anderson perry & associates, inc.

2659 S.W. 4th Street, Suite 200
Redmond, OR 97756
(541) 362-8682, Fax (541) 963-5456
www.andersonperry.com

engineering ▪ surveying ▪ natural resources

TECHNICAL MEMORANDUM

To:	Scott Langum, Town of Lakeview, Oregon
From:	Bryce Wininger, P.E.
Subject:	**Town of Lakeview, Oregon - Water Treatment Facility Process and Technology Alternatives Analysis (Task 1D)**
Date:	September 9, 2022
Job/File No.	214-01-24.2 (w/encl.)
cc:	Michele Parry, Town of Lakeview Dan Scalas, P.E., Adkins Engineering & Surveying, LLP Amber Hudspeth, Hudspeth Land+Water Jeremy Wenger, P.E., Fluent Engineering Tawni Bean, Business Oregon Larry Holzgang, Business Oregon Kat Schwartz, Business Oregon Troy Baker, P.E., Anderson Perry & Associates, Inc. (AP) Lucas Stangel, P.E., AP Austin Byrer, E.I., AP

Introduction

The Town of Lakeview, Oregon, provides drinking water to residents within its urban growth boundary. The Town's sources include Wells No. 1, 2, 6, 7, 8, and 9 (herein referred to as Town Wells) that pump into a common line, one isolated well (North Well), and a spring. Water quality varies from each source, but collectively the Town's drinking water has issues with taste, odor, and color. These issues can generally be attributed to National Secondary Drinking Water Regulations (NSDWRs) water quality constituents including sulfates, iron, and manganese, in addition to hydrogen sulfide, which is not regulated by the U.S. Environmental Protection Agency (EPA). Secondary contaminants have aesthetic, cosmetic, and technical effects to water systems but do not present a risk to human health. Arsenic is also present in the Town's groundwater sources, more significantly in the North Well. As a National Primary Drinking Water Regulations (NPDWRs) contaminant, arsenic is regulated due to its hazard to human health. The North Well has arsenic concentrations above the maximum contaminant level (MCL) regulated by the EPA of 0.010 milligrams per liter (mg/L). Currently, the North Well is not used but may eventually be needed for additional production to meet demands as the Town grows. The Town's other wells have lower levels of arsenic, which have varied through time but are generally less than the MCL. The purpose of this Technical Memorandum (TM) is to evaluate available treatment technologies commonly used to remove arsenic, iron, and manganese from drinking water, provide a lifecycle cost

analysis for viable alternatives, and provide the Town with direction as to the next steps in the planning, procurement, and implementation of the preferred alternative.

Background

Anderson Engineering and Surveying, Inc., prepared a Water System Master Plan (WSMP) for the Town in 2019. The WSMP outlined water quality issues and proposed mitigation alternatives to improve water quality, including constructing separate filtration systems at each well, constructing a combined water treatment facility (WTF), and installing a transmission line from the North Well to the combined WTF. Prior to the preparation of this TM, the Town further refined viable alternatives to two options. The first is to construct a WTF at the North Well to remove arsenic and to construct a second WTF for the Town Wells to remove iron and manganese. The second alternative is to construct a transmission line from the North Well to the Town Wells and to construct a single WTF to remove iron, manganese, and arsenic from the combined sources. These alternatives are referred to further in this TM as Alternatives A and B, respectively, and are evaluated for cost, operation and maintenance, flexibility, and operator skill and attention.

To adequately evaluate the cost and operation of available treatment technologies for each alternative, first water quality samples were analyzed to determine specific constituents of the Town's water, which are provided in a separate TM included as an attachment. Next, WTF manufacturers were engaged to provide proposals for each treatment facility alternative considered. Last, based on the proposals received, a capital cost and present worth analysis was completed for each alternative. This information was evaluated to inform the Town of the most economical approach to address water quality issues.

The Water Quality Sampling, Testing, and Data Analysis (Task 1C) memo indicates the Town's North Well exceeds the NPDWRs' MCLs for arsenic and turbidity and the NSDWRs' secondary standards for iron, sodium, and total dissolved solids (TDS), while the Town Wells exceed the NPDWRs' MCL for turbidity and the NSDWRs' secondary standards for aluminum, color, iron, manganese, odor, and sodium. A brief discussion on the Town's critical water constituents of concern follows.

Arsenic

Arsenic is a semi-metallic element that is odorless and tasteless. It enters drinking water sources from natural deposits in the earth or from agricultural and industrial practices. Arsenic is found naturally in the geological formations around Lakeview and much of southeastern Oregon. The MCLs established by the EPA's primary drinking water regulations for arsenic are 0.01 mg/L, or 10 parts per billion.

Manganese

Manganese is a naturally occurring mineral present in rocks, soil, groundwater, and surface water and is also found in most foods. Manganese is an essential nutrient, and eating a small amount daily is important for human health. The MCL established by the EPA's secondary guidelines for manganese is 0.05 mg/L. Manganese readings above the MCL may result in black to brown water color, staining, and a bitter metallic taste.

Iron

Iron is also a naturally occurring mineral present in both nature and many foods. The MCL established by the EPA's secondary guidelines for iron is 0.3 mg/L. Iron readings above the MCL may result in rusty (red or orange) water color, staining, and a metallic taste. Sediment issues may also occur.

Aluminum

Aluminum is an abundant metal in the earth's crust that can leach from rock and soil to enter groundwater. The MCL established by the EPA's secondary guidelines for aluminum is 0.05 to 0.2 mg/L. Aluminum above the secondary MCL may result in gray colored water.

pH

The pH of water can affect treatment options, and a low pH can be corrosive to metal pipes in distribution systems and places of use. The MCL established by the EPA's secondary guidelines for pH is 6.5 to 8.5. Low pH may result in bitter metallic taste and corrosive properties. A high pH may result in deposits or a baking soda taste.

Sulfates and Hydrogen Sulfide

Sulfates and sulfur compounds occur naturally in rocks and soils. Under anaerobic conditions, sulfur-reducing bacteria produce hydrogen sulfide by chemical reduction of dissolved sulfate. This process can occur both subsurface prior to pumping from the aquifer and/or within the water distribution itself between the treatment system and the end consumer. Sulfate and hydrogen sulfide are not regulated by the EPA. However, sulfate can add a bitter taste to water and have a laxative effect. Hydrogen sulfide is an unpalatable gas, which can create odor and taste issues.

Regulatory Requirements

Arsenic is a contaminant listed by the NPDWRs, which are outlined by the EPA as legally enforceable standards that apply to public water systems. The primary standards are used for public health protection by the limitation of specifically identified constituents. Iron, manganese, hydrogen sulfide, and aluminum are water quality parameters of the NSDWRs, which are non-enforceable guidelines for the outlined contaminants.

Water Treatment Technologies

Many treatment technologies are available to remove the contaminants present in the Town's water. To remove iron and manganese, oxidization of soluble forms of iron and manganese to insoluble forms followed by filtration is commonly used. Filtration of the oxidized precipitates can be achieved using either a synthetic membrane or filter media. Arsenic removal can be achieved with technologies including ion exchange, adsorption, coagulation and filtration, oxidation and filtration, or reverse osmosis. The oxidation/filtration process described above to remove iron and manganese can also be used to remove arsenic when adequate iron is present to facilitate the coprecipitation of the two. A brief description of the treatment technologies follows.

Ion Exchange

Ion exchange is a reversible reaction in which a charged ion in a solution is exchanged for a similarly charged ion electrostatically attached to an immobile solid particle. This exchange process replaces the unwanted ions with ions that do not degrade water quality. Within ion exchange, three types of resins can be utilized: cationic, anionic, and specialty. Cation resins can remove iron and manganese but not arsenic. If an anionic resin is utilized, arsenic can be removed from the water. The economy of ion exchange depends on water quality conditions. Ion exchange resins are susceptible to early fouling when high levels of nitrates, sulfates, TDS, and turbidity are present.

Adsorption

Another technology commonly used to remove arsenic from drinking water is adsorption. The process is similar to ion exchange in that the positively charged media is used to remove the negatively charged arsenic ions. Media replacement costs can become expensive due to reduced media life when certain constituents are present that compete for absorption sites or clog the media. Phosphate and silica have been shown to compete for adsorption sites on iron-based sorbents. Silica, iron, manganese, and sulfates compete for adsorption sites on activated alumina.

Coagulation and Filtration

Coagulation and filtration are processes in which a chemical additive is used to create precipitates in water. For example, arsenic naturally occurs as a fine particle that floats in water. However, when a coagulant such as ferric chloride is added to the water, the arsenic bonds with the ferric chloride, creating larger, heavier particles that can either be settled out by gravity or filtered. This technology's efficiency for removing arsenic can be highly affected by the pH of the water as well as the molecular form of arsenic present. Arsenate [As(V)] is readily adsorbed by most coagulants. However, arsenite [As(III)] is not, and preoxidation must be utilized to convert As(III) to As(V).

Oxidation, Precipitation, and Filtration

Oxidation is commonly used to convert soluble forms of iron and manganese to insoluble forms prior to filtration. Either chlorine or potassium permanganate is injected and mixed into the stream to oxidize iron, manganese, hydrogen sulfide, and arsenic. When a sufficient iron to arsenic ratio is present (usually 20:1), the coprecipitation of iron and arsenic occurs, and filtration effectively removes both constituents from the stream. Filtration can be achieved with pressure media filters or membranes. In both cases, the filters will become clogged as insoluble compounds are filtered, and periodic backwash cycles are needed to facilitate regeneration of the media or cleaning of the membrane. The backwash water is either disposed of or sent to a settling tank. After particulates settle, the clarified water (called supernatant) is recovered by returning to the beginning of the treatment facility while the concentrated sludge is disposed of.

Both the coagulation/filtration and oxidation/precipitation/filtration processes described above can utilize either membrane type or media type filtration technologies. These processes can also be combined to produce an oxidation/precipitation/coagulation/filtration process. Membrane filters physically separate particles larger than the membrane pore size, which are retained on the membrane surface. Media filters utilize a number of different media types including silica sand, Greensand Plus, and pyrolusite. In addition to oxidation by means of a chemical feed upstream of

the filters, these media also oxidize iron and manganese in place on the media surface. Because of this ability, a lesser amount of oxidation by chemical injection can be achieved.

Reverse Osmosis

Reverse osmosis is a membrane separation process that removes contaminants from water. This process forces water at a high pressure through a semi-permeable membrane and retains various constituents based on their size, weight, and charge. Reverse osmosis produces product water and concentrate. Product water is the water with substances that were able to pass through the membrane. Concentrate is the constituents that are unwanted in the system.

Treatment Facilities Alternatives

As detailed in the 2019 WSMP, the Town Wells pump into a common transmission line that discharges into the Town's water storage tanks. The North Well is outside town limits and pumps into a water storage tank, independent of the other wells. The North Well requires arsenic treatment to meet water quality standards, while the Town Wells require the removal of iron and manganese. Combining the sources would require the removal of all three constituents. Aside from the actual type of treatment system to be utilized, two alternatives, referred to as Alternatives A and B, were considered.

Alternative A includes constructing separate treatment systems for the North Well and combined water of the Town Wells. The North Well treatment system would have a capacity of 400 gallons per minute (gpm) and be designed to only remove arsenic. The combined water central treatment system would have a capacity of 2,000 gpm and be designed to only remove iron and manganese.

Alternative B includes constructing a single centralized WTF designed to treat all combined water sources. The North Well would be connected to the Town Wells through a new 14,500 linear foot transmission line. The central treatment system would have a capacity of 2,400 gpm and be designed to remove arsenic, iron, and manganese. pH adjustment would be needed for this alternative to facilitate the coprecipitation of iron and arsenic.

During preparation of this TM, a third alternative, Alternative C, was discussed with the Town. Alternative C includes deferring use of the North Well, increasing the capacity of the Town Wells by 400 gpm to make up the difference lost by the North Well, and constructing a single combined water central treatment system with a capacity of 2,400 gpm. The WTF would be designed to remove iron and manganese only. By deferring use of the North Well, arsenic removal would not be required until such time that the North Well is brought back online.

The Town has already purchased a property that will be utilized for the central treatment facility included in Alternatives A, B, and C. The specific site for Alternative A's North Well WTF has not been determined or considered for this evaluation.

Manufacturer's Proposals

Six manufacturers were engaged to provide water treatment system proposals for Alternatives A and B. Five proposals were received. Alternative C was not considered until after proposals were received. Therefore, proposals were not received specifically for Alternative C. The manufacturers' type of proposed treatment system for each alternative are shown on Table 1.

