November 2025

## Oregon Public Water Systems

# Surface Water Resource Guide

For Drinking Water Source Protection

DEQ

OREGON HEALTH AUTHORITY

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NOTE: The internet web addresses listed in this document were included as a convenience for the users of this document. All web addresses were functional at the time this publication was last updated (November 2025). This document will be updated as new information becomes available. Please feel free to make suggestions for improvements so that we can make the document more valuable to the public water systems in Oregon.

# Executive Summary

Surface water is a vital drinking water source in Oregon. According to the Oregon Health Authority, about 75% of Oregonians depend on surface water for their drinking water. Public water systems can help ensure that their surface water sources are of high-quality by voluntarily taking actions to protect these invaluable resources. **The primary purpose of this resource guide is to provide tools and guidance to assist public water systems in their efforts to voluntarily prevent or reduce contamination from activities within their surface water source area(s).**

Most federally regulated public water systems in Oregon have received a Source Water Assessment and/or an Updated Source Water Assessment developed by the Oregon Department of Environmental Quality and the Oregon Health Authority drinking water source protection programs. The source water assessments provide the water systems and communities detailed information on the drinking water source area that supplies their intake, spring, or well. Public water systems and local communities can use the information in the assessments to voluntarily develop and implement drinking water protection strategies.

Requirements for water quality monitoring of public water systems in Oregon provide some degree of assurance of safe drinking water. However, all systems are vulnerable to potential contamination. One of the best ways to ensure safe drinking water and minimize future treatment costs is to develop local strategies designed to protect against potential contamination. Not only will this add a margin of safety, but it will also raise community awareness of drinking water contamination risks and provide information about how communities and local landowners can help protect their drinking water sources.

Public water systems can rarely develop and implement strategic plans or risk reduction projects without assistance from partner organizations. This document provides detailed information on potential partner organizations, resources available, and funding. To increase the likelihood that voluntary pollution reduction strategies will be successful, this report provides in-depth information on various water quality protection tools and how to develop effective place-based plans through collaborative partnerships.

This surface water resource guide is a "toolbox" for using the source water assessment information and covers the following topics:

**Section 1** provides a regulatory overview of drinking water and drinking water source protection. It also includes information on DEQ and OHA source water assessment reports provided for all federally regulated public water systems in Oregon.

**Section 2** describes the geologic and hydrologic framework impacting surface water resources in Oregon and provides an overview of what makes surface water susceptible to contamination. It also details how source water assessment information and other resources can be used to understand the potential risks to surface water sources of drinking water.

**Section 3** includes information that water systems can use to form partnerships, find technical assistance, and apply for funding for projects to protect their sources of drinking water.

**Section 4** describes a model of place-based planning that brings together local groups of interested parties to plan for and implement actions that protect the quality of drinking water sources. This section also provides information on Oregon's formal Place-Based Integrated Water Resources Planning process.

**Section 5** covers pollutant reduction tools with summaries and examples of tools public water systems may find useful for implementing pollutant reduction in drinking water source areas.

**Section 6** discusses land use activities that potentially impact water quality and the state agencies and rules that regulate these activities. This section highlights the importance of public water systems and community members understanding which agencies have authority for regulation of human land use activities, the structure of those regulations, and the individual agency responsibilities.

**Section 7** covers water quality issues of particular importance to surface water sources, including climate resilience, harmful algal blooms, nonpoint sources of pollution, and per- and poly-fluoroalkyl (PFAS) substances. This section also includes information about programs with a potential drinking water quality nexus that can be potential resources or partners, including DEQ's Standards, Assessment, and Total Maximum Daily Loads program.

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# Glossary of acronyms

| | |
|---|---|
| BLM | Bureau of Land Management |
| CAFO | Confined Animal Feeding Operation |
| CWSRF | Clean Water State Revolving Fund |
| DEQ | Department of Environmental Quality |
| DOGAMI | Department of Geological and Mineral Industries |
| DWSA | Drinking Water Source Area |
| EPA / USEPA | Environmental Protection Agency |
| FERNS | Forest Activity Electronic Reporting and Notification System |
| GIS | Geographic Information Systems |
| IWRS | Integrated Water Resources Strategy |
| MCL | Maximum Contaminant Levels |
| NASS | National Agricultural Statistics Service |
| NAWQA | National Water-Quality Assessment |
| NPDES | National Pollution Discharge Elimination System |
| NRCS | Natural Resources Conservation Service |
| OAR | Oregon Administrative Rule |
| OAWU | Oregon Association of Water Utilities |
| OCCRI | Oregon Climate Change Research Institute |
| ODA | Oregon Department of Environmental Quality |
| ODF | Oregon Department of Forestry |
| OHA | Oregon Health Authority |
| ORS | Oregon Revised Statute |
| ORWARN | Oregon Water/ Wastewater Agency Response Network |
| OSFM | Oregon State Fire Marshall |
| OSU | Oregon State University |
| OWRD / WRD | Oregon Water Resources Department |
| PARC | Pesticide Analytical and Response Center |
| PFAS | per- and polyfluoroalkyl substances |
| PSP | Pesticide Stewardship Partnership |
| RCAC | Rural Community Assistance Corporation |
| SWCD | Soil and Water Conservation Districts |
| TMDL | Total Maximum Daily Loads and the related implementation plans |
| UIC | Underground Injection Control |
| USDA | United States Department of Agriculture |
| USFS | United States Forest Service |
| USGS | US Geological Survey |
| UST | Underground Storage Tanks |

| | |
|---|---|
| WPCF | Water Pollution Control Facility |
| WSU | Washington State University |

# Project Purpose

**Why is there a need for a surface water resource guide?**

Oregon faces many challenges with water quantity, water quality, and ecosystem needs. Oregon's people rely upon water to drink, to irrigate and grow food, to supply livestock, to build products, to move goods, to recreate, and to produce energy. Clean water is essential to Oregon's environmental health—for the trees, native plants, wetlands, aquatic life, and human health. Oregon's economy is highly dependent upon a healthy environment and clean, reliable sources of water.

As Oregon's population grows, the importance of high-quality drinking water sources to meet the demands of that population will increase. Ensuring high quality sources of water is essential for providing clean drinking water to agricultural growers/ranchers, rural homeowners, businesses, and urban communities of all sizes.

Today, and historically, the public is concerned about the safety of its drinking water. This project---developing a "Resource Guide" for public water systems---was initiated after several multi-agency meetings during 2013-14 regarding how to address community concerns about drinking water quality. During the meetings is became clear that local government and community members needed more information about the various authorities associated with water quality in their source area. In addition, communities needed more information about the tools and assistance available to them to help voluntarily reduce the risk of contamination of their drinking water. Oregon's Department of Environmental Quality developed the Resource Guides in response to this need.

While the risk of intentional contamination is small, drinking water sources can become contaminated by a variety of human activities and natural causes. Most water resource work to date has focused on identifying pollutant impacts, then reducing the levels of pollutants and restoring impaired or polluted waters. While we will continue to do this as resources allow, it is also important to prevent problems from occurring. Pollution prevention does not depend on data showing there is an existing problem, but an understanding of factors that pose a risk of pollution. If there is already a pollution problem, it is too late to prevent it.

Pollution prevention is fundamentally different from pollutant removal or treatment. With regard to safe drinking water, many studies have shown that it is more cost-effective to prevent pollution than to remove it through treatment or implement restoration. Reducing or eliminating off-site releases of pollutants through protection and prevention activities can effectively lower treatment and maintenance costs and improve the long-term viability of surface water drinking water sources (Freeman et al 2008). Reducing or preventing pollutant

loading to source water can reduce the need for equipment replacement or upgrades, as well as reduce risks associated with contaminants for which regulatory standards and/or monitoring requirements are lacking. Long-term assurances of a safe and adequate drinking water supply also protects property values and preserves the local and regional economic potential for the area.

This Resource Guide provides the information necessary for Oregon's public water system officials and community partners to implement local place-based planning to prevent pollutant impacts that could affect their drinking water quality. Pollution prevention can help protect public health, enhance public confidence in their drinking water, and reduce the need for expensive treatment in both surface water and groundwater sources.

There have been many studies showing the cost-effectiveness of source water protection. One of the most comprehensive is a 2017 report from the Nature Conservancy's Global Water Program titled "Beyond the Source: The environmental, economic, and community benefits of source water protection," which is paired with a companion decision tool mapping website. The report analyzes the source watersheds of more than 4000 large cities worldwide and highlights how nature-based solutions can be scaled up and implemented to make a difference in biodiversity conservation, resilience, and public health. For example, the analysis shows that 4 out of 5 of the ~4000 cities studied could meaningfully reduce sediment and nutrient pollution in their source water through implementation of three source water protection activities: reforestation, forest protection, and planting cover crops. It also dedicates significant discussion to the potential cost-savings of source water protection efforts. Go to the **Nature Conservancy's website** to read the "Beyond the Source" report.

The American Water Works Association also makes a strong case for how protecting sources of drinking water is an effective way to control water treatment cost while building customer confidence and reducing risks to public health. Go to the American Water Works Association's **Source Water Protection website** to access resources tailored to helping water systems understand the value of protecting their drinking water sources. The Trust for Public Land published an article focused on the potential costs to water systems that do not engage in drinking water source protection actions. Go to the **Trust for Public Land's website** to view the full article, "The Cost of Not Protecting Source Waters (2010)."

More recently, the American Water Works Association's annual State of the Water Industry 2024 report highlighted source water protection as the #1 issue facing the water sector today based on survey responses from water professionals across the industry and nation. This Resource Guide is designed to help Oregon's surface water systems access information to initiate source water protection efforts for their community. Visit the **American Water Works Association's website** to view the annual State of the Water Industry reports.

# 1.0 Drinking Water Regulatory Overview

It is important to understand the regulatory context of water quality as it relates to drinking water source protection. We all depend on clean water. This section will highlight the federal and state regulations related directly to public drinking water. Several of Oregon's state agencies administer different aspects of water quality regulations to protect public health and water resources.

In Oregon, there are no state or federal regulations specifically requiring public water systems to protect drinking water sources from contamination. Instead, water systems are encouraged to take voluntary actions to develop and implement drinking water protection strategies and promote implementation of existing state rules and programs within their source area. Oregon implements its non-regulatory drinking water source protection program through a partnership between the Oregon Health Authority and the Oregon Department of Environmental Quality. An Interagency Agreement between OHA and DEQ provides a framework to ensure DEQ's responsibilities and tasks associated with assisting public water systems with drinking water source protection are clearly articulated.

## 1.1 The Safe Drinking Water Act and the Oregon Health Authority

OHA is the state agency responsible for the implementation of the federal Safe Drinking Water Act in Oregon. OHA administers and enforces drinking water quality standards through its Drinking Water Services program. Oregon Administrative Rules include requirements for systems to meet the Safe Drinking Water Act maximum contaminant levels, which are legal threshold limits on the amount of a substance that is allowed in drinking water which is delivered to the consumer. Water systems are also required to submit to periodic inspections and meet enforcement requirements as administered by OHA (reference Oregon Administrative Rules 333.061, 338.277, and 448.131 for more information). As the primacy agency responsible for implementing the Safe Drinking Water Act, OHA also approves drinking water treatment plans, sets construction and operator certification standards, and enforces rules to ensure safe drinking water.  OHA assists systems in complying with standards by providing technical assistance and provides grants and loans to aid public water system operations.

Go to **OHA's Drinking Water Services website** to learn more about public water system regulatory requirements and the various resources available to public water systems.

Learn more about Oregon's Maximum Contaminant Level rules by referencing **Oregon Administrative Rules 333.061**. Contact OHA Drinking Water Services staff for assistance in

understanding MCL rules or any other water screening levels for contaminants in finished drinking water.

## 1.1.1 Regulated Public Water Systems in Oregon

In Oregon, public water systems with 4 or more connections or serving more than 10 people for at least 60 days of the year are regulated. There are approximately 3,300 public water systems in Oregon (including Oregon Very Small systems). Most of these use groundwater wells or springs, and approximately 350 of these use surface water from rivers, reservoirs, or *wells that have been determined to be under the direct influence of surface water*. Surface water serves most of the larger municipalities in Oregon and many of these large municipalities have more than one intake. As of October 2025, active surface water intakes were providing drinking water to ~2,550,000 Oregonians.

## 1.1.2 Chemicals of Concern in Drinking Water

The federal Safe Drinking Water Act currently regulates over 90 of the most commonly occurring pollutants in drinking water in the United States. In April 2024, the United States Environmental Protection Agency announced Primary Drinking Water Regulations for six per- and polyfluoroalkyl substances. Oregon has two years to adopt the regulations. This is the first new Maximum Contaminant Level established in over 10 years.

There are many pollutants used in Oregon that are not regulated in treated drinking water — including pharmaceuticals, wood preservatives, personal care products, and many pesticides. Community public water systems (places where people live) and non-transient non-community public water systems (places where people work or attend school) test for regulated synthetic organic contaminants every three years in treated drinking water, but there is no required monitoring for unregulated compounds. The testing requirements for transient non-community public water systems (places that don't serve the same people every day) are limited to bacteria and nitrate, which are pollutants that carry an acute risk of illness.

Through extensive sampling and analysis done by the U.S. Geological Survey, EPA, and others, we know that many pollutants found in drinking water sources cannot be fully removed through standard drinking water treatment technologies (Stackelberg et al 2004, Glassmeyer et al 2017). The inability to remove certain pollutants from source water highlights the importance of taking actions that reduce or prevent pollutants in source waters.

## 1.1.3 Source Water Assessments

Amendments to the federal Safe Drinking Water Act in 1996 required that Oregon delineate the individual drinking water source areas for public water systems and develop source water assessments that identify potential sources of pollutants (USEPA 1996). For surface water systems, the drinking water source area for an intake is the water collection zone upstream of the intake to either the drainage area boundaries or the next upstream intake, whichever is closer. In terms of total land area, drinking water source areas represent a significant proportion of the land area west of the Cascade Mountain crest and account for a significantly smaller proportion of the state's land area east of the Cascades (Figure 1).

Between 1999 and 2005, OHA and DEQ completed source water assessments for 2,656 public water systems (the total number of federally regulated community and non-transient non community water systems in Oregon at that time). Oregon's source water assessment procedures, including the development of the list of potential contaminant risks, were established by a statewide citizen's advisory committee (Feb 1998-June 1999) and approved by the United States Environmental Protection Agency in July 1999.

Go to **DEQ's Source Water Assessment Results for Public Water Systems Using Surface Water website** to find assessment information and maps specific to each water system.

Accurate source area mapping and visual resources to share with community residents and officials is one of the most important and valuable assets a public water system can have. Understanding the source water assessment is the first step in developing protection strategies to address potential risks. The source water assessments provide a broad view of information that is intended to be supplemented and refined with local knowledge from the water system, community, and other interested parties. This resource guide offers additional tools to help water systems and communities enhance assessment(s), build partnerships, and to develop meaningful strategies to reduce risk and improve resilience.

The source water assessment reports for each public water system provide community officials with detailed information on the watershed or recharge area that supplies their well, spring, or surface water intake and identify potential risks within the source area.

Assessments also identify potential risks, including both point and nonpoint sources of contamination.

- Point sources come from a single, identifiable origin, such as a wastewater treatment plant outfall.
- Nonpoint sources are more diffuse, with no single origin, such as nutrient runoff from agricultural land.

Each assessment includes descriptions of land uses or activities that are considered potential contamination risks, along with maps showing locational data. These potential risks were identified through a review of nine agency databases (DEQ, US EPA, State Fire Marshall, etc.), interviews with public water system officials, a windshield survey and other data sources.

In response to more advanced data and analyses becoming available, OHA and DEQ began completing Updated Source Water Assessments for public water systems in 2016. Updated Source Water Assessments provide enhanced maps displaying locational data and updated information on source water susceptibility and potential sources of contamination.

Updated Source Water Assessments have been developed for most community public water systems using surface water sources. Go to **DEQ's Source Water Assessment Results for Public Water Systems Using Surface Water website** to find assessment information and maps specific to each water system. OHA is updating the groundwater assessments.

## 1.2 The Clean Water Act and the Oregon Department of Environmental Quality

The Safe Drinking Water Act does not provide regulatory authority to prevent pollution in source waters. Protecting water quality in source waters for public water systems requires implementation of federal Clean Water Act authorities and state law. DEQ is responsible for the implementation and enforcement of the federal Clean Water Act and state water quality laws in Oregon. The federal Clean Water Act authorities apply to all surface waters in the United States. Oregon state statutes (ORS 468B.005(10)) expand upon the federal Clean Water Act to afford protection for all waters of the state, including groundwater.

Oregon Department of Environmental Quality implements surface water quality protection through a variety of programs and responsibilities that are designed to monitor and assess water quality, develop and implement water quality standards and clean water plans, prevent contamination from point and non-point sources of pollution, and clean up pollution sources. Oregon DEQ coordinates water quality protection with other state and federal agencies which have overlapping responsibilities for regulation, involvement, or oversight.

DEQ is responsible for addressing pollutants from point and nonpoint sources of pollution that affect water quality throughout the state. Point sources of pollution come from a single, identifiable origin (such as a wastewater treatment plant outfall) whereas nonpoint sources of pollution have no clearly identifiable origin point (such as nutrient run off from agricultural land).

Go to **DEQ's Water Quality home page** to learn more about Oregon's water quality programs.

Refer to Section 7.0 in this resource guide to learn more about other DEQ water quality programs that can intersect with drinking water source area planning and protection.

While DEQ has overall regulatory authority over the Clean Water Act, the state has delegated some industry-specific oversight to other agencies such as the Oregon Department of Forestry, Oregon Department of Agriculture, or to the Department of Geology and Mineral Industries. For example, in agricultural areas, ODA is responsible for ensuring that agriculture practices meet state water quality standards. However, DEQ has the overall authority and responsibility to ensure state water quality standards are being met.

The federal Clean Water Act authorities apply to all surface waters in the United States. Oregon state statutes (ORS 468B.005(10)) expand upon the federal Clean Water Act to afford protection for all waters of the state, including groundwater. Oregon statues authorize DEQ to implement and enforce the federal Clean Water Act within Oregon. Pertinent Oregon Revised Statutes that provide the basis for prevention of contamination include:

ORS 468B.005 Definitions for water pollution control laws.

> *…(5) "Pollution" or "water pollution" means such alteration of the physical, chemical or biological properties of any waters of the state, including change in temperature, taste, color, turbidity, silt or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the state, which will or tends to, either by itself or in connection with any other substance, create a public nuisance or which will or tends to render such waters harmful, detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational or other legitimate beneficial uses or to livestock, wildlife, fish or other aquatic life or the habitat thereof.*
>
> *…(10) "Water" or "the waters of the state" include lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction.*

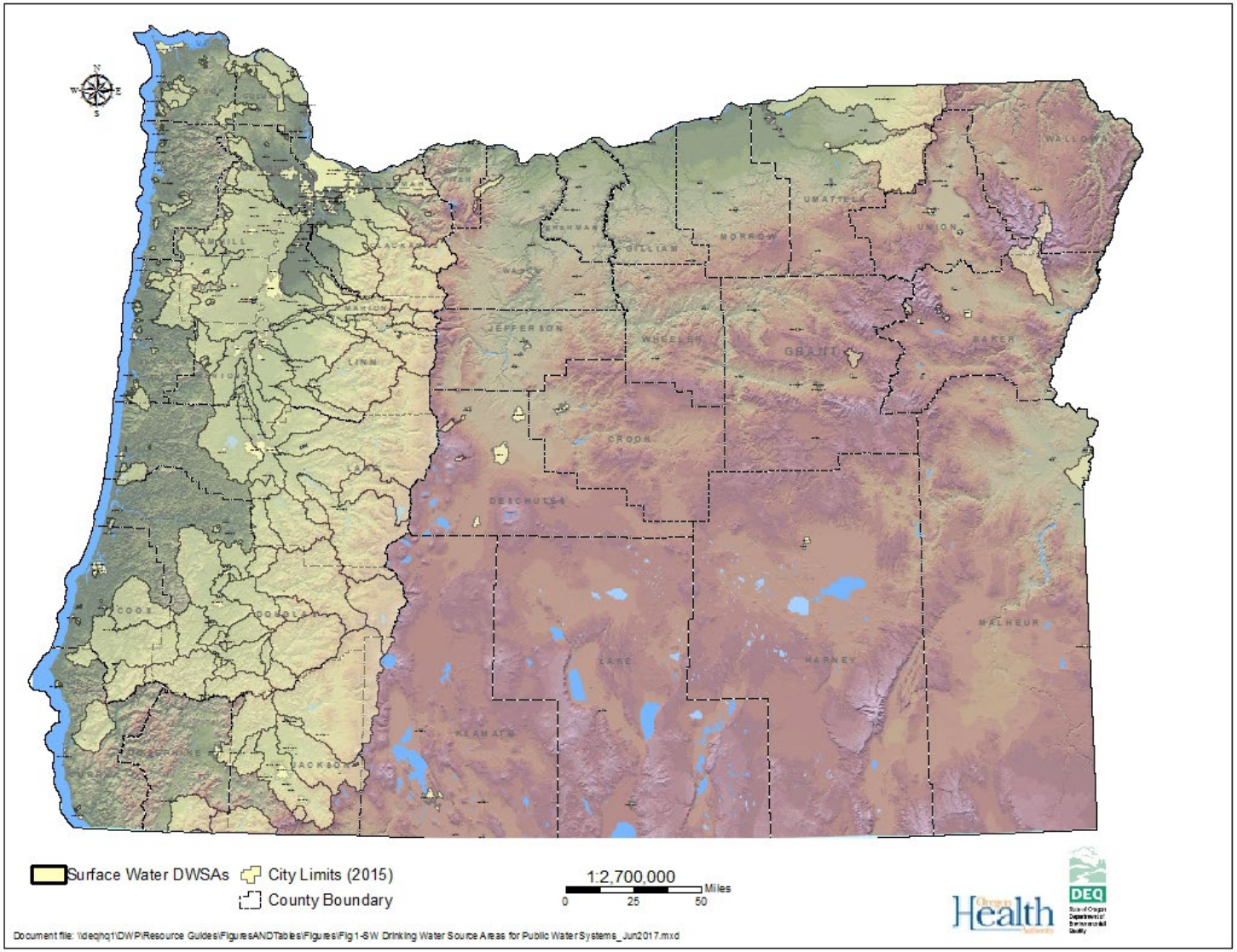


**Figure 1. Drinking water source areas for public water systems using surface water.**

ORS 468B.015 Policy:

> *Whereas pollution of the waters of the state constitutes a menace to public health and welfare, creates public nuisances, is harmful to wildlife, fish and aquatic life and impairs domestic, agricultural, industrial, recreational and other legitimate beneficial uses of water... it is hereby declared to be the public policy of the state:*
>
> *...(2**)** To protect, maintain and improve the quality of the waters of the state for public water supplies, for the propagation of wildlife, fish and aquatic life and for domestic, agricultural, industrial, municipal, recreational and other legitimate beneficial uses;*
>
> *...(5) To cooperate with other agencies of the state, agencies of other states and the federal government in carrying out these objectives.*

Oregon's Department of Environmental Quality is responsible for protecting the state's water quality. The agency works to prevent and clean up pollution from various sources and regularly monitors water quality. A key focus for DEQ is safeguarding public health by maintaining healthy watersheds, assessing water basins, setting water quality standards, and regulating pollution sources. DEQ also coordinates efforts across different programs, such as reducing toxic substances, managing pesticide use, responding to spills, and cleaning up hazardous waste. Protecting public drinking water sources is a priority in statewide planning.

## 1.3 Water Quantity, Water Rights, and Oregon Water Resources Department

The Oregon Water Resources Department is the state agency charged with administration of the laws governing surface and groundwater resources, and as such has significant water quantity authorities related to issuing and regulating water rights, oversight of the demands on the state's water resources, providing water resource data, and facilitating water supply solutions (especially as is necessary in drought conditions). Refer to Section 3.2.1 in this resource guide for more information on the role of the Oregon Water Resources Department and the various funding opportunities and programs related to drinking water that they administer.

# 2.0 Surface Water Characterization, Susceptibility, and Assessment

This section describes the geologic framework impacting surface water resources in Oregon, provides an overview of what makes surface water susceptible to contamination, and details how source water assessment information and the Department of Environmental Quality Drinking Water Source Protection Program resources can be used to understand potential risks to surface water drinking water sources. This section also highlights sources of available data that can be used to assess surface water quality in drinking water source areas.

- Surface water is an essential resource and has many valuable uses and functions:
- Surface water makes up of the most visible and sensitive of available freshwater resources
- Surface water is a vital drinking water source in Oregon. Approximately 10% of the Oregon public water systems get their drinking water from surface water, but those include large municipalities such as Portland, Salem, Eugene, Medford, Bend, and others According to the Oregon Health Authority, about 75% of Oregonians depend on surface water, either fully or partially, for their drinking water.
- Oregon's businesses require clean water for industries such as food processing, breweries, dairies, manufacturing, and computer chip production
- Surface water provides irrigation water for Oregon agriculture and water for livestock
- Surface water provides recreational opportunities including swimming, boating, and fishing
- Surface water in streams and rivers provides critical habitat for fish, animals, insects, and plants

## 2.1 Geologic Framework

The Pacific Northwest is a dynamic natural environment. Understanding the geographic setting of a drinking water source area improves the process of identifying potential risks and vulnerabilities to a drinking water source. Watershed protection in Oregon requires understanding the unique influences of geology, topography, climate and ecology within drinking water source watersheds.

Plate tectonics, a subducting ocean plate off of Oregon’s coast, volcanoes, and uplift have all created (and continue to create) diverse geological conditions in the Oregon Coast Range, the Cascades, Blue, Wallowa, and Klamath Mountains. The Blue, Wallowa, and Klamath Mountains are remnants of historic coastlines and coastal ranges from when the majority of the current Oregon land mass was underwater. The Cascade Mountains are primarily of volcanic origin and

continue to be tectonically active with volcanoes and earthquakes as major forces that can drastically alter the landscape. Much of Oregon's landscape is covered with thick volcanic basalt deposits from historic eruptions and flood basalt flows.

Topographically, the younger terrain near the coast is mountainous. The Coast Range is the youngest of Oregon's mountains and is primarily interlayered oceanic sediment deposits and lava flows, pushed upward because of plate tectonics. This means there are large areas of highly erodible sedimentary rocks, including some of oceanic origin, with sections of harder igneous (volcanic) rocks. There are also large sea floor faults off the coast of Oregon that are active and can cause both earthquakes and tsunamis. Earthquake-driven tsunamis present a risk to coastal drinking water supplies due to the possibility of saltwater surges upstream and physical damage to the infrastructure of community water supplies.

Regional geology can be a factor in climate conditions as well. For example, the topography of the mountains and proximity of the ocean makes for a unique climate on the west side of the Cascade Mountains that is very different from the climate on the east side of the mountains. Oregon's Coast Range is characterized by a dry summer season with high amounts of precipitation between October and April, including frequent large storms. Yearly average precipitation can regularly exceed 100 inches in many mountainous locations. In contrast, the high desert region of eastern Oregon is characterized by average precipitation of only 8-12 inches per year.

Oregon has a very active and diverse geologic history and the conditions driving movement and change continue today. The landscape is shaped by erosion and sediment movement processes that vary locally due to site-specific rock types and how firmly they are held together. Steep slopes are prone to shallow, rapidly moving landslides, and there are numerous large, deep-seated landslides as well. Understanding the geology and landscape conditions are an important first step in determining the characteristics of watersheds in Oregon.

## 2.2 Surface Water Susceptibility

Understanding surface water hydrology is key to protecting water sources for public use. Surface water comes from precipitation (rain, fog, snow) and can flow directly into waterbodies, be stored as snow and ice, or seep into the ground, replenishing aquifers and streams. Groundwater and surface water are interconnected, with water moving between them.

Timing, form, and intensity of precipitation can all influence water availability, quality, and seasonal flow patterns. Peak flows happen during storms and snowmelt (usually in winter and spring), while low flows typically occur at the end of summer (September or October). However, climate change is causing longer dry periods, sometimes extending into spring or early summer.

Soil and stream channel structures vary across the state based on geology, topography, elevation, and precipitation. Streams can be ephemeral (flowing only after storms), intermittent (flowing most of the year but drying in summer), or perennial (flowing year-round). Headwater streams merge into larger channels, usually increasing in volume downstream. As water moves across the landscape, it is exposed to contamination from pollutants carried by air and water.

Water quality in Oregon can vary due to either natural or human influences. Fires periodically burn through forests and rangelands at low, medium, or high intensities. In steep areas and based on local geology, landslides can occur and move large amounts of soil, rock and debris. Windstorms can blow over trees and destabilize sediment, and flooding periodically affects streamside areas and associated floodplains. Erosion of streambanks and falling vegetation can add sediments and organic matter to surface waters. These disturbances, large and small, are important ecological processes, rejuvenating and reorganizing ecosystems, and can also interfere with the beneficial uses of surface waters for drinking water production (Reeves et al 1995, Gomi et al 2005, Reeves et al 2006).

Human activities and pollution sources can be a risk to a drinking water intake that serves as a private or public water system source. Surface water is susceptible to contamination from many different land uses and activities. Common potential sources of pollution within drinking water source areas include urban stormwater runoff, municipal and industrial wastewater, gravel quarries and other mining sites, animal management areas (including confined livestock or animal feeding operations), onsite wastewater systems (domestic or industrial), fuel and hazardous material storage/use locations, boat ramps and marinas, agricultural practices, forestry operations, roads and transportation corridors, and solid waste handling sites (landfills or transfer stations). The Source Water Assessment reports produced for public water systems by the OHA and DEQ identified a broad range of these "potential contaminant sources" for each drinking water source area. Refer to section 1.1.3 to learn more about what Source Water Assessment reports are, or to section 2.3 to understand how to use the information in a Source Water Assessment to assess the susceptibility of a surface water source.

To summarize, potential water quality risks and impacts can be roughly divided into natural and human factors.

Natural factors that can affect water quality include:

- Amount and form of precipitation
- Erodibility of soils
- Locations of steep slopes prone to shallow, rapidly moving landslides (>70-85% slope, depending on geology and landform)

- Locations of earthflows and other deep-seated earth movements
- Eroding streambanks, inner gorges and cliffs, and other erosion-prone, stream-adjacent features
- Natural disturbances and recently disturbed uplands and riparian areas (for example, fire or windstorm in the past 10 to 30 years)
- Naturally occurring mineral deposits such as mercury, nickel, chromium, and arsenic
- Near-stream vegetation communities (for example, certain tree species can cause higher water tannin levels or influence nutrient levels in streams

Human factors affecting water quality include:

- Human activities and facilities, especially within riparian areas and floodplains
- Road locations and conditions, especially stream crossings, roads near streams, roads on steep slopes, and roads with drainage systems connected to the stream network
- Actively used pastures and/or cropland located adjacent to streams or with hydrologic connections to streams
- Stormwater runoff from high-risk areas (for example, urban and/or industrial areas or areas with high phosphorus and/or nitrogen content)
- Recently managed forestland which has been harvested, replanted, treated with herbicides or fertilizers, etc.
- Quarries and associated infrastructure
- Construction sites
- Residential land (rural, suburban, urban) and infrastructure (for example, onsite/septic systems and stormwater discharge pipes)
- Hazardous material sites
- Industrial sites
- Solid waste landfill sites

It is important to recognize that some locations on the landscape are more sensitive to disturbances and may warrant either prioritized protection or additional protection measures. Sensitive areas include:

- Riparian and floodplain areas
- Springs, seeps, and wetlands
- Steep slopes (>70-85%)
- Areas with highly erodible soil
- Any areas with disturbed or bare soil
- High water table areas

More specific information about the common land uses and activities within drinking water source areas that are potential sources of contamination and associated pollutant reduction strategies can be found in Appendix 1.

Source water contamination from turbidity, bacteria, and/or pesticides are common concerns for public water systems in Oregon. For more information about the susceptibility of water systems to these common pollutants refer to sections 2.4.2 (Bacteria Data and Susceptibility), 2.4.3 (Turbidity and Disinfection By-Product Data and Susceptibility) and 2.4.4 (Pesticide Data and Susceptibility) of this resource document.

## 2.2.1 Impacts of Surface Water Quality on Treatment Cost

The costs associated with treating surface water can be directly related to raw source water quality conditions (Brown 2000, Postel and Thompson 2005, Freeman et al 2008). Natural processes in combination with both human activities and natural disturbances can affect water quality in ways that become problematic for drinking water treatment processes. Degraded source water quality can raise the cost of drinking water treatment, require treatment plant shutdowns, or result in finished drinking water that does not meet Safe Drinking Water Act maximum contaminant levels or treatment technique standards. Increased turbidity (cloudiness) and suspended sediment in source water can clog filters, require more water treatment chemical use, and carry pollutants and pathogenic microorganisms into the water supply (Meschke and Sobsey 1998, Lick 2008). Dissolved organic matter is a necessary precursor to potentially carcinogenic disinfection byproducts, which are formed when commonly used disinfectants react with dissolved organic carbon compounds. Reducing pollutant levels in source water can reduce the production of harmful disinfection byproducts and improve public health outcomes (Nikolaou et al 1999, US EPA 2002). Providing reliable, clean, and safe drinking water to the public requires both prevention of pollutants entering source water and water treatment technology (the "multiple barrier approach"). *Reducing the pollutant loading in source waters can avoid additional treatment costs and improve the reliability of treatment (US EPA 2001a, US EPA 2001b).* In particular, the protection and sustainable management of forested watersheds is often more cost-effective than upgrading treatment due to degradation of source water from land use conversion (Gartner et al 2014).

## 2.2.2 Susceptibility of Various Water Treatment Technologies to Contamination

The type of treatment technology in use at a drinking water treatment facility should also be considered when determining the susceptibility of a public water system to potential contaminant sources in the source water area. A water system's susceptibility to changes in raw water quality can depend on the treatment technology in use. For example, the type of filtration system in use determines what raw water turbidity levels are too high for optimal treatment. For unfiltered systems, raw water turbidity levels must remain consistently below 1.0 nephelometric

turbidity units, whereas slow- and rapid-sand systems typically require turbidity levels below 5-10 NTU and direct filtration typically requires turbidity levels below 15 NTU. In practical applications, this means that one raw water turbidity value can cause a treatment facility to shut down their intake while the same turbidity value can result in optimal treatment processes for a different system type. Smaller communities with fewer resources typically have treatment that is less able to manage extensive chemical contamination, tastes and odors, and/or high turbidity, according to the Oregon Health Authority.

