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Department of Environmental Quality

Statewide Groundwater Quality Monitoring Program:

Southern Deschutes County – 2023-2024

DEQ26-LAB-0032-TR (Rev. 1.0)

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Executive summary

Oregon’s overarching goal for groundwater quality is to prevent contamination of Oregon’s groundwater resource while striving to conserve and restore this resource and to maintain the high quality of Oregon’s groundwater resource for present and future uses (ORS 468B.155). Oregon DEQ’s statewide groundwater quality monitoring program contributes to this goal by assessing the quality of groundwater across the state and identifying areas with-widespread nonpoint source contamination. The goals of the statewide groundwater monitoring program are to evaluate existing groundwater conditions, identify emerging groundwater quality problems and inform groundwater users of potential risks from contamination.

The Southern Deschutes County study area was selected based on concerns about shallow groundwater contamination in an area of high septic system and drinking water well use and an interest in collecting updated groundwater quality samples to compare with previous studies.

In spring of 2023 and 2024, DEQ collected water samples from 100 wells in the Southern Deschutes County around La Pine. One of the sampled wells was a public water supply. All others were domestic drinking water wells. 20 of the wells were sampled in both spring and fall of 2023. 12 of the wells sampled for this project were sampled in previous decades by DEQ. Results from the study are summarized below in Table 1 of the report:

- Nitrate was present in 65% of the 100 wells sampled. Eight wells had detections of nitrate above 3 mg/L including two wells with detections exceeding the EPA drinking water standard of 10 mg/L.
- Arsenic was detected in 68% of wells sampled. No wells had levels above the drinking water standard of 10 µg/L.
- Manganese was detected in 77% of wells sampled. Six wells had concentrations over the Health Based Screening Level of 300 µg/L.
- Aluminum was detected in 26% of wells sampled. Ten wells exceeded the 70 µg/L Health Based Screening Level.
- Lead was detected in 38% of the wells sampled. Only one well had a concentration over the lead drinking water standard of 15 µg/L.
- Total coliform bacteria were detected in 3% of the 100 wells. E. coli was not detected in any well.
- The pesticides atrazine and/or its breakdown product were detected at low levels in six wells and 2,6-Dichlorobenzamide was detected in two wells.
- Pharmaceuticals were detected in 16 separate wells. Three wells had two separate pharmaceutical detections in addition to nitrate detections.
- Two volatile organic compounds (VOCs) were detected in two different wells.

Well users who participated in the study received laboratory reports and educational resources about common groundwater contaminants and domestic well and septic tank maintenance. For questions related to health concerns, participants were referred to the Oregon Health Authority Domestic Well Safety program toxicologists as well as county environmental and public health representatives to learn about water treatment options and well stewardship. In addition, DEQ laboratory staff shared results with interested parties.

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1. Background

Groundwater is a vital resource in Oregon. Over 600,000 Oregonians rely on private wells for their drinking water (Maupin et al., 2014). Public water systems, the agricultural community and industry all rely on groundwater to meet their operational needs. Oregon's rivers and streams depend on groundwater for the maintenance of summer flows and cooling temperatures for fish populations and for recreation. Groundwater is a vast and critical water reserve that can be used when surface water resources are inadequate to meet demands. It is important that Oregon's groundwater remain protected from contamination.

Oregon's overarching goal for groundwater quality is "to prevent contamination of Oregon's groundwater resource while striving to conserve and restore this resource and to maintain the high quality of Oregon's groundwater resource for present and future uses" (ORS 468B.155). Oregon DEQ's statewide groundwater quality monitoring program is in place to identify and characterize groundwater quality, identify areas that are vulnerable to contamination, identify long term trends in quality, determine ambient groundwater quality and evaluate any emerging concerns. Recent groundwater quality studies include the Mid-Rogue Basin (2011 and 2015), North Coast (2015-2016), the Walla Walla Basin (2016), the Mid-Willamette Basin (2017), Harney County (2018), and the Klamath Basin (2019-2022) in addition to this study and ongoing groundwater monitoring in the three Groundwater Management Areas (Lower Umatilla Basin, Northern Malheur County, and the Southern Willamette Valley).

1.1 Statewide groundwater monitoring

The Oregon Department of Environmental Quality has conducted groundwater quality monitoring in various parts of the state since the agency's inception. In groundwater quality studies since 2015, DEQ has sampled and analyzed groundwater collected in two seasons from 60 to 100 wells in each groundwater area of interest.

Informed by previous investigations and guided by the goals of the Statewide Groundwater Monitoring Program, the objectives of the 2023-2024 Southern Deschutes County groundwater study were:

1. To collect high-quality data on nitrate, arsenic, coliform bacteria, pesticides, volatile organic compounds, pharmaceuticals and personal care products in groundwater throughout the study area
2. To identify areas of groundwater contamination related to these parameters
3. To inform well water users of the results of this study and provide information regarding potential risks to human health
4. To identify areas needing additional investigation and help focus efforts to prevent further contamination
5. To help establish long-term trending data and describe changes over time.

The following work products are outside the scope of this study and report:

- Hydrogeologic characterization of the study area and contamination
- Investigation of the sources of contamination
- Health risk assessments.

Groundwater reports that DEQ's Laboratory and Environmental Assessment Division published from 2015 through 2021 summarized and provided context for the analytical data but had limited hydrogeological data interpretation. For this report, DEQ's groundwater protection program staff co-authored the report and provided additional data interpretation.

1.2 Study area description

The Southern Deschutes County study area was selected based on concerns about shallow groundwater contamination in an area of high septic system and drinking water well use and an interest in collecting updated groundwater quality samples to compare with previous study results. Other factors considered in the selection of this area for study included current available data from Real Estate Transactions, results from previous DEQ and USGS studies in the area and detections of contaminants in area Public Water Systems (PWS) that rely on groundwater.

Contamination in Southern Deschutes County is known to be influenced by high density development using various onsite sewage treatment systems. Of primary concern is that most households in the area are served by drinking water wells that may draw from the same aquifer that is contaminated by individual household domestic sewage treatment systems. In some cases, there may not be sufficient separation between the same household's septic system and drinking water well or that of their neighbor.

In March of 2023, the Oregon DEQ collected and analyzed water samples from 60 wells in the Southern Deschutes County area of central Oregon. Twenty of those wells were re-sampled in October 2023. Forty new wells were selected for sampling in March and April of 2024 for a total of 100 wells sampled. Twelve of the 100 wells sampled for this project were sampled in previous years by DEQ. All but one of the sampled wells were domestic drinking water wells. One sampled location was a public water supply well serving a campground.

1.2.1 Study area boundary

The Southern Deschutes County groundwater study extends from just south of the Deschutes County border, through La Pine, to Sunriver, approximately 13 miles south of Bend, Oregon. The Little Deschutes River meanders north through the study area and joins the Deschutes River in the Sunriver area. The land surrounding residential developments in the area is primarily forested.

Figure 1 shows the area's location within Oregon, and identifies wells tested with the corresponding DEQ well ID number. Well numbers 1 through 88 are new wells tested in this study. Wells with numbers above 88 are locations from previous DEQ studies. A shallow aquifer defined in a 1980 study (Sweet, 1980) is present in the lower half of the study area and shown in light blue-green in Figure 1.

Wells used in the study were selected from a pool of well-owners who volunteered to participate in this project. DEQ used the EPA EJSCREEN (an environmental justice screening and mapping tool that utilizes standard and nationally consistent census data to highlight places that may have higher environmental burdens and vulnerable populations) to identify areas with higher percentages of low-income households, residents of color, linguistically isolated populations, and populations aged over 65 or under 5 years of age. DEQ included these areas in solicitations (with translated materials) for project participant volunteers, in an effort to include demographically sensitive populations.

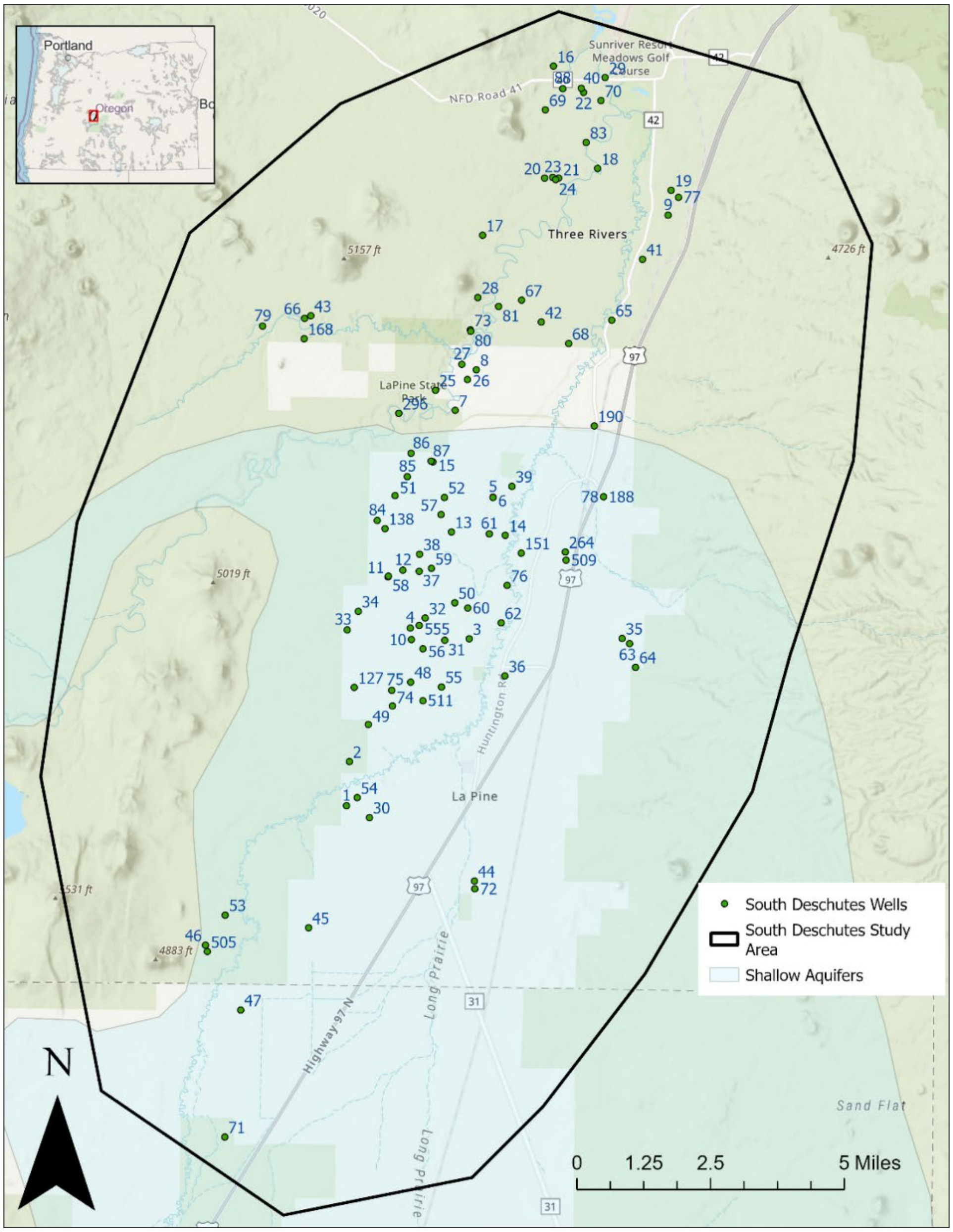

Figure 1. Location of wells within Southern Deschutes County study area.

1.2.2 Geology

The study area is located within the La Pine subbasin of the Upper Deschutes river basin which is bounded by the Cascade Range to the west and the Newberry volcano to the east. Land surface within the study area is covered with Quaternary-aged sedimentary deposits, reworked glacial deposits, and volcanic rocks of the Cascade Range and Newberry Volcano.

Specifically, most of the study area, including the central and southern portion, is covered with sand, silt, and gravel primarily from reworked late Pleistocene glacial outwash deposits and basin-filling deposits from several sources. The eastern portion is covered with Holocene and Pleistocene basaltic lava flows and lesser amounts of Pleistocene pyroclastic flow deposits of the Cascade Range and Newberry Volcano. The northwest portion of the study area is covered by Holocene and Pleistocene basaltic andesite lava flows from the Cascade Range and smaller amounts of Holocene and Pleistocene volcanic vent deposits of the Cascade Range and Newberry Volcano. The western and southwestern portion of the study area includes Pliocene to Pleistocene basaltic andesite lava flows, and volcanic vent deposits (e.g., cinders, bombs, blocks, domes, and lava flows (Lite, 2002).

1.2.3 Hydrogeology

Most groundwater within the Upper Deschutes basin originates as precipitation and snowmelt in the Cascade Range (Gannett, 2001). Highly permeable young volcanic rocks of the Cascade Range and Deschutes Formation form the principal regional aquifers. The Deschutes Formation consists of a variety of late Miocene to Pliocene aged volcanic and sedimentary deposits (Lite, 2002).

Groundwater infiltrates highly permeable volcanic rocks in the Cascades, moves east into the basin, and then generally north through permeable volcanic formations. Approximately half of this groundwater discharges to spring-fed streams near the Cascades, while the remainder continues north primarily through rocks of the Deschutes Formation and eventually encounters the low-permeability John Day Formation where it is forced to surface and discharge to streams near the confluence of the Deschutes, Crooked, and Metolius Rivers (Gannett, 2001).

A substantial thickness of unconsolidated sediment of fluvial and lacustrine origin is present in the subbasin around La Pine. The underlying bedrock of fractured basalt, interflow zones, and coarse-grained volcaniclastic sediments are generally highly productive water bearing units. The shallow Quaternary fine to coarse sand, fine to coarse gravel and cinder fluvial deposits are particularly productive. Most wells in the area are screened in the fluvial deposits. Soils are highly porous and permeable. Because of the intercalated and discontinuous nature of the fluvial and lacustrine deposits, the shallow alluvial aquifer is considered unconfined (Deschutes Co., 1999 and Caldwell, 1997).

A review of the water-bearing geology of the wells sampled in this study (Appendix A) indicates that most wells draw water from shallow sands and gravels with water levels from 4 to 100 feet below grade. Fractured basalt is more commonly associated with the deeper wells in the study area. Surface ponding of groundwater is not uncommon in wet weather months (Hurley, 2025). The riparian area along the Little Deschutes River includes some wetlands.

Groundwater temperatures are low, generally 42.5 to 48.2°F with a high dissolved oxygen content of 3 to 6 mg/L. Groundwater table elevation measurements indicate groundwater flow is generally northeastward west of the Deschutes River and northwestward east of the Little Deschutes River. In the north portion of the study area, flow is northeastward. Stream gauging shows that the Deschutes and Little Deschutes rivers receive water from groundwater in the area. Spring River and Fall River are fed by springs from fractured volcanic rocks (Deschutes Co., 1999). The Little Deschutes River is estimated to gain 9.3 cubic feet per second per mile between Gilchrist and the confluence with the Deschutes River (Gannett, 2001)

Groundwater levels are declining in the southern Deschutes county primarily as a result of below normal precipitation in recent years. In March 2026, the Oregon Water Resources Department gave a presentation to the Deschutes County Commissioners in which they described declining water levels of 15 to 20 feet in multiple long term observations wells in the La Pine area in addition to an increase in well deepenings and replacements (Kemper, 2026).

OWRD operates a Dry Well Reporting database as well as the Well Abandonment, Repair, and Replacement Fund (WARRF) which provides financial assistance to low to moderate income homeowners experiencing well water supply issues including declining water levels. Both programs have seen high concentrations of activity in southern Deschutes County. A heat map produced by OWRD illustrates an area of approximately 300 reports of dry or nearly dry wells in the La Pine area since 2021, and the true number of dry wells is likely much higher. Activity in both programs corroborates the observed declines mentioned above (OWRD, 2026).

1.2.4 Land use

Land use in the study area is primarily forested with a few agricultural fields and dense residential development in the rural areas outside the small city of La Pine. About 15,000 lots of one-half to one acre were platted in the 1960s and 1970, prior to Oregon's land use planning laws. Projections in 2008 were for 9,700 homes served by onsite (septic) systems and domestic wells in rural areas of this region by 2025. In 2025, the number of developed lots was reported at 7,085 with 1,576 vacant and potentially buildable lots available. The potential number of onsite systems needing upgrades to nitrogen-reducing systems was estimated at 5,800 properties (Cleveland, 2025). Tourism and outdoor recreation are popular in the area (Deschutes Co., 2008).

The population of La Pine, Oregon was 2,512 in the 2020 census. Median household income was $54,946 and unemployment rate was 40.4%. La Pine's website estimates an unincorporated population of 20,000.

1.2.5 Climate

La Pine and Sunriver are located in the high desert region of central Oregon, approximately 4,200 feet above mean sea level. Summers in the area are short, warm, dry and mostly clear and the winters are very cold, snowy and partly cloudy. Weatherspark.com reports temperatures range from below zero to mid-50°F in the winter and 50 to 90°F in the summers, with averages of 24 to 37°F in December and 49 to 80°F in July. USClimatedata.com reports average annual precipitation is 19.52 inches and average annual snowfall is 74 inches.

1.3 Previous groundwater quality efforts

The following sections summarize groundwater quality studies and actions in the area over several decades to provide context for the findings of the 2023-2024 study.

1.3.1 DEQ, USGS, Deschutes County groundwater quality studies and actions

1970s: DEQ conducted sampling of 46 domestic wells in the La Pine area in 1978 and 1979 to evaluate shallow groundwater quality. Seventeen percent of the wells had nitrate concentrations above the EPA drinking water standard (otherwise known as maximum contamination level or MCL) of 10 mg/L. This study was followed by further studies conducted by Century West Engineering Corporation in 1981-1982, which found similar nitrate concentrations with a high of 41 mg/L, primarily in the La Pine core business area. The study also showed that nitrate concentrations were lower in areas with no housing development. These findings led to installation of a sewage collection and treatment system for the core business area of La Pine. At the time, DEQ also noted localized impacts at the Shields Septic Disposal area seven miles south of La Pine but concluded that it did not have a regional influence (Cole, 2006).

1990s: In May and July of 1993, DEQ sampled 39 wells in the rural areas around La Pine for a full suite of analytes including VOCs, pesticides, metals, common ions, nutrients and physical parameters. In this study, nitrate was detected in 36 wells (92%). Only four wells (10%) had concentrations above the MCL of 10 mg/L, an additional 10 wells (25%) had concentrations above 3 mg/L. The pesticide atrazine was detected at low levels in five wells, three of which occurred in wells where dicamba was also detected. 1,2-dichloroethane was detected above the MCL in one well and various VOCs were detected in seven (18%) other wells (Cole, 2006).

Follow-up testing by DEQ was conducted in 1994 and 1995 for 120 wells. In this period, only 13 (10%) of the wells tested had nitrate concentrations above background levels of 3 mg/L. No wells had levels above the MCL.

2000s: In 1999, an EPA grant was secured for the USGS, DEQ, and Deschutes County Environmental Health Department to conduct a five-year demonstration project. The goal was to determine an optimal development density by using innovative denitrification on-site technology, replacing existing systems, monitoring groundwater quality, and conducting 3-D modelling. The project tested 15 types of on-site systems, with 1-5 monitoring wells each (Cole, 2006).