TABLE 1
MANUFACTURER PROPOSED TREATMENT SYSTEMS PER APPLICATION

	Alternative A		Alternative B
Manufacturer	**North Well Treatment System - 400 gpm Capacity with Arsenic Removal Only**	**Central Treatment System - 2,000 gpm Capacity with Iron and Manganese Removal Only**	**Central Treatment System - 2,400 gpm Capacity with Arsenic, Iron, and Manganese Removal**
Continental Carbon Group	O/C/P/F with dual media (GSP and ANTHRA) filtration	O/P/F with dual media (GSP and ANTHRA) filtration	O/P/F with dual media (GSP and ANTHRA) filtration
Ovivo	C/F with 0.1-micron ceramic ultrafiltration membranes	C/F with 0.1-micron ceramic ultrafiltration membranes	C/F with 0.1-micron ceramic ultrafiltration membranes
Tonka Water	O/P/F with Proprietary Media Filtration	O/P/F with Proprietary Media Filtration	O/P/F with Proprietary Media Filtration
WesTech	O/C/P/F with dual media (ANTHRA and SIL) filtration	O/P/F with dual media (ANTHRA and SIL) filtration	O/C/P/F with dual media (ANTHRA and SIL) filtration
Wigen	O/C/P/F with dual media (GSP and ANTHRA) filtration	O/P/F with dual media (GSP and ANTHRA) filtration	O/C/P/F with dual media (GSP and ANTHRA) filtration

ANTHRA - Anthracite
C/F - Treatment process utilizing coagulation and filtration
CCG - Continental Carbon Group
GSP - Greensand Plus media
O/C/P/F - Treatment process utilizing oxidation, coagulation, precipitation, and filtration
O/P/F - Treatment process utilizing oxidation, precipitation, and filtration
SIL - Silica sand

As shown on Table 1, various combinations of oxidation, coagulation, precipitation, and filtration were proposed by all manufacturers. Aside from Ovivo, the pressure vessel filtration systems proposed were similar in design, with some variation to the types and combinations of filter media, which included Greensand Plus, anthracite, and silica sand. Systems that included removing arsenic generally included the addition of a coagulant chemical feed system to aid in coprecipitation of iron and arsenic prior to removal. Ovivo was the only manufacturer to propose an alternative technology utilizing media filtration. CCG, Tonka Water, WesTech, and Wigen all proposed systems with similar cost, design, and operation, utilizing either vertical or horizontal pressure vessel filtration systems. AdEdge Technologies was contacted separately to consider the viability of an adsorption water treatment system. Due to water quality parameters and associated costs with replacing spent media, AdEdge responded that adsorption would not be a good candidate for this application.

All systems proposed above produce backwash water as a bioproduct of the treatment process. Backwash cycles continuously regenerate and clean filter media and membranes. Backwash water must either be disposed of or reclaimed through a settling tank and pump-assisted return line. Because the quantities of chemical feeds and backwash water produced have significant capital and life cycle costs, additional information was sought by the manufacturers regarding typical backwash and chemical feed rates.

Another consideration of Alternative B is that the pH must be adjusted to less than 8.0 to facilitate the coprecipitation of iron and arsenic. Because the mixed well water associated with Alternative B has a pH greater than 8.0, the pH must be adjusted, ideally to 7.5. This operational consideration is discussed in more detail below. In contrast, lower pH significantly affects the oxidation rates of iron and manganese, creating further operational complications. These considerations in conjunction with the high cost of constructing the transmission line associated with Alternative B led to the development of Alternative C.

Figures 1 and 2 schematically show the treatment processes of pressure vessel media filtration and membrane filtration, respectively. Both systems show preceding oxidation and coagulation chemical feeds, and backwash reclaim systems. The need to utilize potassium permanganate as the oxidizing agent and use of coagulants may not be necessary if pilot studies demonstrate adequate removal utilizing only sodium hypochlorite. The primary difference between the systems is the physical means of filtration and regeneration and cleaning of media versus cleaning and scouring of the ceramic membranes. Figure 3 shows a typical site layout for either the 2,000 or 2,400 gpm treatment systems to be located on the Town's purchased property site.

Water Treatment System Life Cycle Cost Analysis

To determine the most economical water treatment approach for the Town, two cost analyses were developed for Alternatives A, B, and C. One analysis evaluates costs associated with using a membrane filtration technology, while the other evaluates costs associated with using a pressure vessel media filtration technology. Because the relative costs associated with pressure vessel media filtration were similar amongst the proposals received, the average cost of equipment and operational parameters were used to develop these analyses.

For this evaluation, the total capital cost and 20-year total present worth were evaluated under each option for each alternative. The total capital cost includes the procurement and installation of proposed equipment, and the manufacture and installation or construction of any additional ancillary facilities needed to provide the Town with a fully functional WTF. The costs include, but are not limited to, treatment equipment, buildings, backwash tanks, backwash sludge disposal facilities, and ancillary equipment and components.

The total present worth includes the total project cost as well as annual operation, maintenance, and replacements (OM&R) costs over a 20-year life cycle. These include, but are not limited to, labor, utilities, parts, sampling and testing, media replacement, chemical costs, and equipment replacement. Each system has different chemical feed rates. The values presented are preliminary based on manufacturer-provided best estimates for each system. For better accuracy, the dosing rates will be field-verified during a pilot program and associated costs will be adjusted prior to selection of the preferred system. Further detail is given below as to the primary considerations that affect costs with the various systems.

Equipment and Building Costs

Each proposed treatment system has different spatial requirements. This evaluation assumes the building needed to house treatment equipment will be a concrete masonry unit (CMU) structure with internal framing on a concrete slab foundation and reinforced concrete equipment pads as necessary. Pre-engineered steel frame structures may be considered to reduce capital costs, but CMU buildings are generally more robust and last longer than steel structures.

The water treatment building must be of sufficient size to house the treatment equipment, chemical feed stations, chemical storage, instrumentation and controls, and booster pumps, as well as any additional storage or office space the Town deems necessary for operations. The Town requested that the centralized treatment plant building should include four offices and a bathroom in addition to space needed for treatment and process equipment. An additional building footprint was included depending on the size of each manufacturer's proposed equipment. This generally includes the footprint of the equipment plus 10 feet on all sides for access and process piping connections. A 40 percent markup was applied to the manufacturer's budget proposal equipment costs for delivery and installation by the general contractor.

Backwash Facilities

Significant backwash volumes are produced at WTFs in most applications. Up to 95 percent of backwash volumes can be recovered and returned to the head end of the treatment plant. When backwash recovery facilities are not present, an increase in supply capacity results, which must be accounted for regarding source supply (installed pumping capacity) and maximum permitted water right withdrawal rates. Disposal of the backwash water must also be accounted for. Due to limited water rights, source capacity, and capacity of the existing wastewater collection and lagoon treatment systems to accept the backwash water volume and to promote water conservation, the Town should include backwash recovery facilities. Backwash facilities generally include backwash settling tanks, supernatant return lines with booster pumps, and sludge disposal facilities. The sludge disposal facilities consist of a lined evaporation pond, piping, and control structures. The pond surface area must be adequately sized to allow the liquid portion of the sludge disposed to evaporate. The pond storage volume must be adequate to store approximately two-thirds of the annual volume of sludge disposal. Backwash settling tanks should be sized for peak demand periods. Two tanks should be installed, each with the capacity to store the volume of one complete backwash cycle plus 15 percent.

Various water treatment systems and technologies produce different quantities of backwash water. Therefore, the cost associated with recycling backwash water for each individual system must be considered. Typical backwash volumes are best determined from pilot studies. Manufacturers can estimate backwash volumes based on water quality data for preliminary design purposes. Sizes of backwash tanks, pumps, and disposal facilities are based on estimated backwash volumes. This TM assumes preliminary backwash volumes provided with proposals received for evaluation purposes.

Other Equipment and Construction Costs

Costs common to all proposed treatment systems include backwash tank cathodic protection systems; mechanical; electrical; heating, ventilation, and air conditioning; plumbing work; chemical feed pumps and equipment; controls and instrumentation work; and standby power systems. The costs associated with this work are similar between various treatment systems with minor variations.

Chemical Costs

Water treatment requires various chemical feeds for the purposes of oxidation, coagulation, disinfection, facilitating media regeneration, and membrane cleaning when applicable. All proposed systems require oxidation of soluble forms of iron, manganese, and arsenic to insoluble forms. This

is achieved by injecting either chlorine or potassium permanganate into the raw water stream. Chlorine is generally less expensive than potassium permanganate when used as an oxidizer, produces less quantities of sludge, and is easier to handle from an operational standpoint. Potassium permanganate may be needed if high chlorine feed rates result in disinfection byproducts, or when raw water pH is too low, which may result in an inadequate contact time for the oxidation of manganese. The use of potassium permanganate should be avoided if possible. Coagulation is needed for arsenic removal systems to facilitate coprecipitation of arsenic and iron. A pilot study will indicate which oxidizer will best suit the application and more accurately determine the anticipated chemical feed rates for each alternative.

Media Replacement Costs

Filter media will periodically require replacement as the media degenerates. Typically, this occurs every eight to ten years. Ovivo's ceramic membrane does not have media, but the membrane still needs to be inspected on a regular basis, and damaged membranes need to be replaced. Media replacement should be considered for life cycle present worth comparisons.

Total Capital Cost; Annual Operation, Maintenance, and Replacement; and Net Present Worth

To evaluate the most economical treatment system for the Town, two 20-year present worth analyses were completed for Alternatives A, B, and C. For each alternative, one present worth analysis assumes a membrane filtration technology is used, while the second assumes a media filtration is used. Total estimated construction costs include mobilization and furnishing and installing or constructing well and well pump station improvements, transmission lines, equipment, structures, backwash tanks, and sludge disposal evaporation ponds. Annual OM&R costs include labor, utilities, chemicals, filter media replacement (when applicable), and equipment replacement.

Table 2 presents the total estimated construction cost, total annual OM&R cost, and 20-year total present worth for each alternative. See Figures 4 through 9 for detailed cost estimates for each alternative option shown on Table 2.

TABLE 2
TREATMENT TECHNOLOGY TOTAL PRESENT WORTH COMPARISON

Type of Filtration	Total Estimated Construction Cost (2022 Dollars)	Total annual OM&R (5 percent, 20 years)	Total Present Worth (2022 Dollars)
Alternative A			
Membrane	$13.3 million	$820,000	$23.5 million
Media	$13.4 million	$680,000	$21.9 million
Alternative B			
Membrane	$13.3 million	$540,000	$19.9 million
Media	$14.1 million	$450,000	$19.7 million
Alternative C			
Membrane	$10.4 million	$510,000	$16.8 million
Media	$11.2 million	$430,000	$16.6 million

As shown on Table 2, Alternative A is the most expensive option for both capital costs and annual OM&R, and Alternative C is the least expensive option for both capital costs and annual OM&R. For each alternative, the capital cost associated with utilizing a membrane filtration technology is lower than with

a media filtration type technology, but the annual OM&R is higher. Relatively speaking, the total present worth of utilizing a membrane filtration technology is similar to that of a media filtration type technology.

In comparison to pressure vessel media type filtration systems, membrane filtration will require more operator skill and attention. Membrane filtration will also require a greater number of chemical feeds, which further increases operator skill and attention. The primary disadvantage to Alternative A is that the Town would have to operate and maintain two WTFs compared with only a single facility for Alternatives B and C. The primary disadvantage to Alternative B is that to removal iron, manganese, and arsenic with a single system, the pH would need to be adjusted, which further increases chemical costs and operator skill and attention. Advantages of Alternative C in comparison to Alternatives A and B include, but are not limited to:

- Only a single combined water central treatment system is needed.
- Necessary improvements to the North Well Pump Station and construction of a new transmission line is removed from the cost of Alternative B.
- Neither ferric chloride nor pH adjustment is needed, effectively removing two chemical feed processes from the system, and reducing operator skill and attention.
- The system will create less backwash water and sludge in comparison to the other alternatives.

Based on a capital cost and net present worth analysis, it is recommended that the Town select Alternative C. The viability of this alternative must be confirmed with further investigation. If it is found that Alternative C is not viable due to limited source capacity and/or water rights, it is recommended that the Town select Alternative B.

Recommended Treatment Technology

Based on the information gathered, the recommended treatment technology for all alternatives is oxidation and filtration. Coagulation will be needed if the North Well is to be brought back online. Filtration by silica sand, Greensand Plus, or pyrolusite media is the likely candidate for this application. Membrane filtration may be considered; however, Ovivo, which was the only manufacturer to propose such a system, was unable to provide examples of similar installations using the proposed technology in the U.S. Without having examples of a proposed technology's implementation and success, it is not recommended the Town select such a system.

Conceptual Discussion of the Viability of Alternative C

Due to the high cost of treating the North Well for arsenic, or alternatively, piping the North Well to the central treatment facility with a transmission line and other upgrades, increasing the capacity of other Town Wells by 400 gpm was evaluated to preliminarily consider the viability of Alternative C. For each well, Table 3 shows the current installed pump capacity, current water right maximum withdrawal rate, initial yield during original construction, drawdown during initial yield test, and approximate pump setting below ground surface (BGS). Table 3 was used to determine if increasing the capacity of any combination of the Town's wells is a viable solution if the North Well is abandoned.

TABLE 3
CONCEPTUAL SOURCE CAPACITY EVALUATION

Well ID[1]	Existing Pumping Capacity	Maximum Permitted Withdrawal Rate (gpm)	Initial Yield (gpm)	Drawdown (feet BGS)	Maximum Potential Yield[2] (gpm)	Water Quality
Well No. 2	550	0	500	N/A	N/A	Poor
Well No. 6	500	750	800	75	1,300	Poor
Well No. 7	550	600	1,200	55	2,500	Fair
Well No. 8	0[3]	350	350	181	300	Fair
Well No. 9	500	1,125	750	135	1,100	Poor
North Well	700	400				Poor

[1]Well No. 1 is abandoned; therefore it is not included herein.
[2]Based on the measured specific capacity assuming pumping drawdown to 150 feet from the bottom of well as shown on the Oregon well log.
[3]Well No. 8 is currently plugged.
N/A = not applicable

As shown on Table 3, if the existing pumping capacities of Wells No. 6, 7, and 9 were increased to their maximum permitted withdrawal rates, the sources could supply the Town with the 2,400 gpm needed to meet the 2019 WSMP planning year's maximum daily demand. Due to the age of the wells, well and aquifer drawdown tests will be needed to confirm each well's ability to produce these rates before the viability of this alternative is confirmed.

Recommended Approach

The detailed design of a WTF depends heavily on the technology and specific equipment selected. The total building footprint, installation of process piping and ancillary equipment, backwash reclamation facilities, and sludge disposal facilities all depend on treatment performance, which differs between manufacturers and the type of media selected. To properly design a fully functional WTF, a specific manufacturer and type of media must be selected for use as the basis of final full-scale design. Additionally, the exact treatment efficiency cannot be precisely determined until a pilot study is performed. Because pilot studies are specific to a manufacturer's specific equipment, no single pilot study can guarantee the performance of various systems.

