Rogue Drinking Water Providers Source Water Protection Plan

NRCS National Water Quality Initiative

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1.0 INTRODUCTION

Project Area Overview

The Rogue Drinking Water Providers (RDWP) Source Water Protection (SWP) project area (Figure 1.1) encompasses 148,273 acres and includes six United States Geological Survey (USGS) 12th- field watershed hydrologic unit codes (HUC): Lower Antelope, Whetstone, Reece, Lick, Kanutchan, and Indian Creek. Table 1.1 summarizes the size (acres) and percent of project area for each subwatershed. The project area was chosen for SWP following collaborative discussions with members of the RDWP, the Oregon Department of Environmental Quality (DEQ), and the Natural Resources Conservation Service (NRCS). The project area starts at the Rogue River above Shady Cove, and extends past the old Gold Ray Dam site to approximately 2.75 miles upstream of the Gold Hill surface water intake. Additionally, it is located almost entirely (78%) in the 783,300-acre Upper Rogue Watershed. The Upper Rogue Watershed begins at the headwaters near Crater Lake and ends at Dodge Bridge, south of the city of Shady Cove, and represents approximately 25% of the Rogue Basin.

Figure 1.1: Project Area Location

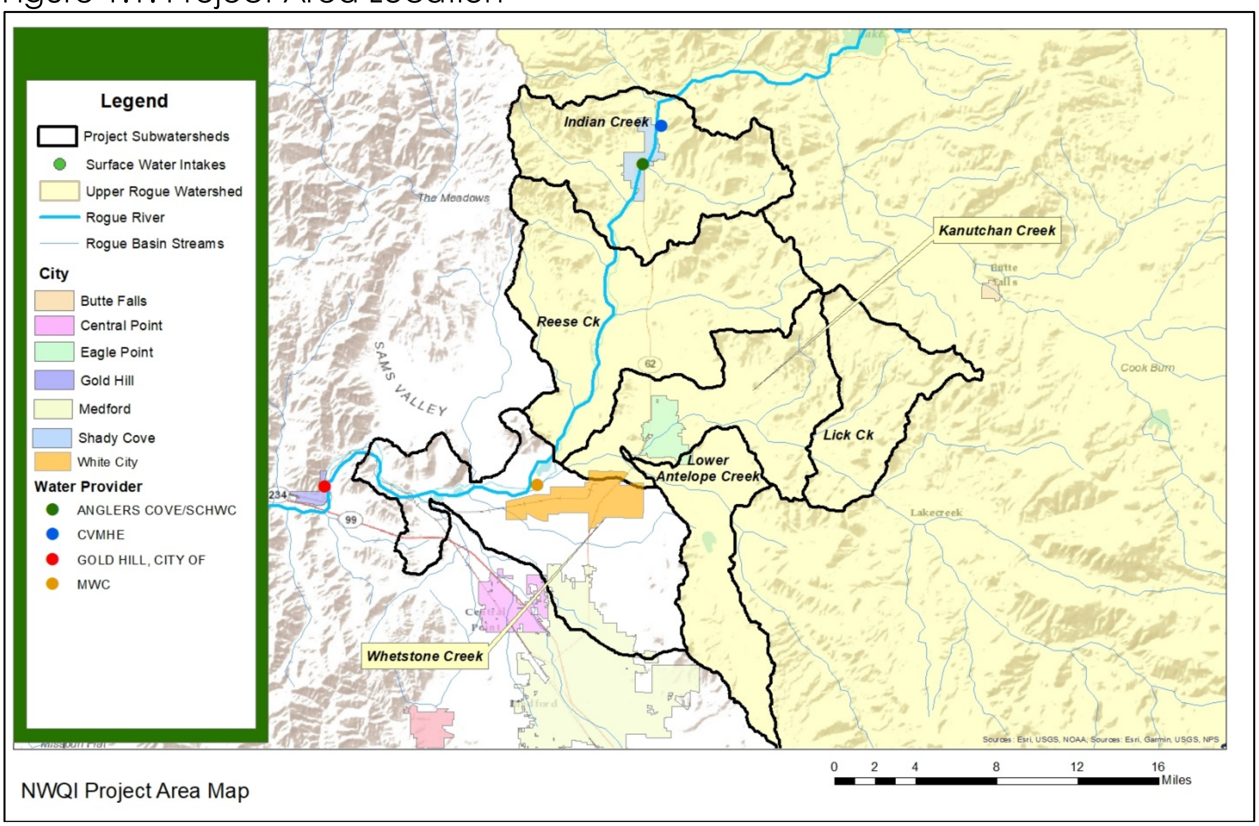


Table 1.1: Subwatershed Summary

Subwatershed	Area (Ac)	Percent of Project Area
Lower Antelope Creek	16,097	11
Whetstone Creek	32,763	22
Reese Creek	37,467	25
Lick Creek	14,839	10
Kanutchan Creek	21,960	15
Indian Creek	25,237	17

Drinking Water Providers and System Information

The Upper Rogue Watershed serves as the drinking water source for over 160,000 people in Jackson County, Oregon, with total withdrawals (from both surface and groundwater) equaling 39.04 million gallons per day (Mgal/d) (USGS, 2015). The drinking water providers (DWP) that utilize groundwater and surface water within the project area include Anglers Cove/Shady Cove Heights Water Company (SCHWC), Country View Mobile Home Estates (CVMHE), Hiland Water Company, and Medford Water Commission (MWC). Tables 1.2 and 1.3 (a.) and (b.) provide summary information for each of the DWPs, including treatment technologies needed to meet standards based on local water quality conditions, the number of surface water (SW) intakes and groundwater (GW) wells, and if there is a Source Water Protection Plan (SWP) completed. The locations of the surface water intakes are shown in Figure 1.1.

Table 1.2: Drinking Water Provider Information

Water Provider	Owner Type	Start of Operation	# SW Intakes	# GW Wells	# People Served	# Connections	SWP Plan?
Anglers Cove/SCHWC	Private	1999	1	1	83	42	No
CVMHE	Private	2002	1	3	132	53	No
Hiland Water Company	Private	2011	1	1	1,000	234	No
MWC	Public	1927	1	9	140,000	31,195	No[1]

[1]Plan is in development/drafted.

Table 1.3(a.) and (b.): Treatment Technologies Utilized

Water Provider	***Filtration***	***Pressure Sand***	***Rapid Sand***	***Membrane***	***Coagulation***	***Flocculation***
Anglers Cove/SCHWC	Yes	Yes	No	No	Yes	No
CVMHE	Yes	No	Yes	No	Yes	Yes
Hiland Water Company	Yes	No	No	Yes	No	No
MWC	Yes	No	Yes	No	Yes	Yes

Water Provider	***Rapid Mix***	***Sedimentation***	***Hypochlorination (pre or post)***	***Ozonation (pre or post)***	***pH Adjustment (pre or post)***
Anglers Cove/SCHWC	No	No	Yes; post	No	No
CVMHE	Yes	Yes	Yes; pre	No	No
Hiland Water Company	No	No	Yes; post	No	No
MWC	Yes	Yes	Yes; pre and post	Yes; pre	Yes; pre, post pending

Drinking Water for Rural Residents (Other Supplies)

While the majority of residents in Jackson County receive their drinking water through private or public DWPs, over 50,000 people utilize surface water (0.24 Mgal/d) and groundwater (7.91 Mgal/d) outside of DWPs (USGS, 2015) as their drinking water source. Contrary to the minimum treatment requirements of the private and public DWPs, domestic well water is only regulated, under the Domestic Well Testing Act, during a sale or exchange of real estate in Oregon (OHA, 2020). Due to water quality concerns with many domestic wells in Jackson County (more information in section 3.0), it is recommended that well owners get their well water tested for total coliform, *E. coli,* and nitrate every year, and tested for arsenic every three to five years (OHA, 2020).

Land Ownership

The project area comprises approximately 148,273 acres. Private lands make up most of the land ownership (83%), as seen in Figure 1.2. Private land includes urbanized areas of Shady Cove, Eagle Point, White City (unincorporated), and a portion of Medford. The cities comprise approximately 15% of the total private land, seen as the colored City polygons overlaid by the light blue Private Land

Ownership polygon. In addition, the land use is largely agricultural and rangeland. Federal lands (primarily BLM) comprise approximately 11% of the land, the State of Oregon: 2% (including Oregon State Forest Lands), Jackson County: 2%, and City Land: 2% (all cities).

Figure 1.2: Land Ownership

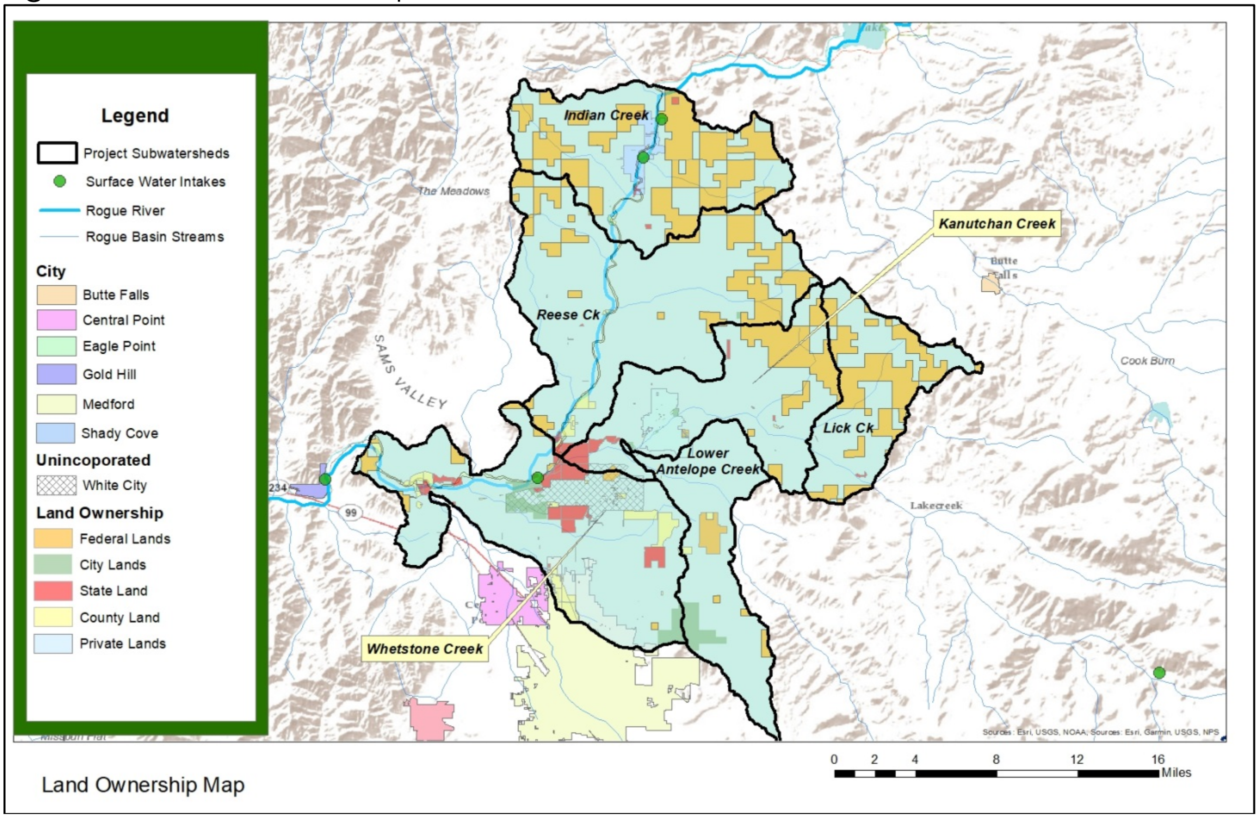


Table 1.4: Land Ownership by Subwatershed (Percent)

	Lower Antelope Creek	Whetstone Creek	Reese Creek	Lick Creek	Kanutchan Creek	Indian Creek
Federal	89	84.3	83.1	62	79.8	39.1
Private	5.4	2.4	15.2	37.8	16.7	60.3
State	<0.1	5	0.5	0.2	3.1	0.3
County	0.6	4.8	1.1	<0.1	0.1	0.2
City	5	3.4	0.1	0	0.4	0.04

NRCS – NWQI

In 2012, the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) launched the National Water Quality Initiative (NWQI), in collaboration with the Environmental Protection Agency (EPA) and state water quality agencies, to reduce nonpoint sources of nutrients, sediment, and pathogens related to agriculture in small high-priority watersheds in each state. These priority watersheds have been selected by NRCS State Conservationists, in consultation with state water quality agencies and NRCS State Technical Committees, where targeted on-farm conservation investments will deliver the greatest water quality benefits. NWQI provides a means to accelerate voluntary, private lands conservation investments to improve water quality with dedicated financial assistance through NRCS's Environmental Quality Incentives Program (EQIP), Clean Water Act Section 319, or other funds to focus state water quality monitoring and assessment efforts where they are most needed to track change. A key part of the NWQI targeting effort includes the implementation of conservation systems that avoid, trap, and control run-off in these high-priority watersheds (https://www.epa.gov/nps/nonpoint-source-national-water-quality-initiative).

As part of the NWQI process, a multi-phased area-wide plan is developed for each identified area of interest. This document represents the framework area-wide plan focusing on SWP.

2.0 OVERVIEW OF THE SOURCE WATER PROTECTION AREA

2.1 Physical Geography

The project area is located in the Upper Rogue Watershed from Shady Cove to downstream of the former Gold Ray Dam area, approximately 2.75 miles upstream of the Gold Hill water intake. The project area encompasses 148,273 acres (232 square miles). Elevations range from 1,120 to 4,320 feet.

Table 2.1(a): Physical Characteristics Summary

Physical Characteristics	Project Area
Basin Size (square miles)	232
Basin size (acres)	148,273
Maximum Elevation (feet)[1]	1,120
Minimum Elevation (feet)[1]	4,320

[1] Based on available contour data analysis

Table 2.1(b): Physical Characteristics Summary – Subwatersheds

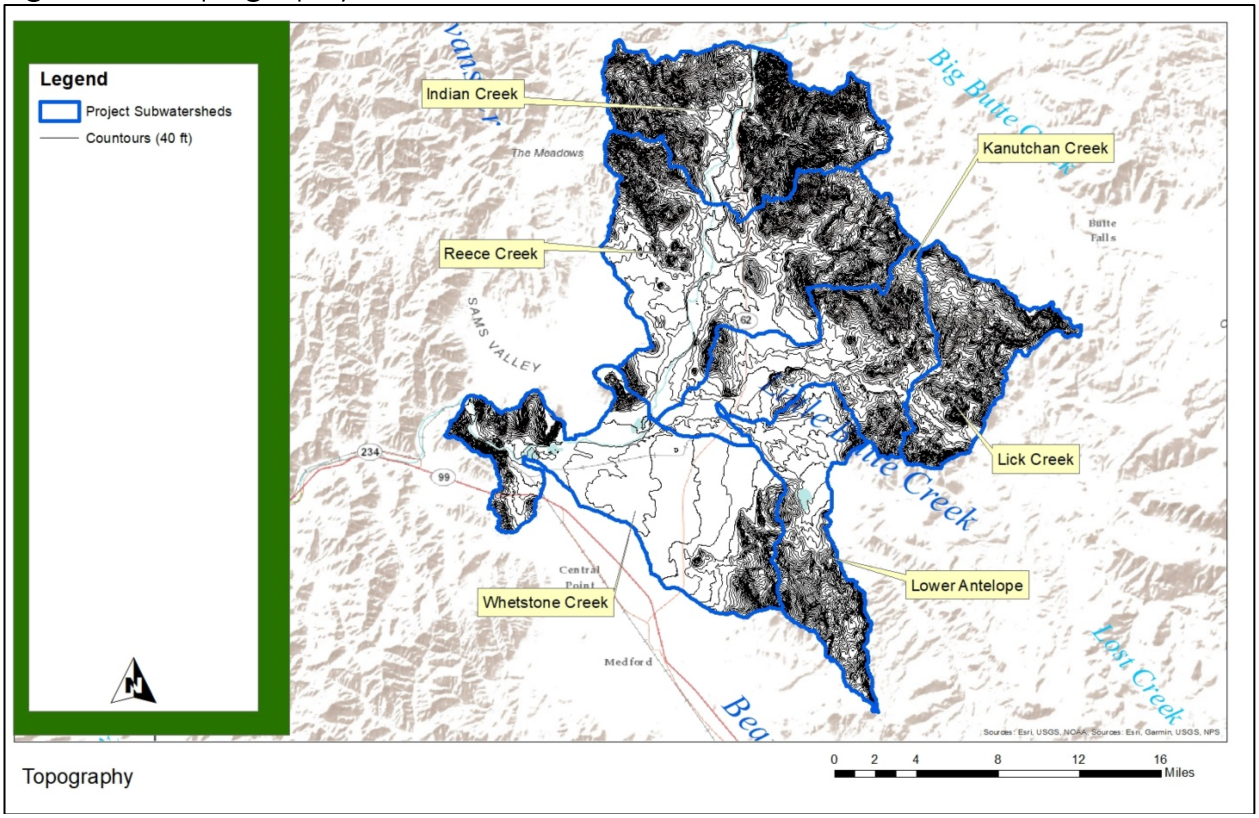
Subwatershed	Area (Square Miles)	Area (Ac)	Maximum Elevation (feet)[1]	Minimum Elevation (feet)[1]
Lower Antelope Creek	25	16,097	4,320	1,280
Whetstone Creek	51	32,763	3,560	1,120
Reese Creek	59	37,467	3,560	1,200
Lick Creek	23	14,839	4,160	1,480
Kanutchan Creek	34	21,960	3,680	1,200
Indian Creek	39	25,237	3,520	1,360

[1] Based on available contour data analysis

Topography

The topography of the project area (Figure 2.1) is characterized by mountainous terrain along the outskirts, with gentle valleys in the center. These flatter valleys are the result of the Rogue River, Little Butte Creek, and other tributaries flowing through the area. The steep slopes of the mountains provide a continuous direction for drainage, and this precipitation flows down as rainfall and snowmelt to empty into the various waterways.

Figure 2.1: Topography



2.2 Climate, Water, Geology, and Soils

Climate

Average annual precipitation in Jackson County is 26 inches, which generally occurs as low-intensity rainfall. Greater amounts of precipitation, including snow, fall in higher elevations; conversely, the valley floors are very dry. Very little precipitation occurs in the summer months, with most occurring between November and April. Representative average temperatures range between 31 degrees (January) and 89 degrees (July) Fahrenheit. Climate averages and ranges in the project area are summarized in Table 2.2.