Results of water quality sampling at system discharge points during the demonstration project indicated that of the 63 organic wastewater compounds tested , 45 were detected in 21 samples of wastewater. Nine organic wastewater compounds were detected at low concentrations in groundwater samples collected from monitoring wells located as close as 19 feet from the discharge point. These included caffeine, cholesterol, TCEP (tris(2-chloroethyl)phosphate), TDCP (tris(dichloroisopropyl)phosphate), DEET (N,N-diethyl-*meta*-touamide), PCE (tetrachloroethene), AHTN (acetyl-hexamethyl-tetrahydro-naphthalene), hexahydrohexamethyl-cyclopentabenzopyran and tributyl phosphate. Of 18 pharmaceuticals tested in one area, eight were detected in the wastewater effluent (including 120 µg/L acetaminophen) but only three were detected in the downgradient groundwater wells (acetaminophen, sulfamethoxazole, and caffeine). Coliphage (viruses that infect coliform bacteria) were detected at high concentrations in the wastewater but low concentrations in downgradient groundwater wells, indicating attenuation in soils (Hinkle, 2009).

The USGS model developed following the demonstration project indicated that, if all platted lots were developed using conventional on-site wastewater systems, that nitrate concentrations would exceed drinking water standards over an area of 9,400 acres (Morgan, 2007).

In 2007, USGS produced a report suggesting that the Deschutes and Little Deschutes rivers were vulnerable to contamination from septic system wastewater discharging through the aquifer to the rivers (Hinkle, 2007).

Deschutes County amended their Comprehensive Plan in 2000 and 2003 to address development in the area to protect groundwater quality. DEQ amended state rules in 2005 to allow alternative treatment technologies (ATTs) for onsite systems. Deschutes County adopted ordinances in 2008 to require upgrading of all existing septic systems in the area but voters overturned this Local Rule in 2009. The county continues to replace aging septic systems with upgraded systems and requires advanced onsite wastewater treatment systems for new construction, major repairs or residential alterations and new connections (Deschutes Co., 2025). However, many standard septic systems still exist from older development with total nitrogen outputs roughly three times higher than newer systems utilizing alternative treatment technologies. These older standard systems continue to be large contributors to nitrate loading of the groundwater until they fail and are replaced with alternative treatment technology systems.

1.3.2 Real estate transaction domestic well testing

Since 1989, Oregon statute (ORS 448.271) requires that groundwater wells that are used for domestic purposes be sampled for nitrate and bacteria when a house is sold or transferred. Requirements for arsenic testing were added in 2009. Additional requirements for lead testing, and notification to tenants of well water quality within Groundwater Quality Management Areas, were added in 2025 (ORS 90.321), effective 1/1/2027. The Oregon Health Authority houses this data.

Real Estate Transaction data (from OHA DWTA-RET database 1989-2020) in groundwater in southern Deschutes County highlights an area of elevated nitrate in a developed area just north of La Pine (Figure 2). The OHA RET data for arsenic in groundwater shows mostly low levels of arsenic in the study area (Figure 3).

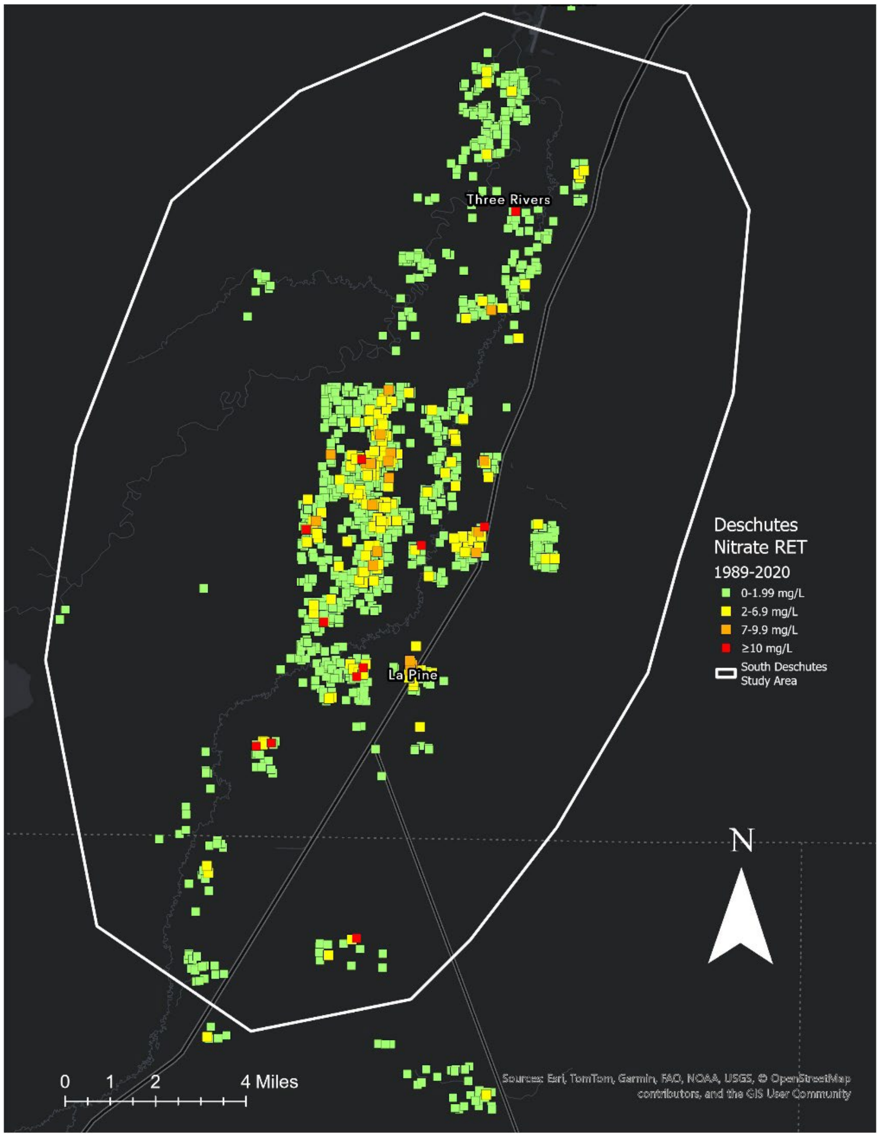

Figure 2. Nitrate in groundwater-Oregon Health Authority Real Estate Transaction data.

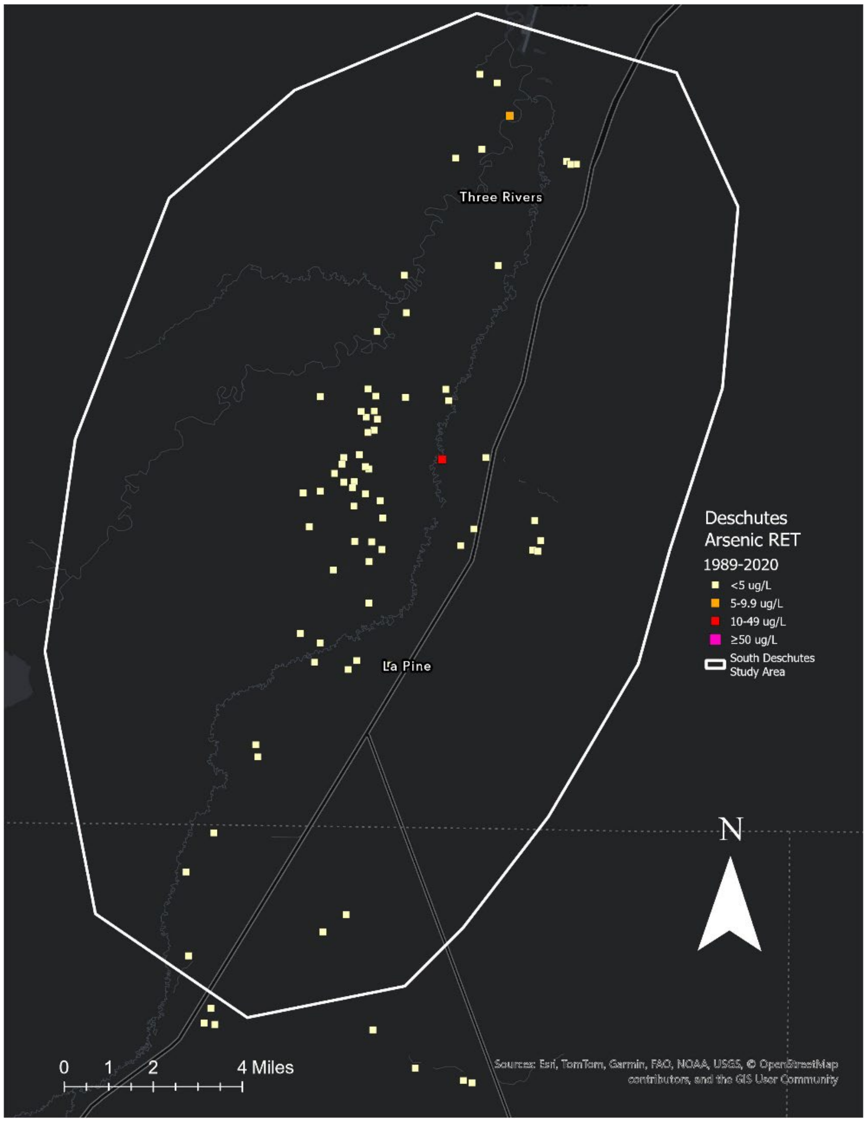

Figure 3. Arsenic in groundwater-Oregon Health Authority Real Estate Transaction data.

1.3.3 Public drinking water systems

There are 23 public water systems (PWS) using groundwater wells with drinking water source areas that intersect the study area. These systems serve approximately 11,250 people. A drinking water source area is defined as the area of land which contributes water to the drinking water supply and where potential contamination from human activities or natural sources may pose a threat to the water quality.

Of the 23 PWS in the study area, seven are active "community" PWS which use groundwater to serve 6,825 people including visitors at recreation sites. There are two inactive "non-transient, non-community" PWS (for workplaces or schools). There are 12 active and two inactive PWS "transient non-community" systems and state-regulated systems (such as for gas stations or campgrounds) with an estimated service population of 1875. See Appendix B for a list of the

PWS, their classifications, primary source and activity status, and populations served. A brief summary of recent PWS data is presented below.

Bacteria: Total coliform bacteria alerts and E. coli bacteria alerts for PWS are generated by the Oregon Health Authority when their presence is detected in sample results. Water systems sample for total coliform bacteria and confirmed detections trigger additional sampling for fecal coliforms or E. coli. Within the study area, one PWS had one or more alerts for detections of E. coli bacteria in the past ten years (Appendix B). When E. coli is detected, additional site-specific review is typically needed to evaluate the source of E. coli, which may not be related to impacts to groundwater quality. If confirmed E. coli detections are considered to be contributing to groundwater contamination, PWS repairs are required by OHA. PWS with E. coli detections are dispersed in the study area, indicating regional aquifer contamination issues are not likely.

Nitrate, Arsenic, Manganese: An alert for elevated nitrate concentrations is generated by the Oregon Health Authority when nitrate sample results for PWS exceed 5 mg/L which is half the EPA's maximum contaminant level. Within the study area, two of the PWS had alerts for elevated nitrate results in the past ten years; Riverview Trailer Park (16 alerts) and Hidden Pines RV Park (21 alerts).

Within the study area, none of the PWS had alerts for arsenic concentrations exceeding the drinking water standard of 10 µg/L or for manganese exceeding 300 µg/L in the past ten years.

Other contaminants: Water quality samples from public water systems within the study area also detected the additional contaminant benzo(a)pyrene). Benzo(a)pyrene does not dissolve well in water so groundwater contamination may indicate a proximate source relating to burning or combustion of organic materials (Minnesota Department of Health, 2018).

Community and Non-Transient, Non-Community public water systems in Oregon are testing for six PFAS compounds in their water supplies. Results are due to OHA by April 2027. Many tests have been completed and data is available on OHA's online PWS database or under individual PWS data at OHA's Drinking Water Data Online site. More details about PFAS testing requirements are provided on OHA's website.

2. Well selection, sampling and analysis

The study design for this Southern Deschutes County groundwater quality monitoring project is similar in structure to previous DEQ studies since 2015, with the intention of monitoring ambient groundwater quality, identifying water quality and health concerns and presenting results to well users. The availability and diversity of wells change with each study area identified, as does the list of relevant contaminants based on historical data, current use conditions and interests of local partners. Analytical methodologies available at the DEQ Laboratory also shift over time. This section details the consideration that went into sample site selection, analyte selection, sampling methods and context for data interpretation. Any DEQ quality assurance documents referenced in this report can be made available upon request.

2.1 Sample site (well) selection

DEQ's statewide groundwater monitoring program relies primarily on well owners who volunteer to have their wells tested in exchange for a complete report of the analytical results from their well. A limitation of using active, private wells versus monitoring wells installed specifically for this purpose is that private wells are not always available in the desired locations or constructed to desired depths. However, dozens of partnerships with well users within a geographic area can allow access to a range of well depths and locations within the aquifer area of interest. This approach meets the objectives of the DEQ Statewide Groundwater Quality Monitoring Quality Assurance Project Plan (DEQ93-LAB-0024-QAPP). DEQ recruited well owner volunteers for this study using flyers, emails, a press release, and other announcements with the help of local partners, including Deschutes County Environmental Health. Communications offering free well water testing to participants in this study were provided in English and Spanish to reach a diversity of well users. Flyers were posted at libraries and post offices in target communities.

DEQ continued to recruit volunteers until adequate options were available to select 100 study wells of various depths and geographic locations sufficient to represent conditions in the study area (Figure 1). Well selection was limited to the availability of well users who volunteered, the accessibility of their well and the location of an access point prior to water treatment. Wells without a working pump could be included if the associated well head could accommodate a submersible pump. All wells selected for this study were drinking water wells. All but one were private, domestic use wells. One public water supply well was also included.

The Oregon Department of Water Resources has required filing records of drilled wells in the state since 1955. These records, called well logs in this report, are available on the OWRD website at Well Report Query. Well logs contain valuable information such as depth of well, depth of first water, well construction materials, screened interval, materials encountered while drilling (to evaluate aquifer type), seal depth and material, use of well, age of the well, and estimated yield. Many of these well characteristics are helpful in the evaluation of which aquifer a water sample might represent. An example well log is included in Appendix C. All but three wells selected for this study had a documented well log. Although we don't have well characteristics on those wells, any detections of analytes in those wells still offer insight into groundwater quality in the area. Appendix A presents a list of all sampled wells and pertinent well log information.

Sample collection dates attempted to capture seasonal and land activity differences between the spring and fall in Oregon. Sixty wells were sampled in the spring of 2023 and 20 of those wells were resampled in the fall of 2023. Forty additional wells were sampled in the spring of 2024 to reach a total of 100 wells, with 20 resampled wells. These wells were selected based on spatial distribution, availability and cooperation of the well owners. Twelve of the wells were included because they had been sampled several times since 1995. Detections of contaminants in the spring sampling event influenced the wells that were selected for resampling in the fall. Section 3.2 provides DEQ's evaluation of correlations between water quality sampling results and the season in which samples were collected.

Personal data collected from participants during this study is not included in this report. All volunteer well owners received an individualized copy of groundwater quality laboratory report associated with their well along with resources for data interpretation and well maintenance. Appendix D provides an example of the letter and laboratory report that participants received.

2.2 Analyte selection

Sample analyses included common ions and common field parameters, nitrate/nitrite as N (referred to as nitrate in this report), total coliform bacteria, E. coli bacteria, arsenic, other metals, current use and legacy pesticides, and volatile and semi-volatile organic compounds (VOCs and SVOCs). Pharmaceuticals and personal care products (referred to as consumer product constituents in this report) were included in this study based on the knowledge of high septic tank densities in the area. In total, 249 chemicals or water quality parameters were analyzed for each well water sample tested. A complete analyte list can be found in Appendix E. The corresponding laboratory methods and reporting limits are in the Sampling and Analysis Plan (DEQ26-LAB-0017-SAP).

2.3 Sampling methods

DEQ water quality monitoring staff collected and processed samples in the field according to standard procedures found in the Mode of Operations Manual: Field Collection Methods (DEQ03-LAB-0036-SOP_V3), and the project Sampling and Analysis Plan (DEQ26-LAB-0017-SAP). Where possible, samples were collected from an outdoor spigot closest to the well head, and always before any water filtration or treatment. Some samples were collected from a pressure tank or large storage reservoir when access to water directly from the well was not available. In those cases, the pressure or storage tank volume was purged prior to collecting the sample to ensure a representative sample from the aquifer. Wells with active pumps were purged for at least five minutes and until field readings of conductivity, temperature and dissolved oxygen stabilized. Bacteria samples were collected last, after the sample point was disinfected with isopropyl alcohol.

Determination of a direct connection between the spigot used for sample collection and the well was evaluated based on best available information. It was either visually clear that the spigot was plumbed to the wellhead, or the well user or well owner confirmed verbally or with written instructions that the spigot was connected to the wellhead.

For collection of samples for lead analysis, the goal was to measure the quality of the water coming from the aquifer rather than from static water in piping. Therefore, pipes were flushed for 5-10 minutes before the lead sample was collected. For homeowners to evaluate for potential worst case lead contamination of drinking water from plumbing, samples should be collected differently, using the first draw method described in the EPA document, Module 5: Conducting Sampling and Interpreting Results - 2-Step Sampling Protocol

2.4 Context for data interpretation

Many of the chemicals analyzed in this study are not found naturally in groundwater (e.g., pesticides, personal care products, volatile organic compounds) or have very low natural background concentrations (e.g. nitrate). Detection of these chemicals indicates an influence from human activities such as leaching from agricultural or residential use of fertilizers and pesticides, improperly designed or maintained septic systems, poor well construction, or improper storage/disposal of solvents or leaking underground storage tanks. These contaminants, along with minerals and elements generally considered to be naturally occurring, such as arsenic and manganese, may be harmful to human health when present in drinking water above certain levels.

The quality and safety of drinking water from private, domestic wells is generally not regulated. However, as mentioned in section 1.3.2, domestic well testing is required at the time of real estate transactions that involve a drinking water well.

For this study, the water quality results have been compared to various health-based screening levels. For public water systems, EPA sets a maximum contaminant level goal (MCLG) as the concentration of a contaminant below which there is no known or expected health risk. The EPA then sets the maximum contaminant level (MCL) as close to the MCLG as feasible considering treatment technologies and cost. MCLs, otherwise known as drinking water standards, are enforceable water quality criteria for public water systems. Secondary MCLs (SMCLs) are non-enforceable guidelines indicating concentrations at which aesthetic effects might be noticeable (scaling, odor, taste) which are not health related. EPA also develops Action Levels for responses to concentrations of copper or lead in drinking water (U.S. EPA, 2018). DEQ's analytical reports sent to well owners included information on the MCLs for relevant contaminants. See Appendix D for an example of a laboratory report.

For this project, results are compared to maximum contaminant level goal and maximum contaminant levels when available. If no maximum contaminant level is available, the result is compared to the lowest value of the current Human Health Benchmarks for Pesticides, Regional Screening Levels, or USGS Health-Based Screening Levels. HBSLs are non-regulatory screening values are based on available toxicological research and can be used to determine whether the concentration of a contaminant in drinking water may pose a risk to human health (Toccalino, 2014 and USGS, 2024). Table 1 lists the relevant screening level for each detected analyte.

Health screening levels related to soil health, crops, or livestock are not widely available. DEQ referred participants in this study to their local Oregon State University (OSU) Extension Service Agent to discuss the impacts that particular contaminants may have on their soil, crops, livestock management, or food gardens.