This **treatment system susceptibility map** shows the types of drinking water treatment technologies employed by public water systems in Oregon and their relative susceptibility to particulate matter and turbidity in the water.

While different treatment systems have varying contaminant removal limits, there are some contaminants that cannot be effectively removed from most common treatment types. Removal of pesticides, human waste products, petroleum and chemical contaminants, and so on is incomplete in most common treatment types, and expensive to treat with additional technology. Exceedances of treatment capacities lead to exceedances of Maximum Contaminant Levels or shutdowns of water systems until conditions improve. Smaller systems in particular frequently rely on technologies which are more sensitive to declines in raw water quality (approximately 65% of Oregon surface water public water systems serve populations of 3,300 or fewer persons). For this reason, source water protection is the first barrier, and an important one for many contaminants. Prevention is often more effective and economically efficient than enhancing treatment facilities to remove contaminants after the fact.

## 2.3 Using Source Water Assessment Information to Assess the Susceptibility of a Surface Water Source

In 1996, new amendments to the Safe Drinking Water Act required states develop source water assessments for all community water systems. Reference section 1.1.3 of this resource guide for more detailed information on source water assessments. The first step to complete a source water assessment is to delineate the drinking water source area for a given source. **For surface water systems, the drinking water source area is defined as all land area within the watershed upstream from an intake.**

One of the most important aspects of the source water assessment process was determining the "susceptibility" of each system to contamination. Susceptibility in the assessment was defined as the potential for contamination in the source area to reach the public water system intake(s). Whether or not a particular drinking water source becomes contaminated depends on three major factors:

1) the occurrence of a land use/activity that releases contamination,
2) the location of the release, and
3) the hydrologic, ecological, and/or soil characteristics in the source area that allow the transport of the contaminants to the waterbody and thereby the intake.

The source water assessments contain basic maps of susceptible areas within the delineated drinking water source area for public water intakes and highlight the location of potential sources of contamination.

Important maps from the Updated Source Water Assessment report that can help to assess a drinking water source's susceptibility to contamination from soil erosion and landslides include:

- **Drinking Water Source Area Erosion Potential Map:** The map highlights streams in the drinking water source area that are at increased risk of erosion potential in response to ground disturbance activities.
- **Drinking Water Source Area Landslide Hazards Map:** The map highlights existing landslide hazard features in the drinking water source area as an indicator of potential future risk. The data includes identified earth and debris slides, flows, slumps, falls and complex landslide types, but does not include rock material landslide deposits.
- Another important map from the Updated Source Water Assessment report that can help to assess a drinking water source's susceptibility to other potential sources of contamination is the **Drinking Water Source Area – Potential Anthropogenic Sources, Transportation Corridors and Land Ownership/Use Map**.

Based on statewide occurrence in source areas, the following categories were identified as having a high risk for contamination of surface water sources:

- **Managed Forests** (harvests/pesticides): Cutting and yarding of trees may contribute to increased erosion, resulting in turbidity and chemical changes in drinking water supply. Application or improper handling of pesticides or fertilizers may impact drinking water sources, depending on site conditions and procedures. Areas with a high density of roads can present additional risks associated with sediment transport, accidents and spills, and fire risk.
- **Crops – Irrigated**: Application or improper handling of pesticides or fertilizers may impact drinking water (dependent on-site conditions and procedures). Excessive irrigation may cause transport of contaminants or sediments to groundwater/surface water through runoff. NOTE: Drip-irrigated crops, such as vineyards and some vegetables, are a lower risk.
- **Grazing Animals/confined livestock** (>5 large /acre): Improper storage and management of animal wastes may impact drinking water supply. Concentrated livestock or wild animals may contribute to bacterial contamination, soil erosion, and increased turbidity in surface water bodies.

- **Above Ground Tanks**: Spills, leaks, or improper handling of stored materials may impact the drinking water supply.
- **Auto Repair**: Spills, leaks, or improper handling of automotive fluids, solvents, and repair materials during transportation, use, storage and disposal may impact the drinking water supply.
- **Other significant potential risk categories** include:
    - Wastewater Treatment Plants — permitted sources of pollution discharged into streams and regulated by permit conditions
    - Heavy Recreation —reservoirs and lakes that serve as community drinking water sources are also used for recreation including human contact.

For more information on how Oregon determined the risk levels for potential contaminant sources in source water assessment reports, reference this factsheet on **Oregon's Source Water Assessment Methodology**. For more information on how soil erosion and landslide hazard analyses were completed refer to Appendix 2 in the Updated Source Water Assessment.

The assessment inventory results are an important summary of *potential* risks to Oregon public water systems. Within surface water source areas, the most commonly occurring land uses that pose a high to moderate risk to source water quality are private industrial forests, agriculture, and private rural lands (Figure 2). Federal ownership accounts for over 40% of land use in surface water source areas; the high level of federal ownership highlights the importance of developing partnerships with the United States Forest Service or Bureau of Land Management in managing for shared goals within drinking water source watersheds.

For any water system or community interested in voluntarily developing a local protection plan or local protection strategies, the next step is to conduct an enhanced inventory that looks at site-specific practices within the context of the drinking water source area(s). The source water assessment provides a broad view of susceptibility information and is meant to be supplemented and refined with local knowledge from the water system, community, and other interested parties. Refinement of potential risk from sources of contamination can also be accomplished through further research and coordination with state agencies. Refer to section 4 of this resource guide for more information on collaborating with interested parties within drinking water source areas to achieve drinking water source protection planning or implementation goals.

1) For the purposes of providing statewide guidance to public water systems, drinking water source protection priorities to focus on could be selected by either:
   Compile predominant land uses, evaluate overall risk to water quality, then develop and prioritize strategies to address the highest risks.
2) Compiling monitoring data to determine the most significant contaminant or chemical in surface water at or near public water systems.

The original and updated source water assessment reports for public water systems using surface water sources are available from DEQ's website. Go to **DEQ's Source Water Assessment website** to find assessments for public water systems using surface water sources. More information on the groundwater assessment reports can be found on the OHA Drinking Water Services website. Go to the **OHA Drinking Water Source Protection website** to find information on accessing groundwater assessment reports.

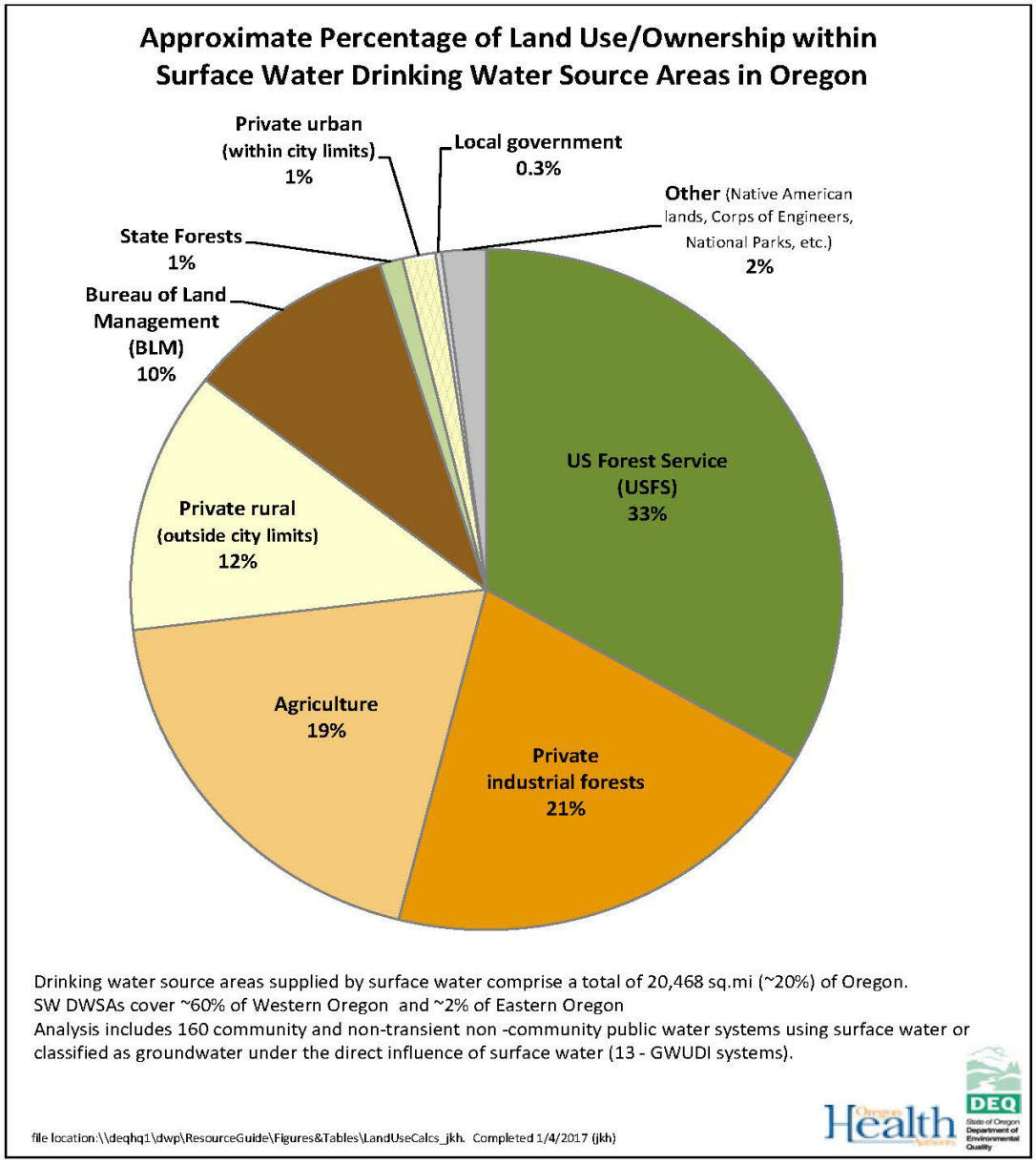


**Figure 2. Approximate percentage of land uses within surface water drinking water source areas. Note that data on land uses is only approximate.**

# 2.4 Other Surface Water Assessment Resources

Surface water contamination is a serious issue in some areas of Oregon. Many state and federal agencies have studied the quantity and quality of surface water in specific areas, but there are still significant gaps and data needs to fully characterize Oregon's water resources. This section will summarize some of the best sources of data that help water systems to determine the priorities for surface water contaminant reduction work in their drinking water source areas.

## 2.4.1 Drinking Water Data Online

Public water systems in Oregon are subject to Safe Drinking Water Act regulations, which includes requirements for water systems to test their finished (or treated) water for substances with established Maximum Contaminant Levels before delivery to consumers. The detection data results for public water systems are publicly available information and can be accessed online through the OHA 's Drinking Water Data Online website. The Drinking Water Data Online website also contains information about basic water system information, public notices, enforcements, violations, and chemical testing schedules.

Go to **OHA's Drinking Water Data Online website** to look up information for public drinking water systems.

The results of routine water testing can be evaluated to determine drinking water priorities for a particular water system. While most water quality testing requirements are for treated water, the results are still useful for prioritizing source protection efforts because any contamination in the finished water must be addressed within the source. Detections of contaminants in regulatory monitoring are a clear indication that there is an existing pathway of contamination from the landscape to the waterbody and intake. Public water systems that have contaminant detections can develop targeted protection strategies to reduce or eliminate the source(s) of contamination in their drinking water source.

There is not a requirement to routinely collect samples of source water (also known as raw water) prior to treatment. There are some data on surface water quality prior to treatment, but it is limited.

## 2.4.2 Bacteria Data and Surface Water Susceptibility

Bacteria are a critical part of digestion processes in animals, and masses of living and dead bacteria are a component of feces. The term "bacteria" in this context refers to fecal bacteria such as *E. coli* or other fecal coliform bacteria from human and/or animal sources. Agencies like DEQ use some of these bacteria species as indicators of contamination of waterbodies by

human and/or animal wastes because they are pathogens (disease-causing organisms) or co-occur with pathogenic bacteria, viruses, protozoa, and parasites from wastes. Bacteria sources include wildlife, domestic animals (pets and livestock), septic systems, recreation, and wastewater treatment facilities.

Bacteria can wash into streams and rivers from the land surface or be directly discharged there, causing elevated fecal bacteria levels in surface waters (Cabral 2010). Precipitation runoff can carry improperly handled human, pet, and livestock waste into surface water. Inadequate treatment of wastewater and failing onsite septic systems can release bacteria into waterbodies. Wildlife and grazing animals can defecate directly into surface water. Bacteria may also infiltrate into shallow groundwater from septic systems or animal agriculture operations and then be transported with subsurface water into surface waterbodies.

Fecal bacteria such as *E. coli* and other coliforms may or may not themselves be pathogenic. Regardless, they are useful indicators of contamination by human and/or animal waste and potential waste-borne pathogens. Consumption of infected water or food (known as the fecal-oral route of infection) introduces the pathogen into the human body, potentially leading to infection, sickness and disease, or even death. Feces-borne organisms include dangerous viruses (e.g. Hepatitis A virus, noroviruses, and poliovirus), bacteria (e.g. cholera, *Shigella*, and *Campylobacter*), protozoa (e.g. *Giardia*, *Cryptosporidium*, and *Toxoplasma gondii*), and parasites (e.g. tapeworms and hookworms). Depending on the pathogen, infected persons can experience diarrhea, cramping, anemia, dehydration, malnutrition, nerve damage, and death. Effective use of prevention (e.g. sanitation and manure management) and treatment (e.g. filtration and disinfection) can prevent fecal-borne diseases.

While every community should ensure they reduce bacterial contamination of drinking water, small and rural communities may need to pay heightened attention due to the higher prevalence of agricultural activities and associated fertilizer (manure) applications, septic systems, and animal wastes. There are several sectors of development that contribute to the transport of bacteria to waterbodies. These sectors include agriculture (e.g. manure application, composting operations, animal waste from livestock) and residential (e.g. septic systems, pets, stormwater, breaks in sewer lines or inadequate treatment of sewage). By increasing the density of humans and livestock near waterbodies, humans can increase the presence and infectiousness of fecal bacteria in surface waters used for drinking and contact recreation (Cabral 2010). Note that larger confined animal operations in the state operate under permits through the Oregon Department of Agriculture (ODA) that limit their discharges to surface water. Reference section 6.2 in this resource guide for information about ODA and confined animal operations.

Water samples collected from DEQ's laboratory and partners detected bacteria above water quality standards in water bodies throughout the state. In addition, required testing of finished (treated) drinking water sometimes detects bacteria, triggering alerts and violations of Safe Drinking Water Act Maximum Contaminant Levels. Figure 3 is a compilation of bacteria data from throughout the state and highlights areas of concern for fecal bacteria contamination in surface waterbodies. This figure includes data from public water systems (alerts and violations in finished drinking water testing from Oregon's Safe Drinking Water Information System) and DEQ's database of streams which are water quality limited due to *E. coli* or fecal bacteria (2012 list of impaired waters, Categories 4 & 5).

## 2.4.3 Turbidity and Disinfection By-Product Data and Water System Susceptibility

Turbidity is an optical characteristic of water and is a measurement of the amount of light scattered when shined through water. The higher the intensity of scattered light, the higher the turbidity. It is a useful measurement of the concentration of mineral (clay, silt, tiny particles of inorganic matter) or organic (algae, plankton, microscopic organisms or tiny particle of organic matter) particulate matter in water. One reason turbidity is regulated in public drinking water is because it can interfere with effective disinfection treatment meant to inactivate harmful microorganisms (LeChevallier et al 1981). Particulate matter shields infectious microorganisms from disinfection mechanisms like chlorine, ozone, and UV light. Particulates can also use up the supply of the disinfectant dosage and residual concentrations necessary to keep treated water safe. Some organisms (e.g. *Cryptosporidium*) form spores that are resistant to chlorine, so turbidity removal through both source water protection and filtration is important to prevent disease (Betancourt and Rose 2004). Accordingly, most public water systems must practice filtration treatment to remove particulate matter prior to disinfection. (There are a very few water systems with highly protected and unique surface water sources that can meet turbidity limits without filtration.)

Turbidity is also a strong indicator of filtration performance. Filtration treatment systems can be highly effective in removing turbidity, and thus microorganisms, but that effectiveness is dependent on a combination of the turbidity levels in the source water, treatment technology, and public water system resources and expertise. High turbidity episodes, such as those from heavy rainfall events, require increased application of coagulant chemicals and result in reduced filter run times and increased backwashing (Postel and Thompson 2005, Freeman et al 2008). High source water turbidity can also result in higher finished water turbidity despite treatment adjustments, reducing disinfection effectiveness (LeChevallier et al 1981, Betancourt and Rose 2004).

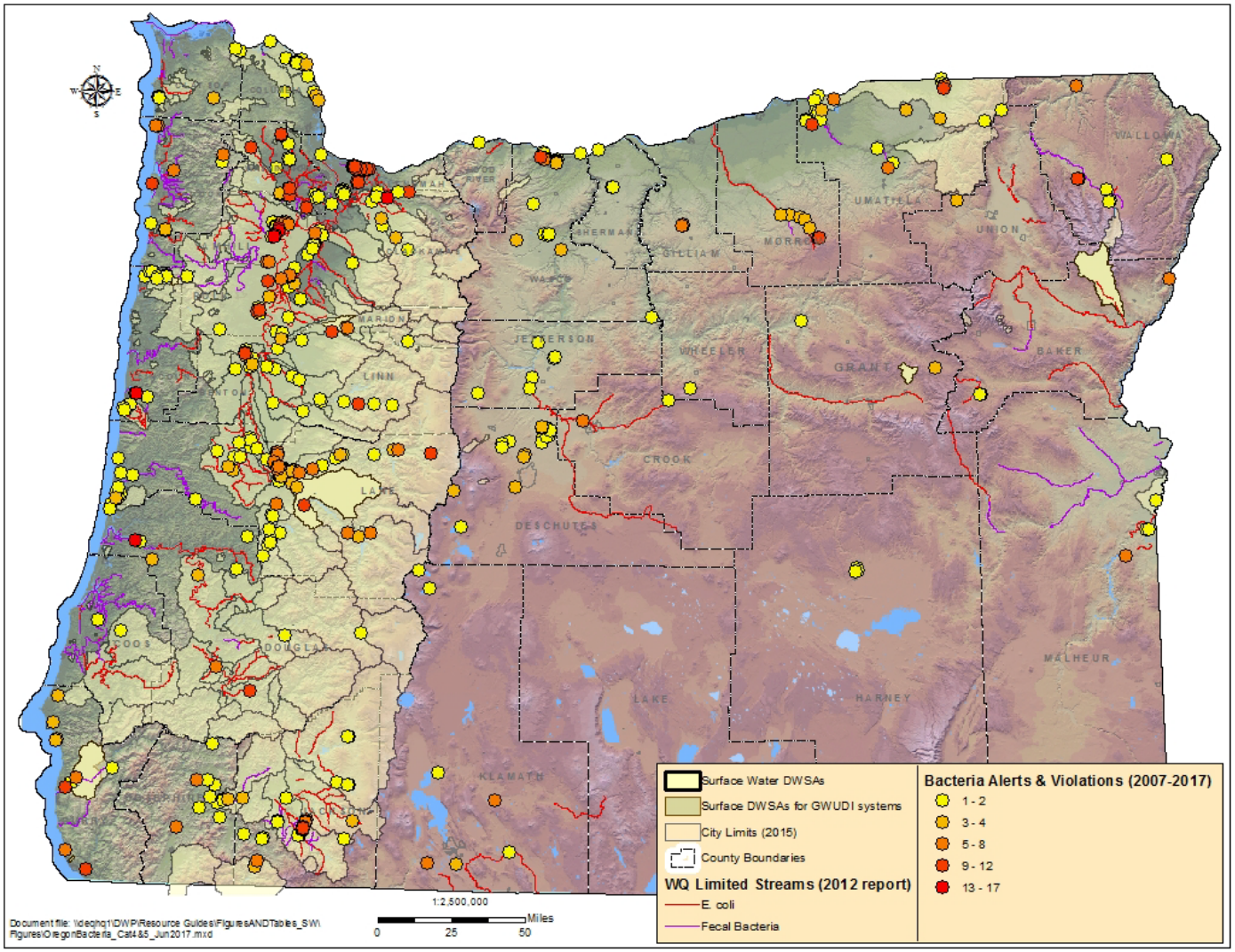


**Figure 3. Oregon data for bacterial alerts and violations in surface water from 2007-2017.**

Strategies to manage runoff and sediment production in watersheds and reduce the frequency, magnitude, and duration of high turbidity in water sources used for drinking water can help ensure safe drinking water, especially considering possible future impacts of climate change on storm intensity and frequency (Dalton et al 2013, Abatzoglou et al 2014, Mote et al 2014).

Disinfection is essential to inactivate harmful microorganisms. However, undesirable by-products can form. Disinfection by-products are regulated in public drinking water systems because of chronic health effects including cancer risk. Disinfection by-products are formed in drinking water when organic matter present in source waters reacts with chlorine- or bromine-based disinfectants, or by oxidation with ozone and subsequent reaction with naturally occurring halide atoms (US EPA 2001a). Organic matter comes from natural materials in the environment such as decaying plants, leaves, organic matter in eroded soil, and other vegetative materials and is measured and reported as total organic carbon. The dissolved (and more chemically available) fraction of total organic carbon is known as dissolved organic carbon. High total and/or dissolved organic carbon may manifest as visible color or turbidity in water, especially in late fall when lots of leaves fall and water flows are still low.

Formation of disinfection by-products is directly related to the quality of the source water and to the configuration and operation of public water system infrastructure (US EPA 2001a). Source water quality factors that contribute to disinfection by-products formation include total or dissolved organic carbon concentrations, pH, temperature, and halide (i.e. chlorine, bromine, iodine) ion concentration. Infrastructure factors that contribute to disinfection by-products formation include chlorine dosage and application point, as well as residence time of treated water in distribution piping and storage tanks. The EPA requires public water systems with high source water organic carbon concentrations and that are using filtration treatment to practice enhanced coagulation to reduce organic carbon concentrations prior to disinfection. The public health objectives are to prevent acute illness by assuring that disinfection treatment inactivates microorganisms, while also limiting chronic exposure of water users to disinfection by-products. Reducing organic carbon in source water can be one of the strategies to assure safe drinking water.

When human land management activities disturb habitat, especially in streamside areas, there is the potential to alter water quality and aquatic habitat conditions. Farming, forest management, urban and residential development, roads, recreation and other activities can cause erosion, trigger landslides, add organic matter and pollutants, change flows and stream temperature, or alter stream structure. For example, clearcut timber harvesting can increase landslide rates on steep slopes, increase sediment delivery to streams from cleared upland areas, and can increase stream flows (Montgomery et al 2000). Narrow riparian buffers are subject to frequent windthrow (toppling of trees by wind), a fraction of which will become a source of fine sediment

into the stream (Rashin et al 2006). Roads are a well-known source of fine sediments, petroleum products, and other pollutants into streams (Christensen et al 1997, Trombulak & Frissell 2000). Bank disturbance by development, agricultural practices and grazing animals, and forest harvest can also contribute sediment and organic matter to stream systems, such as slash from forest harvests adjacent to unbuffered headwaters streams (Jackson et al 2001, Kibler et al 2013) or eroded soil, nutrients, or fecal bacteria-containing manure from cropland and grazing (Roni et al 2002, Durán-Zuazo and Rodríguez-Pleguezuelo 2008, Holz et al 2015). Land clearing and construction disturb the soil and can increase erosion rates if improperly managed or when riparian protections are lacking (see DEQ 1200-C Construction Stormwater General Permit, 2015). Municipal and industrial stormwater can carry sediments, metals, nutrients, and other pollutants into waterbodies (Hughes et al 2014, Kolpin et al 2002). Eroded soil can transport soil-bound pesticides or other toxic substances into waterbodies (Gevao et al 2000, Ambachtsheer et al 2007). The timing and magnitude of the effect on water quality is highly variable and based on several factors related to the source of disturbance or contamination and local watershed conditions. Water quality impacts may be immediate or can develop over time; impacts may be only local in effect, or they could be cumulative across the landscape.

Figure 4 illustrates a compilation of Oregon turbidity, sedimentation, and disinfection by-product data and highlights areas of surface water quality concern for turbidity and disinfection by-product forming organic carbon concentrations. This figure includes data from public water systems with alerts and violations for turbidity and/or disinfection by-products in their finished drinking water and streams which are water quality limited due to turbidity or sedimentation (OHA Safe Drinking Water Information System 2018 & DEQ 2012 list of impaired waters).

DEQ consulted a variety of sources of information and technical data to find tools to identify areas that may be susceptible to streamside erosion. Determining the relative susceptibility to erosion within a drinking water source area will allow a public water system to focus technical assistance and resources on the highest priority sections of the drinking water source area. Three types of data from the USDA National Soil Information System are highlighted in this guide as potential tools for predicting relative susceptibilities to streamside erosion:

1) Revised Universal Soil Loss Equation method using soil erodibility ($K_f$) factor ≥0.25 (rock-free) for slopes greater than 30%. The soil erodibility factor quantifies the susceptibility of soil particles to detachment and movement by water.
2) Off-Road/Off-Trail Erosion Hazard Ratings developed by the USDA NRCS to estimate the risk of soil erosion after disturbance activities that expose less than 75% of the soil surface in a given area (i.e. silviculture, grazing, mining, fire, etc.).
3) A combination of USDA NRCS's Revised Universal Soil Loss Equation -2 and Oregon Department of Agriculture's Erosion Vulnerability Index, which is appropriate for

assessing erosion risk in valley floors and agricultural areas with lower slopes (generally less than 30%) when greater than 75% of an area experiences soil disturbance (such as occurs with bare ground or tilled soils).

Figure 5 visualizes erosion susceptibility on moderately-to-severely disturbed bare soils for slopes greater than 30% using the rock-free soil erodibility ($K_f$) factor from the Revised Universal Soil Loss Equation. This evaluation is focused on steeper landforms and is an update of the method for identifying sensitive areas that was used in the original Source Water Assessments.

Figure 6 visualizes the Off-Road/Off-Trail Erosion Hazard Ratings developed by the USDA NRCS to estimate the risk of soil erosion after disturbance that exposes 75% or less of the soil surface in a given area. The erosion hazard ratings are based upon soil properties and slope and reflect management disturbances such as uncontrolled grazing, forestry, heavy equipment use, fire and fire control techniques, and mining. Certain disturbances are not adequately characterized by this method and erosion effects will be underestimated for (1) gully erosion, (2) plowing, (3) other disturbances that expose up to nearly 100 percent of the area's soil, and (4) Histosol soil types. This method does evaluate mobilization potential of soil through sheet and rill erosion but does not evaluate delivery to surface waters. In the Updated Source Water Assessments, DEQ mapped those locations where erosion risk is moderate to very severe AND that are within 300 feet of surface water in order to estimate those places where delivery to water is possible.

The erosion risk ratings for the NRCS Off-Road/Off-Trail method are:

Slight— Erosion is unlikely under ordinary climatic conditions.

Moderate— Some erosion is likely; control measures may be needed.

Severe— Erosion is very likely; control measures for vegetation re-establishment on bare areas and structural measures are advised.

Very Severe— Significant erosion is expected; loss of soil productivity and off-site damages are likely; control measures are costly and generally impractical.

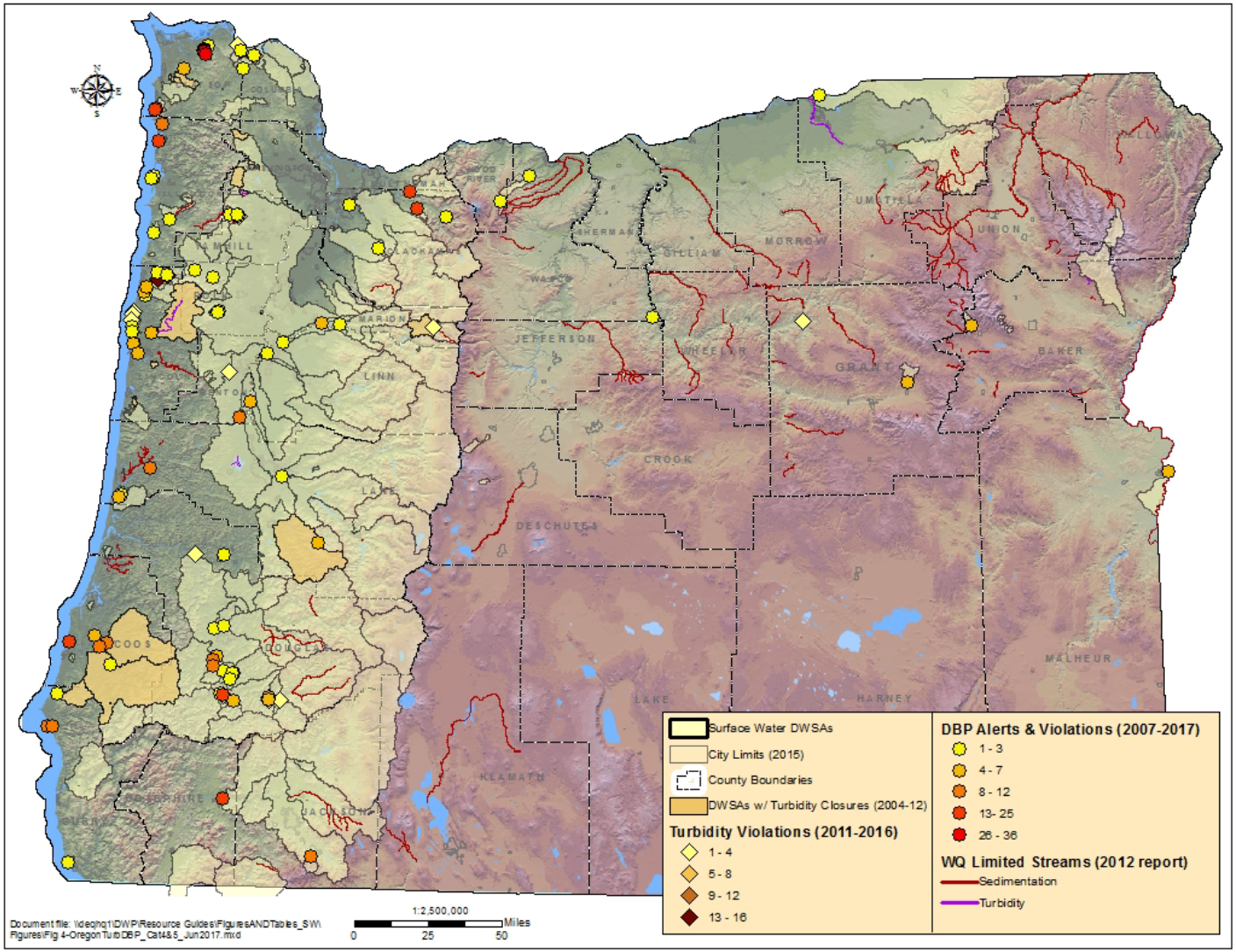


**Figure 4. Compilation of Oregon data for turbidity, disinfection by-products, and water quality limited streams.**

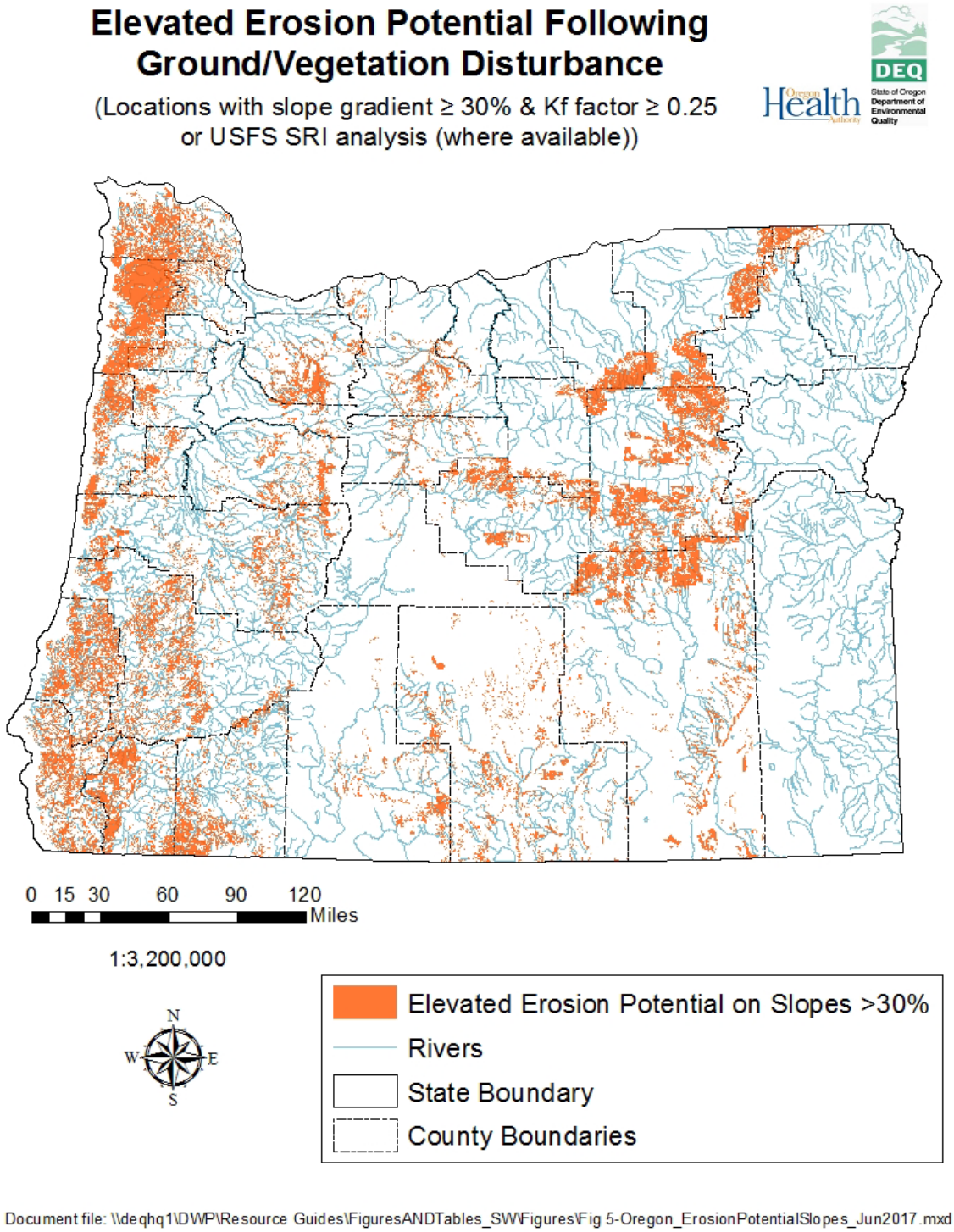


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**Figure 5. Predicted soil erosion potential from moderate ground disturbance on slopes greater than 30%.**