Table 2.2: Climate Averages

	Jackson County	Shady Cove	Eagle Point	Gold Hill	United States
Rainfall	25.8 in.	26.2 in.	25.0 in.	25.1 in.	38.1 in.
Snowfall	6.0 in.	3.5 in.	3.7 in.	3.6 in.	27.8 in.
Precipitation	108.8 days	113.5 days	111.4 days	96.4 days	106.2 days
Sunny	196 days	194 days	199 days	197 days	205 days
Avg. July High	88.9°	89.2°	89.3°	89.8°	85.8°
Avg. Jan. Low	30.6°	31.0°	31.2°	31.1°	21.7°
Comfort Index (higher=better)	7.4	7.4	7.4	7.5	7
UV Index	3.2	3.2	3.2	3.2	4.3
Elevation	3173 ft.	1394 ft.	1306 ft.	1093 ft.	2443 ft.

https://www.bestplaces.net/climate/

Water

With the amount of precipitation that occurs each year (26 inches average annual precipitation) and the abundance of groundwater present in alluvial deposits within Jackson County, freshwater is available for a number of beneficial uses including drinking water, irrigation, livestock, industry and the natural environment. Using information from the Upper Rogue Watershed Assessment (2006), consumptive use data for the Indian Creek and Reese Creek subwatersheds was compiled into Table 2.3 and Table 2.4 below.

Table 2.3: Indian Creek Consumptive Use Data

Subwatershed	Storage	Irrigation	Total
Indian Creek	16.6 cfs – 87%	2.47 cfs – 13%	19.07 cfs

Table 2.4: Reese Creek Consumptive Use Data

Subwatershed	Storage	Irrigation	Domestic	Agricultural	Total
Reese Creek	0.06 cfs – 1%	3.41 cfs – 79%	0.24 cfs – 6%	0.6 cfs – 14%	4.31 cfs

Geology

Figure 2.2 and Table 2.5 show the geological diversity in the project area. Alluvial deposits flank the Rogue River and its tributaries, with adjacent terraces, pediments, and lag gravels. Basaltic lava flows comprise much of the eastern half of the project area, while nonmarine sedimentary rocks, gabbro, and ultramafic rocks characterize much of the western half. Additionally, there are several other smaller segments of varying geologies within the project area.

Figure 2.2: Local Geology

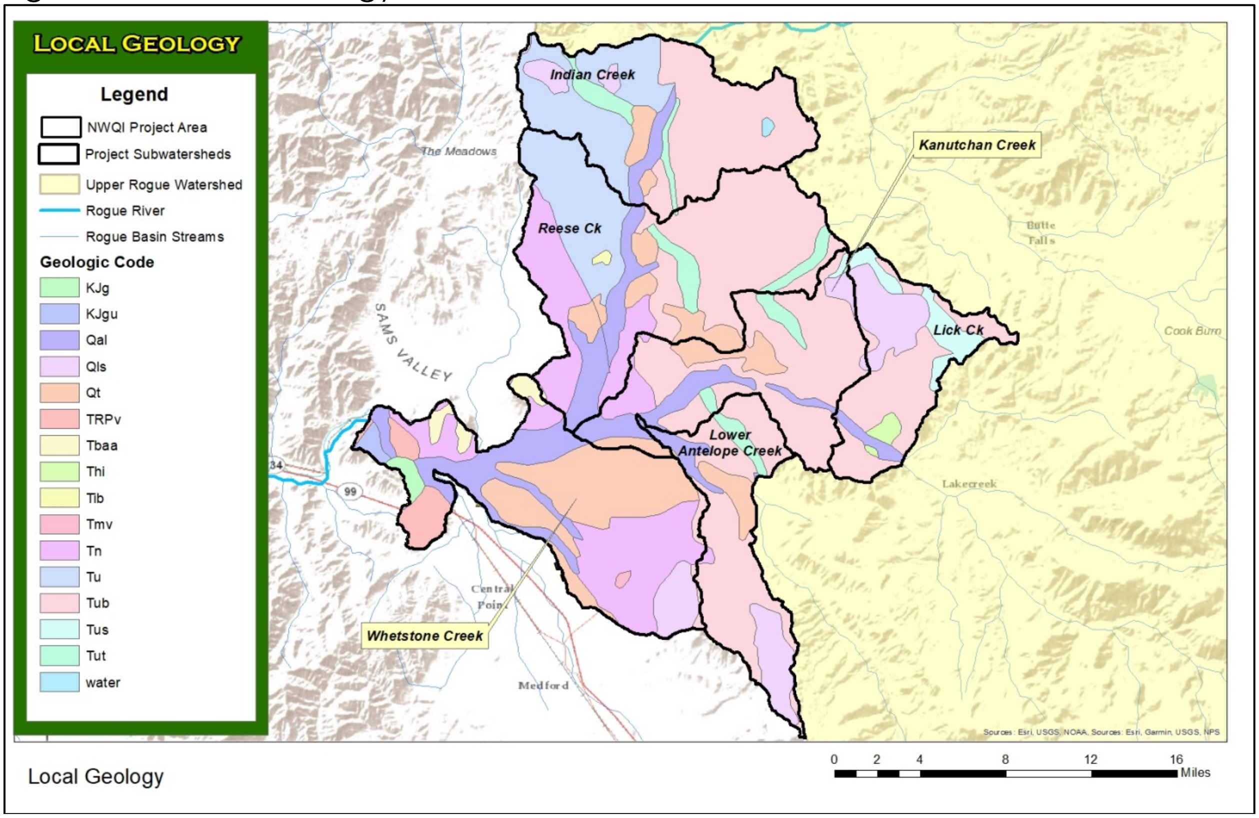


Table 2.5: Geologic Descriptions

Geologic Code	Unit Name	Age
KJg	Granitic rocks	Late Jurassic and Early Cretaceous
KJgu	Gabbro and ultramafic rocks associated with granitic plutons	Late Jurassic and Early Cretaceous
Qal	Alluvial deposits	Holocene
Qls	Landslide and debris-flow deposits	Pleistocene to Holocene
Qt	Terrace, pediment, and lag gravels	Pleistocene to Holocene
TRPv	Volcanic rocks	Triassic and (or) Jurassic
Tbaa	Basaltic and andesitic rocks	Middle to Late Miocene
Thi	Hypabyssal intrusive rocks	Miocene
Tib	Basalt and andesite intrusions	Oligocene(?) to Pliocene
Tmv	Mafic vent complexes	Late Miocene to Pleistocene
Tn	Nonmarine sedimentary rocks	Eocene
Tu	Undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt	Oligocene to Miocene
Tub	Basaltic lava flows	Oligocene to Miocene
Tus	Sedimentary and volcanoclastic rocks	Tertiary
Tut	Tuff	Tertiary

https://mrdata.usgs.gov/geology/state/fips-unit.php?code=f41029

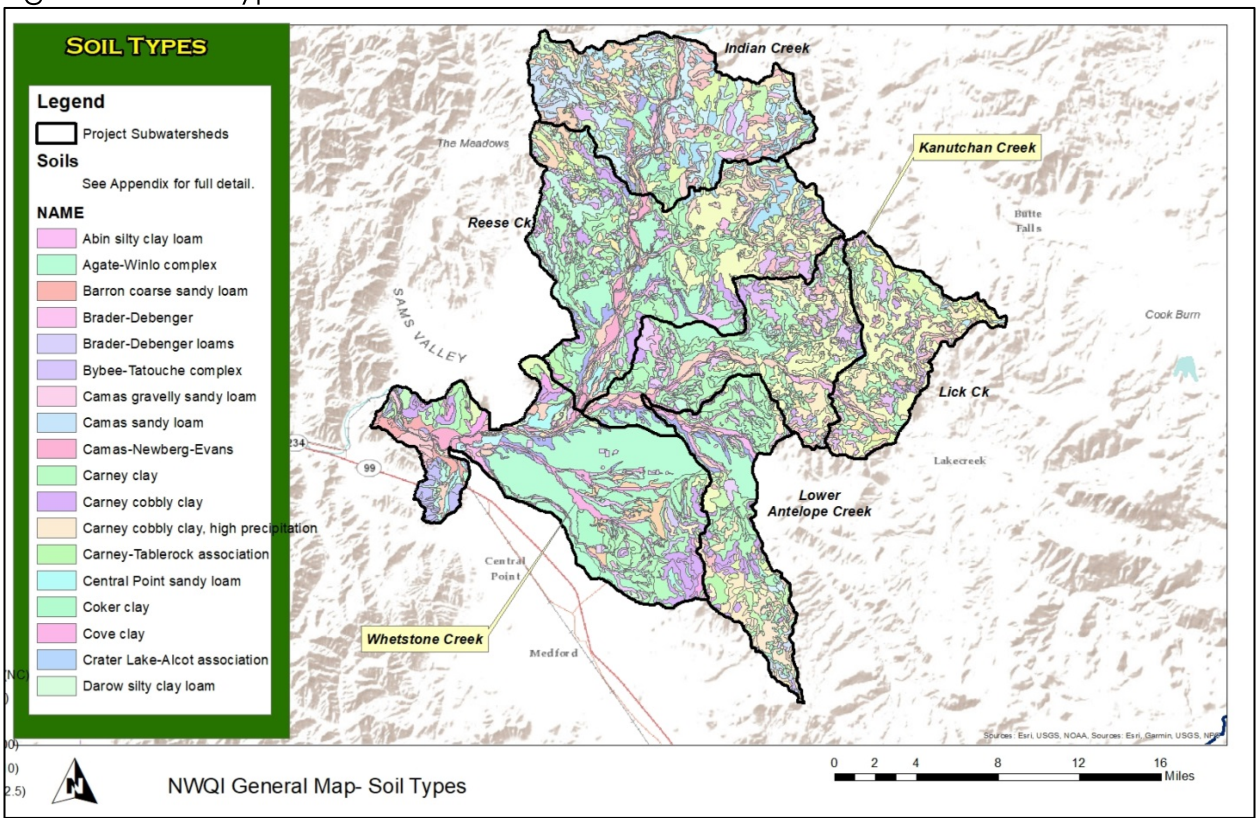
Soil Types

Within the project area, the dominant soil orders include: Alfisols, Inceptisols, and Ultisols. For descriptions of these soil orders, see Appendix B.

Figure 2.3 shows the soil types found in the project area. The legend on the figure shows a partial list of the soil types (only those that would fit in the legend). A full list can be found in the Appendix C. Additional information on each soil type including specific descriptions, engineering properties, water management, characteristic plant communities, crop and pasture capability and yields, and physical and chemical properties can be found in the Soil Survey of Jackson County Area, Oregon or accessed online through the NRCS' web soil survey site: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

All soils data was collected by the NRCS and was summarized from the Soil Survey of Jackson County accessed online (websoilsurvey), electronically (GIS files), or referenced from hard copies.

Figure 2.3: Soil Types



Soil Limitations

Figure 2.4 shows severe and severe-moderate soil limitations in the project area. These limitations may be due to surface runoff, wind erosion, and/or other causes that have led to a decrease in fertile topsoil. Many of the areas adjacent to the Rogue River and other tributaries do not appear to be as heavily impacted. This may be attributed to the gentler topography (seen in Figure 2.5) within the valleys and the reduced impact of water erosion. Additional limitations (slope hazards) are also shown on Figure 2.5.

Figure 2.4: Soil Limitations

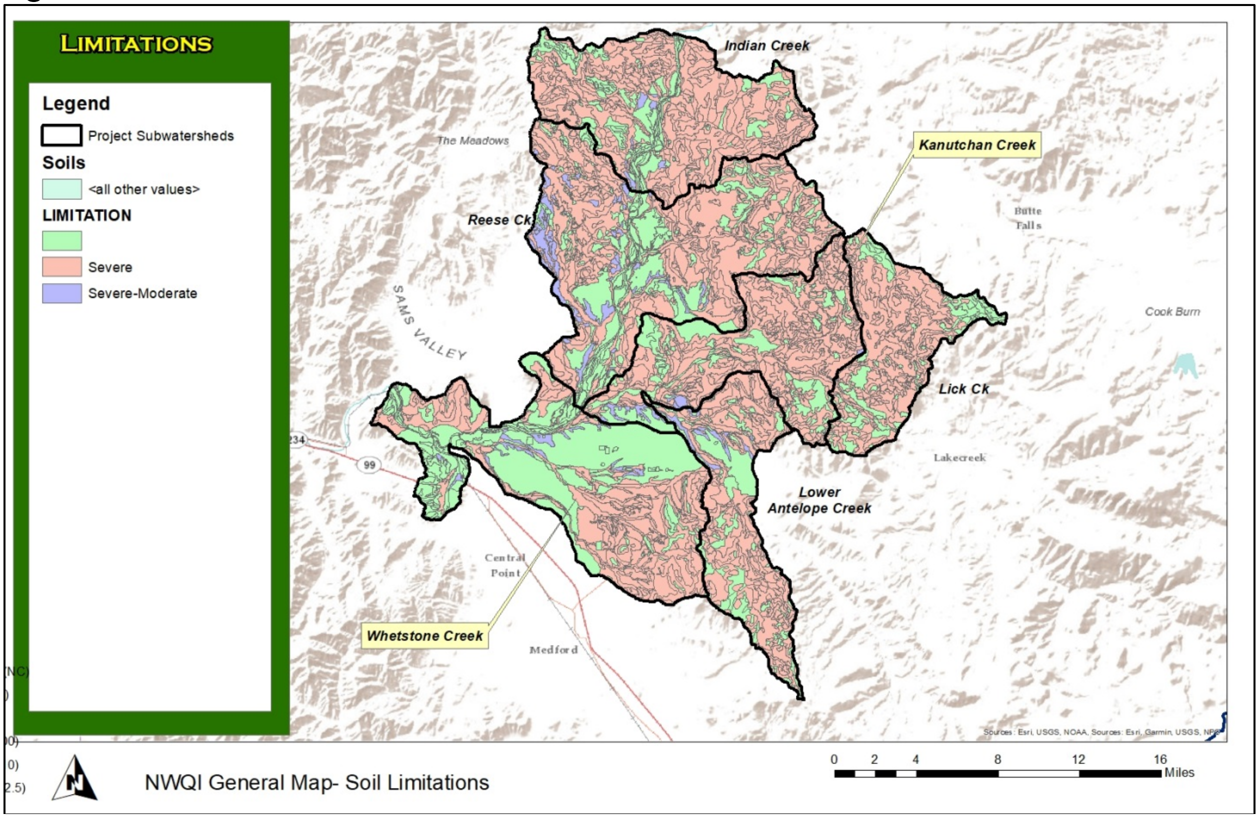
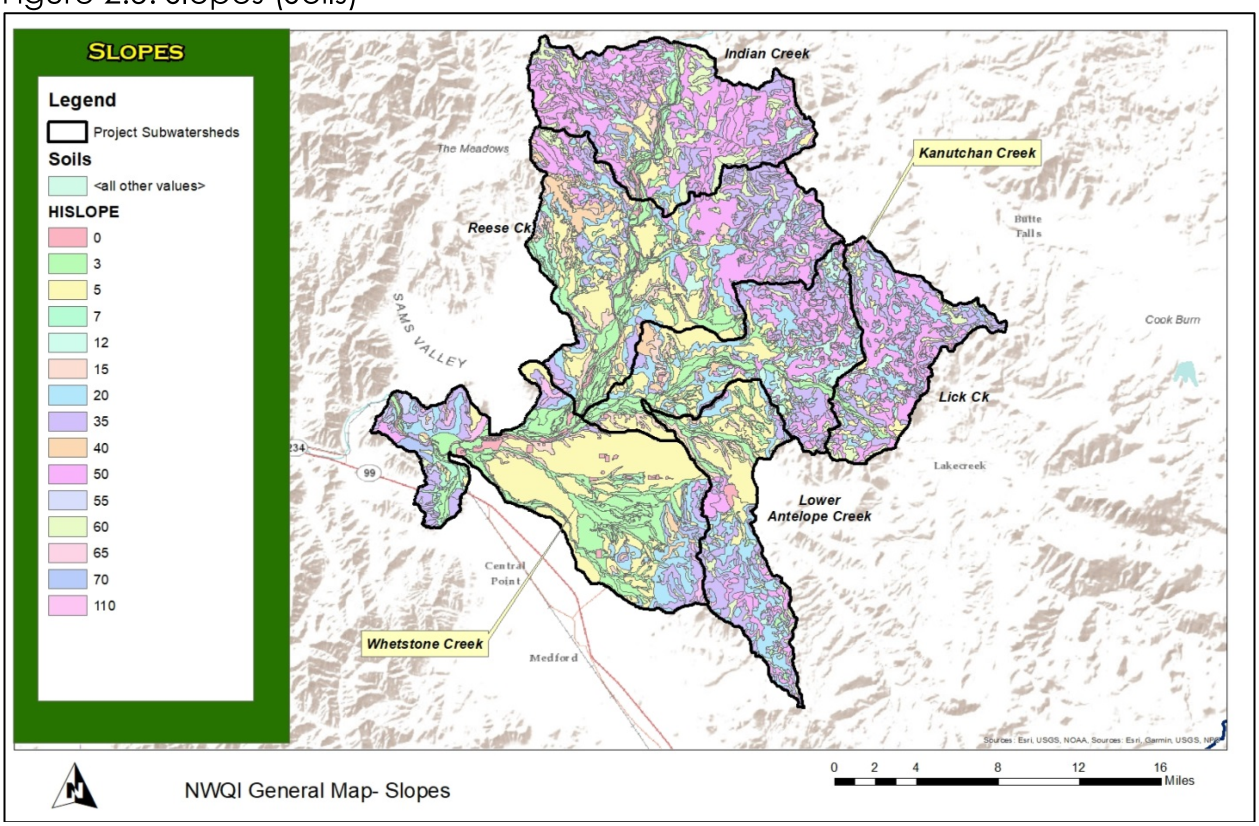


Figure 2.5: Slopes (Soils)



2.3 Land Use and Population

Land Use

Figures 2.6 through 2.9 show land use in the project area based on zoning, agricultural land use, and protected areas in the watershed, both private and public, including National Forests, BLM land, parks, trails, nature preserves, cemeteries, athletic fields, historical sites, and greenways.

A large portion of the project area (45%) is zoned for agricultural use (EFU or AG) and almost all agricultural land is private (97%).