A note about quantitative data summaries of analytes: due to quality assurance measures related to sampling, sample preparation and analysis, some samples or analytes were downgraded to a lower data quality level and rejected from the data used in Table 1. Only samples and analytes that maintained an A or B data quality level were included in the quantitative analysis described in this report. This may affect how the numbers and percentages of samples add up for each analyte quantitatively described in this report.

3. Water quality results and discussion

The results of the Southern Deschutes County Groundwater Quality Study are presented below. The complete raw data from this study may be obtained through the Ambient Water Quality Monitoring System (AWQMS) data portal or by contacting DEQ at Groundwater.Monitoring@deq.oregon.gov.

3.1 Water quality results

Table 1 identifies the maximum concentrations for all detected parameters out of 249 separate parameters analyzed for the study. The health-based screening levels for each parameter are also listed in the table as well as how many samples exceeded the screening level for each parameter. The following sub-sections of the report highlight results that may present a potential human health risk for people drinking the water and/or may indicate contamination of groundwater due to human activities.

Factors that influence the likelihood of groundwater contamination include: 1) proximity of a well to the source of contamination, 2) the concentration of chemical naturally present in soils, native rock, 3) chemicals that are applied, spilled, or discharged to the ground or below the ground surface, 4) depth of groundwater accessed by a well (shallow groundwater is affected by surface spills or discharges more quickly and more severely than deep groundwater), 5) local geology (aquifers present below a clay or other confining layer are less vulnerable to contamination), and 6) time (groundwater generally moves slowly, so it can take months or years for surface contamination to reach well water).

3.1.1 Nitrate

Nitrate in this study was measured as nitrate/nitrite. While nitrite is rarely found naturally in groundwater at significant levels due to geochemical conditions, these results represent a conservative measurement of nitrate. Nitrate is a natural and necessary nutrient found in soil and surface water. Human activities, however, can influence the concentrations of nitrate found in soil and water. Nitrate-enriched water can leach into aquifers from areas of fertilizer use, improper composting, manure storage or application, or from improperly designed or maintained septic systems (Powers, 1989). Background concentrations of nitrate in groundwater have been conservatively estimated by the United States Geological Survey as 1.1 mg/L (Nolan, 2003). Other reports (Mueller, 1996 and Madison, 1985) have estimated background levels of 2 or 3 mg/L. The large number (35%) of non-detectable nitrate (<0.005 mg/L) indicates that the actual background concentration in this area is likely less than 1 mg/L.

Table 1. Summary of 31 detected analytes, maximum concentrations, and number of wells with detections exceeding health-based screening levels

Characteristic	Units	Screening Level*	# Wells w/ Detections	Max Conc	# Wells with Detections above Screening Levels
General Chemistry and Common Ions (Ca, SO_4)					
Alkalinity, total	mg/L	not available	100	276	NA
Calcium	mg/L	not available	100	37.9	NA
Chloride	mg/L	250[3]	99	55.6	0
Conductivity	umhos/cm	not available	100	518	NA
Dissolved oxygen (DO)	mg/L	not available	88	10.4	NA
Hardness, Ca, Mg	mg/L	not available	100	194	NA
pH	SU	<6.5, >8.5[3]	100	8.4	0
Sodium	mg/L	not available	100	54.6	NA
Sulfate	mg/L	250[3]	82	58.1	0
Total dissolved solids	mg/L	not available	100	388	NA
Nutrients					
Nitrate + Nitrite	mg/L	10[1]	65	23.4	2
Total Phosphorus, mixed forms	mg/L	NA	100	3.37	NA
Bacteria					
Total Coliform	MPN/100mL	0	3	40	3
Escherichia coli	MPN/100mL	0	0	0	0
Metals					
Aluminum	µg/L	70[2]	26	624	10
Arsenic	µg/L	10/zero[1]	68	6.19	0>MCL, 68>MCLG
Boron	µg/L	5000[2]	23	672	0
Iron	µg/L	4000[2]	70	10600	4
Lead	µg/L	15/zero[1]	38	86.7	1>MCL, 38>MCLG
Magnesium	mg/L	NA	100	31.8	NA
Manganese	µg/L	300[2]	77	2200	6
Potassium	mg/L	NA	100	5.42	NA
Uranium	µg/L	30[1]	10	0.88	0
Vanadium	µg/L	86[4]	64	47.1	0
Pesticides					
2,6-Dichlorobenzamide	ng/L	270,000[5]	2	24.6	0
Atrazine	ng/L	3,000[1]	2	24.3	0
Desethylatrazine	ng/L	not available	6	47	NA
VOCs and SVOCs					
Toluene	µg/L	1000[1]	1	0.89	0
Tris(2-chloroethyl) phosphate (TCEP)	ng/L	3,800[4]	1	757	0
Consumer Product Constituents					
Carbamazepine	ng/L	not available	3	18.2	NA
Sulfamethoxazole	ng/L	not available	16	271	NA

*If an EPA MCL is not available, the lowest concentration of other available screening levels is referenced.
NA = Not applicable
[1]EPA MCL/MCLG (drinking water standards/goals)
[2]USGS Non-Cancer HBSL-Health Based Screening Levels for evaluating water quality (Smith, 2024)
[3]EPA Secondary MCL for aesthetic purposes
[4]EPA Regional Screening Levels
[5]EPA HHBP-Human Health Benchmarks for Pesticides

Figure 4 illustrates nitrate detections in sampled wells. Sixty-five (65%) of the 100 wells tested had nitrate detections. Eight wells had detections of nitrate above 3 mg/L and only two of the eight had detections (2%) exceeding the EPA drinking water standard of 10 mg/L. Wells that were sampled more than once had similar nitrate concentrations on both sample dates. The range of concentrations was from non-detect to 23.4 mg/L.

Previous studies in the area have similarly shown higher nitrate concentrations in more densely populated areas of La Pine and lower concentrations outside those areas (Deschutes County, 1999). Four wells out of 39 (10%) had nitrate above the drinking water standard in DEQ's 1993 study (Cole, 2006). Figure 5 charts nitrate concentrations in the 12 wells sampled since 1995, showing varying concentrations over the years.

Health concerns associated with elevated nitrate in drinking water include potential problems for infants, pregnant women and nursing mothers. More information for well users about nitrate in drinking water can be found on the Oregon Health Authority's Well User Resource Toolkit web page.

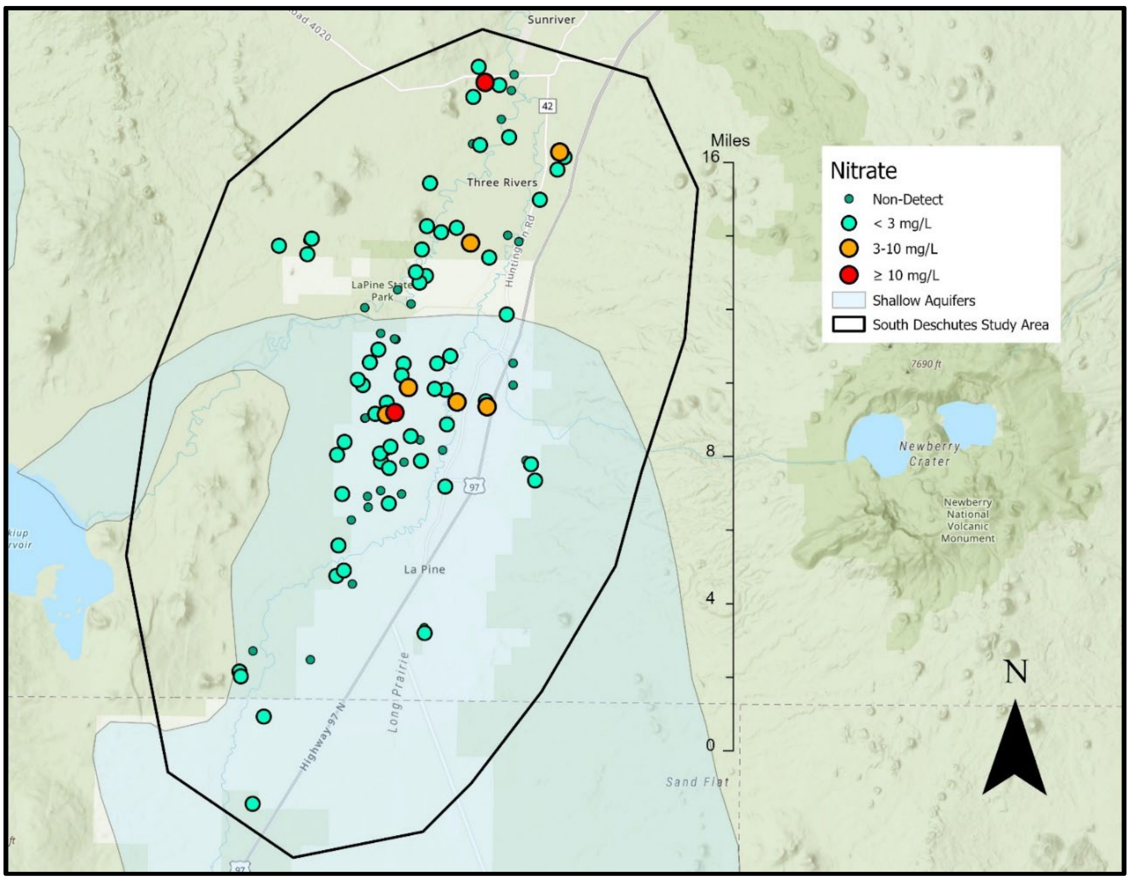

Figure 4. Nitrate in groundwater in Southern Deschutes County study area.

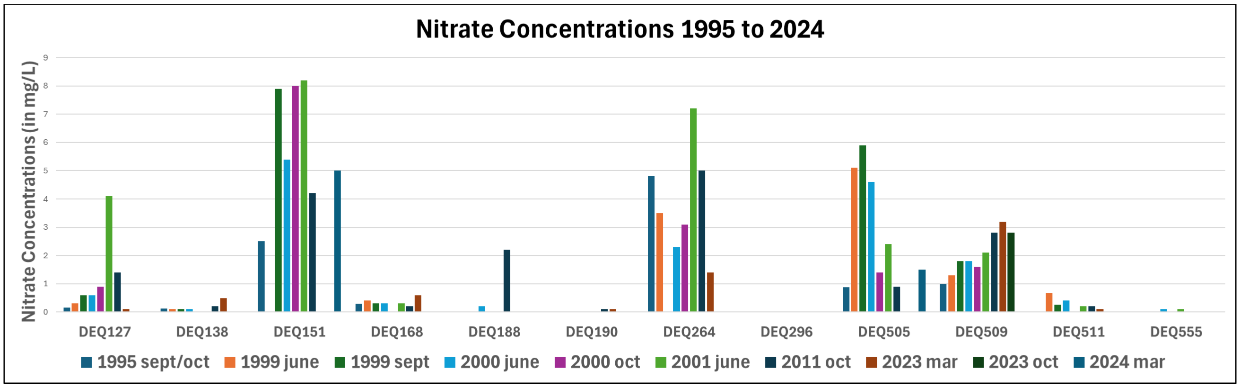

Figure 5. Nitrate concentrations in select wells 1995-2024.

3.1.2 Arsenic

Arsenic is a naturally occurring element found in the earth's crust. It is found in groundwater in many areas of Oregon, often due to dissolution of arsenic-containing minerals associated with volcanic rock or soils. Other potential sources include use as a wood preservative, historic uses as an insecticide for orchards, and for embalming fluids prior to 1945, indicating that historic cemeteries and orchards may be potential sources of arsenic in addition to the natural sources. Arsenic geochemistry is complex, and several factors may influence its mobility through soils and into shallow groundwater and wells (Welch, 2000). Arsenic in drinking water presents a health risk and EPA has established an MCL of 10 µg/L for total arsenic. The MCLG is zero.

Figure 6 illustrates the distribution of arsenic in groundwater in the study area. Sixty-eight of the 100 wells (68%) tested had detections of arsenic above the detection level of 0.25 µg/L. No wells showed arsenic levels exceeding the MCL. The range of detections was from non-detect (ND) to 6.19 µg/L. The widespread distribution of arsenic at low to moderate concentrations indicates a likely natural source. Of the 29 wells with arsenic concentrations above 1 µg/L, only four were sampled in both March and October of 2023. Of those four, concentrations were similar in all wells except Well 6, which increased by 2.2 µg/L over the period.

Results from nine wells tested in the 1982 Century West study indicated levels of arsenic in three wells (33%) at or just below the drinking water standard. No arsenic was detected in 31 wells sampled in DEQ's 1993 study (Cole, 2006).

More information for well users about arsenic in drinking water can be found on Oregon State University's Well Water Program website or from the Oregon Health Authority's Testing Recommendations web page

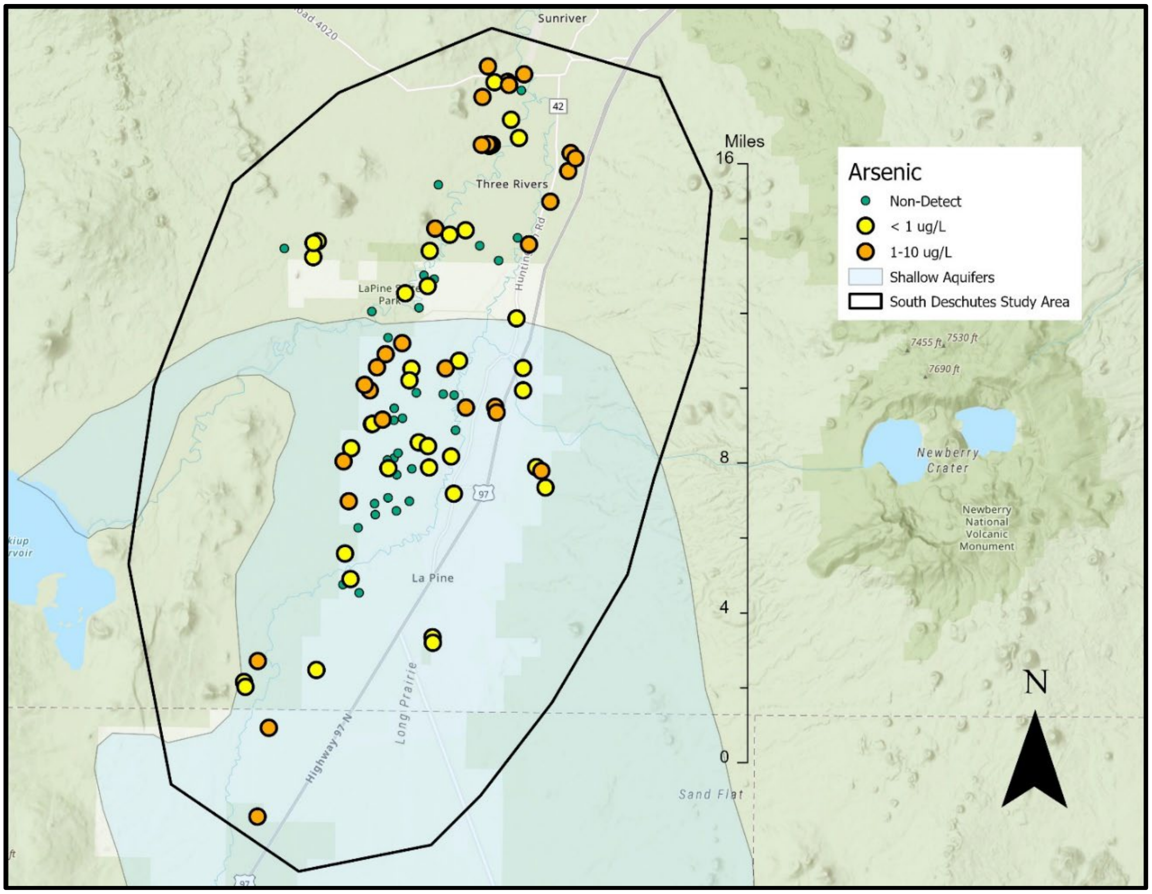

Figure 6. Arsenic in groundwater in Southern Deschutes County study area.

3.1.3 Lead

DEQ includes lead in the statewide groundwater monitoring program as a public health screen. Although there are naturally occurring sources of lead, most lead detections in drinking water are from localized contamination, not an area-wide concern. Lead in drinking water is often the result of leaching from pipes, plumbing, solder used in well construction, and pump machinery, typically from older wells and plumbing in the household. Acidity, temperature and the concentration of other minerals in well water can influence the leaching rate. To avoid detecting lead from stagnant water inside plumbing, DEQ followed sampling methods described in Section 2.3 to ensure that pipes were flushed adequately before sampling. Lead in drinking water presents a health risk and EPA has established an MCL for lead of 15 µg/L. The MCLG is zero. The United States Center for Disease Control and Prevention (CDC) states that lead can be harmful to human health even at low exposure levels since lead can accumulate in the body over time (USCDC, 2025). For adults, high lead can result in high blood pressure or kidney problems. In the case of any lead exceedances discovered in these monitoring events, well users were connected with OHA toxicologists, and/or given the information needed to get assistance with understanding their results and health risks.

Thirty-eight of the 100 wells tested (38%) had detections of lead. One well (Well 138) had a very high concentration of 86.7 µg/L, considerably over the lead MCL of 15 µg/L. Only one of the 10 wells that had lead concentrations above 1 µg/L were sampled twice. Well 19 showed a decrease in concentration from 1.07 µg/L to 0.31 µg/L from Spring to Fall of 2023.

In DEQ's 1993 study, one well out of 31 had detectable lead concentrations of 5 and 9 µg/L. All other wells were below the detection level of 5 µg/L.

More information for well users about lead in drinking water can be found on the Oregon Health Authority's Well User Resource Toolkit web page.

3.1.4 Aluminum, manganese and iron

Aluminum, manganese and iron were also detected in this study. Metals in groundwater typically are the result of the interaction of water with soils and rock of the aquifer (USGS.gov webpage, 2026). Concentrations can be influenced by pH and oxidation as well as the general chemistry of natural groundwater. The USGS HBSL for aluminum is 70 µg/L, 300 µg/L for manganese, and 4000 µg/L for iron. Secondary MCLs are established for some constituents by EPA, primarily as an advisory regarding aesthetic impacts (discoloration or scaling) rather than due to health concerns. The SMCLs for these metals are: aluminum (50-200 µg/L), manganese (50 µg/L), and iron (300 µg/L).

Of the 100 wells tested, 26 (26%) had detections of aluminum ranging from 20.5 µg/L to 624 µg/L. Ten wells (10%) exceeded the 70 µg/L HBSL. Of the 26 wells with aluminum detections, 10 were sampled twice. Eight had higher concentrations of aluminum in spring than in fall of 2023. Three of the samples had significantly reduced concentrations from spring to fall (Well 42 from 355 µg/L to <20 µg/L, Well 36 from 127 µg/L to 52.9 µg/L, Well 19 from 114 µg/L to 43.4 µg/L). Well 6 increased from <20 µg/L to 249 µg/L.

Figure 7 illustrates locations where manganese was detected in six wells (6%) over the HBSL of 300 µg/L. 49 total wells (including the six wells over 300 µg/L) had manganese concentrations over the SMCL of 50 µg/L, indicating a potential for scaling of plumbing or discoloration. The HBSL indicates a concentration below which adverse noncarcinogenic health effects are not expected over a lifetime of exposure (USGS, 2024).