If a single manufacturer is selected for use as the basis of design prior to purchasing the equipment, the Town would lose the benefit of a competitive bid on equipment, and the selected manufacturer may use this to their advantage, increasing the cost of proposed equipment. To maintain the competitive bid process, it is recommended the Town of Lakeview issue a request for proposals (RFP) to solicit proposals from equipment vendors with the intent to select a preferred water treatment equipment package and pre-purchase and procure said package. The RFP would include contract documents and the technical specifications necessary for each equipment vendor to submit a proposal to the Town. Proposals should include, but not be limited to, the proposed equipment's installed footprint, cost, anticipated range of backwash volume and frequency, anticipated chemical feed rates, anticipated media replacement frequency and cost, range of operational flexibility (minimum and maximum flux rates), and list of similar installations. The proposal requirements will also include the design, delivery, set up and operation of a pilot study for the selected package to document and confirm that the proposed package

will effectively and efficiently treat the Town's water prior to moving forward with the full purchase of the package and 30 percent design.

Each RFP will be evaluated using a scoring matrix and weighted ranking criteria. Each RFP will be weighted on the equipment package and delivery cost, pilot study cost, operational flexibility, number of similar installations, required operator skill and attention, and annual chemical costs. The selected vendor will be required to complete a pilot study to confirm treatment performance. If the pilot study fails to meet performance indicated in the RFP, the Town will be given the option to consider other systems at no cost. If the pilot study confirms treatment performance but the Town decides not to select the equipment for other reasons, the Town will be responsible for the cost of the pilot study. The pre-purchased equipment package would then be used as basis of design for the full-scale WTF detailed design, and the selected vendor would be required to provide a process guarantee and bond to the Town as part of the purchase price and agreement. Upon completion and approval of the final design, the overall Water System Improvements project will be put out to bid using a competitive public bid process while the pre-purchased equipment is procured. The awarded contract for the Water System Improvements project will include installation of the Town's pre-purchased treatment equipment package by the contractor.

The advantage for the Town of using this approach is that it retains the competitive bid process for the equipment and delivery costs, while allowing the Town to proceed with a final full-scale design of the WTF designed around the selected equipment. Due to long delivery times from disruptions to current supply chains, another advantage for this approach is that the equipment delivery time frame can coincide with detailed design and bidding of the other project elements. This process would expedite system construction and commissioning of the WTF.

Summary

The purpose of this TM was to evaluate various treatment technologies and proposals received by manufacturers for equipment necessary to remove iron, manganese, and arsenic from the Town's drinking water and to inform the Town of the most economical alternative. The original scope of work included evaluation of two alternatives. Alternative A included installing one WTF to remove arsenic from the North Well, and a separate central WTF to remove iron and manganese from the Town Wells. Alternative B included the installation of a transmission line from the North Well to the Town Wells, and installing a single combined water central treatment system to remove iron, manganese, and arsenic from the combined water. Alternative C was proposed during the preparation of this TM and includes deferring use of the North Well, increasing the capacity of the Town Wells, and installing a single combined water central treatment system to remove iron and manganese.

After review of the Town's water quality constituents and treatment system proposals received, it was determined that pressure vessel filters with either a Greensand Plus or pyrolusite media is the best candidate for any installation associated with the three alternatives. Proposals received for this equipment were similar in cost, application, and operation. However, some variations to anticipated backwash water quantities and chemical feed rates were received. Vendors stated in all cases that actual performance efficiency must be verified with a pilot study.

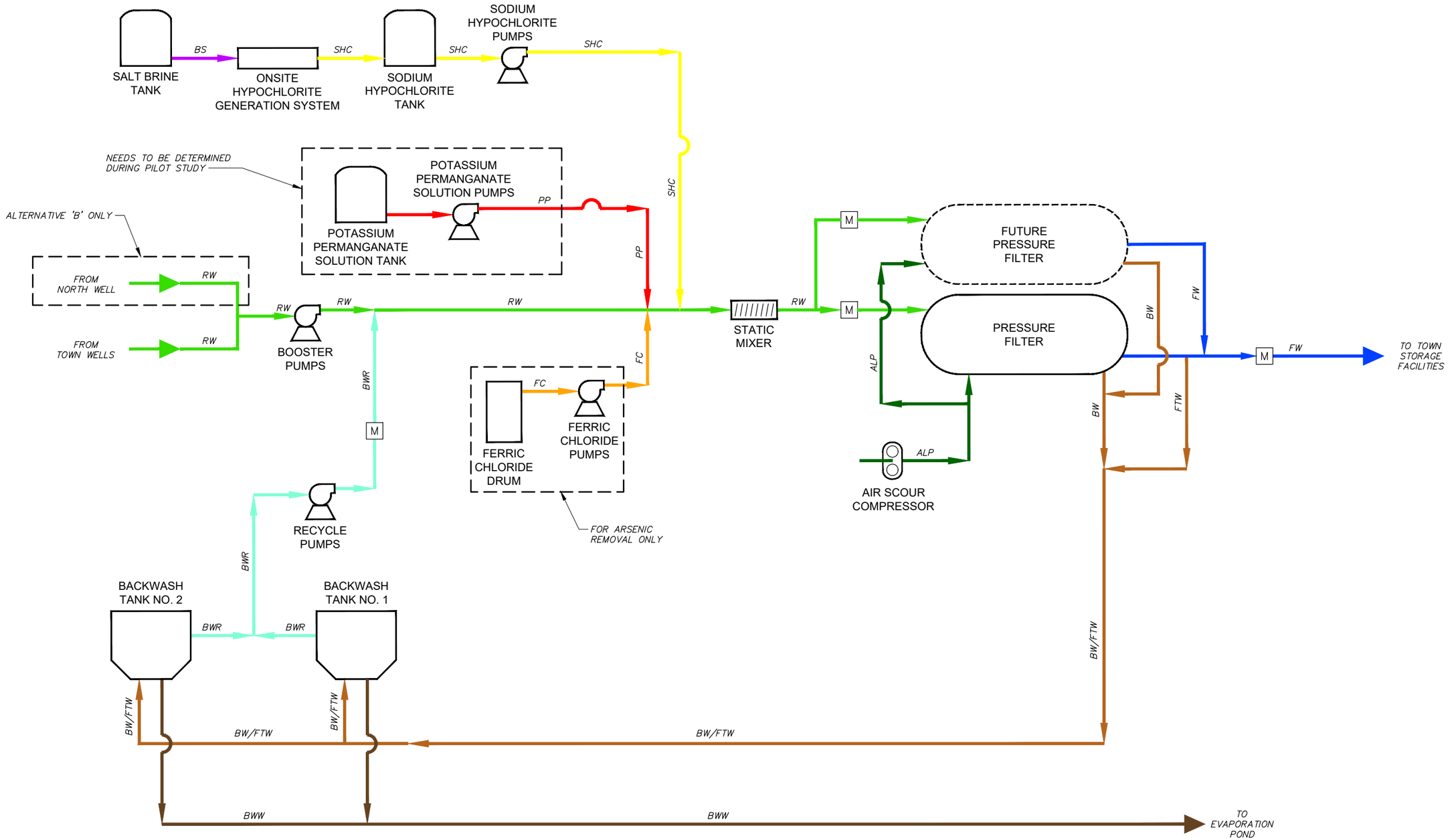
Treatment performance efficiency directly effects the size of facilities needed to provide the Town with a fully operational treatment system. Therefore, a pilot study of selected equipment must be completed to confirm performance, backwash rates and volumes, chemicals needed, and chemical feed

rates, which will then be used as the basis of design for the full-scale WTF. During the preparation of this TM, the Town decided to solicit as an RFP from treatment equipment vendors to select, pre-purchase, and procure equipment to use as the basis of design for the final design. The vendor will be required to verify treatment performance of the proposed equipment prior to the purchase.

After review of the alternatives and net present worth analysis, the Town decided that Alternative C is preferred. The preliminary analysis as presented herein shows that this alternative is likely viable. The design flows will be reevaluated during preliminary design. The maximum treatment capacity of 2,400 gpm was determined by the 2019 WSMP and includes anticipated flows by a new Red Rock Biofuels facility, which was anticipated to go online in 2020. The Red Rock Biofuels facility has yet to break ground and precise water demands by the facility are currently uncertain. The Town is considering installing only enough treatment to meet the Town's 20-year projected capacity without the Red Rock Biofuels facility but provide adequate space within the facilities to expand treatment if necessary. This would include installation of a WTF capable of treating up to 1,700 gpm, with adequate space and ancillary facilities designed to accommodate treatment up to 2,400 gpm.

LS/jg
Enclosures
https://andersonperry.sharepoint.com/sites/LakeviewOR/Projects/214-01 Water System Improvements/024-029 Preliminary Engineering/024 Report - Original/24.2 - Task 1D - Tech Memo WTF Alt. Analysis/Treatment Technology Memo.docx

FIGURES



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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT FACILITY PROCESS AND TECHNOLOGY ALTERNATIVES ANALYSIS

PRESSURE MEDIA FILTER WATER TREATMENT PROCESS SCHEMATIC

FIGURE 1

X:\Clients\Lakeview OR\214-01 WSII\CAD\TM-214-01-FIG01.dwg, Layout1, 9/8/2022 4:19 PM, dchristman

SALT BRINE TANK
BS
ONSITE HYPOCHLORITE GENERATION SYSTEM
SHC
SODIUM HYPOCHLORITE TANK
SHC
SODIUM HYPOCHLORITE PUMPS
SHC

FINISHED WATER FROM DISTRIBUTION SYSTEM
FW
BACKWASH SPRINKLER PUMP
FW

HYDROCHLORIC ACID DRUM
HA
HYDROCHLORIC ACID PUMP
HA
HA/FW

AIR SCOUR BLOWER
ALP
ALP

POLYALUMINUM CHLORIDE SOLUTION TANK
POLYALUMINUM CHLORIDE SOLUTION PUMPS
PCH
PCH

SHC

ALTERNATIVE 'B' ONLY

FROM NORTH WELL
RW
FROM TOWN WELLS
RW
RW
RW
RW
M

HIGH RATE MIXER
RAPID MIX BASIN
GENTLE MIXER
FLOCCULATION BASIN
SHC
HA/FW

ULTRA FILTRATION CERAMIC MEMBRANE STACKS
ULTRA FILTRATION CERAMIC MEMBRANE STACKS
MEMBRANE BASIN

FW
FW
FW
BOOSTER PUMPS
M
FW
TO TOWN STORAGE FACILITIES

BWR
M
RECYCLE PUMPS
FC
FERRIC CHLORIDE PUMPS
FERRIC CHLORIDE DRUM
FOR ARSENIC REMOVAL ONLY

BACKWASH TANK NO. 2
BACKWASH TANK NO. 1
BWR
BWR
BWR

BW
BW
BW
BW
BW
BWW
BWW
TO EVAPORATION POND

LEGEND

- ALP AIR LOW PRESSURE
- BS BRINE SOLUTION
- BW BACKWASH WATER
- BWR BACKWASH RECYCLE
- BWW BACKWASH WASTE
- FC FERRIC CHLORIDE
- FW FINISHED WATER
- HA HYDROCHLORIC ACID
- PCH POLYALUMINUM CHLORIDE
- RW RAW WATER
- SHC SODIUM HYPOCHLORITE

M ELECTROMAGNETIC FLOWMETER

PUMP/BLOWER

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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT FACILITY PROCESS AND TECHNOLOGY ALTERNATIVES ANALYSIS

MEMBRANE FILTRATION WATER TREATMENT PROCESS SCHEMATIC

FIGURE
2

X:\Clients\Lakeview OR\214-01 WSI\CAD\TM-214-01-FIG02.dwg, Layout1, 9/8/2022 2:11 PM, dchristman

WELL NO. 9

EXISTING 16" RAW WATER FROM WELLS NO. 6, 7, AND 8

NEW WATER TREATMENT FACILITY BYPASS VALVE (NORMALLY CLOSED)

CONNECT TO EXISTING 16" WATER LINE, TYP. 2 PLACES

EXISTING 16" FINISHED WATER TO RESERVOIRS

DRAKE ST.

NORTH N ST.

CENTER ST.

SOUTH S ST.

NORTH T ST.

NEW FINISHED WATER LINE

NEW RAW WATER LINE FROM CITY WELLS

BACKWASH WASTE LINE

BACKWASH WASTE RECYCLE LINE

WATER TREAMENT FACILITY BUILDING

ASPHALT PAVEMENT

BACKWASH WASTE EVAPORATION POND

BACKWASH TANKS

SALT BRINE TANK

SITE ACCESS ROAD

SOUTH 3RD ST.

SOUTH 1ST ST.

R.R.

N

100 0 100 200 300
SCALE IN FEET

NOTE

THIS IS A SCHEMATIC SITE PLAN FOR THE SOLE PURPOSE OF ILLUSTRATING THE GENERAL COMPONENTS AND FACILITIES THAT WILL BE NEEDED FOR THE WATER TREATMENT PLANT PROCESS. ACTUAL SITE LAYOUT WILL BE DETERMINED DURING THE 30% AND FINAL DESIGN PHASES OF THE PROJECT.