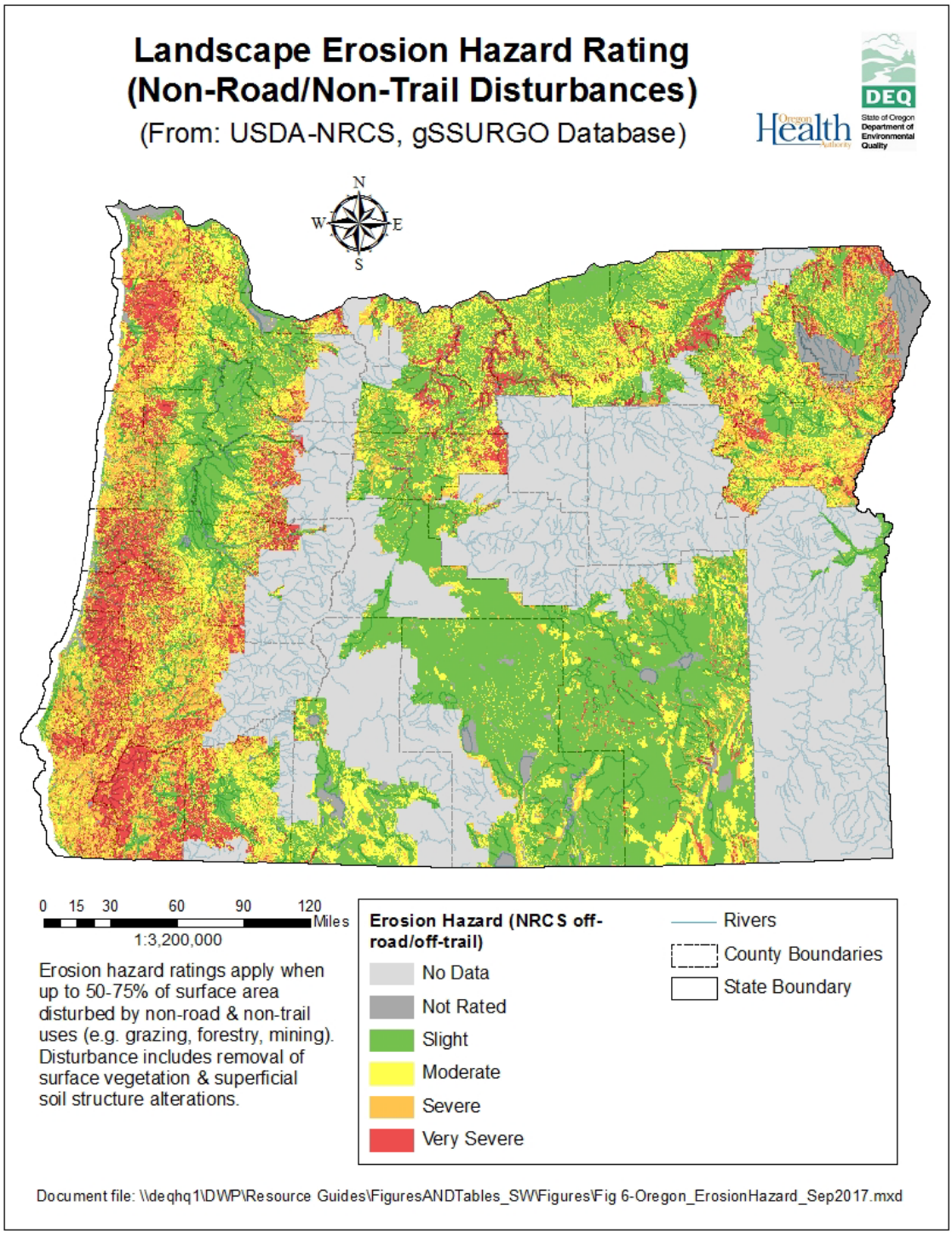


**Figure 6. NRCS erosion hazard ratings for off-road and off-trail uses appropriate for assessing erosion risk for management activities such as silviculture, grazing, mining, etc.**

The data from the combined NRCS Revised Universal Soil Loss Equation -2 and ODA's Erosion Vulnerability Index are shown in Figure 7. The NRCS-RUSLE2/ODA-EVI method assumes conditions of exposed soil lacking both plant roots and conservation practices to reduce or control erosion. The Oregon Department of Agriculture's Erosion Vulnerability Index utilizes the same approach, and erosion rate classifications used are from ODA's Erosion Vulnerability Index documentation. The NRCS-RUSLE2/ODA-EVI method was calculated statewide in 2001 utilizing the whole soil erodibility ($K_w$), rainfall erosivity (R), and length and gradient of slope (LS) factors from NRCS's RUSLE with the soil cover (C) and conservation practice (P) factors set at a value of 1. Setting soil cover and conservation practice factors to "1" illustrates a worst-case scenario where soil is uncovered and exposed directly to precipitation forces and no conservation practices are in place. This method does not evaluate delivery to surface waters. In Source Water Assessments, DEQ maps only those locations where RUSLE2 erosion values are >5 AND that are within 300 feet of surface water to estimate those places where delivery to water is possible.

Water pollution impacts stemming from soil erosion varies greatly among sites and management approaches. The development, prioritization, and implementation of strategic actions to reduce sediment and organic carbon inputs to source water will likely require research and mapping of the site-specific susceptibility within each drinking water source area.

**When using these site-specific soil maps, it is important to keep in mind that interpretations and planning of conservation practices based upon these maps should be done through the involvement of a partner organization that specializes in natural resource conservation.** The organizations that can most likely assist with creating and using site-specific erosion susceptibility maps include local soil and water conservation districts, watershed councils, NRCS districts, the OSU Extension Service, or others. Find more information about partner organizations that can assist water systems in Section 3.0 of this resource guide.

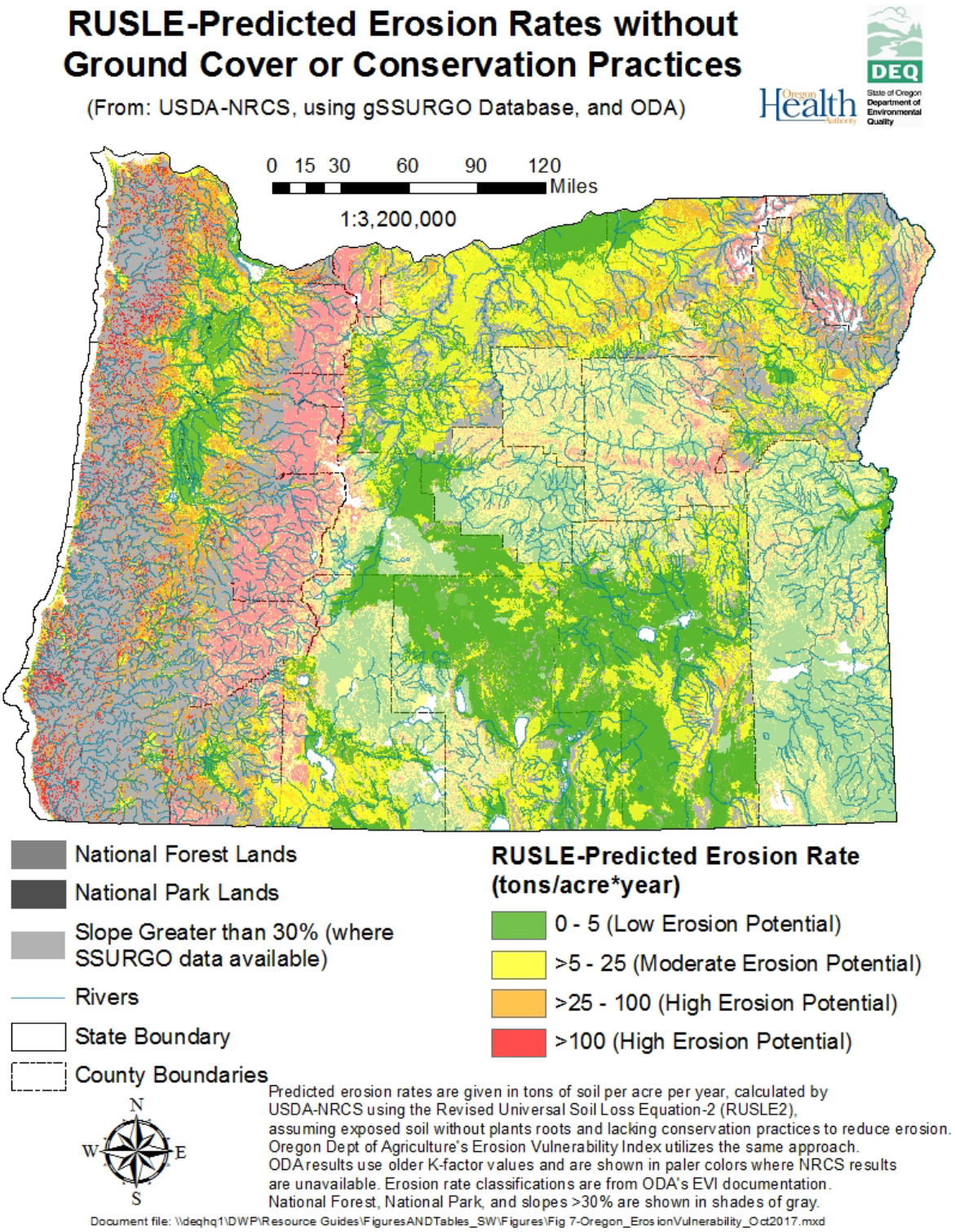


**Figure 7. Statewide erosion vulnerability index ratings appropriate for assessing erosion risk in valley floors and agricultural areas with lower slopes (generally less than 30%) when greater than 75% of an area experiences soil disturbance.**

## 2.4.4 Pesticide Data and Surface Water Susceptibility

Surface water provides drinking water for roughly half of the U.S. population, and therefore pesticide contamination of surface water is a subject of national importance. A summary paper of USGS pesticide sampling results showed that pesticides frequently occur in streams and rivers in the United States. Researchers detected pesticides in greater than 95% of samples analyzed, although sample exceedance of human health benchmarks was rare (Stone et al 2014). Pesticides can reach surface water sources from multiple pathways including from drift (movement by air), precipitation runoff, shallow groundwater transport, accidental spills and leaks, and improper disposal. Most drinking water treatment systems do not effectively remove pesticides and other artificial compounds, and even with technology such as granulated activated charcoal, removal is incomplete (Blomquist and Janet 2001, Carpenter et al 2008). This is why environmental health professionals tend to be cautious about the presence of pesticides in drinking water.

Only a limited number of pesticides have a Safe Drinking Water Act maximum contaminant level established by the U.S. EPA. Furthermore, additive or synergistic toxicity has not been included in the development of these drinking water standards. There are currently several studies examining low levels of pesticide mixtures in the environment and how they may be combining to contribute to environmental carcinogenesis (Alavanja and Bonner 2005, Goodson et al 2015). Environmental carcinogenesis is when the cumulative effects of several individual chemicals act together on cancer pathways to synergistically produce carcinogenic effects at low exposure levels. Most toxicological testing is performed on single chemicals—usually at high exposure levels—whereas most human and ecological exposures are to chemical mixtures at relatively low doses. Unfortunately, there is a lack of research and data on the toxicity of pesticide mixtures in the environment and on the human and ecological health consequences of exposure to these chemical mixtures at repeated low exposure levels.

For more information on the drinking water standards for pesticides and how Oregon regulates pesticides, refer to the Pesticide Regulations section in this resource guide (Section 6.7).

### Pesticide Stewardship Partnership and Pesticide Use Data Across Land Use Types in Oregon

The use of pesticides is prevalent in agricultural activities but also exists in municipalities, rural and urban properties, transportation rights-of-way, parks, forestlands, powerline corridors, golf courses, and other land uses. Refer to section 2.4.4 in this guide for a summary of toxic substance monitoring (including pesticide monitoring) conducted in drinking water source areas by DEQ and partners. In Oregon, the Pesticide Stewardship Partnership program currently

monitors nine watersheds across the state for pesticide water quality with the goal of encouraging voluntary changes in pesticide use and management practices. This monitoring occurs across agriculture, forestry, industrial, and urban land uses. The PSP program currently operates in the following watersheds:

- Hood River
- Mill Creek and Fifteenmile Creek (in Wasco County)
- Walla Walla River
- Clackamas River
- Pudding River
- Yamhill River
- Amazon Creek (in and around Eugene)
- Middle Rogue (near Medford)
- Middle Deschutes (near Madras)

To see the current and historical pesticide water quality data collected by the PSP program, go to DEQ's **Pesticide Stewardship Partnership Data Viewer** website.

For more information on the Pesticide Stewardship Program, refer to the Oregon Department of Agriculture section of this guide (3.2.1). For more information on the ODA Pesticide Program, which includes the PSP program, refer to the Pesticide Regulations section of this resource guide (section 6.7).

## Pesticide Use in Oregon Agriculture

Oregon is the national agricultural leader in the production of hazelnuts, blackberries, Christmas trees, peppermint, orchard grass seed, and other seeds. Oregon exports approximately $1.7 billion in raw agriculture products internationally per year (State of Oregon statistics, 10-year average agricultural products export value). Oregon's success as a leading agricultural producer may be partly due to the use of pesticides to control the insects, weeds, and other organisms that attack food and ornamental crops. Agricultural land uses account for most of the reported pesticide use in Oregon across the multiple land uses/activities that commonly use pesticides (Figure 8). According to the most recently available pesticide use reporting data for Oregon, over 77% of reported pesticide use is attributed to agricultural land uses (ODA 2008). Note that due to the licensing requirements for pesticide use on agricultural and forest lands, pesticide use reporting compliance was likely greatest amongst these users. The most recent pesticide use data in Oregon is from 2007 because in 2009 the state legislature suspended the pesticide reporting requirement. While these data are almost twenty years old, it is likely that the breakdown would be similar today if the data were collected and made available.

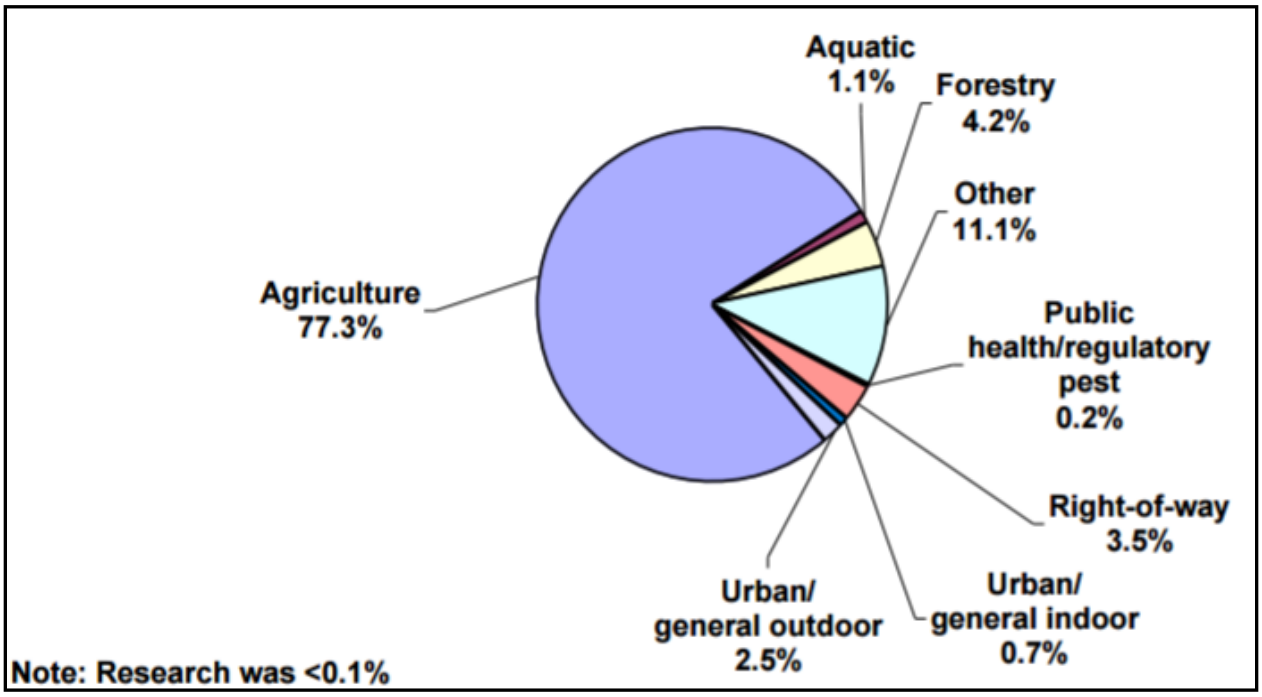


**Figure 8. Percentage of pounds of active pesticide ingredient reported in 2007 through the pesticide use reporting system by land use/activity in Oregon (ODA 2008).**

Oregon Department of Agriculture has an extensive program that works to prevent off-site movement of pesticides applied to agricultural operations (reference Section 6.2 in this resource guide).

## Natural and Human-Caused Factors Influencing Pesticide Contamination of Water Sources

The effects of past and present land-use practices and pesticide applications may take decades to become apparent in groundwater, but any contamination of surface water is more immediate. When weighing pollutant reduction strategies for protection of surface water quality, it is important to consider the means of transport and the effects of weather during and after application of pesticides (and any other chemicals) to the land and subsequent off-target movement of the chemicals into a waterbody. Movement can be immediate (drift) or delayed (runoff mobilization or revolatilization). There is also a time lag before arrival in groundwater which generally decreases with increasing aquifer permeability and with decreasing depth to water. In response to reductions in chemical applications to the land and/or use of practices which reduce off-target movement, the quality of surface water will improve relatively rapidly, excepting cases where contaminated groundwater is a major source.

Natural land conditions and land-management practices can both affect pesticide distribution and occurrence in waterways. Pesticide concentrations in surface water vary by season, with

lengthy periods of low concentrations punctuated by seasonal pulses of much higher concentrations. Concentrations are sensitive to application amount and timing, seasonal wind movement, precipitation, and hydrology variations. Surface water is most vulnerable to contamination in areas with high stream densities, erodible and/or permeable soil (depending on pesticide characteristics), and frequent or intense precipitation. Applications near to waterbodies and/or with air currents moving towards waterbodies are more susceptible to off-target movement into water. Hot, dry conditions can cause some pesticides to revolatilize and then drift on air currents, even after successful deposition during application.

The entire atmospheric-hydrologic system and its complexities need to be considered in evaluating the potential for pesticide contamination of waterbodies, as well as characteristics of pesticide formulations themselves. For example, some pesticides are more water soluble and move with water movement (e.g. atrazine and imazapyr); others bind tightly to soil and organic matter and are more likely to move along with eroded soil (e.g. glyphosate isopropylamine salt and permethrin). Seasonal patterns in pesticide concentrations are important to consider in managing the quality of drinking water withdrawn from surface water in agricultural, forestry, and urban settings. For example, the first large storms after application can move pesticides into water bodies while later storms have less effect (NCASI 2013). For this reason, many water systems with adequate finished water storage will proactively shut down their intakes and let the 'first flush' of water following the first large storm event pass by.

Understanding the correlations of pesticide occurrence with the amounts and characteristics of pesticides used can help land managers to anticipate and prioritize the pesticides most likely to affect water quality in different land-use settings. **Table 1** lists some of the pesticide transport factors and surface water vulnerability factors that make portions of the drinking water source area susceptible to pesticide impacts.

Changes in the occurrence of pesticides over time can be related to changes in pesticide regulations but can also be attributed to other factors. New compounds can be approved for use and some compounds may lose approval of some or all legal uses in response to new research or analyses. For example, certain pesticides have been banned or had their allowable uses severely limited due to environmental or health concerns. One of the most well-known examples is the banning of the pesticide DDT in 1972 by the EPA. Changes in pesticide uses can also be due to market-based decisions related to public demand, acceptance, and perception. For example, an increased awareness of neonics affecting bees has resulted in public pressure to switch back to chlorpyrifos (more toxic) as the most effective insecticide.

| Pesticide Transport Factors | | | | | Water Vulnerability Factors | |
|---|---|---|---|---|---|---|
| **Pesticide Parameters** | **Soil Parameters** | **Crop Parameters** | **Climatological Parameters** | **Management Parameters** | **Site Transport Characteristics** | **WARP Watershed Characteristics** |
| Organic carbon-normalized sorption coefficient ($K_{oc}$) | Dispersion coefficient | Root density distribution | Rainfall or irrigation rates | Pesticide application rate and timing | Surface/near-surface runoff | Rainfall Erosivity (R-factor from USLE) |
| Distribution coefficient ($K_d$) | Saturated water content | Maximum rooting depth | Pan evaporation rates | Pesticide application method and formulation | Soil erosion & transport - Wind & water | % of streamflow from saturation (Dunne) overland flow |
| Aqueous solubility | Field-capacity water content ($\theta_{FC}$) | Pesticide uptake rates | Daily maximum and minimum temperature | Crop production-system variables | Surface water proximity to application | Total precipitation in May & June (spring application period) |
| Henry's constant | Wilting-point water content | | Snow melt | Soil-management variables | Vegetative cover/ disturbance | % of soils with restrictive layer w/in top 25cm |
| Saturated vapor density | Hydraulic properties | | Hours of sunlight | | | |
| Gas phase diffusion coefficient | Bulk density ($\rho_b$) | | | | Wind speed / direction | |
| Biological half-life | Organic carbon content ($f_{oc}$) | | | | Depletion of residues by previous storms | |
| Hydrolysis half-life | pH | | | | | |
| Oxidation half-life | Cation exchange capacity | | | | | |
| Foliar decay rate | Heat flow parameters | | | | | |

**Table 1. Factors influencing pesticide transport and surface water vulnerability. (National Research Council 1993a & 1993b, Holvoet et al 2007, NCASI 2013, National Association of State Departments of Agriculture Research Foundation 2014) WARP stands for watershed regressions for pesticides and is a model developed to predict stream concentrations of pesticides (Stone et al. 2013).**

Other useful resources to learn about pesticides and surface water quality include:

- Section 5.0 of this resource guide will provide several tools that may be useful for reducing off-site migration of pesticides, with the goal of reducing any potential impact to drinking water supplies.

- The Safe Drinking Water Foundation's **Pesticides and Water Pollution Fact Sheet**.

- The **National Pesticide Information Center's database**, which hosts a wide-range of pesticide-related information on pesticide uses, application, safety data, toxicology, environmental chemistry, and more.

- The USGS's National Water-Quality Assessment Program provides the most comprehensive national-scale analysis to date of pesticide occurrence and concentrations in surface and ground water. Go to the **USGS Pesticides and Water Quality website** to access maps, graphics, and tools to aid in understanding where pesticides occur, at what concentrations, and the potential ecological and health consequences of pesticide exposure.

## 2.4.5 Ambient Water Quality Data and the Oregon Water Quality Index

The Water Quality Monitoring section at DEQ's laboratory collects data that supports many statewide programs that monitor and assess both surface and groundwater quality. The laboratory monitors a network of 160 sites throughout the state six times a year as part of the statewide ambient water quality monitoring program. These sites are representative of the diverse land uses and geographies within Oregon and include major rivers and streams throughout the state. The ambient monitoring network and subsequent water quality index reporting is Oregon's only long-term, systematic and continuously funded statewide river water quality monitoring program. DEQ began monitoring the oldest sites in the late 1940s and many sites in the network contain data going back more than 30 years, allowing for long-term trending in DEQ's progress toward meeting state water quality objectives.

The Ambient Water Quality Monitoring System is DEQ's water monitoring data portal – users of the portal can access ambient water quality data in addition to other validated data submitted to the agency. Learn more about the Ambient Water Quality Monitoring System and access the data portal at **DEQ's Water Quality Monitoring Data website**.

The Oregon Water Quality Index is another way that DEQ assesses the health of Oregon's water resources. The index is used to communicate water quality information in an easy-to-understand, non-technical manner. The Oregon Water Quality Index is calculated each year with data from the ambient monitoring network. The index includes eight common water quality variables.

Go to DEQ's **What's in the Oregon Water Quality Index story map** to learn more about the index, including what water quality variables are included, and to see a visual representation across the state. Note that creating an index like the Oregon Water Quality Index simplifies very complex systems and creates a potential loss or distortion of information. The strength of the Oregon Water Quality Index is in its simplicity. However, for more technical reports DEQ also assesses the health of Oregon's water resources in the **Oregon Status and Trends Report** as well as **DEQ's Integrated Report to EPA**.

## 2.4.6 Statewide Water Quality Toxics Data

DEQ's Water Quality Toxics Monitoring Program gathers information to characterize the presence and concentration of chemicals of concern in Oregon's waters and uses this information to evaluate status and trends and to identify and reduce sources of these chemicals. The DEQ laboratory analyzes seven major categories of toxics including consumer product constituents, current-use pesticides, legacy pesticides, flame retardants, combustion products, metals, and industrial intermediates.

In 2015, Oregon DEQ published a report describing the results of a comprehensive 5-year sampling project to survey toxic compounds in Oregon's waters. From 2008 to 2013, DEQ laboratory staff collected water samples from 177 sites across the state to assess the presence and concentration of toxic chemicals in Oregon's waters. These sites included coastal estuaries, large rivers and small streams. The laboratory analyzed these samples for more than 500 different chemicals. Although some chemicals exceeded state criteria or benchmarks for human health and aquatic organisms, most did not. The frequencies of toxic compound detections across the state serve to illustrate the potential value of a source water protection approach to prevent contamination at the source.

Read the **Statewide Water Quality Toxics Assessment Report** (April 2015) here.

Key findings from the Statewide Water Quality Toxics Assessment include:

- 128 unique chemicals were detected in water samples. The most detected groups were priority metals and sterols present at 100% of sites, followed by current-use pesticides, at just over 50% of sites sampled.

- Most detected chemicals were at very low concentrations and within the applicable criteria or benchmarks for environmental and human health.
- The largest variety of chemicals were detected in the Willamette Basin, followed by the Hood River Basin.
- Most samples with at least one chemical over an established criterion or benchmark occurred in the Hood River Basin.
- Detections of current-use pesticides occurred in all basins, often as mixtures and at times at levels above acceptable EPA aquatic life benchmarks; diuron (herbicide) was detected in all but one basin.
- Some pesticides of high concern, such as chlorpyrifos, continue to be found in basins with both urban and rural land uses.
- Legacy pesticides that are no longer used were present in water and frequently at levels above DEQ human health criteria.
- Priority metals (such as copper and lead) were present in some samples at levels above DEQ aquatic life criteria.
- Arsenic measured at levels of concern above the DEQ human health criteria, mainly in Eastern Oregon and in Oregon's coastal estuaries.
- Flame retardants were detected around the state in both urban and rural areas.
- Polycyclic aromatic hydrocarbons (which are combustion by-products from fires, vehicle combustion and waste incineration) were detected above DEQ human health criteria at several locations.

The toxics monitoring results show that current-use pesticides, legacy (or no longer used) pesticides, polycyclic aromatic hydrocarbons and certain metals are of particular concern for human health and aquatic life impacts in Oregon. Continued monitoring will be required to understand the status and trends of these chemicals. The Statewide Water Quality Toxics Assessment was part of a larger evaluation of toxic substances in water and products, including a project to examine drinking water sources directly. Find more information about toxics monitoring in drinking water sources in section 2.4.7 of this resource guide.

Go to **DEQ's Water Quality Toxics Monitoring website** to find more information about water quality toxics monitoring, to view an interactive map showing the toxics monitoring network in Oregon, and to view technical reports such as toxics summary reports for major river basins.

## 2.4.7. Drinking Water Source Toxics Data

In 2008, the Oregon DEQ and the OHA collaborated to launch a Drinking Water Source Monitoring project. The goal of this project was to test for chemicals in the raw source water for public water intakes (in contrast to the monitoring completed by public water systems which tests for chemicals in the finished drinking water). During the period of 2008 through 2014, Oregon DEQ tested source water prior to treatment at 35 surface water intakes throughout the

state. Sample locations were selected based on their proximity to water systems that were either at risk due to nearby sources of contamination or had already shown signs of contamination (primarily nitrate). This raw source water data provided a general characterization of the waterbodies supplying public water intakes in the state. The samples were analyzed at the DEQ Laboratory for over 250 Oregon-specific herbicides, insecticides, pharmaceuticals, volatile organic compounds (including cleaners), fire retardants, polycyclic aromatic hydrocarbons, personal care products, and plasticizers. The results showed very low concentrations of detected water pollutant impacts from the various land uses and activities in typical source areas. **Of all surface water sources, 66% had wastewater constituents and 57% of the samples had pesticide detections.** With the exception of three detections (aluminum), the levels of all detected parameters were very low and met available health standards.

Read the **DEQ Drinking Water Source Monitoring Project Phase 1 and Phase 2 Report** here.

Review the **DEQ Drinking Water Source Monitoring Summary of Analytical Results (2008 – 2014)** here.

Potential Sources of Contaminants Identified in the Drinking Water Source Monitoring Project:

- **Fecal bacteria (*E. coli*)/Pathogens** are human and animal waste byproducts and are potentially from upstream wastewater discharges, concentrated animal feeding operations, livestock grazing, wildlife, high-density onsite septic systems discharging to shallow groundwater and/or surface water, and heavy recreational uses.
- **Turbidity/Fine Sediment** refers to mineral and organic soil constituents and other particles which cause cloudiness (turbidity) when suspended in water. Fine sediment and turbidity-causing particles enter water from wastewater effluent, leaching of compounds from vegetation, and soil erosion due to natural and/or human caused factors. Natural factors include precipitation, wind, slope gradient, and soil and bedrock type. Human caused factors include agricultural and forestry management practices, transportation, recreation, and construction.
- **Pesticides** can enter surface water from agricultural fields, forests, urban lawns, gardens, and roadside spraying. Results from this drinking water source monitoring effort suggest the primary sources are irrigated crops, orchards, and high-density housing. Household lawn applications of pesticides can contribute urban use pesticides to local surface water resources (and can occur at higher concentrations in those areas).
- **Harmful algal blooms** in freshwater are due to drastic population increases of certain algal (cyanobacteria) species. Harmful species produce toxins that can remain in the water even after the death of the organism. These blooms are enabled by slow-moving, warm water and the risk of harmful blooms increase in nitrogen and phosphorous rich

waters. Excess nitrogen and phosphorous in surface water may be caused by onsite septic systems, wastewater treatment facilities, and agriculture or forestry operations.

- **Steroids and hormones** are likely linked to human waste byproducts. These human waste byproducts can be released directly into surface water by sewage treatment facilities or into groundwater by onsite septic systems. The most common marker of these byproducts is coprostanol, found in human feces. Some hormones can also come from livestock wastes.
- **Pharmaceuticals** are commonly detected in surface water that is downstream of wastewater treatment facilities or high-density housing using onsite wastewater disposal. It is well documented that drugs are primarily found in human urine and can also come from improper disposal of unused drugs in toilets. Some pharmaceuticals (for example, antibiotics) can come from livestock wastes (confined feeding or other operations).

Many of the low-level detections from the Drinking Water Source Monitoring project are chemicals in drinking water sources that are not currently regulated. Many volatile organic compounds are regulated and therefore not tested as part of the project. Sampling and analyzing for low levels of a broad range of chemicals in waters of the state is important for several reasons:

- Detections become important priorities for prevention because we lack health standards for many chemicals (e.g. Benotti et al 2009).
- Detections are priorities for prevention because many of the pollutants cannot be removed from finished water through standard treatment technologies (Stackelberg et al 2004, Carpenter et al 2008, Glassmeyer et al 2017).
- Additive or synergistic toxicity was not considered in the development of Maximum Contaminant Levels or screening levels for chemicals (Hayes et al 2006).
- Data are used to prioritize future water quality monitoring.
- Detections provide DEQ and others the ability to prioritize pollutant reduction efforts on activities and land uses that potentially impact water quality.

## North Coast Toxics Monitoring Results

In 2014, the Tillamook Estuary Partnership and DEQ completed an analysis of water samples collected from surface water sources in 5 north coast drinking water source watersheds. The public water systems sampled were the City of Vernonia, Beaver Water District, City of Rockaway Beach, Tillamook Water District, and Neskowin Regional Water District. The samples were analyzed for over 120 different chemicals. DEQ summarized the results and coordinated with OHA toxicologists to compare the results to health standards. Low levels of pesticides were detected, including atrazine and its breakdown products, sulfometuron-methyl, DEET, and

Glyphosate and its breakdown product. The pesticide detections were at low levels and well below any available health standards or maximum contaminant levels. Important take aways from this effort include:

- Pesticides are frequently found in streams and rivers at low levels.
- Only a limited number of pesticides have a Safe Drinking Water Act maximum contaminant level established by the U.S. EPA. Additive or synergistic toxicity has not been included in the development of these drinking water standards.
- Most drinking water treatment systems do not effectively remove pesticides and other artificial compounds, and even with technology such as granulated activated charcoal, removal is incomplete (Blomquist and Janet 2001, Carpenter et al 2008).
- Reducing the risk of pesticides or other toxics from entering a drinking water source by implementing source protection strategies is an effective and prudent strategy for protecting community health.

## 2.4.8. Integrated Report Data

The Oregon DEQ uses monitoring data for both informational and regulatory purposes. Under the Clean Water Act, DEQ is required to assess the condition of waterbodies statewide every two years to determine their support of designated beneficial uses (including drinking water) and to determine whether they contain pollutants at levels that exceed water quality standards.

