lower than the state MCL.
- Iron and manganese did not exceed the screening levels in either of the surface water supplies. However, iron concentrations were above the state's secondary MCL and treatment would be required for either surface water source.
- Based upon the analysis presented in this Technical Memorandum, the raw water sources with appropriate treatment would meet all State and Federal water quality regulations as safe sources of drinking water supply.

Ongoing Water Quality Investigations

Kennedy/Jenks is performing a hydrogeologic study of the deep groundwater aquifer. A three-dimensional numerical groundwater model is also being developed to simulate groundwater flow and evaluate potential contaminants with potential to impact

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production wells. Data collected from the current production well test pumping will be used to evaluate analyte transport from outside the sentinel well network, if any, as well as evaluate the degree of hydraulic connection between the shallow groundwater and deep aquifer. Production well test pumping results are presented in Part 2 of the Preliminary Design Report.

Certain activities will continue in order to monitor ongoing water quality for the life of the groundwater facility:

- The completed groundwater model will evaluate travel time zones for the production well field, serve as a tool to assist in delineation of a well head protection area, and inform a long-term groundwater monitoring program for the sentinel well network.
- Now and in the future, sentinel wells will be monitored for select water quality parameters and groundwater levels. If analytes of concern are detected in these wells a new HHRA may be requested by the City to determine changes in human health risk.

References

National Toxicology Program (NTP). 1992. NTP Technical Report on Toxicity Studies of 2-Hydroxy-4-methoxybenzophenone (CAS Number: 131-57-7). U.S. Department of Health and Human Services. NIH Publication No. 92-3344. October 1992.

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Table A: Summary of Water Quality for Human Health Risk Assessment, Mint Farm Industrial Park Area - City of Longview, WA