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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT FACILITY PROCESS AND TECHNOLOGY ALTERNATIVES ANALYSIS

WATER TREATMENT FACILITY SCHEMATIC SITE PLAN

FIGURE 3

X:\Clients\Lakeview OR\214-01 WSI\CAD\TM-214-01-FIG03.dwg, Layout1, 9/8/2022 2:10 PM, dchristman

TOWN OF LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE A - MEMBRANE FILTRATION OPTION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 550,000	All Req'd	$ 550,000
2	Project Safety, Temporary Traffic Control, and Quality Control	LS	75,000	All Req'd	75,000
3	Rehabilitation of Existing Wells	EA	75,000	3	225,000
4	Improvements to Existing Well Pump Station	EA	200,000	5	1,000,000
				General Subtotal	**$ 1,850,000**
North Well Treatment Facility					
5	Clearing and Grubbing	Acre	$ 5,000	1	$ 5,000
6	Site Work	LS	80,000	All Req'd	80,000
7	Operating/Mechanical Building	SF	210	3,100	651,000
8	Evaporation Pond Excavation/ Embankment	CY	60	1,000	60,000
9	Evaporation Pond Liner	SF	1.20	20,000	24,000
10	Backwash Settling Tanks	LS	100,000	All Req'd	100,000
11	Treatment Equipment	LS	1,450,000	All Req'd	1,450,000
12	Mechanical Work	LS	200,000	All Req'd	200,000
13	Electrical Work	LS	200,000	All Req'd	200,000
14	Heating, Ventilation, and Air Conditioning (HVAC)	LS	50,000	All Req'd	50,000
15	Sodium Hypochlorite System	LS	100,000	All Req'd	100,000
16	Plumbing	LS	30,000	All Req'd	30,000
17	Chemical Feed Pumps and Equipment	LS	50,000	All Req'd	50,000
18	Controls and Instrumentation Work	LS	175,000	All Req'd	175,000
19	Generator Set and Automatic Transfer Switch (ATS)	LS	40,000	All Req'd	40,000
				North Well Treatment Facility Subtotal	**$ 3,215,000**
Central Treatment Facility					
20	Clearing and Grubbing	Acre	$ 5,000	2	$ 10,000
21	Site Work	LS	220,000	All Req'd	220,000
22	Raw Water/Finished Water Pipelines	LF	140	4,000	560,000
23	Raw Water/Finished Water Pipelines Surface Restoration	SY	50	2,700	135,000
24	Operating/Mechanical Building	SF	210	3,800	798,000
25	Evaporation Pond Excavation/ Embankment	CY	60	2,100	126,000
26	Evaporation Pond Liner	SF	1.20	70,000	84,000
27	Backwash Settling Tanks	LS	250,000	All Req'd	250,000
28	Treatment Equipment	LS	2,630,000	All Req'd	2,630,000
29	Mechanical Work	LS	450,000	All Req'd	450,000
30	Electrical Work	LS	500,000	All Req'd	500,000
31	HVAC	LS	75,000	All Req'd	75,000
32	Sodium Hypochlorite System	LS	175,000	All Req'd	175,000
33	Plumbing	LS	45,000	All Req'd	45,000
34	Chemical Feed Pumps and Equipment	LS	50,000	All Req'd	50,000
35	Controls and Instrumentation Work	LS	300,000	All Req'd	300,000
36	Generator Set and ATS	LS	75,000	All Req'd	75,000
				Central Treatment Facility Subtotal	**$ 6,483,000**
				Subtotal Estimated Construction Cost	**$ 11,548,000**
				Construction Contingency (15%)	1,732,000
				TOTAL ESTIMATED CONSTRUCTION COST	**$ 13,300,000**

PRESENT WORTH ANALYSIS (2022 DOLLARS)

Item	Description	Annual Cost
ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)		
1	Labor (including Benefits)	$ 350,000
2	Utilities	150,000
3	Supplies, Parts, Maintenance, and Repairs	50,000
4	Capital Outlay	30,000
5	Chemicals	35,000
6	Replacement	204,000
	Total OM&R	**$ 820,000**
	Present Worth OM&R Cost (5%, 20 years)	10,219,000
	Total Present Worth (2022 Dollars)	**$ 23,500,000**

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TOWN OF
LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE A -
MEMBRANE FILTRATION OPTION
PRELIMINARY COST ESTIMATE

FIGURE
4

TOWN OF LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE A - MEDIA FILTRATION OPTION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 555,000	All Req'd	$ 555,000
2	Project Safety, Temporary Traffic Control, and Quality Control	LS	75,000	All Req'd	75,000
3	Rehabilitation of Existing Wells	EA	75,000	3	225,000
4	Improvements to Existing Well Pump Station	EA	200,000	5	1,000,000
				General Subtotal	**$ 1,855,000**
North Well Treatment Facility					
5	Clearing and Grubbing	Acre	$ 5,000	2	$ 10,000
6	Site Work	LS	80,000	All Req'd	80,000
7	Operating/Mechanical Building	SF	210	3,000	630,000
8	Evaporation Pond Excavation/ Embankment	CY	60	1,650	99,000
9	Evaporation Pond Liner	SF	1.20	50,000	60,000
10	Backwash Settling Tanks	LS	200,000	All Req'd	200,000
11	Treatment Equipment	LS	650,000	All Req'd	650,000
12	Mechanical Work	LS	200,000	All Req'd	200,000
13	Electrical Work	LS	200,000	All Req'd	200,000
14	Heating, Ventilation, and Air Conditioning (HVAC)	LS	50,000	All Req'd	50,000
15	Sodium Hypochlorite System	LS	100,000	All Req'd	100,000
16	Plumbing	LS	30,000	All Req'd	30,000
17	Chemical Feed Pumps and Equipment	LS	50,000	All Req'd	50,000
18	Controls and Instrumentation Work	LS	175,000	All Req'd	175,000
19	Generator Set and Automatic Transfer Switch (ATS)	LS	40,000	All Req'd	40,000
				North Well Treatment Facility Subtotal	**$ 2,574,000**
Central Treatment Facility					
20	Clearing and Grubbing	Acre	$ 5,000	3	$ 15,000
21	Site Work	LS	220,000	All Req'd	220,000
22	Raw Water/Finished Water Pipelines	LF	140	4,000	560,000
23	Raw Water/Finished Water Pipelines Surface Restoration	SY	50	2,700	135,000
24	Operating/Mechanical Building	SF	210	5,100	1,071,000
25	Evaporation Pond Excavation/ Embankment	CY	60	2,450	147,000
26	Evaporation Pond Liner	SF	1.20	90,000	108,000
27	Backwash Settling Tanks	LS	1,000,000	All Req'd	1,000,000
28	Treatment Equipment	LS	2,310,000	All Req'd	2,310,000
29	Mechanical Work	LS	450,000	All Req'd	450,000
30	Electrical Work	LS	500,000	All Req'd	500,000
31	HVAC	LS	75,000	All Req'd	75,000
32	Sodium Hypochlorite System	LS	175,000	All Req'd	175,000
33	Plumbing	LS	45,000	All Req'd	45,000
34	Chemical Feed Pumps and Equipment	LS	30,000	All Req'd	30,000
35	Controls and Instrumentation Work	LS	300,000	All Req'd	300,000
36	Generator Set and ATS	LS	75,000	All Req'd	75,000
				Central Treatment Facility Subtotal	**$ 7,216,000**
				Subtotal Estimated Construction Cost	**$ 11,645,000**
				Construction Contingency (15%)	1,747,000
				TOTAL ESTIMATED CONSTRUCTION COST	**$ 13,400,000**

PRESENT WORTH ANALYSIS (2022 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor (including Benefits)	$ 300,000
2	Utilities	120,000
3	Supplies, Parts, Maintenance, and Repairs	60,000
4	Capital Outlay	30,000
5	Chemicals	12,000
6	Filter Media Replacement	10,000
7	Replacement	148,000
	Total OM&R	**$ 680,000**
	Present Worth OM&R Cost (5%, 20 years)	8,475,000
	Total Present Worth (2022 Dollars)	**$ 21,900,000**

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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT IMPROVEMENTS
ALTERNATIVE A -
MEDIA FILTRATION OPTION
PRELIMINARY COST ESTIMATE

FIGURE
5

TOWN OF LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE B - MEMBRANE FILTRATION OPTION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 546,000	All Req'd	$ 546,000
2	Project Safety, Temporary Traffic Control, and Quality Control	LS	200,000	All Req'd	200,000
3	Rehabilitation of Existing Wells	EA	75,000	3	225,000
4	Improvements to Existing Well Pump Station	EA	200,000	5	1,000,000
				General Subtotal	**$ 1,971,000**
North Well Transmission Line					
5	Well Pump Upgrades	LS	$ 90,000	All Req'd	$ 90,000
6	Controls and Instrumentation Work	LS	50,000	All Req'd	50,000
7	New 8-inch Transmission Line	LF	110	14,500	1,595,000
8	Surface Restoration	SY	50	4,750	237,500
9	8-inch Gate Valve	Each	1,800	14	25,200
				North Well Transmission Line Subtotal	**$ 1,998,000**
Central Treatment Facility					
10	Clearing and Grubbing	Acre	$ 5,000	3	$ 15,000
11	Site Work	LS	220,000	All Req'd	220,000
12	Raw Water/Finished Water Pipelines	LF	140	4,000	560,000
13	Raw Water/Finished Water Pipelines Surface Restoration	SY	50	2,700	135,000
14	Operating/Mechanical Building	SF	210	4,000	840,000
15	Evaporation Pond Excavation/ Embankment	CY	60	2,400	144,000
16	Evaporation Pond Liner	SF	1.20	90,000	108,000
17	Backwash Settling Tanks	LS	300,000	All Req'd	300,000
18	Treatment Equipment	LS	3,255,000	All Req'd	3,255,000
19	Mechanical Work	LS	500,000	All Req'd	500,000
20	Electrical Work	LS	600,000	All Req'd	600,000
21	Heating, Ventilation, and Air Conditioning	LS	80,000	All Req'd	80,000
22	Sodium Hypochlorite System	LS	200,000	All Req'd	200,000
23	Plumbing	LS	50,000	All Req'd	50,000
24	Chemical Feed Pumps and Equipment	LS	100,000	All Req'd	100,000
25	Controls and Instrumentation Work	LS	300,000	All Req'd	300,000
26	Generator Set and Automatic Transfer Switch	LS	85,000	All Req'd	85,000
				Central Treatment Facility Subtotal	**$ 7,492,000**
				Subtotal Estimated Construction Cost	**$ 11,461,000**
				Construction Contingency (15%)	1,719,000
				TOTAL ESTIMATED CONSTRUCTION COST	**$ 13,200,000**

PRESENT WORTH ANALYSIS (2022 DOLLARS)

Item	Description	Annual Cost
ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)		
1	Labor (including Benefits)	$ 175,000
2	Utilities	100,000
3	Supplies, Parts, Maintenance, and Repairs	25,000
4	Capital Outlay	20,000
5	Chemicals	60,000
6	Replacement	162,750
	Total OM&R	**$ 540,000**
	Present Worth OM&R Cost (5%, 20 years)	6,730,000
	Total Present Worth (2022 Dollars)	**$ 19,900,000**

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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT IMPROVEMENTS
ALTERNATIVE B -
MEMBRANE FILTRATION OPTION
PRELIMINARY COST ESTIMATE

FIGURE
6

TOWN OF LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE B - MEDIA FILTRATION OPTION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 582,000	All Req'd	$ 582,000
2	Project Safety, Temporary Traffic Control,	LS	200,000	All Req'd	200,000
3	Rehabilitation of Existing Wells	EA	75,000	3	225,000
4	Improvements to Existing Well Pump Station	EA	200,000	5	1,000,000
				General Subtotal	**$ 2,007,000**
North Well Transmission Line					
5	Well Pump Upgrades	LS	$ 90,000	All Req'd	$ 90,000
6	Controls and Instrumentation Work	LS	50,000	All Req'd	50,000
7	New 8-inch Transmission Line	LF	110	14,500	1,595,000
8	Surface Restoration	SY	50	4,750	237,500
9	8-inch Gate Valve	Each	1,800	14	25,200
				North Well Transmission Line Subtotal	**1,998,000**
Central Treatment Facility					
10	Clearing and Grubbing	Acre	$ 5,000	4	$ 20,000
11	Site Work	LS	220,000	All Req'd	220,000
12	Raw Water/Finished Water Pipelines	LF	140	4,000	560,000
13	Raw Water/Finished Water Pipelines Surface Restoration	SY	50	2,700	135,000
14	Operating/Mechanical Building	SF	210	5,400	1,134,000
15	Evaporation Pond Excavation/ Embankment	CY	60	3,700	222,000
16	Evaporation Pond Liner	SF	1.20	155,000	186,000
17	Backwash Settling Tanks	LS	1,400,000	All Req'd	1,400,000
18	Treatment Equipment	LS	2,450,000	All Req'd	2,450,000
19	Mechanical Work	LS	500,000	All Req'd	500,000
20	Electrical Work	LS	600,000	All Req'd	600,000
21	Heating, Ventilation, and Air Conditioning	LS	80,000	All Req'd	80,000
22	Sodium Hypochlorite System	LS	200,000	All Req'd	200,000
23	Plumbing	LS	50,000	All Req'd	50,000
24	Chemical Feed Pumps and Equipment	LS	80,000	All Req'd	80,000
25	Controls and Instrumentation Work	LS	300,000	All Req'd	300,000
26	Generator Set and Automatic Transfer Switch	LS	85,000	All Req'd	85,000
				Central Treatment Facility Subtotal	**$ 8,222,000**
				Subtotal Estimated Construction Cost	**$ 12,227,000**
				Construction Contingency (15%)	1,834,000
				TOTAL ESTIMATED CONSTRUCTION COST	**$ 14,100,000**

PRESENT WORTH ANALYSIS (2022 DOLLARS)

Item	Description	Annual Cost
ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)		
1	Labor (including Benefits)	$ 155,000
2	Utilities	80,000
3	Supplies, Parts, Maintenance, and Repairs	30,000
4	Capital Outlay	20,000
5	Chemicals	35,000
6	Filter Media Replacement	10,000
7	Equipment Replacement	122,500
	Total OM&R	**$ 450,000**
	Present Worth OM&R Cost (5%, 20 years)	5,608,000
	Total Present Worth (2022 Dollars)	**$ 19,700,000**

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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT IMPROVEMENTS
ALTERNATIVE B -
MEDIA FILTRATION OPTION
PRELIMINARY COST ESTIMATE