Part of the Integrated Report is the list of impaired waters needing Total Maximum Daily Loads, or clean water plans, to be developed. A TMDL is a science-based approach to cleaning up polluted water so that it meets state water quality standards. The list of impaired waters includes waters listed as Category 5 (impaired and needing a TMDL) and waters listed as Category 4 (impaired but not in need of a TMDL because a TMDL or other restoration plan is in place or because flow issues are causing impairment rather than a pollutant). Category 4 waters still require action to bring them into compliance with standards and to fully support beneficial uses such as drinking water. For more information on TMDLs, go to section 7.3 in this resource guide.

The most recent approved Oregon Integrated Report is for the 2022 assessment period and Oregon's draft 2024 Integrated Report is currently being reviewed by EPA. In addition to numerous stream segments in Category 4 or 5 for fecal bacteria, *E. coli*, turbidity, or sedimentation standards exceedances, there are several stream segments and waterbodies listed for impairment of drinking water beneficial uses due to water quality degradation.

Go to the DEQ Water Quality program's **EPA Approved Integrated Report website** to learn more about the Integrated Report.

Go to the interactive **Integrated Report Web Map** to see the assessment status of streams and rivers in Oregon.

DEQ accepts data and information from the public that may be used to assess the condition of Oregon's water bodies approximately every two years. DEQ's Drinking Water Source Protection program encourages and assists public water systems to submit raw water turbidity data where turbidity poses a challenge or increased expense during system maintenance or treatment. See section 7.3.1 in this resource guide for more information on this effort to gather and submit raw water turbidity data from public water systems for inclusion in the Integrated Report.

If your water system is interested in submitting raw turbidity data during the next call for public data, contact DEQ's Drinking Water Source Protection program at: **Drinkingwater.protection@deq.oregon.gov**.

### 2.4.9 United States Geological Survey Data

The U.S. Geological Survey's National Water-Quality Assessment Project was established by Congress in 1991 to determine how water quality in the United States is changing over time and to evaluate if detectable changes are caused by human activities or natural factors. To help answer these questions, the USGS has developed long-term data sets that are consistent and comparable over time. USGS data collection efforts include the presence and concentrations of nutrients, pesticides, volatile organic compounds, and mercury in the nation's streams, as well as the ecological health of streams and the effects of urbanization on water quality. The goal of the scientific studies associated with the NAWQA Project, and the analysis of long-term data sets collected by USGS, is to understand the physical, chemical, biological, and human-caused factors that create susceptibility to pollution and ecosystem degradation. The NAWQA Project is national in scale: data from stream locations across the Pacific Northwest may provide insight into how contaminants can reach drinking water supplies and intakes.

Go to the USGS's **National Water-Quality Assessment Project website** to learn more about water quality trends over time, to download data sets, and access additional resources.

# 3.0 Partner, Resources, and Funds

Communities of sufficient size, resources, and other means may be able to develop drinking water source protection plans or implement protective strategies for their groundwater resources without the use of the tools provided in this Resource Guide. Many communities that fit this description have already taken steps to develop and utilize screening tools, resources, and strategies for reducing potential risks to their drinking water. For smaller communities, partner organizations may be able to assist with drinking water source protection efforts that

cannot be performed with existing staff and resources. Many smaller water systems depend on partners to help with project development, funding resource identification, grant writing, grant administration and project management. Most water systems rely on external funding assistance to complete drinking water source protection planning and/or implementation of protection strategies.

This section will provide an overview of potential partners and funding resources that public water systems can use to protect their drinking water source(s).

**NOTE:** The internet web addresses listed in this section were included as a convenience for the users of this document. All web addresses were functional at the time this publication was last updated (November 2025).

# 3.1 Technical Assistance Partner Organizations

**Cultivating relationships with partners is an important component of developing and implementing protection strategies within any source water area. Early involvement of partner organizations is critical to successful plan or project development and implementation.**

The process of identifying the right partners to help public water systems with source water protection involves finding organizations that operate within the same geographic area as a water system's source water area and/or service area and that have goals that overlap with drinking water source protection. Examples of overlapping goals include promoting water quality or effective water use strategies, engaging with rural landowners or businesses to implement best management practices, community economic development and resiliency, and/or community outreach and education.

Identifying partner organizations is locality and geography specific, but the most common partners for public water systems in Oregon are soil and water conservation districts, watershed councils, local land trusts, Oregon State University Extension Services staff, regional government councils, and not for profit organizations focused on economic development, community outreach, or the environment.

Other common partners include state agency staff and/or federal agency representatives (where federal ownership overlaps with drinking water source areas). See section 3.2 for more information about potential state or federal agency partners.

### 3.1.1 Department of Environmental Quality and Oregon Health Authority's Drinking Water Source Protection Program

Oregon's drinking water source protection program is implemented through a partnership between the Department of Environmental Quality and the Oregon Health Authority. The Drinking Water Source Protection Program is here to help water systems and communities identify and cultivate partnerships, develop projects, locate potential funding sources, and access technical assistance resources. Both DEQ and OHA maintain robust websites with extensive resources for Source Water Protection. Go to **DEQ's Drinking Water Source Protection website** and **OHA's Drinking Water Source Protection Program website** to access these resources and find direct contact information.

Contact the Department of Environmental Quality Drinking Water Source Protection Program by sending an email to: **DrinkingWater.Protection@deq.oregon.gov**

Oregon Health Authority Drinking Water Services can be reached at **Info.drinkingwater@odhsoha.oregon.gov**

### 3.1.2 Soil and Water Conservation Districts

Oregon's Soil and Water Conservation Districts are special districts that support conservation of renewable resources, including water quality, through technical assistance and voluntary collaborative conservation partnerships that can include local landowners and residents, natural resource organizations, natural resource users, and local, state, and the federal government.

Go to the **Oregon Department of Agriculture's About Soil and Water Conservation Districts' website** to learn more about SWCDs and to locate the local SWCD active in your area.

Soil and Water Conservation Districts often work closely with the US Department of Agriculture Natural Resource Conservation Service to assist communities and individuals carry out voluntary conservation projects on private lands. NRCS is further discussed in Section 3.2.

### 3.1.3 Watershed Councils

Watershed Councils are locally organized, voluntary, and non-regulatory groups established to improve the condition of natural resources in watersheds. They assess and monitor environmental conditions and lead voluntary conservation and restoration projects that bring together local, state, and federal land management agencies with local property owners and private land managers.

Go to the **Network of Oregon Watershed Council's website** to learn more about Oregon's watershed councils and to locate the watershed council(s) active in your area.

## 3.1.4 Land Trusts

Land trusts are not for profit organizations that work cooperatively with landowners and partners to conserve land. The most common models of land conservation are the purchase or donation of land and conservation easements from willing landowners. In supporting communities in protecting their drinking water sources, land trusts can assist with land transactions or own land or hold conservation easements. Land transaction assistance could include tax lot research and prioritization, mapping, landowner outreach, and due diligence. Land trusts can also act as bridge buyers to purchase properties and hold them until the permanent holder – which may be the water provider, another land trust, or state, federal, or Tribal government – can purchase the property from the bridge buyer. National land trust organizations are common bridge buyer partners because they can often leverage funding and move quickly to close property transactions. National land trust organizations that have served as partners in Oregon to conserve land in drinking water source areas include The Conservation Fund and The Nature Conservancy. The role of the land trust will depend on the land trust's priorities and capacity in addition to the needs of communities and partners.

Local land trust organizations in Oregon operate within specific geographic localities and have organization-specific missions that guide their conservation mission. Local land trust organizations are important partners for water systems and communities interested in conserving land in their drinking water source area.

Go to the Coalition for Oregon Land Trusts Clean Water for All website to **locate the local land trust** operating in your drinking water source area, **learn about how land conservation can protect drinking water source areas**, and to download their Guide for Protecting Oregon's Drinking Water.

DEQ's drinking water source protection program has highlighted land conservation in several workshops and the presentations and a link to a video playlist of recordings are available on the **DEQ Source Water Protection Workshop website.** For more information on working with a land trust partner, watch Margaret Treadwell's presentation entitled 'Tips and Tricks for Working with Land Trusts' on the **Economic Development Alliance of Lincoln County's Source Water Protection YouTube page.** Margaret works with the local land trust McKenzie River Trust.

## 3.1.5 Oregon State University Extension Services

The Oregon State University Extension Service provides Oregon communities with research-based knowledge and education that can assist in assessing, prioritizing, and planning projects that address risks to source water. Extension services are focused on healthy communities and economies, resilient and productive forests and natural ecosystems, sustainable agriculture, and thriving communities.

For information about the OSU Extension Service county offices and to locate staff visit the **OSU Extension Service website.**

## 3.1.6 Oregon State University Sea Grant Extension

The Sea Grant Extension program strives to engage, listen to, and assist coastal communities to address important social, economic, and environmental issues. The Oregon State University Sea Grant program has four focus areas:

1) Environmental literacy and workforce development
2) Healthy coastal ecosystems
3) Sustainable fisheries and aquaculture
4) Resilient communities and economies

For more information about OSU Sea Grant Extension and to locate staff **visit the OSU Extension and Engagement website.**

## 3.1.7 Regional Government Councils

The Oregon Regional Councils Association promotes cooperation among different levels of government. The councils are multi-jurisdictional and voluntary associations that cooperate on issues and problems that cross city, county, and in some cases, state boundaries. Regional government councils can provide a forum for discussing issues and often have technical assistance resources available to entities in their geographic region.

Go to the **Oregon Secretary of State's 'Regional Governments' website** to identify if a regional government council is operating in your area.

## 3.1.8 Non-Profit Organizations

Non-profit organizations can be valuable partners when their organizational mission overlaps with source water protection goals. Local economic development organizations, local

philanthropic organizations, and/or organizations focused on community engagement, education, and outreach are common partners for public water systems.

Different organizations operate in different areas, so it is not possible to provide one link or resource for how to identify and build relationships with these entities.

### 3.1.9 Other Public Water Systems in Your Area

There is value in identifying other public water systems located nearby – other water systems can be partners in activities ranging from shared resources and mutual aid to emergency preparedness and response for source water protection. Sources of contamination can be regional in scope (for example, nitrate contamination in groundwater), drinking water source areas can overlap, and projects initiated by water system partnerships can access more funding and can be more competitive for funding applications.

There are several examples of regional public water systems working together in Oregon to achieve drinking water source protection goals, including the Clackamas River Water Providers and the Rogue Drinking Water Partnership.

Go to the **Clackamas River Water Providers homepage.**

Go to the **Rogue Drinking Water Partnership homepage.**

There are a number of groundwater systems that have worked together to develop and implement a regional drinking water source protection strategies. If you would like more information, contact DEQ's Drinking Water Source Protection Program at **DrinkingWater.Protection@deq.oregon.gov.**

## 3.2 State Agency Partner and Funding Resources

This section provides information about the state agencies and funding resources available to public water systems in Oregon to complete source water protection planning and implementation projects.

Source water protection projects include a wide variety of actions and activities aimed at safeguarding, maintaining, and improving the quality or quantity of drinking water sources and their contributing areas. **Source water protection projects are focused on the source of drinking water before it enters a well or spring box (for groundwater) or an intake (for surface water).**

The Department of Environmental Quality's Drinking Water Source Protection program maintains resources for public water systems to reference when locating potential funding sources for projects, including a comprehensive source water protection funding guide.

Go to the **DEQ Drinking Water Source Protection Funding for Public Water Systems website** to access these online resources.

Source water protection projects do not include projects related to the purchase or maintenance of intake, treatment, or distribution infrastructure or facilities, the operations and maintenance of the system, routine or required monitoring activities, regulatory requirements, fencing or other protective measures in routine set back areas, or security measures to prevent theft and vandalism of facilities. **If your water system needs assistance with infrastructure projects, please contact Oregon Health Authority Drinking Water Services or Business Oregon:**

For infrastructure financing opportunities, go to the **Oregon Health Authority Drinking Water State Revolving Fund Website** or contact them via phone 971-673-0405 or email: **dws.srf@odhsoha.oregon.gov**. Water systems can also go to the **Business Oregon 'Contact Us' page** to submit an online request for assistance or to look up the Regional Development Officer in your region.

## 3.2.1 Oregon Health Authority Drinking Water Services

Go to the **Oregon Health Authority's Drinking Water Services website.**

The Oregon Health Authority is the primacy agency for the implementation of the federal Safe Drinking Water Act in Oregon and administers and enforces drinking water quality standards through its Drinking Water Services program. ORS 338.277 authorizes the OHA to administer the federal Safe Drinking Water Act in Oregon as the Primacy Agency in agreement with the federal government. ORS 448.131 further authorizes the adoption of standards necessary to protect public health through insuring safe drinking water within a water system. Standards in OAR 333-061 outlines requirements for systems to meet maximum contaminant levels, submit to periodic inspections, and meet enforcement requirements as administered by OHA. As the primacy agency, OHA also approves drinking water treatment plans and sets construction standards, operator certification standards, and enforces rules to ensure safe drinking water. The OHA website above has extensive information on drinking water treatment requirements.

To assist water systems in complying with standards, OHA also provides technical assistance and oversight of grants and loans from the Safe Drinking Water Act for public water system operation and improvements. For those Safe Drinking Water Act loans and grant funds, the Oregon Health Authority partners with Business Oregon to provide the financial services.

One key funding opportunity focused on surface water and groundwater source protection is the Drinking Water Source Protection Fund.

### Drinking Water Source Protection Fund

This funding source is designed for the protection of drinking water sources. Drinking water sources include watersheds above a public water supply surface water intake and/or the delineated portion of the aquifer suppling water to public water supply wells or springs. The Drinking Water Source Protection Fund provides grants of $50,000 (or more depending on project type) and low-interest loans (up to $100,000 per project) for source water protection projects in the following categories: refined or enhanced delineation, updated or enhanced assessment, source protection planning, implementation, and select security projects. Eligible activities include those that lead to risk reduction within the delineated source water area or would contribute to a reduction in contaminant concentration within the drinking water source. Public and privately-owned Community water systems and Non-profit Non-Community water systems with a completed Source Water Assessment are eligible to apply but can work with local partners to complete the work.

Go to the OHA **Drinking Water Source Protection Fund website** for up-to-date program information including application deadlines, grant and loan funding amounts, information on eligible projects, and project rating criteria. Go to OHA's **interactive GIS map** to see examples of previous drinking water source protection funded projects since 2008.

DEQ and OHA Drinking Water Source Protection staff are available for questions and can assist public water systems (and their partners) with the application process. **OHA Drinking Water Source Protection website** has a breadth of resources to support water systems with source water protection initiatives.

## 3.2.2 Business Oregon

Phone: 503-986-0123

**Go to the Business Oregon website.**

As the state's community and economic development agency, Business Oregon manages several state and federal infrastructure funding programs. Business Oregon is not a regulatory agency but collaborates and supports state and federal partners with financing programs and technical assistance. To learn more about Business Oregon's programs and how to apply **contact a Regional Development Officer**.

The funding program most applicable for surface water and groundwater source protection is the Drinking Water Source Protection Fund, which is discussed above in the Oregon Health Authority section.

## Business Oregon funding programs

Business Oregon administers several other finance programs for communities that support the design and construction of public infrastructure and economic and community development. Use this link for a summary of **Business Oregon's Infrastructure Programs.** Many of these funding programs can be used to address potential sources of contamination within a drinking water source area. These include but are not limited to the following:

- Brownfields Revitalization Fund – for assessment and cleanup of a hazardous substance, pollutant, or contaminant that is complicating expansion, redevelopment, or reuse of a property.
- Community Development Block Grants - funding to develop livable urban communities for persons of low and moderate incomes by expanding economic opportunities and providing housing and suitable living environments.
- Special Public Works Fund – funding for planning, design, purchasing, improving and constructing publicly owned facilities; replacing publicly owned essential community facilities; emergency projects as a result of a disaster, and for planning.
- Port Planning and Marketing Fund – funding to assist Oregon ports in the planning and construction of facilities and infrastructure. Could be used to address issues at industrial parks, airports and commercial or industrial developments.
- Safe Drinking Water Revolving Loan Fund –loan funding to support drinking water system infrastructure improvements needed to maintain compliance with the Federal Safe Drinking Water Act.
- Sustainable Infrastructure Planning Projects – a sub-program of the Safe Drinking Water Revolving Loan Fund that provides 100% forgivable loans up to $20,000 or $50,000 (depending on project type) to support water system planning efforts.
- Water/Wastewater Financing Program –technical assistance, design and construction funding that supports public infrastructure projects for drinking water, wastewater, or stormwater systems working to achieve or maintain compliance with drinking water or water quality regulations.

More information, including eligible applicants and allowable funded project activities, are available on **Business Oregon's website**.

## 3.2.3 Oregon Department of Environmental Quality

The Oregon Department of Environmental Quality is responsible for protecting and improving the quality of Oregon's land, air, and water. Key responsibilities include enforcing state environmental laws and ensuring compliance with federal laws like the Clean Air Act and the Clean Water Act and ensuring Oregon's waters are safe for drinking, recreation, agriculture, and fish populations. DEQ also has programs to manage the proper disposal of hazardous and solid wastes, assist with the cleanup of contaminated properties, reduce greenhouse gas emissions and prevent toxic chemical releases, develop and implement air pollution control strategies, supporting product stewardship to reduce environmental impacts throughout a product's life cycle, and improve working relationships with Oregon's nine federally recognized tribes.

DEQ is responsible for the implementation and enforcement of the federal Clean Water Act and state water quality laws in Oregon. The federal Clean Water Act authorities apply to Waters of the United States. Oregon state statutes (ORS 468B.005(10)) expand upon the federal Clean Water Act to afford protection for all waters of the state, which includes groundwater.

DEQ is responsible for addressing pollutants from point and nonpoint sources of pollution that affect water quality throughout the state. Point sources of pollution are from contaminants that enter the environment from a single, identifiable source (such as from the outfall pipe of a wastewater treatment plant) whereas nonpoint sources of pollution refer to contamination that does not originate from a single discrete source (such as contaminated water entering streams as stormwater runoff).

Go to the **DEQ's Water Quality home page** and learn more about Oregon's water quality programs.

### Drinking Water Source Protection Program

The Department of Environmental Quality's drinking water source protection program assists public water systems and communities with protecting their sources of drinking water from contamination. Drinking water protection is implemented through a partnership between DEQ and the Oregon Health Authority. The program offers a range of free technical assistance services and resources to public water systems and communities.

Visit the **DEQ Drinking Water Source Protection website** and **OHA's Drinking Water Source Protection Website**. to learn more about source water protection in Oregon and resources available to public water systems.

Go to the drinking water source protection program's **Funding for Public Water Systems website** to learn more about funding resources for source water protection and to access the comprehensive list of funding opportunities for source water protection guide.

## Clean Water State Revolving Fund

The Department of Environmental Quality's Clean Water State Revolving Fund program provides below-market rate loans to eligible recipients for water infrastructure projects that prevent or mitigate water pollution. Eligible projects include those that are necessary to protect beneficial uses such as drinking water sources, irrigation, and recreation. Public entities, such as cities and counties, Indian tribal governments, sanitary districts, soil and water conservation districts, irrigation districts, various special districts and some intergovernmental entities are eligible to apply. Funding is available to support planning, design, and construction/ implementation project types that maintain or improve water quality standards.

Applications are accepted all year but the program only reviews applications three times per year in the spring, summer, and winter. The application requirements for CWSRF loans may take some lead-time to develop and may require out-of-pocket expense to prepare. Prospective CWSRF applicants should discuss any questions about the required content of these items with a regional DEQ CWSRF Project Officer at the earliest opportunity.

Specific project types that may be applicable to Drinking Water Source Protection include the following:

- **Nonpoint source:** Eligible project types include those that result in water quality improvements by reducing nonpoint sources of pollution from entering waters of the state. Examples of project types include establishing conservation easements, fee simple acquisition, animal waste management, agricultural conservation, protection or restoration of riparian habitat.
- **Point Source:** Eligible projects include those for the design and construction of public wastewater facilities, building or rehab of sewer systems, urban wet weather flow control, and more.
- **Local Community:** Encourages public agencies to use revolving fund financing to establish their own loan program that addresses a local water quality issue occurring within their jurisdiction. This project type allows the borrower to make loans to private entities, like homeowners and farmers to complete projects such as the repair/ replacement of failing septic systems or to implement best management practices for a variety of nonpoint source watershed improvement type projects.

- **Planning:** Eligible project types include those that develop a project such that an applicant could later apply for another loan type (nonpoint source, point source, or local community). Eligible projects include those involving data collection and measurement, evaluation, analysis, and any other activity leading to a written document.
- **Sponsorship Option:** Implement a non-planning nonpoint source project and a traditional point source wastewater treatment project through the same application to reduce your interest rate on the combined two projects to as low as 1%. This combined application is called a sponsorship option.

Go to the **Oregon DEQ Clean Water State Revolving Fund website** for up-to-date program information including application deadlines, information on eligible projects and loan types, and program contacts.

Go to the **Oregon DEQ Clean Water State Revolving Fund 'Program Contacts' website** to locate the correct contact for your region.

## Section 319 grants and the Non-Point Source Program

Under Section 319 of the Clean Water Act, the EPA funds states, territories, and tribes to address nonpoint source pollution which comes from scattered sources, such as city streets, farms, and construction sites, and includes harmful substances like toxins, nutrients, pathogens, and sediments.

Each year, DEQ issues requests for proposals for projects aimed at controlling nonpoint source pollution in priority watersheds. These grants support activities such as watershed-based planning, pollution control, and water quality improvement. DEQ collaborates with municipalities, universities, nonprofits, and other organizations to implement these projects.

The program follows a five-year Nonpoint Source Management Plan, required by the Clean Water Act, to outline strategies for reducing nonpoint source pollution and enhancing water quality. Annual reports document progress, activities, and accomplishments, while a statewide water quality trends report supports ongoing efforts.
Go to the **Oregon DEQ's Nonpoint Source Program** and **319 Grant website** for up-to-date program information including application deadlines, information on eligible projects and loan types, and program contacts.

## Supplemental Environmental Projects

Supplemental Environmental Projects are reviewed and approved on a case-by-case basis by the Department of Environmental Quality's Office of Compliance and Enforcement as part of

settlement of a formal enforcement action. When DEQ assesses civil penalties for environmental law violations, violators can offset up to 80% of their monetary penalty by agreeing to fund a Supplemental Environmental Project that improves Oregon's environment. Supplemental Environmental Projects can be for pollution prevention or reduction, public health protection, environmental restoration and protection if it is a project that the respondent is not already required to do by law or where the project would be financially self-serving for the respondent. The work can be completed by a third-party like a local government, watershed council, non-profit or private entity. Community organizations with proposed projects are also free to contact respondents on their own initiative. According to DEQ's Supplemental Environmental Project policy, DEQ prefers that the project is in the same locale (watershed/ county, etc.) where the violation occurred and in the same media (i.e. air/ water/ land) that were the subject of the enforcement action, however, those requirements are not absolute and DEQ may consider and approve good projects in other locations or media.

**View a fact sheet** about Supplemental Environmental Project Ideas and Contacts.

Go to **DEQ's Public Notices website** to sign up for text or email notifications. When signing up, select "enforcement actions" under types of information and select the counties or subbasins of interest to you.

Go to **DEQ's Enforcement Actions website** to view current enforcement activity.

## 3.2.4 Oregon Water Resources Department

The Oregon Water Resources Department is the state agency charged with administration of the laws governing surface and groundwater resources. By law, (ORS 537.110) all surface and groundwater in Oregon belongs to the public, and with some exceptions, all water users must obtain a permit or license from OWRD to use water from any source. The OWRD's core functions are to protect existing water rights and process water rights transactions, facilitate voluntary streamflow restoration, increase the understanding of the demands on the state's water resources, provide accurate and accessible water resource data, and facilitate water supply solutions. OWRD carries out the water management policies and rules set by the Water Resources Commission and oversees enforcement of Oregon's water laws. The Water Resources Department completed a new groundwater allocation rulemaking in 2024 to update the rules for how OWRD determines if water is available to support new groundwater rights. The updated rules recognize the connection between groundwater and surface water sources and are meant to ensure that new groundwater rights do not negatively impact over-appropriated surface water sources.

Go to the **OWRD homepage** to learn more about water rights, groundwater and wells, streams and dams, and news from the agency. Go to the **OWRD Groundwater Allocation Rulemaking website** to learn more about the new rule and to access fact sheets and resources about the rulemaking process.

The Oregon Water Resources Department is responsible for developing and updating the Oregon Integrated Water Resources Strategy, which is a statewide inter-agency framework developed to better understand and meet the state's instream and out-of-stream water needs. The IWRS addresses water quantity, water quality, and ecosystem needs now and into the future. Oregon's Water Resources Commission adopted the first IWRS in 2012 and the second in 2017. Oregon is in the process of another IWRS update that is anticipated to be finalized in 2025. The IWRS is a helpful resource for understanding water governance in Oregon, in developing source water protection projects, and can help demonstrate the importance of projects that align with actions identified in the plan.

Go to the **Integrated Water Resources Strategy website** to learn more about the draft IWRS schedule, download the IWRS report, and to sign up for announcements about the IWRS.

## OWRD Funding Opportunities

The OWRD has several funding opportunities that allow the agency to strategically invest to achieve a secure and sustainable water future and to address instream and out-of-stream needs for Oregon's environment, economy, communities, and cultures. OWRD funding opportunities can be used to accomplish source water protection or water quantity related projects – consult with OWRD grant program contacts for more information. Funding opportunities available to public water systems include: (1) Planning Grants, (2) Feasibility Study Grants, (3) Water Project Grant and Loans.

Go to the **OWRD Funding Opportunities website** to learn more about available funding opportunities, to find contact information for staff, and to sign up for funding opportunity announcements.

## Watermasters and Water rights

Watermasters respond to complaints from water users and determine in times of water shortage, which generally occur every year, who has the right to use water. Watermasters can also provide information on the potential risks and proper abandonment of unused wells. Watermaster offices across the state offer excellent local information.

Go to the **OWRD's Regional Offices and Watermasters Directory** to locate agency staff in your area.

### Well Abandonment, Repair and Replacement Fund

The Water Resources Department's Well Abandonment, Repair, and Replacement Fund provides financial assistance to help Oregonians repair or replace and permanently abandon a household well that is dry or severely declining or that was damaged or destroyed by wildfire that is unable to supply water for household purposes.

This financial assistance is available to individual low to moderate income households or members of a federally recognized tribe in Oregon. The impacted well must have been used for household purposes and is no longer supplying enough water to sustain the household.

Go to OWRD's **Well Abandonment, Repair, and Replacement Fund** website for more information on eligibility and use.

## 3.2.5 Oregon Department of Forestry

The Oregon Department of Forestry manages and regulates activities on non-federal forestland in Oregon. There are three main divisions under ODF-- Fire Protection, Forest Resources, and State Forests. The Forest Resources Division administers the Forest Practices Act and various forestry incentive programs and employs the use of approximately 70 ODF Foresters who work closely with landowners and operators on privately owned timberlands. The State Forests Division is responsible for forest management to provide economic, environmental, and social benefits to Oregonians.

Go to the **Oregon Department of Forestry's website** to learn more about the agency and its programs.

Visit ODF's Forest Practices Act website to learn more about the **Forest Practices Act** and the **Private Forest Accord**.

Visit **ODF's find a forester website** to find your local Oregon Department of Forestry Forester.

### Forest Activity Electronic Reporting and Notification System (FERNS)

ODF maintains the Forest Activity Electronic Reporting and Notification System – this is an online system for tracking activities on non-federal forested lands in Oregon. The Forest Practices Act requires that a notification of operation is submitted online in FERNS for any commercial forest operation at least 15 days before starting any work. Anyone can subscribe to receive copies of FERNS notifications or updates, request information about written plans for forestry work, or to submit official comments about the written plans. **Water systems that have**

**timberlands in their drinking water source area are highly encouraged to sign up to receive notifications.**

Visit **ODF's FERNS website** to sign up for Forest Activity Electronic Reporting and Notification System notifications.

### ODF Incentive and Funding Programs

Financial incentive programs are aimed at encouraging and assisting landowners in managing their resources and meeting their objectives. Typical forestry projects can be aimed at protecting the landowner's resources/investment from fire or insect and disease infestation, and to increasing its monetary and environmental value in the future. Other grant programs, including the Community Forest Program and Forest Legacy Program, can help to conserve and protect lands through conservation easements or fee simple acquisition. The Forest Stewardship Program can provide cost-share incentives for developing a Forest Stewardship Plan for privately owned forestland.

Go to the **ODF Grants and Incentives website** to learn about all the available funding opportunities.

## 3.2.6 Oregon Department of Agriculture

The Oregon Department of Agriculture's mission is to "safeguard Oregon's agriculture, natural resources, working lands, economies, and communities through assistance, compliance, and market support."

### Natural Resources Division

ODA's Natural Resources Division oversees many programs with the mission to protect water quality and habitat on agricultural lands. ODA is responsible for ensuring that farmers and ranchers achieve water quality standards. As part of this responsibility, ODA develops Agricultural Water Quality plans to prevent and control water pollution from agricultural activities and soil erosion on rural lands. ODA issues Confined Animal Feeding Operation permits to livestock owners to ensure that manure does not pollute ground and surface water. The Natural Resources Division also ensures the proper and legal sale, use, and distribution of pesticide and fertilizer products and assists local soil and water conservation districts in their efforts to provide technical assistance to landowners.

Go to **ODA's Natural Resources website** to learn more about agricultural water quality, confined animal feeding areas, soil and water conservation districts, and more.

Go to the **ODA Agricultural Water Quality website** for more information on the Agricultural Water Quality Plan Areas and Regulations and to find your area's ODA Water Quality Specialist.

DEQ participates in ODA's effort to review and revise Agricultural Water Quality Management Area Plans consistent with ORS568.930. During the biennial review process, DEQ provides status and trends reports, information on drinking water resources near agricultural practices and other water quality comments on ODA's area rules and plans.

To view this information for each agricultural area plan review, visit **DEQ's Area Plan Reviews and Comments** page and **DEQ's Water Quality Status and Trends Analysis** websites.

Go to the **ODA Confined Animal Feeding Operation Program website** for more information on the regulation of animal waste management.

Go to the **ODA Pesticide, Fertilizer, and PARC Programs website** for more information on the regulation and use of pesticides and fertilizers.

## Pesticide Stewardship Partnership Program

The Pesticide Stewardship Partnership Program is a voluntary program that relies on local partnerships to monitor pesticide levels in waterways and to enact solutions to protect water quality while also managing pests and maintaining crop yields. ODA is the state lead for the PSP program and leads an interagency team called the Water Quality Pesticide Management Team.

The PSP Program uses water quality sampling data to evaluate pesticides of concern, conducts local outreach and technical assistance efforts designed and implemented based on water quality data findings, and evaluates the effectiveness of these education and collaboration projects annually. The PSP program also conducts free waste pesticide collection events for proper pesticide disposal from agricultural and commercial applicators.

Go to the **DEQ's PSP website** and **ODA's PSP website** to learn more about where the program currently operates in Oregon, learn about the pesticide waste collection program and to request a pesticide collection event in your area. In addition, **DEQ's PSP Data Viewer** provides access to water quality data collected by the Pesticide Stewardship Partnerships Program.

## Pesticide Analytical and Response Center

The Pesticide Analytical and Response Center was created by executive order in 1978. The program was reauthorized under the Oregon Department of Agriculture in 1991 (ORS 634.550).

PARC is a multi-agency group that responds to pesticide-related incidents in Oregon with suspected health or environmental effects. It acts as a central location that receives Oregon-

specific pesticide incident information. The main activity that PARC is mandated to perform is to **coordinate investigations into pesticide incidents in Oregon.** It also collects and analyzes information about reported incidents. PARC does not have regulatory authority – it relies on member agencies to conduct investigations and take necessary enforcement actions

**To report a pesticide incident that has impacted people, animals, or the environment, you can:**

- **Call: 503-986-6470 -** Your phone call will be routed to a specialist to take your information and PARC staffers will contact you within one business day.
- **Email: naturalresource-complaints@oda.oregon.gov**
- **Notify the Oregon Emergency Response System** by calling 911

Go to the **ODA PARC website** to learn more about PARC and access pesticide resources.

## 3.2.7 Oregon State Fire Marshall

The Oregon State Fire Marshall's mission is to protect people, property, and the environment from fire and hazardous materials. OSFM is the leading authority on fire safety and emergency response in Oregon.

### Community Right to Know Program to Track Hazardous Materials Storage Sites

The Community Right to Know and Protection Act (ORS 453.307-414) requires Oregon employers to report hazardous substances to the Oregon State Fire Marshal, where they are stored, and the associated hazards. The OSFM's Community Right to Know program tracks and maintains these records.

Go to the **OSFM Community Right to Know website** to learn more about this program and to access additional hazardous materials information and resources.

OSFM's **Hazardous Materials Storage Sites interactive map** shows point locations and facility IDs of hazardous substance storage facilities across the state of Oregon.

### Local Area Emergency Planning Committees

Local Emergency Planning Committees help keep communities safe and prepared by improving emergency plans, raising awareness, and ensuring that dangerous materials are handled safely. The groups include a range of interested parties including local leaders, emergency responders,

businesses, and community members. Water system representation on a Local Area Planning Committee can help ensure that the drinking water source is property protected by raising awareness about the source's location and potential sources of contamination within the source area.

Go to the **Oregon State Fire Marshall's Local Emergency Planning Committee website** to view a list of local emergency planning committees and to learn more about potential grant opportunities.