| Method | Tier | Analyte | Cas # | Units | Screening Level | | Surface Water | | Deep Groundwater Aquifer | | | | | | | | | | | | | | | | |
|---|------|--|------------|------------|-----------------|----------------------------------|-----------------------------|----------------------------|---------------------------------|---------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | | | | Value | Source | RSW-1 | RSW-3 | RSW-2 | Chinook | PW-1 | PW-1 | PW-1 | DW-9 | DW-9 | DW-8 | DW-7 | DW-7 | DW-6 | DW-5 | DW-4 | DW-3 | DW-2 | DW-1 | DW-1 |
| | | | | | | | (Columbia River) 06/08/2009 | (Cowlitz River) 06/08/2009 | (Puget Sound Energy) 06/08/2009 | Ventures 07/14/2009 | 10/05/2009 | 11/04/2009 | 11/11/2009 | 08/13/2009 | 11/12/2009 | 06/09/2009 | 06/10/2009 | 11/12/2009 | 06/10/2009 | 06/11/2009 | 06/10/2009 | 06/11/2009 | 06/12/2009 | 06/12/2009 | 06/09/2009 |
| General Parameters | | | | | | | | | | | | | | | | | | | | | | | | | |
| A2120B | 2a | Color, Apparent | COLOR | color unit | -- | -- | 10 | 10 | 5 | 5 | 25 | 20 | 15 | 10 | 20 | 5 | ND | 25 | ND | 10 | 10 | 10 | 5 | 10 | 15 |
| A2320B | 2a | Alkalinity, Total (As CaCO3) | ALK | mg/l | -- | -- | 43 | 27 | 104 | 164 | 105 | 102 | 104 | 112 | 89 | 112 | 86 | 87 | 112 | 112 | 170 | 163 | 133 | 85 | 85 |
| A2340B | 2a | Hardness As CaCO3 | HARDNESS | mg/l | -- | -- | 43.2 | 24 | 87.8 | 140 | 99 | 87 | 88 | 92.9 | 70 | 87.9 | 72.5 | 74 | 85.9 | 99.2 | 134 | 151 | 103 | 69.8 | 74 |
| A2510B | 2a | Conductivity | COND | umhos/cm | -- | -- | 128 | 83 | 247 | 376 | 240 | 232 | 228 | 435 | 194 | 239 | 197 | 191 | 239 | 273 | 377 | 407 | 293 | 194 | 189 |
| A2540C | 2a | Total Dissolved Solids (Residue, Filterable) | TDS | mg/l | -- | -- | 62 | 55 | 164 | 235 | 187 | 166 | 175 | 161 | 145 | 160 | 150 | 147 | 161 | 165 | 233 | 247 | 182 | 160 | 144 |
| A4500SI02C | 2a | Silica | 7631-86-9 | mg/l | -- | -- | 10.7 | 23.9 | 58.8 | 43.1 | 51 | 59 | 59 | 59.7 | 55 | 76.9 | 70.3 | 55 | 64.2 | 67 | 54.3 | 72.5 | 52.6 | 74.7 | 55 |
| A5310C | 2a | Total Organic Carbon | TOC | mg/l | -- | -- | 2.2 | 1.3 | 0.8 | 1.9 | 1.62 | 1.45 | 1.29 | 1.9 | 1.2 | 1.5 | 1.4 | 1.17 | 2.5 | 2.3 | 4.3 | 1.8 | 2.1 | 1.3 | 1.28 |
| A5910B | 2a | UV254 | CASID10075 | cm -1 | -- | -- | 33.4 | 40.9 | 29 | 0.048 | 0.039 | 0.04 | 0.05 | 0.037 | 0.055 | 0.04 | 0.04 | 0.054 | 0.03 | 0.03 | 0.05 | 0.04 | 0.04 | 0.06 | 0.053 |
| E150.1 | 2a | pH | pH | pH units | -- | -- | 7.55 | 7.54 | 7.56 | 7.73 | 7.34 | 7.91 | 7.37 | 7.78 | 7.38 | 7.61 | 7.53 | 7.22 | 7.83 | 8.04 | 7.55 | 7.83 | 8.05 | 7.46 | 7.26 |
| E180.1 | 2a | Turbidity | TURBIDITY | ntu | -- | -- | 6 | 8 | 3.6 | 3.9 | 2.97 | 2.01 | 1.28 | 3.3 | 0.99 | 6.7 | 3.3 | 2.58 | 1.3 | 0.5 | 33.7 | 4.2 | 11.5 | 8.8 | 12 |
| Microbial Parameters | | | | | | | | | | | | | | | | | | | | | | | | | |
| A9221E | 2a | Fecal Coliform | FECCOLI | mpn/100ml | -- | -- | ND | 11 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| A9223B | 2a | Coliform | COLIF | mpn/100ml | -- | -- | 205 | 210 | ND | ND | 7.4 | 1.0 | ND | 2 | ND | 7 | 12 | ND | 1 | 22 | 248 | ND | 7 | ND | ND |
| Contaminants To Be Removed Using Treatment | | | | | | | | | | | | | | | | | | | | | | | | | |
| E200.8 | 2a | Arsenic | 7440-38-2 | µg/l | 10 | MCL | 0.85 | ND | 7.24 | 7.6 | 6.1 | 5.7 | 5.85 | 3.46 | 4.14 | 9.17 | 2.95 | 4.3 | 2.29 | 3.75 | 6.32 | 5.82 | 4.88 | 2.44 | 3.77 |
| E200.7 | 2a | Iron | 7439-89-6 | µg/l | 26,000 | EPA RSL ² | 358 | 492 | 1,110 | 808 | 1,050 | 867 | 901 | 1,060 | 637 | 1,840 | 1,220 | 1,220 | 450 | 308 | 5,030 | 966 | 895 | 2,250 | 2,370 |
| E200.7 | 2a | Manganese | 7439-96-5 | µg/l | 2,200 | MTCA Method B ² | 17.2 | 17 | 498 | 415 | 681 | 554 | 574 | 587 | 513 | 593 | 671 | 662 | 371 | 233 | 804 | 377 | 216 | 605 | 548 |
| Naturally Occurring Minerals and Salts | | | | | | | | | | | | | | | | | | | | | | | | | |
| E200.7 | 2a | Calcium | 7440-70-2 | µg/l | -- | -- | 11,300 | 7,100 | 24,400 | 36,900 | 28,200 | 23,900 | 25,500 | 26,500 | 22,600 | 24,800 | 20,800 | 21,600 | 24,100 | 26,400 | 41,900 | 44,600 | 27,000 | 20,200 | 21,500 |
| E200.7 | 2a | Magnesium | 7439-95-4 | µg/l | -- | -- | 3,630 | 1,530 | 6,530 | 11,500 | 7,020 | 6,670 | 5,790 | 6,500 | 5,010 | 6,280 | 4,950 | 4,950 | 6,270 | 8,070 | 7,030 | 9,730 | 8,660 | 4,740 | 4,810 |
| E200.7 | 2a | Potassium | 7440-09-7 | µg/l | -- | -- | 1,170 | 584 | 4,040 | 5,040 | 3,570 | 3,620 | 3,250 | 3,620 | 3,200 | 4,140 | 3,010 | 2,950 | 3,670 | 4,050 | 3,740 | 3,960 | 5,610 | 2,730 | 2,650 |
| E200.7 | 2a | Silicon | Si | µg/l | -- | -- | 5,630 | 7,550 | 24,100 | 21,500 | 26,400 | 27,200 | 24,700 | 24,600 | 25,300 | 22,600 | 23,200 | 24,200 | 21,100 | 20,400 | 24,000 | 21,500 | 17,900 | 23,400 | 24,500 |
| E200.7 | 2a | Sodium | 7440-23-5 | µg/l | -- | -- | 9,470 | 5,030 | 9,580 | 16,400 | 11,000 | 10,100 | 9,280 | 10,300 | 8,890 | 11,500 | 8,990 | 8,620 | 10,800 | 12,000 | 23,700 | 18,800 | 14,000 | 8,650 | 8,850 |
| E300 | 2a | Bromide | BROMIDE | mg/l | -- | -- | ND | ND | 0.2 | ND | NA | NA | NA | ND | NA | NA | ND | NA | NA | 0.2 | NA | 0.2 | NA | 0.2 | ND |
| E300 | 2a | Chloride | CHLORIDE | mg/l | -- | -- | 5.4 | 3.3 | 12.1 | 19.2 | 8.36 | 7.48 | 7.56 | 6.5 | 5.28 | 7.9 | 5.7 | 6.3 | 12.3 | 16.4 | 18.7 | 32.4 | 12.1 | 5.4 | 5.17 |
| E300 | 2a | Fluoride | FL_T | mg/l | 4 | MCL | ND | ND | 0.2 | 0.3 | ND | 0.21 | 0.24 | ND | 0.27 | ND | 0.3 | 0.28 | 0.2 | ND | ND | 0.3 | 0.2 | 0.31 | |
| E300 | 2a | Nitrogen, Nitrate (As N) | N_NO3 | mg/l | 10 | MCL | 0.4 | 0.3 | ND | ND | ND | ND | ND | ND | ND | 0.3 | 0.3 | ND | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | ND |
| E300 | 2a | Nitrogen, Nitrite | NO2N | mg/l | 1 | MCL | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.1 | ND |
| E350.1 | 2a | Nitrogen, Ammonia (As N) | N_NH3 | mg/l | -- | -- | ND | ND | 0.28 | 0.26 | 0.194 | 0.197 | 0.213 | 0.13 | ND | 0.34 | 0.25 | 0.232 | 0.1 | ND | 0.51 | 0.16 | ND | 0.32 | 0.345 |
| E365.3 | 2a | Phosphate, Ortho- | 14265-44-2 | mg/l | -- | -- | 0.03 | 0.03 | 0.58 | 0.35 | NA | NA | NA | 0.41 | NA | 0.25 | 0.35 | NA | 0.45 | 0.53 | 0.09 | 0.21 | 0.34 | 0.17 | NA |
| E365.3 | 2a | Phosphorus, Total (As P) | | mg/l | -- | -- | NA | NA | NA | NA | NA | NA | 0.585 | NA | 0.566 | NA |
| E365.3 | 2a | Phosphorus, Total Orthophosphate (As P) | | mg/l | -- | -- | NA | NA | NA | NA | 0.329 | 0.346 | 0.575 | NA | 0.386 | NA | NA | 0.247 | NA | NA | NA | NA | NA | NA | 0.102 |
| E300 | 2a | Sulfate | SULFATE | mg/l | -- | -- | 6.9 | 5.8 | 0.3 | 0.2 | 0.45 | 0.57 | 0.6 | 0.4 | 1.42 | 0.3 | 2.4 | 1.61 | 1.7 | 0.7 | 1 | 0.5 | 3.4 | 1.6 | 1.26 |
| Metals | | | | | | | | | | | | | | | | | | | | | | | | | |
| E200.7 | 2a | Aluminum | 7429-90-5 | µg/l | 37,000 | EPA RSL | 392 | 704 | 54 | ND | ND | ND | 2.3 | 23.2 | 2.5 | 4.3 | 4.7 | ND | 47.6 | 23.2 | 1,460 | 37.9 | 435 | 4.3 | ND |
| E200.7 | 2a | Zinc | 7440-66-6 | µg/l | 4,800 | MTCA Method B | 22.3 | ND | ND | ND | ND | ND | 3.6 | ND | 2.3 | ND | ND | ND | ND | 8.5 | ND | ND | ND | ND | ND |
| E200.8 | 2a | Antimony | 7440-36-0 | µg/l | 6 | MCL | 0.12 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.07 | ND | ND | ND |
| E200.8 | 2a | Barium | 7440-39-3 | µg/l | 2,000 | MCL | 18.1 | 4.01 | 20.4 | 25.7 | 14 | 12 | 13 | 13.8 | 10 | 25.1 | 12.9 | 11 | 12.5 | 13.2 | 24.8 | 30.9 | 27.7 | 12 | 11 |
| E200.8 | 2a | Beryllium | 7440-41-7 | µg/l | 4 | MCL | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.043 | ND | 0.021 | ND | ND |
| E200.8 | 2a | Cadmium | 7440-43-9 | µg/l | 5 | MCL | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.029 | ND | 0.039 | ND | ND | ND |
| E200.8 | 2a | Chromium, Total | 7440-47-3 | µg/l | 100 | MCL | 0.34 | 0.26 | ND | ND | 0.2 | ND | 0.73 | ND | ND | ND | ND | ND | ND | 2.59 | ND | 0.63 | ND | 0.27 | |
| E200.8 | 2a | Copper | 7440-50-8 | µg/l | 1,300 | MCL | 1.48 | 2.08 | 0.33 | 0.15 | MCL | 0.2 | ND | 0.3 | ND | ND | ND | ND | ND | 2.27 | 0.17 | 0.8 | ND | ND | |
| E200.8 | 2a | Lead | 7439-92-1 | µg/l | 15 | MCL | 0.267 | 0.105 | 0.061 | ND | ND | ND | 0.05 | ND | ND | ND | ND | 0.033 | ND | 0.355 | 0.022 | 0.177 | ND | ND | |
| E200.8 | 2a | Nickel | 7440-02-0 | µg/l | 100 | MCL | 0.45 | 0.34 | 0.26 | 0.48 | 0.6 | 0.67 | 0.67 | 1.68 | 0.63 | 0.86 | 0.77 | 0.61 | 0.91 | 0.96 | 2.59 | 1.51 | 1.26 | 0.74 | 0.57 |
| E200.8 | 2a | Silver | 7440-22-4 | µg/l | 50 | WA GQC | ND | ND | ND | ND | 0.07 | 0.08 | 0.033 | ND |
| E200.8 | 2a | Uranium | U | µg/l | 30 | MCL | 0.375 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.025 | ND | 0.052 | ND | ND | ND | ND | ND |
| Volatile and Synthetic Organics | | | | | | | | | | | | | | | | | | | | | | | | | |
| E524.2 | 2a | Chloroform | 00067-66-3 | µg/l | 80 | MCL (total trihalomethanes) | ND | ND | ND | ND | NA | NA | NA | ND | ND | ND | ND | 0.86 | ND | ND | ND | 2.4 | ND | ND | |
| E525.2 | 2a | Bis(2-Ethylhexyl) Phthalate | 00117-81-7 | µg/l | 6 | MCL | ND | ND | ND | ND | ND | ND | 0.68 | ND | ND | ND | ND | ND | ND | 1 | ND | ND | ND | ND | |
| E525.2 | 2b | Diocetyl Adipate | 103-23-1 | µg/l | 56 | EPA RSL | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.8 | ND | ND | ND | ND | |
| E525.2 | 2b | Fluoranthene | 00206-44-0 | µg/l | 640 | MTCA Method B | ND | ND | ND | ND | NA | NA | NA | ND | |
| E525.2 | 2b | Isophorone | 00078-59-1 | µg/l | 46 | MTCA Method B | ND | ND | ND | ND | NA | NA | NA | ND | ND | 0.1 | ND | |
| Radiation | | | | | | | | | | | | | | | | | | | | | | | | | |
| E900 | 2a | Alpha, Gross | ALPHA | pci/l | 15 | MCL | 1.5 | 1.5 | 0.79 | | -0.56 | -3.1 | 0.21 | | 0.28 | 3.8 | | 0.34 | -0.26 | 0.57 | 0.47 | -0.5 | 0.37 | | |
| E900 | 2a | Beta, Gross | BETA | pci/l | 50 | WA GQC (MCL is 4 millirems/year) | 3.8 | 0.85 | 6.4 | 4 | 2.9 | 1.2 | 5.0 | 3.7 | 1.2 | 3.6 | 3.3 | 2.0 | 3.9 | 2.9 | 4.2 | 1 | | | |