FIGURE
7

TOWN OF LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE C - MEMBRANE FILTRATION OPTION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 429,000	All Req'd	$ 429,000
2	Project Safety, Temporary Traffic Control, and Quality Control	LS	75,000	All Req'd	75,000
3	Rehabilitation of Existing Wells	EA	75,000	3	225,000
4	Improvements to Existing Well Pump Station	EA	200,000	4	800,000
				General Subtotal	**$ 1,529,000**
Central Treatment Facility					
5	Clearing and Grubbing	Acre	$ 5,000	3	$ 15,000
6	Site Work	LS	220,000	All Req'd	220,000
7	Raw Water/Finished Water Pipelines	LF	140	4,000	560,000
8	Raw Water/Finished Water Pipelines Surface Restoration	SY	50	2,700	135,000
9	Operating/Mechanical Building	SF	210	4,000	840,000
10	Evaporation Pond Excavation/ Embankment	CY	60	2,400	144,000
11	Evaporation Pond Liner	SF	1.20	90,000	108,000
12	Backwash Settling Tanks	LS	325,000	All Req'd	325,000
13	Treatment Equipment	LS	3,260,000	All Req'd	3,260,000
14	Mechanical Work	LS	500,000	All Req'd	500,000
15	Electrical Work	LS	600,000	All Req'd	600,000
16	Heating, Ventilation, and Air Conditioning	LS	80,000	All Req'd	80,000
17	Sodium Hypochlorite System	LS	200,000	All Req'd	200,000
18	Plumbing	LS	50,000	All Req'd	50,000
19	Chemical Feed Pumps and Equipment	LS	50,000	All Req'd	50,000
20	Controls and Instrumentation Work	LS	300,000	All Req'd	300,000
21	Generator Set and Automatic Transfer Switch	LS	85,000	All Req'd	85,000
				Central Treatment Facility Subtotal	**$ 7,472,000**
				Subtotal Estimated Construction Cost	**$ 9,001,000**
				Construction Contingency (15%)	1,350,000
				TOTAL ESTIMATED CONSTRUCTION COST	**$ 10,400,000**

PRESENT WORTH ANALYSIS (2022 DOLLARS)

Item	Description	Annual Cost
ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)		
1	Labor (including Benefits)	$ 175,000
2	Utilities	100,000
3	Supplies, Parts, Maintenance, and Repairs	25,000
4	Capital Outlay	20,000
5	Chemicals	25,000
6	Replacement	163,000
	Total OM&R	**$ 510,000**
	Present Worth OM&R Cost (5%, 20 years)	6,356,000
	Total Present Worth (2022 Dollars)	**$ 16,800,000**

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TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT IMPROVEMENTS
ALTERNATIVE C -
MEMBRANE FILTRATION OPTION
PRELIMINARY COST ESTIMATE

FIGURE
8

TOWN OF LAKEVIEW, OREGON
WATER SYSTEM IMPROVEMENTS
ALTERNATIVE C - MEDIA FILTRATION OPTION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 464,000	All Req'd	$ 464,000
2	Project Safety, Temporary Traffic Control, and Quality Control	LS	75,000	All Req'd	75,000
3	Rehabilitation of Existing Wells	EA	75,000	3	225,000
4	Improvements to Existing Well Pump Station	EA	200,000	4	800,000
				General Subtotal	**$ 1,564,000**
Central Treatment Facility					
5	Clearing and Grubbing	Acre	$ 5,000	4	$ 20,000
6	Site Work	LS	220,000	All Req'd	220,000
7	Raw Water/Finished Water Pipelines	LF	140	4,000	560,000
8	Raw Water/Finished Water Pipelines Surface Restoration	SY	50	2,700	135,000
9	Operating/Mechanical Building	SF	210	5,400	1,134,000
10	Evaporation Pond Excavation/ Embankment	CY	60	3,700	222,000
11	Evaporation Pond Liner	SF	1.20	155,000	186,000
12	Backwash Settling Tanks	LS	1,400,000	All Req'd	1,400,000
13	Treatment Equipment	LS	2,450,000	All Req'd	2,450,000
14	Mechanical Work	LS	500,000	All Req'd	500,000
15	Electrical Work	LS	600,000	All Req'd	600,000
16	Heating, Ventilation, and Air Conditioning	LS	80,000	All Req'd	80,000
17	Sodium Hypochlorite System	LS	200,000	All Req'd	200,000
18	Plumbing	LS	50,000	All Req'd	50,000
19	Chemical Feed Pumps and Equipment	LS	30,000	All Req'd	30,000
20	Controls and Instrumentation Work	LS	300,000	All Req'd	300,000
21	Generator Set and Automatic Transfer Switch	LS	85,000	All Req'd	85,000
				Central Treatment Facility Subtotal	**$ 8,172,000**
				Subtotal Estimated Construction Cost	**$ 9,736,000**
				Construction Contingency (15%)	1,460,000
				TOTAL ESTIMATED CONSTRUCTION COST	**$ 11,200,000**

PRESENT WORTH ANALYSIS (2022 DOLLARS)

Item	Description	Annual Cost
ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)		
1	Labor (including Benefits)	$ 155,000
2	Utilities	80,000
3	Supplies, Parts, Maintenance, and Repairs	30,000
4	Capital Outlay	20,000
5	Chemicals	10,000
6	Filter Media Replacement	10,000
7	Equipment Replacement	122,500
	Total OM&R	**$ 430,000**
	Present Worth OM&R Cost (5%, 20 years)	5,359,000
	Total Present Worth (2022 Dollars)	**$ 16,600,000**

anderson perry & associates, inc.

TOWN OF
LAKEVIEW, OREGON
WATER TREATMENT IMPROVEMENTS
ALTERNATIVE C -
MEDIA FILTRATION OPTION
PRELIMINARY COST ESTIMATE

FIGURE
9

ATTACHMENT
Water Quality Sampling, Testing, and Data Analysis (Task 1C) Technical Memorandum

anderson perry & associates, inc.

1901 N. Fir Street, P.O. Box 1107
La Grande, OR 97850
(541) 963-8309, Fax (541) 963-5456
www.andersonperry.com

engineering ▪ surveying ▪ natural resources

TECHNICAL MEMORANDUM

To:	Scott Langum, Town of Lakeview
From:	Troy Baker, P.E.
Subject:	**Water Quality Sampling, Testing, and Data Analysis (Task 1C)**
Date:	July 15, 2022
Job/File No.	214-01-24.1 (w/encl.)
cc:	Michele Parry, Town of Lakeview Dan Scalas, P.E., Adkins Engineering Amber Hudspeth, Hudspeth Land+Water (HLW) Jeremy Wenger, P.E., Fluent Engineering Tawni Bean, Business Oregon Larry Holzgang, Business Oregon Lucas Stangel, P.E., Anderson Perry & Associates, Inc. (AP) Bryce Wininger, P.E., AP Austin Byrer, AP

Introduction

The purpose of this technical memorandum is to summarize the results of the water quality testing and data analysis for the Town of Lakeview, Oregon's existing water sources. Water quality results provided to AP will help identify water treatment technologies suited for the Town's water quality and provide data to assist with selection of the most appropriate and cost-effective treatment process for the Town's water system improvements (WSI). Under the Professional Services Agreement dated March 9, 2022, the Town hired AP to complete engineering services related to the WSI including summarizing the results of the water samples collected from the Town's existing water sources. Water quality data have been summarized to better evaluate treatment technologies available for the Town. The water quality data summarized were obtained from the reported water quality sampling and testing data provided by independent laboratories. Constituents included in the water quality sampling and testing data are based on the 2018 Water System Master Plan (WSMP) and the Environmental Protection Agency's (EPA) primary and secondary drinking water standards.

The EPA outlines various constituents that can be found in municipal water systems. The EPA has two categories of constituents, primary and secondary drinking water standards, which set limits for each constituent. Primary drinking water standards are legally enforceable contaminant limits established to help protect the health and safety of municipal water system consumers. Secondary drinking water standards are non-enforceable contaminant limits considered to affect taste, odor, and cosmetic qualities of the water and are not necessarily related to protecting the health and safety of consumers.

Testing and Sampling Method

The reported water quality data were derived from water samples collected and packaged by HLW. The water samples were then sent by HLW to Brooks Applied Labs (BAL) and Edge Analytical to test for various water quality constituents. The samples provided to BAL and Edge Analytical were grab samples taken from each existing water source. Grab samples are a single sample collected in an individual container from a specific site to use for testing purposes. They represent an instantaneous sample of water quality constituents found in the associated water source the sample was taken from.

Testing methods performed by both laboratories are shown next to each constituent under the method column in the data reports included in the appendices. Testing methods performed by laboratories for drinking water samples use EPA-approved methods. The definition of each EPA-approved testing method is described on Table 1.

TABLE 1
TESTING METHODS AND METHOD DESCRIPTIONS

Testing Method	Method Description
EPA Method 100.2	Determines the presence and quantifies the number of asbestos structures longer than 10 micrometers in drinking water samples.
EPA Method 200.8	Determines 21 elements shown as dissolved elements in drinking water samples, with organometallic compounds determined as total metals.
Method OIA-1677-DW	Determines the available cyanide in drinking water.
EPA Method 300.0	Determines common inorganic anions in drinking water, and a secondary part determines bromate, chlorate, and chlorite in drinking water.
EPA Method 200.7	Determines 31 analytes in the dissolved fraction of aqueous samples and total recoverable analytes in water.
EPA Method 180.1	Determines the nephelometric turbidity units (NTUs) in drinking water.
EPA Method 900.0	Determines the measurement of gross alpha and beta particle activities in drinking water utilizing a screening technique.
EPA Method 903.1	Determines the measurement of radium-226 in drinking water.
EPA Method 904.0	Determines the beta activity from actinium-228 produced by decaying radium-228; can be related to the radium-228 present in the sample.
EPA Method 245.1	Determines the mercury in drinking water.
EPA Method 548.1	Determines the endothall in drinking water.
EPA Method 549.2	Determines the diquat and paraquat in drinking water.
EPA Method 524.2	Determines the purgeable volatile organic compounds and some disinfection byproducts in drinking water.
IC-ICP-CRC-MS	Determines arsenic speciation in drinking water.

BAL provided arsenic speciation testing for the North Well. This testing was analyzed on May 17, 2022, and the testing results were provided on May 19, 2022. The remaining constituents summarized on Table 2 were taken from each water source during two independent grab sample events and tested by Edge Analytical. Edge Analytical provided testing for the North Well; Wells No. 2, 6, 7, and 9; and the Spring Line. Testing results were provided by Edge Analytical on February 2, 2022, and May 27, 2022, for the first and second set of sampling events, respectively.

Water Quality Data

The following water quality data on Table 2 provide a summary of testing results associated with samples obtained from the Town's existing water sources and tested by BAL and Edge Analytical. The regulatory EPA limits for constituents are also provided on Table 2 for reference. Constituents included on the summarized table are a combination of primary and secondary drinking water standards established by the EPA as well as constituents of interest outlined in the WSMP and scope of work. Two of the Town's existing water sources were not included on Table 2; Well No. 8 and the Spring Line. Well No. 8 was not included, as the well is not currently producing water. The Spring Line was not included as it is not a consistent water source available for the Town year-round, and it is not the intent to treat water from the spring source through the new treatment facility.

TABLE 2
WATER QUALITY DATA

Primary EPA Constituents	North Well	Well No. 2	Well No. 6	Well No. 7	Well No. 9	EPA Limits
Arsenic, Total (mg/L)	0.0306	0.0025	0.0099	0.0076	0.0014	0.0100
Arsenic (III) (mg/L)	0.0280	N/A	N/A	N/A	N/A	
Arsenic (V) (mg/L)	0.0023	N/A	N/A	N/A	N/A	
Copper (mg/L)	ND	0.0020	0.0052	0.0247	0.0246	1.3000
Lead (mg/L)	0.0003	0.0008	0.0007	0.0010	0.0049	0.0150
Mercury (mg/L)	ND	ND	ND	ND	ND	0.002
Nitrate as Nitrogen (mg/L)	ND	ND	ND	ND	ND	10
Total Coliform (CFU) (percent)	ND	ND	ND	ND	ND	5.0[1]
Turbidity (NTU)	8.40	3.60	1.20	0.70	2.20	1
Uranium (mg/L)	ND	ND	0.0001	0.0001	0.0001	0.030
Secondary EPA Constituents						
Alkalinity (mg $CaCO_3$/L)	58.8	225.0	108.0	109.0	161.0	
Aluminum (mg/L)	ND	0.652	0.231	0.060	2.760	0.050 to 0.200
Color (Color Units)	ND	20.0	40.0	20.0	40.0	15.0
Hardness (mg/L)	11.1	169.0	166.0	51.0	13.0	
Iron (mg/L)	0.462	1.620	1.490	0.420	3.200	0.300
Manganese (mg/L)	0.0172	2.2200	2.6400	0.7960	0.1180	0.0500
Nickel (mg/L)	0.0003	0.0010	0.0019	0.0005	0.0026	
Odor (ton)	2.00	1.00	1.06	ND	1.40	3.00
pH (pH Units)	8.18	7.62	7.68	8.24	8.44	6.50 to 8.50
Phosphorous, Total (mg/L)	0.0390	0.3210	0.5080	0.4810	0.4700	
Sodium (mg/L)	192.0	42.1	128.0	86.7	68.7	20.0
Sulfate (mg/L)	239.0	15.0	85.0	74.4	ND	250.0
TDS (mg/L)	650.0	258.0	583.0	340.0	260.0	500.0
Total Inorganic Carbon (mg/L)	10.31	49.34	22.56	22.05	34.41	
Total Organic Carbon (mg/L)	0.20	0.99	1.01	0.87	1.60	
Zinc (mg/L)	ND	0.0171	ND	0.0069	0.0036	5

A blank EPA limit cell indicates a level is not currently established; however, the constituent is important in identifying appropriate treatment technologies. EPA limits for arsenic are only specified for total arsenic.