### Hazardous Materials Emergency Preparedness Grant

The Hazardous Materials Emergency Preparedness grant is a federal grant administered by OSFM which helps communities prepare for emergencies involving hazardous materials. It provides funding for training, planning, and exercises to improve local emergency response. This grant has been used successfully by public water systems to host emergency response trainings for critical local partners (water system employees, first responder personnel, local community representatives, other technical assistance providers, etc.) and to stage spill drills in source water areas. State, local, and tribal governments are eligible to apply. Eligible projects include those that help communities plan for and respond to hazardous materials incidents, including transportation accidents. Projects must have a HAZMAT transportation component to be considered for the grant. For more information contact OSFM at **osfm.hmep@osfm.oregon.gov**

## 3.2.8 Other State Agencies

Many agencies work to protect water quality in Oregon through data sharing, monitoring, technical assistance, setting standards, or regulation. This section highlights the role of other Oregon agencies that can help address potential sources of point and nonpoint sources of pollution and natural resource issues. For help identifying the appropriate agency or contact, please reach out to **DEQ's Drinking Water Source Protection Program**. Other state agencies that may be of assistance include (but are not limited to) the following:

**Department of Land Conservation and Development**: DLCD works in partnership with local governments, and state and federal agencies, to address the land use needs of the public, communities, regions, and the state. Water systems may work with DLCD to address land use planning, resilience, natural hazards, coastal management, mitigating effects of climate change. DLCD's Statewide Planning Goal 5 requires local governments to address a variety of resources such as wetlands, fish and wildlife habitat, renewable energy sources, and water quality when making land use decisions. Go to **DLCD's Natural Resources Planning website** for more information.

**Department of Geology and Mineral Industries**: DOGAMI helps increase understanding of Oregon's geologic resources and hazards through science and stewardship. The Mineral Land Regulation and Reclamation program oversees the state's mineral production including gravel and other mining operations. The Geological Survey and Services program develops maps, reports, and data to help Oregon manage natural resources and prepare for natural hazards.

**Oregon Watershed Enhancement Board:** OWEB provides grants to help Oregonians take care of local streams, rivers, wetlands, and natural areas. **DEQ's comprehensive funding guide** summarizes OWEBs grants that may be applicable to public water systems.

Oregon **Department of Transportation**: ODOT develops programs related to Oregon's system of highways, roads, bridges and railways among other programs. **ODOT's Environmental Programs** address water quality during stormwater management, road surface work, right-of-way maintenance, bridge maintenance, snow and ice removal, and during response to hazards such as slides and settlements.

**Oregon State Marine Board**: OSMB manages many programs serving boaters through education, enforcement, access, and environmental stewardship. OSMB's Environmental Programs address keeping sewage out of waterways, aquatic invasive species, and abandoned vessels. OSMB's Clean Marina and Clean Boater Programs are good resources for water systems with surface water sources.

**Oregon Department of Fish and Wildlife**: ODFW protects and enhances Oregon's fish and wildlife. ODFW can be a good partner where drinking water quality goals overlap with water quality and quantity goals for aquatic habitat for fish and other species.

# 3.3 Federal Agency Partner and Funding Resources

This section provides information about the federal agencies and funding resources available to public water systems in Oregon to complete source water protection planning and implementation projects.

## 3.3.1 U.S. Environmental Protection Agency

The EPA's mission is to protect human health and the environment. The EPA achieves this mission by developing and enforcing regulations, giving grants, studying environmental issues, supporting partnerships, providing education and outreach materials about the environment, and publishing information. The EPA administers the federal Safe Drinking Water Act and is responsible for setting national drinking water standards.

## Environmental Finance Centers

EPA awards grants to Environmental Finance Centers to help deliver targeted technical assistance to local governments, states, Tribes, Territories, and non-governmental organizations to protect public health, safeguard the environment, and advance community engagement. Through the Environmental Finance Center program, technical assistance providers help communities develop and submit project proposals, including for State Revolving Fund applications.

Go to the **EPA Environmental Finance Center website** for more information.

The Environmental Finance Center contracted by the EPA to serve Oregon is the Rural Community Assistance Corporation. RCAC focuses on environmental infrastructure (water, wastewater and solid waste facilities), economic and leadership development, and community development finance. RCAC can provide technical assistance to communities in the following areas:

- Wrap around services for submitting funding applications, including completing all tasks to meet requirements of awarded grants and loans.
- Hands on technical assistance to address technical, managerial, and financial operations of water and wastewater systems serving rural and Indigenous communities.
- Analyze utility rates and finances to recommend appropriate rate structures to meet community needs.
- Facilitate regional partnerships among utilities and communities.
- Host in-person and online training for utility staff, management, boards, and community members on a variety of topics.

Go to the **Rural Community Assistance Corporation website.**

## Water Technical Assistance

WaterTA is EPA's free technical assistance program with services that may include identifying adaptation strategies, addressing stormwater challenges, complying with the Safe Drinking Water Act and Clean Water Acts, and assistance with applying for federal funding opportunities. Eligible entities to receive WaterTA include local governments/communities and drinking water utilities/systems.

Go to the **EPA's Water Technical Assistance Information website** to learn more about eligibility, what technical assistance services are available, and access webinars and presentations about how communities can address water challenges.

Go to the **online Water Technical Assistance Request Form** to submit a request for assistance.

### Thriving Communities Technical Assistance Centers Program

The U.S. Environmental Protection Agency and U.S. Department of Energy Thriving Communities Technical Assistance Centers program funds technical assistance centers throughout the United States to provide technical assistance, training, and support to eligible communities to make environments safer and healthier places. Go to the **EPA Thriving Communities Technical Assistance Centers Program website** to learn more about this initiative.

Willamette Partnership's Northwest Environmental Justice Center and the University of Washington's Center for Environmental Health Equity were the technical assistance centers selected by the EPA to serve Oregon. These organizations can receive funding from the EPA to provide help navigate federal programs, encourage community engagement, and provide other tools to make projects successful.

Go to Willamette Partnership's **Northwest Environmental Justice Center website** to learn more about their services or to fill out a technical assistance form to request help.

Go to the University of Washington's **Center for Environmental Health Equity website** to learn more about their services, request assistance, or access a myriad of resources.

### Funding Integration Tool for Source Water

EPA's FITS is a one-stop-shop tool to help integrate various federal funding sources to support activities that protect sources of drinking water. The website has source water protection funding sources, planning and funding coordination information, and examples of funding sources in action. Go to EPA's **Funding Integration Tool for Source Water** for more information.

### Clearinghouse for Environmental Finance

This is an online database that catalogues available funding sources (grants, loans, cost-sharing) and instructional resources to aid communities in improving environmental conditions for water, land, and air quality projects.

Go to the **EPA Clearinghouse for Environmental Finance website** for more information.

## 3.3.2 USDA National Resource Conservation Service

The United States Department of Agriculture's National Resource Conservation Service is the primary private lands conservation agency responsible for generating, managing, and sharing

the data, technology, and standards that agricultural producers use to protect natural resources on working lands. NRCS helps producers and their partners protect and conserve natural resources on private working lands through voluntary conservation programs. The goal of these programs is to improve water and air quality, conserve groundwater and surface water, and reduce soil erosion and sedimentation.

**Eligibility for NRCS Programs:** Agricultural producers and small forestland owners are eligible to apply for the following conservation programs. Landowners must contact their local NRCS office as the first step to accessing NRCS programs and resources.

**Note: Implementing NRCS Programs within a drinking water source area often requires partnering with technical assistance providers who specialize in working with private landowners (i.e. a soil and water conservation district).**

NRCS programs commonly used to accomplish source water protection goals in Oregon include the following:

- National Water Quality Initiative (note that source water protection was added as a specific focus area in 2019)
- Environmental Quality Incentives Program
- Conservation Stewardship Program
- Agricultural Land Easements
- Wetland Reserve Easements
- Joint Chiefs' Landscape Restoration Partnership
- Regional Conservation Partnership Program

Go to **the Oregon NRCS's Programs and Initiatives website** to access additional information about each of these programs including eligibility and application dates and to see the full list of programs and initiatives that NRCS implements. In addition, you can **find your local NRCS service center here**.

Go to the **NRCS website** more information about the agency.

## 3.3.3 USDA Farm Service Agency

The United States Department of Agriculture's Farm Service Agency oversees several voluntary conservation-related programs including the Conservation Reserve Program, Conservation Reserve Enhancement Program, and the Emergency Conservation Program. These programs work to address farming and ranching related conservation issues including drinking water source protection, soil erosion, wildlife habitat preservation, preservation and restoration of forests and wetlands, and aiding farmers whose farms are damaged by natural disasters.

**Eligibility for FSA programs:** Farmers, ranchers, and agricultural producers are eligible to apply for the following conservation programs. Landowners must contact their local Farm Service Agency office to submit an offer and/or request for assistance.

**Note: Implementing Farm Service Agency Conservation Programs within a drinking water source area will require partnering with technical assistance providers who specialize in working with private landowners (i.e. a soil and water conservation district).**

- Conservation Reserve Program and Conservation Reserve Enhancement Program: Enrolled farmers receive a yearly rental payment for agreeing to remove sensitive land from production and convert it to vegetative cover such as native grasses, trees, and riparian buffers. These programs also offer financial incentives to landowners for implementing certain conservation practices. Contracts for land enrolled in the programs are 10-15 years in length. The long-term goal of the programs is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

- Emergency Conservation Program: This program provides funding and technical assistance for farmers and ranchers to restore farmland damaged by natural disasters and for emergency water conservation measures in severe droughts

Go to the **Farm Service Agency's 'Find a Conservation Program' website** to find more information about conservation programs. You can **find your local Farm Service Agency service center here**.

## 3.3.4 United States Forest Service

The United States Department of Agriculture's Forest Service manages approximately 24.9 million acres of national forest and grasslands across both Oregon and Washington states. In Oregon, the USFS manages ~33% of the lands within surface water drinking water source areas and is therefore an important partner for many public water systems (Figure 2). The USFS manages forestland for multiple beneficial uses including forest products, recreation, jobs and partnerships, clean water, and habitat. Water systems can ensure that USFS's mandate to meet multiple-use goals and objectives will not jeopardize the goal of maintaining and improving water quality by creating partnerships with the relevant USFS contacts. Oregon water systems can enter into Memorandum of Understanding agreements with the USFS to provide a framework for communicating and coordinating efforts to improve, protect and monitor the quality of water from federal lands.

### USFS Funding Resources

The USFS provides funding resources for a variety of programs (i.e. Forest Legacy Program, Community Forest Program, Community Wildfire Defense Grant Program) in partnership with the Oregon Department of Forestry and other funding partners. Reference the **Oregon Department of Forestry's Grants and Incentives website** for more information on these funding opportunities.

The USFS also plays a key role in implementing the Land and Water Conservation Fund land acquisition program, which supports strategic land acquisitions, supports locally led conservation efforts, and protects natural heritage. In Oregon, the Land and Water Conservation Fund is administered by the Oregon Parks and Recreation Department. Go to **OPRD's Land and Water Conservation Fund website** to learn more about this Federally-funded grant program.

## 3.3.5 Bureau of Land Management

The U.S. Department of the Interior Bureau of Land Management manages approximately 15.7 million acres of public land in Oregon. In Oregon, the BLM manages ~10% of the lands within surface water drinking water source areas and is therefore an important partner for many public water systems (Figure 2). The BLM manages public lands and resources to meet multiple-use goals including forest and timber management, wildfire management, wildlife and habitat conservation, recreation management, mineral and energy development, and cultural and archaeological resource protection. The BLM manages grazing permits and leases to ranchers who graze livestock on BLM land and set the number of animals allowed to graze. Oregon water systems can enter into Memorandum of Understanding agreements with the BLM to provide a framework for communicating and coordinating efforts to improve, protect and monitor the quality of water from federal lands.

Learn more about BLM operations and offices by visiting the **Oregon-Washington BLM website**.

## 3.3.6 USDA Rural Development: Emergency Community Water Assistance Grants

This program helps eligible communities prepare, or recover from, an emergency that threatens the availability of safe, reliable drinking water. In Oregon, these grants have been used by public water systems recovering from wildfires, landslides, and stream channel migration.

Rurally located public bodies (populations of 10,000 or less), nonprofit organizations, federally recognized tribes are eligible. The area to be served must have a median household income less than the state's median household income for non-metropolitan areas. Qualifying events

include drought, flood, earthquake, tornado, hurricane, disease outbreak, chemical spill/ leak/ seepage, and other disasters.

Go to the **Emergency Community Water Assistance Grant website** for more information about the grant, how to apply, program contact information, and more.

# 3.4 Other Organizations and Resources

## 3.4.1 Source Water Collaborative

The Source Water Collaborative is a national organization formed in 2006 to protect drinking water sources across the nation by combining the strengths and tools of diverse member organizations. Member organizations include federal, state, and local partners.

**Go to the Source Water Collaborative website** to learn more about the organization, source water protection learning exchange resources, upcoming events, and to access the wealth of other resources and contacts they maintain.

The following are particularly useful tools and resources available to public water systems to support drinking water protection planning and the implementation of projects:

- **How-to-Collaborate Toolkit**
- **Guide for Using Clean Water Act Discharge Permits to Protect Drinking Water Sources**
- **Guide For Land Use Planners**
- **Guide for Agricultural Leaders: Field to Faucet**
- **Learning Exchange Webinars and Associated Resources** Source water collaborative members also have resources for water systems. Many of these national members have already been discussed but here are a few additional resources of note:
- **Association of State Drinking Water Providers Source Water**
- **American Water Works Association Source Water Protection Resources**: Assistance with metrics, justification, and working with agricultural partners. AWWA also recognizes drinking water systems drinking water systems that have developed and are implementing exemplary source water protection programs.

## 3.4.2 Oregon Association of Water Utilities

The Oregon Association of Water Utilities is a nonprofit, independent association of water and wastewater utilities. OAWU represents water utilities' interests in the state legislature, provides training opportunities, and offers onsite technical assistance (including maintaining a circuit rider program). OAWU's source water specialist deals specifically with drinking water source protection and can assist in the development of drinking water source protection plans.

Go to the **Oregon Association of Water Utilities homepage** to learn more about the organization, access their training and events calendar, and to contact an OAWU representative.

## 3.4.3 Oregon Water and Wastewater Agency Response Network

ORWARN is a network of utilities helping other utilities to respond to emergencies. The organization's goal is to provide immediate relief for member utilities during emergencies by matching personnel with the necessary tools and equipment to assess and assist the impacted water system as quickly as possible until a permanent solution can be implemented. ORWARN aims to provide the following for its members:

- A mutual assistance agreement and process for sharing emergency resources among water and wastewater agencies statewide
- A mutual assistance program consistent with other statewide mutual aid and assistance programs and the National Incident Management System
- A legal means to secure the resources to respond and recover quickly from a natural or man-made disaster

Utilities can sign up for free to join ORWARN as a member. Non-utilities involved in emergency management can join as associate members.

Go to the **ORWARN homepage** to learn more about this network of utilities helping utilities and to sign up to become a member.

## 3.4.4 Rural Community Assistance Corporation

RCAC provides environmental technical assistance to small, rural, and indigenous drinking water systems, wastewater systems, and solid waste management programs in 13 western states including Oregon. RCAC provides a variety of technical assistance including source water and wellhead protection, asset management assistance, operations and maintenance manuals, rate studies, funding application assistance, and more. RCAC was selected by the Environmental

Protection Agency as the regional Environmental Finance Center for Region 10, which includes Oregon. See Section 3.2.2 for more information on RCAC's services under the EPA's Environmental Finance Center.

For more information and to request assistance go to the **Rural Community Assistance Corporation website**.

## 3.4.5 Private Charitable Foundations

Private charitable foundations are a potential source of funding to support drinking water source protection projects when the foundation's mission and goals align with environmental protection, public health, economic development, or education and outreach. Each charitable foundation determines its own funding priorities, so it is important for water systems to ensure that their proposed drinking water source protection project fits well with the foundation's mission and goals before applying.

Foundations that fund projects and initiatives in Oregon include, but are not limited to:

### The Oregon Community Foundation

This foundation seeks to help Oregonians through opportunities including the annual Community Grant Program. Details for this grant program are updated annually – go to the **Oregon Community Foundation's grants website** to learn more about the Community Grants Program and other grant opportunities.

### Bandon Dunes Charitable Foundation

This foundation supports communities along Oregon's southern coast whose projects focus on the triple-bottom-line of conservation, community, and economy. Small grants and large grants are available. Go to the **Bandon Dunes Charitable Foundation's website** to learn more.

### Weyerhaeuser Family Foundation

This foundation's Sustainable Forest and Communities Initiative supports the development of environmentally, economically, and socially sustainable communities in forested regions of the United States. Foundation priorities are for projects that promote forest-based communities and address outcomes in the areas of environment, economy, and community. Go to the **Sustainable Forests and Communities Initiative website** to learn more about the program and how to apply.

### The Roundhouse Foundation

The Roundhouse Foundation focuses their work and support in four areas that are fundamental to successful rural communities – Arts and Culture, Environmental Stewardship, Social Services and Education. Within the Environmental Stewardship focus area, the foundation supports projects that help build collective responsibility for and/or improve the health of the environment. The foundation offers several different grant opportunities for eligible applicants, which includes government entities (including special districts) that serve rural Oregon. Go to the **Roundhouse Foundation Grant Focus Areas website** to learn more about the programs and how to apply.

# 4.0 Place-Based Planning for Source Water

Many public water systems in Oregon face challenges implementing drinking water source protection strategies because their drinking water source areas are located partially, if not entirely, outside of municipal jurisdiction or water system control. The jurisdiction of the source water area may also be complicated by several different and overlapping governing agencies. The land uses and potential contaminant sources within the source water area may correspond to a diverse mix of landowners, businesses and residents. One strategy for addressing this challenge is to adopt a 'place-based planning' approach to drinking water source protection.

This section will (1) discuss what a place-based planning is and why it can be an important tool for drinking water source protection, (2) provide an overview of a place-based approach to source water protection planning, (3) review common types of information that are available to support place-based planning efforts, (4) discuss specific considerations for working with private landowners, and (5) highlight land conservation as a tool for protecting critical lands within drinking water source areas.

## 4.1 What is a Place-Based Approach for Source Water Protection Planning

A place-based approach for source water protection planning is voluntary, locally initiated and led, and involves a balanced representation of interested parties who work in partnership to understand local issues, coordinate action, and develop solutions that meet the unique circumstances of a specific place. This approach to planning can be used to achieve drinking water source protection goals by helping to identify the potential risks of contamination to source water quality, along with strategies to reduce that risk and improve water supply resilience within a drinking water source area.

There are several reasons why a place-based approach can be essential to the success of drinking water source protection planning. Perhaps most importantly, when the drinking water source area lies outside of a water system's control, the ability to implement protection activities relies on partnering with private landowners, businesses, and state or federal agencies. When developing protection strategies, the Department of Environmental Quality and the Oregon Health Authority highly recommend that the water system and community involve potentially affected parties early in the process to foster their awareness and trust in the resulting strategies.

There is a greater likelihood of successful implementation of drinking water source protection strategies when protection efforts occur at the community level and involve key interested parties. Protection efforts could take the form of a focused strategy to address a specific issue or could be a broader "action plan" that address short- to long-term drinking water source protection challenges. Regardless of the approach, local engagement is a valuable investment in protecting the quality of life and economic vitality of the local community.

A place-based approach to drinking water source protection planning can also occur as a component of Oregon's Place-Based Integrated Water Resources Planning Program. Place-Based Integrated Water Resources Planning can help address drinking water source protection goals but is broader in scope than drinking water source protection alone.

Refer to section 4.2.1 in this resource guide if your water system or community is interested in engaging in a more comprehensive water planning effort with the state's Place-Based Integrated Water Resources Planning program.

Oregon's Integrated Water Resources Strategy provides helpful recommendations for how to follow a place-based and integrated approach to water resources planning. Elements of Oregon's Place-Based Integrated Water Resources Planning program can be adapted by local groups to achieve goals related to drinking water source protection. Go to the **Oregon Water Resources Department's Place-Based Integrated Water Resources Planning website** to access the Place-Based Planning Guidelines.

The essentials of a place-based approach to planning for drinking water source protection include:

- Voluntary process, driven by local partners
- Involves and integrates diverse and representative perspectives
- Potentially addresses a broad array of common source water challenges that include:
    - Water quality impairments and water supply limitations
    - Identifying data gaps and initiating projects to address these

- Identifying water resource needs and partners to develop solutions
- Lack of water system jurisdiction over lands in watershed or recharge area
- Assessing cumulative effects of regional demands on watersheds and aquifers, including existing uses and new development
- Increasing the visibility and awareness of source water as a priority water resource issue
- Connecting the quality of source water to conditions within the watershed or aquifer recharge area
- Raising awareness regarding the importance of drinking water source protection with decision makers and funders
- Surface impacts on source water, e.g. land use development and subsequent negative effects on water quality or recharge; vulnerability of source water to contamination

Collaborative partners help plan and implement place-based protection efforts. Reference section 3.0 in this resource guide on partners, resources, and funds for more information on technical assistance providers and state or federal agencies that commonly serve as partners in drinking water source protection planning efforts. Other potential partners to consider are:

- Local and Tribal governments
- Special districts (i.e. irrigation districts, parks/recreation, ports)
- Residential homeowners
- Commercial, industrial landowners
- Agricultural and forestry landowners

# 4.2 Planning Process for Protection

Many public water systems do not have the staff or resources necessary to develop comprehensive drinking water source protection plans or to maintain communication and coordination with landowners in their source area. For communities with limited resources, it is critical to streamline the process for developing and implementing strategies for drinking water source protection to ensure that protection efforts focus on the highest priorities.

The first step for public water systems to take is to locate and review the original Source Water Assessment and/or the Updated Source Water Assessment. Each public water system in Oregon has received a source water assessment report completed by the Oregon Department of Environmental Quality and Oregon Health Authority drinking water source protection programs (see section 1.1.3 for more information on source water assessments). The assessment gives the water system and community information on the watershed or recharge area that supplies the

intake, spring, or well (the "drinking water source area") and identifies potential risks within the source area. Public water systems and local communities can use the information in the assessments to voluntarily develop place-based plans and implement drinking water source protection strategies.

Figure 9 provides a visual map or process for moving through the various steps for developing a pollutant reduction or drinking water source protection plan.

The degree of water system resources and the availability of information about a drinking water source will likely define the scope of the drinking water source protection efforts that are achievable. Initially, even a focused effort to address a few higher priority pollutants of concern is a concrete step towards protecting a drinking water source. Then, as resources allow, water systems can build on their initial efforts to pursue a broader approach that engages more local and/or regional partners and diverse community perspectives. With place-based planning, the goal of collaborators could be to develop an aquifer protection or a comprehensive watershed management plan that integrates groundwater and/or surface water drinking water source protection measures with other important water uses in the region. One example is the City of Florence, Oregon's Aquifer Protection plan: go to **the City of Florence's Drinking Water Protection website** to see the plan.

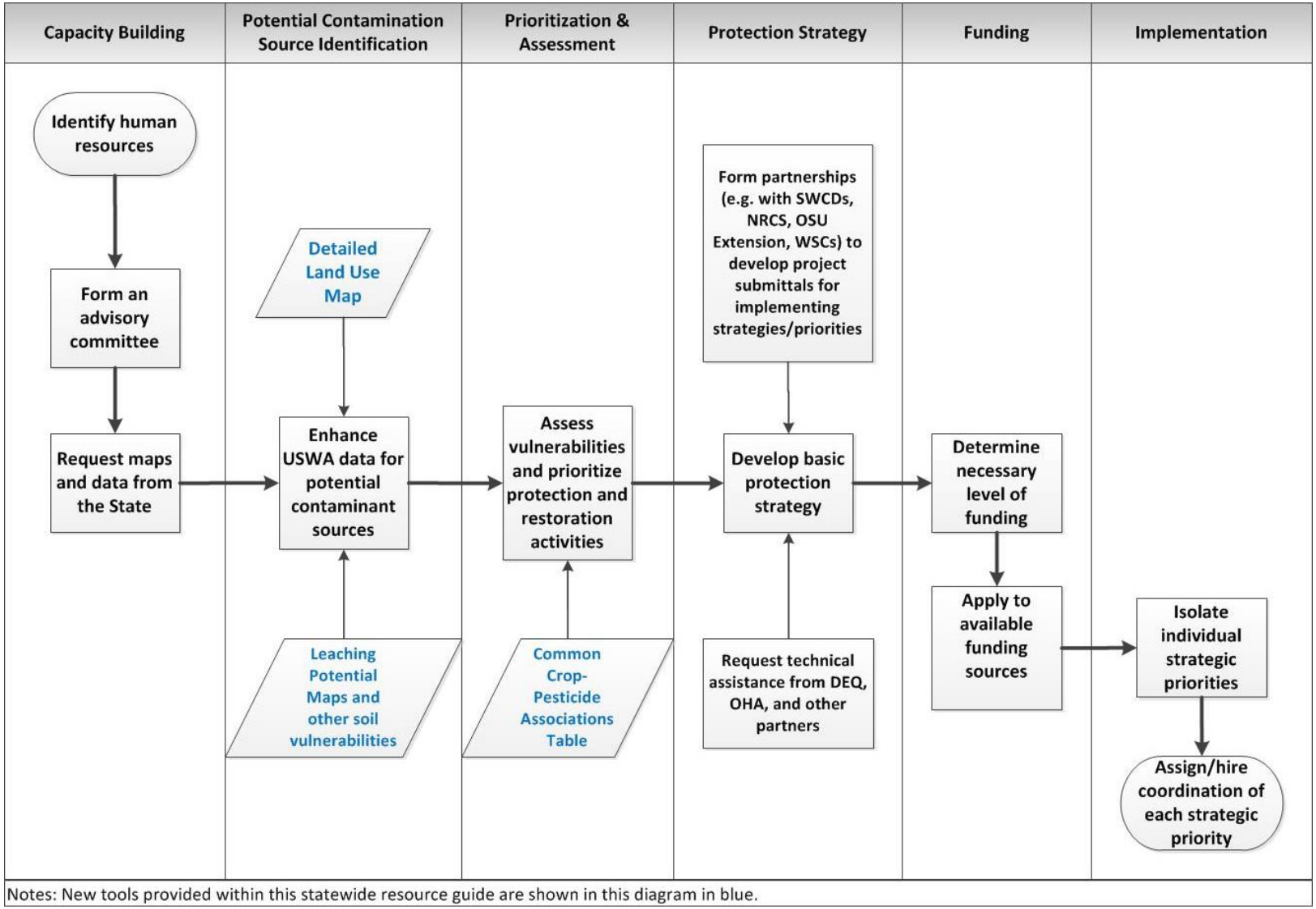


**Figure 9. Process Diagram for Drinking Water Source Protection Planning.**

The process diagram visualized in Figure 9 represents a streamlined approach for drinking water source protection planning. Protection planning includes the following important steps:

1. **Identify human resources** to work on protection/restoration planning.
2. **Solicit available technical experts, community members, and landowners to form an advisory committee:** Review original and/or updated source water assessment(s) and identify potential interested parties and partners. This includes the water system and any other entities that have jurisdiction and/or regulatory authority, such as cities, counties, state and federal agencies, Tribes, or special districts. The DEQ Drinking Water Source Protection Program and/or OHA Drinking Water Services staff can provide technical assistance and/or participate on the committee.
3. **Request state agency assistance** to provide GIS and database information/maps, along with technical support, especially for broader place-based planning efforts.
4. **Develop an enhanced potential contaminant source inventory** to identify and map any additional sources not already included in the original or updated source water assessment(s) or to modify the relative risk rating of a potential contaminant source using local knowledge.
5. **Prioritize protection and restoration activities** using all available information and maps. The general criteria for prioritization include:
    a. Proximity to drinking water intakes, springs, or wells
    b. Location within identified sensitive and/or susceptible areas in the Drinking Water Source Area
    c. Land uses/activities that pose significant threat to surface water
6. **Use available resources to develop protection strategies for high priority sources of potential contaminants** with input from interested parties. If feasible, pursue larger efforts such as Oregon's Place-Based Integrated Water Resources Planning program (refer to section 4.2.1) or a drinking water protection plan (which can be a component of place-based planning.)
7. **Establish a timeline for implementing strategies** and identify individuals and/or organizations that will take the lead and/or assist (utilize technical assistance from DEQ's Drinking Water Source Protection program and OHA).
8. **Determine the level of funding necessary** to accomplish both short-term and longer-term implementation goals and identify potential funding sources.
9. **Isolate individual strategic priorities** and assign (or hire) a coordinator to implement each priority as resources and time permit.
10. **If resources are limited** for accomplishing proposed protection efforts**, apply for grants or loans** with assistance from partners who can implement the work.

Local and statewide technical, financial, and labor resources may be available to assist public water systems with the implementation of source water protection efforts. Community members and private landowners can volunteer to help with the implementation of protection strategies. There are grants and resources available from state and federal government agencies as well as from non-profits and private foundations (see section 3.0). Local experts in water quality, conservation, restoration, forestry, and fisheries may be willing to contribute their knowledge and time. Service organizations, schools (including colleges/universities), OSU county extension offices, soil and water conservation districts, and watershed councils can be a source of knowledge, labor, and sometimes funds. Local landowners and residents are often valuable resources with important insights and understanding of local ecosystems and land management strategies.

### 4.2.1 Oregon's Place-Based Integrated Water Resources Planning

Place-Based Integrated Water Resources Planning is a locally led, voluntary program that helps communities develop a holistic understanding of water resources, address complex water issues, and create a secure water future by identifying actions that promote and sustain a healthy economy, environment, and society. The process is collaborative, inclusive, and is designed to (a) gather information to develop a shared understanding of water resources and identify critical issues and knowledge gaps; (b) examine the existing and future in-stream and out-of-stream water needs for people, the economy and the environment; (c) identify and prioritize strategic, integrated solutions to understand and meet in-stream and out-of-stream water needs; and (d) develop, implement and update a place-based integrated water resources plan.

A place-based integrated water resources plan follows applicable state rules and guidance and:

- Is developed for a planning area associated with waters from sources within a shared hydrologic boundary
- Is developed in collaboration with a balanced representation of interests
- Addresses current and future in-stream and out-of-stream needs
- Includes the development of actions that are consistent with the state water resources policy and other state laws concerning the water resources of this state
- Is developed using an open, equitable and transparent process that fosters public participation and meaningful engagement with environmental justice communities
- Is developed in consultation with the Water Resources Department and other relevant state agencies
- Facilitates implementation of local water resources solutions and supports the knowledge and relationships needed to implement the solutions

- Assesses actions that are compatible with local comprehensive plans
- Strives to integrate solutions to cost-effectively achieve multiple benefits
- Is consistent with the guiding principles of Oregon's Integrated Water Resources Strategy.

The Oregon Water Resources Department and other state agencies provide guidance, funding, and technical assistance to place-based initiatives to bring interested parties together, assess and build collaborative capacity, develop and update plans, and coordinate plan implementation. Upon completion, state-recognized plans guide actions to meet current and future instream and out-of-stream water needs, help state agencies identify and consider regional priorities, and provide a platform for continued collaboration to solve complex water issues.

Public and domestic drinking water quality and quantity are an important existing and future water supply need that would be addressed as part of the OWRD Place-Based Integrated Water Resources Planning process. However, this process is inclusive of all other instream and out-of-stream water needs and is therefore more comprehensive in scope than just focusing on drinking water source protection.

Place-Based Water Planning grants may be available to help support initiatives interested in Place-Based Integrated Water Resources Planning. Go to the **OWRD Place-Based Integrated Water Resources Planning website** to learn more about the state supported planning process, find contact information for the program, and learn about planning grant availability.

## 4.3 Information Available to Support Surface Water Protection Efforts

This section will discuss the numerous sources of information that are freely available to water systems and communities to help identify potential sources of contamination and risks to source water quality. However, it is important to note that most forms of available information can only provide insight into the natural risks for a source area (i.e. areas of highly erodible soils) or for regulated potential contamination sources (i.e. locations of hazardous waste or mining sites). Water systems, communities and local representatives continue to have the best knowledge about unregulated risks in their source water area (i.e. illegal dump sites).

The Department of Environmental Quality's Drinking Water Source Protection program staff are available to assist public water systems with accessing, understanding, and using data to protect their drinking water sources.

Contact the DEQ Drinking Water Program for free technical assistance by emailing: **DrinkingWater.Protection@deq.oregon.gov.**

Sources of data on drinking water source area conditions and natural risks that could aid in developing plans and strategies for surface water protection include, but are not limited to, the following:

1. Data available from the original or updated source water assessment reports completed by Oregon Health Authority and the Department of Environmental Quality. Refer to section 2.3 in this resource guide to learn more about the information included in source water assessments and how to use that information to assess the susceptibility of a source to contamination. The original and updated source water assessment reports for public water systems using surface water sources are available from DEQ's website. Go to **DEQ's Source Water Assessment website** to find assessments for public water systems using surface water sources.
2. Drinking water source area map data layers. This includes data that the Drinking Water Source Protection Program creates and maintains in addition to map data that the Drinking Water Source Protection Program hosts on its online Drinking Water Source Protection online map viewer. Contact the DEQ Drinking Water Source Protection program if you need assistance accessing or understanding these maps and data layers by sending an email to: **DrinkingWater.Protection@deq.oregon.gov**

   Go to the **DEQ Drinking Water Source Protection Program interactive map viewer** to view the following data layers:

   - Drinking water source areas
   - Information on potential contaminant sources, including locations of hazardous materials and locations of roads, highways, and railways
   - Waterbody locations and flow paths from the United States Geological Survey (National Hydrography Dataset)
   - Impaired waterbodies from DEQ's water quality assessment process
   - Land ownership/use data
   - Satellite imagery
3. Past examples of drinking water protection projects undertaken by public water systems with funding support from OHA's Source Water Protection Fund. Go to **OHA's interactive GIS map** to see examples of previous drinking water source protection funded projects since 2008. Refer to the section on Oregon Health Authority Drinking Water Services in this resource guide (3.2.1) for more information on this funding source available annually to public water systems for source protection projects.

4. Land cover data available from the United States Department of Agriculture – National Agricultural Statistics Service. View the **USDA – NASS CroplandCROS web application** to view the Cropland Data Layer, geolocate farms, and assess landcover in map areas of interest.

5. Aerial photography (current and historic) from Google Earth. Go to the **Google Earth website** to explore available imagery and tools.

6. Oregon Department of Geology and Mineral Industries data layers:

   - Hazards data -- landslides, flood, tsunami, coastal erosion, earthquake shaking, fault, and volcano geohazards
   - Mining permit information
   - Geospatial data including Lidar and geologic information (rock types)

   Go to the **DOGAMI 'Interactive Maps and Geospatial Data' website** to access interactive maps, the mine site permit viewer, and the geospatial data.

7. Water quality and quantity data (groundwater levels, water use) from the United States Geologic Survey.

   - Go to **USGS's online National Water Dashboard** to access real-time water data.
   - Go to the **USGS Groundwater Data for Oregon website** to find information on current and historical groundwater data.

Additional data on land uses, management, or potential risks due to human activities:

1. Agricultural Water Quality Management Plan for your area. Agricultural Water Quality Management Area Rules and Plans completed by Oregon Department of Agriculture which are designed to prevent and control water pollution from agricultural activities and soil erosion on rural lands. Go to the **ODA Agricultural Water Quality website** for more information on the Agricultural Water Quality Plan Areas and Regulations. DEQ participates in ODA's effort to review and revise Agricultural Water Quality Management Area Plans and provides **status and trends reports**, information on drinking water resources near agricultural practices and other water quality comments on ODA's area rules and plans. To view this information for each agricultural area plan review, visit the **DEQ Area Plan Comments and Drinking Water Updates page.**

2. Confined animal feeding operations data from the Oregon Department of Agriculture. Various permits are required from ODA depending on the number of animals, length of time the animals are confined, and how manure and wastewater are managed onsite. Activities within the CAFO Program require public notice and

opportunities for participation from the public, and most facilities have an Animal Waste Management Plan. For more information see **Oregon Department of Agriculture's Frequently Asked Questions on the CAFO Program.**

3. Environmental cleanup site information about sites with known or suspected contamination from hazardous substances. Go to DEQ's **Environmental Cleanup Information Database website** to learn about cleanup sites and access cleanup site information via the Your DEQ Online web portal.

4. Leaking underground storage tanks for information on releases of hazardous substances (primarily petroleum products) from regulated or unregulated leaking USTs. Go to DEQ's **Leaking Tanks Database website.** DEQ also maintains information on Heating Oil tanks that have been decommissioned. See the **Heating Oil Tanks website** for more information.

5. Up to date information about locations of hazardous materials from the Oregon State Fire Marshall. Go to the **Hazardous Materials Storage Sites interactive map** to view current Hazardous Substance storage site information available from the OSFM Community Right to Know program**.** This program also tracks hazardous materials stored in aboveground storage tanks.

6. Water quality permits govern how wastewater and stormwater are managed. A DEQ water quality permit is required whenever there is a discharge of pollutants to waters of the state or to the ground. Waters of the state include surface waters (wetlands, pond, lakes, streams, rivers, etc.) and groundwater. Permits are required for discharges of wastewater (sewage, processing water, etc.), wash water, and even for wastewater that may be relatively clean, such as non-contact cooling water. Certain industries and activities may also be required to obtain permits for stormwater runoff from their properties. Go to **DEQ's Water Quality Permitting website** for more information. DEQ has a separate **Underground Injection Control website** for additional information on permitted systems that place fluids into the ground. Interested parties can subscribe to email notifications for all of DEQ's permitting topics by going to **DEQ's Public Notices** page.

7. Notifications for timber harvest, application of pesticides, road building activities, slash burning, etc. in forestlands. Visit the **Oregon Department of Forestry's FERNS website** to sign up for Forest Activity Electronic Reporting and Notification System notifications.

8. The Total Maximum Daily Load, or clean water plan, is a science-based approach to cleaning up polluted water so that it meets state water quality standards. TMDLs

primarily address direct impacts to surface water but may also consider pollutant loading from groundwater discharges. **DEQ's TMDL website** for basin specific information or to contact the appropriate DEQ Basin Coordinator. Refer to section 7.3 of this resource guide for more information on TMDLs and how water systems can leverage them to advance drinking water protection plans or projects.

9. Appendix 2 is a compilation of information on the most common potential impacts to the surface water drinking water sources in Oregon. This fact sheet lists the categories of land uses and activities that are identified in the source water assessment reports, then summarizes the potential impacts or risks from those activities. *Impacts will generally only occur when chemicals are improperly handled, or best management practices are not followed. The purpose of developing strategies to "protect" a drinking water source area is to reduce the risks of spills, pollutant release, or off-site movement of chemicals.* The Appendix 2 table provides key pollutant reduction ideas and resources for implementing drinking water source protection strategies.

## 4.4 Working with Private Landowners in Drinking Water Source Areas

If all or part of the drinking water source area is owned by entities other than the public water supplier, then engagement and cooperation with those landowner(s) is a necessary condition for successful drinking water source protection. Working with private landowners within drinking water source areas must be a top priority for any water system or community interested in implementing protection measures. This engagement could take the form of permission to evaluate and remedy degraded sites on the landowner's property, a cost-share agreement where the landowner does the work and the water system assists with the necessary expenses and resources or simply sharing information and encouraging the landowner to implement risk reduction practices on their own.

Regardless of what the specific protection strategies or goals are, working with private landowners will likely involve working with a technical assistance partner to assist with landowner engagement. Soil and water conservation districts or watershed councils are common partners for water systems to work with when engaging private landowners; see section 3.0 of this resource guide for more information on partnering with technical assistance organizations.

Some landowners will be reluctant to allow access to their property for liability and other reasons. Therefore, developing a carefully negotiated agreement can address those concerns. An agreement may take the form of a "Memorandum of Agreement" often used between municipal

entities and private or public landowners. The discussion and agreements with landowners in the drinking water source area regarding management practices (including potential agreements with monetary compensation attached) are an important tool for the success of the place-based planning process and source water protection projects.

There are many examples in Oregon of water systems and their communities working with private landowners to accomplish drinking water source protection goals. For a comprehensive example that can be applied on a smaller scale where needed, go to the **Eugene Water and Electric Board's Pure Water Partners Program website** to learn more about how this water system engages landowners within its drinking water source area. Landowners are incentivized to work with partner technical assistance organizations to receive property assessments and then can receive financial support to implement restoration work on their properties.

## 4.5 Place-Based Planning and Critical Lands Protection

Public water providers rarely have ownership of all or even part of the drinking water source area for their public supply intake(s), springs, or well(s). This means that water systems and communities lack control over what activities happen on privately owned lands despite their responsibility to respond to any potential contamination resulting from those activities.

A potential outcome of drinking water source protection planning is the identification of critical land areas that may have a substantial impact on source water quality or quantity. One strategy for reducing risk from these land areas is to use conservation tools that provide long-term protection and increase local control and management of environmental resources. Land conservation can provide a mechanism for communities to ensure the management of land within their drinking water source area protects and improves the quality and/or quantity of their drinking water sources. The most common models of land conservation are (1) the purchase or donation of land, and (2) the establishment of conservation easements that define allowable land uses on specified portions of privately owned land. Both methods require the participation of willing landowners.

Conserving land in drinking water source areas can provide many other benefits in addition to maintaining high source water quality or quantity. For example, land conservation can also protect the environment, increase the resiliency of the water system to the impacts from climate change, provide recreation and open space opportunities for communities, support local economies, and result in healthier and more equitable communities.

Water systems and communities that are interested in learning more about land conservation as a strategy should reference the **Guide for Using Land Conservation to Secure Clean and Reliable Drinking Water** (Coalition of Oregon Land Trusts 2022). This guide provides more

information about common land conservation tools, how land conservation tools can protect drinking water sources, and lists funding resources for land conservation projects.

Land trusts are important partners for land conservation projects. Reference section 3.1 in this resource guide for more information about partnering with land trusts.

# 5.0 Pollutant Reduction Tools

This section provides summaries and examples of tools that public water systems may find useful for implementing pollutant reduction strategies within drinking water source areas for surface water intakes.

For the purposes of this guide, a "tool" is defined broadly as an organized collection of data and/or information that may be used in informing technical assistance and implementation of drinking water source protection planning. A partial list of what can be considered a "tool" are maps, tables, diagrams, checklists, charts, online resources, scientific models and estimation methods, and other formats. The land cover related tools provided and referenced within this guide range in complexity from simple tables to high-resolution geospatial information system maps.

Several of the tools display statewide data that may not be directly transferrable for use at the local level due to the lack of resolution. Department of Environmental Quality Drinking Water Source Protection program staff are available to assist public water systems with accessing, understanding, and using data to protect their drinking water sources. In such cases where a local, site-specific, or tailored map or tool is needed, please make these requests directly to the DEQ Drinking Water Source Protection Program by emailing: **DrinkingWater.Protection@deq.oregon.gov** or see our **Drinking Water Source Protection Program Contacts webpage.**

Communities of sufficient size, resources, and other means may be able to develop drinking water source protection plans for their water resources without the use of the tools provided in this section. Many communities that fit this description have already taken steps to develop and utilize screening tools, resources, and strategies for reducing potential risks to their drinking water. Other communities may lack the information or data to engage landowners or land managers within the drinking water source area. These discussions may be aided by the tools provided in this section.

The tools provided in this section are intended to be used by public water system staff, managers, and community leaders with assistance received from their regional or county partner organization. A partner organization for community-led drinking water source protection efforts are most often the local soil and water conservation district, watershed council, the university

extension office, the USDA NRCS district, and/or possibly a contracted natural resources consultant. Early involvement of a partner organization is critical to ensure that screening tools are accessible, used properly, and are effective. It is important that public water systems and community leaders involve their regional partner organization at the outset when using screening tools provided in this section. The consolidated list of potential partner organizations for Oregon counties can be found in Section 3.0 of this resource guide.

The authors of this resource guide would like to stress that **none of the tools provided in this section are regulatory**. A community's decision to put the screening tools into use represents a voluntary community effort towards the broader, long-term goal of drinking water source protection planning. The tools provided in this section do not attempt to model a watershed, an aquifer, or the transport or fate of contaminants. Rather, they are appropriate initial screening tools to assess potential risks to drinking water sources and can guide community-led discussions. Screening tools provide a cost-effective way to focus and prioritize limited resources. None of the tools in this section should be considered "definitive" analysis or a "risk analysis" for surface water vulnerability or bacteria, sediment, or pesticide transport to waterbodies.

# 5.1 Data Available from Source Water Assessment Reports

OHA and DEQ developed source water assessments for all community water systems. Source water assessments provide water systems and communities with detailed information on the water that is the source of their drinking water, whether it comes from a groundwater well, spring, or surface water intake. Source water assessments contain valuable information about potential contaminant sources and susceptibility within the drinking water source area, including information about soil erosion potential, landslide hazards, and land uses.

For more information on why source water assessments were developed refer to Section 1.1.3 of this resource guide.

For more information on using source water assessment information to assess the susceptibility of a surface water source, refer to Section 2.3 of this resource guide.

# 5.2 Urban Homeowners and Pesticides

The use of pesticides in urban settings by residents is more patchy and unpredictable than agricultural pesticide applications. Urban homeowners tend to apply relatively high rates of general use pesticides on a per area basis for the maintenance of lawns, home gardens, and

ornamentals plants. Most homeowners apply pesticides with minimal or no training, and they usually apply pesticides without a pesticide applicator license (as general use pesticides do not require an applicator license). For these reasons there is a reasonable likelihood that residential pesticide applications can result in the transport of pesticides to streams or aquifers and result in localized or even regional water quality problems.

In recognition of this challenge, several larger municipalities in the Pacific Northwest created an online tool called Grow Smart, Grow Safe. The tool is both a website tool as well as a mobile application. Go to the **Grow Smart Grow Safe website** to learn more about this guide to safe lawn and garden products.

The guide provides homeowners with non-chemical options as well as comparative hazard ratings for different products depending on their intended use and application. This is a free resource to the public that is intended to assist homeowners in making informed decisions and thereby lead to a reduction of negative environmental impacts that are commonly associated with pesticide use. Grow Smart Grow Safe organizes its information and ratings by whether the intended user is managing for insects, weeds, plant diseases, and animal pests.

Additional information about less-toxic alternatives can be found at the National Pesticide Information Center's **Low Risk Pesticides website**.

Go to the National Pesticide Information Center's **Pesticide Ingredients Used in Organic Agriculture website** to learn about organic or naturally derived pesticides permittable for use in certified organic agriculture.

## 5.3 Common Crop-Pesticide Associations

Gaining a better understanding of land use activities within a drinking water source area is an important step towards developing strategies for drinking water source protection. It is advisable to use every available source of information about potential risks to a drinking water supply to help inform risk reduction priorities. Refer to section 4.3 in this resource guide for a summary of information available to support surface water protection efforts. After identifying the land uses and activities in the drinking water source area, the next step is to prioritize the reduction work based on the chemicals or pesticides that may impact the drinking water system. In this section, tools are provided that enable the public water system staff to identify the potential risks from pesticides.

The association of pesticides with specific land management practices can vary over time based upon several factors. Today's producers must continually adapt to many factors when considering what to grow year to year. However, county level statistics suggest that crop

selections and their yield tend to be relatively stable over the past two decades. The stability in cropping decisions is further supported by the consistency of USDA satellite crop imagery data. Proven pest management strategies tend to be carried forward from the previous year into the next. Where a crop-rotation plan is practiced, these operations typically rotate back through set grouping of crops as well as a corresponding set of pest management strategies. The possible variability in crops and pesticides can be addressed through precise mapping and working closely with the local agricultural partners.

Several resources or tools are described here that may be useful in identifying pesticides that are most associated with specific land uses or crops.

Appendix 3 at the end of this resource guide provides a starting point for determining which pesticides are most associated with specific crop types. While most of the land uses are specific crops, nursery operations, Christmas trees, and other non-crop land uses are included in these tools as they are available. *Please note that this table is simplistic and may not be representative of crop pesticides in your drinking water source area*. The table is included for educational purposes only. Local partners (reference Section 3.0) will be able to assist in identifying the actual crops and pesticides in use locally, and **site-specific pesticide use practices should be confirmed through communication with producers and landowners directly.**

Washington State University's Extension Service maintains an extensive online resource with information on crops and pesticides. Go to the **WSU Pest Management Resource Service website** to access information and resources targeted at commercial, agricultural, and home uses of pesticides.

WSU Extension Service also maintains the Pesticide Information Center Online Database that provides electronic copies of most Oregon registered pesticide labels. Users can search by pesticide name, by ingredient, or by crop type. This tool is most effectively utilized after drinking water providers and communities have already investigated which crop types or agricultural activities are present in their drinking water source area.

Go to **WSU Extension Service's Pesticide Information Center Online Database website**.

The United States Geological Survey has done extensive research on pesticides in both surface water and groundwater across the country. A summary of the USGS's findings regarding pesticides in surface and groundwater from 1991-2001 can be found at the **USGS's website**.

An important element of the USGS's research into water quality is their National Water-Quality Assessment Program. This program tracks pesticide occurrence and links that data to land uses. The USGS NAWQA program has developed pesticide-use maps that show the geographic distribution of estimated pesticide use on agricultural land in the conterminous United States for

numerous pesticides. Maps were created by allocating county-level use estimates to agricultural land within each county. Graphs at the county level are available that show annual use by major crop for the mapped pesticides (Thelin et al 2013). Pesticide use estimates are suitable for evaluating national and regional patterns and trends of annual pesticide use (Baker et al 2015). USGS notes that the reliability of estimates generally decrease with scale and these maps are not intended for detailed evaluations, such as within or between specific individual counties.

Go to the **USGS's Pesticide National Synthesis Project website** to view pesticide-use maps and to learn about the data sources and methodologies used to create the maps.

For purposes of providing additional tools to be used within drinking water source areas, DEQ used the data from USGS and Oregon-specific data for pesticides in statewide water quality monitoring to create a Categorical Crop to Pesticide Table (Appendix 4). It provides a broad association between common Oregon crops and pesticide use, potentially useful as another starting point in working to develop drinking water source protection strategies.

Additional information on pesticides and crop-pesticide association is the National Pesticide Information Center. The National Pesticide Information Center is a cooperative agreement between Oregon State University and the U.S. EPA. This site is an important reference for pesticide related information, providing science-based information about pesticides and pesticide-related topics, including information on health/environmental impacts, pest identification, pesticide label and MSDS databases, manufacturers, statistics, and records of exposures, etc.

Go to the **National Pesticide Information Center website**.

It is important to state again that pesticide use practices may have variability with respect to geography, time/season, and landowner decisions. The site-specific data for chemical and pesticide usage should be verified at the field level. The specific land uses, cropping patterns, and associated pesticides chosen by landowners/producers can change from one year to the next. Agricultural producers may need to adapt new strategies to manage pests. The pest pressures will vary from year to year, and chemical companies formulate new pesticides for review and potential registered usage in Oregon. Agricultural service partners may be able to assist with the outreach necessary to work with the landowners and operators so that there is an understanding of their practices and product usage.

## 5.4 Agricultural Best Management Practices

Drawing upon the extensive research available nationwide from USDA, universities, and other organizations, it is well known that some agricultural conservation practices are universally

beneficial to reducing the potential for pesticides or other pollutants to reach surface water. To provide background information on potential technical approaches, here are summaries of some of the leading agricultural conservation practices:

- Irrigation practices—restricting irrigation based on plant needs and soil water content can reduce the potential for pesticides to be moved off-target to contaminate groundwater or surface water. A selection of free-for-use irrigation scheduler applications for multiple irrigation methods are available at the **Washington State University Extension's Irrigation Calculator website**.
- Timing of pesticide applications—observing weather patterns and avoiding the application of pesticides preceding rain events considerably reduces the potential for off-target pesticide movement.
- Quantity of pesticide application—precision agriculture techniques are allowing producers to better utilize pesticides and their efficacy as a win-win for producers' profits and a way to reduce the potential for water quality impacts.
- Nutrient management—calculating the necessary nutrients using soil characteristics can maximize yields and protect water quality.
- Integrated Pest Management—developing non-chemical solutions (e.g. crop rotations, trap crops, beneficial insects, etc.)
- Conservation tillage—integrating crop residual through tillage and reduced tillage practices can provide increased returns in crop yield, enhanced soil health (increased nutrients and organic matter, better water infiltration and storage), and reduced erosion and water pollution (USDA 2016).
- Cover cropping—keep the soil surface covered and conserving nutrients by planting cover crops between market crops to build soil structure and health, retain nutrients, prevent erosion, and increase crop yields (USDA 2016).
- Organic farming---approved organic farms generally use natural pesticides or pesticides lower in toxicity and persistence.

The above points are a few of the key strategies that can lead to increased profits while at the same time reducing costs and the risks of off-site movement of potential contaminants.

A sampling of current innovations in Integrated Pest Management can be accessed through Oregon State University's **OSU's Integrated Plant Pest Protection Management Center website**.

Additional strategies for Integrated Pest Management can be sourced from local partner organizations in your county (see section 3.0 in this resource guide). *These same resources should also be consulted for technical assistance when attempting to use or implement the tools provided in this section of the guide.*

# 5.5 Nutrient Management

Municipal stormwater contributes a considerable amount of nitrogen from fertilizers used on private urban and commercial properties. On a per area basis, a relatively high amount of nitrogen and other macronutrients are applied to lawns, gardens, and ornamental plants throughout cities. The high rate of application, when combined with large amounts of impervious surfaces in urban settings, presents a considerable challenge to manage nitrogen and other nutrients for city planners. Urban zoning laws and building codes are increasingly taking into account the influence of impervious surface effect and the corresponding need to construct bioswales, buffers, and constructed wetlands to mitigate these effects. In most cases these requirements are only placed upon new and larger-sized development projects and they do not apply to existing or previously completed projects.

In 2014, DEQ issued "**Oregon's Nutrient Management Program**" guidance that discusses sources and source control for nutrients in Oregon.

Many tools for urban nutrient management can be found on the **EPA's Nutrient Pollution website**.

In agricultural areas, the Oregon Department of Agriculture addresses excessive nutrient runoff through implementation of Agricultural Water Quality Management Area plans and rules. Numerous financial incentives are available to encourage agricultural landowners to reduce nutrient runoff and off-site movement, including programs through the state Soil and Water Conservation Districts, Oregon Watershed Enhancement Board, DEQ's Section 319 nonpoint grants, and federal grant programs. The Oregon Department of Forestry also addresses nutrients in its fertilizer application management program.

Cover crops and no till operations have the benefit of reducing or even eliminating the need for fertilizer application. They reduce the leaching of nutrients, and they are protective of our shared drinking water resources. ODA assists farmers and ranchers in Oregon to prevent and control nutrient pollution from agricultural activities on rural lands.

Go to the **ODA Agricultural Water Quality website** for more information on the Agricultural Water Quality Plan Areas and Regulations and to find your area's ODA Water Quality Specialist.

Nutrient management within the agricultural sector is extremely important for maximizing yields and protecting water quality. Obtaining soil test data can allow producers to fine-tune fertilizer application with each consecutive crop cycle. An additional benefit of obtaining soil sample results is that they may influence a producer's decision for which cover crop to use. Soil sampling for nutrients is best done in the spring before planting and in the fall after harvest. The

spring samples are useful for knowing the concentration of nutrients already present, so the fertilization rates can be adjusted. The fall sample is an effective measure of how much of the nutrient addition was not used by the crop, so the fertilization amount can be adjusted in the next season.

One solution for minimizing fertilizer inputs to agricultural fields is for agricultural producers to incorporate cover crops into their crop cycle. Oregon State University hosts a free online cover crop calculator that allows producers to compare the nutrient value and cost of cover crops, organic and synthetic fertilizers, and compost in acre and 1,000 square foot units. The leftover nutrients after harvest can be carried over to the next seasons and the leaching of these nutrients during heavy winter rainfall events can be minimized through the use of winter cover crops.

Go to **OSU's Organic Fertilizer and Cover Crop Calculator website** to access this tool and other fertilizer related resources.

When excessive nitrogen remains in the soil, a grass cover crop may effectively take up nitrogen and conserve it for spring planting as a "green manure." Legume cover crops fix additional nitrogen from the atmosphere and are best used when soils are deficient for nitrogen. Legume cover crops are capable of fixing up to 150 pounds of nitrogen per acre—enough nitrogen for some of the most heavy nitrogen feeding crops (Hoorman et al 2009). The organic matter produced during the winter months provide a "soil building" benefit to the soil, effectively increasing tilth for present and future production. The use of cover crops have also been found to "jump start" the increase yields obtained from no-till or conservation tillage practices (Hoorman et al 2009). Where conversion to no-till operations have taken as many as nine years to observe increased yields, combining cover crops with no-till practices have reduced or even eliminated this lag time to see increased yields more quickly.

## 5.6 Addressing Per- and Polyfluoroalkyl Substances

In April 2024, EPA announced the final National Primary Drinking Water Regulation for PFAS, establishing legally enforceable levels for six compounds and mixtures containing PFAS. While funding is available to help water systems install treatment, removing PFAS is expensive and requires major investments. One way to reduce PFAS contamination is to understand where it comes from and how vulnerable your water source is.

**Key Steps to Assess and Protect Your Water Source:**

1. Check Your Water Source's Vulnerability
    - Review your Source Water Assessment to understand your susceptibility.

2. Review Your Drinking Water Source Area and Identify Possible PFAS Sources
    - Facilities that have Emergency Response/Fire control capability such as: Airports, military bases, fire training centers, fuel storage areas, railyards.
    - Waste treatment facilities: Sewage plants, landfill sites, areas where biosolids are spread.
    - Industries using PFAS: Factories, cleanup sites, and businesses with a history of PFAS use.
    - Consider both existing and future industrial developments that could pose a risk.
    - More information on potential PFAS sources can be found on the **Interstate Technology Regulatory Council PFAS uses and products website.**
3. Reducing PFAS Risk at Businesses & Industrial Sites
    - Review **DEQ's Drinking Water Source Protection Strategies for Commercial and Industrial Land Uses** and consider other general or business sector specific strategies for pollution risk reduction.
    - Inform facility owners if they are in a drinking water source area.
    - Share information with business owners about pollution prevention.
    - Ask if they have used PFAS and encourage safe handling practices.
    - Provide guidance on reducing toxic chemical use (resources available from **DEQ's non-regulatory Toxics Use/Waste Reduction Technical Assistance Program**).
    - Ensure businesses follow best management practices for wastewater and stormwater.
4. Reducing Risk at Landfills & Wastewater Treatment Plants
    - Inform facility owners if they are in a drinking water source area.
    - Check for past or current PFAS testing and encourage better waste management.
    - Work with regulators to ensure proper compliance and risk reduction.
5. Addressing Contaminated Sites
    - Check **DEQ's Environmental Cleanup Site Information database** for known contamination risks.

Contact **DEQ Cleanup program** or Drinking Water Source Protection staff for guidance and support in reducing water contamination.

An additional resource for water systems is the **Pollution Prevention Resource Center's Preventing PFAS Pollution: Drinking Water Source Protections document**.

By taking these steps, water providers can better protect their sources and reduce PFAS contamination before it becomes a bigger issue.

## 5.7 Potential Goals and Outcomes for Using Tools

The tools in this section are provided to assist public water system officials in understanding some of the primary tools and best management practices to reduce off-site migration of pollutants such as nutrients, sediment (soil), or pesticides. The tools may be useful in the following practical ways:

- For prioritizing technical assistance and outreach efforts
- To inform the creation and composition of an inclusive community-led drinking water source protection planning committee
- As a technical basis for submitting grant requests for drinking water source protection projects
- As a basis for needing comprehensive modeling of local contaminant sources (e.g. follow-on grants, studies, and/or modeling efforts)
- As justification for new/renewed water quality monitoring/sampling activities

The use of these tools is best done through collaborative place-based planning approaches. *In practice, keep in mind that most of the coordination and collaboration of the agricultural community will be done through your local partners such as watershed councils, soil and water conservation districts, and National Resource Conservation Service staff.*

# 6.0 Land Uses and Regulatory Authorities

The Department of Environmental Quality, along with the State Departments of Forestry, Agriculture, State Lands, Geology and Mineral Industries, Fish and Wildlife, Parks and Recreation, Land Conservation and Development, and Marine Board have regulatory authority or advisory roles associated with land use activities that potentially impact water quality. Two of the primary mechanisms for DEQ to regulate pollution is through the adoption of water quality standards and Total Maximum Daily Loads and the related implementation plans. TMDLs and their implementation plans are designed to control source pollution to bring water bodies into attainment with the water quality standards adopted by the state for water bodies in Oregon. Water bodies meeting water quality standards should be readily useable as drinking water sources with use of standard treatment technology.

In DEQ's rules, a "source" is defined as any process, practice, activity or resulting condition that causes or may cause pollution or the introduction of pollutants to a waterbody (OAR 340-42-0025). Sources of pollutants can be point sources or nonpoint sources. Under ORS 468B.110 (1), DEQ has the specific authority to take the actions necessary to attain and maintain water quality standards and to implement load allocations established under a TMDL. Management strategies to achieve wasteload and load allocations in a TMDL are implemented through water quality

permits for those sources subject to permit requirements in ORS 468B.050 and through source-specific Water Quality Management Plans for other sources.

Nonpoint source pollution is pollution from a diffuse area as opposed to point sources from a discrete pipe, ditch, etc. At DEQ, nonpoint sources are addressed through the following programs: Water Quality Standards, Water Quality Assessment, Groundwater, TMDLs, §319 Nonpoint Source Planning and Grants, Drinking Water Source Protection, Clean Water State Revolving Fund, Pesticide Stewardship Partnerships, and Water Quality Monitoring. DEQ also coordinates with federal and state agencies that are responsible for nonpoint source issues and identifies them as Designated Management Agencies. The Water Quality Management Plans identify the source-specific implementation requirements and the persons, including Designated Management Agencies, responsible for developing, implementing, and revising those plans.

There are two areas where DEQ's authority is limited under OAR 340-42-0080 for nonpoint source controls: in forested and agriculture land uses. Nonpoint source discharges of pollutants from forest operations on state or private lands are subject to best management practices and other control measures established by the Oregon Department of Forestry under the ORS 527.610 to 527.992. Oregon DEQ may not impose or enforce effluent limits on nonpoint source discharges from forest operations subject to the State's Forest Practice Act, unless such limits are required by the Clean Water Act or other federal law.

The Oregon Department of Agriculture regulates agricultural activities through Agricultural Water Quality Management Area rules. In areas subject to the Agricultural Water Quality Management Act under ORS 568.900, the Oregon Department of Agriculture develops and implements agricultural water quality management area plans and rules to prevent and control water pollution from agricultural activities and soil erosion on agricultural and rural lands.

Regulatory responsibilities vary by land use and ownership type. It is important that public water systems and community members understand which agencies have authority for regulation of human activities and land uses, the structure of those regulations, and the individual agency responsibilities. *The landowner is ultimately responsible for management activities and potential off-site impacts, so in addition to regulatory agencies, community engagement with landowners in a drinking water source area can be a critical component to implement strategies for improving water quality.*

# 6.1 Agricultural Lands

Oregon regulates agricultural activities through programs administered by the Oregon Department of Agriculture. The Confined Animal Feeding Operation Program regulates animal facilities such as dairies and large chicken and hog operations. CAFOs are point sources of

pollution under Oregon and federal law, and many must have a permit to operate. The permits provide for zero effluent discharge limits. For more information, please go to **ODA's Confined Animal Feeding Operations website**.

The Agricultural Water Quality Management Program regulates animal production activities not regulated by the CAFO Program and all other agricultural activities that may impact water quality. The Agricultural Water Quality Management Act, formerly referred to as Senate Bill 1010, gives the Oregon Department of Agriculture the authority to establish management plans and adopt rules to prevent and control water pollution from agricultural lands. These areas include those where an agricultural water quality management plan is required by state or federal law, such as DEQ Total Maximum Daily Loads and Oregon Groundwater Management Areas (ORS 568.909). ODA's Agricultural Water Quality Management Area plans and rules are the official TMDL implementation plans for agricultural nonpoint sectors.

There are 38 management areas throughout the state with area plans and rules that regulate agricultural activities to prevent and control water pollution. All 38 management areas have riparian rules requiring that agricultural activities allow the establishment and growth of stream-side vegetation to provide specific functions such as: moderation of solar heating (shade), filtration of overland flow, and stream bank stability. Go to **ODA's Agricultural Water Quality Further Plans and TMDL Implementation Plans website** to view a management area map, access management area documents, and find program contact information. There are no explicit statewide buffer requirements for agricultural land uses – refer to Appendix 2 for a compilation of riparian management widths and rules (including for agricultural uses).

DEQ participates in ODA's effort to review and revise Agricultural Water Quality Management Area Plans consistent with ORS568.930. During the biennial review process, DEQ provides status and trends reports, information on drinking water resources near agricultural practices and other water quality comments on ODA's area rules and plans. To view this information for each agricultural area plan review, visit **DEQ's Area Plan Reviews and Comments** page and **DEQ's Water Quality Status and Trends Analysis** webpages

Oregon Department of Agriculture's Pesticide Program regulates the sale and use of pesticides in Oregon. Program staff conduct routine compliance monitoring, investigate complaints of alleged pesticide misuse, and administer enforcement actions when appropriate. Enforcement actions, including civil penalties, play a vital role in deterring unlawful use of pesticides. Additional responsibilities include communicating the laws and regulations to licensed pesticide applicators and the public. This is done through continuing education training resources, informational brochures, the ODA website, and one-on-one communication.

For more information about ODA's regulatory authorities go to the **ODA Laws and Rules website**.

## 6.2 Commercial and Industrial Lands

Oregon waters can be susceptible to contamination from many different commercial or industrial land uses. These facilities are generally the most highly regulated of any land uses. However, even facilities that are required to have permits for building, material storage or waste discharge may still pose a risk. Many regulations applicable to commercial and industrial facilities rely upon response to contamination events, rather than on preventing problems. In addition, some facilities are not regulated. Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact drinking water supplies. There are many ways to raise awareness of the need for protection including facilitating changes in the day-to-day operations at the existing businesses to reduce the risks of surface water or groundwater contamination. See DEQ's **Drinking Water Source Protection Strategies for Commercial and Industrial Land Uses** for strategies designed to protect against potential contamination.

DEQ is responsible for waste reduction and management from commercial and industrial activities, air quality monitoring, spill preparedness and response, environmental assessment and cleanup, and underground storage tank compliance and cleanup. Oregon's Toxics Use Reduction and Hazardous Waste Reduction Act of 1989 was one of the first laws in the nation to mandate pollution prevention planning. The Act outlines a comprehensive approach to reduce or eliminate toxic chemical use and hazardous waste generation. In June 2005, the Oregon Legislature passed a law (Oregon Revised Statute 465.003 to 465.037) that streamlined and made other significant changes to the Toxics Use and Hazardous Waste Reduction Program.

Large toxics users, large quantity generators, and small quantity generators must prepare a Reduction Plan or an Environmental Management System. As part of the planning, a facility must evaluate options to reduce its toxics and hazardous wastes. Materials that must be in the plan include any toxic substance reported to the U.S. Environmental Protection Agency under the Toxics Release Inventory program.

Since the Act's adoption, businesses throughout Oregon have reduced their toxic chemicals and hazardous wastes. DEQ publishes pollution prevention stories to explain how businesses are reducing their toxics and hazardous waste. In the program's 21 years, businesses have voluntarily reported reducing more than 31.5 million pounds of hazardous waste with savings estimated at $5.25 million and reducing more than 56.25 million pounds of toxic chemicals with savings at over $15 million.

Go to **DEQ's Toxic Reduction and Safer Alternatives website** for more information on toxics reduction.

When there are spills or releases that contaminate groundwater or surface water, DEQ's Site Assessment program investigates hazardous substance sites that may require further action to protect health and the environment, ranks sites based on threat to human health and the environment, overseeing limited removal and remedial actions, and maintains DEQ's Environmental Cleanup Site Information database. When extensive investigation and appropriate cleanup of hazardous substance site is necessary to protect public health and the environment, the Site Response program works to investigate and clean up contaminated hazardous waste sites throughout Oregon.

## 6.3 Federal Lands

Federal lands in drinking water source areas are primarily forestlands and rangelands managed for multiple uses including watersheds and water quality, biodiversity and endangered species, recreation, and forest products. The United States Forest Service and the Bureau of Land Management manage these lands in National Forests and Districts, respectively.  Each National Forest and BLM District has a unique management plan, but all have common features. In the past, the federal agencies have entered into agreements with municipalities and water districts to ensure protection of drinking water sources on federal lands.

In August 2016, BLM approved new Resource Management Plans for western Oregon. The approval marked the end of a four-year effort by the BLM to use new science, policies, and technology to protect natural resources and support local communities. DEQ's drinking water source protection staff evaluated the proposals to provide input to BLM so that those federal lands will continue to provide high quality water for ecosystems and domestic use.

BLM's Resource Management Plans provide direction for the management of approximately 2.5 million acres of BLM-administered lands, and maintain strong protections for the northern spotted owl, listed fish species, and water resources while offering predictable and sustainable outcomes for local communities from tourism, recreation, and timber harvest.

Go to **BLM's Oregon/Washington Planning and NEPA website** for more information on the agency's resource management plans.

## 6.4 Aggregate & Mineral Mining / Extraction Wells

Development, use, and reclamation of rock pits or quarries are regulated by the Department of Geology and Mining Industry. DOGAMI acts as DEQ's agent for water quality permitting (under

a *Memorandum of Understanding*) and adds permit conditions to the Operating Permit for each facility to ensure compliance with state regulations. Many quarries contain process water and stormwater runoff on-site which minimizes the risks of groundwater or surface water pollution. Landowners are required to obtain the following Water Pollution Control Facility or National Pollution Discharge Elimination System permits if they discharge process water or otherwise discharge water from their site:

- DEQ WPCF 1000 General Permit--- for disposing of process water by evaporation or seepage in ponds or by irrigation (issued through DOGAMI);
- DEQ NPDES 1200-A General Permit--- for stormwater from the mining operation and haul roads that drains to surface waters (issued through DOGAMI);
- Individual DEQ NPDES or WPCF Permit--- for discharging process wastewater to surface water or groundwater (issued by DEQ).

Rock pits or quarries located on forestland and used for forest management are exempt from needing a DOGAMI mine operating permit but under the Forest Practices Act (OAR 629-625-0500), they "shall be conducted using practices which maintain stable slopes and protect water quality". On forestlands, the regulating agency for rock pits or quarries is the Department of Forestry.

DOGAMI is also the permitting agency for extraction wells, such as gas, oil, and geothermal wells. DOGAMI coordinates with DEQ to address NPDES or WPCF permitting to protect water quality. More information on the permits for surface mining, wells, or chemical process mining in Oregon can be found on **DOGAMI's Mineral Land Regulation and Reclamation website**.

# 6.5 State and Private Forest Lands

Forestry activities on state-owned and private lands are regulated by the Oregon Department of Forestry. The statutes and rules, referred to as the "Forest Practices Act", are implemented by ODF and address the overall maintenance of the following resources: (a) air quality; (b) water resources, including but not limited to sources of domestic drinking water; (c) soil productivity; and (d) fish and wildlife (ORS 527.710(2)). The forest practice rules address chemical use, pesticides, and water protection provisions governing activities in or adjacent to water bodies, wetlands, and riparian areas (OAR 629-635-0000 to 629-660-0060). The overall goal of the water protection rules is to provide resource protection during operations adjacent to and within streams, lakes, wetlands and riparian management areas so that, while continuing to grow and harvest trees, the protection goals for fish, wildlife, and water quality are met. Refer to Appendix 2 for a compilation of riparian management widths and rules for forestry.

Forest practice rules related to water quality (as prescribed in ORS 527.765) must ensure that, to the maximum extent practicable, non-point source discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of the water quality standards (OAR 629-035-0100(7)(a)-(c)). Forestry rules specify harvest protections for riparian areas and some steep slopes, chemical use (including pesticides), reforestation requirements, and road construction and maintenance.

Go to **ODF's Laws & Rules website** to access the Forest Practice Administrative Rules and Forest Practices Act rulebook and to see other laws and rules related to ODF.

Go to the **Oregon Forest Resource Institute's publication library website** to view an illustrated manual for Oregon's forest protection laws that includes the Private Forest Accord updates.

State-owned forestlands are referred to as "Board of Forestry lands". State forestlands are actively managed under forest management plans to provide economic, environmental, and social benefits to Oregonians. ODF manages approximately 745,000 acres, or approximately 3% of the state's forestland.

Go to **ODF's State Forests website** to learn about Oregon's state forest resources, to access management and planning documents, and to learn about conservation and restoration analyses and projects.

The overall goal of managing state-owned forestlands is stated as follows: "Oregon Revised Statutes direct that Board of Forestry Lands shall be managed by the State Forester to 'secure the greatest permanent value of such lands to the state'." The goals for state forestlands include maintaining healthy watershed conditions to support the beneficial uses of the waters of the state both in terms of water quality and water quantity. Public water systems with state forestlands within their source area may consider contacting the District or State Forester to ensure that management of the forest will maintain the quality and quantity of public water supplies for community water systems, and that the drinking water beneficial use is adequately considered when determining the greatest permanent value of these lands to the state. An economic analysis of the value of the land to provide long-term community drinking water may be helpful for demonstrating this.

## 6.6 Onsite Septic Systems

Approximately 30 percent of Oregon households rely on onsite septic systems to treat their sewage. Properly functioning septic systems treat sewage to minimize groundwater and surface

water pollution. A malfunctioning system can be a health hazard and will harm natural resources.

Under state law, the DEQ is responsible for ensuring that septic systems are sited, installed, and operated so that Oregon's land, water, and public health are protected. Improperly functioning septic systems can pollute streams and groundwater and be a public health hazard. Owners of onsite systems must operate and maintain their systems in compliance with all permit conditions and applicable requirements in this rule division and must not create a public health hazard or pollute public waters (*OAR 340-71-0130 General Standards, Prohibitions, and Requirements)*.

Many counties implement the onsite system regulations within their county on behalf of DEQ, and some counties have additional requirements beyond those in state rules. Go to **DEQ's Onsite Wastewater Management Program website** for more information on regulatory oversight and counties that administer state and local rules.

A new program was initiated in 2016 between DEQ and a regional nonprofit lender "Craft3" to make repairs more affordable for Oregonians in need. The new partnership provides funds to help Oregonians get their septic systems fixed.

The Clean Water Loans will allow homeowners to pay for all costs associated with the project, including:

- Septic system design
- Relevant permits
- Installation of the new septic system
- Ongoing maintenance
- Essential safety measures, such as those to prevent children from falling into septic tanks

Special rates and deferred payment options may be available for homeowners with lower incomes. Go to the **Craft3 Clean Water Loans website** to learn more about the program and apply for loans. In addition, several public water systems have implemented cost-share programs for local homeowners conducting septic system inspections and repairs in areas that could impact drinking water quality if the septic system fails or is not functioning properly.

There are excellent resources available to assist homeowners with septic systems. EPA's "Septic Smart" program includes resources for septic system owners for the repair and maintenance of septic systems as this helps protect the quality of groundwater and downgradient surface water. Go to **EPA's Septic Smart website** for resources and more information.

# 6.7 Pesticide Regulations

Pesticide use is governed by the Federal Insecticide, Fungicide, and Rodenticide Act and corresponding state law (ORS634.005-.992). In the United States there are an estimated 18,000 pesticide products currently in use – these products are generally regulated under the Federal Insecticide, Fungicide, and Rodenticide Act although approximately 5,800 pesticide products are used in food production and therefore also regulated under the Federal Food, Drug, and Cosmetic Act (Esworthy & Yen 2012). Agencies responsible for implementation in Oregon are the EPA, the Oregon Department of Agriculture, the DEQ, and the Oregon Department of Forestry (for non-federal forestlands).

For a summary of Oregon pesticide regulations with regard to drinking water sources, please see **DEQ's fact sheet on Pesticide Use in Vicinity of Drinking Water Sources**.

Exposure to various pesticides has been linked to brain/central nervous system, breast, colon, lung, ovarian, pancreatic, kidney, testicular, and stomach cancers, as well as Hodgkins and non-Hodgkins lymphomas, multiple myeloma, and soft tissue sarcoma (Clapp 2007). Chemicals that have been classified by the International Agency for Research on Cancer as known, probable, or possible human carcinogens are used in some EPA-registered pesticides now on the market. For example, glyphosate, malathion, and diazinon are still registered for use in the United States but have been classified as probably carcinogenic to humans by the International Agency for Research on Cancer (2017).

## 6.7.1 Oregon Department of Agriculture Pesticide and Fertilizer Program

ODA's Pesticide Program regulates the sale and use of pesticides. Program staff conduct routine compliance monitoring, investigate complaints of alleged pesticide misuse, and administer enforcement actions when appropriate. Enforcement actions, including civil penalties, play a vital role in deterring unlawful use of pesticides. Additional responsibilities include communicating the laws and regulations to licensed pesticide applicators and the public. This is done through continuing education training resources, informational brochures, the ODA website, and one-on-one communication.

Go to **ODA's Pesticide, Fertilizer, and PARC programs website** to learn more about how ODA's programs regulate the sale and use of pesticides and fertilizers in Oregon.

## 6.7.2 Pesticide Stewardship Partnership Program

The Pesticide Stewardship Partnership Program is a voluntary program that relies on local partnerships to monitor pesticide levels in waterways and to enact solutions to protect water quality while also managing pests and maintaining crop yields. The Oregon Department of Agriculture is the state lead for the PSP program and leads an interagency team called the Water Quality Pesticide Management Team.

The PSP Program uses water quality sampling data to evaluate pesticides of concern, conducts local outreach and technical assistance efforts designed and implemented based on water quality data findings, and evaluates the effectiveness of these education and collaboration projects annually. The PSP program also conducts free waste pesticide collection events for proper pesticide disposal from agricultural and commercial applicators.

The Department of Environmental Quality's drinking water source protection program provides information on public drinking water source areas and public water system partners to help prioritize areas for Pesticide Stewardship Partnership implementation. Several waste pesticide collection events benefiting drinking water source areas occurred in 2014, including a project in Milton-Freewater that collected more than 15,000 pounds of chemical product. The collection area for the Milton-Freewater pesticide waste collection event included the drinking water source area for Milton-Freewater's public supply wells, serving over 7,000 people.

Go to the **DEQ's Pesticide Stewardship Program website** and **ODA's Pesticide Stewardship Partnership website** to learn more about where the program currently operates in Oregon, learn about the pesticide waste collection program and to request a pesticide collection event in your area. In addition, **DEQ's Pesticide Stewardship Program Data Viewer** provides access to water quality data collected by the Pesticide Stewardship Partnerships Program.

Go to the interagency **Pesticide Management Plan for Water Quality Protection** (2011).

## 6.7.3 Pesticide Analytical & Response Center

The Pesticide Analytical and Response Center was created by executive order in 1978. The program was reauthorized under the Oregon Department of Agriculture in 1991 (ORS 634.550).

PARC is a multi-agency group that responds to pesticide-related incidents in Oregon with suspected health or environmental effects. It acts as a central location that receives Oregon-specific pesticide incident information. The main activity that PARC is mandated to perform is to **coordinate investigations into pesticide incidents in Oregon.** It also collects and analyzes

information about reported incidents. PARC does not have regulatory authority – it relies on member agencies to conduct investigations and take necessary enforcement actions

**To report a pesticide incident that has impacted people, animals, or the environment, you can:**

- **Call: 503-986-6470 -** Your phone call will be routed to a specialist to take your information and PARC staffers will contact you within one business day.
- **Email: naturalresource-complaints@oda.oregon.gov**
- **Notify the Oregon Emergency Response System** by calling 911

Go to the **ODA PARC website** to learn more about PARC and access pesticide resources.

Other pesticide resources available for free online include:

- For a summary of Oregon pesticide regulations with regard to drinking water sources, please see **DEQ's fact sheet on Pesticide Use in Vicinity of Drinking Water Sources**.
- Human Health Benchmarks for Pesticides in Drinking Water – the Environmental Protection Agency developed human health benchmarks for 430 pesticides to (1) help provide information about whether the detection level of a pesticide in a drinking water source or in finished water may indicate a potential health risk, and (2) to help prioritize water monitoring efforts. The benchmarks indicate levels in water below which no adverse health effects are anticipated. The benchmarks include values for short term and lifetime exposure and cover both cancer and non-cancer risks. The benchmarks are based on studies and data that EPA receives through the pesticide registration process. The Human Health Benchmarks for Pesticides table includes pesticides for which EPA's Office of Pesticide Programs has toxicity data but for which EPA has not yet developed either enforceable Maximum Contaminant Levels or non-enforceable Health Advisories. Go to the **EPA's Human Health Benchmarks for Pesticides website**. Go to the **EPA Fact Sheet about the Human Health Benchmarks for Pesticides** update that was done in 2021 to learn more about how to interpret Human Health Benchmarks information and how the information was developed.
- The United States Geological Survey developed health-based screening levels to supplement the Environmental Protection Agency's Maximum Contaminant Levels and Human Health Benchmarks for Pesticides information. USGS developed health-based screening levels for contaminants that lack either Maximum Contaminant Levels or Human Health Benchmarks. Go to **USGS's Health-Based Screening Levels for Evaluating Water-Quality Data website** to access the searchable table that includes 835 different contaminants.
- Go to the **EPA's National Primary Drinking Water Regulations website** to learn about legally enforceable standards (i.e. maximum contaminant levels) that apply to public

water systems (including some pesticides). Learn more about Oregon's Maximum Contaminant Level rules by referencing **Oregon Administrative Rules 333.061**. Contact OHA Drinking Water Services staff for assistance in understanding MCL rules or any other water screening levels for contaminants in finished drinking water.

- Go to the **EPA's Drinking Water Health Advisories website** to learn about contaminants (including pesticides) that are not subject to Maximum Contaminant Level regulations but that can cause adverse human health impacts at certain levels of exposure.
- The Pesticide Data Program is a national pesticide residue monitoring program that produces comprehensive pesticide residue databases for the United States. Go to the United States Department of Agriculture's **Pesticide Data Program website**.
- Oregon Department of Agriculture's **ODA's Pesticide Storage and Disposal program website** provides information about the waste pesticide collection program, pesticide storage resources, and pesticide spill reporting and clean up information.
- Oregon Health Authority's Pesticide Exposure, Safety and Tracking Program: This program tracks and investigates health effects reported by people exposed to pesticides. Go to **OHA's Pesticide Exposure website** to learn more about the program or to report a pesticide exposure incident.

# 6.8 Water Quality Permits

Point sources of pollution are from contaminants that enter the environment from a single, identifiable source. These identifiable, point sources of pollution are typically from facilities that receive a permit to discharge a specified amount of a pollutant into a receiving water body under certain conditions. In Oregon, construction stormwater, industrial facilities, municipal stormwater in cities over a certain size, and wastewater/sewage treatment facilities are all regulated by the DEQ through the issuance of National Pollutant Discharge Elimination System permits.

NPDES-permitted facilities are those which discharge pollutants from any point source, such as a pipe, to state waters. If a facility discharges to the ground, it requires a Water Pollution Control Facility permit. NPDES permits from DEQ are required for stormwater and process discharges to surface waters from construction and industrial activities and larger municipalities if stormwater from rain or snow melt leaves a site through a "point source" and reaches surface waters either directly or through storm drainage. As a result, stormwater discharges from large and medium sized municipal storm sewer systems are required to have NPDES permits. Similarly, NPDES stormwater permits are required for most industrial properties and for construction affecting one acre or more of land, including projects that are less than one acre that are part of a larger common plan of development that ultimately disturbs one acre or more.

Some water quality permits are administered directly by DEQ, but several of DEQ's general permits are administered by other agencies through Memoranda of Agreement or Understanding. Examples of permits administered through other agencies include:

- GEN800 permit for Confined Animal Feeding Operations administered by the Oregon Department of Agriculture
- GEN1000 permit for gravel mining administered by the Oregon Department of Geology and Mineral Industries
- National Pollutant Discharge Elimination System 1200A for off-site discharge of storm and process water from gravel mining administered by the Oregon Department of Geology and Mineral Industries
- 1200C and 1200CN for stormwater runoff from construction activities administered by various local government agencies. Other permits are administered directly by DEQ.

In urban areas, city governments are primarily responsible for regulations. In rural areas, counties are primarily responsible. Rural residential activities related to livestock and farming activities are regulated by the Oregon Department of Agriculture. Rules and ordinances vary among cities and counties, so restrictions on residential land activities will be different depending on the location of a given drinking water source area.

Runoff from rural communities and rural residential areas remains largely unregulated, except to the extent that it may be covered by an implementation plan developed by a local government or special district as a designated management agency identified under a Total Maximum Daily Load plan. Small rural "farmsteads" are subject to regulation by the Oregon Department of Agriculture. Local governments operating as designated management agencies may develop TMDL implementation plans both for properties over which they have proprietary control (e.g. a street system or park) and for areas where they maintain regulatory authority (police power or land use planning) over private property.

The DEQ regulates Underground Injection Control well discharges. Underground injection wells are used to place fluid underground into porous geologic formations. These injection systems include any discharges below the ground or subsurface including geothermal systems, large capacity septic systems, and aquifer storage and recovery systems. The most common UIC systems in Oregon are stormwater drywells, which are usually found on large parking lot surfaces or streets. DEQ issues permits for UIC systems under the Safe Drinking Water Act to protect water quality. DEQ maintains a database of Class V wells. Go to **DEQ's Underground Injection Control website** to learn more about the permitting program, learn about the contaminants of concern associated with UICs, and find program contact information.

# 7.0 Important Surface Water Quality Issues and Programs

The number of different potential challenges facing drinking water providers using surface water sources is large. This section provides additional information about water quality issues of particular importance to surface water sources, including climate resilience, harmful algal blooms, nonpoint sources of pollution, and per- and poly-fluoroalkyl (PFAS) substances. This section also includes information about programs with a potential drinking water quality nexus that can be resources or partners to drinking water providers, including DEQ's Standards, Assessment, and Total Maximum Daily Loads program.

## 7.1 Climate Impacts to Surface Water Sources of Drinking Water

The purpose of this section is to provide an overview of how evolving environmental conditions are already affecting and will continue to affect the Pacific Northwest. It is important for water systems and communities to assess how changing conditions will impact their source water area and use this information to update their protection strategies. Climate change will likely increase the risks to water quality from potential sources of contamination, introduce new contamination concerns over time, , and may affect water availability throughout the year.

The Oregon Department of Environmental Quality recognizes the importance of building ecological and social resiliency in watersheds that supply drinking water. While resiliency can help reduce the potential impacts of climate-related pressures, what it looks like will vary for each watershed and community. Land management actions in source areas can help buffer the effects of extreme weather, but they can also unintentionally increase risks to source water quality or quantity if not done carefully. One example of cultivating ecological and cultural resiliency in a forested watershed is community ownership of forestland and subsequent stewardship to meet drinking water quality and community-defined goals.

Climate change is already affecting the Pacific Northwest, and alterations to our regional as well as global climate are expected to continue for decades. Effects of climate change include more frequent and larger storms, drier summers, wetter winters, shifts in the timing and form of precipitation (for example, less snow and more rain), increased wildfire severity, increased stream temperatures, and reductions to summer and early autumn streamflow. Larger storms increase surface erosion (Lanini et al 2009) and are more likely to trigger landslides (Robison et al 1999, Turner et al 2010). Based on evaluation of drinking water data, the most significant

direct impact of intense storms to watersheds is an increase in turbidity levels – that is, an increase in materials in the water that decrease water clarity (commonly soil).

Elevated turbidity often results in increased maintenance for drinking water treatment and costs to residents. Pollutants, such as fuels or pesticides, can stick to the surface of soil particles. When contaminated soil is transported into streams it can also increase public health risks. Regardless of the source, high dissolved and/or fine particulate organic matter in streams often requires more chemicals to treat the water, and can increase the levels of disinfection byproducts, a category of regulated carcinogenic compounds. Reference Section 2.4.3 in this resource guide to learn more about source water turbidity and disinfection by-product data and water system susceptibility to these contaminants.

In areas dependent on groundwater discharges into streams, there may be lower stream flows during the dry seasons that create problems for both water suppliers and aquatic life. Higher stream temperatures in the summer months can increase the frequency and/or duration of algal blooms (including harmful algal blooms); these risks are magnified by drought and lower stream flows in the summer and fall. Incidences of algal blooms can also be increased by storm runoff of nitrate- or phosphorus-rich waters into streams. Impacts from climate change do not occur in isolation: they interact with the effects of human activities and other natural processes.

In the context of long-term drought conditions for Oregon, it makes sense for public water systems to promote water conservation. Reducing water demand can be an important component of protecting the drinking water resource and can help ensure that the resource is available for future growth and expansion of residential and business needs. For more information on Oregon's comprehensive water resource planning framework go to the Oregon Water Resources Department's **Integrated Water Resources Strategy website.**

Some specific examples of how climate may impact surface water systems in Oregon include:

**Changes in Water Availability (Quantity and Seasonality):**

- The time period in each year where public water systems face low water availability and high demand is likely to increase. This may especially impact public water systems with newer or "junior" water rights.
- Increased incidences of above average temperatures and drought (including more frequent, persistent, and severe droughts) may require water systems to initiate water curtailment notices to ratepayers.
- Public water systems may face water shortages, increased cost, and reliability issues. Drinking water uses may come into conflict with other water users.
- Water rights may need to be adjusted to the changing timing and quantity of flows.

**Water Quality:**

- Potential for increased costs for drinking water treatment due to increased algal blooms or bacteria (because of increased stream temperatures and nutrient inputs).
- The risk of contamination of drinking water could increase during and after flooding events and heavy precipitation events.
- Potential for increased costs for drinking water treatment due to water quality effects of low flows causing a higher concentration of nutrients in source water.
- Potential for sea level rise to increase the risk of saltwater intrusion to surface water intakes in low-lying areas near the ocean.
- An increase in wildfire frequency and intensity can lead to negative changes in surface water source quality.

In 2007, the Oregon State Legislature charged the Oregon Climate Change Research Institute with assessing the likely effects of climate change on the state, including biological, physical and social impacts, on a biennial basis. The OCCRI released their seventh Oregon Climate Assessment report in January 2025 as a compendium of the relevant research on climate change and its impacts on Oregon. Go to the Oregon Climate Change Research Institute's **Seventh Oregon Climate Assessment**.

A highlight of the Seventh Oregon Climate Assessment was that Oregon's annual average temperature has increased by 2.2° F per century since 1895. Without considerable reductions in greenhouse gas emissions, annual temperature in Oregon is projected to increase by at least 5° by 2074 and 7.6° F by 2100, with the greatest seasonal increases in the summer.

Other highlights from the Seventh Oregon Climate Assessment report include:

- Precipitation is projected to increase during winter and decrease during summer, and the intensity of heavy winter precipitation events is projected to increase. The proportion of precipitation falling as rain rather than snow is expected to increase.
- Increases in extreme temperatures contributed to recent revisions of the national Plant Hardiness Zone Map.
- During 18 of the 25 years from 1999-2023, Oregon's precipitation was below average. The average temperature was warmer than normal in 21 of those years, which contributed to higher rates of evapotranspiration and more-frequent drought. Drought risk during summer is likely to increase statewide.
- Availability, quality, and cost of water will likely be the most limiting factor for agricultural production under a warmer climate.
- Wildfire is projected to increase in all Oregon forest types in the coming decades.
- Frequency and magnitude of coastal flooding events may continue to increase.

- Many terrestrial, freshwater, and marine plant and animal species have and will shift their distributions and become less or more abundant (invasive species and harmful algal blooms may become more abundant).
- Oregon's economy, like many other states, is likely to be affected by a changing climate and by policies addressing these projected changes.

Go to the Oregon Climate Change Research Institute's **Oregon Climate Assessments website** to access additional resources related to climate change in Oregon, including the Oregon Climate Assessment (2025).

OHA's Environmental Public Health Program has additional information on climate change including **publications and training materials.**

# 7.2 Cyanobacteria Harmful Algae Blooms

CyanoHABs (cyanobacteria harmful algal blooms), commonly known as blue-green algae, can produce cyanotoxins which are toxic substances that may contaminate drinking water sources and pose serious health risks to both humans and animals, ranging from mild gastrointestinal symptoms to severe liver or neurological damage.

Standard water treatment methods can generally remove intact cyanobacterial cells and low levels of cyanotoxins, but high concentrations during a bloom can create operational challenges for drinking water systems. Byproducts of cyanoHABs may affect water taste and odor, alter pH levels, and form algal mats that physically block water system intakes. When intakes become blocked, water systems may have difficulty in accessing and treating water, potentially disrupting supply and increasing operation and maintenance costs.

## 7.2.1 Causes of Cyanobacterial Blooms

Factors that influence cyanoHAB formation and persistence include water temperature, water movement and mixing, and nutrient availability (nitrogen and phosphorus), Climate change may increase both the frequency and severity of cyanoHABs due to rising temperatures, less cloud cover, and stormwater runoff carrying additional nutrients and pollutants into lakes and streams. See **DEQ's Harmful Algal Bloom Strategy** for more information.

## 7.2.2 Regulations and Monitoring in Oregon

OHA's Drinking Water Services requires water systems using surface water sources that are susceptible to cyanoHABs to test for cyanotoxins regularly, notify the public of drinking water detections, and issue drinking water advisories when testing results exceed health advisory

levels for cyanotoxins. DEQ partners with OHA to analyze public water system water samples at no cost to affected water suppliers.

Go to **OHA Drinking Water Services' Cyanotoxin Resources for Drinking Water website** for more information on rules and resources for public water systems.

DEQ is also responsible for identifying pollution sources, investigating causes of cyanoHABs, and developing pollution reduction plans. OHA's Environmental Public Health program is responsible for posting warnings and educating the public about harmful algal blooms in waterbodies. To support these efforts, limited statewide monitoring exists and some water bodies are sampled by DEQ, OHA, and local agencies. Satellite data also provide estimates of cyanobacteria levels in Oregon's largest lakes and reservoirs.

Go to **OHA Environmental Public Health Cyanobacteria Harmful Algae Bloom website** for more information on the effects of harmful algal blooms on human health and pets current and past lists of waterbodies with recreational and drinking water advisories or to report a potential bloom

Go to **DEQ's Harmful Algal Blooms website** for more information on causes, response, actions and prevention DEQ's Freshwater CyanoHAB strategy to review Satellite Estimates of Cyanobacteria in Oregon Lakes and Reservoirs

### 7.2.3 Harmful Algal Bloom Prevention and Management Strategies

Reducing nutrient pollution and addressing warm water temperatures are key to managing cyanoHABs. Excess nutrients may originate from agricultural, industrial and urban sources as well as from atmospheric deposition. The specific management strategies needed may depend on the watershed characteristics, type of cyanoHABs present, and local regulations. Section 5.0, Pollutant Reduction Tools, will provide several tools that may be useful for source water protection and Section 3.0 details the various partners for collaboration. Examples of strategies for reducing and preventing cyanoHABs include:

- Implementing agricultural practices to reduce fertilizer runoff (e.g., cover crops, proper manure management).
- Improving stormwater management to prevent excess nutrients from entering water bodies.
- Ensuring health riparian buffers to shade streams and reduce erosion.
- Educating the public on responsible fertilizer use and septic system maintenance.

DEQ is developing a statewide nutrient reduction strategy to prevent nutrient pollution from human activities. Water systems and communities are encouraged to provide input on this effort. For more information go to **DEQ's Nutrient Reduction Strategy website.**

## 7.3 Addressing Nonpoint Sources of Pollution in Oregon

Nonpoint source pollution is often linked with agricultural, forestry, urban, and rural residential land use activities where rain or snow runs off to surface waters. As the runoff moves, it picks up and carries away natural pollutants and pollutants resulting from human activity, finally depositing them into lakes, rivers, wetlands, coastal waters, and groundwater. Nonpoint source pollution in Oregon is addressed through several programs at DEQ and other agencies. The following programs are implemented by DEQ: Water Quality Standards, Water Quality Assessment, TMDLs and Water Quality Management Plans, §319 Nonpoint Source Planning and Grants, Water Quality Trading, Drinking Water Source Protection, Groundwater Protection and Groundwater Management Areas, Clean Water State Revolving Fund, Pesticide Stewardship Partnerships, and Water Quality Monitoring.

DEQ also coordinates with other federal and state agencies that are responsible for nonpoint source issues. The Oregon Department of Forestry regulates commercial harvesting on private and state forest lands. Likewise, the Oregon Department of Agriculture regulates agricultural activities. The Nonpoint Source Program at DEQ coordinates with ODA and ODF to ensure that forestry and agriculture on non-federal lands meets water quality standards and TMDL load allocations. The Nonpoint Source Program also coordinates with other state agencies (i.e. Oregon Water Resources Department and Department of Land Use Planning) and with outside partners to prevent and remediate nonpoint sources of pollution using cooperation, technical assistance, and federal pass-through (§319) grants. Federal land management agencies (e.g. USFS and BLM) work with the Nonpoint Source Program to ensure management is consistent with state and federal water quality laws and regulations. An additional responsibility of the program is the creation, approval, and implementation of a Coastal Nonpoint Pollution Control Plan under the federal Coastal Zone Act Reauthorization Amendments statute.

Additional information on agency roles, administrative rules and responsibilities is provided in **Oregon's Nonpoint Source Management Program Plan.**

## 7.4 Per- and Poly-Fluoroalkyl Substances

Per- and polyfluoroalkyl substances, known as PFAS, are a class of thousands of chemical compounds that have been used since the 1940s for a wide range of consumer and industrial

products. PFAS provide grease- and water-resistance properties to many consumer products, such as clothing, shoes, and outerwear. They are also used in firefighting foam, electronics manufacturing, bulk fuel facilities, chrome-plating, paper manufacturing, and other consumer and industrial processes, products, and applications. Substances in the PFAS family are very stable and persistent in the environment (or transform to different PFAS that are persistent), meaning that once released, they do not break down easily and can build up in the environment, wildlife, and humans.

Oregon legislation defines PFAS broadly as a class of organic chemicals containing at least one fully fluorinated carbon atom (ORS 459.465 to ORS 459.477; OR SB543, 2023), which encompasses over 15,000 individual PFAS chemicals. Over the past 20 years, PFAS have been considered an important class of emerging contaminants that, due to their widespread use in consumer and industrial applications, are being detected in drinking water supplies, groundwater, surface waters, landfill leachate, soil, sediment, fish, and air. The U.S. Environmental Protection Agency identified PFAS as an urgent public health and environmental issue facing communities across the country in 2016 and has taken several actions since including introducing new Maximum Contaminant Levels for drinking water in April 2024.

For more information on the new PFAS drinking water rule, see **EPA's Final PFAS National Primary Drinking Water Regulation website**. Oregon Health Authority Drinking Water Services is the lead agency for oversight of public drinking water systems including evaluating and adopting new requirements from EPA and coordinating PFAS sampling with EPA and public water systems. More information on PFAS regulation, PFAS monitoring, and sample results for public water systems can be found on **OHA-DWS PFAS website**. For updates on how Oregon is implementing PFAS drinking water system regulations, see **OHA-DWS PFAS Rule website**.

If PFAS is found, funding may be available to help install treatment systems, but removing PFAS is costly and requires significant investment. One of the best ways to reduce PFAS risk is to understand where it comes from and how vulnerable your water source is. Section 5.0 in this resource guide, Pollutant Reduction Tools, will provide several tools that may be useful for source water protection regarding PFAS.

# 7.5 Total Maximum Daily Loads

DEQ prepares Total Maximum Daily Load and Water Quality Management Plan documents for waterbodies in Oregon designated as water quality limited and on DEQ's list of impaired waters. A TMDL uses scientific data collection and analysis to determine the amount and source of each pollutant entering streams. A Total Maximum Daily Load is the maximum amount of pollutant that can be present in a waterbody while meeting water quality standards. These maximum

allowable pollutant loads are assigned to contributing sources, typically to point sources (waste load allocations) and land use authorities or nonpoint source sectors (load allocations). The Water Quality Management Plan provides the framework for management strategies to attain and maintain water quality standards. The framework is designed to work in conjunction with detailed plans and analyses provided in sector-specific or source-specific implementation plans. The plan designates organizations to prepare and carry out source-specific TMDL implementation plans such as the U.S. Forest Service and Bureau of Land Management, the Oregon Departments of Agriculture and Oregon Department of Forestry, counties, cities, and others. The implementation plans identify management measures that will be used to achieve and maintain water quality standards.

When TMDLs are developed, it is necessary to identify, assess, and implement control measures that limit the known and potential sources of pollutants entering the surface water that did not meet water quality standards. *Any pollutants entering the surface water from groundwater discharge is considered a nonpoint source.* These are evaluated as part of the allocation process when the TMDL is developed. Groundwater is generally a transport mechanism for pollutants entering surface waters and should be considered as part of the load allocations for pollutants. Go to **DEQ's Total Maximum Daily Load website** for more information on the TMDL program and the status of TMDL development for impaired water bodies in Oregon.

### 7.5.1 Public Water System Turbidity Data, the DEQ Integrated Report, and Total Maximum Daily Loads

In compliance with the federal Clean Water Act, Oregon DEQ assesses the quality of surface waters of the state (streams and lakes) every two years to determine their support of designated beneficial uses and to determine whether they contain pollutants at levels that exceed water quality standards. DEQ reports this information in the Integrated Report. The Integrated Report includes the status and assessment report and the list of impaired waters. The impaired waters list consists of waterbodies identified as impaired for exceeding protective water quality standards. The most common beneficial uses assessed for are aquatic life, drinking water, and recreation.

DEQ's Integrated Report methodology includes soliciting external data from the public that may be used to assess the condition of Oregon's waterbodies. DEQ's Drinking Water Source Protection program encourages and assists public water systems to submit raw water turbidity data where turbidity poses a challenge or increased expense for system maintenance or treatment. DEQ staff help to format the data using the Integrated Report's submission form and submit the data to the DEQ lab on behalf of public water systems. One of DEQ's goals is to

elevate drinking water sources as important resources for Oregon agencies and local community members to protect.

The current method to list a water body as impaired for the drinking water beneficial use due to turbidity states: "*For impairments to beneficial use as drinking water supply, Public Water System operator indicates that high turbidity days (days with turbidity ≥5 NTU) are causing operational difficulty AND source water data validate this impairment. The data are considered to validate an impairment if more than 45 high turbidity days per year occur for any year for which data are available*." If an impairment for turbidity is documented in source water, it indicates that a water system cannot treat or has difficulty treating using conventional treatment methods to achieve Safe Drinking Water Act requirements.

When public water systems provide data, it helps DEQ document whether drinking water sources are water quality limited and in need of Total Maximum Daily Load, or TMDL, development. Water bodies can also be classified as a potential concern when there is insufficient data to list the waterbody as impaired. Waterbodies not meeting statewide standards are evaluated and prioritized for activities designed to improve water quality. This can help adjust land management activities in source watersheds to meet the water quality standards. This may create requirements for landowners in the watershed but does not create any new regulatory requirements for public water systems. When water bodies are categorized as impaired for the drinking water use due to turbidity, there can be an added benefit of increasing the likelihood of securing funding for source water protection activities for water system and/or other partners in the watershed when addressing water quality impairments as well as source water protection.

# 8.0 Next Steps and Oregon's Recognition Program

Drinking water source protection is already at work in Oregon. Many Oregon communities are currently developing and implementing strategies to protect their drinking water source areas. Successful drinking water source protection plans developed in Oregon are available to communities as templates or examples. DEQ and OHA Drinking Water Source Protection program staff are available to assist public water systems, local community groups or consultants as they develop drinking water source protection plans and strategies.

Detailed information about developing drinking water source protection strategies can be found on **DEQ's Drinking Water Source Protection Program website** and on **OHA's Drinking Water Source Protection Program website.** Water systems or community members interested in the potential of developing drinking water source protection strategies should contact DEQ

Drinking Water Program for free technical assistance by emailing: **DrinkingWater.Protection@deq.oregon.gov.**

To acknowledge excellence in drinking water source protection efforts, the state of Oregon awards a certificate of recognition to water systems that have made substantial progress in implementing measures to protect their drinking water sources from contamination. Receipt of the award is displayed on each system's Water System Information page on **OHA's Drinking Water Data Online website**. The Drinking Water Source Protection Award may be used to promote consumer trust, positive customer relations, and public support in protecting drinking water sources. To be eligible for the award, the water system must show that strategies are in place to reduce the risk of contamination from one or more high- or moderate-risk land-use activities within the drinking water source area. The strategy also must be commonly considered an effective risk-reduction measure for the drinking water supply (either groundwater or surface water). Risk-reduction strategies can be implemented through actions taken by state agencies, regional management authorities, local government, and the water system.

If your water system has implemented drinking water source protection measures that protect your drinking water source from contamination and you are interested in receiving the Drinking Water Source Protection Award, find your water system on **OHA's Drinking Water Data Online webpage** then please go here. To view your current status, go to Drinking Water Data Online, search for your system, and the click on the "Source Water Protection Status" link. From there, you may press the Source Protection Activities Survey button and complete the survey. Information provided in the survey will be used to document drinking water source protection activities and to determine if your water system is eligible to receive the award. If you have questions or would like further information, please contact Drinking Water Services at 971-673-0405 or email the DEQ at **Drinkingwater.Protection@deq.oregon.gov**.

# 9.0 References

Abatzoglou, J. T., D.E. Rupp, P.W. Mote. 2014. Seasonal climate variability and change in the Pacific Northwest of the United States**.** Journal of Climate 27: 2125-2142, doi:10.1175/JCLI-D-13-00218.1.

Alavanja, M.C.R. and M.R. Bonner. 2005. Pesticides and Human Cancers. Cancer Invest. 23: 700-11.

Ambachtsheer, J., J. Kron, R.A. Liroff, T. Little, and R. Massey. 2007. Fiduciary Guide to Toxic Chemical Risk. Investor Environmental Health Network & Rose Foundation for Communities and the Environment. pp 50.

Baker, N.T., and W.W. Stone. 2015. Estimated Annual Agricultural Pesticide Use for Counties of the Conterminous United States, 2008-12. U.S. Geological Survey National Water Quality Asessment Program.

Benotti, M. J., R.A. Trenholm, B.J. Vanderford, J.C. Holady, B.D. Stanford, and S.A. Snyder. 2009. Pharmaceuticals and Endocrine Disrupting Compounds in U.S Drinking Water. Environmental Science and Technology 43: 597-603.

Betancourt, W.Q., and J.B. Rose. 2004. Drinking water treatment processes for removal of *Cryptosporidium* and *Giardia*. Veterinary Parasitology 126: 219-234.

Blomquist, J. D., and Janet M. D. 2001. Pesticides in Water-Supply Reservoirs and Finished Drinking Water: A Pilot Monitoring Program. USGS Open File Report 01-456.

Brown, Thomas C. 2000. Economic issues for watersheds supplying drinking water. *In:* Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. George E Dissmeyer, *ed*. General Technical Report SRS-39. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. p42-51.

Cabral, Joao P. S. 2010. Water Microbiology. Bacterial Pathogens and Water. Int J Environ Res Public Health 7: 3657–3703.

Carpenter, K.D., S. Sobieszczyk, A.J. Arnsberg, and F.A. Rinella. 2008. Pesticide occurrence and distribution in the lower Clackamas River basin, Oregon, 2000-2005. U.S. Geological Survey Scientific Investigations Report 2008-5027, 98pp.

Christensen, E.R., A. Li, I.A.A. Razak, et al 1997. Sources of polycyclic aromatic hydrocarbons in sediments of the Kinnickinnic River, Wisconsin. *Journal of Great Lakes Research* 23: 61-73.

Clapp RW, Jacobs MM, Loechler EL. 2007. Environmental & Occupational Causes of Cancer: New Evidence 2005-2007. Lowell (MA): Lowell Center for Sustainable Production.

Dalton, M., P.W. Mote, and A.K. Snover, eds. 2013. Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities. Island Press. 224 pp.

Durán Zuazo, V.H., and C.R. Rodríguez Pleguezuelo. 2008. Soil erosion and runoff prevention by plant covers. A review. Agron. Sustain. Dev. 28: 65–86.

Esworthy, Robert & Yen, Jerry H. 2012. Pesticide Law: A Summary of the Statutes. Library of Congress Report, Product Number RL31921. Accessed October 2025.

Freeman J., R. Madsen, K. Hart. 2008. *Statistical Analysis of Drinking Water Treatment Plant Costs, Source Water Quality, and Land Cover Characteristics.* Trust for Public Land.

Gartner, T., Mehan III, T., Mulligan, J., Roberson, J.A., Stangel, P., and Qin, Y. 2014. Protecting Forested Watersheds is Smart Economics for Water Utilities. American Water Works Association Journal 106.9: 54-64.

Gevao, B. K.T. Semple, and K.C. Jones. 2000. Bound pesticide residues in soils: a review. Environmental Pollution 108: 3-14.

Glassmeyer, S.T., E.T. Furlong, D.W. Kolpin, A.L. Batt, R. Benson, J.S. Boone, O. Conerly, M.J. Donohue, D.N. King, M.S. Kostich, H.E. Mash, S.L. Pfaller, K.M. Schenck, J.E. Simmons, E.A. Varughese, S.J. Vesper, E.N. Villegas, and V.S. Wilson. 2017. Nationwide Reconnaissance of Contaminants of Emerging Concern in Source and Treated Drinking Waters of the United States. Science of the Total Environment 581-582: 909-922.

Gomi, T., R.D. Moore, and M.A. Hassan. 2005. Suspended sediment dynamics in small forest streams of the Pacific Northwest. J. Amer. Water Resources Assoc. 41: 877-898.

Goodson, W.H., L. Lowe, D.O. Carpenter, M. Gilbertson A.M. Ali, A.L.de C. Salsamendi, et al. 2015. Assessing the carcinogenic potential of low-dose exposures to chemical mixtures in the environment: the challenge ahead. Carcinogenesis 36: S254–S296.

Hayes, T.B., P. Case, S. Chui, D. Chung, C. Haefele, K. Haston, M. Lee, V.P. Mai, Y. Marjuoa, J. Parker, and M. Tsui. 2006. Pesticide mixtures, endocrine disruption, and amphibian declines: Are we underestimating the impact? Environmental Health Perspectives 114suppl: 140-150.

Holvoet, K.M.A., P. Seuntjens, and P.A. Vanrolleghem. 2007. Monitoring and modeling pesticide fate in surface waters at the catchment scale. Ecological Modelling 209: 53–64.

Holz, D.J., K.W.J. Williard, P.J. Edwards, and J.E. Schoonover. 2015. Soil Erosion in Humid Regions: A Review. Journal of Contemporary Water Research & Education 154: 48-59.

Hoorman, J., R. Islam, A. Sundermeier, and R. Reeder. 2009. Using Cover Crops to Convert to No-till. Agriculture and Natural Resources Fact Sheet. SAG-11-09, AEX-540-09. Retrieved October 2025.

Hughes, Robert M., Susie Dunham, Kathleen G. Maas-Hebner, J. Alan Yeakley, Carl Schreck, Michael Harte, Nancy Molina, Clinton C. Shock, Victor W. Kaczynski, and Jeff Schaeffer. 2014. "A Review of Urban Water Body Challenges and Approaches: (1) Rehabilitation and Remediation." Fisheries 39 (1): 18–29. doi:10.1080/03632415.2013.836500.

International Agency for Research on Cancer. 2017. IARC monographs on the evaluation of carcinogenic risks to humans: some organophosphate insecticides and herbicides. World Health Organization Press Volume 112.

Jackson, C.R., C.A. Sturm, and J.M. Ward. 2001. Timber harvest impacts on small headwater stream channels in the coast ranges of Washington. Journal of the American Water Resources Association 37: 1533-1549.

Kibler, K.M., A. Skaugset, L.M. Ganio, and M.M. Huso. 2013. Effect of contemporary forest harvesting practices on headwater stream temperatures: Initial response of the Hinkle Creek catchment, Pacific Northwest, USA. Forest Ecology and Management 310: 680-691.

Kolpin, D.W., E.T. Furlong, M.T. Meyer, E.M. Thurman, S.D. Zaugg, L.B. Barber, and H.T. Buxton. 2002. Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000—A national reconnaissance. Environmental Science and Technology 36: 1202-1211, doi: 10.1021/es011055j.

Lanini, Jordan S., Elizabeth A. Clark, and Dennis P. Lettenmaier. 2009. Effects of Fire-Precipitation Timing and Regime on Post-Fire Sediment Delivery in Pacific Northwest Forests. Geophysical Research Letters 36 (1): L01402. doi:10.1029/2008GL034588.

LeChevallier, M.W., T.M. Evans, and R.J. Seidler. 1981. Effect of turbidity on chlorination efficiency and bacterial persistence in drinking water. Applied and Environmental Microbiology 42: 159-167.

Lick, William. 2008. Sediment and Contaminant Transport in Surface Waters. CRC Press. 404pp.

Meschke, J.S., and M.D. Sobsey. 1998. Comparative adsorption of Norwalk virus, poliovirus 1 and F+ RNA coliphage MS2 to soils suspended in treated wastewater. Water Sci. Technol. 38: 187-189.

Montgomery, D.R., K.M. Schmidt, H.M. Greenberg, and W.E. Dietrich. 2000. Forest clearing and regional landsliding. Geology 28: 311-314.

Mote, P., A.K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder. 2014. Ch. 21: Northwest**.** Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds. U.S. Global Change Research Program, pp495-521.

National Association of State Departments of Agriculture Research Foundation. 2014. National Pesticide Applicator Certification Core Manual, 2nd edition. Arlington, VA.

National Research Council. 1993b. Committee on Long-Range Soil and Water Conservation Policy. Soil and Water Quality: An Agenda for Agriculture, Chapter 8: Fate and Transport of Pesticides. National Academy Press , Washington, D.C.

National Research Council. 1993a. Committee on Techniques for Assessing Ground Water Vulnerability. Ground water vulnerability assessment: Contamination potential under conditions of uncertainty. National Academy Press, Washington, D.C.

NCASI (National Council for Air and Stream Improvement). 2013. Measurement of glyphosate, imazapyr, sulfometuron methyl, and metsulfuron methyl in Needle Branch stream water. Special Report No. 13-01. 130pp.

Nikolaou, A.D., M.N. Kostopoulou, and T.D. Lekkas. 1999. Organic by-products of drinking water chlorination. Global Nest: The Int. J. 1: 143-156.

Oregon Department of Agriculture. July 2008. Pesticide Use Reporting System 2007 Annual Report. Available from the State Library of Oregon Digital Collections.

Oregon Department of Environmental Quality. 1200-C General Permit, National Pollution Discharge Elimination System, Stormwater Discharge Permit for Construction.

Oregon Department of Human Services Public Health Division and Oregon Department of Environmental Quality. 2010. Interagency Agreement – Harmful Blue-Green Algae Monitoring. DHS/OEPH Agreement #131357.

Oregon Water Resources Department. 2015. Draft Guidelines: A Tool for Conducting Place-Based Integrated Water Resources Planning in Oregon.

Paerl, H.W., N.S. Hall and E.S. Calandrino. 2011. Controlling Harmful Cyanobacterial Blooms in a World Experiencing Anthropogenic and Climatic-induced Change. Science of the Total Environment. 409: 1739-1745.

Postel, S.L., and B.H. Thompson, Jr. 2005. Watershed protection: Capturing the benefits of nature's water supply services. Natural Resources Forum 29: 98-108.

Rashin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of the American Water Resources Association 42: 1307-1327.

Reeves, G.H., L.E. Benda, K.M. Burnett, P.A. Bisson, and J.R. Sedell. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionarily significant units of anadromous salmonids in the Pacific Northwest. American Fisheries Society Symposium 17: 334-349.

Reeves, G.H., P.A. Bisson, B.E. Rieman and L.E. Benda. 2006. Postfire logging in riparian areas. Conservation Biology 20: 994-1004.

Robison, E.G., K. Mills, J. Paul, L. Dent, and A. Skaugset. 1999. Oregon Department of Forestry Storm Impacts and Landslides of 1996: Final Report. Forest Practices Technical Report No. 4. Oregon Department of Forestry, Salem, Oregon.

Roni, Philip, Timothy J. Beechie, Robert E. Bilby, Frank E. Leonetti, Michael M. Pollock, and George R. Pess. 2002. A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific Northwest Watersheds. North American Journal of Fisheries Management 22 (1): 1–20. doi:10.1577/1548-8675(2002)022<0001:AROSRT>2.0.CO;2.

Schaedel, Andy. 2011. Oregon Department of Environmental Quality Harmful Algal Bloom Strategy, Water Quality Division, June 2011.

Seeds, Joshua. 2010. Turbidity Analysis for Oregon Public Water Systems - Water Quality in Coast Range Drinking Water Source Areas. Oregon Department of Environmental Quality, Water Quality Division.

Stackelberg, P.E, E.T. Furlong, M.T. Meyer, S.D. Zaugg, A.K. Henderson, and D.B. Reissman. 2004. Persistence of pharmaceutical compounds and other organic wastewater contaminants in a conventional drinking-water-treatment plant. Science of the Total Environment 329: 99-113.

Stone, W.W., C.G. Crawford, and R.J. Gilliom. 2013. Watershed Regressions for Pesticides (WARP) Models for Predicting Stream Concentrations of Multiple Pesticides. Journal of Environmental Quality 42: 1838-1851.

Stone, W.W., R.J. Gilliom, and K.R. Ryberg. 2014. Pesticides in U.S. Streams and Rivers: Occurrence and Trends during 1992–2011. Environ. Sci. Technol. 48: 11025–11030.

Thelin, G.P., and W.W. Stone. 2013. Estimation of annual agricultural pesticide use for counties of the conterminous United States, 1992-2009. U.S. Geological Survey Scientific Investigations Report 2013-5009.

Trombulak, S.C., and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14: 18-30.

Turner, T.R., S.D. Duke, B.R. Fransen, M.L. Reiter, A.J. Kroll, J.W. Ward, J.L. Bach, T.E. Justice, and R.E. Bilby. 2010. Landslide densities associated with rainfall, stand age, and topography on forested landscapes, southwestern Washington, USA. Forest Ecology and Management 259: 2233-2247.

USDA National Agricultural Statistics Service. Cropland Data Layer v 1.6. USDA-NASS, Washington, DC. Retrieved October 2025.

USDA Natural Resources Conservation Service. 2016. Residue and Tillage Management, Reduced Till Conservation Practice Standard. Retrieved October 2025.

US Department of Health and Human Services, National Institutes of Health, National Cancer Institute. 2010. Reducing Environmental Cancer Risk: What We Can Do Now. 2008-2009 Annual Report for the President's Cancer Panel. (*nitrates-pg. 47; pesticides-pg. 45*)

US Environmental Protection Agency. 1996. Pub 1. 104-183, 110 Stat. 1613 "Safe Drinking Water Act Amendments of 1996" 1996-08-06.

US Environmental Protection Agency. 1999. Guidance Manual for Compliance with the Interim Enhanced Surface Water Treatment Rule: Turbidity Provisions. EPA-815-R-99-010.

US Environmental Protection Agency. 2001a. Controlling Disinfection By-Products and Microbial Contaminants in Drinking Water. EPA-600-R-01-110.

US Environmental Protection Agency. 2001b. Revisions to the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR), and Revisions to State Primacy Requirements to Implement the Safe Drinking Water Act Amendments: 66 FR 3770, January 16, 2001, Vol 66, No. 29.

US Environmental Protection Agency. 2002. Health Advisories, EPA 822-R-02-038.

US Environmental Protection Agency. 2025. Ground Water and Drinking Water, National Primary Drinking Water Regulations.

Washington State Department of Health. 2009. Water System Design Manual. DOH PUB. #331-123 (Rev. 12/09).

Weber, J. A. 2015. Regional Framework for Climate Adaptation: Clatsop and Tillamook Counties. Joint project by the NOAA's Oregon Coastal Management Program, Oregon Sea Grant, and the Oregon Department of Land Conservation and Development. 58pp.

# APPENDICES

APPENDIX 1. Pollutant reduction strategies for common land uses and activities within drinking water source areas.

APPENDIX 2. Buffers affecting public drinking water supplies.

APPENDIX 3. Common crop-pesticide associations in Oregon

APPENDIX 4. Categorical crop to pesticide table

# Appendix 1. Pollutant reduction strategies for common land uses/activities within drinking water source areas

This link leads to a document with a compilation of information on the most common potential impacts to surface water drinking water sources in Oregon. "Pollutant Reduction Strategies for Land Uses/Activities" lists the categories of land uses and activities that are identified in the Updated Source Water Assessments, then summarizes the potential impacts or risks from those activities. Impacts generally will only occur when chemicals are improperly handled, or best management practices are not followed. The purpose of developing strategies to "protect" a drinking water source area is to reduce the risks of spills, pollutant release, or off-site movement of chemicals. This table provides key pollutant reduction ideas and resources for implementing drinking water source protection strategies.

View **DEQ and OHA's table of Pollutant Reduction Strategies for Common Land Uses/Activities Within the Drinking Water Source Areas**.

# Appendix 2. Buffers Affecting Public Drinking Water Supplies

While there are statewide setbacks near water sources for various land uses or facilities in the Oregon Health Authority and Oregon Water Resources Department rules, there are no statewide buffers for streams. This link leads to a fact sheet that provides a summary of setbacks and buffers affecting public drinking water supplies in Oregon.

View **DEQ's Setbacks/buffers affecting public drinking water supplies fact sheet** here.

# Appendix 3: Common Crop-Pesticide Associations in Oregon

**DATA SOURCES:** Much of the data in this table are survey data provided by the USDA-NASS Agricultural Chemical Use Program, with the additional data sources listed at the bottom of the table. The NASS program is USDA's official source of statistics about on-farm pesticide use and pest management practices. NASS collects information directly from growers, who participate voluntarily and on a confidential basis. The NASS data are empirical and report actual pesticide use. Estimates were subject to sampling variability; sampling variability was measured by the coefficient of variation, expressed as a percent of the estimate.

There are limitations associated with the data. For example, the USDA surveys of Washington wine grape and potato producers were used since Oregon data of this type was not available at the time this table was compiled. The data on the percentage of total acreage treated are for the first (predominant) pesticide listed by the survey, and the data are not always available. The table does not include common "organic-approved pesticides" that may be used in both organic and conventional agricultural systems. The Pesticide Information Center Online Database was accessed and cross-referenced for Oregon-registered products.

**Table 2. Common crop-pesticide associations in Oregon.**

| Crop | Type of Pesticide | Predominant | Estimate of % Acres Treated | Additional commonly- used chemicals | Data Source | Year |
|---|---|---|---|---|---|---|
| **Alfalfa** | Herbicide | Metribuzin | -- | Diuron | 2 | 1992-2013 |
| **Apples** | Fungicide | Triflumizole | 55 | Penthiopyrad, Myclobutanil, Mancozeb, Streptomycin sulfate, Trifloxystrobin | 1 | 2015 |
| **Apples** | Herbicide | Glyphosate | 49 | -- | 1 | 2015 |
| **Apples** | Insecticide | Chlorantraniliprole | 58 | Carbaryl, Methoxyfenozide, Spinetoram | 1 | 2015 |
| **Blackberries** | Fungicide | Cyprodinil; Fludioxonil | 52 | Azoxystrobin, Pyraclostrobin, Captan | 1 | 2015 |
| **Blackberries** | Herbicide | Carfentrazone-ethyl | 54 | Simazine, Paraquat, Diuron | 1 | 2015 |
| **Blackberries** | Insecticide | Zeta-Cypermethrin | 64 | Bifenthrin | 1 | 2015 |
| **Blueberries** | Fungicide | Cyprodinil | 54 | Fludioxonil, Azoxystrobin, Captan, Fenhexamid, Boscalid, Pyraclostrobin, Fenbuconazole | 1 | 2015 |
| **Blueberries** | Herbicide | Simazine | 35 | Diuron, Flumioxazin | 1 | 2015 |
| **Blueberries** | Insecticide | Zeta-Cypermethrin | 61 | Malathion, Thiamethoxam, Bifenthrin | 1 | 2015 |
| **Cherries, Sweet** | Fungicide | Quinoxyfen | 54 | Triflumizole, Pyraclostrobin, Boscalid, Trifloxystrobin | 1 | 2015 |
| **Cherries, Sweet** | Herbicide | Glyphosate | 25 | -- | 1 | 2015 |
| **Cherries, Sweet** | Insecticide | Imidacloprid | 44 | Fenpropathrin, Malathion, Lambda-Cyhalothrin | 1 | 2015 |
| **Christmas Trees[1]** | Fungicide | Chlorothalonil | -- | -- | 1 | 2009 |
| **Christmas Trees[1]** | Herbicide | Glyphosate Iso. Salt | -- | -- | 1 | 2009 |
| **Christmas Trees[1]** | Insecticide | Chlorpyrifos | -- | -- | 1 | 2009 |
| **Corn, Sweet** | Herbicide | Atrazine | 95 | Dimethenamid-P | 1 | 2014 |
| **Grapes, Wine[2]** | Fungicide | Quinoxyfen | 70 | Cyclufenamid, Boscalid, Pyraclostrobin, Fluopyram, Ebuconazole, Triflumizole | 1 | 2015 |
| **Grapes, Wine[2]** | Herbicide | Glyphosate Iso-Salt | 67 | Paraquat, Glyphosate Amm. Salt, Carfentrazone-Ethyl | 1 | 2015 |

| Crop | Type of Pesticide | Predominant | Estimate of % Acres Treated | Additional commonly- used chemicals | Data Source | Year |
|---|---|---|---|---|---|---|
| **Grapes, Wine[2]** | Insecticide | Bifenthrin | 26 | Abamectin | 1 | 2015 |
| **Hazelnuts** | Fungicide | Chlorothalonil | -- | -- | 7 | 2006 |
| **Hazelnuts** | Herbicide | Paraquat | -- | 2,4-D | 7 | 2006 |
| **Hazelnuts** | Insecticide | Esfenvalerate | 80 | Chlorpyrifos, Permethrin, Pyriproxyfen | 7 | 2006 |
| **Hops** | Fungicide | Quinoxyfen | -- | Pyraclostrobin, Boscalid | 5 | 2013 |
| **Hops** | Herbicide | Carfentrazone ethyl | -- | Paraquat, Clethodim, 2,4-D | 5 | 2014 |
| **Hops** | Insecticide | Imidacloprid | -- | Bifenthrin, abamectin (mite), spiridoclofen (mite), hexythiazox (mite) | 5 | 2010, 2013 |
| **Mint** | Herbicide | Bromoxynil | -- | Bentazon | 3 | 2011 |
| **Mint** | Insecticide | Chlorpyrifos, Acephate | -- | Chloranthraniliprole | 4 | 2015 |
| **Nursery Stock[1]** | Fungicide | Chlorothalonil | -- | -- | 1 | 2009 |
| **Nursery Stock[1]** | Herbicide | Glyphosate Iso. Salt | -- | -- | 1 | 2009 |
| **Nursery Stock[1]** | Insecticide | Petroleum Distillate | -- | -- | 1 | 2009 |
| **Onions** | Fungicide | Mancozeb | 48 | Pyraclostrobin, Mefenoxam, Chlorothalonil | 1 | 2014 |
| **Onions** | Herbicide | Pendimethalin | 88 | Bromoxynil Octanoate, Oxyfluorfen, Clethodim, Dimethenamid-P, Glyphosate | 1 | 2014 |
| **Onions** | Insecticide | Methomyl | 90 | Spirotetramat, Azadirachtin, Chlorpyrifos | 1 | 2014 |
| **Pasture and Hay** | Herbicide | 2,4-D | -- | MCPA, Diuron | 2 | 1992-2013 |
| **Pears** | Fungicide | Mancozeb | 84 | Penthiopyrad,Triflumizole, Pyraclostrobin, Boscalid | 1 | 2015 |
| **Pears** | Herbicide | Glyphosate | 42 | 2,4-D | 1 | 2015 |
| **Pears** | Insecticide | Spirotetramat | 82 | Pyridaben, Pyriproxyfen, Abamectin, Chlorantraniliprole, Etoxazole, Lambda-Cyhalothrin | 1 | 2015 |
| **Potatoes [2]** | Fungicide | Chlorothalonil | 78 | Mancozeb, Mefenoxam, Fluazinam, Azoxystrobin, Boscalid, Fludioxonil, Cymoxanil, Famoxadone, Difenoconazole | 1 | 2014 |

| Crop | Type of Pesticide | Predominant | Estimate of % Acres Treated | Additional commonly- used chemicals | Data Source | Year |
|---|---|---|---|---|---|---|
| **Potatoes [2]** | Herbicide | Rimsulfuron | 37 | -- | 1 | 2014 |
| **Potatoes [2]** | Insecticide | Novaluron | 29 | Flonicamid | 1 | 2014 |
| **Raspberries** | Fungicide | Cyprodinil | 58 | Fludioxonil, Boscalid, Pyraclostrobin, Azoxystrobin | 1 | 2015 |
| **Raspberries** | Herbicide | Simazine | 42 | Paraquat | 1 | 2015 |
| **Raspberries** | Insecticide | Zeta-Cypermethrin | 58 | Bifenthrin | 1 | 2015 |
| **Ryegrass seed** | Insecticide | Chlorpyrifos | -- | -- | 6 | 2002 |
| **Strawberries** | Fungicide | Boscalid, Pyraclostrobin | 67 | -- | 1 | 2014 |
| **Strawberries** | Herbicide | Flumioxazin | 54 | -- | 1 | 2014 |
| **Winter Wheat** | Herbicide | 2,4-D | 49 | Imazamox, Metsulfuron-Methyl, Thifensulfuron, Tribenuron-Methyl | 1 | 2015 |

**Table Notes**

1 -Cut Christmas tree and nursery survey data from the USDA chemical use program include data from multiple program states, of which Oregon was one of the participating program states.

2 -USDA surveys of Washington wine grape and potato producers were used since Oregon data of this type was not available at the time this table was compiled.

**Table References/ Data Sources**

1 -[USDA-NASS] U.S. Department of Agriculture–National Agricultural Statistics Service. 2016. Agricultural Chemical Use Program. Washington, D.C.: USDA National Agricultural Statistics Service, Accessed online October, 18, 2016

2 -Pesticide use estimates are based upon USGS NAWQA project data. Nancy T. Baker, U.S. Geological Survey, 2016, written communication.

3 -Sbatella G and Twelker S, "Weed Control Programs in Mint Based Upon Spring Applied Herbicides to Minimize Rotational Restrictions," Central Oregon Agricultural Research Center, Oregon State University. Accessed online February 2017

4 -Butler M, Walenta D, Sullivan C, Anderson N, Berry R, "Electronic Mint Pest Alert Newsletter to Promote Optimal Application of Coragen (R) to Control Mint Root Borer, Cutworms, Armyworms and Loopers." Central Oregon Agricultural Research Center, Oregon State University. Accessed online February 2017

5 -O'Neal S, "Pest Management Strategic Plan for U.S. Hops," Washington State University Irrigated Agriculture Research and Extension Center. Accessed online February 2017

6 -USDA Integrated Pest Management Center, [Report], "Crop Profile for Ryegrass Seed in Oregon." Accessed online February 2017

7 -DeFrancesco J, Oregon State University, Workshop Summary, "Pest Management Strategic Plan for Hazelnuts in Oregon and Washington." Accessed online February 2017

# Appendix 4. Categorical crop to pesticide table

**Table 3. Common pesticide use per crop in Oregon.**

Based upon USGS Pesticide Synthesis Project using EPest Low method, for years 1992-2013. The below table is based upon the estimated kilograms of pesticide applied in Oregon by crop/crop category.

1. This table is comprised of selected pesticides ingredients as per their designation as an Oregon Pesticide of Concern, Pesticides of Interest, or as per water quality monitoring results.
2. The research/scientific basis for color coding ratings for crop and pesticide application rates are explained below the table in the references and notes section.

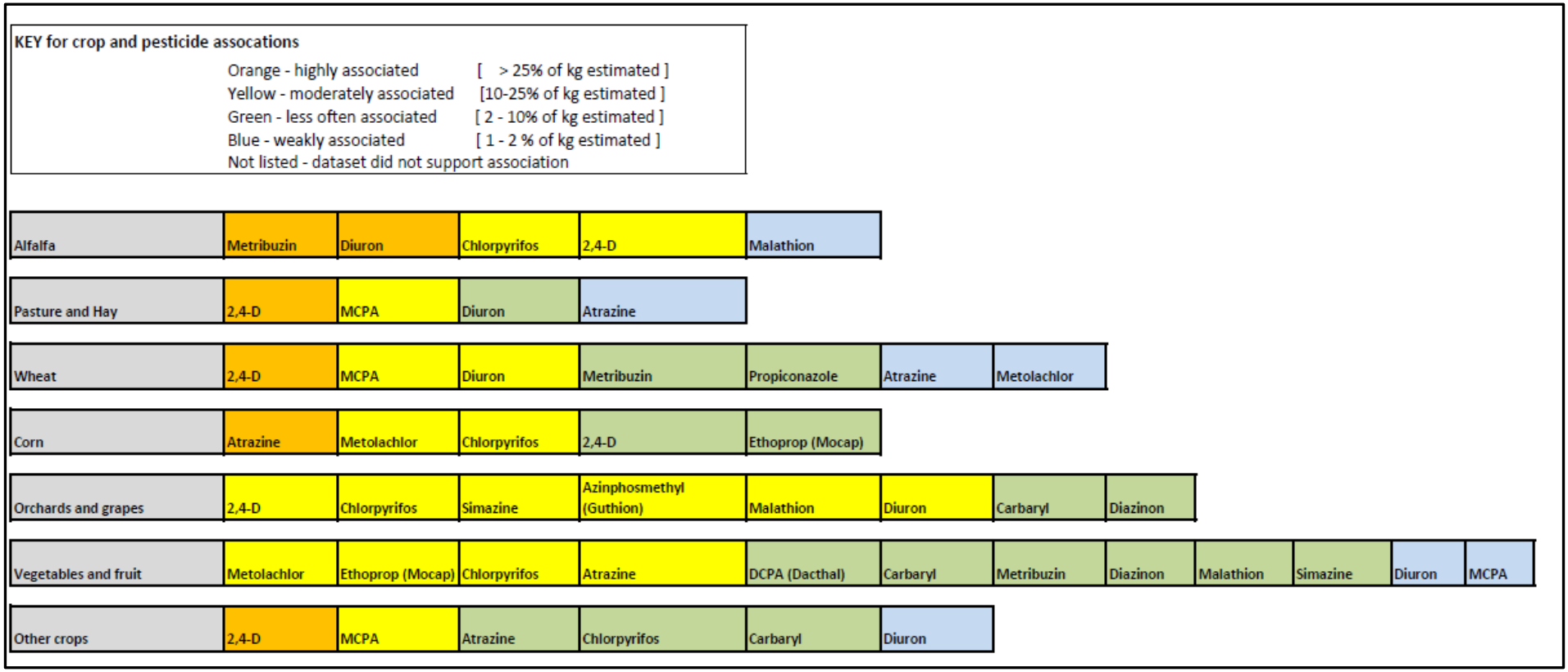

**Table References and Notes**

- Orchard and grape crop group in Oregon principally include: hazelnuts, pears, wine grapes, cherries, apples, and other crops
- Vegetable and Fruit crops group in Oregon principally include: Potatoes, onions, blueberries, other berries, snap beans, strawberries, garlic, green peas, cranberries, and others
- Other crops groups in Oregon principally include: Field and grass seeds, hops, and others

Pesticides selected on the basis of water quality monitoring results: DCPA, diazinon, and MCPA. Source: DEQ December 2009 report for LASAR data: "Analysis of DEQ and DHS Pesticide Data in Oregon"

Pesticide use estimates are based on USGS NAWQA project data. Source data: Nancy T. Baker, U.S. Geological Survey, 2016, written communication

Limitations: EPest values form this study are suitable for making national, regional, and watershed assessments of annual pesticide use. Although estimates are provided by county to facilitate estimation of watershed pesticide for a variety of watersheds, there is a greater degree of uncertainty in individual county-level estimates when compared to Crop Reporting District or state-level estimates because (1) EPest crop-use rates were developed in the basis of pesticide use on harvested acres in multi-county areas (Crop Reporting Districts) and then allocated to county harvested cropland; (2) pesticide-by-crop use rates were not available for all Crop Reporting Districts in the conterminous Untied States, and extrapolation methods were used to estimate pesticide use for some counties; and (3) it is possible that surveyed pesticide-by-crop use rates do not reflect all agricultural use in all crops grown. The methods developed in this study also are applicable to other agricultural pesticides and years.

Note 1: One POI, Sulfometuron, was not included in the table above due to the lack of sufficient available data.

Note 2: Bromacil was also considered as part of the analysis based on water quality monitoring results, however the data did not support an association with a crop/crop category.

Note 3: Grass seed is included under "other crops" category.