The 1982 Century West study reported elevated manganese at just below the HBSL of 300 µg/L in the La Pine School well out of nine samples reported. Three wells out of 31 (10%) in the 1993 DEQ study had manganese concentrations above the HBSL of 300 µg/L, ranging from 360 to 1,300 µg/L. The detection level was 100 µg/L for aluminum in the 1993 DEQ study. One well had an aluminum concentration of 300 µg/L (Cole, 2006).

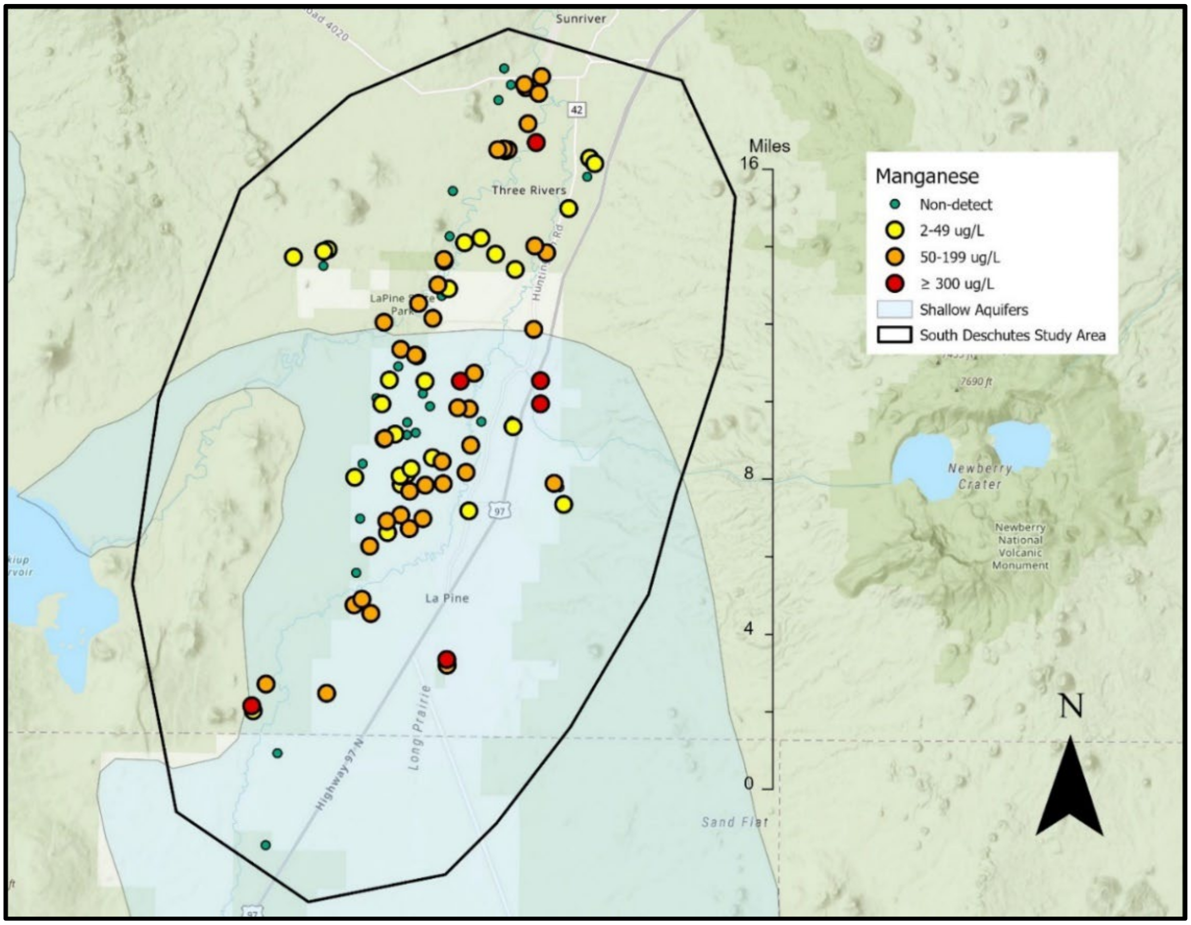

Figure 7. Manganese concentrations in sampled wells.

Iron concentrations were detected in four wells above the HBSL of 4000 µg/L although two of those wells (Wells 006 and 014) had significantly lower concentrations (982 and 402 µg/L, respectively) on a different sampling date. One of the high-concentration iron wells (Well 18) had very similar results on both the spring and fall 2023 sampling dates. Detections of iron ranged from concentrations of 50 to 10,600 µg/L. Iron concentrations were detected above the SMCL of 300 µg/L in 59 of the 100 wells tested (59%). Concentrations above the SMCL are not expected to cause human health concerns but may lead to discoloration of sinks and scaling issues.

More information for well users about manganese in drinking water is available from the Oregon Health Authority [Oregon Health Authority : Well User Resource Toolkit : Domestic Well Safety : State of Oregon.]

3.1.5 Coliform bacteria and Escherichia coli

Coliform bacteria are a group of closely related bacteria that are typically not harmful to humans. However, coliform bacteria are a useful indicator to determine if similar, disease-causing microorganisms (e.g. bacteria, viruses) may be present in water bodies. E. coli is a specific class of coliform bacteria more commonly associated with illness. The presence of coliform bacteria may indicate a problem with the integrity of a well's construction, allowing contamination from surface or soil sources into the well. Bacterial contamination may also indicate potential contamination in shallow groundwater from improperly designed or maintained septic systems, or from leaching of materials through soils where manure is stored or has been spread. The MCLG for coliform bacteria is zero.

Total coliform bacteria were detected in 3% of the 100 wells. E. coli was not detected in any well. Total coliform bacteria sampling was not conducted for the 1993 DEQ study. More information for well users about testing for bacteria and understanding test results is available from the Oregon Health Authority's Well User Resource Toolkit web page.

3.1.6 Pesticides

Pesticides are a broad class of chemicals that include insecticides, herbicides and fungicides. This study tested for current use and legacy pesticides. Legacy pesticides are no longer in use since many have been banned from use for environmental reasons. No legacy pesticides were detected in the 2023-2024 study.

The study also measured several chemicals that are the breakdown products of the original pesticides. Physical processes, such as photo-degradation from sunlight, or biological processes, such as metabolism from bacteria, can break parent pesticides down into different chemicals. In some cases, the breakdown products may be more toxic than the parent compound. In addition, some breakdown products may have different chemical structures making them more soluble and mobile in the groundwater or more resistant to further degradation and persistent. In general, less is known about the potential health impacts of the breakdown products than the parent pesticides. Due to chemical properties or time passed since application, often the breakdown products are detected, and not the parent (Mitra, 2024).

Table 1 lists the pesticides that were detected in area wells. None of the detections were above human health screening levels. Of the 135 pesticides analyzed, 93 were current use pesticides and 42 were legacy pesticides. Three different pesticide-related chemicals were detected in this study, representing two different parent pesticides (atrazine and dichlobenil). Seven wells had at least one pesticide detection, with one well containing detections of all three.

Figure 8 shows that most pesticides were detected in a similar area, north of La Pine, and mostly within the shallow aquifer boundary defined by Sweet et al., 1980. Atrazine was detected in two wells. Its breakdown product desethylatrazine (also known as 2-chloro-4-isopropylamino-6-amino-s-triazine) was detected in six wells, including the two wells with atrazine. Atrazine is a chlorinated herbicide used on roadsides, lawns, golf courses and other places for weed and grass control. Atrazine-related pesticides that were detected in spring were also detected in the fall in the same well at similar concentrations. Atrazine uses were canceled in 2021 for roadsides and Conservation Reserve Program land. Atrazine and simazine uses were cancelled for forestry in 2021 (EPA, 2021).

In DEQ's 1993 study, atrazine was detected in five wells at low levels. Dicamba was detected in three of the 1993 wells with atrazine. Dicamba, an herbicide commonly used for weed control, was not detected in the 2023-2024 study.

Two wells located near each other had detections of 2,6-Dichlorobenzamide, a breakdown product of dichlobenil. Dichlobenil is an herbicide used on roadsides and other places for weed and grass control. There were no detections of dichlobenil.

Detected pesticides for which drinking water standards exist had levels below those standards.

3.1.7 Volatile and semi-volatile organic compounds

Volatile Organic Compounds are a class of chemical compounds that share two main properties: (1) they evaporate easily from water into the air and (2) they contain carbon. They are associated with products such as plastics, adhesives, cleaning fluids, paints, gasoline and other fuels, fumigants, refrigerants, and dry-cleaning fluids. Biological sources of VOCs are from the degradation of organic matter in feed and manure. VOCs may be released into the environment and may reach groundwater through many sources and pathways, including leaking storage tanks, landfills, infiltration of urban stormwater and wastewater, septic systems, and injection through wells. Some VOCs are known or suspected human carcinogens and their concentrations in drinking water from public water systems are regulated by the EPA (Zogorski, 2006). A fact sheet about VOCs for well owners is available on the wellcarehotline.org website.

Semi-volatile organic compounds (SVOCs) are less volatile than VOCs, making them more persistent. SVOCs may be present in cleaning agents, paints, pesticides, some flame retardants, and plasticizers. Health impacts vary but can include carcinogenicity and endocrine disruption (Scienceinsights.org, 2026).

Out of the 65 VOC and 2 SVOCs analyzed in this study, only two were detected in two different wells (at levels below drinking water standards). Figure 8 identifies the location of these two wells. Toluene, commonly associated with gasoline hydrocarbons was detected in the north of the study area, in Well 40. Toluene is used in the production of paints, gasoline, and solvents, and leaks and spills from storage containers can cause groundwater contamination. Tris(2-chloroethyl)phosphate (TCEP) was detected in Well 59 (which also had detections of pesticides and consumer product constituents) in the center of the study area. TCEP belongs to the family of organophosphate flame retardants (OPFRs) which may be used as flame retardants in flexible PUR foams found in baby mattresses, car safety seats, residential upholstered furniture, and paints and coatings. These chemicals have been detected in sewage effluent, river water, seawater, drinking water, sediment, and in fish throughout the world. In laboratory animal studies, TDCP and TCEP have been associated with cancer of the liver, kidney, brain and testis (NRDC, 2010). In this study, toluene and TCEP were not detected at concentrations above the EPA regional screening levels.

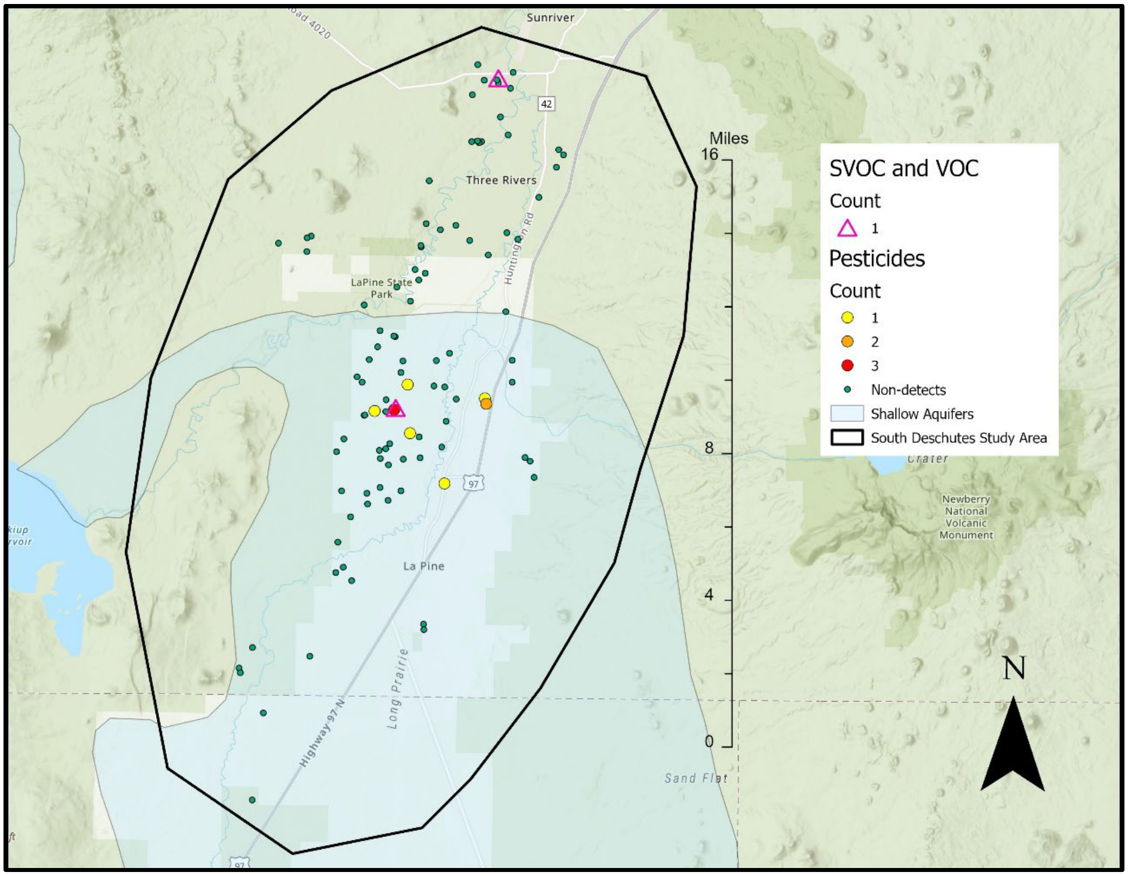

Figure 8. Number of pesticides, volatile and semi-volatile organic compounds detected.

In DEQ's 1993 study, six out of 31 wells tested (19%) had various detections of five benzene-related VOCs and toluene. 1,2-dichloroethane (otherwise known as ethylene dichloride, EDC), a solvent and lead scavenger in gasoline, was also detected in two of those wells. 1,1,1-trichloroethane, used as a drycleaning solvent and other purposes, was detected in one well.

In the DEQ/USGS/Deschutes County 1999 demonstration project study, TCEP and TDCP were two of the nine organic wastewater compounds (out of 63 tested) detected in groundwater - at low concentrations - at monitoring wells located as close as 19 feet from the wastewater discharge points (Hinkle, 2009).

Only two of the organic compounds detected in the 1993 and 1999 studies, toluene and TCEP, were also detected in the 2023-2024 study.

3.1.8 Consumer product constituents

Consumer product constituents include fragrances, pharmaceuticals, insect repellants and other products found in everyday household chemicals, cleaning products, beauty products, clothing, and medications. One of the goals for the Statewide Groundwater Monitoring Program is to investigate emerging groundwater quality problems. Consumer product constituents detected in groundwater are considered indicators of nearby septic or ground discharging wastewater treatment systems that have not been primarily designed to function as treatment for pharmaceuticals and personal care products (Phillips, 2015).

Examples of commonly detected consumer products in other studies include the insect repellant DEET, the stimulant caffeine, and the antibiotic sulfamethoxazole (Groundwater Foundation, 2022). These constituents likely make their way into the water through wastewater discharges and septic systems. Although concentrations detected in this study were significantly lower than a human pharmaceutical dose, the presence of these chemicals in groundwater may lead to aquatic life impacts through surface and groundwater interactions (Hejna, 2022). No water quality criteria or benchmarks currently exist for most of these compounds.

Two of the 20 consumer product constituents analyzed were detected during this study. Figure 9 indicates where one or both of those constituents were detected. Sulfamethoxazole (an antibiotic) was detected in 16 wells, including nine wells in the spring of 2023, five wells (four re-sampled) in the fall of 2023, and six wells in the spring of 2024. Four wells that were sampled in both spring and fall of 2023 had similar concentrations of sulfamethoxazole on both dates.

All of the 16 wells with pharmaceutical detections also had concentrations of nitrate of 0.84 to 23.4 1 mg/L indicating a potential similar source of nitrate and pharmaceuticals. Seven of the eight wells (88%) with nitrate concentrations over the potential background concentration of 3 mg/L had pharmaceutical detections. However, as shown in a graph of all wells with detected pharmaceuticals versus nitrate concentrations in the same wells (Figure 10) there was no obvious correlation between nitrate concentrations and the concentration of pharmaceuticals in the wells.

Carbamazepine was detected in three wells at concentrations of 5, 8.3 and 18.2 ng/L. These wells also had detected sulfamethoxazole and nitrate contamination. Carbamazepine is an anticonvulsant medication prescribed for seizures or for nerve pain such as for diabetic neuropathy.

Sulfamethoxazole was also detected in groundwater during the 1999 Demonstration Project study, along with acetaminophen and caffeine (Hinkle, 2009).

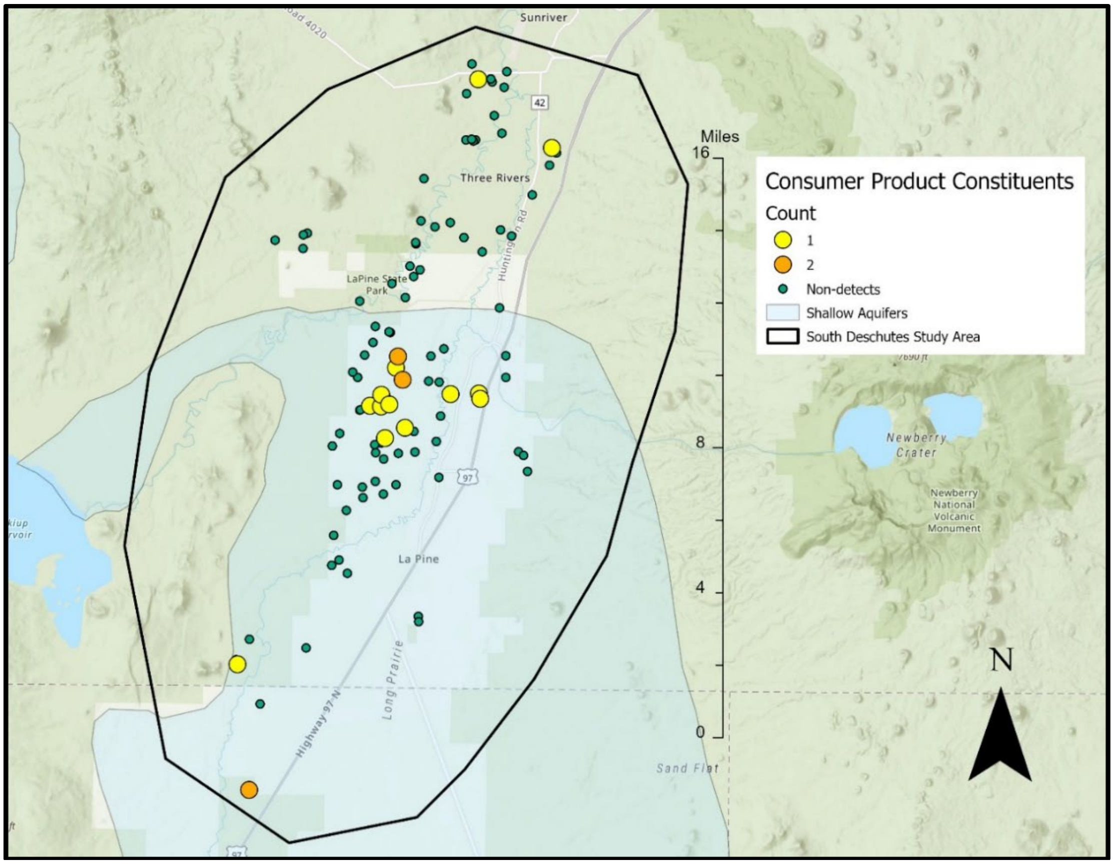

Figure 9. Number of consumer product constituents detected in sampled wells.

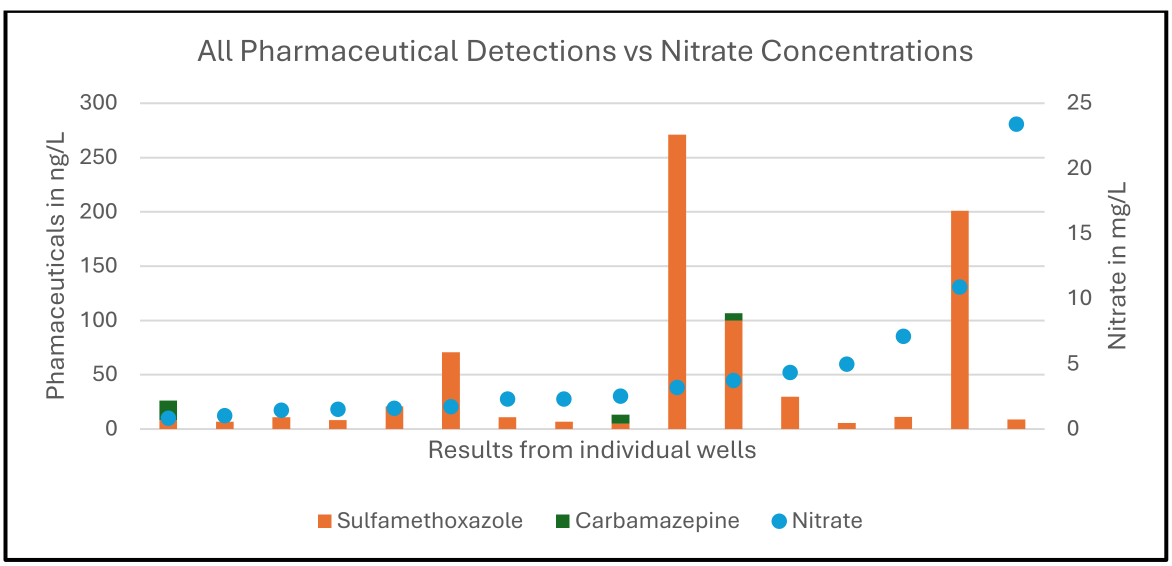

Figure 10. All pharmaceutical detections vs. nitrate concentrations.

3.2 Effects of season or depth of groundwater on water quality

3.2.1 Seasonal characteristics

To evaluate the potential for seasonal variations in nitrate concentrations in groundwater due to surface activities or precipitation levels, nitrate concentrations were compared for samples collected at 20 of the same wells in both the spring and fall of 2023. As mentioned in section 3.1.1, wells that were sampled in both seasons had similar nitrate concentrations on both sample dates. The small sample size of wells sampled in both spring and fall (20 wells) did not allow for statistical evaluation.

3.2.2 Depth of water in contributing aquifer

A thorough evaluation of factors affecting nitrate concentrations in groundwater was beyond the scope of this project. Shallow groundwater often has higher nitrate concentrations because (1) nitrate contamination originates at land surface, (2) shallow groundwater generally represents recent recharge, (3) deep groundwater is often older and was recharged before modern land uses, and (4) denitrification can remove nitrate as groundwater moves deeper into reducing environments. Groundwater nitrate concentrations are often best explained by the combination of land use in the recharge area, groundwater age, well depth, redox conditions, and aquifer geology (Burow, 2010, MacLeod, 1995, Frans, L., 2000).

To evaluate the potential relationship between nitrate concentrations and the depth of groundwater sampled, 97 available well logs from this project were reviewed to determine whether the samples were likely collected from a "deep" or "shallow" groundwater aquifer.

DEQ does not collect groundwater level data from domestic wells since the tools and process for this measurement could introduce contaminants into the wells. Therefore, the likely depth of groundwater collected from each well was estimated using data from 72 available well logs. Well logs provide information on first water encountered while drilling, static water level (the level of the water in the well after drilling), and depth of well screen interval or other well openings. For this project, a combination of first water level information and the shallowest depth of well screening was used to estimate the depth of groundwater sampled at the site. Factors such as confining clay layers and different aquifer materials at the well screen depth were also considered in the evaluation. Note that since well log notations are recorded by well drillers on the date the well is drilled, actual water levels could have changed over time. Note, also, that water levels in wells sampled for this study were very shallow, with a limited reported range of depths (from four to 145 feet below ground level).

Sixty-nine of the wells were considered "shallow" water wells. These included 63 wells with well logs indicating the wells drew water from depths of less than 45 feet below ground and three wells which had estimated water depths of 48, 48 and 65 feet below ground and drew water from what appeared to be unconfined aquifers.

Twenty-eight of the wells were considered “deep” water wells. These included 27 wells with estimated water depths of 45 or more feet below ground and one well with estimated water at 42 feet deep which drew water from below a reported clay layer. Although several of the deep water wells had a reported clay layer above the screened interval, many of the wells are still quite shallow and may be susceptible to contamination from surface activities.

The Peto & Peto modification of the Gehan-Wilcoxon test was conducted to compare nitrate concentrations between samples collected from “deep” water wells versus from “shallow” water wells. The test was run in R using the Cendiff function in the NADA package. This test is used in environmental statistics to analyze data with non-detects (censored data) and determine if there is a difference in the distribution of data across multiple groups.

For the 97 wells included in this study, the evaluation of nitrate concentrations versus water depth in the contributing aquifer indicated a statistically significant difference between nitrate in well water supplied by a shallow aquifer versus nitrate in well water supplied by a deeper aquifer (n = 69 [shallow], 28 [deep], $\chi^2 = 10.9$, $p = .001$).

4. Summary

The 2023-2024 Southern Deschutes County groundwater quality study met the following study objectives:

1. **To collect high-quality data on nitrate, arsenic, coliform bacteria, pesticides, pharmaceutical and personal care products, and volatile organic in groundwater throughout the study area.**
   Groundwater samples were collected from 100 wells within the study area and analyzed for 249 chemical parameters. The data collection and analysis were quality-controlled, allowing the data to be useable for future data comparisons.

2. **To identify areas of groundwater contamination related to these parameters.**
   Nitrate: 65% wells tested had nitrate detections. Eight had detections of nitrate above 3 mg/L and two wells had detections (2%) exceeding the EPA drinking water standard of 10 mg/L. The Nitrate RET results indicate elevated levels north of La Pine. No clear trends in nitrate concentrations were identified in the 12 wells sampled since 1995.
   Arsenic: 68% of the wells tested had detections of arsenic above the detection level of 0.25 µg/L. No wells showed arsenic levels exceeding the MCL. The range of detections was from non-detect (ND) to 6.19 µg/L.
   Lead: 38% of the wells tested had detections of lead. One well had a very high lead concentration of 86.7 µg/L, considerably over the lead MCL of 15 µg/L. Lead in drinking water is often the result leaching of lead from household plumbing and is not necessarily indicative of groundwater quality conditions.
   Aluminum: 26% of wells tested had detections of aluminum ranging from 20.5 µg/L to 624 µg/L. Ten wells (10%) exceeded the 70 µg/L USGS HBSL.
   Manganese: 6% of wells tested had detections of manganese over the USGS non-cancer HBSL of 300 µg/L. 49 total wells (including the six wells over 300 µg/L) had

manganese concentrations over the SMCL of 50 µg/L, indicating a potential for scaling of plumbing or discoloration.

Bacteria: 3% of wells tested had detections of total coliform bacteria. *E. coli* was not detected in any well.

Pesticides: Of the 135 pesticides analyzed, three different pesticide-related chemicals were detected in this study. Most pesticides were detected in the area north of La Pine, and mostly within the shallow aquifer boundary. Atrazine was detected in two wells; its breakdown product desethylatrazine was detected in six wells, including the two wells with atrazine. Atrazine is a chlorinated herbicide used on roadsides, lawns, golf courses and other places for weed and grass control. Two wells located near each other had detections of 2,6-Dichlorobenzamide, a breakdown product of dichlobenil, used on roadsides and other places for weed and grass control.

Consumer Product Constituents: Two of the 20 consumer product constituents analyzed were detected during this study. Sulfamethoxazole (an antibiotic) was detected in 16 wells. Carbamazepine (an anticonvulsant) was detected in three wells which also had detected sulfamethoxazole. All of the 16 wells with pharmaceutical detections also had concentrations of nitrate of 0.84 to 23.4 mg/L, and seven of the eight wells (88%) with nitrate concentrations over 3 mg/L also had pharmaceutical detections, indicating a potential similar source of nitrate and pharmaceuticals.

3. **To inform well water users of the results of this study and provide information regarding potential risks to human health.**
   All well owners who participated in this study received a report of test results for their wells and information related to health-based screening levels in Summer 2023 and Fall 2024. DEQ provided educational packets of information about contaminants, potential health concerns, and actions that can be taken to reduce risk. Contacts for toxicologists at the Oregon Health Authority were provided as well as local county public environmental health representatives to assist with questions related to health concerns or well inspections or treatment options. In addition, DEQ shared results in packaged data sets with any interested parties who inquired.

4. **To identify areas needing additional investigation in order to describe the extent of contamination and help focus efforts to prevent further contamination.** The study results indicated continued groundwater quality impacts to drinking water wells from septic systems in the area. Continued monitoring of these impacts and efforts to replace standard and/or aging septic systems with upgraded systems is recommended.

5. **To help establish long-term trending data and describe changes over time.**
   Conducting future testing of groundwater from selected wells from this and previous studies, if possible (with permission from well owners), would allow comparison of data and trend analyses over time.

5. Recommendations

Based on the evaluation of current and past data from the area, DEQ reiterates concerns raised in a December 19, 2023 letter to the Board of County Commissioners:

- The Sunriver and La Pine area is vulnerable to nitrate contamination from septic systems where private wells are the primary drinking water source for most properties in this area.
- Testing and research indicate most of the contamination in this region comes from septic systems. This means contaminants from septic systems are seeping into the area's porous volcanic soil and into the aquifer used as a primary drinking water source.
- Continued unrestricted development in the area will reach a tipping point that may be difficult or impossible to recover from due to groundwater contamination which will then require additional regulation and funding to address.
- Even with a septic design capable of producing high quality effluent, the treatment may not sufficiently minimize or eliminate nutrients and pathogens from wastewater or future impacts to the aquifer system as outlined by a USGS model.
- Some parcels are not suitable for septic systems.
- DEQ previously determined that a variety of approaches were likely needed to properly manage wastewater pollutants and nitrate loading, including individual onsite wastewater treatment systems and various types of community sewer systems.
- DEQ believes the use of various types of community sewer systems and/or drinking water systems may be a better long-term solution to human health impacts. However, drinking water systems may not mitigate the effect on surface water or ecological impacts.
- Convene a meeting with non-government organizations, non-profits, and 3rd party groups on support of installation and funding of sanitary systems, water systems, Goal 11 exemptions or other alternatives.
- DEQ still believes that conditions in southern Deschutes County are a potential public health and ecological impact issue.
- DEQ understands that there will be further aspects of this process that will require additional work, refinement, clarification and coordination and they stand committed to helping Deschutes County and the citizens in South Deschutes County.

In addition, DEQ recommends the following actions:

Additional Evaluation and Determination of Groundwater Quality Trends: DEQ recommends the identification of selected wells in this study area for periodic testing to monitor any trends in nitrate, bacteria, pesticide or pharmaceutical contamination of the shallow aquifer.

RET test data is a useful screening tool to highlight areas of potential concern for domestic drinking water wells. Samples are required to be collected and analyzed prior to every sale of a home supplied by a domestic well. Education and outreach to realty organizations in the area (and banks which provide mortgage loans) may increase the number of wells tested and provide the state with valuable and updated information about well water quality in the region.

Public Education and Training: DEQ recommends public education about the presence of groundwater contaminants in the area. This could be provided through OHA's Domestic Well Safety program, DEQ's ongoing work with OHA's Drinking Water Source Protection program, the county health departments, and through local drinking water testing laboratories, well drillers and water well maintenance providers. Education would ensure that well owners are aware of potential contaminants in groundwater and potential health considerations of drinking and cooking with elevated concentrations of these chemicals in their water supply, where to find assistance, and what steps they can take to test their wells and treat their well water if needed.

The study results indicate groundwater contamination from domestic wastewater in addition to naturally occurring arsenic and manganese. Septic system maintenance providers and the county health departments could be a point of distribution for information about how septic system users can ensure proper functioning and maintenance of their systems and where they can go for assistance and possible funding in the event of system failure.

The study results also indicated some groundwater contamination from land applications of pesticides. Educational outreach to well owners encouraging evaluation of practices in and around their wells may prevent additional introduction of these chemicals.

The following resources are available to well owners:

Deschutes County's website has a wealth of information about the history of groundwater contamination in the La Pine area and local regulations and resources.

The **U.S. Environmental Protection Agency** website has links and information for private well owners.

The **Oregon State University** Well Water Program website is dedicated to protection of the groundwater that provides our drinking water through education. Their site has many resources and a wealth of information about Willamette Valley groundwater quality.

The Oregon Health Authority runs the Oregon Domestic Well Safety Program which has resources to assist private well owners, including the Well User Resource Toolkit. OHA partners with other state agencies to assess health risks associated with private wells and promote domestic well safety. The program currently includes a special focus on domestic wells in the Lower Umatilla Basin Groundwater Quality Management Area.

The **Oregon Department of Agriculture** works with landowners to implement the Agricultural Water Quality Rules to prevent and control water pollution from agricultural activities. ODA created 38 watershed-based regions with focused Area Plans and required Area Rules for each. There is an Area Plan for the Upper Deschutes area with recommended practices for farmers and ranchers. Landowners must prevent movement of excess sediment, animal waste, fertilizers, or excess chemicals into groundwater or surface water and protect streamside vegetation. The Deschutes Soil and Water Conservation District is available to provide technical and financial assistance with these efforts. Site specific information about these programs are available on ODA's Agricultural Water Quality website.

The **Oregon Water Resources Department** operates a Well Abandonment, Repair and Replacement Fund (WAARF) which provides grants to qualifying low to moderate income homeowners and tribal members to address dry wells due to declining water levels in counties with drought declarations and for wells damaged by wildfire.

The **Oregon Water Resources Department** and Oregon Health Authority jointly publish The Water Well Owners Handbook, also available in Spanish (Pozos de Agua: Manual para el Propietario**)**. This guide to water wells in Oregon is a useful resource for well owners and available online or at your local watermaster's office.

A **Department of Environmental Quality** proposal for an Oregon Environmental Restoration Fund project to finance the repair and replacement of failing septic systems for low to moderate income households was accepted in 2026. Final approvals and administrative details were not available at the time of this report's publication. Prioritization for funding under this program will be in the LUB GWMA and South Coast areas of Oregon. However, funding may be available for septic needs in other areas of the state as well. Look for updates on DEQ's Water Quality Grants website.

The **Department of Environmental Quality's** Groundwater Protection Program website has links to previous groundwater studies around the state and information about grants, loans and technical assistance for communities or individuals. DEQ's Drinking Water Protection Program has developed many tools to assist public water systems to prevent contamination of their groundwater supplies. Many of the tools are also applicable to domestic well users.

- Basic Tips for Keeping Drinking Water Clean and Safe
- Groundwater Basics for Drinking Water Protection

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Appendix A – Study well log information

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 001	Domestic	43.6654	-121.5530	DESC56666_L76033	32	14	S	Sand & gravel	2005
Spring 2023	Southern Deschutes Groundwater Well 002	Domestic	43.6774	-121.5522	DESC1110_noID	42	23	S	Sand, medium	1991
Spring 2023	Southern Deschutes Groundwater Well 003	Domestic	43.7111	-121.5079	DESC59237_L104522	35	20	S	Sand, med & gravel	2011
Spring 2023	Southern Deschutes Groundwater Well 004	Domestic	43.7138	-121.5301	DESC54144_L50955	40	20	S	Sand & gravel	2001
Spring 2023	Southern Deschutes Groundwater Well 005	Domestic	43.7495	-121.4997	DESC56430_L74882	35	15	S	Sand, fine, coarse, cinders	2004
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 006	Domestic	43.7495	-121.4997	DESC59018_L100877	25	18	S	Sand	2010
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 007	Domestic	43.7729	-121.5142	DESC5820_noID	60	45	S	Sand, coarse	1988
Spring 2023	Southern Deschutes Groundwater Well 008	Domestic	43.7840	-121.5065	DESC58169_L85950	25	14	S	Sand & gravel	2007
Spring 2023	Southern Deschutes Groundwater Well 009	Domestic	43.8265	-121.4354	DESC1164_noID	40	18	S	Sand, cinders, gravel	1992
Spring 2023	Southern Deschutes Groundwater Well 010	Domestic	43.7106	-121.5295	DESC55919_L68558	40	31	S	Sand, coarse	2004
Spring 2023	Southern Deschutes Groundwater Well 011	Domestic	43.7276	-121.5386	DESC55777_L63703	75	65	D	Sand, coarse	2003

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 012	Domestic	43.7294	-121.5330	DESC62869_L143763	56	39	S	Sand, fine	2021
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 013	Domestic	43.7400	-121.5151	DESC56627_L74894	50	33	S	Sand, coarse	2005
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 014	Domestic	43.7392	-121.4949	DESC63107_L126519	24	11	S	Sand, fine & gravel	2017
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 015	Domestic	43.7589	-121.5224	DESC52152_L25161	59	54	D	Sand, fine	1999
Spring 2023	Southern Deschutes Groundwater Well 016	Domestic	43.8666	-121.4789	DESC5778_L65445	58	48	S	Fractured black lava	1981
Spring 2023	Southern Deschutes Groundwater Well 017	Domestic	43.8205	-121.5048	DESC51500_L08711	52	38	S	Basalt, grey	1998
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 018	Domestic	43.8389	-121.4620	DESC53142_L34083	60	58	D	Sand & gravel under clay	2000
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 019	Domestic	43.8333	-121.4344	DESC55470_L65512	30	21	S	Fractured Basalt	2003
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 020	Domestic	43.8362	-121.4819	DESC54084_L50752	89	87	D	Sand, coarse under 70' clay	2001

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
Spring 2023	Southern Deschutes Groundwater Well 021	Domestic	43.8362	-121.4765	DESC52347_L25547	87.5	82	D	Sand, under clay & cemented gravel	1999
Spring 2023	Southern Deschutes Groundwater Well 022	Domestic	43.8595	-121.4676	DESC63064_L144532	85	65	D	Soft black rock over fractured brown rock	2021
Spring 2023	Southern Deschutes Groundwater Well 023	Domestic	43.8364	-121.4787	DESC62378_L140805	87	75	D	Sand, fine, med under 30' clay, silt	2020
Spring 2023	Southern Deschutes Groundwater Well 024	Domestic	43.8358	-121.4777	DESC1560	102	85	D	Gravel & sand under 70' clay	1992
Spring 2023	Southern Deschutes Groundwater Well 025	Domestic	43.7783	-121.5218	DESC63326_L145164	63	54	D	Sand, coarse under 30' clay	2022
Spring 2023	Southern Deschutes Groundwater Well 026	Domestic	43.7813	-121.5098	DESC57324_L83306	31	13	S	Sand, med & coarse	2006
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 027	Domestic	43.7854	-121.5119	DESC6544_L91318	27	23	S	Sand, ultra-fine	1984
Spring 2023	Southern Deschutes Groundwater Well 028	Domestic	43.8036	-121.5062	DESC57963_L88633	85	72	D	Basalt, fractured below solid basalt	2007
Spring 2023	Southern Deschutes Groundwater Well 029	Domestic	43.8636	-121.4596	DESC51537_L20847	38	4	S	Sand & clay	1998

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 030	Domestic	43.6623	-121.5444	DESC63114_L124228	27.5	12	S	Sand, fine	2016
Spring 2023	Southern Deschutes Groundwater Well 031	Domestic	43.7105	-121.5171	DESC61233_L130873	55	45	S	Sand, coarse, med	2018
Spring 2023	Southern Deschutes Groundwater Well 032	Domestic	43.7165	-121.5245	DESC63503_L147242	44	27	S	Sand, medium	2022
Spring 2023	Southern Deschutes Groundwater Well 033	Domestic	43.7131	-121.5535	DESC55878_L68555	76	65	S	Sand & gravel	2004
Spring 2023	Southern Deschutes Groundwater Well 034	Domestic	43.7182	-121.5496	DESC63406_L146300	75	45	S	Sand, coarse, fine	2022
Spring 2023	Southern Deschutes Groundwater Well 035	Domestic	43.7117	-121.4509	DESC61063_L126520	124	100	D	Sand & coarse gravel	2017
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 036	Domestic	43.7011	-121.4944	perhapsDESC55898	36	25	S	Sand, fine	2004
Spring 2023	Southern Deschutes Groundwater Well 037	Domestic	43.7292	-121.5270	DESC1711_noID	50	34	S	Sand & gravel	1993
Spring 2023	Southern Deschutes Groundwater Well 038	Domestic	43.7339	-121.5269	DESC63029_L145476	49	29	S	Sand, coarse	2021
Spring 2023	Southern Deschutes Groundwater Well 039	Domestic	43.7525	-121.4927	DESC54277_L54636	51	32	S	Sand	2001
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 040	Domestic	43.8606	-121.4685	DESC63073_L145481	84	58	D	Gravel, cinder, fractured brown rock	2021

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
Spring 2023	Southern Deschutes Groundwater Well 041	Domestic	43.8145	-121.4448	DESC6398_notag	54	42	D	Broken "lava" below clay	1981
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 042	Domestic	43.7971	-121.4824	DESC59409_L107979	24	8	S	Sand & gravel	2011
Spring 2023	Southern Deschutes Groundwater Well 043	Domestic	43.7981	-121.5687	DESC52644_L34139	65	42	S	Fractured basalt	1999
Spring 2023	Southern Deschutes Groundwater Well 044	Domestic	43.6454	-121.5050	NA	not found	not found	NA	not found	not found
Spring 2023	Southern Deschutes Groundwater Well 045	Domestic	43.6322	-121.5666	_L134698	not found	not found	NA	not found	not found
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 046	Domestic	43.6272	-121.6050	DESC59910_L114153	35	34	S	Pumice, white under clay/pumice	2014
Spring 2023	Southern Deschutes Groundwater Well 047	Domestic	43.6097	-121.5915	KLAM60004_L130074	38	28	S	Sand, med fine	2018
Spring 2023	Southern Deschutes Groundwater Well 048	Domestic	43.6991	-121.5296	DESC62689_L142390	38	20	S	Sand, fine	2021
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 049	Domestic	43.6875	-121.5453	DESC63125_L145455	44	27	S	Sand, fine, coarse	2021
Spring 2023	Southern Deschutes Groundwater Well 050	Domestic	43.7208	-121.5136	DESC60561_L121976	45	27	S	Sand, coarse, fine	2016
Spring 2023	Southern Deschutes Groundwater Well 051	Domestic	43.7496	-121.5363	NA	not found	not found	NA	not found	not found

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING AND FALL 2023	Southern Deschutes Groundwater Well 052	Domestic	43.7493	-121.5178	DESC9581_L100450	39	30	S	Sand, fine, med, coarse	1994
SPRING 2024	Southern Deschutes Groundwater Well 053	Domestic	43.6354	-121.5977	DESC62418_L140823	33	19	S	Sand, medium	2021
SPRING 2024	Southern Deschutes Groundwater Well 054	Domestic	43.6676	-121.5491	DESC8265_L145908	34	28	S	Sand, medium	1987
SPRING 2024	Southern Deschutes Groundwater Well 055	Domestic	43.6979	-121.5181	DESC59682_L109796	37	30	S	Sand, med, coarse	2012
SPRING 2024	Southern Deschutes Groundwater Well 056	Domestic	43.7082	-121.5252	DESC59918_L114154	50	18	S	Sand, coarse,fine, cinders	2014
SPRING 2024	Southern Deschutes Groundwater Well 057	Domestic	43.7447	-121.5190	DESC608_L120425	37	27	S	Sand, coarse	1986
SPRING 2024	Southern Deschutes Groundwater Well 058	Domestic	43.7278	-121.5384	DESC54103_L50757	74	68	D	Gravel & Sand	2001
SPRING 2024	Southern Deschutes Groundwater Well 059	Domestic	43.7300	-121.5224	DESC62696_L142310	45	27	S	Sand, coarse	2021
SPRING 2024	Southern Deschutes Groundwater Well 060	Domestic	43.7194	-121.5087	DESC51126_L61827	36	16	S	Sand & gravel	2003
SPRING 2024	Southern Deschutes Groundwater Well 061	Domestic	43.7396	-121.5009	DESC57115_L81849	34	12	S	Sand, med, fine	2005
SPRING 2024	Southern Deschutes Groundwater Well 062	Domestic	43.7155	-121.4961	DESC51983_L25142	24	9	S	Sand, med, fine	1998
SPRING 2024	Southern Deschutes Groundwater Well 063	Domestic	43.7102	-121.4481	DESC51527_L21317	110	68	D	Sand & gravel under pumice & basalt	1998

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING 2024	Southern Deschutes Groundwater Well 064	Domestic	43.7039	-121.4457	DESC63582_L145624	118	89	D	Cinders, pumice	2022
SPRING 2024	Southern Deschutes Groundwater Well 065	Domestic	43.7979	-121.4560	DESC6137	40	22	S	Gravel & cinders	1977
SPRING 2024	Southern Deschutes Groundwater Well 066	Domestic	43.7974	-121.5710	DESC61004_L126793	54	45	D	Sand, coarse & gravel under20' clay	2017
SPRING 2024	Southern Deschutes Groundwater Well 067	Domestic	43.8030	-121.4899	DESC50649_L09575	42	36.5	S	Sand, fine, coarse	1996
SPRING 2024	Southern Deschutes Groundwater Well 068	Domestic	43.7914	-121.4721	DESC55058_L60979	32	19	S	Sand, fine	2002
SPRING 2024	Southern Deschutes Groundwater Well 069	Domestic	43.8547	-121.4818	DESC58182_L92276	30	15	S	Sand & gravel	2007
SPRING 2024	Southern Deschutes Groundwater Well 070	Domestic	43.8574	-121.4610	DESC6233	55	49	D	Sand & gravel under clay	1979
SPRING 2024	Southern Deschutes Groundwater Well 071	Domestic	43.5752	-121.5969	KLAM52802	35	15	S	Sand & gravel	2001
SPRING 2024	Southern Deschutes Groundwater Well 072	Domestic	43.6433	-121.5047	DESC8352	30	17	S	Sand, coarse & gravel	1978
SPRING 2024	Southern Deschutes Groundwater Well 073	Domestic	43.7948	-121.5088	DESC54265_L50788	86	71	D	Gravel, fine under sand, clay	2001
SPRING 2024	Southern Deschutes Groundwater Well 074	Domestic	43.6926	-121.5363	DESC56484_L43438	95	87	D	Gravel & cinders under 6' sandy clay	2004

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING 2024	Southern Deschutes Groundwater Well 075	Domestic	43.6969	-121.5367	DESC63762_L147096	44	27	S	Sand, fine	2022
SPRING 2024	Southern Deschutes Groundwater Well 076	Domestic	43.7257	-121.4940	DESC624	41	21	S	Sand & gravel	1986
SPRING 2024	Southern Deschutes Groundwater Well 077	Domestic	43.8314	-121.4316	DESC59567_L109777	40	35	S	Sand, coarse	2012
SPRING 2024	Southern Deschutes Groundwater Well 078	Domestic	43.7500	-121.4583	DESC62940_L142672	151	145	D	Fractured black"lava" under clay	2021
SPRING 2024	Southern Deschutes Groundwater Well 079	Domestic	43.7951	-121.5866	DESC8551	50	39	S	Sand, coarse & gravel	1993
SPRING 2024	Southern Deschutes Groundwater Well 080	Domestic	43.7944	-121.5087	DESC58212_L9075162	62	55	D	Sand, coarse under 40' clay	2007
SPRING 2024	Southern Deschutes Groundwater Well 081	Domestic	43.8012	-121.4984	DESC61488_L129509	29.5	13	S	Sand, fine	2018
SPRING 2024	Southern Deschutes Groundwater Well 082	Domestic	43.8004	-121.462159°	DESC53594	31	29	S	Sand	2001
SPRING 2024	Southern Deschutes Groundwater Well 083	Domestic	43.8460	-121.4664	DESC978	66	58	D	Sand & gravel under 50' clay	1991
SPRING 2024	Southern Deschutes Groundwater Well 084	Domestic	43.7428	-121.5428	DESC58905_L102366	76	66	D	Sand, coarse, fine	2009
SPRING 2024	Southern Deschutes Groundwater Well 085	Domestic	43.7548	-121.5318	DESC61719_L135004	90	70	D	Sand, coarse, fine	2019
SPRING 2024	Southern Deschutes Groundwater Well 086	Domestic	43.7612	-121.5306	DESC54197_L50774	69	69	D	Gravel under 65' fine sand, clay mix	2001

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING 2024	Southern Deschutes Groundwater Well 087	Domestic	43.7591	-121.5230	DESC64580_L153580	86	46	D	Sand, med under 50' fine sand	2023
SPRING 2024	Southern Deschutes Groundwater Well 088	Domestic	43.8604	-121.4754	DESC544	40	24	S	Sand, medium	1978
Spring 2023	DEQ127	Domestic	43.6975	-121.5506	DESC748_notag	50	31	S	Sand, fine-med	1991
Spring 2023	DEQ138	Domestic	43.7407	-121.5400	DESC8560_notag	80	58	S	Cinders, sand	1993
SPRING 2024	DEQ151	Domestic	43.7345	-121.4889	DESC6959_notag	47	40	S	Sand, med	1989
Spring 2023	DEQ168	Domestic	43.7919	-121.5710	DESC1727_notag	85	65	D	Cinders, sand	1993
SPRING 2024	DEQ188	Domestic	43.7500	-121.4584	DESC51944_L25714	40	30	S	Sand	1998
Spring 2023	DEQ190	Domestic	43.7692	-121.4622	DESC_732	60	23	S	Gravel, fine sand	1990
Spring 2023	DEQ264	Domestic	43.7349	-121.4725	DESC7044_notag	38	30	S	Sand & gravel	1979
SPRING 2024	DEQ296	PWS State Park	43.7720	-121.5353	DESC6571_notag	65	13	S	Sand, coarse & gravel, fine	1966
SPRING 2024	DEQ505	Domestic	43.6254	-121.6043	DESC682_L29090	43	30	S	Sand & gravel	1982
SPRING AND FALL 2023	DEQ509	Domestic	43.7327	-121.4722	DESC1302_notag	45	24	S	Sand, fine-med	1992

Spring or Fall sampling, Year	Southern Deschutes County GW Study ID	Well Type	Latitude	Longitude	WRD Well Log #	Depth of well	Depth to water in contributing aquifer in ft. (estimated)*	Deep or Shallow water	Water-bearing geology	Year well drilled
SPRING AND FALL 2023	DEQ511	Domestic	43.6942	-121.5250	DESC7918_notag	30	20	S	Gravel, fine	1978
Spring 2023	DEQ555	Domestic	43.7145	-121.5267	DESC805_noID	50	25	S	Sand, med coarse	1991

D = Considered deep water well

S = Considered shallow water well

NA = Data not available

*First water level information and the shallowest depth of well screening were used to estimate the depth of groundwater sampled at the site

Gray shading indicates information was obtained from well owner, not an official well record or could not confirm well log number

Appendix B – Public water systems

Note: This summary does not include public water systems that purchase drinking water from these systems.

Public Water System ID	Public Water System Name	Primary Source	System Type	Population	MCL Alerts
4100975	Avion WC - Wild River	GW	C	276	n/a
4194193	Bend-La Pine Public Schools (Inactive)	GW	NTNC	1650	n/a
4194834	Ed Staub & Sons - La Pine	GW	NC	45	n/a
4195393	Fast Break Corner Store	GW	NC	75	n/a
4195096	Gordys Truck Stop (Inactive)	GW	NC	750	n/a
4190137	Hidden Pines RV Park	GW	NC	46	Nitrate
4194752	High Lakes Christian Church	GW	NC	60	n/a
4195440	Holy Redeemer Catholic Church	GW	NC	150	n/a
4194069	La Pine Pks & Rec Rosland Cg	GW	NC	35	n/a
4101496	La Pine, City Of	GW	C	2807	n/a
4194935	ODFW Fall River Fish Hatchery	GW	NC	25	n/a
4191022	OPRD La Pine Rec Area-O/Nite	GW	NC	300	n/a
4100106	Ponderosa Pines Water Company	GW	C	900	n/a
4194805	Quail Run Golf Course Inc	GW	NC	150	n/a
4101232	River Meadows Improvement Dist.	GW	C	432	n/a
4101129	Riverview Trailer Park	GW	C	60	Nitrate
4194977	Russell Ind WC (Inactive)	GW	NTNC	125	n/a
4191745	Sound Pacific Cascade RV Park	GW	NC	150	n/a
4191761	Spring River Plaza	GW	NC	250	E.coli
4193777	Thousand Trails Inc	GW	NC	575	n/a
4192542	USFS Prairie Campground (Inactive)	GW	NC	25	n/a
4101109	Water Wonderland Improv Dist. 1	GW	C	550	n/a
4101181	Water Wonderland Improv Dist. 2	GW	C	1800	n/a

A.1 System Type:

C - "Community Water System (C)” means a public water system that has 15 or more service connections used by year-round residents, or that regularly serves 25 or more year-round residents.

NTNC - "Non-Transient Non-Community Water System (NTNC)" means a public water system that is not a Community Water System and that regularly serves at least 25 of the same persons over 6 months per year.

NC - "Transient Non-Community Water System (NC)" means a public water system that serves a transient population of 25 or more persons.

NP or OVS - "State Regulated Water System (NP)” means a public water system, which serves 4 to 14 service connections or serves 10 to 24 people. Monitoring requirements for these systems are the same as those for Transient Non-Community water systems. This designation was recently changed to OVS for Oregon Very Small systems. Both designations are still used.

Appendix C – Example Well Report (Log)

11

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

Desc 978

20S/10E/13 aa

(START CARD) # 31600

(1) OWNER: Well Number:
Name JOHN SCHILSTRA
Address 3468 DUNBAR RD.
City RESCUE State Ca. Zip 95672

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☐ Rotary Air ☐ Rotary Mud ☒ Cable
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☐ No ☒ Depth of Completed Well 66 ft.
Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10	0	20	cement	0	20	8 sac.
~~6~~	~~+1~~	66				
6	20	66				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☒ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
	6	+2	66	250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) 66

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Torch
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
60	65	1/4	28	6		☒	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☒ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
50	5		2 hr.

Temperature of water 51 Depth Artesian Flow Found
Was a water analysis done? NO Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little NO
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County DECHUTES Latitude Longitude
Township 20S N or S. Range 10E E or W. WM.
Section 13 NE ¼ NE ¼
Tax Lot 25600 Lot Block Subdivision
Street Address of Well (or nearest address) 56332 Solar Dr.
Sunriver Ore. 97707

(10) STATIC WATER LEVEL:
2 ft. below land surface. Date 8-1-91
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 58

From	To	Estimated Flow Rate	SWL
58	66	50	2

(12) WELL LOG: Ground elevation

Material	From	To	SWL
Top Soil	0	3	
Clay	3	58	
Sand Gravel	58	66	2

RECEIVED
AUG - 9 1991
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 7-31-91 Completed 8-1-91

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
WWC Number 556
Signed Harry Tray Date 8-2-91

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1525
Signed James B. Palmer Date 8-7-91

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

Appendix D – Example Results Letter and Laboratory Report

Oregon

Tina Kotek, Governor

Department of Environmental Quality
Laboratory and Environmental Assessment Division
7202 NE Evergreen Parkway, Suite 150
Hillsboro, OR 97124
Voice & TTY (503) 693-5700
FAX (503) 693-4999

November 2024

[redacted]

Station Description: 41742 - Southern Deschutes Groundwater Well 071

[redacted]

Well Location, depth: [redacted] 35 ft

Thank you for volunteering to have your well sampled in Spring 2024 as part of the Statewide Groundwater Monitoring Program in Southern Deschutes County. Your test results will help us develop a better understanding of the quality of Oregon's groundwater resources, including any potential health concerns in Southern Deschutes County. With this letter, we have included a report of your well water analytical test results.

We would like to assist you with the following:

- Understanding how the report is presented
- Providing the Analytical Report for your records
- Understanding what your results mean for your health
- Explaining the terms and definitions used in the report

Should you or other members of the household have health concerns that you feel may be related to your domestic well, we encourage you to talk with your physician or contact the **Oregon Health Authority's (OHA)** Domestic Well Safety Program (DWSP) at **971-673-0440**.

For additional questions about:
- **Your report,** call DEQ at 503-693-5736
- **Water treatment options,** call your County Environmental Health Representative:
Jeff Freund | Jeff.Freund@deschutes.org | 541 388-6563
- **For agricultural questions** related to livestock watering or irrigation, call your local OSU Extension service at 1-541-883-7131

Understanding your Report

The Analytical Report is organized so that the chemicals that were detected in your well water are **highlighted in bold** and at the top of the list. Many of these are basic parameters used to characterize the groundwater aquifer (under the headings *Nutrients, General Chemistry, Total Metals by Inductively Coupled Mass Spectrometry and General Field Parameters*). Bacteria (coliform, total and *E. coli*) are also listed (*Microbiology*). The last few sections contain the results for the pesticides, and volatile organic compounds (VOCs) tested. If there was a detection of any of these pesticides in your water it will be listed in bold at the top of the report, all other analytes are considered non-detect, designated by "<". If there were any detections of contaminants known to have a potential health risk (such as bacteria, nitrate, arsenic, lead, manganese, pesticides or VOCs), we provided a brief description of the chemical, compared your result to the known risk levels, and made recommendations for follow-up testing or treatment at the end of the report. These recommendations are provided with cooperation from OHA.

Translation or other formats
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800-452-4011 | Oregon TTY: 711 | deqinfo@deq.state.or.us

***A note about lead results**:* Your well water was tested for lead. However, in order to measure the quality of the water coming from the aquifer, rather than the water sitting in the pipes, our sampling procedures include a 5-10 minute flushing period before we collect a sample. If you are concerned about lead contamination from your plumbing you should retest your water using the "first flush" method.

A note about *radiochemistry:* Radionuclides occur naturally in rocks and soils from the radioactive decay of uranium-238 and thorium-232. Breathing air or drinking water contaminated with radionuclides can have health effects. This study did not have the capacity to sample for radiochemistry, however, if you are concerned about radionuclides in your well water, please visit these webpages to learn more.

>> https://www3.epa.gov/radtown/private-wells.html

>> http://wellowner.org/water-quality/radionuclides/

There are also some online tools you may find helpful in understanding your results:

- Drinking Water Interpretation Tool: https://extension.psu.edu/drinking-water- interpretation-tool-dwit
- Well Water Interpretation Tool: http://ohiowatersheds.osu.edu/know-your-well- water/well-water- interpretation-tool

We are available to answer questions you may have about this analytical report or to provide additional resources on groundwater quality. Please feel free to contact us at: groundwater.monitoring@deq.oregon.gov **or 503-693-5736**

If we do not know the answer, we will direct you to health professionals at OHA or technical experts at your local health authority to assist you. Thank you again for participating in this study!

Sincerely,

Groundwater Monitoring Staff
Oregon Department of Environmental Quality
Laboratory Environmental Assessment Program

Translation or other formats
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800-452-4011 | Oregon TTY: 711 | deqinfo@deq.state.or.us

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Nutrients			
Nitrate/Nitrite as N	0.840	mg/L	A
Phosphate, Total as P	0.16	mg/L	A
General Chemistry			
Alkalinity, Total as CaCO3	34	mg/L	A
Chloride	2.02	mg/L	A
Sulfate	0.97	mg/L	A
Total Dissolved Solids	104	mg/L	A
Total Metals by Inductively Coupled Plasma Mass Spectrometry			
Arsenic, Total recoverable	1.64	µg/L	A
Calcium, Total recoverable	5.46	mg/L	A
Hardness as CaCO3, Total recoverable	29.8	mg/L	A
Lead, Total recoverable	0.26	µg/L	A
Magnesium, Total recoverable	3.92	mg/L	A
Potassium, Total recoverable	1.68	mg/L	A
Sodium, Total recoverable	5.57	mg/L	A
Vanadium, Total recoverable	18.3	µg/L	A
General Field Parameters			
Conductivity at 25°C	82	µmhos/cm	A
Dissolved Oxygen	5.3	mg/L	A
pH	7.4	pH Units	A
Temperature	8.3	°C	A
Pharmaceuticals and Personal Care Products by Liquid Chromatography/Tandem Mass Spectrometry			
Carbamazepine	18.2	ng/L	B
Sulfamethoxazole	8.13	ng/L	A
Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry			
Tentatively Identified Compounds	0.00	µg/L	A
Microbiology			
Coliform, Total	< 1	MPN/100 mL	A
E. Coli	< 1	MPN/100 mL	A
General Chemistry			
Total Suspended Solids	< 1	mg/L	A
Total Metals by Inductively Coupled Plasma Mass Spectrometry			
Aluminum, Total recoverable	< 20.0	µg/L	A
Boron, Total recoverable	< 20.0	µg/L	A
Iron, Total recoverable	< 50.0	µg/L	A
Manganese, Total recoverable	< 2.00	µg/L	A
Selenium, Total recoverable	< 1.00	µg/L	A

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Total Metals by Inductively Coupled Plasma Mass Spectrometry			
Uranium, Total recoverable	< 0.10	µg/L	A
Low Level Analysis of Pesticides by Gas Chromatography/Mass Spectrometry			
2,4´-DDD	< 0.0513	ng/L	A
2,4´-DDE	< 0.0513	ng/L	A
2,4´-DDT	< 0.0513	ng/L	A
2,6-Dichlorobenzamide	< 21.1	ng/L	A
4,4´-DDD	< 0.0513	ng/L	B
4,4´-DDE	< 0.0513	ng/L	B
4,4´-DDT	< 0.149	ng/L	C
Acephate	< 107	ng/L	A
Aldrin	< 0.103	ng/L	A
alpha-BHC	< 0.0513	ng/L	A
Azoxystrobin	< 21.1	ng/L	A
beta-BHC	< 0.0513	ng/L	A
Bifenthrin	< 21.1	ng/L	A
Bromacil	< 52.9	ng/L	A
Butachlor	< 21.1	ng/L	A
Butylate	< 21.1	ng/L	A
Chlorobenzilate	< 21.1	ng/L	A
Chloroneb	< 21.1	ng/L	A
Chlorothalonil	< 21.1	ng/L	A
Chlorpropham	< 21.1	ng/L	A
Chlorpyrifos	< 21.1	ng/L	A
cis-Chlordane	< 21.1	ng/L	A
cis-Chlordane	< 0.0513	ng/L	A
cis-Nonachlor	< 0.0513	ng/L	A
Cyanazine	< 21.4	ng/L	A
Cycloate	< 21.1	ng/L	A
Dacthal (DCPA)	< 21.1	ng/L	A
delta-BHC	< 0.0513	ng/L	A
Diazinon	< 21.1	ng/L	A
Dichlobenil	< 21.1	ng/L	A
Dichlorvos	< 21.1	ng/L	A
Dieldrin	< 21.1	ng/L	A
Dieldrin	< 0.256	ng/L	A
Dimethenamid	< 21.1	ng/L	A
Dimethoate	< 52.9	ng/L	A

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Low Level Analysis of Pesticides by Gas Chromatography/Mass Spectrometry			
Diphenamid	< 21.1	ng/L	A
Endosulfan I	< 0.256	ng/L	A
Endosulfan II	< 0.103	ng/L	A
Endosulfan sulfate	< 0.0513	ng/L	A
Endrin	< 0.256	ng/L	A
Endrin aldehyde	< 52.9	ng/L	A
Endrin ketone	< 0.513	ng/L	A
EPTC	< 21.1	ng/L	A
Ethoprop	< 21.1	ng/L	A
Etridiazole	< 21.1	ng/L	A
Fenamiphos	< 106	ng/L	A
Fenarimol	< 21.1	ng/L	A
Fenvalerate+Esfenvalerate	< 211	ng/L	A
Fipronil	< 21.1	ng/L	A
Fludioxonil	< 52.9	ng/L	A
Fluridone	< 52.9	ng/L	A
gamma-BHC (Lindane)	< 0.0513	ng/L	A
Heptachlor	< 0.103	ng/L	A
Heptachlor epoxide	< 0.0513	ng/L	A
Hexachlorobenzene	< 0.256	ng/L	A
Hexazinone	< 21.1	ng/L	A
Malathion	< 21.1	ng/L	A
Methoxychlor	< 0.410	ng/L	A
Methyl paraoxon	< 52.9	ng/L	A
Mevinphos	< 21.1	ng/L	A
MGK 264	< 21.1	ng/L	A
Mirex	< 0.0513	ng/L	A
Molinate	< 21.1	ng/L	A
Napropamide	< 52.9	ng/L	A
Norflurazon	< 52.9	ng/L	A
Oxychlordane	< 0.0513	ng/L	A
Oxyfluorfen	< 21.1	ng/L	A
Parathion-ethyl	< 52.9	ng/L	A
Parathion-methyl	< 52.9	ng/L	A
Pebulate	< 21.1	ng/L	A
Pendimethalin	< 21.1	ng/L	A
Permethrin	< 42.3	ng/L	A

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Low Level Analysis of Pesticides by Gas Chromatography/Mass Spectrometry			
Pronamide	< 21.1	ng/L	A
Propachlor	< 21.1	ng/L	A
Pyraflufen ethyl	< 21.1	ng/L	A
Pyriproxyfen	< 106	ng/L	A
Tebuthiuron	Void	ng/L	D
Terbacil	< 21.1	ng/L	A
Terbufos	< 52.9	ng/L	A
Tetrachlorvinphos (Stirophos)	< 21.1	ng/L	A
trans-Chlordane	< 21.1	ng/L	A
trans-Chlordane	< 0.0513	ng/L	A
trans-Nonachlor	< 0.0513	ng/L	A
Triadimefon	< 21.1	ng/L	A
Tricyclazole	< 53.3	ng/L	A
Trifloxystrobin	< 52.9	ng/L	A
Trifluralin	< 0.513	ng/L	A
Tris (1,3-dichloro-2-propyl) phosphate (TDCP)	< 106	ng/L	A
Tris (2-chloroethyl) phosphate (TCEP)	< 21.4	ng/L	A
Vernolate	< 21.1	ng/L	A
Pesticides by Liquid Chromatography/Tandem Mass Spectrometry			
Acetamiprid	< 4.23	ng/L	A
Acetochlor	< 10.6	ng/L	A
Alachlor	< 10.6	ng/L	A
Ametryn	< 4.23	ng/L	A
Aminocarb	Void	ng/L	D
Atrazine	< 4.23	ng/L	A
Azinphos-methyl (Guthion)	< 21.1	ng/L	A
Baygon (Propoxur)	< 4.23	ng/L	A
Carbaryl	< 5.29	ng/L	A
Carbofuran	< 4.23	ng/L	A
DEET	< 31.7	ng/L	A
Deisopropylatrazine	< 4.23	ng/L	A
Desethylatrazine	< 4.23	ng/L	A
Diuron	< 4.23	ng/L	A
Fluometuron	< 4.23	ng/L	A
Imazapyr	< 42.3	ng/L	A
Imidacloprid	< 21.1	ng/L	A
Linuron	< 4.23	ng/L	A

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DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Pesticides by Liquid Chromatography/Tandem Mass Spectrometry			
Methiocarb	< 4.23	ng/L	A
Methomyl	< 4.23	ng/L	A
Metolachlor	< 10.6	ng/L	A
Metribuzin	< 4.23	ng/L	A
Metsulfuron Methyl	< 4.23	ng/L	B
Mexacarbate	< 4.23	ng/L	B
Neburon	< 5.29	ng/L	A
Oxamyl	< 4.23	ng/L	A
Prometon	< 4.23	ng/L	A
Prometryn	< 4.23	ng/L	A
Propazine	< 4.23	ng/L	A
Propiconazole	< 21.1	ng/L	A
Pyraclostrobin	< 4.23	ng/L	B
Siduron	< 4.23	ng/L	A
Simazine	< 4.23	ng/L	A
Simetryn	< 4.23	ng/L	A
Sulfometuron-methyl	< 4.23	ng/L	B
Terbutryn (Prebane)	< 4.23	ng/L	A
Terbutylazine	< 4.23	ng/L	A
Phenoxy Herbicides by Electron Capture Detector			
2,4,5-T	< 0.3	µg/L	B
2,4,5-TP (Silvex)	< 0.1	µg/L	B
2,4-D	< 0.2	µg/L	B
2,4-DB	< 0.6	µg/L	B
3,5-Dichlorobenzoic acid	< 0.3	µg/L	B
Acifluorfen	< 0.3	µg/L	B
DCPA acid metabolites	< 0.6	µg/L	B
Dicamba	< 0.3	µg/L	B
Dichloroprop	< 0.6	µg/L	B
Dinoseb	< 0.3	µg/L	B
MCPA	< 19.9	µg/L	B
MCPP	< 59.6	µg/L	B
Pentachlorophenol	< 0.1	µg/L	B
Picloram	< 0.6	µg/L	B
Triclopyr	< 0.3	µg/L	B
Pharmaceuticals and Personal Care Products by Liquid Chromatography/Tandem Mass Spectrometry			
Acetaminophen	< 20.0	ng/L	A

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DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Pharmaceuticals and Personal Care Products by Liquid Chromatography/Tandem Mass Spectrometry			
Caffeine	< 20.0	ng/L	A
Codeine	< 9.98	ng/L	A
Cotinine	Void	ng/L	D
Diphenhydramine	< 4.99	ng/L	A
Erythromycin	< 9.98	ng/L	B
Ibuprofen	Void	ng/L	D
Lincomycin	< 4.99	ng/L	A
Paraxanthine	< 20.0	ng/L	A
Roxithromycin	< 4.99	ng/L	A
Thiabendazole	< 4.99	ng/L	A
Triclosan	< 99.8	ng/L	A
Trimethoprim	< 9.98	ng/L	A
Venlafaxine	< 4.99	ng/L	A
Warfarin	< 9.98	ng/L	A
Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry			
1,1,1,2-Tetrachloroethane	< 0.500	µg/L	A
1,1,1-Trichloroethane	< 0.500	µg/L	A
1,1,2,2-Tetrachloroethane	< 0.500	µg/L	A
1,1,2-Trichloroethane	< 0.500	µg/L	A
1,1-Dichloroethane	< 0.500	µg/L	A
1,1-Dichloroethylene	< 0.500	µg/L	A
1,1-Dichloropropene	< 0.600	µg/L	A
1,2,3-Trichlorobenzene	< 0.500	µg/L	A
1,2,3-Trichloropropane (TCP)	< 0.500	µg/L	A
1,2,4-Trichlorobenzene	< 0.500	µg/L	A
1,2,4-Trimethylbenzene	< 0.500	µg/L	A
1,2-Dibromo-3-chloropropane (DBCP)	< 1.25	µg/L	A
1,2-Dibromoethane (EDB)	< 0.500	µg/L	A
1,2-Dichlorobenzene	< 0.500	µg/L	A
1,2-Dichloroethane (EDC)	< 0.500	µg/L	A
1,2-Dichloropropane	< 0.500	µg/L	A
1,2-Dimethylbenzene	< 1.00	µg/L	A
1,3,5-Trimethylbenzene	< 0.800	µg/L	A
1,3-Dichlorobenzene	< 0.500	µg/L	A
1,3-Dichloropropane	< 0.500	µg/L	A
1,4-Dichlorobenzene	< 0.500	µg/L	A
1,4-Dimethylbenzene + 1,3-Dimethylbenzene	< 1.50	µg/L	A

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry			
2,2-Dichloropropane	< 0.500	µg/L	A
2-Butanone (MEK)	< 50.0	µg/L	A
2-Chlorotoluene	< 0.500	µg/L	A
4-Chlorotoluene	< 0.800	µg/L	A
4-Isopropyltoluene	< 0.500	µg/L	A
4-Methyl-2-pentanone (MIBK)	< 5.00	µg/L	A
Acetone	< 40.0	µg/L	A
Benzene	< 0.500	µg/L	A
Bromobenzene	< 0.500	µg/L	A
Bromochloromethane	< 0.600	µg/L	A
Bromodichloromethane	< 0.500	µg/L	A
Bromoform	< 0.500	µg/L	A
Bromomethane	< 1.00	µg/L	A
Carbon disulfide	< 2.00	µg/L	A
Carbon tetrachloride	< 0.500	µg/L	A
Chlorobenzene	< 0.500	µg/L	A
Chloroethane	< 0.500	µg/L	A
Chloroform	< 0.500	µg/L	A
Chloromethane	< 1.00	µg/L	A
cis-1,2-Dichloroethene	< 0.500	µg/L	A
cis-1,3-Dichloropropene	< 0.500	µg/L	A
Dibromochloromethane	< 0.500	µg/L	A
Dibromomethane	< 0.500	µg/L	A
Dichlorodifluoromethane (Freon 12)	< 0.500	µg/L	A
Dichloromethane	< 1.00	µg/L	A
Ethylbenzene	< 1.00	µg/L	A
Hexachloro-1,3-butadiene	< 1.00	µg/L	A
Isopropylbenzene (Cumene)	< 0.500	µg/L	A
Methyl tert-butyl ether (MTBE)	< 0.500	µg/L	A
Naphthalene	< 2.50	µg/L	A
n-Butylbenzene	< 2.50	µg/L	A
n-Propylbenzene	< 0.800	µg/L	A
sec-Butylbenzene	< 0.500	µg/L	A
Styrene	< 0.500	µg/L	A
tert-Butylbenzene	< 0.500	µg/L	A
Tetrachloroethylene	< 0.500	µg/L	A
Toluene	< 0.500	µg/L	A

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742
Station Description: Southern Deschutes Groundwater Well 071
Sampled Date/Time: 4/17/2024 9:21:00AM
Laboratory ID: 2404096-17
Sample Type: Grab Sample::GS

Analysis Summary

Analyte Name	Result:	Units:	DQL:
Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry			
trans-1,2-Dichloroethene	< 0.500	µg/L	A
trans-1,3-Dichloropropene	< 0.500	µg/L	A
Trichloroethylene	< 0.500	µg/L	A
Trichlorofluoromethane (Freon 11)	< 0.500	µg/L	A
Vinyl chloride	< 0.500	µg/L	A
Xylenes, total	< 2.50	µg/L	A

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Nitrate/Nitrite as N

Nitrate is a naturally occurring oxide of nitrogen and is an essential component of all living things. It is the primary source of nitrogen for plants and it occurs naturally in soil and water. But if the levels of nitrate get too high it can pose a potential health risk. Sources of excess nitrate in water include fertilizers, septic systems, wastewater treatment effluent, animal wastes, industrial wastes, and food processing wastes. Nitrite is a chemical related to nitrate that quickly converts to nitrate in the presence of oxygen. The DEQ laboratory measures nitrate and nitrite together and reports the amount of nitrogen (nitrate/nitrite as N). Since the concentration of nitrate is often much higher than nitrite, we compare the combined nitrate/nitrite concentration to the nitrate MCL to evaluate risk. Nitrate levels of up to 2 mg/ L (milligrams per liter) in well water may be naturally-occurring or possibly indicates some low level of contamination. The EPA has set an MCL of 10 mg/L for nitrate (nitrate as N) for drinking water. Nitrate levels above 10 mg/L may present a serious health concern for infants and pregnant or nursing women. The concentration of nitrate in your well was **0.840 mg/L**.

Less than 2 mg/L -- no or very little impact from human activities and your results likely represent natural background levels.
2 to 4 mg/L-- a small impact from human activities may be present. However, this level of nitrate is not a health concern for most people.
4 to 7 mg/L-- obvious impact from human activities
7 to 9.9 mg/L-- obvious impact from human activities. Your water is approaching public health limits for nitrate (10 mg/L).
Recommendations for non-detect (ND) up to 10 mg/L:

1. Nitrate in this range does not pose a significant health risk for healthy individuals, but increased monitoring for nitrate is recommended.

2. Annual testing for nitrate is recommended. Seasonal monitoring once every six months in the middle of the wet and dry seasons is best for detecting seasonal highs and lows

3. When considering nitrate treatment options remember to account for individual tolerance to risk. For example, dietary exposure to foods that have nitrates, such as cured meats; pregnant women, infants, and children; pre-existing medical conditions; or persons who are 65 years of age or older may be at higher risk. We recommend that you share these test results with your physician if you have health concerns.

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Sulfate

As water moves through soil and rock formations that contain sulfate minerals, some of the sulfate dissolves into the groundwater. Minerals that contain sulfate include magnesium sulfate (Epsom salt), sodium sulfate (Glauber's salt), and calcium sulfate (gypsum). People unaccustomed to drinking water with elevated levels of sulfate, above 250 mg/L, can experience diarrhea and dehydration. Infants are often more sensitive to sulfate than adults. **As a precaution, water with a sulfate level exceeding 500 mg/L should not be used in the preparation of infant formula.** Older children and adults become accustomed to high sulfate levels after a few days.

Animals are also sensitive to high levels of sulfate. In young animals, high levels may be associated with severe, chronic diarrhea, and in few instances, death. As with humans, animals tend to become accustomed to sulfate over time. **Diluting water high in sulfate with water low in sulfate can help avoid problems of diarrhea and dehydration in young animals and animals not accustomed to drinking high sulfate water.** The ratio of water high in sulfate to water low in sulfate can be gradually increased until the animals can tolerate the high sulfate water.

If sulfate in water exceeds 250 mg/L, a bitter of medicinal taste may render the water unpleasant to drink. High sulfate levels may also corrode plumbing, particularly copper piping. In areas with high sulfate levels, plumbing materials more resistant to corrosion, such as plastic pipe, are commonly used.

Three types of treatment systems will remove sulfate from drinking water: reverse osmosis, distillation, or ion exchange. Water softeners, carbon filters, and sediment filters do **not** remove sulfate. Water softeners merely change magnesium or calcium sulfate into sodium sulfate, which is somewhat more laxative.

The EPA has established a Secondary MCL for sulfate at 250 mg/L (ppm). The concentration of sulfate in your well water was **0.97 mg/L**.

Up to 250 mg/L: This concentration is not expected to have any aesthetic effects or pose a significant health risk to you or your family.

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Chloride

Chloride occurs naturally in groundwater but is found in greater concentrations where seawater and run- off from road salts (salts used to de-ice icy roads) can make their way into water sources. It generally combines with calcium, magnesium, or sodium to form various salts: for example, sodium chloride (NaCl) is formed when chloride and sodium combine. Over time, sodium chloride's high corrosivity will also damage plumbing, appliances, and water heaters. There is no federally enforceable standard for chlorides in drinking water.
Although chlorides are harmless at low levels, well water high in sodium chloride can damage plants if used for gardening or irrigation, and give drinking water an unpleasant taste. Chlorides can be removed from water with either a reverse osmosis system or a distiller.

The EPA has established a Secondary MCL level of 250 mg/L to avoid salty tastes and undesirable odors.

The concentration of chloride in your well water was **2.02 mg/L**.

Up to 250 mg/L: This concentration is not expected to have any aesthetic effects or pose a significant health risk to you or your family.

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Arsenic

Arsenic is a naturally occurring element found in the earth's crust. As water flows through certain rock formations, arsenic can be dissolved and carried into underground aquifers, streams or rivers. In addition to naturally occurring arsenic, in the past arsenic was also used in some agricultural practices as a component of pesticides. Drinking water with high levels of arsenic can cause health effects such as:

- Thickening and discoloration of the skin;
- Stomach pain, nausea, vomiting and diarrhea;
- Heart, lung, liver, immune, nervous or reproductive system disorders and diabetes; and
- Cancer of the bladder, lungs, skin, kidney, liver and prostate.

The EPA has established an MCL for arsenic at 10 ug/L (parts per billion). **Total Recoverable Arsenic was detected in your well water at a concentration of 1.64 µg/L** .

Arsenic equal to 9.99 ppb or below -- Arsenic in this range does not pose a significant health risk for healthy individuals.

Recommendations:

1. Treatment of the well water is not recommended.
2. If considering treatment, think about how much risk you are willing to accept, including your dietary exposure to foods that have naturally occurring arsenic, your current or past occupational exposure to arsenic, and pre-existing medical conditions. Pregnant women, children, and persons who are 65 years of age or older may be at higher risk. We recommend that you share these test results with your physician if you have health concerns.
3. Your well should be tested for arsenic should at least once to see if it is present and at what levels. If arsenic is present in an initial test above 8 µg/L, you should retest. Upon the retest, if high concentrations continue, a treatment system should be installed. With a treatment system, testing should be done each year at point of use and every three years at the well head.

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Lead

This result may not represent the level of lead in the water in your home. DEQ's sampling procedure is different than that recommended for testing lead in the home and may result in a lower concentration. If you are concerned about lead in your household water, you should arrange for a point of use test with an accredited laboratory. A list of accredited laboratories in Oregon can be found here: http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Documents/AllLabsDWMatrix.pdf

Lead is a metal that occurs naturally in the earth's surface. Lead can also be produced from burning fossil fuels, manufacturing, and mining. Lead is used to produce many items such as batteries, certain kinds of solder, and metal parts for machinery. Because of health concerns, its use has been discontinued in many products such as paint, fuel and kitchenware. However, lead levels can still be present in drinking water. The most common source of lead in drinking water is due to leaching from lead in solder used to join drinking water pipes. Although rare, lead can also enter drinking water through erosion of natural deposits in the earth's crust. Lead is a health hazard. Infants and children are particularly susceptible to the health effects of lead. Drinking water with more than 15 micrograms per liter (µg/L) of lead over long periods of time can cause health effects such as:

- Delay in children's physical or mental development
- Decreased IQ in children
- Kidney problems
- High blood pressure
- Increased risk of cancer

The EPA has established an action level of 15 µg/L for lead in drinking water. **Total Recoverable Lead was detected in your well water at a concentration of 0.26 µg/L** .

Up to 15 µg/L: This concentration of lead is not expected to cause health effects for children or adults in your family.

>15 µg/L: The level of lead in your water is above the EPA action level and may be a risk to your health. It is important to find out whether or not your plumbing and/or well components are the source. You can do this by collecting one sample at the point of use, and another directly from the well. Once the source of lead is determined, treatment options are available for various sources. Your local environmental health drinking water specialist can help you through this process. Contact information can be found in the letter accompanying this report. You may also find more information in the packet left with you on the day your well was sampled.

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Vanadium, Total Recoverable

Vanadium and vanadium compounds are found in the earth's crust, rocks, some iron ores, and crude petroleum deposits. It is used in producing rust-resistant metal alloys, springs, high-speed tools, as a catalyst in ceramics, and in the production of superconductive magnets. Vanadium compounds have been used as dietary supplements. Vanadium mainly enters the environment from natural sources and from the burning of fuel oils. Nausea, mild diarrhea, and stomach cramps have been reported in people who have been exposed to some vanadium compounds. A number of effects have been found in animals ingesting vanadium compounds, including decreases in the number of red blood cells, increased blood pressure, and mild neurological effects. The amounts of vanadium given in these animal studies that resulted in harmful effects are much higher than those likely to occur in the environment. There is no drinking water standard for vanadium. The EPA has calculated a health-based regional screening level (RSL) for vanadium at 86 µg/L.

Total Recoverable Vanadium was detected in your well water at a concentration of 18.3 µg/L and is not expected to pose a significant health risk to you or your family.

Up to 86 µg/L: This concentration of vanadium is not expected to pose a significant health risk to you or your family.

>86 µg/L: This concentration of vanadium exceeds the EPA health-based regional screening level (RSL) and may be a risk to your health. It is recommended that you consider finding a safe source of drinking water or use bottled water from an approved source, until you can talk with a health professional about your exposure risks. Boiling your water will **not** remove the vanadium. There are several water treatment options available for vanadium. If you choose to treat your water, make sure your system is certified by NSF (www.nsf.org) to remove vanadium.

DEQ Laboratory and Environmental Assessment Division

Analytical Report

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Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Sulfamethoxazole

Sulfamethoxazole is an antibiotic commonly used in human and veterinary medicine. Possible sources of pharmaceuticals in groundwater are septic systems, aquifer recharge with treated wastewater effluent, and land application of manure or biosolids. There is no health-based standard or screening level for sulfamethoxazole. However, the concentration found in your well, **8.13 ng/L**, is well below a typical therapeutic dose (the amount that would be prescribed to people).

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Station: 41742

Station Description: Southern Deschutes Groundwater Well 071

Sampled Date/Time: 04/17/2024 09:21 AM

Laboratory ID: 2404096-17

Sample Type: Grab Sample::GS

Information about your detection

Carbamazepine

Carbamazepine is an anticonvulsant or anti-epileptic pharmaceutical used to treat certain types of seizures (eg, partial seizures, tonic-clonic seizures) and bipolar disorder. It is also used to relieve pain caused by trigeminal neuralgia (tic douloureux). Possible sources of pharmaceuticals in groundwater are septic systems, aquifer recharge with treated wastewater effluent, and land application of manure or biosolids. There is no health-based standard or screening level for carbamazepine. However, the concentration of carbamazepine found in your well, **18.2 ng/L** is below a typical therapeutic dose (the amount that would be prescribed to people).

DEQ Laboratory and Environmental Assessment Division

Analytical Report

Explanation of terms and phrases used in your Analytical Report

Data Quality Levels (DQL) listed on your Analytical Report:

A = Data of known Quality; meets Quality Control (QC) limits established in a DEQ approved plan.

B = Data of known but lesser quality; Data may not meet established QC but is within marginal acceptance criteria; or data value may be accurate, however controls used to measure Data Quality Objective elements failed (e.g. batch failed to meet blank QC limit); the data is generally usable for most situations or in supporting other, higher quality data.

C= Data of unacceptable quality; Generally due to QC failures but may be related to other known information about the sample. Data should not be used for a single result but may provide information about water quality in general.

D= No data available; No sample collected or no reportable results. Samples are either voided or cancelled.

Terms

mg/L (milligrams per liter; parts per million; ppm)

Unit of concentration equivalent to one penny in $10,000; or 2 quarts (half gallon) in an Olympic sized swimming pool (- 600,000 gallons).

µg/L (micrograms per liter; parts per billion; ppb)

Unit of concentration equivalent to one second in 32 years; or 1 gallon jug of milk distributed in Detroit Lake Reservoir at it's fullest (-1.5 billion gallons). There are 1,000 µg/L in 1 mg/L.

ng/L (nanograms per liter; parts per trillion; ppt)

Unit of concentration equivalent to one 5 gallon bucket of liquid distributed in the entirety of Crater Lake (-4.6 trillion gallons). There are 1,000 ng/L in 1 µg/L and 1,000,000 ng/L in 1 mg/L.

EPA United States Environmental Protection Agency

MCL Maximum Contaminant Level defined by EPA as the maximum permissible level of a contaminant in water, which is delivered to any user of a public water system. There are no regulations for water that comes from a private, domestic well. However, the MCL set for public water systems is a very reliable health based standard for domestic wells. http://water.epa.gov/drink/contaminants

SMCL EPA has established National Secondary Drinking Water Regulations (NSDWRs) that set non-mandatory water quality standards for 15 contaminants. EPA does not enforce these "secondary maximum contaminant levels" (SMCLs). They are established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. These contaminants are not considered to present a risk to human health at the SMCL. https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals

Human health benchmark for pesticides (HHBP), Regional Screening Level (RSL) and Health-based screening level (HBSL)

Non-Enforceable benchmark concentrations in water below which adverse health effects are not expected over a lifetime of exposure calculated by the EPA and the United States Geological Survey, respectively. http://www.epa.gov/region9/superfund/prg/, http://water.usgs.gov/nawqa/HBSL

Breakdown product

A new chemical that results from the degradation of another (parent) chemical. Degradation may occur because of biological activity, exposure to light or air, or by another similar process.

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Appendix E – Complete Analyte List

Southern Deschutes Groundwater Study 2023-24 Analyte List of 249	
Analyte group, *Analyte sub-group*, Analyte Name	1/4
Bacteria	**Pesticides (current use and legacy) cont'd**
Total Coliform	*Herbicides*
E.coli	Aminocarb
Consumer Product Constituents	**2,4,5-T (banned in US since 1985)**
Acetaminophen	**2,4,5-TP (Silvex) (herbicide banned in US since 1985)**
Caffeine	2,4-D
Carbamazepine	2,4-DB
Codeine	2,6-Dichlorobenzamide (DBA)
Cotinine	Acetochlor
N,N-Diethyl-m-toluamide (DEET)	Acifluorfen
Diphenhydramine, Ethanamine, 2-(diphenylmethoxy)-N,N-dimethyl-	Alachlor
Erythromycin	Ametryn
Fipronil	Atrazine
Fludioxonil	Bromacil
Ibuprofen, Benzeneacetic acid, .alpha.-methyl-4-(2-methylpropyl)-	Butachlor
Lincomycin	Butylate
Paraxanthine	Chlorpropham
Roxithromycin	Cyanazine
Sulfamethoxazole	Cycloate
Thiabendazole	**Dacthal (DCPA) (Chlorthal-dimethyl) (banned in US in 2024)**
Triclosan	DCPA acid metabolites (Chlorthal monoacid and diacid degradates)
Trimethoprim	Deisopropylatrazine [diaminochlorotriazine (DACT)]
Venlafaxine	Desethylatrazine (2-Chloro-4-isopropylamino-6-amino-s-triazine)
Warfarin	Dichlobenil
Pesticides (current use and legacy)	Dichlorprop
Fungicides	Dimethenamid
Azoxystrobin	**Dinoseb (banned in 1986)**
Chloroneb	Diphenamid
Chlorothalonil	Diuron
Etridiazole	EPTC (S-Ethyl dipropylthiocarbamate)
Fenarimol	Fluometuron
Hexachlorobenzene (banned in US in 1984)	Fluridone
Propiconazole	Hexazinone
Pyraclostrobin	Imazapyr
Triadimefon	Linuron
Tricyclazole	MCPA
Trifloxystrobin	Mecoprop-p (MCPP-P)

Analyte group, *Analyte sub-group*, Analyte Name	2/4
Pesticides (current use and legacy) cont'd	**Pesticides (current use and legacy) cont'd**
Herbicides	**Carbofuran (banned in US in 2009)**
Metolachlor	Chlorpyrifos
Metribuzin	Diazinon
Metsulfuron-methyl	Dicamba
Molinate	Dichlorvos
Napropamide	Dimethoate
Neburon	Ethoprop
Norflurazon	Fenamiphos
Oxyfluorfen (not banned but heavily regulated)	Fenvalerate + Esfenvalerate
Pebulate	Imidacloprid
Pendimethalin	Malathion
Picloram	Methiocarb
Prometon	Methomyl
Prometryn	Methyl paraoxon
Pronamide	**Methyl parathion (banned in US in 2014)**
Propachlor (discontinued in 1998)	Mevinphos
Propazine (banned in 2021)	**Mexacarbate (Zectran) (considered discontinued as of 2009)**
Pyraflufen-ethyl	MGK264 (N-2-Ethylhexylbicycloheptenedicarboximide)
Siduron	Oxamyl
Simazine	**Parathion (banned in US in 1998)**
Simetryn	Permethrin
Sulfometuron methyl	Propoxur (Baygon)
Tebuthiuron	Pyriproxyfen
Terbacil	Terbufos
Terbutryn (Prebane)	Tetrachlorvinphos (Stirophos)
Terbuthylazine	**Other Legacy Pesticides**
Triclopyr	**Aldrin (banned in US in 1987)**
Trifluralin	**Chlorobenzilate (banned in US in 1999)**
Vernolate	**Dieldrin (banned in US in 1987)**
Insecticides	**alpha.-Endosulfan, Endosulfan I (banned in US in 2010)**
3,5-Dichlorobenzoic acid	**beta.-Endosulfan, Endosulfan II (banned in US in 2010)**
Acephate	**Endosulfan sulfate (banned in 2010)**
Acetamiprid	**Endrin (banned in US in 1986)**
Azinphos-methyl (Guthion)	**Endrin aldehyde (banned in US in 1986)**
Bifenthrin	**Endrin ketone (banned in US in 1986)**
Carbaryl	**Heptachlor (banned in 1988)**

Analyte group, *Analyte sub-group*, Analyte Name	3/4
Other Legacy Pesticides, cont'd	**Metals, Total Recoverable, cont'd**
Heptachlor epoxide (banned in 1988)	Sodium
Methoxychlor (banned in US in 2003)	Uranium
Mirex (banned in US in 1978)	Vanadium
Pentachlorophenol (banned in US in 2024)	**Standard Parameters**
BHC-Technical (HCH)	Alkalinity, total as CaCO3
alpha.-Hexachlorocyclohexane (alpha BHC) (banned in US in 1985)	Chloride
beta.-Hexachlorocyclohexane (beta BHC) (banned in the 1980s)	Hardness as CaCO3, Total recoverable
delta.-Hexachlorocyclohexane (delta-BHC) (banned in 1976)	Nitrate + Nitrite as N
gamma-BHC (Lindane) (banned in US in 2023)	Phosphate, Total as P
Chlordane	Sulfate
cis-Chlordane (alpha-chlordane) (banned in US in 1988)	Total Dissolved Solid
cis-Nonachlor (banned in US in 1988)	Total Suspended Solids
gamma-Chlordane + trans-Nonachlor (banned in 1988)	**Field Parameters**
Oxychlordane (banned in US in 1998)	Conductivity
trans-Chlordane (banned in 1988)	Dissolved oxygen (DO)
trans-Nonachlor (banned in 1988)	pH
Total DDT	Temperature
o,p'-DDD (2,4´-DDD) (banned in US in 1972)	**Volatile Organic Compounds**
o,p'-DDE (2,4´-DDE) (banned in US in 1972)	1,1,1,2-Tetrachloroethane
o,p'-DDT (2,4´-DDT) (banned in US in 1972)	1,1,1-Trichloroethane
p,p'-DDD (4,4´-DDD) (banned in US in 1972)	1,1,2,2-Tetrachloroethane
p,p'-DDE (4,4´-DDE) (banned in US in 1972)	1,1,2-Trichloroethane
p,p'-DDT (4,4´-DDT) (banned in US in 1972)	1,1-Dichloroethane
Metals, Total Recoverable	1,1-Dichloroethylene
Aluminum	1,1-Dichloropropene
Arsenic	1,2,3-Trichlorobenzene
Boron	1,2,3-Trichloropropane (TCP)
Calcium	1,2,4-Trichlorobenzene
Iron	1,2,4-Trimethylbenzene
Lead	1,2-Dibromo-3-chloropropane
Magnesium	1,2-Dichloroethane (EDC)
Manganese	1,2-Dichloropropane
Potassium	1,3,5-Trimethylbenzene
Selenium	1,3-Dichloropropane

Analyte group, *Analyte sub-group*, Analyte Name	4/4
Volatile Organic Compounds, cont'd	Methyl isobutyl ketone (MIBK)
2,2-Dichloropropane	Methyl tert-butyl ether
Acetone	Methylene chloride
Benzene	**Volatile Organic Compounds, cont'd**
Bromobenzene	Naphthalene
Carbon disulfide	n-Butylbenzene
Carbon tetrachloride	n-Propylbenzene
CFC-11 (Trichlorofluoromethane (Freon 11))	o-Chlorotoluene
CFC-12 (Dichlorodifluoromethane (Freon 12))	o-Dichlorobenzene (1,2-Dichlorobenzene)
Chlorobenzene	o-Xylene (1,2-Dimethylbenzene)
Chlorodibromomethane (Dibromochloromethane)	p-Chlorotoluene
Chloroethane	p-Cymene, 4-Isopropyltoluene
Chloroform	p-Dichlorobenzene (1,4-Dichlorobenzene)
Chloromethane	sec-Butylbenzene
cis-1,2-Dichloroethylene	Styrene
cis-1,3-Dichloropropene	tert-Butylbenzene
Cumene (Isopropylbenzene)	Tetrachloroethylene
Dibromomethane	Toluene
Dichlorobromomethane (Bromodichloromethane)	trans-1,2-Dichloroethylene
Ethylbenzene	trans-1,3-Dichloropropene
Ethylene dibromide (1,2 Dibromoethane) (EDB)	Tribromomethane (Bromoform)
Halon 1011 (Bromochloromethane)	Trichloroethylene
Hexachlorobutadiene	Vinyl chloride
m,p-Xylene (1,4-Dimethylbenzene + 1,3-Dimethylbenzene)	Xylenes
m-Dichlorobenzene (1,3-Dichlorobenzene)	**Semi-volatiles**
Methyl bromide(Bromomethane)	Tris (1,3-dichloro-2-propyl) phosphate (TDCP)
Methyl ethyl ketone (2-Butanone (MEK))	Tris (2-chloroethyl) phosphate (TCEP)