[1] No more than 5.0 percent of samples collected in a month may be total coliform positive. For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform positive per month.

CFU = colony-forming units
mg $CaCO_3$/L = milligrams per liter as calcium carbonate
mg/L = milligrams per liter
N/A = not applicable
ND = not detected
NTU = nephelometric turbidity units
TDS = Total Dissolved Solids

Conclusion

As shown on Table 2, the Town of Lakeview has water quality issues that need to be addressed to meet EPA limits and to provide aesthetically pleasing water for residents. Arsenic is the main constituent within the Town's water sources that has an EPA primary standard above the enforceable limit. High levels of aluminum, iron, manganese, and TDS all are EPA secondary standards identified as contaminants that may account for colored water and taste issues. Other constituents, such as pH or sulfate, may affect how treatment of the water is achieved, which will help determine the treatment technology required for the Town's needs. It is important to note that the water quality data analyzed were from a small sample set of water quality data; therefore, the higher constituent value between the two testing results was used. This allows for a conservative estimate when determining an appropriate treatment technology. The Water Treatment Facility Process and Technology Alternatives Analysis technical memorandum provided as Task 1D will outline additional information and analysis with respect to water quality, explore available treatment technologies, and outline the technology recommended for and selected by the Town. For additional sampled and tested constituents, refer to Appendix A for the BAL testing report, Appendix B for the Edge Analytical Report from February 2, 2022, and Appendix C for the Edge Analytical Report from May 27, 2022.

Enclosures
Appendix A - Brooks Applied Labs Testing Report
Appendix B - Edge Analytical Testing Report - February 2, 2022
Appendix C - Edge Analytical Testing Report - May 27, 2022

TB/bh

APPENDIX A
BROOKS APPLIED LABS TESTING REPORT

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

May 19, 2022

Hudspeth Land and Water, LLC
ATTN: Amber L. Hudspeth
7485 SW Joshua Court
Powell Butte, Oregon 97753
amber@hlworegon.com

RE: Project HUD-BD2201 Client Project: Drinking Water

Dear Amber L. Hudspeth,

On May 11, 2022, Brooks Applied Labs (BAL) received one (1) water sample. The sample was logged-in for the analyses of Arsenic Speciation (arsenite [*As(III)*], arsenate [*As(V)*], monomethylarsonic acid [*MMAs*], dimethylarsinic acid [*DMAs*], and unknown arsenic species) according to the chain-of-custody form. All samples were received and stored according to BAL SOPs and EPA methodology.

The sample was field filtered by the client.

Arsenic Speciation Quantitation by IC-ICP-CRC-MS
Arsenic speciation was performed by ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Arsenic species are first chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS). For more information on this determinative technique, please visit the Interference Reduction Technology section on our website.

In instances where the native sample result and/or the associated duplicate (DUP) result were below the MDL the RPD was not calculated (**N/C**).

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOP(s), and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

All data was reported without further qualification and all other associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information please see the *Report Information* page in your report. This report should be used in its entirety for interpretation of results.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Amy Goodall
Project Manager
Brooks Applied Labs
amy@brooksapplied.com

Project ID: HUD-BD2201
PM: Amy Goodall

Client PM: Amber L. Hudspeth
Client Project: Drinking Water

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations /certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received
BAL	Brooks Applied Labs
BLK	method blank
BS	blank spike
CAL	calibration standard
CCB	continuing calibration blank
CCV	continuing calibration verification
COC	chain of custody record
D	dissolved fraction
DUP	duplicate
IBL	instrument blank
ICV	initial calibration verification
MDL	method detection limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
ND	non-detect
NR	non-reportable
N/C	not calculated
PS	post preparation spike
REC	percent recovery
RPD	relative percent difference
SCV	secondary calibration verification
SOP	standard operating procedure
SRM	reference material
T	total fraction
TR	total recoverable fraction

Definition of Data Qualifiers

(Effective 3/23/2020)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Project ID: HUD-BD2201
PM: Amy Goodall

Client PM: Amber L. Hudspeth
Client Project: Drinking Water

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
No Well	2205123-01	Water	Sample	05/09/2022	05/11/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
As(III)	Water	SOP BAL-4100	05/16/2022	05/17/2022	B220995	S220545
As(V)	Water	SOP BAL-4100	05/16/2022	05/17/2022	B220995	S220545
DMAs	Water	SOP BAL-4100	05/16/2022	05/17/2022	B220995	S220545
MMAs	Water	SOP BAL-4100	05/16/2022	05/17/2022	B220995	S220545
Unk As Sp	Water	SOP BAL-4100	05/16/2022	05/17/2022	B220995	S220545

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
No Well										
2205123-01	As(III)	Water	D	28.0		0.200	1.05	µg/L	B220995	S220545
2205123-01	As(V)	Water	D	2.28		0.200	1.05	µg/L	B220995	S220545
2205123-01	DMAs	Water	D	≤ 0.250	U	0.250	1.05	µg/L	B220995	S220545
2205123-01	MMAs	Water	D	≤ 0.200	U	0.200	1.05	µg/L	B220995	S220545
2205123-01	Unk As Sp	Water	D	0.277	J	0.250	1.05	µg/L	B220995	S220545

Accuracy & Precision Summary

Batch: B220995
Lab Matrix: Water
Method: SOP BAL-4100

Sample	Analyte	Native	Spike	Result	Units	REC & Limits	RPD & Limits
B220995-BS1	**Blank Spike, (2137025)**						
	As(III)		5.000	4.641	µg/L	93% 75-125	
	As(V)		5.000	4.393	µg/L	88% 75-125	
	DMAs		5.210	5.349	µg/L	103% 75-125	
B220995-BS2	**Blank Spike, (2207028)**						
	MMAs		4.490	4.272	µg/L	95% 75-125	
B220995-DUP1	**Duplicate, (2204279-04)**						
	As(III)	ND		ND	µg/L		N/C 25
	As(V)	3.740		3.667	µg/L		2% 25
	DMAs	0.769		0.767	µg/L		0.2% 25
	MMAs	ND		ND	µg/L		N/C 25
	Unk As Sp	0.378		0.367	µg/L		3% 25
B220995-MS1	**Matrix Spike, (2204279-04)**						
	As(III)	ND	5.225	4.850	µg/L	93% 75-125	
	As(V)	3.740	4.855	8.208	µg/L	92% 75-125	
	DMAs	0.769	5.000	5.614	µg/L	97% 75-125	
	MMAs	ND	5.000	4.581	µg/L	92% 75-125	
B220995-MSD1	**Matrix Spike Duplicate, (2204279-04)**						
	As(III)	ND	5.225	4.752	µg/L	91% 75-125	2% 25
	As(V)	3.740	4.855	8.171	µg/L	91% 75-125	0.4% 25
	DMAs	0.769	5.000	5.471	µg/L	94% 75-125	3% 25
	MMAs	ND	5.000	4.570	µg/L	91% 75-125	0.2% 25

Method Blanks & Reporting Limits

Batch: B220995
Matrix: Water
Method: SOP BAL-4100
Analyte: As(III)

Sample	Result	Units
B220995-BLK1	0.00	µg/L
B220995-BLK2	0.00	µg/L
B220995-BLK3	0.00	µg/L
B220995-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.021
MDL: 0.004
MRL: 0.021

Analyte: As(V)

Sample	Result	Units
B220995-BLK1	0.00	µg/L
B220995-BLK2	0.00	µg/L
B220995-BLK3	0.00	µg/L
B220995-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.021
MDL: 0.004
MRL: 0.021

Analyte: DMAs

Sample	Result	Units
B220995-BLK1	0.00	µg/L
B220995-BLK2	0.00	µg/L
B220995-BLK3	0.00	µg/L
B220995-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.021
MDL: 0.005
MRL: 0.021

Method Blanks & Reporting Limits

Analyte: MMAs

Sample	Result	Units
B220995-BLK1	0.00	µg/L
B220995-BLK2	0.00	µg/L
B220995-BLK3	0.00	µg/L
B220995-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.021

MDL: 0.004
MRL: 0.021

Analyte: Unk As Sp

Sample	Result	Units
B220995-BLK1	0.00	µg/L
B220995-BLK2	0.00	µg/L
B220995-BLK3	0.00	µg/L
B220995-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.021

MDL: 0.005
MRL: 0.021

Project ID: HUD-BD2201
PM: Amy Goodall

Client PM: Amber L. Hudspeth
Client Project: Drinking Water

Sample Containers

Lab ID: 2205123-01
Sample: No Well

Report Matrix: Water
Sample Type: Sample + Sum

Collected: 05/09/2022
Received: 05/11/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Vacutainer	10 mL	22-0017	EDTA (vial)	n/a	n/a	Cooler - 2205123
B	XTRA_VOL	10 mL	22-0017	EDTA (vial)	n/a	n/a	Cooler - 2205123

Shipping Containers

Cooler - 2205123

Received: May 11, 2022 9:42
Tracking No: 2729 8408 8673 via FedEx
Coolant Type: Ice
Temperature: 4.8 °C

Description: Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#: 33

Custody seals present? No
Custody seals intact? No
COC present? Yes

Chain-of-Custody Form

BROOKS APPLIED LABS

Ship samples to:
18804 North Creek Parkway, Suite 100
Bothell, WA 98011

BAL Report 2205123

For BAL use only
Received by: LNW Date: 5/11/22
Work Order ID: Time: 9:42
Project ID:

Client: Hudspeth Land + Water
Contact: Amber Hudspeth
Client Project ID: Drinking Water
Samples Collected By: ALH

PO Number:
Phone: 541.420.2710
Email: amber@HLWcga.com

Mailing Address:
Email Receipt Confirmation? (Yes/No)
BAL PM:

Requested TAT (business days)
- ☐ 20 (standard)
- ☐ 15*
- ☐ 10*
- ☐ 5*
- ☐ Other ____

*Surcharges may apply to expedited TATs

	Sample ID	Collection: Date	Collection: Time	Client Sample Info: Matrix Type	Client Sample Info: Number of Containers	Client Sample Info: Field Filtered? (Yes/No)	Client Sample Info: Preservation Type HCl /HNO_3/Other	BAL Analyses Required: Total Hg, EPA 1631	Methyl Hg, EPA 1630	ICP-MS Metals (specify)	As Species (specify) InOrg, III, V, MMA, DMA	Se Species (specify) Se(IV), Se(VI), SeCN, Uknown	Filtration	Other (specify)	Other (specify)	Comments
1	No Well	050922	1024	W	2	Y					/					Specify Here: arsenic 3/5
2																
3																
4																
5																
6																
7																
8																
9																
10																
	Trip Blank															

Relinquished By:	Date: 05/10/22	Time: 1145	Relinquished By:	Date:	Time:
Received By:	Date: 5/11/22	Time: 9:42	Total Number of Packages:		

Page 1 of 1

List Hazardous Contaminants:

samples@brooksapplied.com | brooksapplied.com

APPENDIX B
EDGE ANALYTICAL TESTING REPORT - FEBRUARY 2, 2022

Burlington, WA *Corporate Laboratory (a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400
Bellingham, WA *Microbiology (b)*
805 Orchard Dr Ste 4 - Bellingham, WA 98225 - 360.715.1212
Portland, OR *Microbiology/Chemistry (c)*
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Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946
Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: North Well
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90387
Collect Date: 12/9/21 10:15
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/17/21	Analyzed by EMSL
1074	ANTIMONY	**ND**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**0.0306**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0050**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**ND**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**4.64**	mg/L	0.10	4	crc	4072 a	300.0	12/15/21	
1030	LEAD	**0.00026 J**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0002	0.002	tjb	4072 a	245.1	12/22/21	
1036	NICKEL	**0.0003 J**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/15/21	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/15/21	
1038	TOTAL NITRATE+NITRITE as N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/15/21	
1045	SELENIUM	**ND**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**192**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**8.4**	NTU	0.10	1	crc	4072 a	180.1	12/14/21 16:05	
	Radiological									
4006	URANIUM	**ND**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**ND**	pCi/L	3	15	rjs		900.0	01/26/22	Analyzed by Pace PA200002-010

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
* Lab Code - lists the laborstory accreditation code plus a letter at the far right to indicate the Edge Analytical lab facility where the analyses was performed.

If you have any questions concerning this report contact us at the above phone number.