Figure 2.6: General Zoning (County)

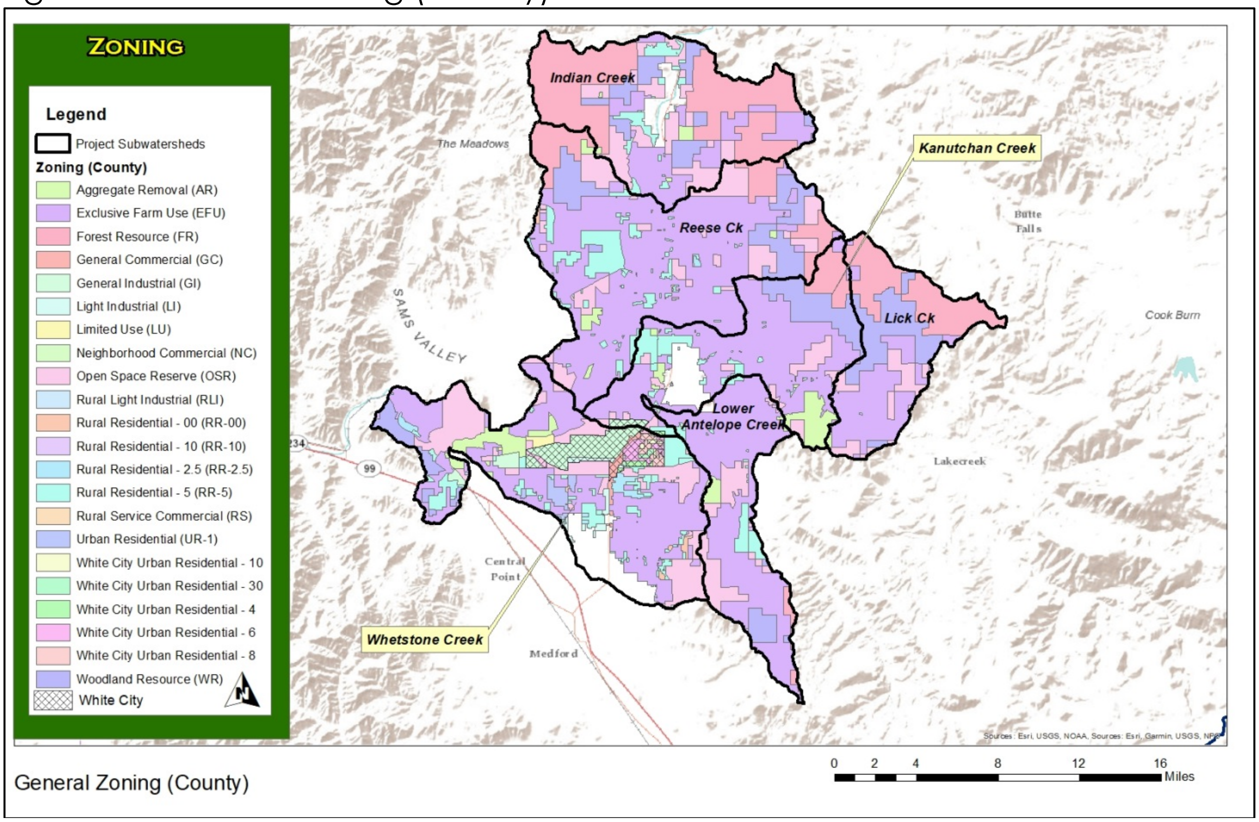


Figure 2.7: General Zoning (City)

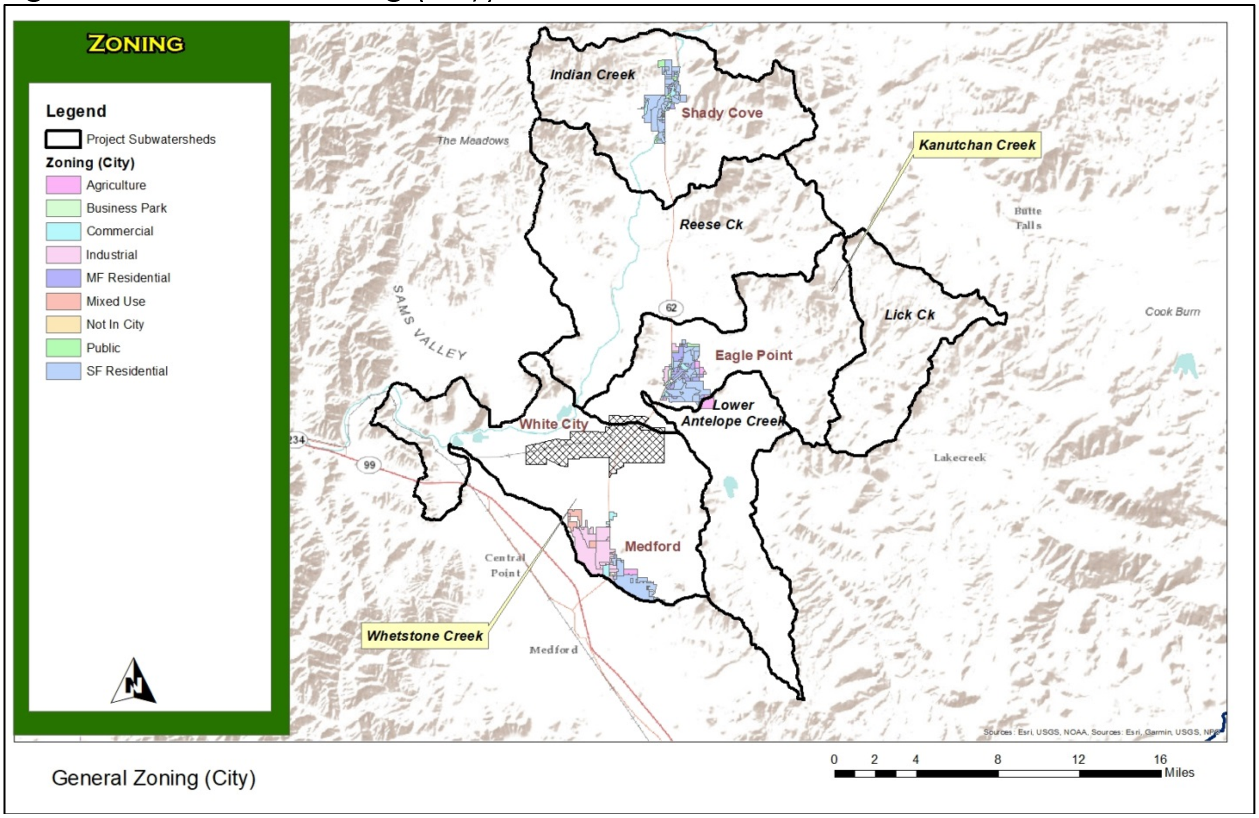


Figure 2.8: South Obenchain Fire and Agricultural Lands

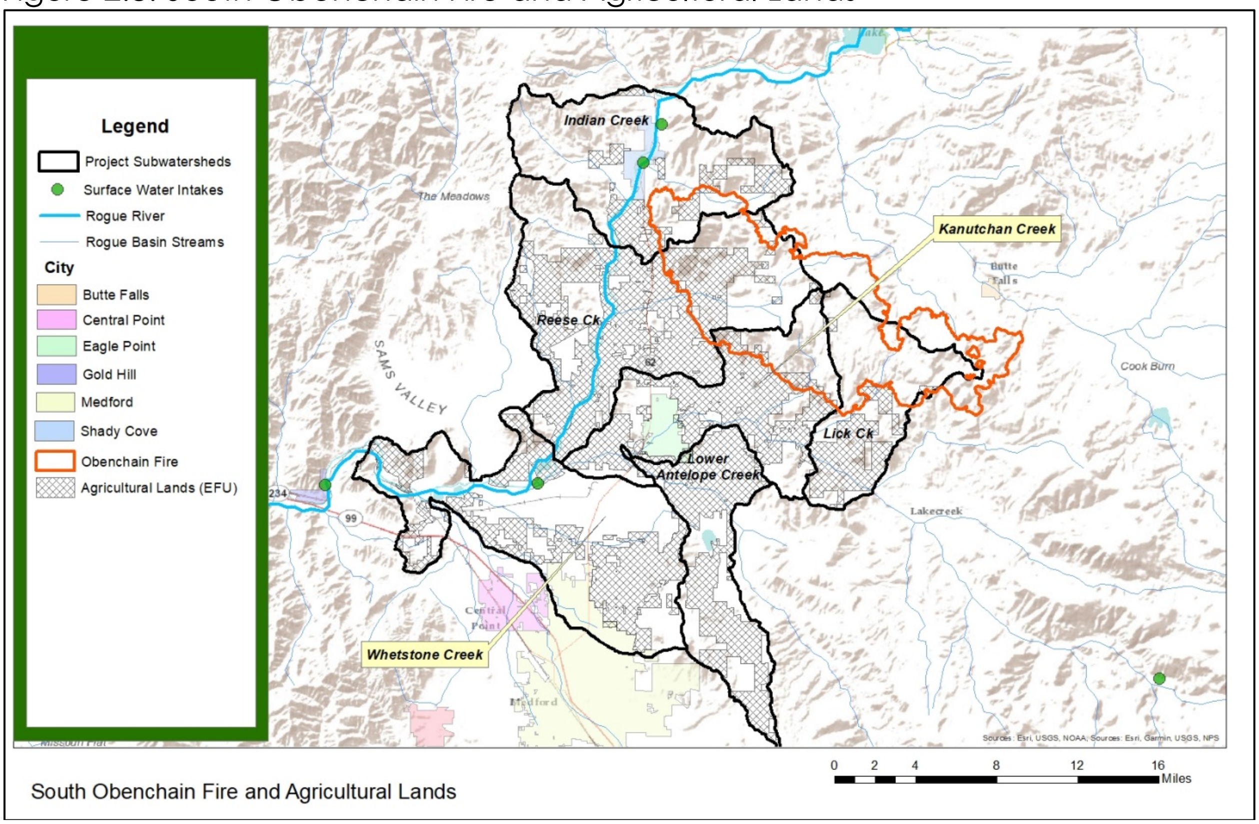
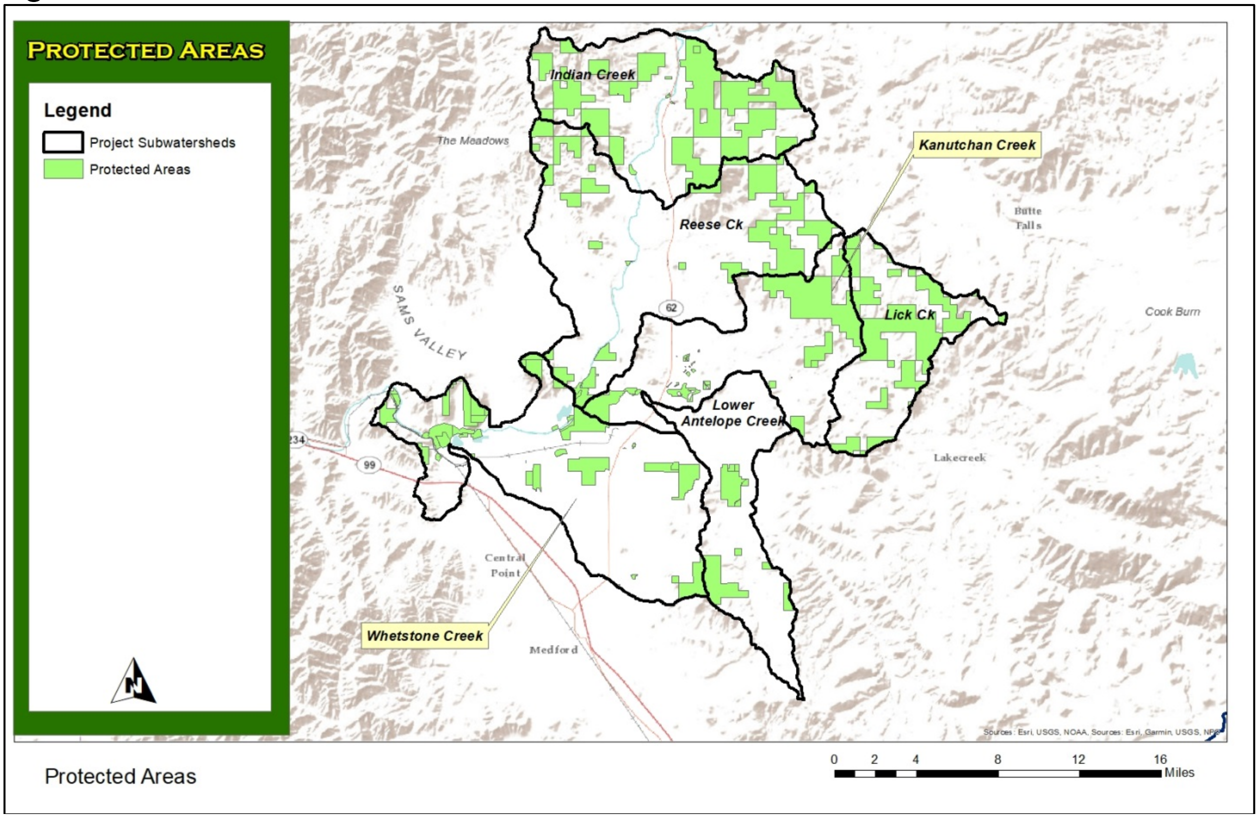


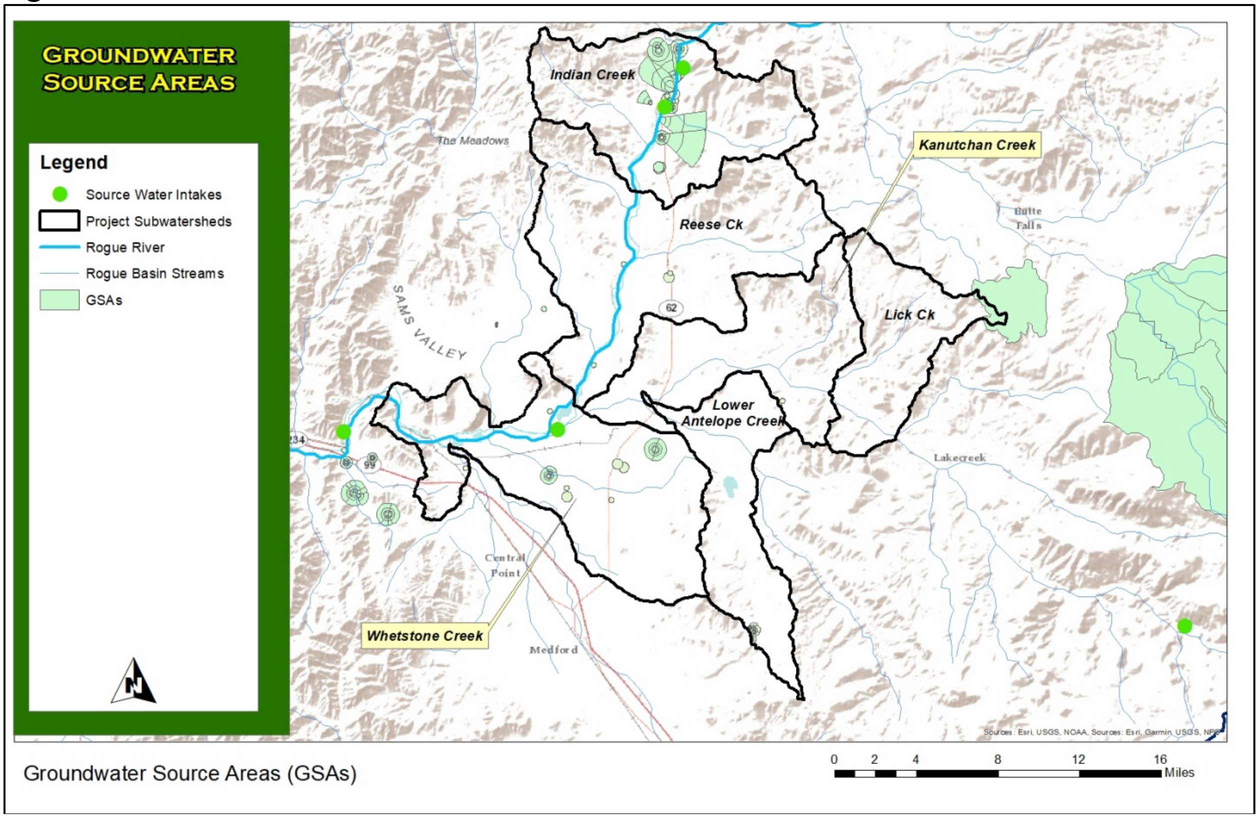
Figure 2.9: Protected Areas



Population

The project area includes the communities of Shady Cove (pop. 2,904*), Eagle Point (8,469*), White City (7,975*), parts of Medford (estimated 11,236 residents*), and Jackson County (*population figures from the 2010 census). These residents rely not only on the private (non-public) and public water suppliers, but on private domestic-use wells for their drinking water. Refer to Table 1.2 for information on the private and public drinking water providers. Figure 2.10 shows the location of known Groundwater Source Areas (GSAs).

Figure 2.10: Groundwater Source Areas



2.4 Socioeconomic Conditions

Beginning in the 1840s, Euro-American settlers began farming and ranching in the Rogue Valley. In the 1850s, the first wave of agricultural growth within the region was the result of miners flocking to Jacksonville to find gold, followed by the second wave in the 1890s for timber. With new harvesting equipment and methods, along with the establishment of the Oregon and California Railroad in 1887, both the agricultural and timber industries grew rapidly.

During the early 1900s, the Rogue River Electrical Company, which was absorbed by the California-Oregon Power Company, harnessed the technology of hydroelectric power on the Rogue River. Mines, such as the Elk Creek Mine, produced gold, silver, and lead. To attract tourists to the areas of the Upper Rogue, poor road conditions were improved (URWA, 2006).

While the Upper Rogue Watershed is mainly rural, the project area includes several towns and a portion of Medford. Overall, populations in the small towns of Shady Cove and Trail, as well as the larger cities of Eagle Point and White City, have grown significantly over the last fifty years.

For a more current picture of the project area's environmental and demographic indicators, the EPA's Environmental Justice Screen (EJSCREEN) online tool was used to reveal variables, such as particulate matter, ozone, hazardous waste proximity, minority and low income populations, and others, summarized in Table 2.6 below.

Table 2.6: Environmental and Demographic Indicators for the Project Area

Selected Variables	Value	State		EPA Region		USA	
		Avg.	%tile	Avg.	%tile	Avg.	%tile
Environmental Indicators							
Particulate Matter (PM 2.5 in μg/m³)	6.4	6.63	35	6.6	47	8.3	10
Ozone (ppb)	36	34.2	77	35.1	69	43	13
NATA* Diesel PM (μg/m³)	0.264	0.393	40	0.479	<50th	0.479	<50th
NATA* Air Toxics Cancer Risk (risk per MM)	34	31	59	31	50-60th	32	60-70th
NATA* Respiratory Hazard Index	0.55	0.48	70	0.46	60-70th	0.44	70-80th
Traffic Proximity and Volume (daily traffic count/distance to road)	230	480	55	500	55	750	51
Lead Paint Indicator (% pre-1960s housing)	0.098	0.25	34	0.23	42	0.28	37
Superfund Proximity (site count/km distance)	0.019	0.083	15	0.13	19	0.13	16
RMP Proximity (facility count/km distance)	0.24	0.78	47	0.65	50	0.74	43
Hazardous Waste Proximity (facility count/km distance)	0.24	1.4	37	1.5	41	4	39
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	9.5E-05	0.0056	53	31	60	14	54
Demographic Indicators							
Demographic Index	29%	29%	59	29%	59	36%	48
Minority Population	20%	23%	51	27%	44	39%	37
Low Income Population	39%	34%	63	31%	69	33%	64
Linguistically Isolated Population	1%	3%	55	3%	52	4%	49
Population with Less Than High School Education	12%	10%	68	9%	71	13%	59
Population under Age 5	6%	6%	61	6%	55	6%	56
Population over Age 64	18%	16%	65	15%	72	15%	72

*The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

2.5 Goals and Objectives of the Source Water Protection Plan

Source Water Protection Plan Goals and Objectives

1. Provide an overview of the source water protection area and at-risk public water system(s).

2. Characterize the areas of influence for the SWP.

3. Identify and prioritize areas that require the implementation of SWP measures in the project area.

4. Identify best management practices (BMP) to protect source water quality in relation to pollution and chemicals, including pesticides and CAFOs.

5. Identify BMPs that will help protect source water quality from the impacts of erosion related to landslides and wildfires.

6. Increase coordination and collaboration between local, state, and federal partners to address SWP and the actions that can be taken.

7. Increase the capacity of the RDWP to respond to the actions of private landowners and provide guidance for implementing BMPs.

8. Develop an outreach strategy for partners and the greater RDWP to utilize when providing assistance to private landowners in critical areas.

9. Highlight education and outreach as an effective strategy for effecting change within critical areas.

10. Through BMP implementation, reduce the total amount of contaminants that enter waterways within the SWP project area.

Assessment of NRCS' Ability to Help Partners Reach Source Water Protection Goals

1. NRCS can support the goal of reducing the total amount of contaminants that enter waterways through BMP implementation.

2. NRCS can provide technical assistance and resources to increase the capacity of partners to provide education and outreach to private landowners within the SWP project area.

3. NRCS can provide support to partners and the RDWP to leverage funding from multiple local, state, and federal sources to address threats to the SWP project area.

3.0 IDENTIFIED THREATS TO THE SOURCE WATER PROTECTION AREA

Source water is surface and/or groundwater that serve as a source of drinking water. When source water is heavily impacted by residential, urban, industrial, and agricultural activities, as well as natural disasters (erosion, landslides, wildfires, etc.), potential contaminant sources (PCS) can enter waterways. Furthermore, infrastructure can be damaged, releasing additional pollutants. Commonly identified PCS and threats to source water include pollution/chemicals, pesticides, concentrated animal feeding operations (CAFOs), high risk land uses, erosion, landslides, and debris flows, and wildfires. A list of PCS and potential water quality impacts are shown in Appendix A.

PCS – General

PCS within the source water and/or delivery and treatment infrastructure can lead to both short-term and long-term supply interruptions, including system shut-downs, use of alternate supplies, diminished reservoir capacity, and/or increased maintenance costs for drinking water treatment facilities. These increased maintenance costs come in the form of more frequent backwashing (forcing clean water through filters in a direction opposite to normal flow) of filters and repeated replacement of filter media (sand, gravel, and/or charcoal), as well as an elevated use of disinfectants (chlorine or chloramine). In addition to increased costs, the use of additional disinfectant to treat drinking water can cause the water to have a slight chemical smell and/or taste, which may lead to customer dissatisfaction.

In order to combat both the increasing presence of PCS in the source water and the costs of drinking water treatment, it is important to understand the types of pollution and chemicals that currently exist in the watershed, including pesticides, natural processes (which are often exacerbated by human influence), and the mix of land use activities. Specific threats are discussed in more detail in the following sections.

Pollution/Chemicals

Pollutants of concern that have been identified during discussions with local drinking water providers, or identified in research completed for this report, include: ammonium, bacteria (total coliform and *E. coli*), barium, bromate, dioxin and furan, inorganic arsenic, nickel, polychlorinated biphenyls (PCB), radon, total organic carbon (TOC), turbidity, and uranium (DEQ, 2020). A summary of violations and alerts for each provider is provided in Table 3.1 below.

Table 3.1: Violation and Alert Summary by Water Provider

Water Provider	Current MCL Violations?	Years	Alerts	Other Substances of Concern
Anglers Cove/SCHWC	No	2007	Total coliform[A]	Barium[1], radon[2], and uranium[2]
CVMHE	No	2010-2015, 2018	Sodium[3], total coliform[3], and xylenes[3]	-
Hiland Water Company	No	-	-	Barium[1], radon[2], and uranium[2]
MWC	No	2003, 2007-2017	Bromate[4], nickel[5], and total coliform[4] and *E. coli*[4]	High levels of turbidity[6] and total organic carbon[6] (TOC)

[A]Violation
[1]Barium is a naturally-occurring substance in Shady Cove's source water (Hiland Water Company, 2017).
[2]Radon and uranium in the source water are a result of the erosion of natural deposits and/or mining activities (Hiland Water Company, 2017).
[3]Sodium (2010), total coliform (2011 and 2018) and xylenes (2010-2015) alerts listed in the updated source water assessments (SWA) (DEQ, 2018).
[4]Bromate (2009; at surface water intake) and total coliform and *E. coli* (2007-2017; at Big Butte Springs groundwater well) alerts listed in the updated SWA (DEQ, 2018; OHA, 2020).
[5]Nickel (2003; at Big Butte Springs groundwater well) alert listed under public water system alerts on Oregon Public Health's Drinking Water Data Online platform (OHA, 2020).
[6]Heightened levels of turbidity and organic matter can create issues for drinking water treatment, as well as aquatic life (DEQ, 2020), which will be discussed in a later section.

According to the updated SWA from DEQ for each of the drinking water providers, substances identified within each DWP area will likely continue to be present in the source water due to high soil erosion potential and erodible soils within the 8-hour time of travel (TOT) (the distance that PCS can travel within 8 hours). Appendix D. shows the 8-hour TOT in the vicinity of the project area. Issues with erosion are discussed further in later sections.

Regarding domestic well water, both groundwater quantity and quality is declining within the Rogue Basin. Decreasing groundwater recharge and an increasing rural population has caused a significant drop in the water table. Paired with the issue of groundwater quantity are pollutants present within the groundwater system, including: bacteria, nitrate, arsenic, salts and minerals, fluoride, and boron (DEQ, 2011). These pollutants pose as a threat to human health, especially the levels of nitrate seen in the Rogue Basin. Nitrate concentrations within several wells in the Rogue Basin amount to 7 milligrams per liter (mg/L); concentrations at or above 11 mg/L begin to limit the recommended water use for those wells (OHA, 2016). Although the Rogue Basin is not yet designated as a Groundwater Management Area (GWMA), if nitrate concentrations continue to trend upwards, DEQ may declare the area as such (DEQ, 2020).

Pesticides

Two pesticides of concern and one local problem pesticide were identified in the Middle Rogue Pesticide Stewardship Partnership (MRPSP) 2019 Strategic Plan: Diuron, Imidacloprid, and Oxyfluorfen, respectively (MRPSP, 2019). Both Diuron and Imidacloprid are pesticides of concern throughout Oregon. It has been suggested that these pesticides' widespread surface water contamination is linked to regulatory and labelling issues at the state level, rather than local misuse and application in excess amounts. While these pesticides were found within the Bear Creek Watershed, it can be inferred that these pesticides would likely be detected within the project area. Specifically, these pesticides are likely to be found in the Whetstone Creek area, which is the most similar to the Bear Creek subwatersheds in terms of land use and ownership.

CAFOs

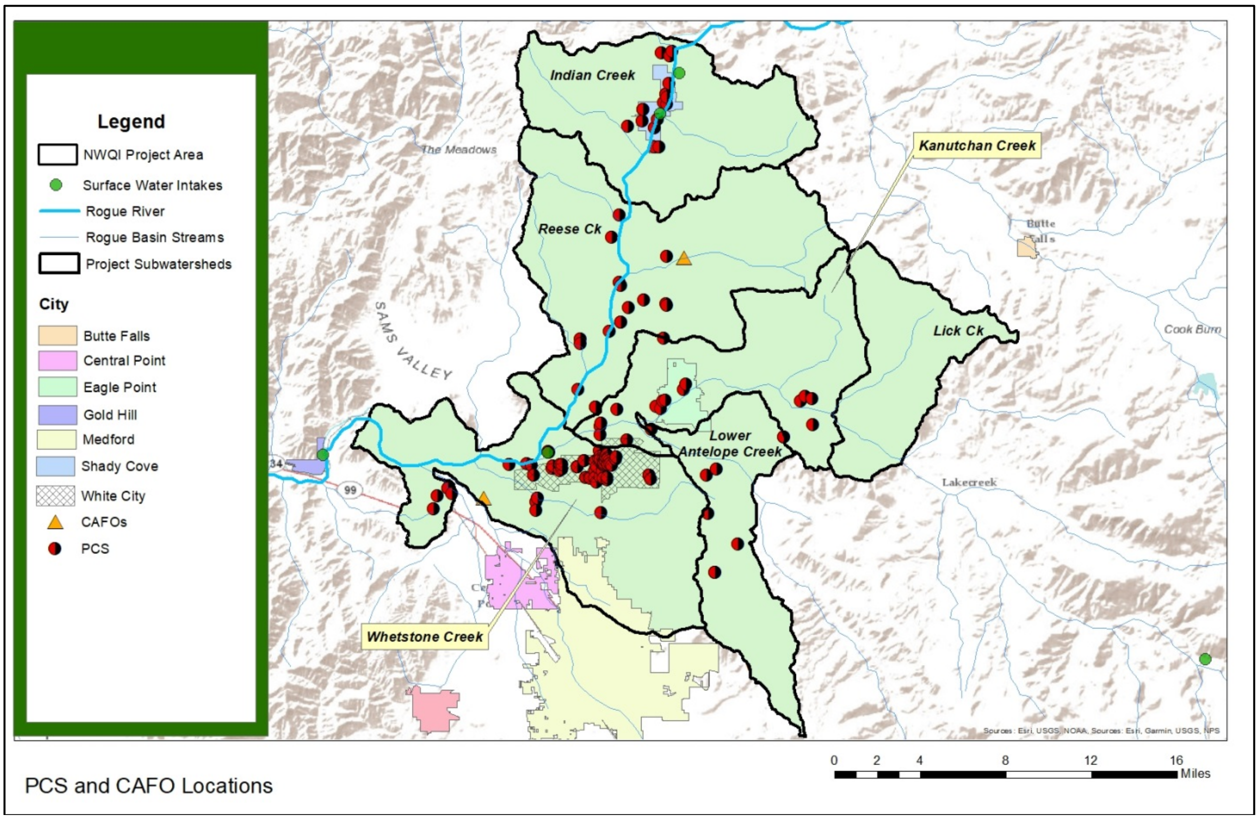
A concentrated animal feeding operation (CAFO) is an agricultural enterprise in which more than 1,000 animal units are confined on site for more than 45 days during the year (NRCS, 2020). Animals, along with their feed, manure and urine, are kept within a small land area. In addition, dead animals, tools, and other materials supporting the CAFOs may also be kept onsite. While CAFOs have the potential to negatively impact both air and water quality, NRCS provides both technical and financial assistance to landowners to help them protect natural resources. As such, two CAFOs are located in the project area, and these operations are designated by the orange triangles in Figure 3.1. The CAFOs do not overlap with any Groundwater Source Areas (GSAs), or areas where groundwater aquifers are utilized for source water, which would present a high risk for the project area and source water.

High Risk Land Use

Evaluation of high risk land uses was completed using the PCS rating data provided by DEQ and others. PCS locations were plotted in Figure 3.1. Individual ratings were evaluated (high, moderate, and low rankings), and the highest risk land uses were selected based on data evaluations and discussions with the Rogue Drinking Water Partnership (RDWP) members, including MWC, City of Grants Pass, DEQ, and the Rogue River Watershed Council (RRWC).

Descriptions of PCS codes, activity types, risks to surface water (SW) and groundwater (GW), and potential water quality impacts can be found in Appendix A.

Figure 3.1: PCS and CAFO Locations in the Project Area

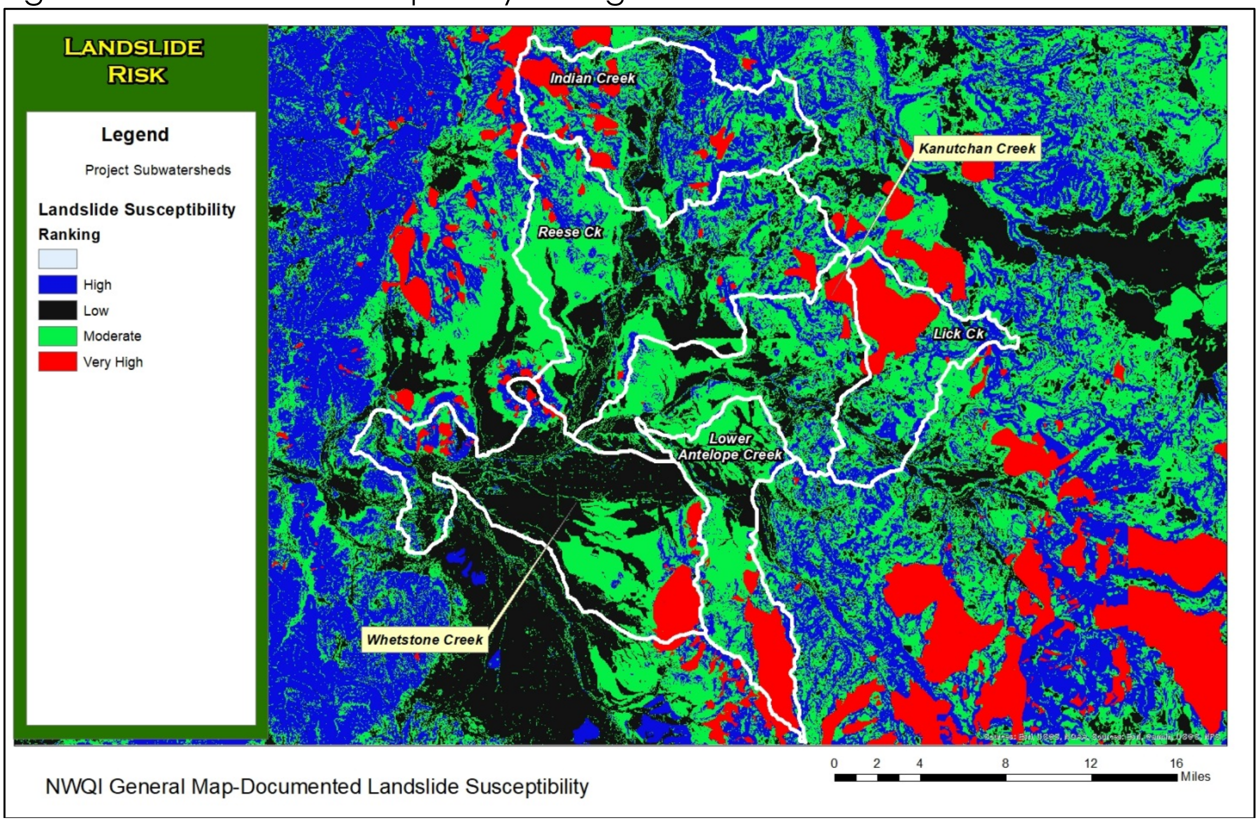


Erosion, Landslides, and Debris Flows

The risk of soil erosion and transport to waterbodies increases substantially with both steep slopes and in post-fire environments (DEQ, 2020). Associated with soil erosion is ash and loosened sediments from logging roads, landings on steep slopes, and burned areas, which may include chemicals bonded to these sediments. Monitoring is currently underway to determine specifically which chemicals are of a concern from the fires. Additional information relating to chemicals from fires can be found in the wildfire discussion below. Sediments, and especially those that have bonded with chemicals, pose as major water quality concerns for both drinking water and aquatic life.

Landslides also present a risk in the project area, specifically in portions of the upper area of most subwatersheds. Figure 3.2 shows landslide susceptibility (risk) in the watershed, including very high risk (red areas), high risk (blue), and moderate risk (green) from LIDAR imaging provided by DOGAMI.

Figure 3.2: Landslide Susceptibility Ratings



Four recent landslides have been documented in the project area as shown in Figure 3.3. Two of the landslides occurred in the Indian Creek Basin and two in the Whetstone Creek Basin. In addition, a debris slide occurred in June of 2018 in the upper Little Butte Creek Basin (MWC, 2021), and the impacts of that debris slide can be seen in Figure 3.4 below.

Figure 3.3: Documented Landslides

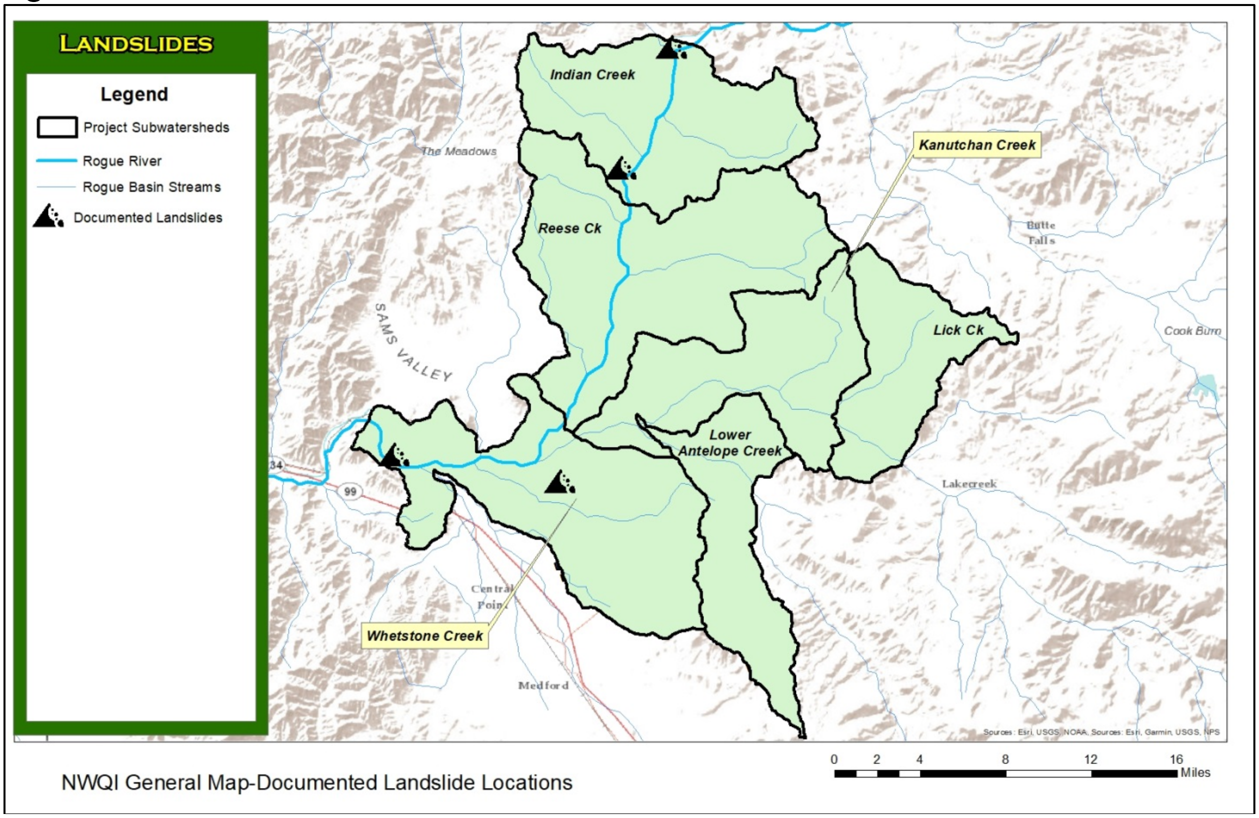


Figure 3.4: Turbidity Plume Entering the Rogue River from Little Butte Creek

Debris flows, which are slurries of rocks, water, logs, and other debris, are often influenced by landslides. Often occurring on steep slopes and drainages after storm events and snowmelt, debris flow hazards are elevated in the absence of vegetation and in the presence of soil disturbance. Debris flows can cause damage to drinking water infrastructure (intakes, treatment plants, storage ponds, and tanks), as well as lead to massive spikes in turbidity and organic matter concentrations in nearby waterbodies. Heightened levels of turbidity and organic matter can create issues for drinking water treatment, such as the creation of disinfection by-products, as well as aquatic life (i.e., smothering of salmonid eggs by sediments) (DEQ, 2020). Fires (discussed in the next section) can increase the risk and occurrences of debris flows.

Wildfire (South Obenchain Fire)

On September 8th, 2020 at 1:59 P.M., the South Obenchain Fire started five miles east of Eagle Point. Due to extremely dry and hot conditions, wind gusts, and an abundance of fuel (timber, brush, and logging slash), the wildfire had engulfed 32,671 acres by the end of September, which is an estimated 20% of the project area (seen as the orange area in Figure 3.5(a.) and (b.) below).

Figure 3.5(a.): South Obenchain Fire Location

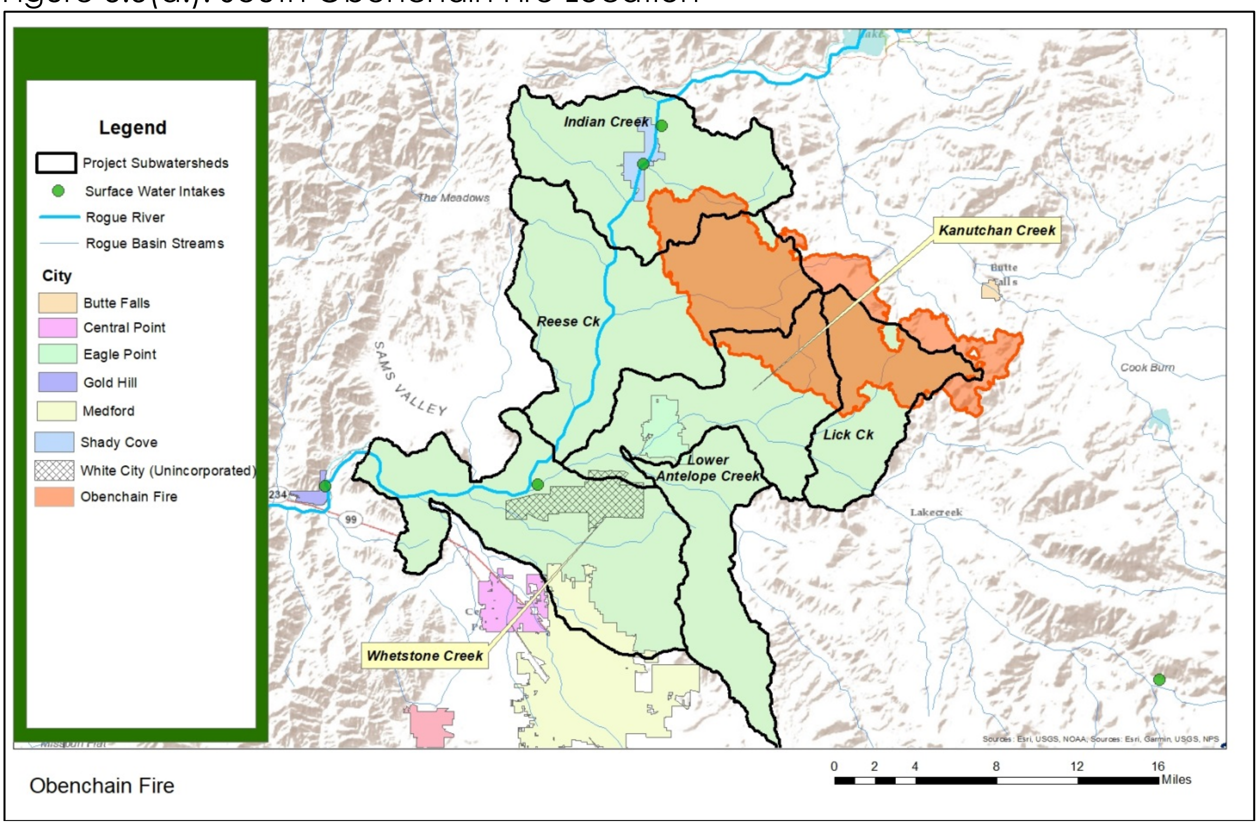
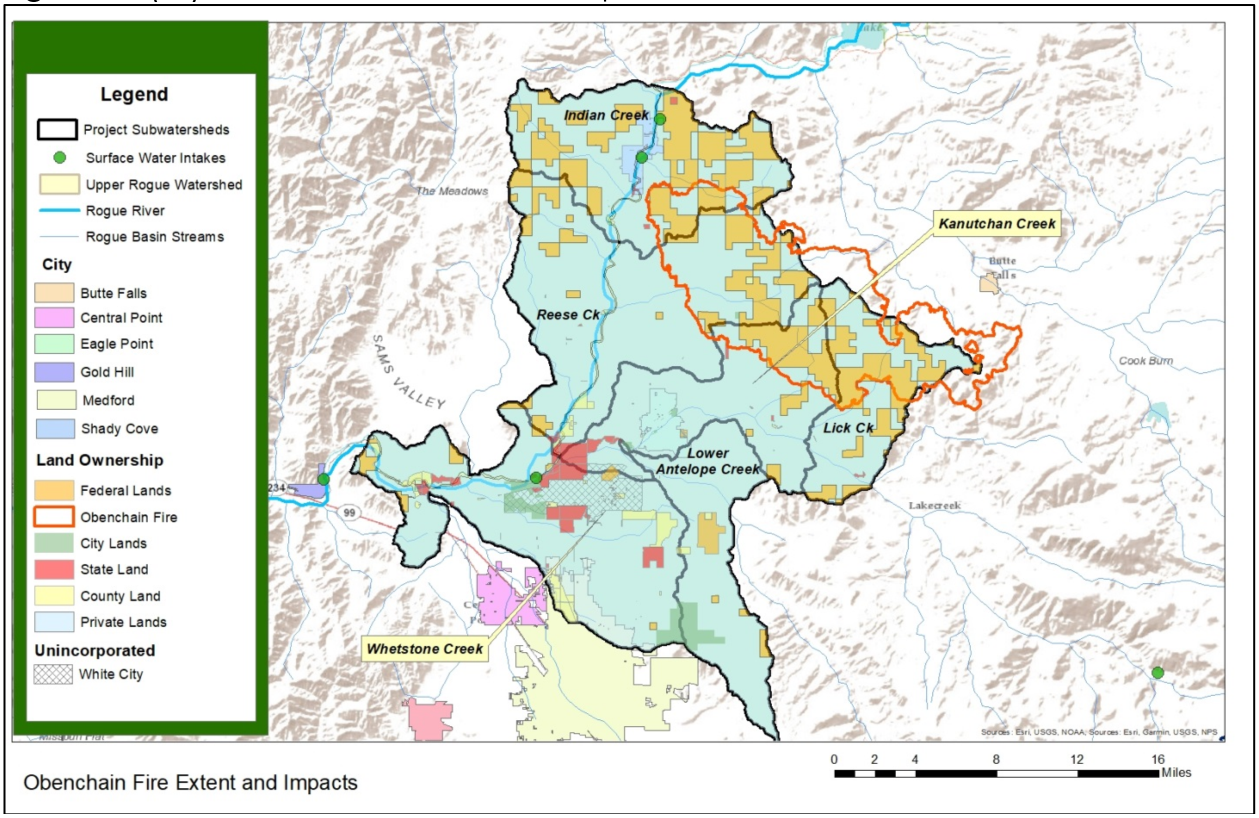


Figure 3.5(b.): South Obenchain Fire Impacts



https://inciweb.nwcg.gov/incident/7185/

Potential water quality concerns related to local wildfires (Almeda and South Obenchain Fires) are elevated levels of aluminum (Al), perfluorinated compounds (PFAS; used for fire suppression), total phosphorus (TP), total organic carbon (TOC), turbidity, and volatile and semi-volatile organic compounds (VOC and SVOC). In the absence of healthy root systems to keep soils in place, these contaminants wash into waterways adjacent to burn areas. It is likely that Al, TP, and TOC are linked to turbidity, in that these materials are bonded and are adhered to soil particles. While natural sources and levels of Al, phosphorus, and TOC exist in soils, current water samples indicate concentrations that have the potential to lead to major losses of macroinvertebrates and fish, as well as harmful algal blooms (DEQ 2020).

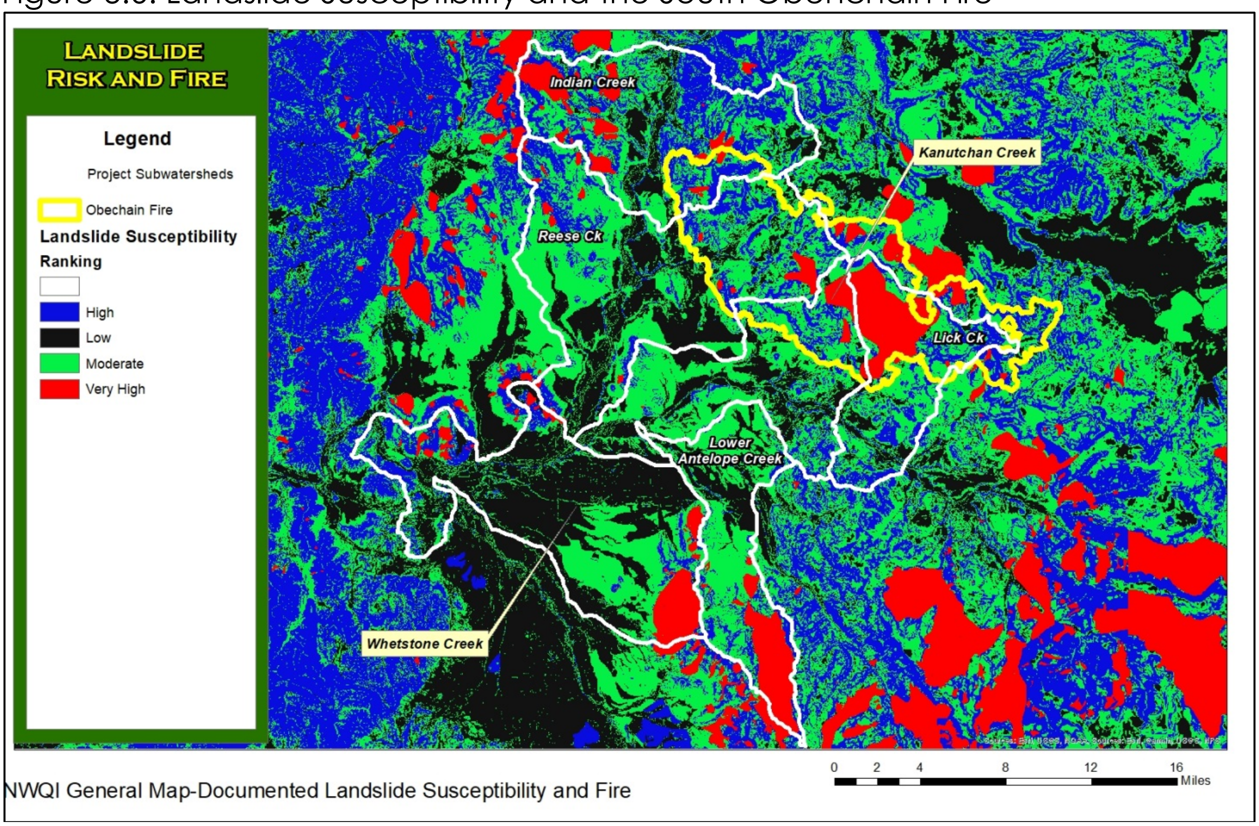
Additional constituents of concern that have been identified following other wildfires, such as the 2015 Butte and Valley Wildfires, the 2017 Tubbs Fire, and the 2018 Camp Fire in Central and Northern California, include: bacteria (*E. coli)*, ammonium and nitrates, metals (antimony, arsenic, cadmium, copper, lead, nickel, mercury, and zinc), pesticides and herbicides, polycyclic aromatic hydrocarbons (PAH; dioxins and furans), asbestos, polychlorinated biphenyls (PCB), and disinfection by-products, which are formed when water treatments, like chlorination, react with dissolved organic matter (Geosyntec Consultants, 2015; EOS, 2020). Following Geosyntec's investigation of the harmful contaminants in burn debris and ash from these fires, it was concluded that metals concentrations exceeded human health screening levels, as well as the U.S. Environmental Protection Agency's (EPA) soil screening levels for groundwater protection, within both fire footprints.

It is important to note that harmful pollutants can also arise within drinking water distribution networks, rather than the source water itself, following urban fire events. For example, following the Tubbs Fire and the Camp Fire, benzene, a known carcinogen, was found in the distribution network, caused by the burning of plastic pipes and other plastics used in urban areas (EOS, 2020).

Fire and Landslide Risk

With the loss of thousands of acres of vegetation, erosion is a major concern within the steep, burned areas where fire damage overlaps with very high risk or high risk areas for landslides. Figure 3.6 shows the overlap of the burned area and landslide risk. Areas in red and blue are of particular concern for further analysis, as these areas represent very high and high landslide susceptible areas, respectively.

Figure 3.6: Landslide Susceptibility and the South Obenchain Fire



4.0 ACTIONS TO PROTECT SOURCE WATER

The Rogue Drinking Water Partnership (RDWP) is an informal coalition of municipal and private drinking water providers and other partners seeking to protect and enhance source water quality. The Rogue River provides drinking water for over 200,000 people, recreation for thousands, and habitat for fish and wildlife. In 2017, the RDWP set a trajectory to focus group actions on source water protection. As such, a grant application was submitted and awarded that funded the initial work of the partnership to inventory PCS and evaluate potential threats to water quality. That work resulted in updates to the DEQ source water assessments for the area, identifying high priority areas of concern, developing educational and outreach components, identifying BMPs to protect drinking water, and creating a document including initial elements of an emergency response and contingency plan for providers to refer to. As a result of this work, a Memorandum of Agreement committing to engagement and cooperation between partners was developed by the RDWP.

The RRWC works throughout the Middle and Upper Rogue River areas. Specifically, RRWC has developed and implemented ecological restoration projects that address degraded instream and riparian habitat conditions in the Elk Creek and Little Butte Creek watersheds. This includes treatment of noxious and invasive species, revegetation of streamside riparian buffers with native vegetation, and installation of instream complex habitat structures that encourages floodplain connectivity. Collectively, these actions improve water quality conditions that benefit aquatic species and drinking water providers.

RRWC led the baseline water quality data collection of the Water for Irrigation, Streams, and Economy (WISE) Project. Baseline data is important for identifying and defining changes in water quality that may result from watershed restoration activities. This monitoring effort focused on the WISE Project because its impact on water quality is expected to be substantial. The project monitoring team measured water quality at upstream and downstream locations in both the Bear Creek and Little Butte Creek watersheds. Each monitoring station was co-located with an Oregon Water Resources Division near-real time flow gage. This monitoring effort was designed to track longitudinal and temporal changes in water quality that may result from regional water quality improvement and salmon recovery activities.

Jackson Soil and Water Conservation District (JSWCD) has been working extensively with agricultural landowners in the Little Butte Creek watershed to improve the agricultural impacts on water quality in this area. To this end, JSWCD has worked with landowners to improve or modernize their irrigation systems to eliminate agricultural runoff, develop grazing management plans to improve upland landscape health, and restore riparian areas to combat noxious weeds, re-establish native vegetation, and install fencing to provide healthy stream buffers and restrict the amount of time livestock spend directly in creeks. JSWCD also hosts a series of technical assistance seminars designed for landowners in this watershed to provide resources and information on natural resource management that will help them individually improve water quality.

To address erosion concerns within the fire-affected areas of the South Obenchain Fire, JSWCD distributed dryland pasture and wildlife habitat/erosion control seed mixes to landowners. Laying these seed mixes, especially in previously forested areas and riparian zones, is the first step in combatting future erosion and sediment concerns, as well as protecting water quality.

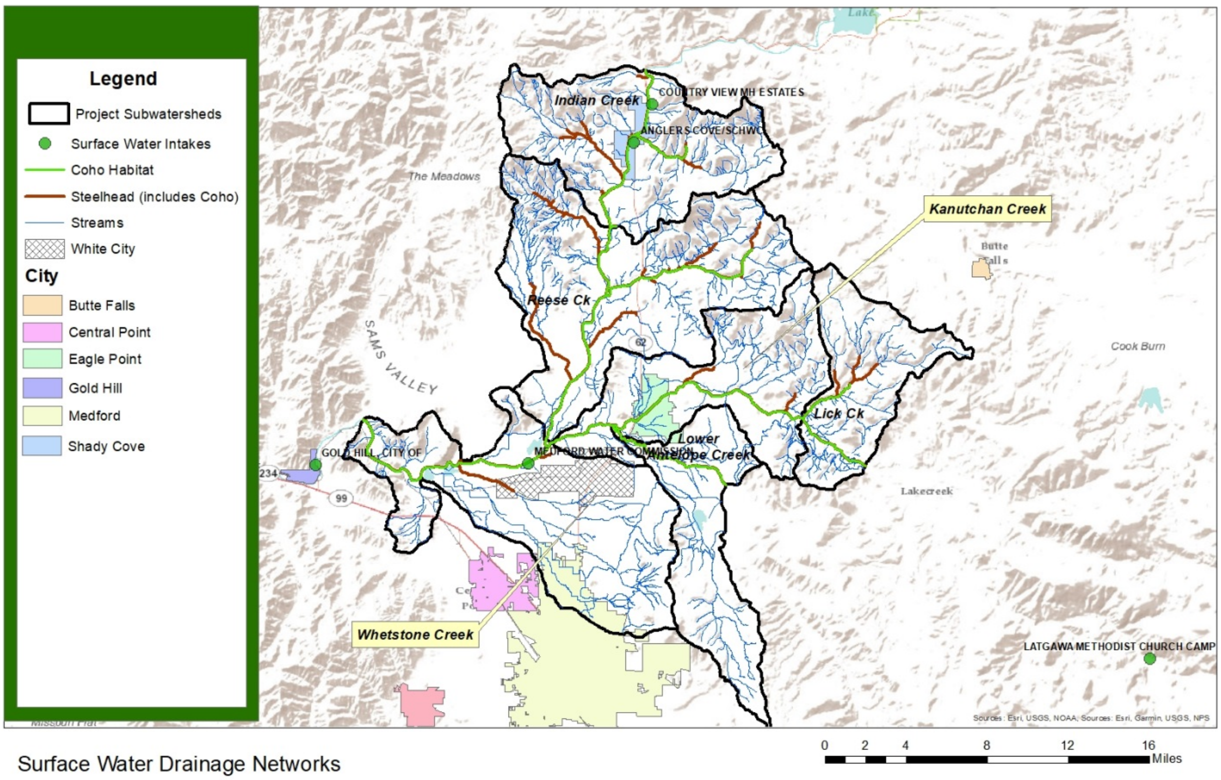
The MRPSP formed in 2014 to identify potential concerns and improve water quality affected by pesticide use in the Middle Rogue area. The MRPSP brings together partner organizations, agricultural producers, DWPs, local and state agencies, and Oregon State University technical providers to encourage voluntary changes in pesticide use and management practices, while also promoting BMPs in all users of pesticides from licensed applicators to backyard gardeners. In 2019, the MRPSP developed a 5-year strategic plan to guide the partnerships resources to reduce pesticide detections in the area.

4.1 Proposed Actions to Protect the Source Water Protection Area

5.0 HYDROLOGY AND WATER QUALITY CHARACTERIZATION

This section provides a summary of the water quality conditions in the project area based on available data.

5.1.8 Surface Water Drainage Networks



Surface Water Drainage Networks

Hydrogeology of the source water protection area including:

i. Major and minor aquifers providing domestic and public water supplies

There are several aquifers providing groundwater within the Jackson County portion of the study area. There are three alluvial aquifer units and several Tertiary and older, granitic and metamorphic rocks which produce water via fractures. Surface water from creeks, rivers, reservoirs and lakes, irrigation, and seepage from irrigation ditches in the valley locally recharge the alluvial aquifers. Additionally, precipitation in the highlands recharges the bedrock aquifers which may recharge alluvial aquifers via fracture flow (Orzal, 1993).

Other than shallow stream deposits, most formations have little or no primary porosity so wells depend on secondary porosity, or, fractures. Steep slopes hinder the recharge of groundwater and encourage runoff. However, precipitation stored as snowfall at higher elevations will allow higher infiltration rates. The Tertiary volcanic rocks, the Tertiary sedimentary rocks and the Paleo-Mesozoic rocks each have low permeability, capable of yielding only small quantities of groundwater. The quantities are generally adequate, however, for domestic or livestock use (Young, 1985). Some of the aquifers accessed by fractures, can produce substantial volumes of water, but perhaps not sustainably.

Alluvium provides the most productive aquifer in the area. Where total thickness is generally 30 feet or more, the units generally had a saturated thickness of more than 10-15 feet and would yield 10 to 50 gallons per minute (gpm) (per bailer test results prior to 1971). In a few areas, yields of 100 gpm or more were obtainable (Robison, 1971).

The Tertiary Roxy Formation volcanics are located above the water table in much of the area but is capable of yielding 10 gpm where available. Water is likely to be of good quality. The older, Colestine Formation, tuffs and conglomerates are capable of yielding about 20 gpm in many places. Water may be hard or saline in some areas. The Tertiary nonmarine sedimentary rocks are capable of yielding 5 to 15 gpm in most areas, however it can yield water with excessive boron and fluoride and may be too saline in some areas. Wells in the Sams Valley area and in the area near Jacksonville commonly draw from this formation (Robison, 1971).

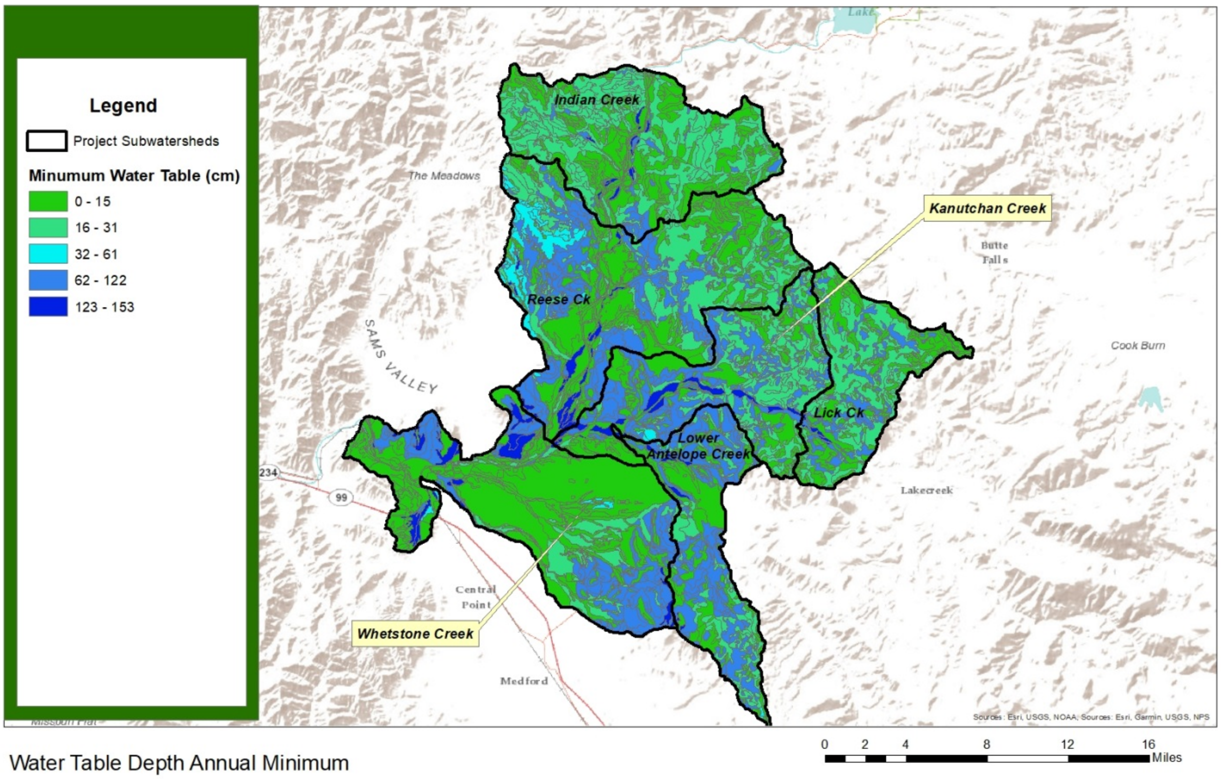
Of Cretaceous age, the Hornbrook Formation sandstones can yield 5 to 10 gpm in some areas and less than 1 gpm in others. The chemical quality of the water varies. Granodiorite and quartz diorite units of Jurassic or Cretaceous age yield less than 5 gpm generally, yet water is expected to be of good quality (Robison, 1971).

ii. Ground water (aquifer) depths, potentiometric levels, and flow directions

The average well depth is increasing over the years, as drillers need to drill deeper to encounter adequate water yields. In the 1950s and 1960, the typical well depth was 100 to 200 feet. In the 1990s, wells were occasionally extending to 800 or 1,000 feet deep. Over 13% of wells drilled from August 1991 to July 1992 yielded less than 1 gpm and 4% were dry. Nevertheless, the increase in number of wells in the early 1990s was approximately 2.7% per year (Dittmer, 1994).

Southern Oregon University (then Southern Oregon State College) graduate student Gail Elder conducted a statistical study of 7500 wells drilled in the Shady Cove area between 1950 and 1995. Elder found that the average depth of wells drilled increased in each decade of her study period, from an average depth of 88.5 feet in the 1950s to an average depth of 229 feet in the 1990s. This corresponded to a consistent increase in depth to first water encountered, from an average of 57 feet in the 1950s to an average of 133 feet in the 1990s. Average water yield of the wells stayed between 18 and 21 gpm. However, yields vary significantly, with many wells yielding barely 1 gpm to others yielding 100 to 224 gpm. Elder notes that "many people I talked with buy their drinking water." They say, "our water used to taste better than it does now" (Elder, 1995). Shady Cove is the only municipality in the study area that does not have a public water supply and is supplied primarily by private water wells. The City of Rogue River utilizes groundwater for a portion of its public water supply (2019 Consumer Confidence Report). Butte Falls also utilizes groundwater (from Ginger Springs) for its water supply.

Figure 8.1: Minimum Depth to the Water Table (cm)



A Jackson County Water Resources Study was compiled in December 2001 to evaluate the adequacy of available water supplies through 2050. This report states that groundwater is generally being used in many locations faster than it is being recharged. It was estimated that the population in the Eagle Point through Ashland area in 2001 was approximately 176,000 and approximately 1/3 of that population (60,000) relied on groundwater for their water supply, suggesting a groundwater usage of about 10,000 acre-feet per year (AF/Y). This is an increase from the approximation of 50,000 people dependent on groundwater in 1992, and an estimated use of 8,400 AF/Y. At the time of the 2001 report, the Medford Water Commission was selling over 4.8 million gallons (14.73 AF) of water per year through vending machines (Ryan and Dittmer, November 2001).

The report concludes that some rural homeowners are facing groundwater shortages and deteriorating water quality. Limitations in groundwater quantity and/or quality may influence the decisions of new comers to Jackson County as to whether to live in cities where the water supply is more reliable or choose to live on property served by a well. It is also likely that residents dependent on marginal well yields or wells with poor water quality will seek alternate sources (Ryan and Dittmer, November 2001).

iii. Surface and Ground water withdrawals

Surface water Information

There are a number of stations that are sampled regularly in the watershed by the Department of Environmental Quality and Medford Water Commission. In addition, there is information contained in the Consumer Confidence reports for local providers.

Medford Water Commission Community Confidence Report

2019 WATER QUALITY TEST RESULTS FOR TREATED WATER

REGULATED CONTAMINANTS ANALYSES

Substance	MCL (Maximum Allowed)	MCLG (Ideal Goal)	Source	Average Amount Detected	Range	Complies?	Typical Source
Barium (ppm)	2	2	Big Butte Springs	0.006	0.005 - 0.007	YES	Erosion of Natural Deposits
			Rogue River	0.003	0.003 - 0.004		
Beryllium (ppb)	4	4	Big Butte Springs	0.3	ND - 0.3	YES	Discharge from metal refineries, coal-burning factories; and electrical, aerospace, and defense industries
			Rogue River	0.2	ND - 0.2		

MICROBIOLOGICAL CONTAMINANTS

Substance	MCL (Maximum Allowed)	MCLG (Ideal Goal)	Detected Level	Complies?	Typical Source
Coliform bacteria	N/A	0% Presence	0	YES	Naturally present in the environment
E. coli	0	0	0	YES	Human and animal fecal waste

OTHER ANALYSES – ROGUE RIVER

Substance	TT	Maximum Amount Detected	Range	Complies?	Typical Source
Turbidity	95% < 0.3 NTU	0.1	N/A	YES	Soil erosion and stream sediments
Total Organic Carbon	N/A	1.1	0.4 - 1.1 ppm	YES	Soil erosion and stream sediments

UNDERSTANDING THE RESULTS: Medford Water Commission and each of the Partner Cities participating in this report run water quality tests according to specific schedules. Thousands of tests are run each year to ensure that no substances are present at harmful levels. Although continuously improving testing techniques allow contaminants to be detected at truly miniscule levels, most of the contaminants we test for have never been found in our water. Those that we do detect are found at levels well below health standards, as shown in the adjacent tables.

Medford Water Commission received a reporting violation for failing to report all microbiological sample results by the end of the reporting period. All correct samples were collected, but results were reported to the State after the reporting period had closed. There are no expected health effects due to this error in reporting.

TESTING FOR MICROBES: Unlike most contaminants, microscopic organisms can appear suddenly and cause immediate illness. Testing for bacteria is therefore done on a frequent basis by Medford Water Commission and the Partner Cities participating in this report. This includes looking for coliform bacteria as well as confirming that adequate chlorine is present in the water to provide ongoing disinfection. While most coliforms do not pose a health threat, they are a good indicator of whether other bacteria might be present. If found, further testing is conducted for harmful forms of bacteria.

CHLORINE RESIDUAL: Sodium hypochlorite is used as a disinfectant and provides continuous protection to customers' taps. Sampling throughout the distribution system confirms that the amount of chlorine present is neither too low nor too high. Our water is effectively disinfected with much less chlorine than is allowed.

RADON TESTING: The most common source of this colorless, odorless gas is from the soil, but a small amount of exposure can come from tap water. We conduct testing, but radon is not currently regulated. Radon is considered to be a cause of cancer.

SPECIAL NOTICE FOR IMMUNO-COMPROMISED PERSONS: Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can particularly be at risk from infections. These people should seek advice about drinking water from their health care providers. Guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the U.S. Environmental Protection Agency's (EPA's) Safe Drinking Water Hotline (1-800-426-4791).

WHAT THE EPA SAYS ABOUT DRINKING WATER CONTAMINANTS: Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791) or at www.epa.gov/safewater. The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

CONTAMINANTS IN DRINKING WATER SOURCES MAY INCLUDE:

Microbial contaminants, such as viruses and bacteria, which may come from wildlife or septic systems.

Inorganic contaminants, such as salts and metals, which can occur naturally or result from urban stormwater runoff, industrial or domestic wastewater discharges, farming and leaching from plumbing materials.

Pesticides and herbicides, which may come from a variety of sources such as farming, urban stormwater runoff and home or business use.

Organic chemical contaminants, which are byproducts of industrial processes, and can also come from gas stations, urban stormwater runoff and septic systems.

Radioactive contaminants, which can occur naturally. In order to ensure that tap water is safe to drink, the EPA has regulations that limit the amount of certain contaminants in water provided by public water systems and require monitoring for these contaminants. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health.

MEDFORD WATER COMMISSION AND PARTNER CITIES' DISINFECTION AND DISINFECTION BY-PRODUCT ANALYSES

Substance	Entity	Average for Highest Location	Range	MCL (maximum allowed)	MCLG (ideal goal)	Complies?	Typical Source
Total Trihalomethanes (ppb)	M.W.C	17.2	ND - 41	80	0	YES	By-products of chlorination used in the water treatment process
	Central Point	19.6	2 - 53				
	Eagle Point	37.8	37 - 38				
	Jacksonville	9.2	1 - 31				
	Phoenix	1.3	ND - 1.3				
Haloacetic Acids (ppb)	M.W.C	15.6	ND - 46	60	0	YES	By-products of chlorination used in the water treatment process
	Central Point	4.7	ND - 19				
	Eagle Point	0.2	0.2 - 0.2				
	Jacksonville	3.2	ND - 12.6				
	Phoenix	ND	ND				
Chlorine Residual (ppm)	M.W.C	0.6	0.2 - 1.0	4.0 (MRDL)	4.0 (MRDLG)	YES	Treatment additive for disinfection
	Central Point	0.4	0.1 - 0.7				
	Eagle Point	0.5	0.1 - 0.9				
	Jacksonville	0.5	0.3 - 0.7				
	Phoenix	0.5	0.3 - 0.7				

RADIOACTIVE CONTAMINANTS

Substance	MCL	MCLG	Amount Detected	Typical Source
Radon-222 (pCi/L)	N/A	N/A	Big Butte Springs - 88 pCi/L	Erosion of Natural Deposit

LEAD AND COPPER SAMPLING FROM RESIDENTIAL WATER TAPS

Substance	Entity	Amount Detected (90th percentile value)	Date of most recent test	Action Level	MCLG (ideal goal)	Complies?	Typical Source
Lead (ppb)	M.W.C	0.9	2019	90% of homes tested must have lead levels less than 15 ppb	0	YES (No sample exceeded the action level)	Corrosion of household plumbing
	Central Point	1.8	2017				
	Eagle Point	2.6	2019				
	Jacksonville	3.8	2019				
	Phoenix	1.4	2018				
Copper (ppm)	M.W.C	0.8	2019	90% of homes tested must have copper levels less than 1.3 ppm	1.3	YES (No sample exceeded the action level)	Corrosion of household plumbing
	Central Point	0.4	2017				
	Eagle Point	0.1	2019				
	Jacksonville	0.4	2019				
	Phoenix	0.7	2018				

REDUCING EXPOSURE TO LEAD AND COPPER:

Our water sources, Big Butte Springs and the Rogue River, do not contain lead or copper. However, because these metals can leach into drinking water through contact with household plumbing or distribution system pipes, additional testing is conducted at residences considered to be at greatest risk. Within the homes we've sampled, lead and copper have not been detected at levels that exceed EPA rules for safe drinking water.

However, customers should be aware that lead and/or copper levels can increase when water stands in contact with lead or copper pipes, lead-based solder and brass faucets containing lead. If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children.

Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Medford Water Commission and each of our Partner Cities are responsible for providing high-quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by running the cold water tap for 30 seconds to 2 minutes before using water for drinking or cooking.

If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline (1-800-426-4791) or at www.epa.gov/safewater/lead.

TERMS AND ABBREVIATIONS

Terms used in the table are explained below.

Contaminant: A potentially harmful physical, biological, chemical or radiological substance.

Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a system must follow.

MCL (Maximum Contaminant Level): The highest level of a contaminant allowed in drinking water. MCLs are set as close to the Maximum Contaminant Level Goal as feasible using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MRDL (Maximum Residual Disinfectant Level): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

ND (Non-detect): Not detected at an established minimum reporting level.

pCi/L (Picocuries per Liter): A measurement of radioactivity equivalent to a trillion times smaller than one curie.

ppm (Parts Per Million): One part per million means that one part of a particular substance is present for every million parts of water. This is the equivalent of one penny in $10,000 or approximately one minute in two years.

ppb (Parts Per Billion): One part per billion corresponds to one penny in $10,000,000 or approximately one minute in 2,000 years.

TT (Treatment Technique): A required treatment process intended to reduce the level of a contaminant in drinking water.

Turbidity: A measure of how clear water is, expressed in Nephelometric Turbidity Units (NTU). Turbidity does not necessarily indicate that water is unhealthy, but it can interfere with disinfection and can be an indicator of microorganisms.

OHA Drinking Water Services
Water Advisory Details

PWS ID:	OR41 06155
PWS Name:	MANZANITA HILLS SUBDIVISION
Advisory Type:	Do Not Drink Water
Reason:	Arsenic
Area Affected:	System-wide
Affected Populations:	All
Begin Date:	Jan 07, 2020
Date Lifted:	*Open*
Contacted By:	BAKER, SUSAN (JACKSON COUNTY)
Who Was Contacted:	James Robinson
Contact Phone:	541-951-1183
Details:	Contact operator regarding the recent arsenic test results with the Acute Level of 35 ppm. I have informed the operator that a Tier 1 Public Notice is required to be posted within the next 24 hours. Public Notice posted on 1-7-20. Operator reports that a arsenic removal system has been ed and installation will occur as soon as possible.
Associated Alerts:	CHEM8789 - 01/07/2020 - ARSENIC

iv. Characterization of aquifer water chemistry

Most available aquifer data can be inferred by reviewing well logs. Wells 21 and 22 are in the study area.

Table 4: Rogue Valley Groundwater Quality Investigation Results , Department of Environmental Quality 1992.

Station Identifier	Nitrate/nitrite as N (mg/L)	Total Arsenic (mg/L)	Fluoride (mg/L)	Dissolved Boron (mg/L)	Dissolved Manganese (mg/L)
ROG001	<0.02	<0.005	0.8	1.3	<0.01
ROG002	0.06	<0.005	0.2	0.17	0.02
ROG003	<0.02	<0.005	0.2	0.39	0.02
ROG004	0.68	<0.005	0.2	0.38	<0.01
ROG005	<0.02	<0.005	11	12	<0.01
ROG006	1.1	<0.005	0.1	0.07	0.63
ROG007	<0.02	<0.005	1.4	2.8	<0.01
ROG008	<0.02	<0.005	0.5	0.36	0.13
ROG009	2	<0.005	0.1	0.08	<0.01
ROG012	0.81	<0.005		0.43	<0.01
ROG013	0.04	<0.005		14	<0.01
ROG014	2.7	<0.005		0.15	<0.01
ROG015	0.51	<0.005		0.37	0.1
ROG016	0.02	<0.005		1.2	0.16
ROG017	4.6	<0.005		0.12	<0.01
ROG018	2.9	<0.005		0.16	<0.01
ROG019	<0.02	<0.005		2.2	0.05
ROG020	6.7	<0.005		0.05	<0.01
ROG021	<0.02	0.006		0.61	<0.01
ROG022	<0.02	0.026		1	0.02
ROG023	0.02	<0.005		1.6	0.01
ROG024	<0.02	<0.005		1.1	<0.01
ROG025	1.3	<0.005		0.08	0.03
ROG026	0.15	<0.005		0.04	<0.01
ROG027	<0.02	<0.005		0.43	0.18
ROG028	0.06	<0.005		<0.03	<0.01
ROG029	1.9	<0.005	0.1	0.06	<0.01

Water samples were also analyzed for selected pesticides (those expected to be in use in the area). Pentachlorophenol was detected in one well near a parking lot and area of intensive agricultural activity. Dacthal Acid, a pesticide, was detected in another well—surprisingly—in the deepest well (200 feet deep) of the study. The Dacthal was not detectable in a confirmation sample collected two months later, although Trichlorofluoromethane and Chloroform were detected in an increased Volatile Organic Compounds scan.

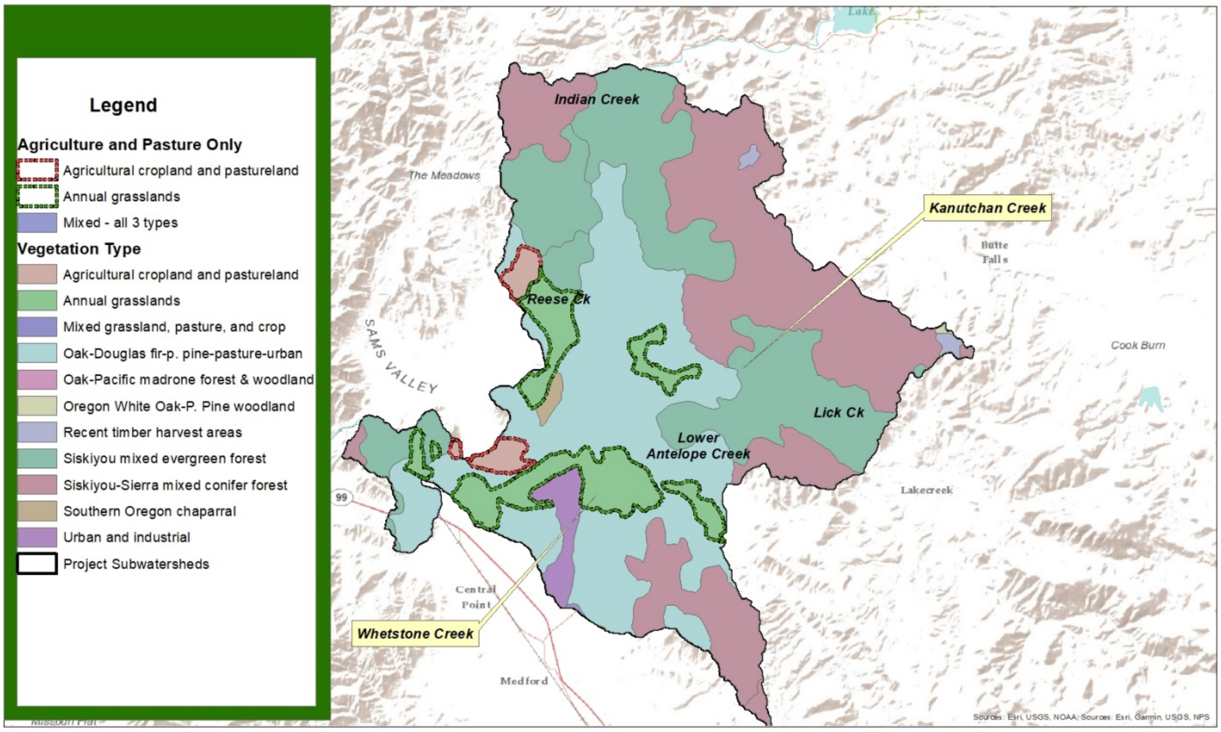
Table 5: Bear Creek Valley Groundwater Quality Investigation Results, Department of Environmental Quality 1994

Station Identifier	Nitrate/nitrite as N (mg/L)	Total Arsenic (mg/L)	Fluoride (mg/L)	Dissolved Boron (mg/L)	Total Manganese (mg/L)
BCV01	3.1	<0.005	0.1	<0.03	<0.01
BCV02	3.9	<0.005	0.1	<0.03	<0.01
BCV03	<0.02	0.016	0.2	0.19	0.23
BCV04	<0.02	<0.005		0.13	0.11
BCV06	9.2	<0.005	0.1	<0.03	0.02
BCV07	4.5	<0.005		0.35	<0.01
BCV08	4.5	<0.005		0.35	<0.01
BCV09	3.9	<0.005	0.5	0.54	<0.01
BCV10	13	<0.005	0.2	0.19	<0.01
BCV11	5	<0.005	0.1	0.29	<0.01
BCV12	12	<0.005		0.37	<0.01
BCV13	10	<0.005		0.34	<0.01
BCV14	0.85	<0.005	0.1	0.17	<0.01
BCV15	4.2	<0.005	0.7	0.99	0.03
BCV16	5.7	<0.005	0.2	0.24	<0.01
BCV17	0.34	<0.005	0.2	0.36	<0.01
BCV18	3.3	<0.005	0.2	<0.03	<0.01
BCV19	2.4	<0.005	0.2	<0.03	<0.01
BCV20	<0.02	<0.005	0.6	0.8	0.01

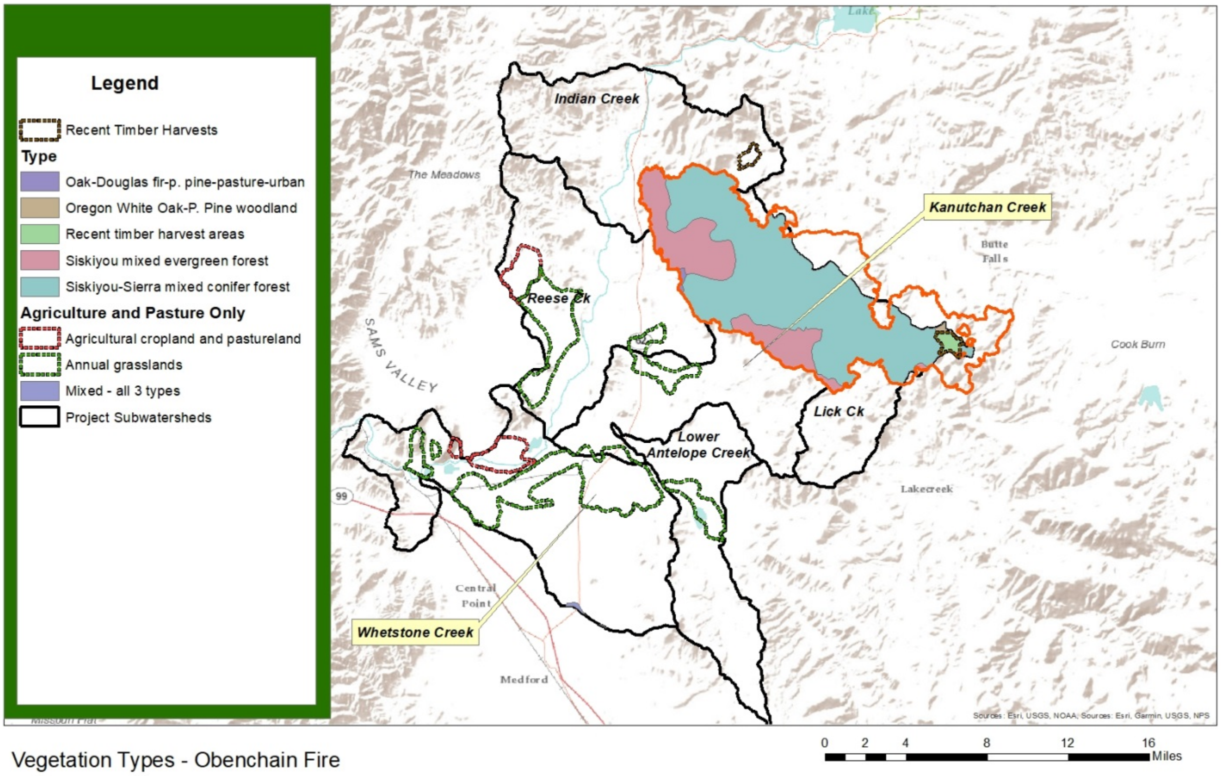
Wells 17-20 are in Whetstone Creek and are in or close to the project area. Wells 1 and 6 are also close to the project area.

Section 8: Potential Contaminants of Concern and Sources

8.1 Agricultural sources of concern



Vegetation Types - Highlighting Agriculture, Grasslands, and Pasture lands.



Vegetation Types - Obenchain Fire

8.1.1. Crop growing operations

8.1.2. Animal feeding operations

There are 2 registered CAFOs located in the area. In addition, there are other livestock operations that do not meet the CAFO criteria and therefore are not registered. Livestock manure and urine can pollute both ground and surface water with nutrients and organic matter. The waste contains the nutrients nitrogen and phosphorus, which cause algal blooms that kill fish. And the waste carries sediments, hormones, antibiotics, ammonia, heavy metals and pathogens. Ammonia is highly toxic to fish and can be converted to nitrates that are poisonous to adults and deadly for infants. In addition to pathogens, "parasites from livestock waste can cause disease in humans. Giardia and Cryptosporidia are considered to be the two most important waterborne protozoa carried by livestock according to the University of Minnesota Extension"

8.2. Other potential sources (which may confound agricultural conservation solutions)

8.2.1 Urban and industrial wastewater lagoons

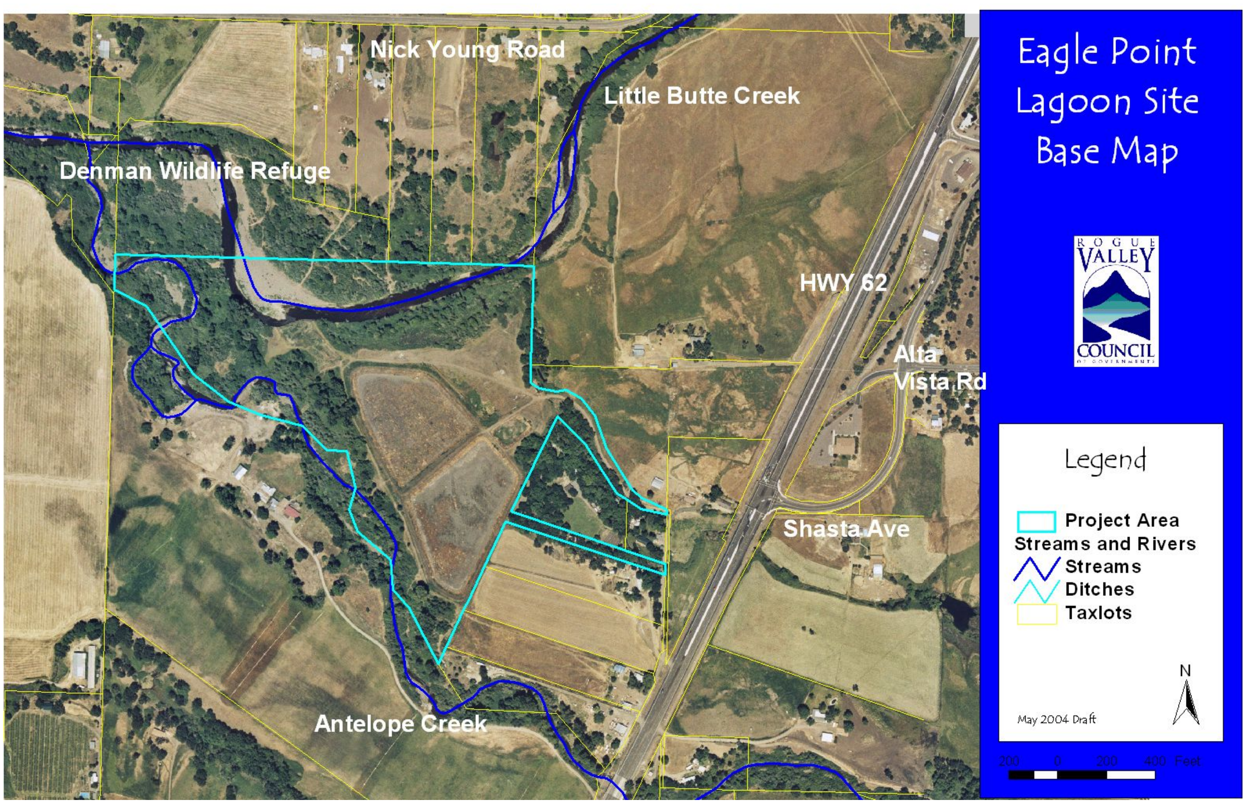
There is an old sewage treatment lagoon downstream of the City of Eagle Point that was used by the City until the mid-1990's when the lagoon was shut down after the City connected to the

Rogue Valley Sewer Services network. In 2004, the City commissioned RVCOG to complete a study. Full details on the study can be found in the report which is available digitally and in a few libraries (e.g., RVCOG). A summary of the lagoon system and study results follows.

The lagoons are located on a 48-acre parcel owned by the City of Eagle Point located west of Highway 62 and south of the City of Eagle Point. Little Butte Creek flows along the northern section of the property, and Antelope Creek flows along the south (Figure 1-1). The parcel served as the primary sewage treatment system for the City from the 1950's to 1996. The system was incapable of handling flows in the winter as the City grew, resulting in the City connecting with the Rogue Valley Sewer Services (RVS) system in the mid 1990's.

The site consists of three treatment ponds (two large ponds and a smaller pond), relic treatment structures (pipes, aerators, small buildings), a storage area used by the City, and gravel access roads on the site. The parcel also includes grassed open areas, riparian areas, and wetlands. The site has not been actively used since connection to the RVS system, with the exception of the City storage area.

Figure 8-2: Eagle Point Lagoon Site



As part of the study, limited soil samples were taken. Sampling indicated that there were only trace amounts of metals on site. As a result of the sampling, and its location, current use, planned use, and decades of not being in use, the site is not considered a low risk.

8.2.2 Septic systems

An estimated XX homes are on sept

8.2.3. Active and non-active landfills

8.2.4. Mining (active/abandoned), petroleum operations, and underground injection

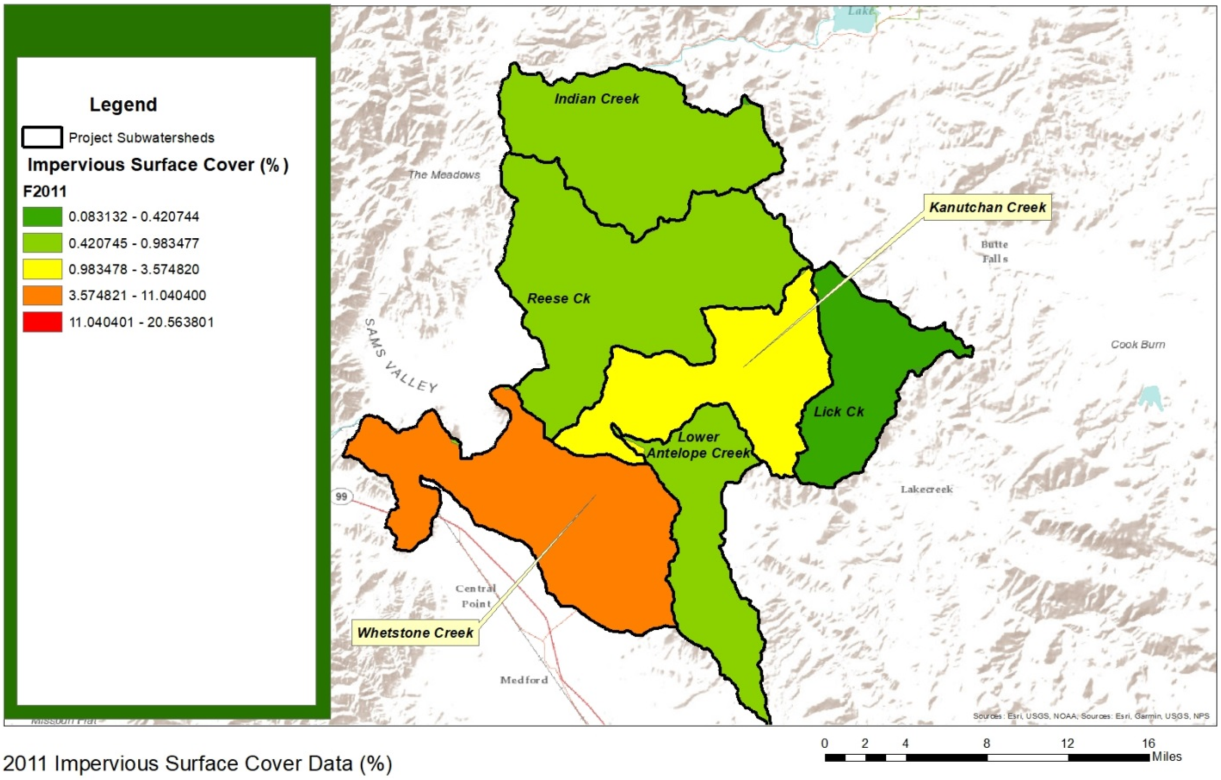
8.3. Contaminant physical and chemical properties that influence modes of transport to the surface and ground water systems

Well water info

https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/SOURCEWATER/DOMESTICWELLSAFETY/Pages/Human-Health-Water.aspx#whatcontaminants

Naturally occurring contaminants and contaminants introduced by people can be present in water systems. Natural chemical or mineral contaminants may include arsenic and radon. Contaminants introduced by people result from land use, stormwater overflow, and other events happening near a source including spills and illegal dumping.

Both physical and chemical properties will influence modes of transport. Properties include solubility, size, dissolvability.



2011 Impervious Surface Cover Data (%)

Appendix A: PCS Information

Potential Contaminant Sources and Potential Water Quality Impacts (High Risk to Groundwater and/or Surface Water)

PCS Code	TYPE OF ACTIVITY	GW Risk	SW Risk	POTENTIAL WATER QUALITY IMPACTS
C03	Automobiles - Gas Stations	H	M	Spills, leaks, or improper handling of fuels and other materials during transportation, transfer, and storage may impact the drinking water supply.
C07	Chemical/Petroleum Processing/Storage	H	H	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.
C18	Mining Activities - Gravel Mines/Gravel Pits	H	H	Spills, leaks, or improper handling of chemicals and wastes generated in mining operations or from heavy equipment may impact the drinking water supply.
C21	Photo Processing/Printing	H	H	Spills, leaks, or improper handling of photographic chemicals during transportation, use, storage and disposal may impact the drinking water supply.
C25	Wood Preserving/Treating	H	H	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.
C26	Wood/Pulp/Paper Processing and Mills	H	H	Spills, leaks, or improper handling of wood preservatives and other chemicals during transportation, use, storage and disposal may impact the drinking water supply.
A03	Confined Animal Feeding Operations (CAFOs)	H	H	Improper storage and management of animal wastes and wastewater in areas of concentrated animals may impact drinking water.
M31	Large Capacity Septic Systems (serves > 20 people) - Class V UICs	H	M	If not properly sited, designed, installed, and maintained, septic systems can impact drinking water.
M32	Construction/Demolition Areas	M	H	Construction/demolition activities may contribute to erosion and increased turbidity in surface water drinking water supplies. Equipment usage increases the risks of leaks or spills of fuels and other chemicals.
M04	Stormwater Outfalls	L	H	Stormwater run-off may contain contaminants from residential (home sites and roads), commercial/industrial, and agricultural use areas.
M22	Transportation - Stream Crossing - Perennial	L	H	Road building, maintenance & use may increase erosion & slope failure causing turbidity. Vehicle use increases the risk of leaks or spills of fuel & other chemicals. Over-application/improper handling of pesticides in right-of-way may also impact water.

Appendix B: Dominant Soil Orders

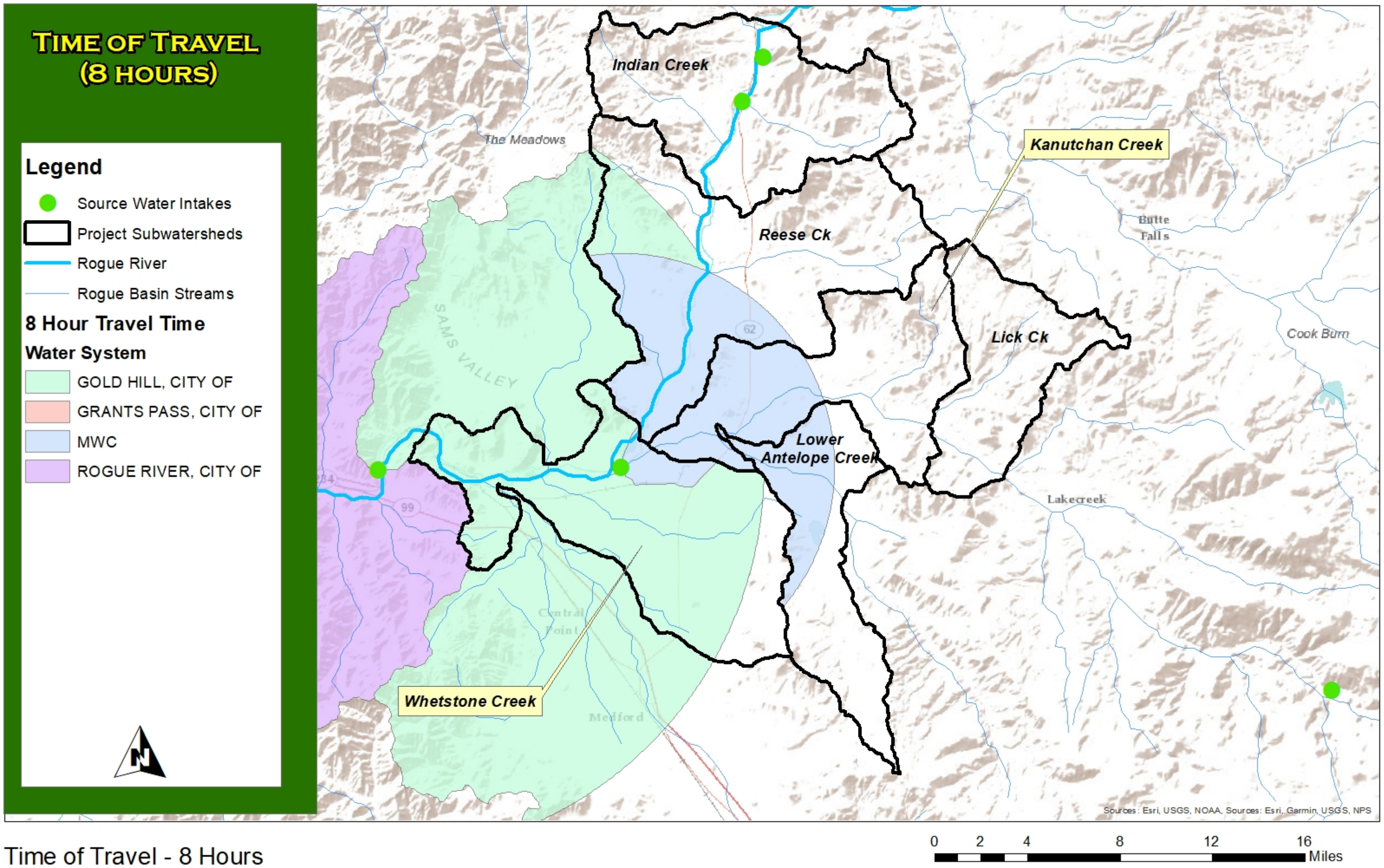
Soil Order	Description	Soil Suborders
Alfisols	• Moderately leached soils, • Subsurface horizon of accumulated clays, • Relatively high native fertility for agriculture and silviculture, • Formed under forest canopies in temperate humid and subhumid regions, and • Occupy 13.9% of the land area in the U.S.	Aqualfs Cryalfs Udalfs Ustalfs Xeralfs
Inceptisols	• Soils with minimal horizon development, • Found on fairly steep slopes, young geomorphic surfaces, and on resistant parent materials in mountainous areas, • Widely distributed and occur across a wide range of ecological settings, and • Occupy 9.7% of the land area in the U.S.	Aquepts Gelepts Cryepts Ustepts Xerepts Udepts
Ultisols	• Strongly leached soils (loss of calcium, magnesium, and potassium), • Subsurface horizon of accumulated clays with yellow and/or red coloration due to the presence of iron oxides, • Acid forest soils with relatively low native fertility, • Support productive forests, but not continuous agriculture, • Found older, stable landscapes in humid temperate and tropical areas, and • Occupy 9.2% of the land area in the U.S.	Aquults Humults Udults Ustults Xerults

Appendix C: Soil Type Details

SYMBOL	NAME
2A	Abin silty clay loam
6B	Agate-Winlo complex
10B	Barron coarse sandy loam
17C	Brader-Debenger
17E	Brader-Debenger loams
19E	Bybee-Tatouche complex
22A	Camas gravelly sandy loam
21A	Camas sandy loam
23A	Camas-Newberg-Evans
27D	Carney clay
28D	Carney cobbly clay
29D	Carney cobbly clay, high precipitation
30E	Carney-Tablerock association
31A	Central Point sandy loam
33A	Coker clay
35A	Cove clay
38C	Crater Lake-Alcot association
43B	Darow silty clay loam
44E	Debenger-Brader loams
55A	Evans loam
57E	Farva very cobbly loam
64E	Freezener gravelly loam
67G	Freezener-Geppert complex
69E	Geppert very cobbly loam
76A	Gregory silty clay loam
81G	Heppsie clay
82G	Heppsie-McMullin complex
100A	Kubli loam
101E	Langellain loam
102D	Langellian-Brader loams
108D	Manita loam
109E	Manita-Vannoy complex
110E	McMullin gravelly loam
111G	McMullin-McNull gravelly loams
112F	McMullin-Medco complex
113E	McMullin-Rock outcrop complex
115E	McNull gravelly loam
114G	McNull loam
117G	McNull-McMullin complex
116E	McNull-McMullin gravelly loams
118E	McNull-Medco complex
119F	McNull-Medco complex, hi precipitation
120C	Medco clay loam
123F	Medco clay loam, high precipitation
121E	Medco cobbly clay loam
125F	Medco-McMullin complex

126F	Medco-McNull complex
128B	Medford clay loam, gravelly substratum
127A	Medford silty clay loam
133A	Newberg fine sandy loam
139A	Padigan clay
141A	Phoenix clay
146	Pits, gravel
150E	Provig very gravelly loam
151C	Provig-Agate complex
152B	Randcore-Shoat complex
154	Riverwash
158D	Ruch gravelly silt loam
157B	Ruch silt loam
163A	Sevenoaks loamy sand
165E	Shefflein loam
183E	Straight extremely gravelly loam
185G	Straight-Shippa extremely gravelly loams
186H	Tablerock-Rock outcrop association
187A	Takilma cobbly loam
189E	Tallowbox gravelly sandy loam
190G	Tatouche gravelly loam
195F	Vannoy silt loam
197F	Vannoy-Voorhies
W	Water
198A	Winlo very gravelly clay loam

Appendix D: Time of Travel Map (citation)



Time of Travel - 8 Hours

References

Oregon Health Authority and Oregon Department of Environmental Quality (2018). *Updated Source Water Assessment: Country View Mobile Home Estates.* USWA_00808CountryView.pdf

Upper Rogue Watershed Association (2006). *Upper Rogue Watershed Assessment.* file:///W:/Project%20Folders/NWQI%202020/Reference%20Materials/Upper-Rogue-Watershed-Assessment.pdf file:///W:/Project%20Folders/NWQI%202020/Reference%20Materials/Watershed%20Councils_837_2_URWA_Chapter1_FINAL%2012-15-06.pdf

BestPlaces. Climate in Shady Cove, Oregon. https://www.bestplaces.net/climate/

Resource Guide

Natural Resources Conservation Service Resources:

For information on the **National Water Quality Initiative** in Oregon, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/contact/?cid=nrcs144p2_036223

For access to the **Web Soil Survey**, visit: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Oregon Department of Environmental Quality Resources, such as Status and Action Plans, Investigations, and other reports are listed below:

For information pertaining to water quality in the Rogue Basin, visit:

- **Water Quality Status and Actions Plan: Rogue Basin (September 2011)**: https://www.oregon.gov/deq/FilterDocs/BasinRoguePlan.pdf
- **2011 Rogue Basin Groundwater Investigation:** https://www.oregon.gov/deq/FilterDocs/gw-2013RogueReport.pdf

Oregon Health Authority Resources:

For information on OHA's Domestic Well Safety, visit:

- https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/SOURCEWATER/DOMESTICWELLSAFETY/Pages/Testing-Regulations.aspx
- https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/SOURCEWATER/DOMESTICWELLSAFETY/Documents/Contaminant%20Factsheets/OHA%208342%20Nitrate.pdf

Oregon Water Resources Department (OWRD) Resources:

For access to subsurface data managed by the state, visit: OWRD's **Groundwater Information System**: https://apps.wrd.state.or.us/apps/gw/gw_info/gw_info_report/Default.aspx

For flow and water level data, visit: OWRD's **Historical Streamflow and Lake Level Data**: https://apps.wrd.state.or.us/apps/sw/hydro_report/

For real-time hydrographics data from several gage stations in Oregon, visit OWRD's **Near Real Time Hydrographics Data**: https://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/

For information on major and minor aquifers providing domestic and public water supplies within the project area, visit the following webpages:

- **Anglers Cove/Shady Cove Heights Water Company (SCHWC)** (well repot: location, owner, depth, water level, yield, completion date): https://apps.wrd.state.or.us/apps/gw/well_log/well_report.aspx?well_tag_nbr=49327
- **Country View Mobile Home Estates (CVMHE)**: https://apps.wrd.state.or.us/apps/gw/well_log/well_report.aspx?wl_county_code=JACK&wl_nbr=293 https://apps.wrd.state.or.us/apps/gw/well_log/well_report.aspx?wl_county_code=JACK&wl_nbr=372
- **Hiland Water Company** (well repot: location, owner, depth, water level, yield, completion date): https://apps.wrd.state.or.us/apps/gw/well_log/well_report.aspx?well_tag_nbr=95157

For information on surface and groundwater withdrawals for drinking water within the project area (system information, alerts, violations, coliform and chemical results, etc.), visit the following webpages:

- **Anglers Cove/SCHWC**: https://yourwater.oregon.gov/inventory.php?pwsno=01483
- **CVMHE**: https://yourwater.oregon.gov/inventory.php?pwsno=00808
- **Hiland Water Company**: https://yourwater.oregon.gov/inventory.php?pwsno=01520 https://hilandwater.com/2019ShadyCoveCCR.pdf https://hilandwater.com/2017ShadyCoveCCR.pdf
- **Medford Water Commission**: https://yourwater.oregon.gov/inventory.php?pwsno=00513

For information on surface and groundwater withdrawals/storage for agriculture and water rights within the project area, visit the following webpages:

- **OWRD - Surface water withdrawals for agriculture in the Rogue Basin**: 81 records ("points of diversion" selected, rather than "places of use"): https://apps.wrd.state.or.us/apps/wr/wrinfo/wr_query.aspx?SearchType=PODbyTRS&township=&township_char=S&range=&range_char=E&sctns=&basin_nbr=15&meridian=WM&start_priority=&end_priority=&use_category=1&wr_type=SW&view_canceled_rights=False
- **OWRD – Groundwater withdrawals for agriculture in the Rogue Basin**: 126 records ("points of diversion" selected, rather than "places of use"): https://apps.wrd.state.or.us/apps/wr/wrinfo/wr_query.aspx?SearchType=P

ODbyTRS&township=&township_char=S&range=&range_char=E&sctns=&basin_nbr=15&meridian=WM&start_priority=&end_priority=&use_category=1&wr_type=GW&view_canceled_rights=False

- **OWRD – Storage for agriculture in the Rogue Basin**: 55 records ("places of use" selected, rather than "points of diversion"): https://apps.wrd.state.or.us/apps/wr/wrinfo/wr_query.aspx?SearchType=POUbyTRS&township=&township_char=S&range=&range_char=E&sctns=&basin_nbr=15&meridian=WM&start_priority=&end_priority=&use_category=1&wr_type=ST&view_canceled_rights=False

U.S. Geological Survey (USGS) Resources, such as Water-Supply Papers, Water-Resource Investigations, Bulletins, Professional Papers, Hydrologic Atlases, and other reports are listed below:

For information on stream flow, flood stage and flood-tracking, drought table and low-flow map, past-flow and runoff, annual summaries, and **WaterQualityWatch** (temperature and discharge information available for the Rogue Basin), visit: USGS's **WaterWatch**.

- **WaterQualityWatch**: https://waterwatch.usgs.gov/wqwatch/map?state=or&pcode=00010
- **WaterWatch**: https://waterwatch.usgs.gov/?m=real&r=or

For real-time data from stream gages within the Project Area, visit the following stream gage webpages:

- **14359000 – Rogue River at Raygold** near Central Point, Oregon: https://waterdata.usgs.gov/monitoring-location/14359000/#parameterCode=00065
- **14339000 – Rogue River at Dodge Bridge** near Eagle Point, Oregon: https://waterdata.usgs.gov/monitoring-location/14339000/#parameterCode=00065
- **14338000 – Elk Creek** near Trail, Oregon: https://waterdata.usgs.gov/monitoring-location/14338000/#parameterCode=00065

For water quality information from domestic wells and principal aquifers, visit: USGS's **National Water Quality Assessment, USGS, DeSimone (2009)**: https://pubs.usgs.gov/circ/circ1332/includes/circ1332.pdf

For access to USGS's **National Land Cover Database (2016)**: https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects

For **Water Use Data in Oregon**:

https://waterdata.usgs.gov/or/nwis/water_use?format=html_table&rdb_compression=file&wu_area=County&wu_year=2015&wu_county=029&wu_category=DO&wu_county_nms=Jackson%2BCounty&wu_category_nms=Domestic

https://waterdata.usgs.gov/or/nwis/water_use?format=html_table&rdb_compression=file&wu_area=County&wu_year=2015&wu_county=029&wu_category=PS&wu_county_nms=Jackson%2BCounty&wu_category_nms=Public%2BSupply

For geological information, such as **Jackson County, Oregon Geologic Units**, visit: https://mrdata.usgs.gov/geology/state/fips-unit.php?code=f41029

Surface and Groundwater Monitoring Data:

Source Water Quality Data:

Potential Contaminant/Pollutant Source Data:

Other Resources:

Incident Information System – South Obenchain Fire:
https://inciweb.nwcg.gov/incident/7185/

Big Butte Springs: https://www.medfordwater.org/Page.asp?NavID=62

Rogue River: https://www.medfordwater.org/Page.asp?NavID=61

Southern Oregon Forest Restoration Collaborative: The Rogue Basin Action Plan for Resilient Watersheds and Forests in a Changing Climate:
https://www.mfpp.org/wp-content/uploads/2011/04/SOFRC-Watersheds-and-Forests-Climate-Adaptation-Plan-FINAL21.pdf