FORM: cIOC OR.rpt

Burlington, WA *Corporate Laboratory (a)*
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Bellingham, WA *Microbiology (b)*
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Portland, OR *Microbiology/Chemistry (c)*
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Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: North Well
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90387
Collect Date: 12/9/21 10:15
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	**RESULTS**	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
4100	GROSS BETA	**7.29**	pCi/L	4	50	rjs		900.0	01/26/22	Analyzed by Pace PA200002-010
	Radiological									
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk!	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 2
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90388
Collect Date: 12/9/21 12:45
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/20/21	Analyzed by EMSL
1074	ANTIMONY	**ND**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**0.0025**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0144**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**ND**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**0.21**	mg/L	0.10	4	crc	4072 a	300.0	12/14/21	
1030	LEAD	**0.0008 J**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/14/21	
1036	NICKEL	**0.0010**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 23:53	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/14/21 23:53	
1038	TOTAL NITRATE+NITRITE as N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 23:53	
1045	SELENIUM	**ND**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**42.1**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**3.6**	NTU	0.10	1	crc	4072 a	180.1	12/14/21 16:07	
	Radiological									
4006	URANIUM	**ND**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**ND**	pCi/L	3	15	rjs	156	900.0	01/17/22	Analyzed by Pace
4100	GROSS BETA	**ND**	pCi/L	4	50	rjs	156	900.0	01/17/22	Analyzed by Pace
	Radiological									

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
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Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 2
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90388
Collect Date: 12/9/21 12:45
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk1	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
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EDGE ANALYTICAL

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Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 6
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90389
Collect Date: 12/9/21 11:05
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/20/21	Analyzed by EMSL
1074	ANTIMONY	**ND**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**0.00997**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0139**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**ND**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**1.03**	mg/L	0.10	4	crc	4072 a	300.0	12/14/21	
1030	LEAD	**0.0007 J**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0002	0.002	tjb	4072 a	245.1	12/22/21	
1036	NICKEL	**0.0019**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 23:09	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/14/21 23:09	
1038	TOTAL NITRATE+NITRITE as N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 23:09	
1045	SELENIUM	**0.0008 J**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**128**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**1.2**	NTU	0.10	1	crc	4072 a	180.1	12/14/21 16:12	
	Radiological									
4006	URANIUM	**0.0001 J**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**ND**	pCi/L	3	15	rjs	156	900.0	01/17/22	Analyzed by Pace
4100	GROSS BETA	**ND**	pCi/L	4	50	rjs	156	900.0	01/17/22	Analyzed by Pace
	Radiological									

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 6
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90389
Collect Date: 12/9/21 11:05
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk1	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
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MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 7
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90390
Collect Date: 12/9/21 11:45
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	**RESULTS**	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/20/21	Analyzed by EMSL
1074	ANTIMONY	**0.0018**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**0.0076**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0084**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**ND**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**0.83**	mg/L	0.10	4	crc	4072 a	300.0	12/14/21	
1030	LEAD	**0.00098 J**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0002	0.002	tjb	4072 a	245.1	12/22/21	
1036	NICKEL	**0.0005 J**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 23:31	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/14/21 23:31	
1038	TOTAL NITRATE+NITRITE as N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 23:31	
1045	SELENIUM	**0.0006 J**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**86.7**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**0.0002**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**0.48**	NTU	0.10	1	crc	4072 a	180.1	12/14/21 16:17	
	Radiological									
4006	URANIUM	**0.00008 J**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**ND**	pCi/L	3	15	rjs	156	900.0	01/17/22	Analyzed by Pace
4100	GROSS BETA	**ND**	pCi/L	4	50	rjs	156	900.0	01/17/22	Analyzed by Pace
	Radiological									

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
* Lab Code - lists the laborstory accreditation code plus a letter at the far right to indicate the Edge Analytical lab facility where the analyses was performed.

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FORM: cIOC OR.rpt

Burlington, WA *Corporate Laboratory (a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400

Bellingham, WA *Microbiology (b)*
805 Orchard Dr Ste 4 - Bellingham, WA 98225 - 360.715.1212

Portland, OR *Microbiology/Chemistry (c)*
9725 SW Commerce Cr Ste A2 - Wilsonville, OR 97070 - 503.682.7802

Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 7
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90390
Collect Date: 12/9/21 11:45
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk1	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
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Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 8
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90391
Collect Date: 12/9/21 12:10
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/20/21	Analyzed by EMSL
1074	ANTIMONY	**0.0011**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**0.0036**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0129**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**0.0002 J**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**0.92**	mg/L	0.10	4	crc	4072 a	300.0	12/14/21	
1030	LEAD	**0.0202**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0002	0.002	tjb	4072 a	245.1	12/22/21	
1036	NICKEL	**0.0116**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 22:47	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/14/21 22:47	
1038	TOTAL NITRATE+NITRITE as N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 22:47	
1045	SELENIUM	**ND**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**69.1**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**0.0003**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**16**	NTU	1	1	crc	4072 a	180.1	12/14/21 16:25	
	Radiological									
4006	URANIUM	**0.0004 J**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**11.2**	pCi/L	3	15	rjs	156	900.0	01/17/22	Analyzed by Pace
4100	GROSS BETA	**7.12**	pCi/L	4	50	rjs	156	900.0	01/17/22	Analyzed by Pace
	Radiological									

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Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 8
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90391
Collect Date: 12/9/21 12:10
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk1	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
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1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 9
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90392
Collect Date: 12/9/21 14:00
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/21/21	Analyzed by EMSL
1074	ANTIMONY	**0.00028 J**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**0.0014**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0053**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**ND**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**0.72**	mg/L	0.10	4	crc	4072 a	300.0	12/14/21	
1030	LEAD	**0.0049**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0002	0.002	tjb	4072 a	245.1	12/22/21	
1036	NICKEL	**0.0026**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 22:25	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/14/21 22:25	
1038	TOTAL NITRATE+NITRITE as N	**ND H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 22:25	
1045	SELENIUM	**ND**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**68.7**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**2.2**	NTU	0.10	1	crc	4072 a	180.1	12/14/21 16:28	
	Radiological									
4006	URANIUM	**0.0001 J**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**ND**	pCi/L	3	15	rjs	156	900.0	01/17/22	Analyzed by Pace
4100	GROSS BETA	**ND**	pCi/L	4	50	rjs	156	900.0	01/17/22	Analyzed by Pace
	Radiological									

NOTES:
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Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Well 9
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90392
Collect Date: 12/9/21 14:00
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk1	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
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20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Spring Line
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90393
Collect Date: 12/9/21 14:40
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
1094	ASBESTOS	**ND**	MFL>10um	0.098	7	sb	186	100.2	12/21/21	Analyzed by EMSL
1074	ANTIMONY	**ND**	mg/L	0.001	0.006	bj	4072 a	200.8	12/30/21	
1005	ARSENIC	**ND**	mg/L	0.001	0.010	bj	4072 a	200.8	12/30/21	
1010	BARIUM	**0.0047**	mg/L	0.001	2	bj	4072 a	200.8	12/30/21	
1075	BERYLLIUM	**ND**	mg/L	0.0003	0.004	bj	4072 a	200.8	12/30/21	
1015	CADMIUM	**ND**	mg/L	0.001	0.005	bj	4072 a	200.8	12/30/21	
1020	CHROMIUM	**ND**	mg/L	0.001	0.1	bj	4072 a	200.8	12/30/21	
1024	CYANIDE, AVAILABLE	**ND**	mg/L	0.010	0.2	crc	4072 a	OIA-1677-DW	12/15/21	
1025	FLUORIDE	**ND**	mg/L	0.10	4	crc	4072 a	300.0	12/14/21	
1030	LEAD	**0.0001 J**	mg/L	0.001	0.015	bj	4072 a	200.8	12/30/21	
1035	MERCURY	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/14/21	
1036	NICKEL	**0.0002 J**	mg/L	0.001		bj	4072 a	200.8	12/30/21	
1040	NITRATE-N	**0.21 H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 21:19	
1041	NITRITE-N	**ND H1**	mg/L	0.10	1	crc	4072 a	300.0	12/14/21 21:19	
1038	TOTAL NITRATE+NITRITE as N	**0.21 H1**	mg/L	0.10	10	crc	4072 a	300.0	12/14/21 21:19	
1045	SELENIUM	**ND**	mg/L	0.002	0.05	bj	4072 a	200.8	12/30/21	
1052	SODIUM	**4.2**	mg/L	0.5	200	bj	4072 a	200.7	12/17/21	
1085	THALLIUM	**ND**	mg/L	0.0001	0.002	bj	4072 a	200.8	12/30/21	
0100	TURBIDITY	**0.41**	NTU	0.10	1	crc	4072 a	180.1	12/14/21 16:01	
	Radiological									
4006	URANIUM	**ND**	mg/L	0.001	0.030	bj	4072 a	200.8	12/30/21	
4000	GROSS ALPHA	**ND**	pCi/L	3	15	rjs	156	900.0	01/17/22	Analyzed by Pace
4100	GROSS BETA	**ND**	pCi/L	4	50	rjs	156	900.0	01/17/22	Analyzed by Pace
	Radiological									

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1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

System Name:
System ID Number:
Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: Investigative or Other
Sample Location: Spring Line
County:

Reference Number: 21-46821
Project: Well Sampling

Sample Number:
Lab Number: 21_90393
Collect Date: 12/9/21 14:40
Date Received: 12/10/21
Report Date: 2/2/22
Sampled By: AH, EW
Sampler Phone:
Approved by: anp,bj,mcs,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

EPA#	ANALYTES	RESULTS	UNITS	LRL	MCL	Analyst	Lab Code*	METHOD	Analyzed	COMMENT
	Radium 226	**ND**	pCi/L	1		mk1	156	903.1	01/24/22	Analyzed by Pace
	Radium 228	**ND**	pCi/L	1	5	val		904.0	01/20/22	Analyzed by Pace
	Radium 226,228 (combined)	**ND**	pCi/L	1	5	mk1	156	903.1/904.0	01/24/22	Analyzed by Pace

NOTES:
ND (Not Detected): indicates that the parameter was not detected above the Lower Reporting limit (LRL).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
* Lab Code - lists the laborstory accreditation code plus a letter at the far right to indicate the Edge Analytical lab facility where the analyses was performed.

If you have any questions concerning this report contact us at the above phone number.

FORM: cIOC OR.rpt

APPENDIX C
EDGE ANALYTICAL TESTING REPORT - MAY 27, 2022

EDGE ANALYTICAL

Burlington, WA *Corporate Laboratory (a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400

Bellingham, WA *Microbiology (b)*
805 Orchard Dr Ste 4 - Bellingham, WA 98225 - 360.715.1212

Portland, OR *Microbiology/Chemistry (c)*
9725 SW Commerce Cr Ste A2 - Wilsonville, OR 97070 - 503.682.7802

Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

Draft 5.27.22 MRA

Data Report

Client Name: Hudspeth Land and Water
7485 SW Joshua Ct
Powell Butte, OR 97753

Reference Number: **22-15633**
Project: Drinking Water

Report Date: 5/27/22

Date Received: 5/10/22
Approved by: anp,bj,crc,jnr,ljh,mra,pap,rlv,tjb
Authorized by:

Michelle R Angland
Lab Manager, Bend

Sample Description: Drinking Water North Well — Matrix W — Sample Date: 5/9/22 10:24 am
Lab Number: 29937 — Sample Comment: — Collected By: Amber

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
E-10617	**TURBIDITY**	1.9 H3	0.10		**NTU**	1.0	180.1	c	5/12/22	RLV	cturb_220512	
7429-90-5	**ALUMINUM**	ND	0.010	0.004	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-89-6	**IRON**	0.11	0.05	0.001	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-96-5	**MANGANESE**	0.0157	0.001	0.0002	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7440-50-8	**COPPER**	ND	0.002	0.00027	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-22-4	**SILVER**	ND	0.01	0.00013	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-66-6	**ZINC**	ND	0.0025	0.0001	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
16887-00-6	**CHLORIDE**	106	0.1	0.07	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
16984-48-8	**FLUORIDE**	4.92	0.1	0.037	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
14808-79-8	**SULFATE**	239	0.2	0.025	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
E-10162	**TOTAL SUSPENDED SOLIDS**	ND NN	2		**mg/L**	1.0	I-3765-85	c	5/13/22	PAP	ctss_220513	
NA	**CORROSIVITY**	-1.08			**SI**	1.0	SM203	a	5/27/22	BJ	COR_220527	
E-11712	**COLOR**	ND H3	5		**Color Units**	1.0	SM2120 B	c	5/11/22	PAP	ccolor_220511	pH: 4.5
E-11734	**ODOR**	ND			**TON**	1.0	SM2150	a	5/13/22	CRC	ODOR_220513	Temp(C) : 40.7
E-14506	**ALKALINITY**	58.8	2		**mg CaCO3/L**	2.0	SM2320 B	a	5/16/22	ADL	ALK_220516	
E-10139	**HYDROGEN ION (pH)**	8.24 H5			**pH Units**	1.0	SM4500-H+ B		5/10/22	KRH	EpH_220510	Temp (C) : 14.3
14265-44-2	**ORTHO-PHOSPHATE**	0.04 H3	0.01	0.0073	**mg/L**	1.0	SM4500-P F	c	5/11/22	JNR	cpo4_220511	
7723-14-0	**TOTAL PHOSPHORUS**	0.039	0.010	0.0021	**mg/L**	1.0	SM4500-P F/SM4500-P B(5)	a	5/20/22	TJB	TPHOS_220520	
18496-25-8	**SULFIDE AS HYDROGEN SULFIDE**	ND	0.05	0.044	**mg/L**	1.0	SM4500-S2 F	a	5/11/22	TJB	h2s_220511a	
	TOTAL INORGANIC CARBON	10.31	0.5		**mg/L**	1.0	SM5310 B	a	5/12/22	BJ	TIC_220512A	
E-10195	**TOTAL ORGANIC CARBON**	0.20	0.15	0.045	**mg/L**	1.0	SM5310 B	a	5/14/22	BJ	TOC_220513A	

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

If you have any questions concerning this report contact us at the above phone number.

Form: cRslt_2.rpt

EDGE ANALYTICAL

Reference Number: **22-15633**
Report Date: 5/27/22

Data Report

Sample Description: Drinking Water Well 2 | Matrix W | Sample Date: 5/9/22 2:05 pm
Lab Number: 29938 | Sample Comment: | Collected By: Amber

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
E-10617	**TURBIDITY**	3.3 H1	0.10		**NTU**	1.0	180.1	c	5/12/22	RLV	cturb_220512	
7429-90-5	**ALUMINUM**	0.03	0.010	0.004	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-89-6	**IRON**	0.75	0.05	0.001	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-96-5	**MANGANESE**	2.03	0.001	0.0002	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7440-50-8	**COPPER**	0.002	0.002	0.00027	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-22-4	**SILVER**	ND	0.01	0.00013	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-66-6	**ZINC**	0.0171	0.0025	0.0001	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
16887-00-6	**CHLORIDE**	18.2	0.1	0.07	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
14808-79-8	**SULFATE**	15.0	0.2	0.025	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
E-10162	**TOTAL SUSPENDED SOLIDS**	4.0 NN	2		**mg/L**	1.0	I-3765-85	c	5/13/22	PAP	ctss_220513	
NA	**CORROSIVITY**	-0.39			**SI**	1.0	SM203	a	5/27/22	BJ	COR_220527	
E-11712	**COLOR**	10	5		**Color Units**	1.0	SM2120 B	c	5/11/22	PAP	ccolor_220511	pH: 7.0
E-11734	**ODOR**	ND	1		**TON**	1.0	SM2150	a	5/11/22	CRC	ODOR_220511	Temp (C): 40.4
E-14506	**ALKALINITY**	225	2		**mg CaCO3/L**	2.0	SM2320 B	a	5/16/22	ADL	ALK_220516	
E-10139	**HYDROGEN ION (pH)**	7.40 H5			**pH Units**	1.0	SM4500-H+ B		5/10/22	KRH	EpH_220510	Temp (C) : 13.7
14265-44-2	**ORTHO-PHOSPHATE**	0.29	0.01	0.0073	**mg/L**	1.0	SM4500-P F	c	5/11/22	JNR	cpo4_220511	
7723-14-0	**TOTAL PHOSPHORUS**	0.321	0.010	0.0021	**mg/L**	1.0	SM4500-P F/SM4500-P B(5)	a	5/20/22	TJB	TPHOS_220520	
18496-25-8	**SULFIDE AS HYDROGEN SULFIDE**	ND	0.05	0.044	**mg/L**	1.0	SM4500-S2 F	a	5/11/22	TJB	h2s_220511a	
	TOTAL INORGANIC CARBON	49.34	0.5		**mg/L**	1.0	SM5310 B	a	5/12/22	BJ	TIC_220512A	
E-10195	**TOTAL ORGANIC CARBON**	0.99	0.15	0.045	**mg/L**	1.0	SM5310 B	a	5/14/22	BJ	TOC_220513A	

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

EDGE ANALYTICAL

Reference Number: **22-15633**
Report Date: 5/27/22

Data Report

Sample Description: Drinking Water Well 6 | Matrix W | Sample Date: 5/9/22 12:05 pm
Lab Number: 29939 | Sample Comment: | Collected By: Amber

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
E-10617	**TURBIDITY**	1.2 H1	0.10		NTU	1.0	180.1	c	5/12/22	RLV	cturb_220512	
7429-90-5	**ALUMINUM**	0.02	0.010	0.004	mg/L	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-89-6	**IRON**	0.12	0.05	0.001	mg/L	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-96-5	**MANGANESE**	0.715	0.001	0.0002	mg/L	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7440-50-8	**COPPER**	0.0052	0.002	0.00027	mg/L	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-22-4	**SILVER**	ND	0.01	0.00013	mg/L	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-66-6	**ZINC**	ND	0.0025	0.0001	mg/L	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
16887-00-6	**CHLORIDE**	77.0	0.1	0.07	mg/L	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
14808-79-8	**SULFATE**	85.0	0.2	0.025	mg/L	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
E-10162	**TOTAL SUSPENDED SOLIDS**	ND NN	2		mg/L	1.0	I-3765-85	c	5/13/22	PAP	ctss_220513	
NA	**CORROSIVITY**	-1.06			SI	1.0	SM203	a	5/27/22	BJ	COR_220527	
E-11712	**COLOR**	15	5		Color Units	1.0	SM2120 B	c	5/11/22	PAP	ccolor_220511	pH: 4.5
E-11734	**ODOR**	1.06	1		TON	1.0	SM2150	a	5/11/22	CRC	ODOR_220511	Temp (C): 39.6 sulfur was smelled
E-14506	**ALKALINITY**	108	2		mg CaCO3/L	2.0	SM2320 B	a	5/16/22	ADL	ALK_220516	
E-10139	**HYDROGEN ION (pH)**	7.37 H5			pH Units	1.0	SM4500-H+ B		5/10/22	KRH	EpH_220510	Temp (C) : 12.5
14265-44-2	**ORTHO-PHOSPHATE**	0.47 H1	0.01	0.0073	mg/L	1.0	SM4500-P F	c	5/11/22	JNR	cpo4_220511	
7723-14-0	**TOTAL PHOSPHORUS**	0.508	0.020	0.0042	mg/L	2.0	SM4500-P F/SM4500-P B(5)	a	5/20/22	TJB	TPHOS_220520	
18496-25-8	**SULFIDE AS HYDROGEN SULFIDE**	ND	0.05	0.044	mg/L	1.0	SM4500-S2 F	a	5/11/22	TJB	h2s_220511a	
	TOTAL INORGANIC CARBON	22.56	0.5		mg/L	1.0	SM5310 B	a	5/12/22	BJ	TIC_220512A	
E-10195	**TOTAL ORGANIC CARBON**	1.01	0.15	0.045	mg/L	1.0	SM5310 B	a	5/14/22	BJ	TOC_220513A	

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

EDGE ANALYTICAL

Reference Number: **22-15633**
Report Date: 5/27/22

Data Report

Sample Description: Drinking Water Well 7 | Matrix W | Sample Date: 5/9/22 11:24 am
Lab Number: 29940 | Sample Comment: | Collected By: Amber

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
E-10617	**TURBIDITY**	0.7 H1	0.10		**NTU**	1.0	180.1	c	5/12/22	RLV	cturb_220512	
7429-90-5	**ALUMINUM**	0.06	0.010	0.004	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-89-6	**IRON**	0.42	0.05	0.001	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-96-5	**MANGANESE**	0.796	0.001	0.0002	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7440-50-8	**COPPER**	0.0247	0.002	0.00027	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-22-4	**SILVER**	ND	0.01	0.00013	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-66-6	**ZINC**	0.0069	0.0025	0.0001	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
16887-00-6	**CHLORIDE**	68.4	0.1	0.07	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
14808-79-8	**SULFATE**	74.4	0.2	0.025	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
E-10162	**TOTAL SUSPENDED SOLIDS**	ND NN	2		**mg/L**	1.0	I-3765-85	c	5/13/22	PAP	ctss_220513	
NA	**CORROSIVITY**	-0.42			**SI**	1.0	SM203	a	5/27/22	BJ	COR_220527	
E-11712	**COLOR**	15	5		**Color Units**	1.0	SM2120 B	c	5/11/22	PAP	ccolor_220511	pH: 4.5
E-11734	**ODOR**	ND	1		**TON**	1.0	SM2150	a	5/11/22	CRC	ODOR_220511	Temp (C): 39.4
E-14506	**ALKALINITY**	109	1		**mg CaCO3/L**	1.0	SM2320 B	a	5/16/22	ADL	ALK_220516	
E-10139	**HYDROGEN ION (pH)**	8.08 H5			**pH Units**	1.0	SM4500-H+ B		5/10/22	KRH	EpH_220510	Temp (C) : 12.7
14265-44-2	**ORTHO-PHOSPHATE**	0.43 H1	0.01	0.0073	**mg/L**	1.0	SM4500-P F	c	5/11/22	JNR	cpo4_220511	
7723-14-0	**TOTAL PHOSPHORUS**	0.481	0.020	0.0042	**mg/L**	2.0	SM4500-P F/SM4500-P B(5)	a	5/20/22	TJB	TPHOS_220520	
18496-25-8	**SULFIDE AS HYDROGEN SULFIDE**	ND	0.05	0.044	**mg/L**	1.0	SM4500-S2 F	a	5/11/22	TJB	h2s_220511a	
	TOTAL INORGANIC CARBON	22.05	0.5		**mg/L**	1.0	SM5310 B	a	5/12/22	BJ	TIC_220512A	
E-10195	**TOTAL ORGANIC CARBON**	0.87	0.15	0.045	**mg/L**	1.0	SM5310 B	a	5/14/22	BJ	TOC_220513A	

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

Reference Number: **22-15633**
Report Date: 5/27/22

Data Report

Sample Description: Drinking Water Well 9 | Matrix W | Sample Date: 5/9/22 1:37 pm
Lab Number: 29941 | Sample Comment: | Collected By: Amber

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
E-10617	**TURBIDITY**	1.55 H1	0.10		NTU	1.0	180.1	c	5/12/22	RLV	cturb_220512	
7429-90-5	**ALUMINUM**	0.04	0.010	0.004	mg/L	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-89-6	**IRON**	0.17	0.05	0.001	mg/L	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-96-5	**MANGANESE**	0.0420	0.001	0.0002	mg/L	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7440-50-8	**COPPER**	0.0246	0.002	0.00027	mg/L	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-22-4	**SILVER**	ND	0.01	0.00013	mg/L	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-66-6	**ZINC**	0.0036	0.0025	0.0001	mg/L	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
16887-00-6	**CHLORIDE**	25.8	0.1	0.07	mg/L	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
14808-79-8	**SULFATE**	ND	0.2	0.025	mg/L	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
E-10162	**TOTAL SUSPENDED SOLIDS**	ND NN	2		mg/L	1.0	I-3765-85	c	5/13/22	PAP	ctss_220513	
NA	**CORROSIVITY**	-0.98			SI	1.0	SM203	a	5/27/22	BJ	COR_220527	
E-11712	**COLOR**	25	5		Color Units	1.0	SM2120 B	c	5/11/22	PAP	ccolor_220511	pH: 6.5
E-11734	**ODOR**	ND			TON	1.0	SM2150	a	5/13/22	CRC	ODOR_220513	Temp (C) : 40.1
E-14506	**ALKALINITY**	161	2		mg CaCO3/L	2.0	SM2320 B	a	5/20/22	ADL	ALK_220520	
E-10139	**HYDROGEN ION (pH)**	8.17 H5			pH Units	1.0	SM4500-H+ B		5/10/22	KRH	EpH_220510	Temp (C) : 12.8
14265-44-2	**ORTHO-PHOSPHATE**	0.43	0.01	0.0073	mg/L	1.0	SM4500-P F	c	5/11/22	JNR	cpo4_220511	
7723-14-0	**TOTAL PHOSPHORUS**	0.470	0.020	0.0042	mg/L	2.0	SM4500-P F/SM4500-P B(5)	a	5/20/22	TJB	TPHOS_220520	
18496-25-8	**SULFIDE AS HYDROGEN SULFIDE**	0.06	0.05	0.044	mg/L	1.0	SM4500-S2 F	a	5/11/22	TJB	h2s_220511a	
	TOTAL INORGANIC CARBON	34.41	0.5		mg/L	1.0	SM5310 B	a	5/12/22	BJ	TIC_220512A	
E-10195	**TOTAL ORGANIC CARBON**	1.60	0.15	0.045	mg/L	1.0	SM5310 B	a	5/14/22	BJ	TOC_220513A	

Notes:

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PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

EDGE ANALYTICAL

Reference Number: **22-15633**
Report Date: 5/27/22

Data Report

Sample Description: Drinking Water Springline | Matrix W | Sample Date: 5/9/22 2:34 pm
Lab Number: 29942 | Sample Comment: | Collected By: Amber

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
E-10617	**TURBIDITY**	3.6 H1	0.10		**NTU**	1.0	180.1	c	5/12/22	RLV	cturb_220512	
7429-90-5	**ALUMINUM**	0.59	0.010	0.004	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-89-6	**IRON**	0.37	0.05	0.001	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7439-96-5	**MANGANESE**	0.0045	0.001	0.0002	**mg/L**	1.0	200.7	a	5/18/22	BJ	200.7_220518B	
7440-50-8	**COPPER**	0.0028	0.002	0.00027	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-22-4	**SILVER**	ND	0.01	0.00013	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
7440-66-6	**ZINC**	0.0065	0.0025	0.0001	**mg/L**	1.0	200.8	a	5/13/22	BJ	200.8_220513A2	
16887-00-6	**CHLORIDE**	0.3	0.1	0.07	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
14808-79-8	**SULFATE**	0.5	0.2	0.025	**mg/L**	1.0	300.0	a	5/12/22	ADL	IC06_220511A	
E-10162	**TOTAL SUSPENDED SOLIDS**	ND NN	2		**mg/L**	1.0	I-3765-85	c	5/13/22	PAP	ctss_220513	
NA	**CORROSIVITY**	-2.81			**SI**	1.0	SM203	a	5/27/22	BJ	COR_220527	
E-11712	**COLOR**	ND	5		**Color Units**	1.0	SM2120 B	c	5/11/22	PAP	ccolor_220511	pH: 4.5
E-11734	**ODOR**	ND	1		**TON**	1.0	SM2150	a	5/11/22	CRC	ODOR_220511	Temp (C): 40.4
E-14506	**ALKALINITY**	37.7	1		**mg CaCO3/L**	1.0	SM2320 B	a	5/20/22	ADL	ALK_220520	
E-10139	**HYDROGEN ION (pH)**	6.47 H5			**pH Units**	1.0	SM4500-H+ B		5/10/22	KRH	EpH_220510	Temp (C) : 11.5
14265-44-2	**ORTHO-PHOSPHATE**	0.06	0.01	0.0073	**mg/L**	1.0	SM4500-P F	c	5/11/22	JNR	cpo4_220511	
7723-14-0	**TOTAL PHOSPHORUS**	0.072	0.010	0.0021	**mg/L**	1.0	SM4500-P F/SM4500-P B(5)	a	5/20/22	TJB	TPHOS_220520	
18496-25-8	**SULFIDE AS HYDROGEN SULFIDE**	0.06	0.05	0.044	**mg/L**	1.0	SM4500-S2 F	a	5/11/22	TJB	h2s_220511a	
	TOTAL INORGANIC CARBON	7.67	0.5		**mg/L**	1.0	SM5310 B	a	5/12/22	BJ	TIC_220512A	
E-10195	**TOTAL ORGANIC CARBON**	1.27	0.15	0.045	**mg/L**	1.0	SM5310 B	a	5/14/22	BJ	TOC_220513A	

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor