Umpqua Basin Status Report and Action Plan

July 30, 2014

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Department of Environmental Quality

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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

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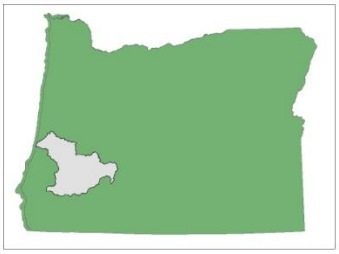
Table of Contents

Table of Figures, Maps and Tables

Executive Summary



The Umpqua Basin Watershed Status Report and Action Plan summarizes the Oregon Department of Environmental Quality's current knowledge of the water quality conditions for the three subbasins that collectively comprise the approximately three million acre Umpqua Basin: the South Umpqua, North Umpqua, and Umpqua.

This status report will be used in conjunction with an action matrix to help guide DEQ's actions in the Umpqua Basin for the next five years, 2014-2019. The document is organized to describe general water quality conditions, potential human health related impacts, potential impacts to fish and aquatic life and implementation highlights. In addition, action items as well as alignment opportunities between DEQ programs are identified. Actions and alignment opportunities will be prioritized for implementation over the next several years and will be utilized to guide DEQ areas of focus and will also be used to track meaningful progress.

General Water Quality Conditions

Of the three subbasins in the Umpqua Basin, the South Umpqua subbasin is the most populated, heavily cultivated, mineral rich, and most challenged with respect to water quality. However, a trend analysis of Oregon's water quality index shows an improving trend in water quality in the South Umpqua River, with sites moving from the very poor category to the poor category (Merrick, 2013).

The North Umpqua subbasin has less pressure from population growth and has the best general water quality of the subbasins but is heavily impacted by hydropower projects and historic logging practices.

The Umpqua subbasin, which contains the mainstem of the Umpqua River, receives drainage from the other two subbasins as well as from smaller tributaries. Water quality is heavily influenced by forestry and agricultural practices. Water quality trends in this subbasin are mixed.

Encouragingly, there are significant improving trends at four of the ten long-term DEQ ambient monitoring sites. The primary pollutants responsible for positive trends toward better water quality conditions include reductions in bacteria and nitrogen.

DEQ developed a Total Maximum Daily Load, often referred to as a "TMDL", for the Little River watershed that addresses temperature, pH, and sedimentation. TMDLs identify pollutants of concern and capture the amount of a particular pollutant that can enter or be present in a water body without violating water quality standards. Typically, water quality standards are set based on how the water is used, for example, drinking water source, recreation, fish habitat or other specified uses.

The Umpqua Basin TMDL addresses temperature, bacteria, aquatic weeds, dissolved oxygen and pH. In addition, DEQ completed a TMDL for Diamond Lake to address the harmful algal blooms. Since the completion of the TMDLs additional streams and lakes have been identified as impaired for a variety of pollutants. TMDLs will need to be developed for the additional streams and lakes in the future. DEQ's Umpqua Basin Coordinator position has not been fully staffed since late 2009 and DEQ's presence in the Basin has therefore been inconsistent with minimal regional coordination. Adequate TMDL staffing for the Umpqua Basin is needed to ensure TMDL development, implementation, and coordination.

Potential Human Health Related Impacts

Drinking water concerns exist for both surface and groundwater sources in the Umpqua Basin. In the Umpqua Basin there are 30 public water systems that rely on surface water as their primary source of water, and 61 public water systems that rely on groundwater as a primary or secondary source of water. Safe Drinking Water Act monitoring data indicates that 25 water systems in the Basin served by surface water have experienced contamination problems in finished (post-treatment) water. Contaminants of concern include volatile organic compounds, synthetic organic compounds, turbidity, bacteria, disinfection byproducts and sodium.

Surface water pollutants of concern related to activities in the Basin are primarily turbidity and bacteria (intake contamination) and, less frequently, turbidity, bacteria, and resulting disinfection byproducts in treated water. Twenty-seven public drinking water systems have had turbidity above Oregon Health Authority screening level of 0.3 NTU for treated water. From 2008-2010, 16 of these public water systems reported *E. coli* counts over 50 MPN per 100mL in the drinking water supply. Almost half of all Umpqua Basin drinking water systems supplied by surface water have had significant detections of disinfection byproducts.

Figure 1: Umpqua River at Yellow Creek Boat Ramp
Photo credit Partnership for the Umpqua Rivers

Source water for drinking water facilities in the South Umpqua subbasin have shown low levels of pesticides, steroids, hormones, phthalates, and occasional pharmaceuticals. These studies provide a basis for prioritizing pollutant reduction strategies for drinking water in the basin, but more data will be needed to identify the source of these contaminants and develop specific technical assistance and management strategies.

Wastewater has also been tested to evaluate the presence of toxic chemicals. The number of detections of priority persistent pollutants was low. In total, the detection of 11 priority persistent pollutants occurred in Roseburg Urban Sanitary Authority's effluent. No measured levels of these pollutants exceeded the corresponding initiation levels that would require a pollution reduction plan, except cholesterol and coprostanol, two commonly occurring animal-based steroids. The Environmental Quality Commission recently passed a temporary rule to suspend municipalities' requirement to develop reduction plans for these two chemicals.

Harmful algae blooms, also known as HABs, pose a threat to recreation and a number of public water systems in the Umpqua Basin. Three lakes and three river segments have had health advisories posted due to algae blooms and several other lakes in the area potentially have these blooms. The TMDL for Diamond Lake identified an over abundance of the invasive fish, Tui Chub, as the root cause of the harmful algae blooms and set a trout stocking load allocation. Recent data show the presence of another non-native fish, the Golden shiner, may be one factor contributing to recent blooms. Interagency coordination is needed to continue long-term monitoring of Diamond Lake and the response to the 2006 Rotenone treatment and subsequent fish stocking. In addition, monitoring is needed to assess the cause of algae blooms in other impaired waterbodies.

Groundwater quality and quantity is impaired in areas of the basin due to a combination of non-point source pollution and natural geology. Groundwater concerns consist of localized nitrate and bacterial contamination, and metal contamination. Based on the results of the Department of Human Services, Health Division real estate transaction testing results from 719 domestic wells, nitrate levels between five and 10 mg/L have been reported for 22 wells and four wells with nitrate concentrations that were between 10 and 40 mg/L. Nitrate concentrations exceeding 3 mg/L generally indicate anthropogenic contributions of nitrate. EPA's maximum contaminant level for nitrate (nitrate as nitrogen) in drinking water is 10 mg/L.

Elevated levels of bacteria are seen in the Umpqua mainstem, the South Umpqua, and several tributaries throughout the basin and appear to be the result of pollution from nonpoint sources. Nonpoint source pollution comes from diffuse sources such as runoff from streets, lawns, agricultural activities, malfunctioning septic systems, illegal dumping, and other sources. Currently, there are 28 stream segments identified as impaired for fecal bacteria and are either under a TMDL or were added to the list of impaired streams in 2010. High bacteria levels continue to threaten the shellfish industry, as well as pose risks to recreational uses and drinking water treatment operations. Bacteria tests also indicated a potential concern for domestic drinking water wells, as 164 indicated a positive test result for total coliform and eight of the wells tested positive for fecal coliform.

Encouragingly, DEQ's ambient monitoring data indicates improvements in bacteria concentrations in much of the basin over the past ten years. However, finer scale monitoring points to significant areas of concern, particularly in the South Umpqua subbasin. DEQ identified several actions necessary to reduce bacteria pollution in the Umpqua Basin, including: evaluating agricultural land conditions coupled with continued monitoring, and implementing best management practices where assessment indicates land use activities are contributing to elevated bacteria.

High levels of arsenic were found in seven wells. A focused assessment of arsenic concentrations from 144 private wells within the Sutherlin area showed 33 percent of the wells tested met or exceeded the maximum contaminant level for arsenic (0.01 mg/L), with the highest recorded at 4.6 mg/L. The high concentrations were mostly along alluvial floodplains, indicating they were likely derived from mineral laden volcanic materials eroded from locations upstream.

Although there have been relatively few groundwater studies in the Klamath Mountain region, a case can be made for the natural groundwater quality of some areas having elevated levels of arsenic, fluoride, nickel, chromium, iron, and manganese. The Coast Range sediments have a significant amount of brackish material remaining between sediment layers. As such, the groundwater pumped from some locations can be salty and often unsuitable for domestic consumption. Additional groundwater studies are needed to determine if pollution sources are naturally occurring or are influenced by land uses. Additional studies are also needed in order to fully understand the spatial distribution of groundwater quality concerns.

Potential Impacts to Fish and Aquatic Life

There are a number of pollutants and habitat impairments that threaten fish and aquatic life uses. A number of studies, including the Coastal Coho Stream Assessment which synthesized biological surveys and water and habitat surveys, have identified temperature, total solids, total phosphorus, fine sediment, and habitat modification as primary concerns. These studies indicate land use activities degrade the biological and water quality condition in the Umpqua and demonstrate a great need to improve water temperature and fine sediment conditions.

Temperature and fine sediment have been identified as pollutant stressors that affect fish and other aquatic life throughout the basin. Oregon's 2010 Water Quality Assessment identified 177 individual temperature impaired waterbodies and 5 segments impaired for sedimentation in the Umpqua Basin. Macroinvertebrate sampling of wadeable streams in the basin found that 47 percent of the 158 sites were in "most disturbed" condition, 16 percent were in "moderately disturbed" condition, and 35 percent were in "least disturbed" condition. Only 2 percent of wadeable streams were recorded as exhibiting "enriched" condition.

Figure 2: Calapooya Creek
Photo credit Partnership for the Umpqua Rivers

Macroinvertebrate population assessment showed 52 percent of sites in the Umpqua Basin were dominated by macroinvertebrates with tolerances to high water temperatures. In addition, 57 percent of surveyed streams were dominated by macroinvertebrates with tolerance to high levels of fine sediment. However, there is no formal DEQ strategy for assessing, addressing or responding to sediment concerns. The development of either numeric sediment criteria or clear guidance on how the narrative standard should be applied is needed.

Nutrient enrichment, organic solids, and/or temperature impairments are the underlying causes for most of the Umpqua Basin's impairments for dissolved oxygen, pH, and aquatic weeds algae. In the 2010 Water Quality Assessment, DEQ identified 17 stream segments impaired by dissolved oxygen, 23 segments impaired by pH, one segment impaired by phosphorus, and two segments on the South Umpqua impaired by aquatic weeds and algae (these listings do not include harmful algae bloom listings). Both nonpoint and point sources contribute nutrients, but streams with wastewater treatment plants typically show the most impact, particularly in the late summer and fall. DEQ needs to continue to work with wastewater treatment plants to support facility upgrades and provide technical and financial support to install best management practices on private and public lands.

A number of toxic pollutants including pesticides, poly-chlorinated biphenyls, polycyclic aromatic hydrocarbons, and heavy metals have been detected in sediment and fish tissue samples in the basin. The Coastal Environmental Monitoring and Assessment Program sampled the Umpqua estuary in 2001, 2002, 2004, 2005, and 2006. Seven of the twenty-one sites had at least one polycyclic aromatic hydrocarbon compound that could be quantified, through many detections were below the reporting limit. Two locations tested positive for pesticides in the sediment, and three pesticides were detected above the reporting limit. Twelve sites tested positive for poly-chlorinated biphenyls, or PCBs, however no stations exceeded the total PCB Effects Range Low (22.7 µg/Kg dry wt). Five PCBs were detected above the reporting limit. PCB-52 was the most ubiquitous, with detections at nine sites. Five metals exceeded the sediment toxicity guideline (Effects Range Low) in at least one sample.

Fish samples were also analyzed, however, fish were not caught at all sites, but some sites produced more than one species. Of twelve fish composite samples, four had detectable pesticides consisting of five

pesticides. 4,4'-DDE and Hexachlorobenzene were detected in more estuarine areas than other chlorinated pesticides. Polycyclic aromatic hydrocarbon were not analyzed in fish because they are typically metabolized. Four polychlorinated biphenyls were detected, and only at one location. Fish samples tested positive for 12 metals. Median mercury levels were greater than 0.02 mg/kg wet weight; the maximum mercury concentration was 0.07 mg/kg wet weight. Data from the Coastal Environmental Monitoring and Assessment Program indicates that toxic contaminates are a concern in the estuary, further investigation of shellfish is needed.

Figure 3: Diamond Lake and Mt. Thielsen
Photo credit Douglas County

DEQs Toxics Monitoring Program assessed surface water and sediment samples for seven major categories of toxics. Sediment samples are still being analyzed. Surface water samples have shown low levels of emerging pollutants like pharmaceuticals, personal care products, industrial chemicals, and metals. The number and concentrations of chemicals detected in surface water in the Umpqua Basin was low. The herbicides, diuron and sulfometuron-methyl, were detected at two locations. Sulfamethoxazole, a common antibiotic, was found at one site. DEET, an insect repellant, was detected at all sites sampled. Metals that were detected include arsenic, chromium, iron, and nickel. All detections were below the established water quality criteria.

Three fish consumption advisories for mercury have been issued in the basin by the Oregon Health Authority due to elevated concentrations of mercury found in sport-caught fish. Acid mine drainage and metals contamination, such as mercury, is a concern at a number of historic mining sites. There are currently 155 mines in the Umpqua Basin, 11 are on DEQs cleanup list, one the former Formosa Mine is listed as a federal superfund site by EPA and is currently being evaluated for cleanup. If not managed appropriately, metal mining activities, by their nature, often have a tendency to generate significant amounts of pollution. Source assessments are needed to determine if sources are naturally occurring or are influenced by landuses.

Reduced flow and habitat modification and the resulting effects to fish habitat and water quality are also a concern. Flow and habitat are impacted by irrigation, land development, domestic water, hydropower facilities, and other activities. Currently, most of the basin has been closed to further summer surface water appropriation since natural flow amounts are not adequate to satisfy all water rights. Water conservation measures and habitat restoration projects need to be implemented across the basin to benefit both instream and out-of-stream uses.

Implementation Highlights

The cities, counties, state and federal agencies that have land use jurisdiction within the Umpqua Basin have been designated as management agencies per TMDL program guidelines. Nearly all of these designated management agencies developed an implementation plan, which describes actions that will be undertaken to address water quality impairments and nonpoint source pollution within their jurisdiction or regulatory authority. Since 2000, DEQ has allocated over $1 million of Clean Water Act Section 319 grant dollars within the Umpqua Basin to support nonpoint source pollution reduction projects including planning, restoration projects and monitoring.

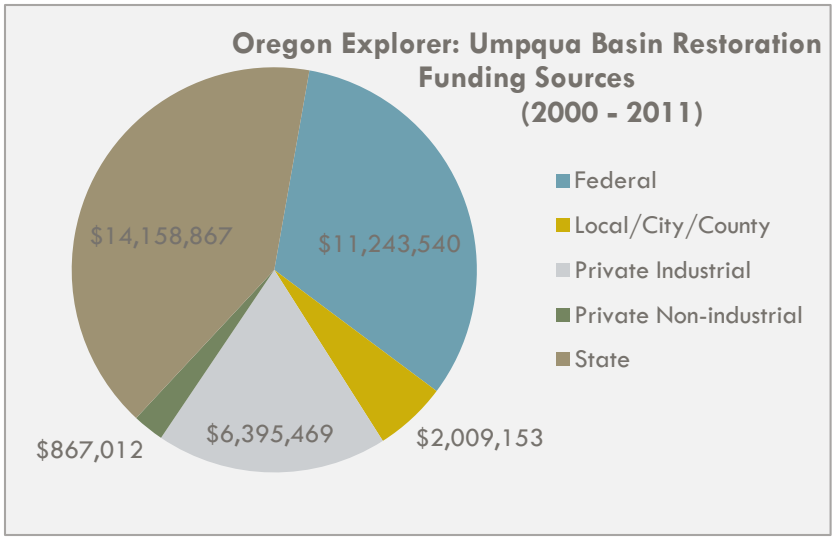
Recent collaborative actions (supported in part by 319 grant allocations) among state and local agencies, watershed councils, and landowners, minimized blue green algae blooms in Diamond Lake and are the subject of an EPA success story[1].

Municipal wastewater treatment plant upgrades have resulted in water quality improvements in the Umpqua River, with nutrient reductions observed in the South Umpqua. As a result of the 2006 Umpqua Basin TMDL, the Roseburg Urban Sanitary Authority assessed several wastewater control alternatives for meeting the more stringent water quality requirements developed for the summer months. The sanitary authority selected a natural treatment system in order to meet the phosphorus, temperature, and chlorine residual discharge limits for the wastewater treatment facility. The system cost one-third the price of a conventional treatment system and is located on 340 acres of farm land owned by the authority and includes constructed wetlands, land application and high-rate irrigation, hyporheic discharge, and restoration of historic natural wetlands. Compliance monitoring includes a unique performance monitoring strategy that measures surface water quality upstream and downstream of Roseburg's sewer outfall and creek discharge out of the authority-owned farm. Even though the permit is on hold due to litigation, Roseburg Urban Sanitary Authority has begun utilizing the new treatment system and phosphorous levels downstream of the treatment plant show a decrease in concentration. Community members reported a decline in aquatic weed growth in 2012. Other parameters need to be analyzed to establish an overall trend in water quality.

Beginning in 2003, PacifiCorp began implementing the settlement agreement for the North Umpqua Hydroelectric Project, which outlines management goals to protect watershed function and minimize impacts from dam operations. As part of the settlement agreement, minimum streamflows are established to maintain water quality conditions to protect habitat. A fish passage project was completed in 2012 at the Soda Springs Dam that opened nearly six miles of spawning habitat for salmon and steelhead. Watershed partners are now implementing habitat restoration projects in the newly opened habitat.

Numerous restoration projects on both private and public lands have been completed by watershed partners. As part of the Oregon Plan for Salmon and Watersheds, restoration projects have been implemented to restore salmon runs, improve water quality, and achieve healthy watersheds. In addition, a local watershed council, the Partnership for the Umpqua River, has developed a successful volunteer monitoring program that provides substantial benefit in evaluating current conditions in the basin.

Figure 4: Sources of Funding for Completed and Reported Restoration, Umpqua Basin (2000-2011)

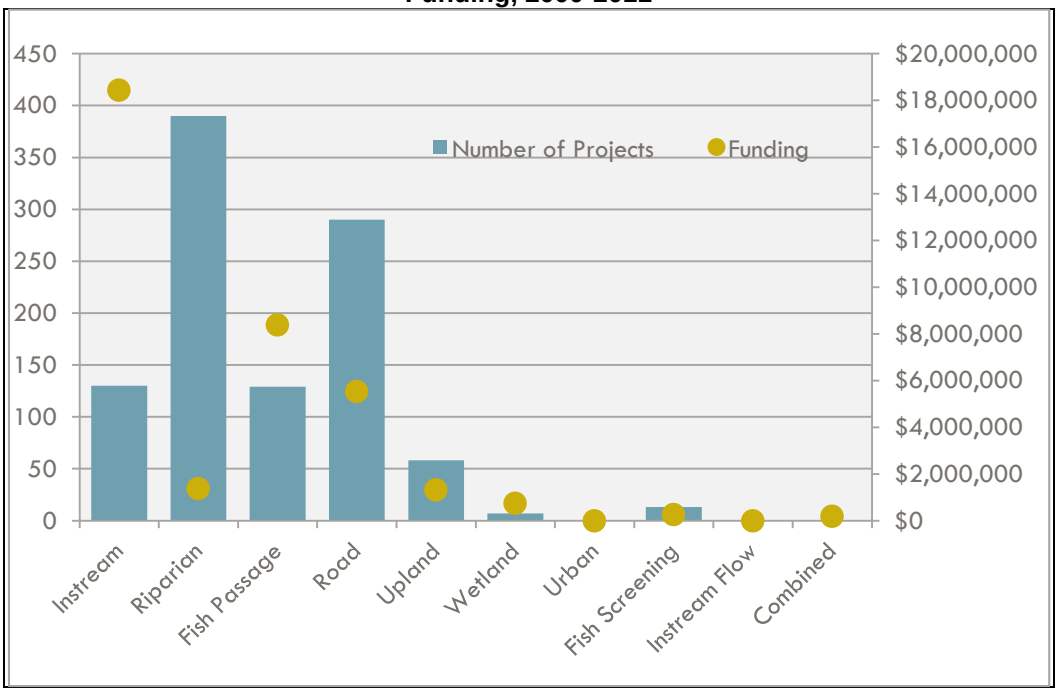


The Oregon Watershed Restoration Inventory tracks restoration data for the state of Oregon and is managed by the Oregon Watershed Enhancement Board. Information provided to the inventory has been used to report on activities and progress supported by the Oregon Plan for Salmon and Watersheds, support effectiveness monitoring of restoration activities, and support watershed assessments and future restoration project planning and

[1] http://water.epa.gov/polwaste/nps/success319/or_diamond.cfm

prioritization. Approximately $36,639,980 was spent on watershed restoration projects from 2000-2011 on 931 projects in the Umpqua Basin. The 2007 Diamond Lake drawdown and rotenone treatment accounts for about 20 percent of the Umpqua Basin restoration funding recorded in the inventory from 2000-2011.

Figure 5: Oregon Explorer Umpqua Basin Watershed Restoration Number of Projects by Project Type and Funding, 2000-2011



According to Oregon Water Restoration Tool[2], from 2000-2011, approximately 169 river miles of riparian corridor have been restored, 208 miles of instream habitat have been restored, 1,561 acres of riparian land have been treated, and 169 fish barriers have been reconditioned to open 203 miles of stream to fish.

[2] oe.oregonexplorer.info/RestorationTool

1. Introduction

1.1 Purpose

The Oregon Department of Environmental Quality is undertaking a Watershed Approach to assist in managing water quality in the State of Oregon. This approach will provide a broad assessment of the status of water quality and other environmental indicators within a basin. The Watershed Approach will also work to augment the efforts of the Total Maximum Daily Load program to guide implementation actions to address the region's water quality issues. This geographic focus will allow DEQ to better coordinate internally with its 17 water quality subprograms, and it will allow DEQ to more effectively work with stakeholders to identify and address the most pressing needs of each watershed.

It is intended for the watershed assessment process to eventually be implemented state-wide. Currently each DEQ region (Eastern, Western and Northwest Oregon) is completing a watershed assessment for one basin each year and will update them every five years. There are approximately 15 basins within the state. Details on DEQ's assessment of basins and the watershed assessment can be viewed at www.deq.state.or.us/wq/watershed/watershed.htm

1.2 Plan Overview

The report summarizes DEQ's knowledge of water quality conditions, gives a brief overview of DEQ's water quality programs, and outlines priorities and actions for DEQ's water quality management in the Umpqua Basin for the next five years (2014-2019). This report builds on previous management history, water quality studies and assessments, and summarizes this information in a way that is useful for identifying future actions. The plan covers both the work that DEQ's various Water Quality sub-programs, e.g., TMDLs, Permitting, Monitoring will be doing, as well as the important efforts that its watershed partners will be conducting. The goal is to update the Watershed Assessment for the Umpqua Basin in 2019 but new information will be considered throughout the process.

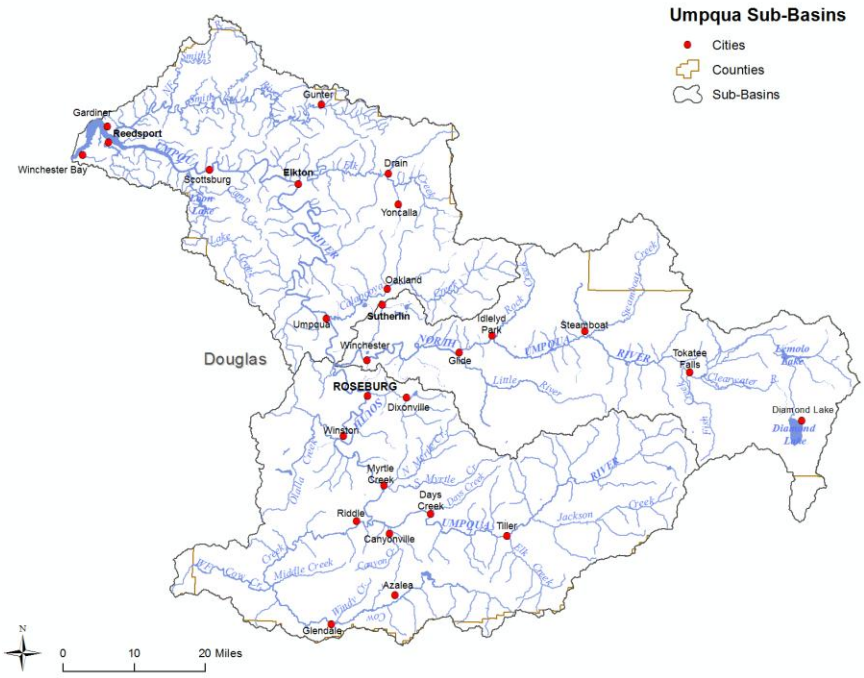
Note: This report does not attempt to provide information about groundwater or surface water conditions related to spills, industrial sites, underground tanks or other site specific pollution sources. Data on individual sites is available on the DEQ website.[3]

1.3 Geographic Area

The Umpqua Basin is located in Southwestern Oregon and is one of only two Oregon rivers that extend from the Cascades to the Pacific Ocean, draining a varied landscape from steep-sloped uplands to low gradient broad floodplain. The watershed basin boundary closely aligns with Douglas County political boundary lines.

[3] http://deq12.deq.state.or.us/fp20/

Map 1: Umpqua Subbasin Cities and Counties

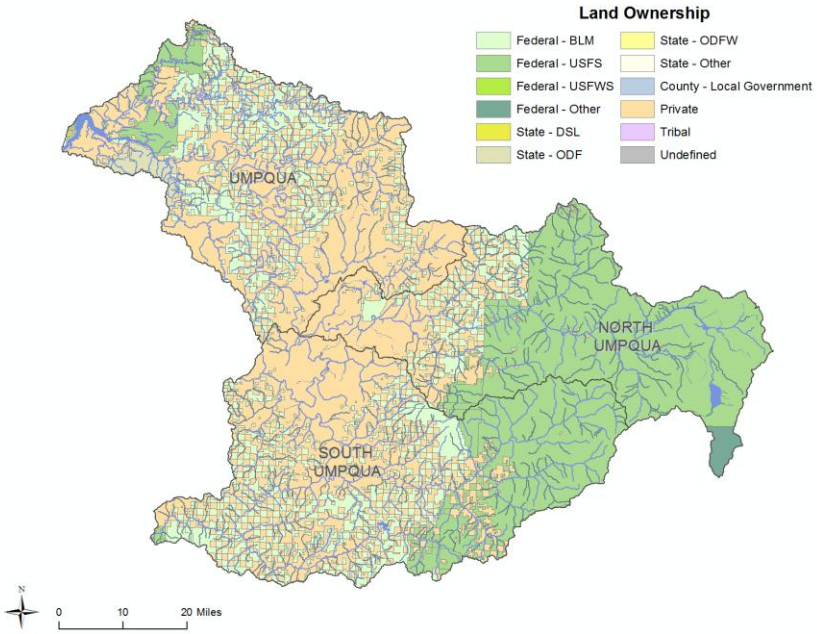


The Umpqua Basin itself is comprised of three United States Geological Survey 4th Field Hydrological Unit Codes: North Umpqua (17100301), South Umpqua (17100302), and the mainstem Umpqua (17100303). Within these three subbasins are 33 fifth-field watersheds: 13 watersheds in the South Umpqua subbasin, 12 watersheds in the North Umpqua subbasin, and 8 watersheds in the Umpqua subbasin. Watershed divides that delineate the basin are found at the crest of the High Cascade range to the east, in the Coast Range to the northwest, and the Klamath Mountains to the south.

The headwaters of the North Umpqua River and the South Umpqua River are located in the Umpqua National Forest. The North Umpqua River flows generally west until it meets the South Umpqua downstream from Roseburg. The South Umpqua River flows west then north after its confluence with Cow Creek, a major tributary. After it flows through the Umpqua Valley, the South Umpqua meets the North Umpqua downstream of Roseburg. The mainstem Umpqua flows generally north then west where it enters the shellfish growing areas of Winchester Bay and then enters the Pacific Ocean.

1.4 Current Land Uses/Cover and Land Ownership

Map 2: Umpqua Subbasin Land Ownership



The Umpqua Basin encompasses approximately three million acres (approximately 4,660 sq mi.). Over half of the Umpqua Basin is managed by the federal government. The Umpqua National Forest encompasses nearly one million acres in the Umpqua Basin, mostly located in the eastern portion of the basin. The Bureau of Land Management administers another 593,000 acres of land throughout the higher elevations of the central and western portions of the basin. About 28,000 acres of the Elliot State Forest are in the Umpqua Basin. While forestry

use is active from the higher elevations to the foothills, agricultural lands are the largest land uses in the lowlands. Land cover in the basin is 5 percent agriculture, 70 percent forest, 20 percent grassland/shrub, 3 percent urban, and 2 percent other. (USGS 2006 National Land Cover Database (NLCD) Land Cover GIS layer).

Map 3: Umpqua Subbasin Land Cover Class

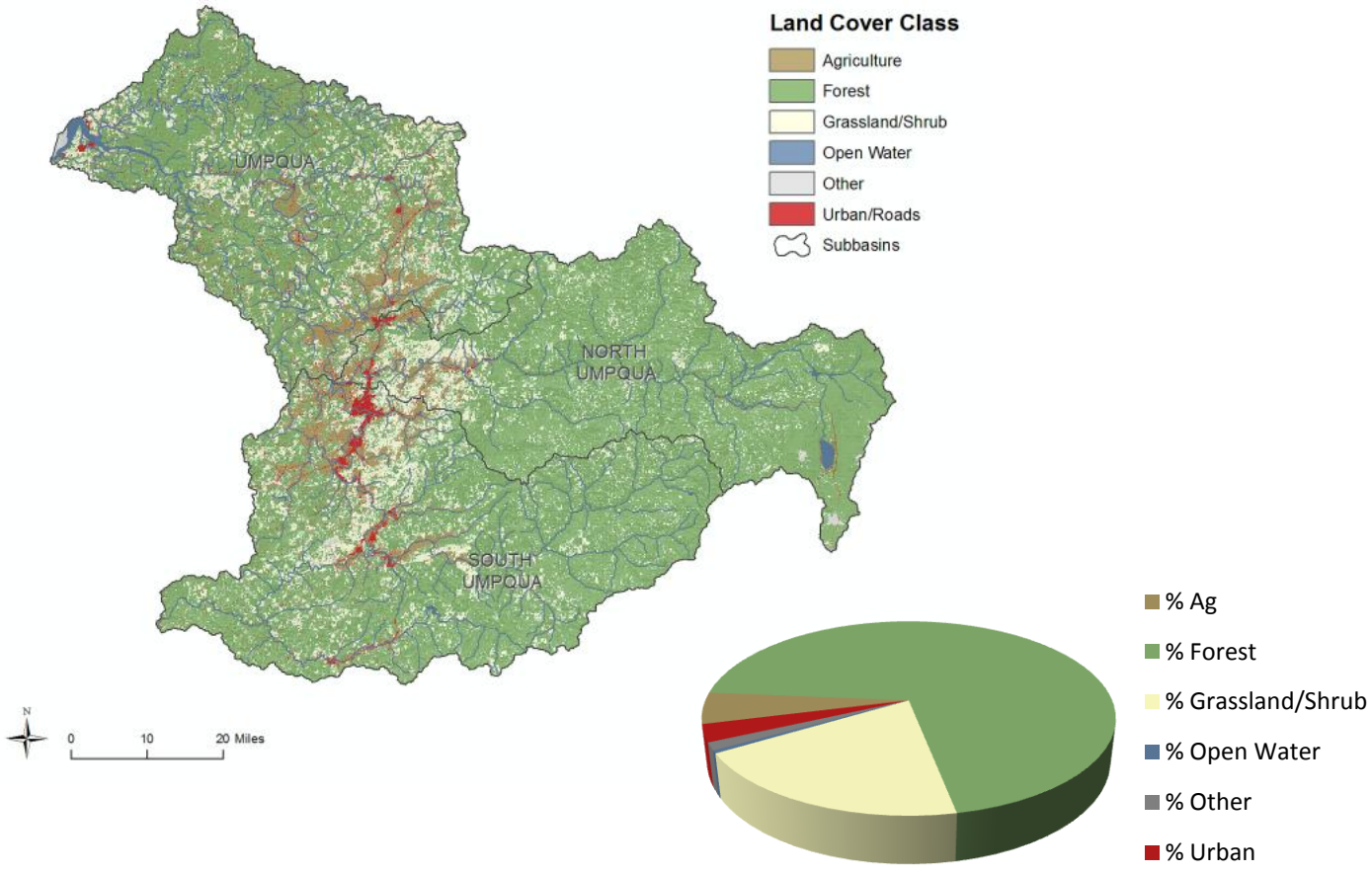
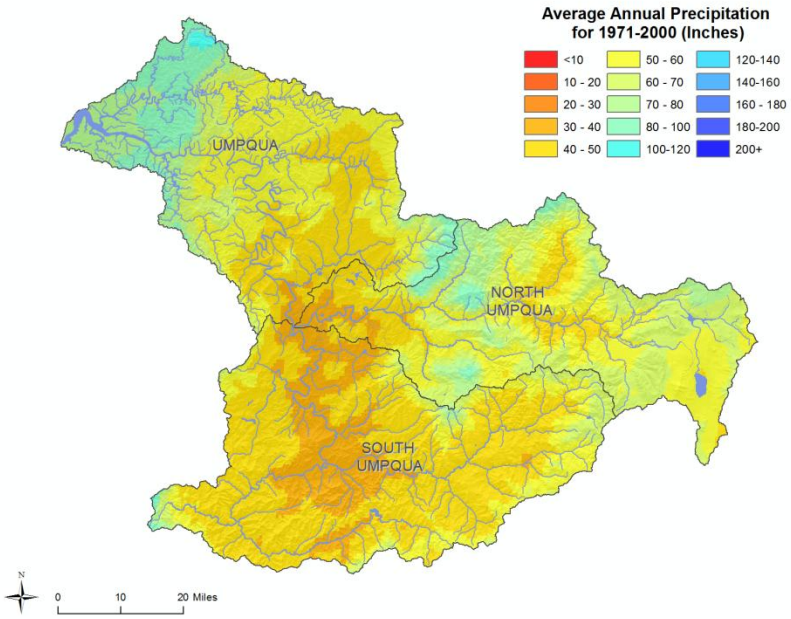


Figure 6: Umpqua Subbasin Land Use

1.5 Climate

The basin varies from alpine conditions in the Cascade Range to extremely moist rain-forest-type conditions in the Coast Range. Annual precipitation ranges between 50 inches at Diamond Lake, to 34 inches at Roseburg, to 80 inches at Reedsport. Streams in the mountainous regions can be flashy and respond quickly to rainfall due to high stream density and steep topography. Runoff from the Cascades and Coast Ranges feeds the rivers year round. The lowland valleys are generally dry and hot in the summer, with some areas averaging less than one inch precipitation per month during the summer; in these areas, it is very common for streams to become dry in the summer. Elevations range from sea level at the mouth of the Umpqua River to a maximum height of 9,182 feet at Mount Thielsen. As elevations rise, so do precipitation levels. Groundwater recharge remains unknown at this time.

Map 4: Umpqua Subbasin Average Annual Precipitation

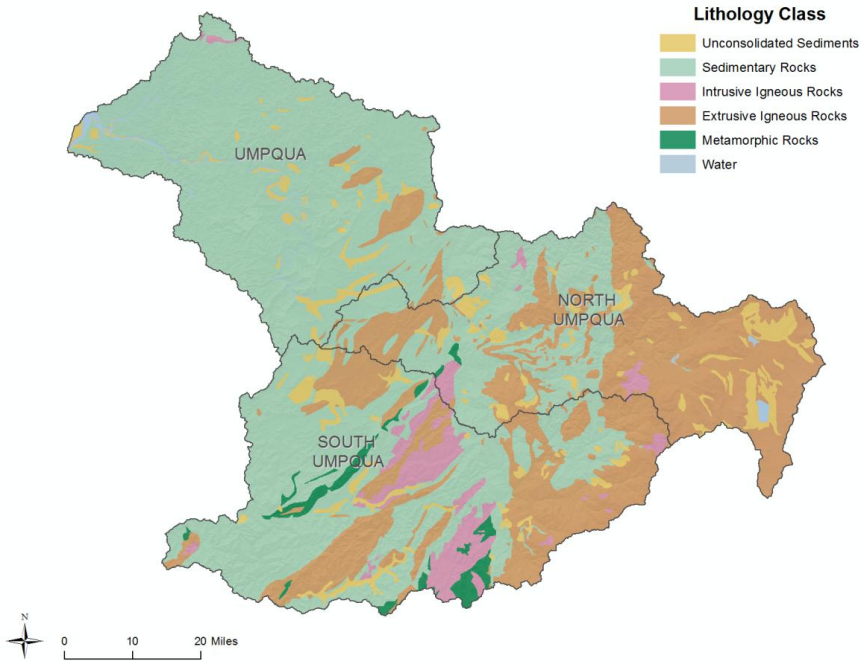


1.6 Geology

The Umpqua Basin contains four distinct geological provinces called the High Cascades, Western Cascades, Klamath Mountains and the Coast Range. Each province is unique from the others featuring different types of landscape and topography. The soil and rocks – the mineral composition – also vary in each province posing unique challenges to maintaining water quality.

Mineral composition plays a critical role in water quality. For example, during rainfall in the Coast Range, significant amounts of very fine-grained sediments can choke gravel beds in streams and clog up drinking water intakes. This problem can be exacerbated by land management activities that hasten erosion, disturb soil, or hydraulically connect run-off to streams. Similar results can be expected in the upper reaches of the Umpqua Basin where unconsolidated ash and pumice deposits are located.

Map 5: Lithology Class of the Umpqua Basin



The basin also features a similarly complex groundwater system. The area does not contain many productive aquifers for drinking water or other types of water wells except in a few localized pockets. Additional information regarding the Umpqua Basin's geology is discussed in Appendix B.

Klamath Mountains

The oldest rocks in the basin are around 250 million years old and found mostly in the southern part of the basin in the Klamath Mountains. The Klamath Mountains consist primarily of marine sediments and volcanic rocks and have a composite thickness of about six miles deep.

Metamorphic and sedimentary rocks extend in a northeast trending band

west of Myrtle Creek. These rock formations are generally low in permeability so water only moves through fractures, joints and weathered areas.

The processes that led to the creation of the Klamath Mountains enriched the subsurface with gold, copper, nickel, chromite and other metals. The metal content of the Klamath Mountains has a significant effect on the geochemistry of the groundwater. Although there have been relatively few groundwater studies in the Klamath Mountains it is extremely likely that some areas naturally contain elevated levels of arsenic, fluoride, nickel, chromium, iron, and manganese.

Coast Range

The main stem of the Umpqua River flows through the Coast Range into broad estuaries, where the saltwater tides often reach 20-30 miles upstream. These salty waters are unsuitable for domestic use but provide a critical habitat for fish and other wildlife. The Coast Range is composed of pillow basalt flows and inter-bedded marine sediments that have a significant amount of brackish material remaining between flow zones and in the sedimentary portions. As such, the groundwater pumped from these zones can be salty and unsuitable for domestic or agricultural use.

The Coast Range features soils of varying depth. Sometimes the soils are only a thin veneer that may be mere inches to a few feet in depth. Intense rainfall occurs in the coastal area and often soaks through the soil where it encounters a less permeable zone. Rainwater runs along this layer until it surfaces as natural seeps. In steep terrain, these shallow surface flows often lead to landslides.

Coal and natural gas deposits were discovered and mined in the southern and northern portions of the Coast Range, but economically attractive concentrations have yet to be encountered in the Umpqua Basin. These deposits, especially when disturbed, can degrade local surface and groundwater quality.

Western Cascades

The Western Cascades, composed of sedimentary rocks formed 56 million to 23 million years ago, extend through the eastern third of the basin and abut the High Cascades. The region also contains silica ash-flow tuffs and volcanic rock from 20 million to 5 million years ago. Andesitic flow rocks and lavas (andesite is a fine-grained, volcanic rock) are exposed in the headwaters of the North and South Umpqua Rivers.

The volcanic rocks and soil in the Western Cascades generally have low permeability. Wells drilled into these formations tend to have low yields. With the exception of runoff from weakly mineralized zones in the Bohemia Mining district in Lane County, groundwater quality of the Western Cascade Province appears to be exceptionally good. Arsenic concentrations are occasionally detected in groundwater, but most often, secondary contaminants (iron and manganese) and bacteria from failing septic systems are a greater threat to water quality.

High Cascades

The geologically youthful High Cascades Province consists of flows of basalt and basaltic andesite that are spotted with several volcanic peaks and cinder cones. The southern portion is “mantled” with tan to beige colored ash and pumice deposits derived from the eruption of Mount Mazama at Crater Lake. The glacially carved basins of the province are littered with numerous fresh water lakes, ponds, and marshes that represent some of the most pristine conditions on the planet.

1.7 Beneficial Uses

Surface water quality standards have been developed to protect beneficial uses in the Umpqua Basin (OAR 340-41-0320), Table 1.

Table 1: Designated Beneficial Uses Umpqua Basin (OAR 340-041-0320)

Beneficial Uses	Umpqua R. Estuary to Head of Tidewater & Adjacent Marine Waters	Umpqua R. Main from Head of Tidewater to Confluence of N. & S. Umpqua Rivers	North Umpqua River Main Stem	South Umpqua River Main Stem	All Other Tributaries to Umpqua, North & South Umpqua Rivers
Public Domestic Water Supply[1]		X	X	X	X
Private Domestic Water Supply[1]		X	X	X	X
Industrial Water Supply	X	X	X	X	X
Irrigation		X	X	X	X
Livestock Watering		X	X	X	X
Fish & Aquatic Life	X	X	X	X	X
Wildlife & Hunting	X	X	X	X	X
Fishing	X	X	X	X	X
Boating	X	X	X	X	X
Water Contact Recreation	X	X	X	X	X
Aesthetic Quality	X	X	X	X	X
Hydro Power			X	X	X
Commercial Navigation & Transportation	X				

[1]With adequate pretreatment (filtration & disinfection) and natural quality to meet drinking water standards.

Groundwater quality standards are published in OAR 340-40-0020[4] and OAR 340-40-0090. In practice, water quality standards are set at a level to protect the most sensitive beneficial uses. The beneficial uses which are most sensitive to water quality impairments are typically fish and aquatic life, public and private drinking water supply (both groundwater and surface water), and water contact recreation. Temperature, dissolved oxygen, pH, sediment and pesticides are examples of pollutants which directly affect fish and aquatic life. Bacteria, nitrates, turbidity, radon, and toxics are examples of pollutants which directly affect human health. The affects of these and other pollutants on beneficial uses will be discussed in more detail in the following sections.

[4] More information about groundwater quality standards can be found at: http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_340/340_040.html

1.8 Water Rights

Under Oregon law, all water is publicly owned. With some exceptions, water users must obtain a permit, known as a water right, from the Oregon Water Resources Department to use water from any source— whether it is underground, or from lakes or streams. Generally speaking, landowners with water flowing past, through, or under their property do not automatically have the right to use the water without a permit. The major uses of diverted water in Oregon are to supply the water needed for agricultural, municipal, and industrial purposes. More information can be found on OWRD's website.[5]

With the exception of a few waterways located near Reedsport, the Umpqua Basin is fully allocated during the warm, dry month of August, meaning there is no excess water available to obtain surface water rights. Water is available for use and storage during the cool, wet winter months. At the time of this writing, there are 5,227 surface water rights, 99 groundwater rights, and 1,072 storage water rights in the Umpqua Basin. A recent query of OWRD water rights database for private domestic points of diversion (using a threshold of 0.005 cfs for domestic water rights that are household use only, not irrigation) identified 759 private domestic water rights in the Umpqua Basin. There are also numerous private groundwater wells that do not require a permit due to the exempt use (ORS 537.545). OWRD regularly grants the "human use exemption' (i.e., year-round human consumption use (indoor use only: cooling, drinking, sanitation at a rate of 0.005 CFS, further limited to 500 gallons per day).

Water rights in the Umpqua Basin are allocated to support the basin's beneficial uses, such as: irrigation, mining, domestic, livestock, municipal, recreation, wildlife, and commercial industrial. The Douglas County Water Master periodically regulates junior users in the late summer and early fall months due to low streamflows. As streamflows recede, those users with junior rights are the first required to curtail their water use. Senior water right holders are allowed to continue using water, even in dry years and low flow conditions, as long as water is available to meet demand under their priority date. Low summer flows can worsen the effects of water pollution in water quality limited streams, exacerbating the stressors on aquatic life. Water conservation for domestic, industrial and agricultural uses will need to be implemented in order to meet instream and out of stream needs.

In the Umpqua Basin, groundwater is a critical natural resource providing domestic water supply, baseflow for rivers, lakes, streams and wetlands, and other beneficial uses. Groundwater can travel very slowly, and once contaminated, can be very difficult or nearly impossible to clean up. In areas where groundwater supply wells are hydraulically connected to surface water bodies, groundwater extraction can impact surface water resources. The groundwater resource in the Umpqua Basin is limited in terms of quantity and quality due to underlying rock formations. The variability in water quantity limits use by industrial, municipal, and other large water users. For example, naturally occurring arsenic is known to occur in portions of Douglas County, specifically near the Sutherlin area. The public drinking water systems serving these communities contain no detectable levels of arsenic. Within Douglas County, there are 61 public groundwater water systems serving a population of approximately 7,000 people.

Oregon Water Resources Department worked with other state agencies and the gathered public input to develop an integrated water resources strategy for the Oregon Legislature in which the foundation was set to address the impacts of water withdrawals and integrating collaboration on data collection and monitoring between state agencies[6].

[5]More information on OWRD can be found at: www.oregon.gov/owrd/Pages/wr/index.aspx

[6] More information on Oregon's Integrated Water Resources Strategy can be found at: www.oregon.gov/owrd/LAW/docs/IWRS_Final_2.pdf

1.9 Fisheries

Streams in the Umpqua Basin provide habitat for a wide variety of cold-water fish species[7]. There are over 2,600 stream miles of potential anadromous fish habitat in the Umpqua Basin. The following list represents the major fish species found within the basin:

Steelhead Trout (Onchorhyncus mykiss)
Striped bass (Morone saxatilis)
Chinook Salmon (Oncorhynchus tshawytscha)
Smallmouth bass (Micropterus dolomieu)
Coho Salmon (Onchorhyncus kisutch)
Largemouth bass (Micropterus salmoides)
Coastal Cutthroat Trout (*Onchorhynchus clarki clark*i)
Pumpkinseed (Lepomis gibbosus)
Chum salmon (Oncorhynchus keta)
Rainbow trout (*Oncorhynchus mykiss*)
Pacific lamprey (Lampetra tridentata)
Yellow perch (Perca flavescens)
River lamprey (*Lampetra ayresi*)
Bluegill (Lepomis macrochirus)
Western brook lamprey *(Lampetra richardsoni)*
Sculpin (*Cottus sp*.)
American shad (Alusa sapidissima)
Redside shiner (Richardsonius balteatus)
Eastern brook trout (*Salvelinus frontinalis*)
Umpqua dace (Rhinicthys cataractae)
Brown trout (*Salmo trutta*)
Long-nose dace (Rhinicthys cataractae)
Largescale sucher (Catostomus macrocheilus)
Speckled dace (Rhinichthys osculus)
Umpqua chub (Oregonichthuys kalawatseti)
Umpqua pikeminnow (Ptychocheilus umpquae)
Fathead minnow (Pimephales promelas)
Brown bullhead (Ameiurus nebulosus)
Tui chub (Gila bicolor) Mosquitofish (Gambusia affinis)
White sturgeon *(Acipenser transmontanus)*
White sturgeon (Acipenser medirostrus)
Umpqua squawfish (*Ptychocheilus umpquae*)

Key species of interest to TMDL development and implementation include the Steelhead Trout *(Onchorhyncus mykiss)*, the Chinook Salmon *(Oncorhynchus tshawytscha)*, Coho Salmon *(Onchorhyncus kisutch)* [8] and the Coastal Cutthroat Trout *(Onchorhynchus clarki clarki).* Life stages for these key species are listed in Table 2. It is important to note that the table below covers the entire Umpqua Basin, and fish use is different in the different subbasins. Table 3 lists threatened and endangered species in the Umpqua Basin.

[7] More information about fish species in the Umpqua Basin can be found at: http://oregonexplorer.info/umpqua/Fish/FishSpecies
[8] More information about Endangered Species can be found at: www.fws.gov/endangered/

Table 2: Umpqua Basin Fish Use (Oregon Department of Fish and Wildlife, 2005)

Species	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter Steelhead	Adult migration												
	Adult Spawning												
	Adult Holding												
	Eggs to Fry												
	Juvenile Rearing												
	Juvenile migration												
Summer Steelhead	Adult migration												
	Adult Spawning												
	Adult Holding												
	Eggs to Fry												
	Juvenile Rearing												
	Juvenile migration												
Fall Chinook Salmon	Adult migration												
	Adult Spawning												
	Adult Holding												
	Eggs to Fry												
	Juvenile Rearing												
	Juvenile migration												
Spring Chinook Salmon	Adult migration												
	Adult Spawning												
	Adult Holding												
	Eggs to Fry												
	Juvenile Rearing												
	Juvenile migration												
Coho Salmon	Adult migration												
	Adult Spawning												
	Adult Holding												
	Emergence												
	Juvenile Rearing												
	Juvenile migration												
Searun Cutthroat Trout	Adult migration												
	Adult Spawning												
	Adult Holding												
	Emergence												
	Juvenile Rearing												
	Juvenile migration												

The Umpqua estuary is the fourth largest estuary in Oregon and provides important habitat for marine mammals, birds and a wide variety of fish[9]. Commercial and recreational shellfish harvesting, fishing and boating in the river, estuary and offshore, have been a important economic resources for generations. The basin also contains a number of lakes which provide numerous fishing, boating, swimming and other recreational opportunities.

[9] More information on fish distribution in the Umpqua Estuary can be found at: https://nrimp.dfw.state.or.us/CRL/Reports/Info/86-6.pdf

Table 3: Federally Listed Threatened and Endangered Species, Umpqua Basin

UMPQUA BASIN: FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES	
THREATENED SPECIES	**CANDIDATE SPECIES**
Birds – Marbled murrelet (T), Western snowy plover (T), Short-tailed albatross (E), Northern spotted owl (T) **Fish – Coho salmon (T), Green sturgeon (T), Pacific eulachon (T)** **Reptiles – Leatherback sea turtle (E), Green sea turtle (T), Loggerhead sea turtle (E)** **Plants – Kincaid's lupine (T), Rough popcorn flower (E), Gentner's Fritillary (E)**	**Fish** – Steelhead **Plants –** Whitebark Pine **Mammal –** Fisher
ESSENTIAL FISH HABITAT	**PROPOSED SPECIES**
Chinook, Coho, Green sturgeon, Pacific eulachon	None
DELISTED SPECIES	**KEY**
Birds - American Peregrine falcon, Bald eagle, Brown pelican	**E –** Endangered **T -** Threatened

Temperature and fine sediment have been identified as pollutant stressors that affect fish and other aquatic life throughout the basin. Macroinvertebrate sampling by DEQ showed 47 percent of the sampled sites to be in "most disturbed" condition[10]. In some portions of the Umpqua Basin, such as the South Umpqua, dissolved oxygen, nutrients, and pH have also been identified as stressors. Habitat and flow modification, while not technically considered pollutants, are also of concern and impact 134 stream segments (1,611 collective miles) within the Umpqua Basin.

A significant number of watershed restoration projects have been implemented to restore salmon runs by improving habitat and water quality conditions. Economically this restoration work is important because the Umpqua River boasts some of the world's best fly-fishing, salmon fishing, sturgeon fishing, and water-based recreation.

1.10 Land Use and Resource Concerns

Urban Development

According to US Census data, Douglas County population was estimated at 107,667 in 2010. Over 40 percent of Douglas County residents live outside incorporated cities (Table 4). There are 12 incorporated cities within the Umpqua Basin: Canyonville, Drain, Elkton, Glendale, Myrtle Creek, Oakland, Reedsport, Riddle, Roseburg,

[10] More information about the PREDATOR model can be found at: www.deq.state.or.us/lab/techrpts/docs/10-lab-004.pdf

Sutherlin, Winston, and Yoncalla. The majority of the population is located within the Sutherlin, Roseburg, Winston, Myrtle Creek corridor, and is concentrated in areas with public water and/or sewer services. The County also has several urban unincorporated areas with high growth rates. Over 30 percent of the population is within the South Umpqua subbasin and dependent on water from the South Umpqua River.

Table 4: 2010 Census data, population and housing units

CENSUS DATA, 2010		
	Population	Housing Units
Urban	63,332	28,553
Rural	44,335	20,362
Total for Douglas County	107,667	48,915

In urban and suburban areas, much of the land surface is covered by buildings and pavement, which do not allow rain and snowmelt to soak into the ground. Instead, most developed areas rely on storm drains to carry large amounts of runoff from roofs and paved areas to nearby waterways. The stormwater runoff carries pollutants such as oil, dirt, chemicals and lawn fertilizers directly to streams and rivers, where they harm water quality. To protect surface water quality and groundwater resources, development should be designed and built to minimize increases in runoff and citizens educated about pollution prevention actions and alternatives.

Agriculture

Agriculture in the Umpqua Basin includes livestock, hay and silage, wine grapes, small grains, fruit crops, Christmas trees, and vegetables (truck crops). The majority of the agricultural lands are used for grazing and permanent hay fields. According to OSU, in 2011, the total estimated agricultural gross receipts for Douglas County were $79.2 million[11] for animal and crop sales.

If not managed appropriately, agricultural practices can impact surface and groundwater quality. Poor grazing management may result in bare or sparsely vegetated areas, contributing to the runoff of pollutants such as bacteria, streambank erosion, and elevated water temperatures. Excessive fertilizer application can lead to elevated nitrate levels in groundwater. Unsuitable irrigation practices, for a particular topography or soil, can cause soil erosion and runoff of polluted water. Natural regeneration of a riparian forest is possible if farming and grazing practices are modified and natural vegetation is allowed to grow. However, riparian planting and bank stabilization projects will accelerate habitat recovery. Although progress is being made in this area, it will take a significant amount of time for these riparian areas to recover to a fully functioning condition.

The goal of the Umpqua Basin Agriculture Water Quality Management Area Plan is to prevent and control water pollution from agricultural activities and soil erosion and to achieve applicable water quality standards. The Agriculture WQMAP is implemented through voluntary efforts, outreach and education, technical and financial assistance from Soil and Water Conservation Districts and other entities, and ODA's compliance program. The Umpqua Basin Agricultural Water Quality Management Plan and Rules were developed by the Umpqua Basin Local Advisory Committee and the Oregon Department of Agriculture.

The Douglas Soil and Water Conservation District and the Umpqua Soil and Water Conservation District have selected focus areas to work in during the 2013-2015 biennium. Pre and post landscape condition assessments will be completed and SWCDs will focus their outreach and education and technical and financial

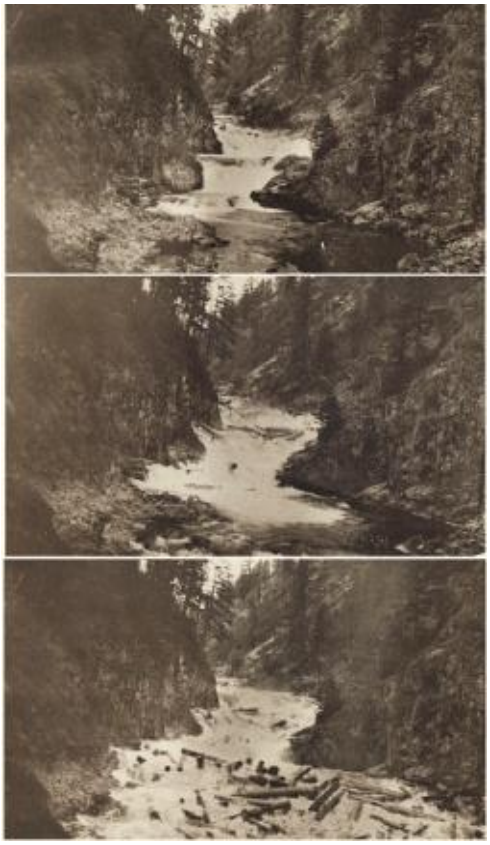
[11] www.oregon.gov/ODA/docs/pdf/pubs/agripedia_stats.pdf

assistance in these areas with the goal of demonstrating improvement in conditions affecting agricultural water quality. Strategically focused work has been identified as a way to maximize use of limited resources and provide measurable changes in landscape conditions and compliance with the regulations.

Forestry

Douglas County contains nearly 1.8 million acres of commercial forestlands and one of the largest stands of old growth timber in the world[12]. Logging still provides the region's main livelihood; approximately a quarter of the labor force is employed in the forest products industry. Although current logging practices provide greater protection of waterways, legacy timber harvest has resulted in adverse impacts to riparian vegetation, concentrated flows from roads and landings, and disruption of stream channel stability. Legacy splash dams have caused lasting scars in many waterways. Today most logs are trucked to mills, but in the early twentieth century, waterways were a major means of transporting logs[13]. Since stream flow in smaller tributaries was insufficient to float logs, splash dams were built to create artificial ponds where logs were stored. The dams were then opened periodically, releasing a flood of water and logs downstream. Obstructions were often blasted out of streams to further improve the flow of logs. This practice eroded stream banks, scoured spawning beds, and destroyed habitat.

Figure 7: Oregon Historical Society: This sequence of photographs shows logs released from behind a splash dam moving through southern Washington's Wind River. The photographs were most likely taken sometime between the early 1900s and the mid-1920s.



The effect of forest practices (road networks, clear cut harvesting, shallow landslides) on temperature and aquatic ecosystems in stream corridors is a significant natural resource concern[14]. Legacy timber practices have resulted in adverse impacts to riparian vegetation and stream channel stability. Conservation on private and industrial forestland, where timber production is the primary emphasis, is limited as a result of the short timber harvest cycle (40 to 60 years). Ownerships where medium to long term harvest cycles are employed offer more potential for conservation of forest biodiversity and habitat structure.

The Oregon Department of Forestry through the Oregon Forest Practices Act is the authority for regulating forest practices. However, in some cases other state agencies' regulatory programs apply to certain aspects of forest operations. The Act regulates timber harvest, road construction, chemical use and other practices on private lands by regulating post-harvest reforestation, streamside buffers and other measures, and specifies best management practices to protect water, soil, sensitive wildlife sites and other resources.

[12] More information on the history of Douglas County can be found at: http://arcweb.sos.state.or.us/pages/records/local/county/douglas/hist.html

[13] www.ohs.org/the-oregon-history-project/historical-records/wind-river-log-drive.cfm

[14] The Report of the Ad Hoc Forest Practices Advisory Committee on Salmon and Watersheds: www.oregon.gov/odf/privateforests/docs/fpacreport.pdf

Mining

Historic mining practices also reshaped the landscape. Hydraulic mining used high pressure water to remove soil from a placer deposit, washing the soil into flumes. The flumes had riffles that trapped the heavier valuable minerals while allowing the waste sediment to flow away. Most of the unwanted sediment ended up in streams and rivers where it smothered the spawning beds of fish and filled wetlands and other low-lying areas, increasing the frequency and intensity of floods. Hydraulic mining resulted in widened banks, loss of fish habitat, and degraded water quality.[15]

Figure 8: Small Oregon Hydraulic Gold Mining Operation – 1885, Mining artifacts.org

A number of historic ore mines have been identified as clean-up sites by DEQ, the most well known is the Formosa Mine, located on Silver Butte, about 10 miles south of the town of Riddle. The 76-acre mine has been identified as an EPA superfund site due to the acid rock drainage flowing from the mine. Thirteen miles of Middle Creek and the South Fork of Middle Creek have been impacted, affecting macroinvertebrates, resident fish, coastal steelhead trout, and Oregon coastal Coho salmon. More information can be found on EPA's website[16].

Modern mining operations may also result in substantial environmental impact if protective measures are not taken. If not properly located and managed, aggregate mining can result in stream capture of the pit or landslides, increasing turbidity and modifying habitat. Improper management or closure of a mineral mine can result in surface and groundwater contamination, resulting in unnaturally high concentrations of some chemicals, such as arsenic, sulfuric acid, and mercury in acid mine drainage.

Mineral exploration and production in Oregon is regulated by the Department of Geology and Mineral Industries. The department regulates surface mining, in addition to oil, gas and geothermal resource exploration to ensure that mine operators protect the environment while mining and return the land to beneficial use after mines are closed.

[15] www.miningartifacts.org/OregonMines.html

[16] http://yosemite.epa.gov/r10/cleanup.nsf/5c8919bc41f032578825685f006fd670/2e0107830190476a882571f0006623b0!OpenDocument

2. Water Quality Status and Impacts to Beneficial Uses

The following sections discuss the status of water quality as it relates to the specific beneficial uses of human health and fish and aquatic life and by the pollutant(s) identified as responsible for the water quality impairment. Water quality trending for these uses and pollutants will also be discussed where the data are available.

2.1 General Surface Water Quality Conditions

2.1.1 Oregon Water Quality Index

Surface water quality conditions in the Umpqua Basin were examined using data from DEQ's Oregon Water Quality Index, also known as OWQI[17]. This index provides a general assessment of water quality at a site by combining information from eight different sub-indices: temperature (T), dissolved oxygen (DO), pH, biochemical oxygen demand (BOD), total solids (TS), nutrients (nitrogen (N) and phosphorus (P)) and bacteria (BacT). The index scores are classified into five condition classes from excellent to very poor.

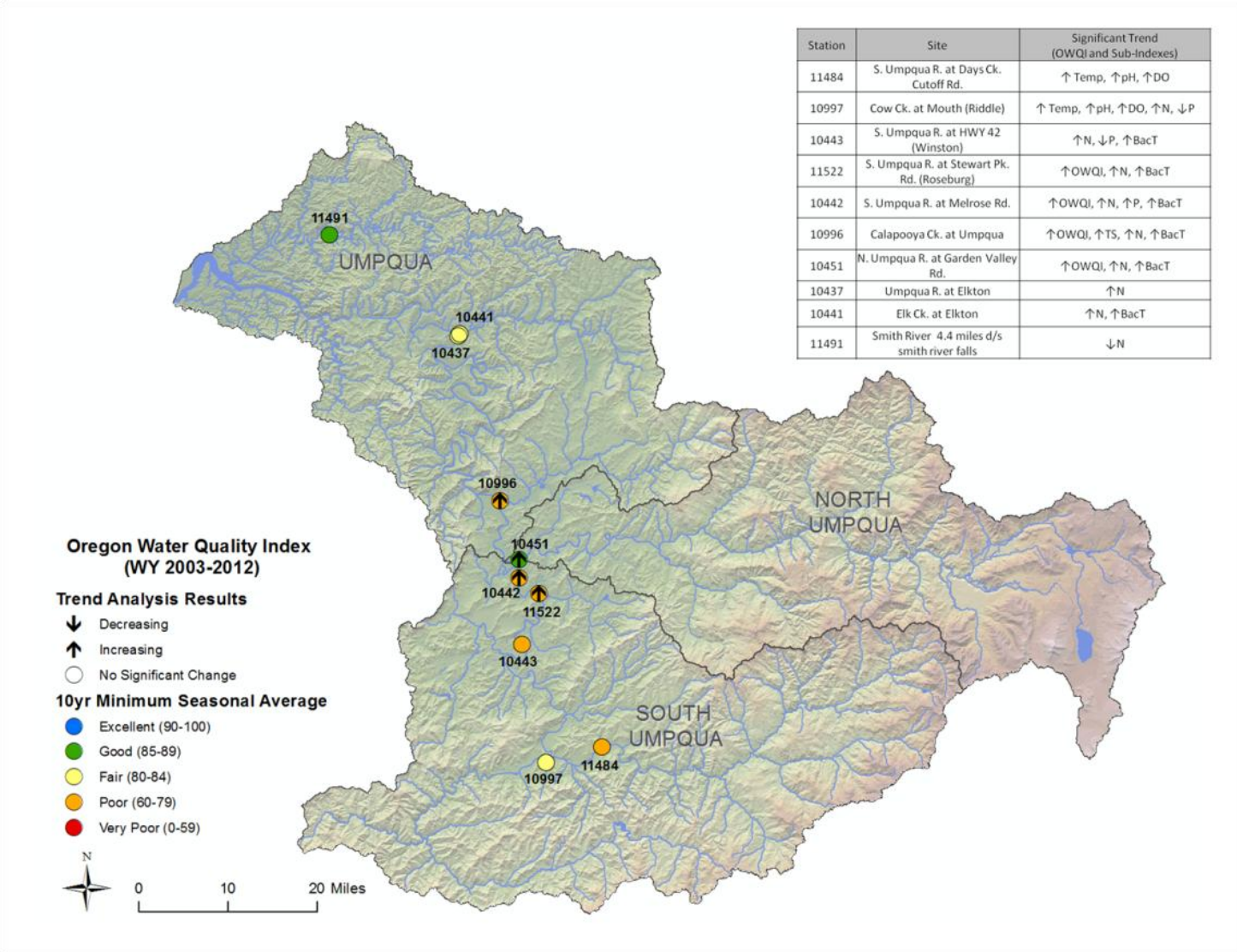
The OWQI results for the Umpqua Basin show sites to be ranging from good to poor condition for the analysis of the data collected during the water years 2003 through 2012. Of the ten DEQ river monitoring stations in the Umpqua Basin, five sites are in the poor category, three sites are in the fair category, and two sites fall into the good category. Significant increasing (improving) trends in the OWQI (using the nonparametric Seasonal-Kendall test) were found at 4 of 10 sites in the basin (Map 6).

Going down stream in the South Umpqua subbasin, we see poor OWQI condition for each of the main stem Umpqua sites. The poor condition at all of these sites is driven by temperature, total solids, and to a lesser extent the BOD sub-indexes. Encouragingly, there are significant increasing (improving) trends in temperature, pH, and dissolved oxygen sub-indexes at the South Umpqua River at Days Creek (11484). In addition to the sub-indexes mentioned above, the South Umpqua at HWY 42 (10443) condition is also negatively affected by the bacteria sub-index. Here we see significant improving trends in nitrogen and bacteria sub-indexes, however, the phosphorous sub-index is showing a declining (decreasing) trend. Conditions at the South Umpqua R. at Stewart Pk. Rd. (Roseburg) (11522) is negatively impacted by the pH sub-index, but nitrogen and bacteria sub-indexes are showing an improving trend, which results in an overall increase in the OWQI. At the South Umpqua R. at Melrose Rd. (10442) pH, dissolved oxygen, and phosphorus drive the condition down. Fortunately, the overall OWQI, nitrogen, phosphorus, and bacteria all have improving trends. The one tributary sampled in the subbasin, Cow Ck. at the mouth (10997), is in fair condition due to temperature, dissolved oxygen, and total solids sub-indexes. This site has significant improving trends in temperature, pH, dissolved oxygen, and nitrogen sub-indexes and a declining trend in phosphorus.

[17] More information on the OWQI index scoring and trending can be found in the following document www.deq.state.or.us/lab/wqm/docs/OWQISummary12.pdf.

There is only one sample location in the North Umpqua subbasin, North Umpqua R. at Garden Valley Rd. (10451). It is in good condition but shows low sub-index scores (poor) for temperature and BOD, while sub-indexes, nitrogen and bacteria, and the OWQI, indicate improving trends.

Map 6: Oregon Water Quality Index conditions at ten ambient monitoring stations in the Umpqua Basin



Note: Colors indicate quality (blue = excellent, green = good, yellow = fair, red = very poor). Arrows indicate significant trends in OWQI scores over the last ten year period. Up arrows indicate improving trends, down arrows indicate declining trends.

In the lower basin, the Calapooya Ck. at Umpqua (10996) is in poor condition which is driven by temperature, BOD, total solids, phosphorus, and bacteria. However, OWQI total solids, nitrogen, and bacteria sub-indexes are showing improving trends. Umpqua at Elkton (10437) and Elk Creek at Elkton (10441) are both in fair condition and have similar sub-indexes. Temperature, BOD, total solids, and phosphorus shows low sub-index scores. However, both sites show improving trends in nitrogen and Elk Creek is also showing an improvement in bacteria sub-index. The Smith River 4.4 miles downstream of Smith River Falls (11491) is in good condition,

yet the temperature and BOD sub-indexes are in poor condition. The nitrogen sub-index is showing a declining trend. In summary, all sites in the basin are in poor or very poor condition for temperature, and all but the North Umpqua and Smith River are in poor condition for total solids. The 10 year (2003-2012) trending data shows a general increasing trend at most sites, with a few exceptions. Water quality trends for the sites are shown in Table 5.

Table 5: Pollutant Trends at Umpqua Basin OWQI Monitoring Sites

Site #	Site	Significant sub-index trends*
11484	S. Umpqua R. at Days Ck. Cutoff Rd.	↑T, ↑pH, ↑DO
10997	Cow Ck at Mouth (Riddle)	↑Temp; ↑pH, ↑DO, ↑N, ↓P
10443	S. Umpqua R. at HWY 42 (Winston)	↑N, ↓P, ↑BacT
11522	S. Umpqua R. at Stewart Pk. Rd. (Roseburg)	↑OWQI, ↑N, ↑BacT
10442	S. Umpqua R. at Melrose Rd.	↑OWQI, ↑N, ↑P, ↑BacT
10996	Calapooya Ck. At Umpqua	↑OWQI, ↑TS, ↑N, ↑BacT
10451	N. Umpqua r. at Garden Valley Rd.	↑OWQI, ↑N, ↑BacT
10437	Umpqua R. at Elkton	↑N
10441	Elk Ck. at Elkton	↑N, ↑BacT
11491	Smith River 4.4 miles d/s smith river falls	↓N

** dissolved oxygen (DO), biochemical oxygen demand (BOD), total solids (TS), nitrogen (N), phosphorus (P)) and bacteria (BacT).*

In the South Umpqua River at Melrose Road, example below (Figure 9 and 10), the entire period of record has been assessed (1981 – 2012). Note the parameters phosphorus and bacteria sub-indices (dashed lines) track well with the OWQI scores (solid lines) illustrating these parameters are having a large influence on OWQI scores through time.

Figure 9: South Umpqua River at Melrose Road Bacteria Sub-index

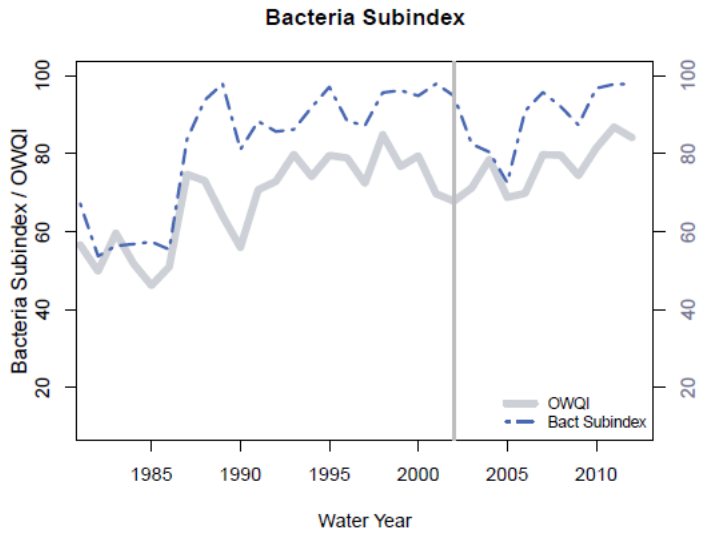
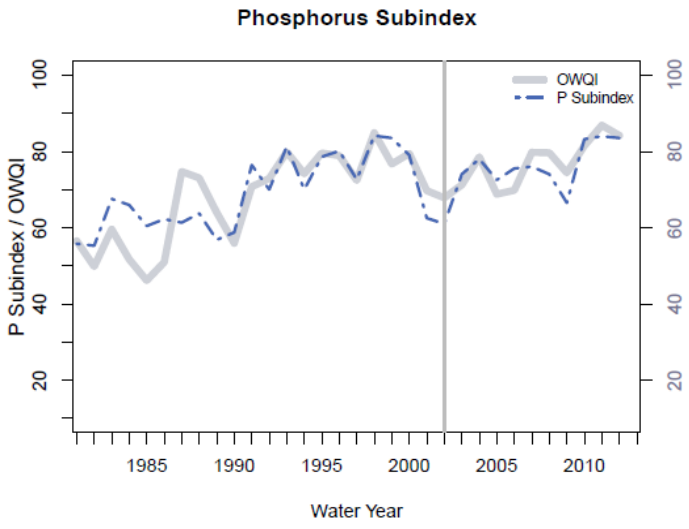


Figure 10: South Umpqua River at Melrose Road Phosphorous Sub-index



Note some parameters assessed in the OWQI may be subject to diel fluctuations and are more sensitive to time of day sampling. These parameters include temperature, dissolved oxygen, and pH. More temporally intensive monitoring efforts may be useful in more fully understanding these parameters.

2.1.2 Coastal Environmental Monitoring and Assessment

The Coastal Environmental Monitoring and Assessment Program, also known as CEMAP[18], was designed to estimate the current status and trends in coastal waters. Water column measurements are combined with information about sediment characteristics and chemistry, benthic organisms, and fish to describe the current estuarine condition.

CEMAP randomly sampled Oregon's estuaries during the summer between 1999 and 2006. A total of twenty-one monitoring sites fell in the Umpqua estuary and includes samples from 2001, 2002, 2004, 2005, and 2006. The following information is a summary of the CEMAP data collected in the Umpqua Basin.

[18] www.deq.state.or.us/lab/wqm/CEMAP.htm

Table 6: Umpqua Estuary CEMAP Stations

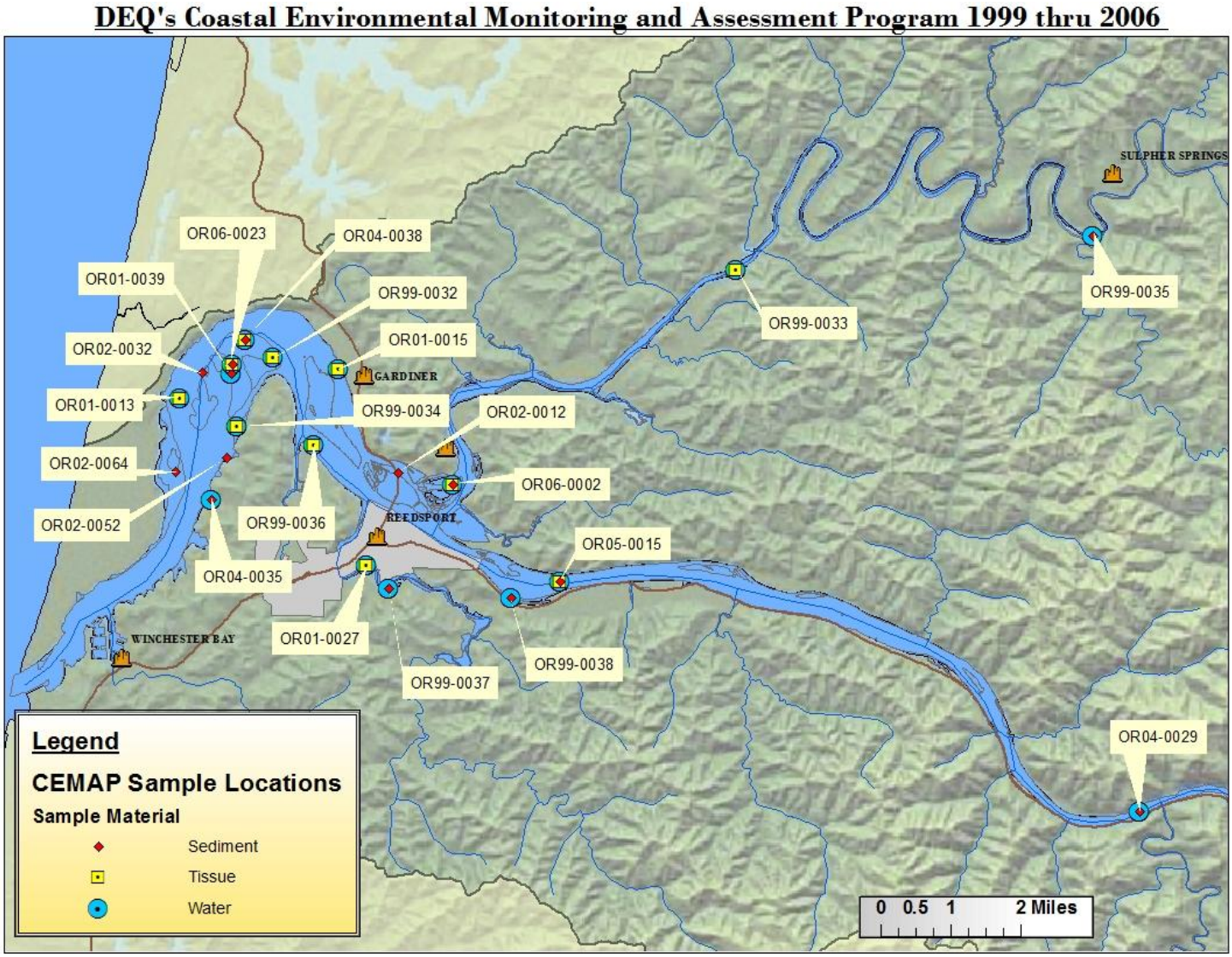
No. of Stations	LASAR ID	1999 - 2006 EMAP Station	Lat	Long	Station Description
1	20691	OR99-0032	43.74	-124.1363889	Umpqua River
2	20692	OR99-0033	43.7625	-124.0044444	Smith River @ RM 7
3	20693	OR99-0034	43.7252778	-124.1458333	Umpqua River
4	20694	OR99-0035	43.7725	-123.9025	Smith River
5	20695	OR99-0036	43.7222222	-124.1236111	Umpqua River
6	20696	OR99-0037	43.6930556	-124.1002778	Scholfield Creek
7	20697	OR99-0038	43.6922222	-124.0652778	Umpqua River
8	25649	OR01-0013	43.730689	-124.162773	Umpqua River @ RM 5.4 near Barretts Landing
9	25651	OR01-0015	43.738133	-124.117411	Umpqua River @ RM 8.5 East shore near sawmill
10	25663	OR01-0027	43.69767	-124.107074	Scholfield Creek
11	25675	OR01-0039	43.73628	-124.14821	Umpqua River @ RM 6 South of The Point
12	28916	OR02-0012	43.717161	-124.099205	Umpqua River @ RM 10.4 north of Bolon Island
13	28936	OR02-0032	43.736131	-124.156538	Umpqua River @RM 5.7 east of Barretts Landing
14	28990	OR02-0052	43.718665	-124.148633	Umpqua River @RM 4.4 near Henderson Cove
15	29009	OR02-0064	43.715237	-124.162962	Umpqua River @RM 4.2 west side
16	31593	OR04-0029	43.653333	-123.882346	Umpqua River RM 23.9 0.6 NM D/S of Mill Cr.
17	31599	OR04-0035	43.709798	-124.152368	Umpqua River RM 3.9 in Hunt Cove
18	31602	OR04-0038	43.74351	-124.144748	Umpqua River RM 6.6 N of The Point
19	32175	OR05-0015	43.69608	-124.05115	Umpqua River RM 13.8 0.9 NM DS of Koapke Slu
20	32936	OR06-0002	43.71518	-124.08326	Smith River RM 0.9 near N tip of Blacks Island
21	32957	OR06-0023	43.73822	-124.14825	Umpqua River RM 6 W of The Point

2.1.2.1 Water Quality

Water quality nutrient levels and trophic status were generally good. The river dominated surface water generally had lower levels of nitrogen and phosphorus than the deeper more saline water. This is a common summer-time condition for small Oregon estuaries where large tidal exchanges introduce comparatively nutrient rich sea water. Of thirty-one discrete water samples, the median dissolved inorganic nitrogen concentration was 0.13 mg/l, and median dissolved inorganic phosphate was 0.015 mg/l. The National Coastal Condition Report (EPA-620/R-03/002) ranked estuarine surface waters as “Good” when dissolved inorganic nitrogen was less than 0.5 mg/l and “Fair” when dissolved inorganic phosphate was 0.01 – 0.1 mg/l. Median chlorophyll *a* values were below the DEQ water quality criteria of 15 ug/l. The maximum chlorophyll *a* result was 9.4 ug/l, with a median of 3.6 ug/l.

Water clarity is important to ensure enough sunlight reaches submerged aquatic vegetation. Underwater measurements of photosynthetically active radiation (PAR) showed that 20 to 40 percent of ambient PAR was reflected or absorbed just below the water surface. At 0.5 meter depth, the median PAR was 45 percent of ambient. A median of 30 percent PAR reached one meter, and about 10 percent penetrated from one to three meters. The National Coastal Condition Report (EPA-620/R-03/002) considered 20 percent PAR at one meter

sufficient for submerged aquatic vegetation beds. Pacific Northwest submerged aquatic vegetation commonly inhabit depths in the range of one to three meters. Water clarity in the Umpqua estuary typically supports submerged aquatic vegetation.



Map 7: Umpqua Estuary CEMAP Stations

2.1.2.2 Pollutant Exposure: Sediment Quality

Metals

Sediment samples were analyzed for a suite of metals and organic compounds. The metals aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver and zinc were detected in Umpqua estuary sediments. Only five of 15 metals (arsenic, chromium, copper, mercury, and nickel) exceeded the Effects Range Low (ERL). Tin and antimony were the only metals not detected.

Nine of the 15 metals have published Effects Range Low and Effects Range Median concentrations (Long, MacDonald, Smith and Calder 1995). An ERL corresponds roughly to a 10 percent likelihood of sediment

toxicity. An ERM is the 50th percentile of sediment concentrations in the literature that had any biological effect. EPA's Mid-Atlantic Integrated Assessment ranked sediments exceeding one or more metal ERL as intermediate, and those exceeding any ERM as poor.

Table 7: ERL and ERM guideline values for trace metals (ppm, dry wt.) (Long et al., 1995) and Umpqua Estuary sediment metal detections and exceedences.

Metal	Effects Range Low (ERL)	Effects Range Median (ERM)	# of detections/ # of total samples	Median (mg/kg dry wt)	# of samples exceeding ERL	# of samples exceeding ERM
Arsenic	8.2	70	20/21	5	2	0
Cadmium	1.2	9.6	7/21	0.101	0	0
Chromium	81	370	21/21	68	8	0
Copper	34	270	21/21	13.9	1	0
Lead	46.7	218	21/21	9.8	0	0
Mercury	0.15	0.71	21/21	0.05	2	0
Nickel	20.9	51.6	21/21	36.7	17	2
Silver	1.0	3.7	20/21	0.05	0	0
Zinc	150	410	21/21	49.6	0	0

Aluminum and iron are among the most abundant elements in the earths' crust, and their estuarine sediment concentrations have be used as a baseline for identifying anthropogenic sources of other metals (Schropp and Windom, 1988; Weisberg, et. al., 2000). Future data analyses could compare estuarine reference site concentrations.

Polycyclic Aromatic Hydrocarbon

Seven of twenty-one sites had at least one polycyclic aromatic hydrocarbon compounds detected at a level that could be quantified, though many more detections were below the reporting limits. None of the samples exceeded the Total PAH ERL (4022 ug/kg dry wt). One station located near Gardiner had more PAH detections above the reporting limit than any other site. The same site was the only station with ERL exceedances. Acenaphthene (88 ug/kg dry wt), anthracene (690 ug/kg dry wt), and fluorene (72 ug/kg dry imately wt) concentrations were four to eight times their ERLs. The fluoranthene concentration nearly met the ERL.

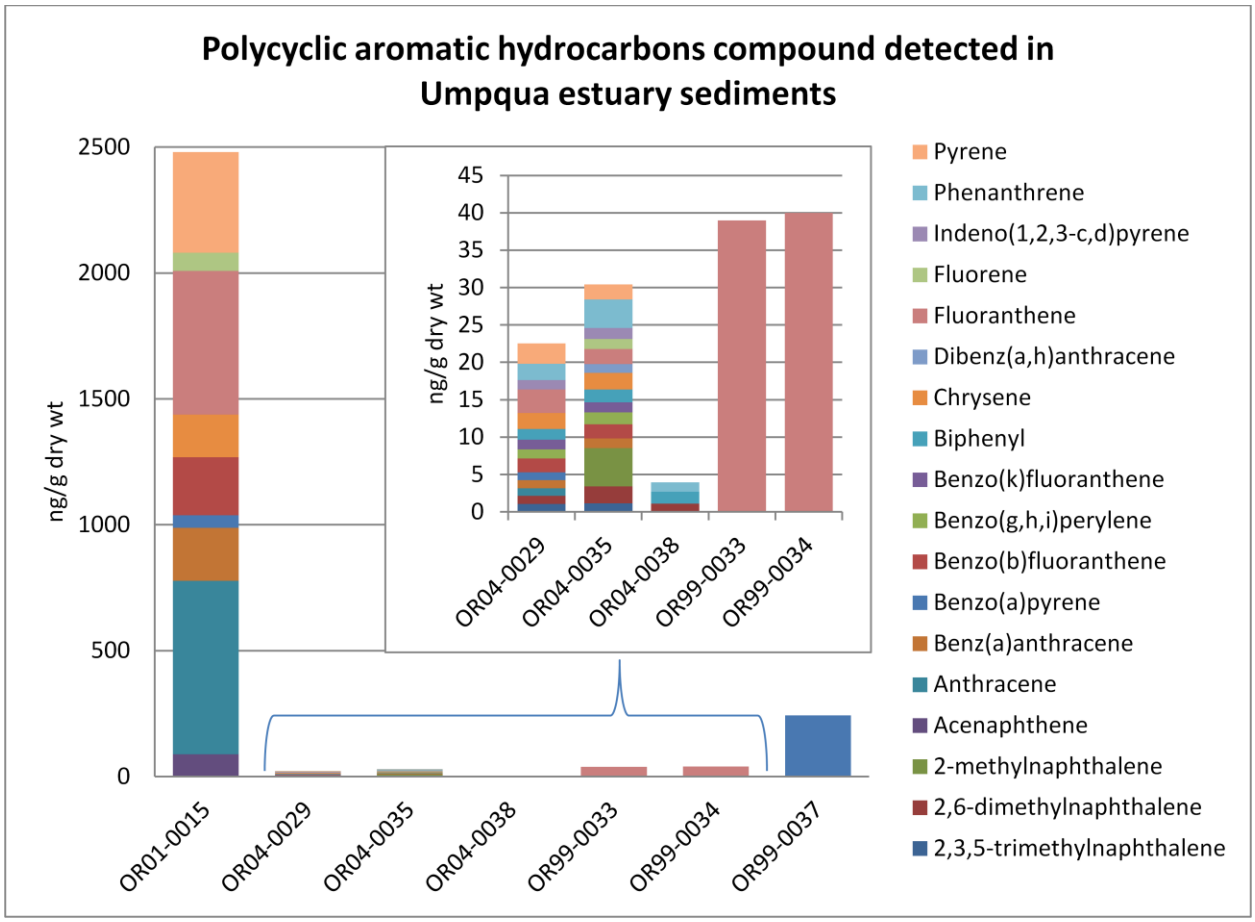


Figure 11: Polycyclic Aromatic Hydrocarbon Compounds Detected in Umpqua Estuary Sediments

Chlorinated Pesticides and PCBs

Umpqua sediments were screened for twenty-two legacy pesticides:

Table 8: Pesticide Analyte List

1.	2,4'-DDD		**10.**	Endosulfan I		**16.**	Heptachlor
2.	2,4'-DDE		**11.**	Endosulfan II		**17.**	Heptachlor epoxide
3.	2,4'-DDT		**12.**	Endosulfan sulfate		**18.**	Hexachlorobenzene
4.	4,4'-DDD		**13.**	Endrin		**19.**	Lindane (gamma-BHC)
5.	4,4'-DDE		**14.**	Endrin Aldehyde		**20.**	Mirex
6.	4,4'-DDT		**12.**	Endosulfan sulfate		**21.**	Toxaphene
7.	Aldrin		**13.**	Endrin		**22.**	Trans-Nonachlor
8.	Alpha-Chlordane		**14.**	Endrin Aldehyde			
9.	Dieldrin		**15.**	Endrin Ketone			

Of the twenty-one sampling locations, only two locations tested positive for pesticides in the sediments, and only three pesticides were detected above the reporting limit. The station near Gardiner is the same site with the greatest PAH detections.

Table 9: Sediment Pesticide Detections

EMAP Station	Location	Pesticide	Result	Units
OR01-0015	Near Gardiner	Heptachlor	2.3	µg/Kg dry wt
OR01-0015	Near Gardiner	Lindane (gamma-BHC)	6.6	µg/Kg dry wt
OR99-0033	Smith River at R.M. 7	Hexachlorobenzene	1.2	µg/Kg dry wt

Map 8: CEMAP Pesticide Detections in Sediment

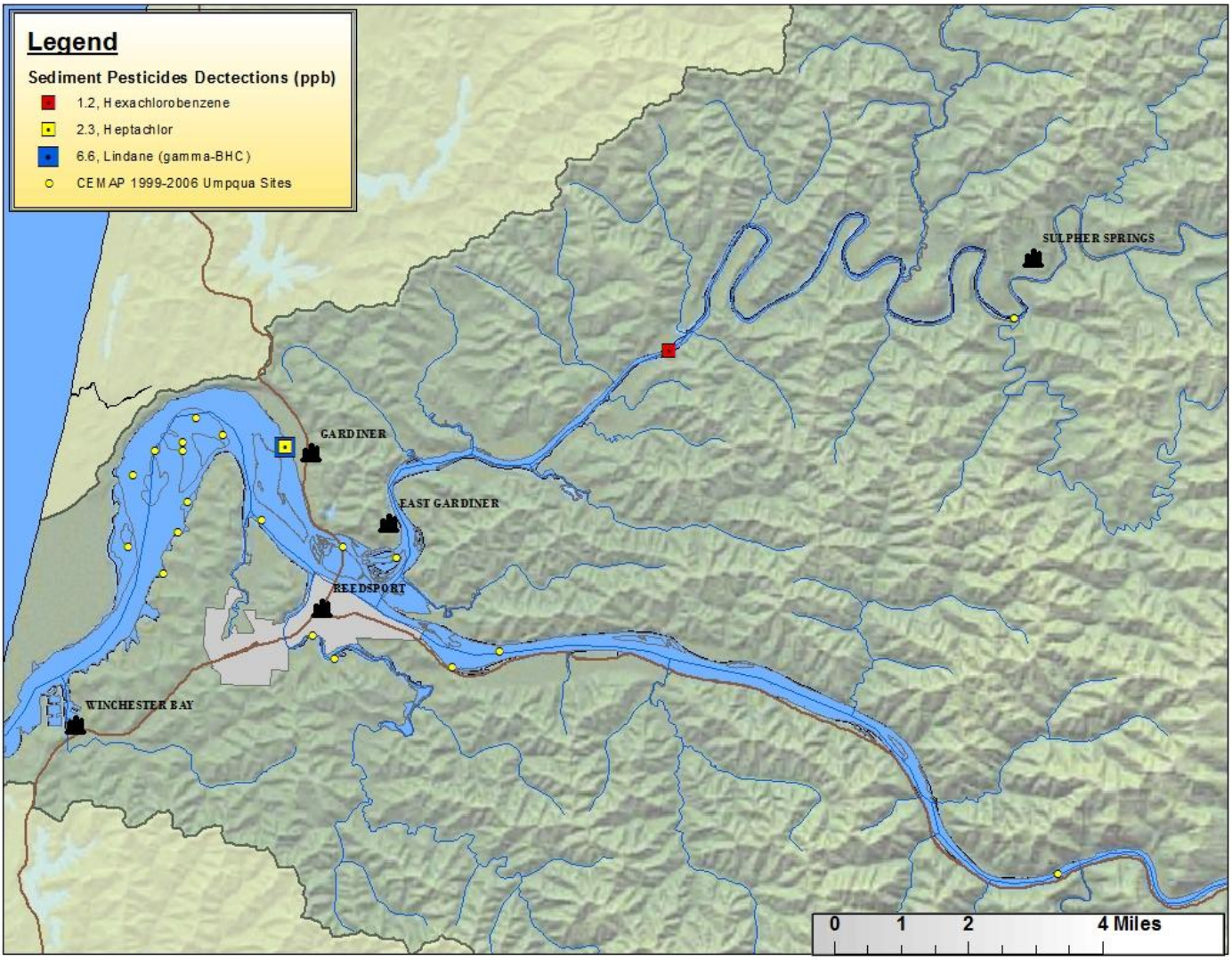
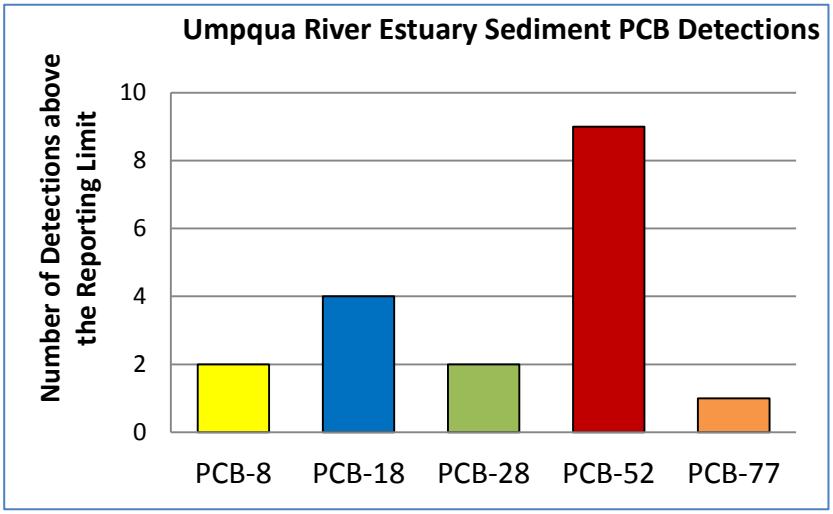
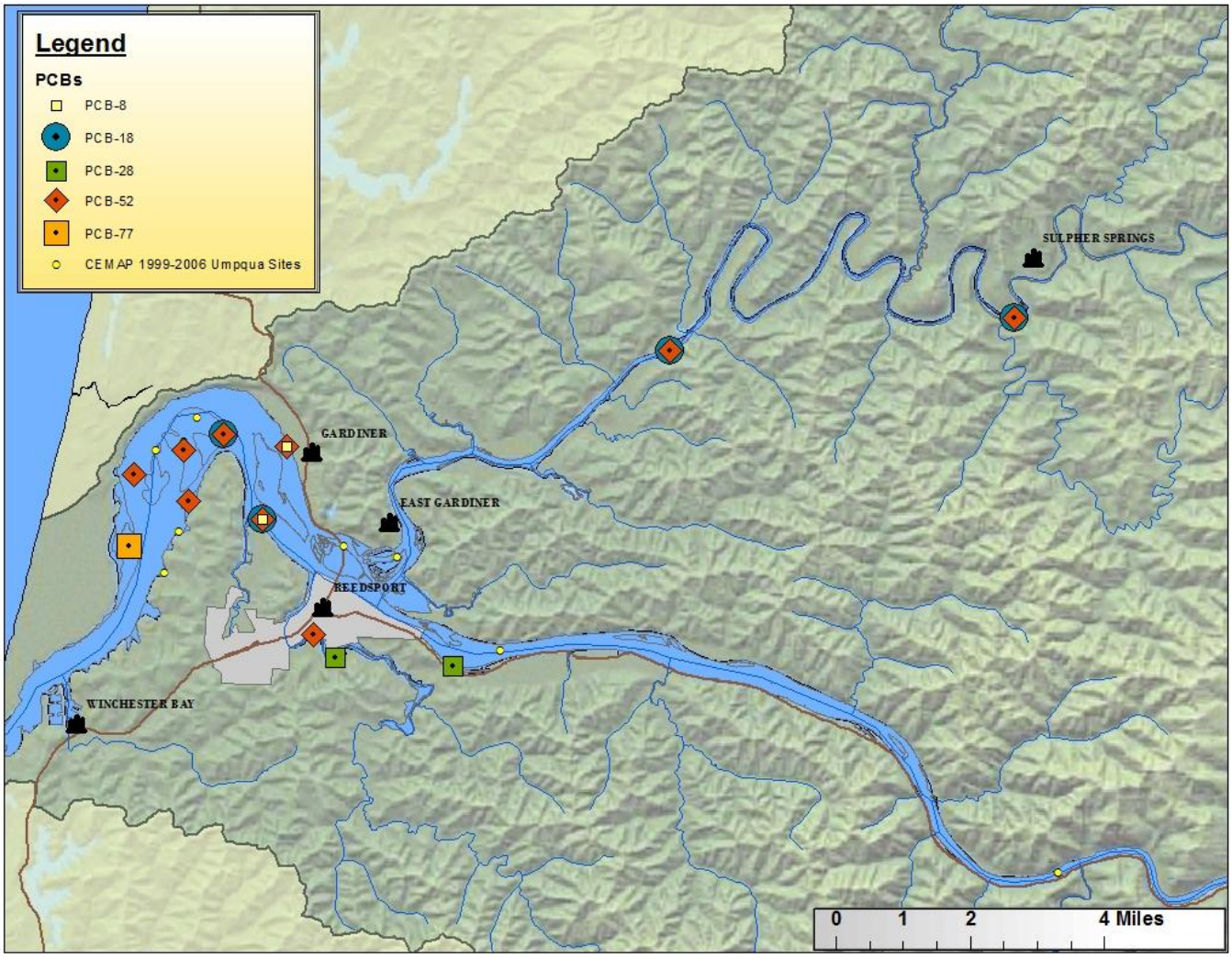


Figure 12: CEMAP Sediment PCB Detections above the Reporting Limit

Sediment samples were also screened for poly-chlorinated biphenyls congeners. Of the twelve sites where PCBs were detected, no stations exceeded the total PCB ERL (22.7 µg/Kg dry wt). Of the twenty-three PCB congeners screened, only five were detected above the reporting limit (PCB- 8, PCB-18, PCB-28, PCB-52 and PCB-77). PCB-52 was the most ubiquitous, with detections at nine sites.



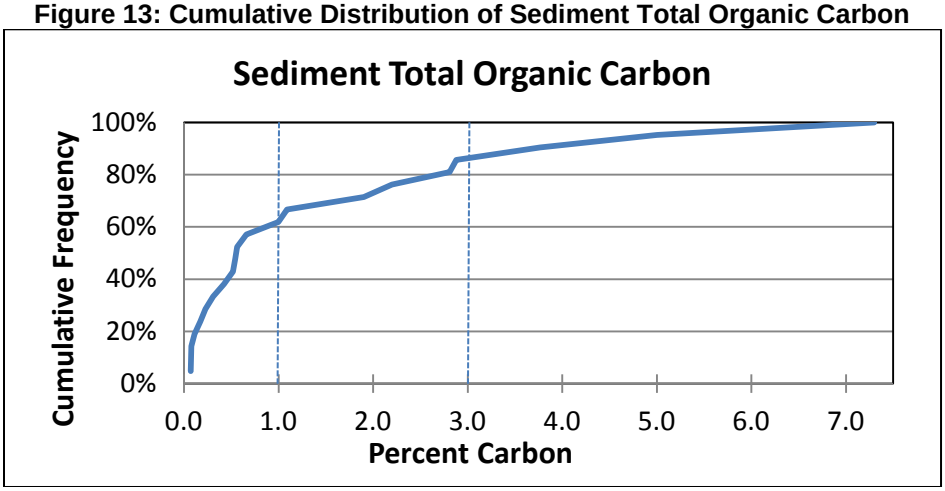


Map 9: CEMAP PCB Detections in Sediment above the Reporting Limit

Total Organic Carbon

Approximately 60 percent of the sites had total organic carbon concentrations of less than one percent carbon. The remaining 40 percent of sites had total organic carbon concentrations greater than one percent, which is indicative of moderate enrichment. About 15 percent of sites were highly enriched (3% to 7.3% TOC).

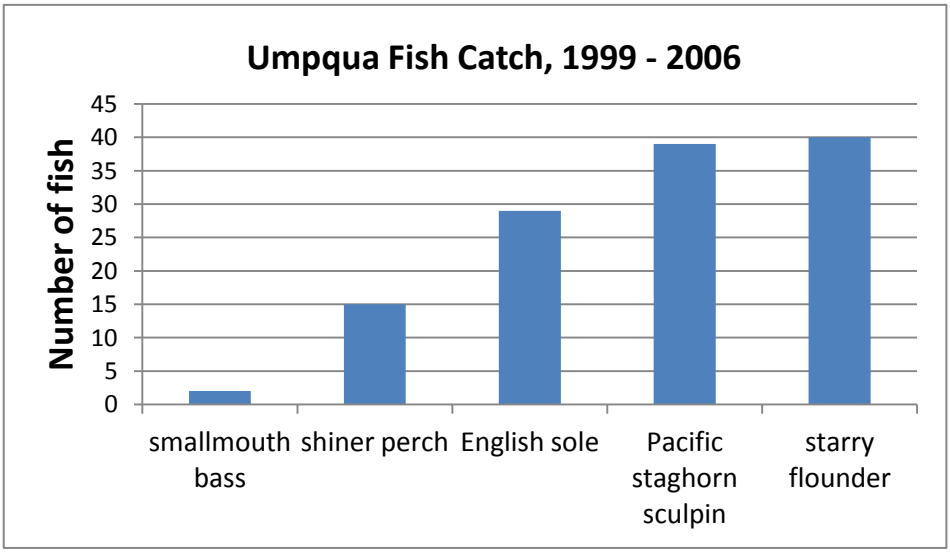
Figure 13: Cumulative Distribution of Sediment Total Organic Carbon



2.1.2.2 Pollutant Exposure: Fish and Contaminants

Bottom-feeding fish were targeted for whole tissue contaminant analysis. Of the 125 fish caught in the Umpqua estuary between 1999 and 2009, all but two appeared healthy and free of anomalies. Two Pacific staghorn sculpin (*Leptocottus armatus*) caught in 2001 had parasites. Whole fish of the same species at each sampling location were ground and composited prior to chemical analyses. Fish were not caught at all sites, but some sites produced more than one species. The Umpqua estuary specimens had a median length and mass of 9 cm and 7 g, respectively. In the tidal freshwater portion of the estuary, five species were caught, including freshwater species (smallmouth bass): Starry flounder (*Platichthys stellatus*), Pacific staghorn sculpin (*Leptocottus armatus*) and English sole (*Parophrys vetulus*) dominated the catch, while shiner surf perch (*Cymatogaster aggregata*) and smallmouth bass (*Micropterus dolomieu*) were less common. PAH were not analyzed in fish because they are typically metabolized.

Figure 14: Abundance of Fish Species Collected in the Umpqua Estuary



Metals

Aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, and zinc were detected above the lab's reporting limit in one or more fish samples. Tin was not detected in any fish samples. Median mercury levels were greater than 0.02 mg/kg wet weight; the maximum mercury concentration was 0.07 mg/kg wet weight.

Table 10: Metals Detected in Umpqua Estuary Fish Samples

Metal	No. of Detections	Percent Detections	mg/kg wet wt.		
			Min	Max	Median
Aluminum	12	100	22	144	92
Arsenic	8	67	0.163	0.497	0.288
Cadmium	1	8	0.034	0.034	0.034
Chromium	12	100	0.129	0.583	0.256
Copper	11	8	0.552	1.61	0.902
Iron	12	100	23	137	68
Lead	3	25	0.068	0.108	0.073
Mercury	11	92	0.013	0.070	0.025
Nickel	6	50	0.11	0.30	0.18
Selenium	12	100	0.19	0.35	0.27
Silver	8	67	0.005	0.009	0.007
Tin	0	0	ND	ND	ND
Zinc	12	100	10	27	15

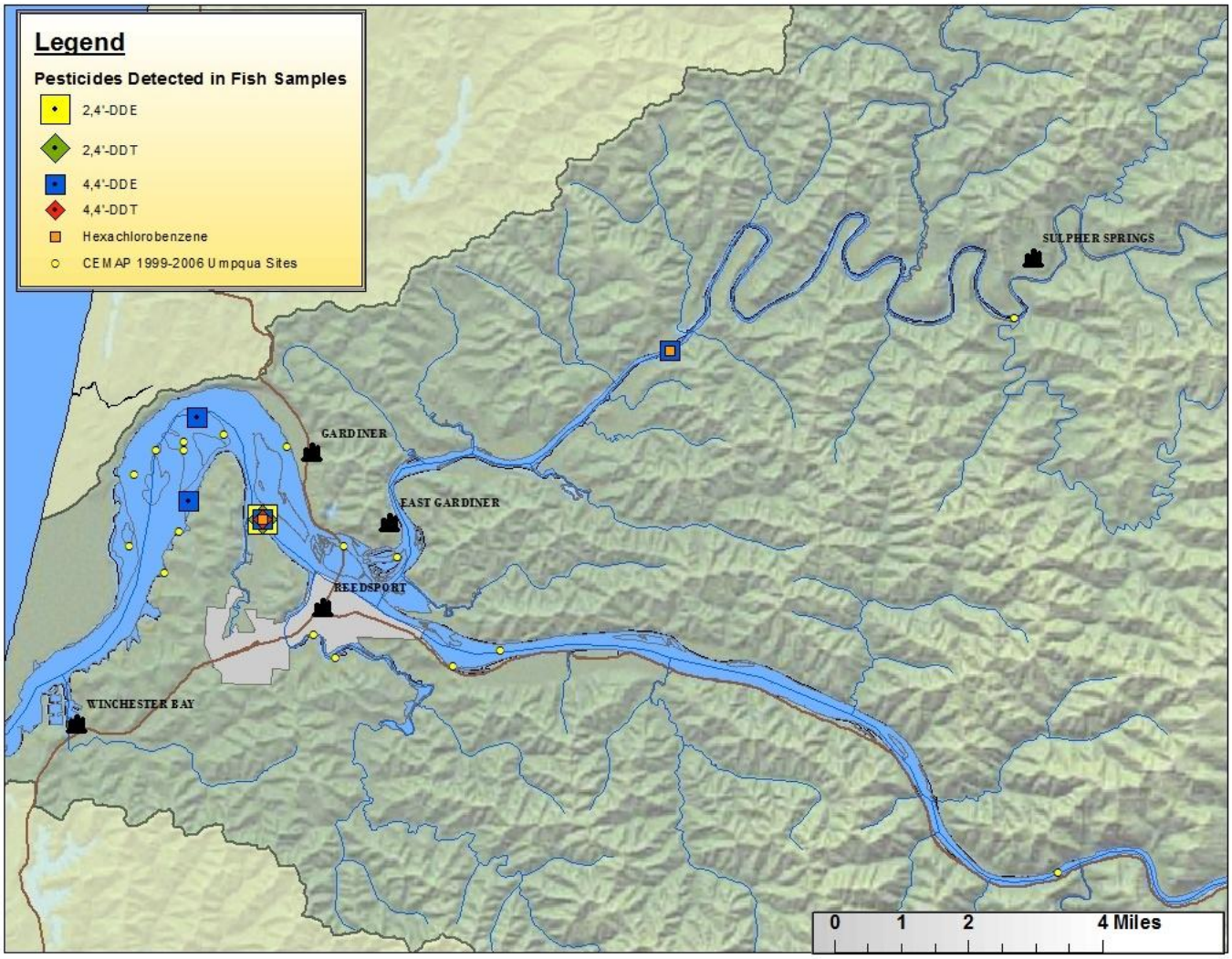
Chlorinated Pesticides and Polychlorinated biphenyls

Umpqua fish were screened for twenty-two legacy pesticides (Table 8. Pesticide Analyst List). Of twelve fish composite samples, four had detectable pesticides above the reporting limit consisting of five pesticides. 4,4'-DDE and Hexachlorobenzene were detected in more estuarine areas than other chlorinated pesticides.

Table 11: Pesticides Detected in Umpqua Estuary Fish Samples

EMAP Station	Analyte	µg/kg wet wt
OR99-0036	2,4'-DDE	1.28
OR99-0036	2,4'-DDT	1.70
OR04-0038	4,4'-DDE	10
OR99-0033	4,4'-DDE	0.82
OR99-0034	4,4'-DDE	2.59
OR99-0036	4,4'-DDE	1.28
OR99-0036	4,4'-DDE	1.05
OR99-0036	4,4'-DDT	1.70
OR06-0023	Hexachlorobenzene	2.23
OR99-0033	Hexachlorobenzene	3.06
OR99-0036	Hexachlorobenzene	3.62

Map 10: CEMAP Pesticides Detected in Fish Samples



Fish samples were also screened for twenty-three polychlorinated biphenyl, also known as PCB, congeners. Only four were detected (PCB- 52, PCB-101, PCB-110, PCB-118), and only at one location (river mile 6.6).

Table 12: PCBs Detected in Umpqua Estuary Fish Samples

Station	Analyte	ug/kg wet wt
OR04-0038	PCB-52	0.74
OR04-0038	PCB-101	1.35
OR04-0038	PCB-110	0.83
OR04-0038	PCB-118	0.68

Non-native species
Benthic infauna were collected with a Van Veen grab sampler on each survey. Sixteen of the twenty-one sites sampled had at least one "exotic" species, a total of twelve exotic species were identified. The greatest species abundance was M*anayunkia aestuarina,* of which 1147 were found at one site in 2002. The next most abundant species was also a worm, *Boccardiello legerica*; 1064 individuals were found at one site in 1999. New Zealand Mud Snail (*Potamopyrgus antipodarum)* was found at one site in 2004.

2.2 Water Contact Recreation

2.2.1 Fecal bacteria, *E. coli,* and other pathogens.

High levels of bacteria and other pathogens can quickly make Oregon's rivers, lakes and streams unsafe for recreation, drinking, and harvesting shellfish. Fecal bacteria can enter waterways via wildlife, livestock waste, failing septic systems, wastewater treatment plant malfunctions, rural or residential runoff, and urban runoff. DEQ has two sets of bacteria criteria that apply to coastal basins and protect the various beneficial uses as described in OAR 340-041 Tables 101A to 340 A. The beneficial uses that primarily determine the application of the bacteria criteria are *Water Contact Recreation* (swimming, boating, wadding, etc.) and *Fishing* (including shellfish growing and rearing).

Table 13: Water Quality Standards Summary for Bacteria in the Umpqua Basin

Water quality standards summary for bacteria in the Umpqua Basin	
Use	**Description**
Freshwaters and estuarine waters other than shellfish growing waters **(340-041-0009(1)(a))**	A 30-day log mean of 126 *E. coli* organisms per 100 milliliters, based on a minimum of five samples; No single sample may exceed 406 *E. coli* organisms per 100 milliliters
Marine waters and estuarine shellfish*growing waters **(340-041-0009(1)(b))**	A fecal coliform median concentration of 14 organisms per 100 milliliters, with not more than 10 percent of the samples exceeding 43 organisms per 100 milliliters

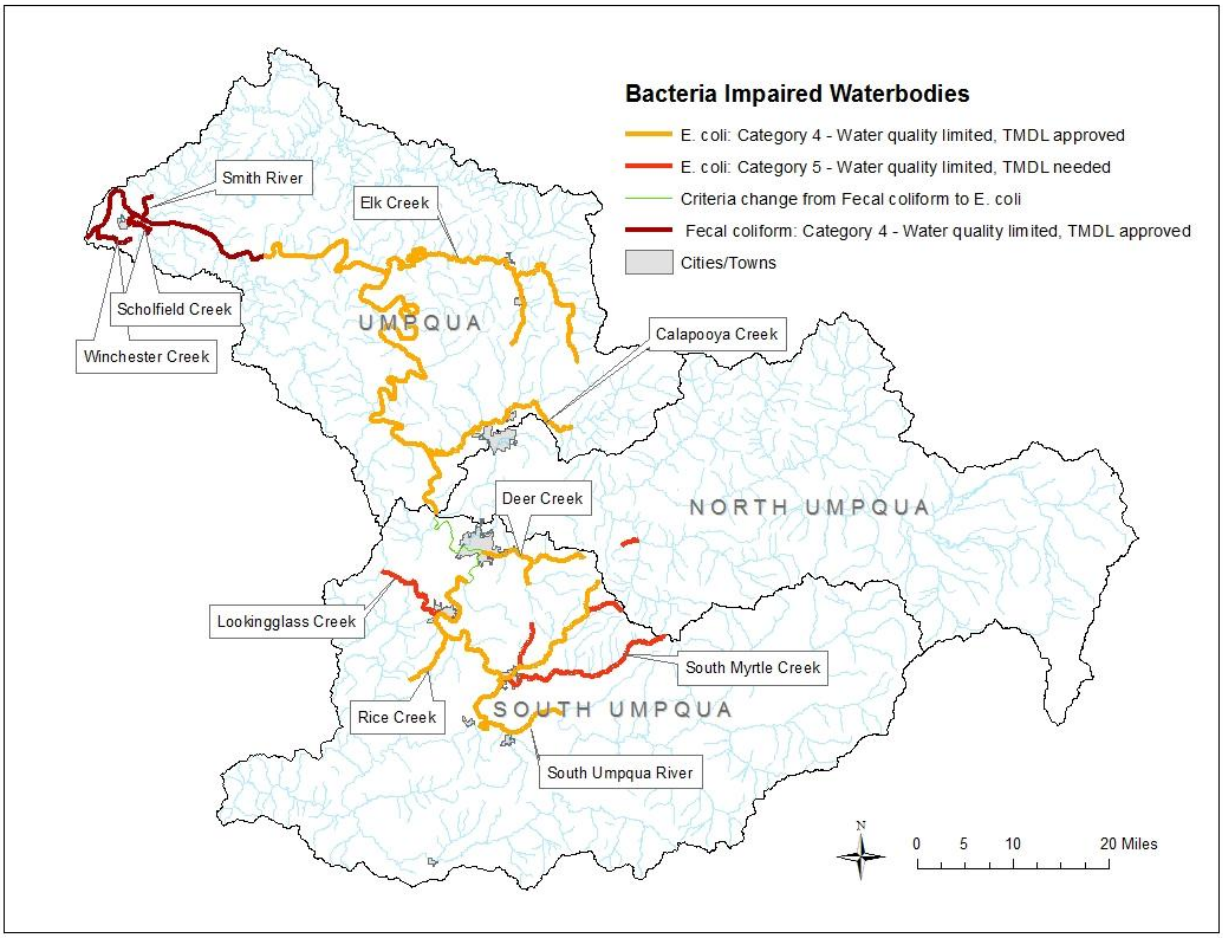
*The term "shellfish" generally applies to mollusks, including all edible species of oysters, clams, mussels, and scallops. For purposes of implementation of Oregon's bacteria criteria, the Department has identified "marine waters" as "all oceanic, offshore waters outside of estuaries or bays, and within the territorial limits of the State of Oregon". "Estuarine waters" are defined as: *"all mixed fresh and oceanic waters in estuaries or bays from the point of oceanic water intrusion inland to a line connecting the outermost points of the headlands or protective jetties".*

According to DEQs 2010 Water Quality Assessment[19], within the mainstem Umpqua and the South Umpqua, fecal bacteria levels are high enough to violate health standards designed to protect in-water recreation in 19 stream segments in the Umpqua Basin. Waters in the North Umpqua subbasin are generally meeting fecal bacteria water quality standards for recreational use except for one segment. Some streams may have more than one fecal bacteria listing. For example, Bilger Creek in the South Umpqua subbasin is identified as exceeding bacteria standards during two seasons (summer and fall/winter). Seven of these impaired

[19] www.deq.state.or.us/wq/assessment/2010Report.htm

waterbodies are on Oregon's 2010 303(d) list and will require the development of a TMDL, as well as a water quality management plan that sets limits for fecal bacteria and identifies recommended actions to reduce bacteria.

Map 11: Fecal Coliform and *E. Coli* Impaired Waterbodies in the Umpqua Basin



Category 4: Water is water quality limited but a TMDL is not needed. This includes:

- **4A:** TMDL approved - TMDLs needed to attain applicable water quality standards have been approved.
- **4B:** Other pollution control requirements are expected to address all pollutants and will attain water quality standards.
- **4C**: Impairment is not caused by a pollutant, e.g., flow or lack of flow is not considered a pollutant.

Category 5: Water is water quality limited and a TMDL is needed, Section 303(d) list.

RESPONSE: A TMDL has been developed to address twelve stream segments in the Umpqua Basin that were identified as impaired for bacteria prior to 2004. The TMDL set limits for bacteria, identified sources and described actions necessary to reduce bacteria levels. Visit DEQ's Umpqua Basin TMDL web page for more information.[20]

[20] www.deq.state.or.us/wq/tmdls/umpqua.htm

TMDL analysis indicates that nonpoint sources contribute the most fecal bacteria in the basin. Most water quality violations occur during rainfall and when streamflows are high. When it rains, runoff from urban, rural and residential areas and agricultural operations carry bacteria into the basin's waterways. Historical storm survey data show a positive correlation between *E. coli* concentrations and the amount of land in the basin zoned for agriculture.

One exception to higher wet weather bacteria loading is found in the South Umpqua subbasin, where summer bacteria levels require load reductions during the dry and low flow seasons. It is expected that failing septic systems, direct delivery of bacteria from swimmers and watering animals to the river, or illegal discharges are sources of bacteria. Additional monitoring and a summer time source assessment is needed in order to identify source areas.

A limited number of waste water treatment plants in the Umpqua Basin experience reoccurring storm-related overflows. Recent upgrades to the treatment system and collections system has improved the situation. However, with few exceptions, the TMDL identified nonpoint sources, not wastewater treatment plants, as the major contributors to bacterial pollution.

The Umpqua TMDL provides percent reduction targets, representing the amount that bacteria loads must be reduced during different flow levels. See Table 14. Reduction targets were determined for five streamflow ranges. Percent reduction targets varied from 0 percent to over 86 percent depending on flow and waterway. High concentrations of bacteria were observed in several South Umpqua tributaries. For example, Myrtle Creek was assigned a 69 percent reduction and Rice Creek was assigned a 30 percent reduction in *E. coli* loading to meet water quality standards. Despite the high concentration observed in some of the tributaries, they did not appear to impact concentrations in the South Umpqua River.

Table 14: Percent Reduction Needed to Meet Applicable Bacteria Standard at Different Flows

River	High Flow	Wet	Mid-Range	Dry	Low Flow
Umpqua River (1 mile upstream of Reedsport)*	54%	50%	0%	0%	0%
Smith River* (RM 0)	50%	39%	0%	0%	0%
Scholfield Slough* (RM 0)	86%	64%	0%	0%	0%
Calapooya Creek (RM 10)	73%	7%	21%	0%	0%
Elk Creek (RM 22.8)	78%	7%	46%	0%	0%
Deer Creek (RM 0)	44%	62%	64%	58%	86%
South Umpqua River (RM 21.2)	0%	0%	0%	13%	45%

** Note the Oregon shellfish criterion was used to determine the loading capacities for the Umpqua River, Smith River, and Scholfield Slough were percent reductions based on meeting a log-mean 14 org/100mL colony forming units (CFU) Fecal Coliform bacteria standard. Freshwater percent reduction targets are based on a log-mean criterion of 126 E. coli/100mL.*

Additional monitoring of tributary streams, conducted after the TMDL was developed, shows exceedances of the single sample maximum of 406 organisms per 100mL in multiple South Umpqua tributaries. A limited number of North Umpqua and Umpqua tributaries (PUR, 2012) also show exceedances. Additional analysis is needed to evaluate the extent and timing of bacteria exceedances. Although bacteria concentrations in the South Umpqua are high, the overall trend in bacteria concentrations in the South Umpqua River has been improving over the past 10 years[21].

DEQ is currently working with Gardner, Reedsport, and other partners to develop a plan to repair or replace a damaged sewage pipe located near the mouth of the Umpqua River. The sewer pipe runs under the Umpqua River from Gardner to the Reedsport treatment plant and has been in need of repair for over 10 years. Occasionally sewage spills occur due to a break, or a rupture in the line.

DEQ is working with key partners and designated management agencies (DMAs) to reduce bacteria contributions from nonpoint sources by identifying best management practices, monitoring, and education and outreach. Projects include water quality monitoring in the South Umpqua and its tributaries, livestock exclusion & fencing, correction of cross connections between sanitary sewers and stormwater sewers, and the development of an outreach program focused on streamside landowners and others. The Oregon Department of Agriculture and Douglas Soil and Water Conservation Districts are key partner in a focus area project in Morgan Creek (Ollala-Lookinglass watershed) that includes landowner outreach and education, pre- & post–project water quality monitoring and BMP implementation.

2.2.2. Harmful Algal Blooms (HABs)

Harmful algae blooms can negatively impact beneficial uses of waterways, including: aesthetics, livestock watering, fishing, water contact recreation, and drinking water supply. Harmful algae blooms are produced by certain species of cyanobacteria (also known as blue-green algae), which produce toxins that can cause serious illness or death in pets, livestock, wildlife, and humans.

The Oregon Health Authority (OHA) runs the Harmful Algae Bloom Surveillance (HABs) program which issues and tracks blue-green algae health advisories[22]: Funding for OHAs HABS program ended as of September 30, 2013, and many program functions are no longer available. However, the OHA will continue to collect and review information on harmful algae blooms and to inform the public through the issuing and lifting of advisories when water sampling data warrants. Health advisories are generally posted if the cell density of toxigenic blue-green algae equals or exceeds 100,000 cells/mL (OHA, 2012)[23]. Waterbody managers also have the option to perform toxin testing when a bloom is first identified and throughout the bloom lifecycle. This testing provides 'actual' toxin and exposure data rather than 'potential' for exposure to toxins that may or may not be present at harmful levels.

Table 15 shows the health advisories that have been posted since the HABs program began in 2004. The table also indicates the proposed impaired waterway listing designations in Oregon DEQ's draft 2010 Water Quality Assessment and the number of days the advisory was in place.

[21] www.deq.state.or.us/lab/wqm/wqimain.htm
[22] http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/index.aspx
[23] http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Documents/HABPublicHealthAdvisoryGuidelines.10.10.12.pdf

Table 15: Harmful Algae Blooms Resulting in Health Advisories Within the Umpqua Basins Beginning in 2004

Waterbody	Proposed listing of impairment**	Years with HABs Health Advisories (No. of days)						
Diamond Lake	Category 4 (TMDL approved)	2011 (11)	2010 (19)				2006 (42)	2001 - 2004
Fish Lake	Category 5 (303d list)		2010 (35)					
Lemolo Lake	Category 5 (303d list)	2011 (19)	2010 (32)	2009 (26)	2008 (48)(27)	2007 (55)	2006 (17)(21)	
Elk Creek @ Umpqua River	Category 5 (303d list)			2009 (18)				
S. Umpqua River, near Myrtle Creek*	Category 4 and 5	2013 2012 2011 (164)	2010 (106)					

*** Important note about the South Umpqua River in Douglas County - There is a permanent advisory in place for this portion of the river. Signs are posted along the shoreline at most popular river access routes that read "Be aware of stagnant pools of water that can develop in the bedrock along the riverbank. These pools are known to develop blue-green algae blooms that can be very harmful to pets and children if exposed".[24]**

****Note: Category 4 indicates that "Water is water quality limited but a TMDL is not needed". This includes:**

- **4A: TMDL approved - TMDLs needed to attain applicable water quality standards have been approved.**
- **4B: Other pollution control requirements are expected to address all pollutants and will attain water quality standards.**
- **4C: Impairment is not caused by a pollutant, e.g., flow or lack of flow is not considered a pollutant.**
- **Category 5 indicates that "Water is water quality limited and a TMDL is needed."**

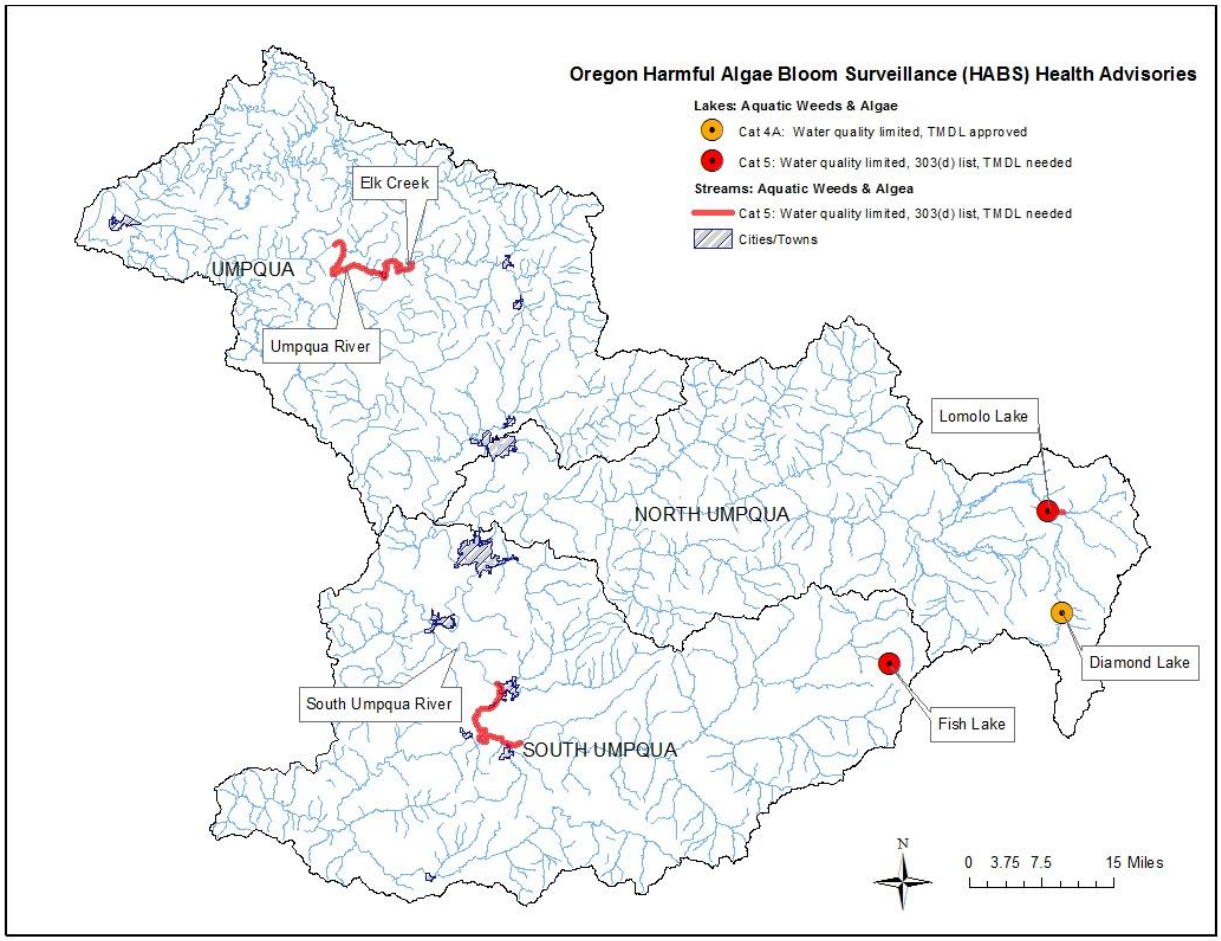
[24] http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/Blue-GreenAlgaeAdvisories.aspx

RESPONSE: A TMDL has been developed to address the harmful algae blooms in Diamond Lake. The Diamond Lake TMDL identified limitations on fish biomass as a means for addressing imbalances in the trophic level nutrient (phosphorus) cycling in the lake which led to blooms of *Anabaena flos-aquae*, a species of cyanobacteria which produces cyanotoxins under certain conditions. The harmful algae blooms also impacted water column dissolved oxygen and pH levels in the lake and downstream in Lake Creek (DEQ, 2006). In 2006, following an extensive evaluation and federal environmental impact statement process involving a multi-agency group[25] a rotenone treatment of Diamond Lake was implemented to eradicate Tui Chub, a non-native invasive fish. Over 30 metric tons of fish biomass was removed from the lake (Eilers and others, 2008). The Oregon Department of Fish and Wildlife (ODFW) is identified as the management agency responsible for maintaining a healthy, limited stock of sport fish (trout) and a model is used to test trophic and water column response to stocking levels. Studies documenting the chemical and biological changes within Diamond Lake have been ongoing. Two harmful algae bloom recreational health advisories have been issued by OHA since the rotenone treatment and water quality conditions appear to be declining. The mechanisms behind the water quality declines are not clear and additional monitoring is needed (PSU 2012). Unfortunately, a second invasive fish species has been identified in the lake. The Golden Shiner that may be affecting trophic and water quality conditions as its population expands.

Two river HABs advisories received significant media coverage as a result of dog deaths on the South Umpqua River near Myrtle Creek (2010 and 2011) and Elk Creek in the Umpqua subbasin (2009). In partnership with Douglas County, the Oregon Health Authority posted signs along the river to highlight the risk of toxins in bedrock pools. Dog safety posters were distributed to pet businesses in the area. Through a Nonpoint Source 319 Grant, the Partnership for the Umpqua Rivers has developed a HABs river monitoring program. This monitoring program is intended to provide public health authorities the data necessary to timely respond to a harmful algae blooms but funding is not secure beyond summer 2014.

[25] www.fs.usda.gov/detail/umpqua/landmanagement/?cid=stelprdb5336043

Map 12: Harmful Algae Blooms in the Umpqua Basin



2.3 Fish and Shellfish Consumption

2.3.1 Fecal Coliform

Fecal coliform have been used as an indicator for the presence of pathogens and the risk of disease from ingestion of contaminated water or raw shellfish. This fecal coliform criterion was adopted to protect humans from pathogenic disease when consuming shellfish.

Criteria:

- ***Marine waters and estuarine shellfish growing waters* (340-041-0009(1)(b))**
    - A fecal coliform median concentration of 14 organisms per 100 milliliters, with not more than 10 percent of the samples exceeding 43 organisms per 100 milliliters

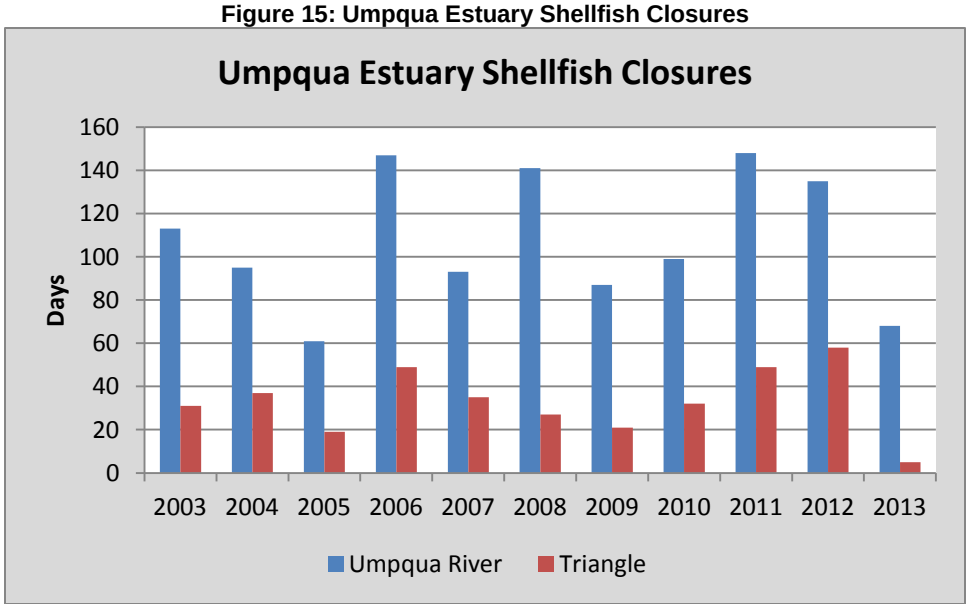
Shellfish are filter feeders and tend to ingest and concentrate contaminants present in the water column. Rainfall events trigger runoff carrying elevated bacteria and other pollutants which adversely impact water quality resulting in harvest closures. The Umpqua estuary refers to the tidally influenced portion of the Umpqua

River, from its mouth to approximately river mile 27 near Scottsburg. However, shellfish growing waters are limited to approximately the first 12 miles of estuary.

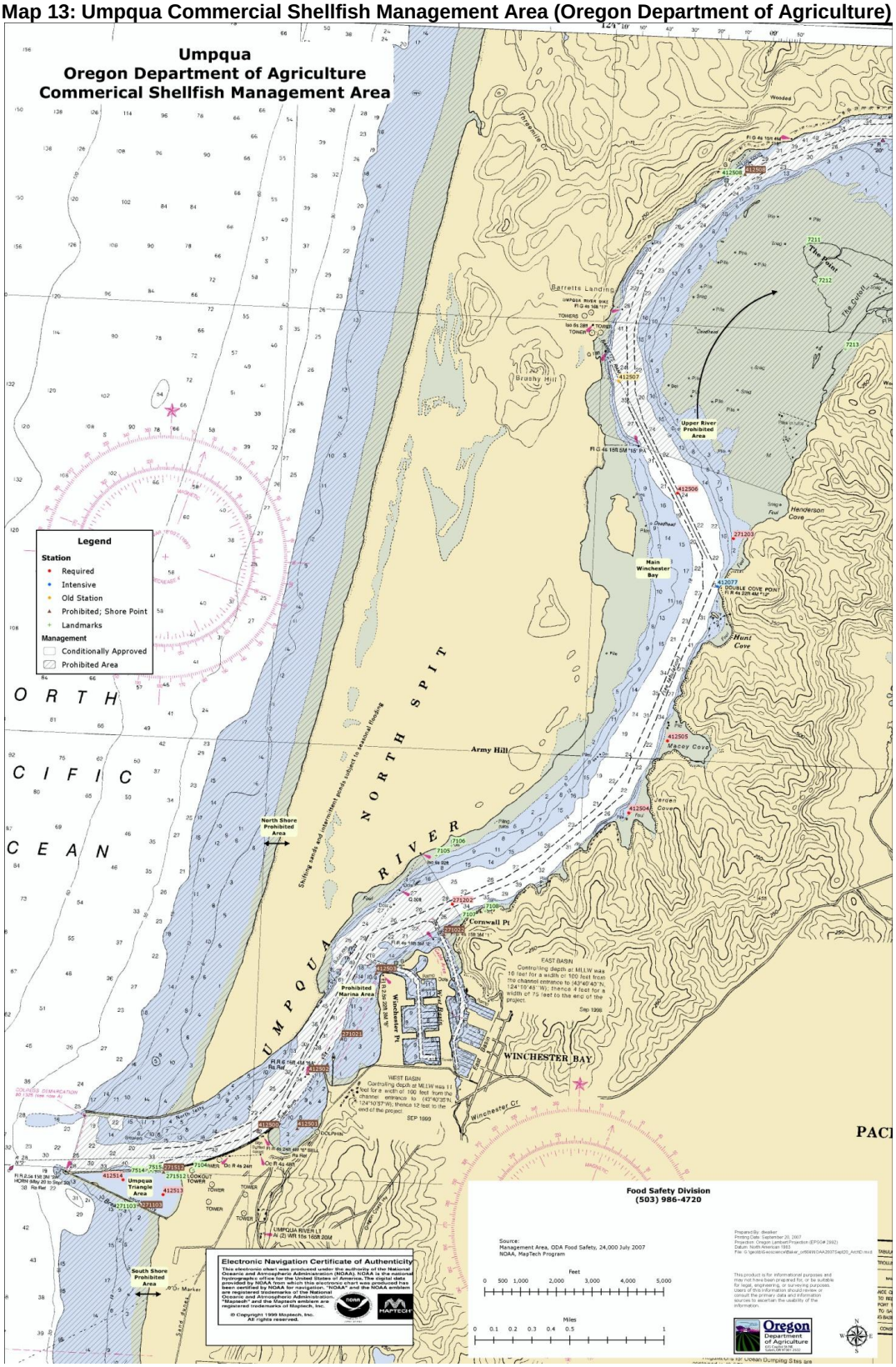
Winchester Bay, located at the mouth of the Umpqua River, supports both commercial and recreational shellfish harvesting. Oregon Department of Agriculture monitors fecal coliform levels in Winchester Bay and regulates the commercial oyster harvest based on the results, in accordance with the ODA Shellfish Plan. Elevated levels of fecal coliform bacteria result in recreation and commercial shellfish growing area advisories and closures. Some areas of the bay are closed, or are more restricted, for commercial harvesting due to their proximity to sources of contamination. See Map 13.

“The Triangle” is a 60 acre shellfish growing area located on the south jetty at the mouth of Winchester Bay. The Triangle has less restrictive closure criteria than the "River" area due to its proximity to the ocean and the tidal flushing effect, as opposed to the River which has less marine influence. The River growing area is closed by ODA when the Umpqua River at the Elkton gage rises above 7.5 feet. The Triangle is closed when this same gage exceeds 12 feet. Minimum closure periods are five days, but reopening cannot occur until the river has fallen below the closure threshold.

Figure 15: Umpqua Estuary Shellfish Closures

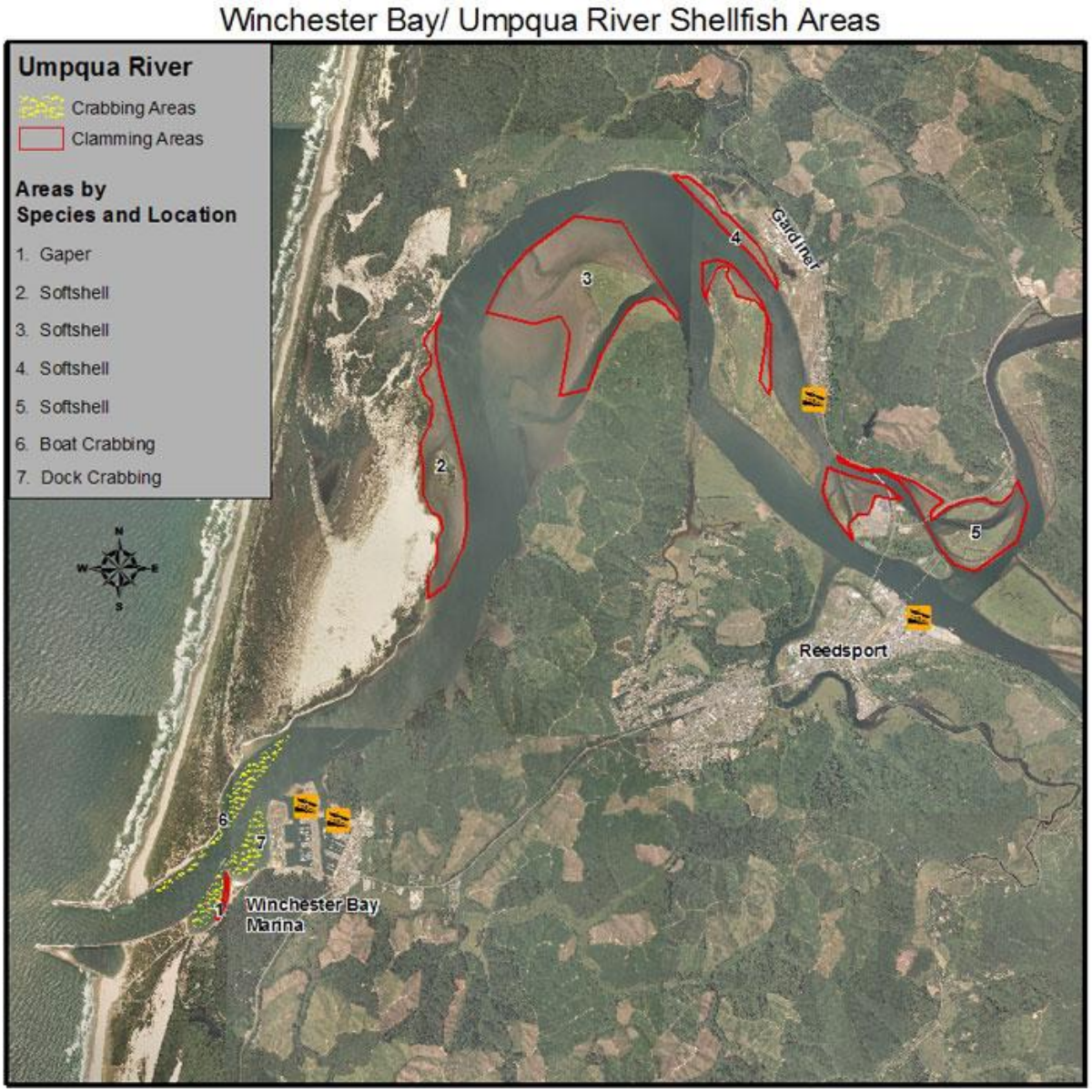


Map 13: Umpqua Commercial Shellfish Management Area (Oregon Department of Agriculture)



The Department of Agriculture is responsible for closing the bay to the commercial industry and advising recreation shellfish harvesters. Map 14 displays recreational shellfish harvest areas designated by the Oregon Department of Fish and Wildlife for recreational crabbing and clamming.

Map 14: Recreational Shellfish Harvest, Winchester Bay/Umpqua River (Oregon Department of Fish and Wildlife)



RESPONSE:

Scholfield Creek, Smith River, Winchester Creek, and five river segments of the Umpqua River were listed as impaired for exceeding the fecal coliform criteria for shellfish growing waters and TMDLs have been developed for the 8 listed segments of river (Map 12). DEQ will continue to work with DMAs and watershed partners to implement bacteria reduction projects such as livestock fencing, wastewater upgrades, and septic system outreach programs.

The Costal Environmental Monitoring and Assessment Program (CEMAP)[26] collected information about the presence and distribution of toxic compounds in fish and sediment in the Umpqua Estuary that could be relevant to consumption of filter feeders, but the data has not been used for 303(d) listings or TMDLs. Direct measurements of toxics affecting shellfish or other invertebrates needs to be investigated further.

2.3.3 Metals

Douglas County has historically been one of the richest mineral producers in the state. However, little is currently known about the occurrence of toxic pollutants in the waters and in fish tissue of the basin. Even at low concentrations, some metals are highly toxic to aquatic ecosystems. Metal mining activities have a tendency to generate significant amounts of pollution, if not managed appropriately. There are currently 155 recorded mines in the Umpqua Basin (Map 15).

Mercury is a naturally occurring element found in cinnabar deposits and areas of geothermal activity. In the Umpqua Basin, mercury was mined commercially and used extensively in gold and silver amalgamation. In addition, mercury has been used historically in fungicide formulations and can still be found in many commercial products including fluorescent lights, thermometers, automobile switches and dental amalgam. Mercury is also naturally present in trees and fossil fuels such as coal, natural gas, diesel fuel and heating oil. The mercury present in these fuel sources is released into the atmosphere upon combustion. This atmospheric mercury can be transported great distances and is known to be deposited on the landscape via either wet or dry deposition (Sweet *et al*., 1999, 2003).

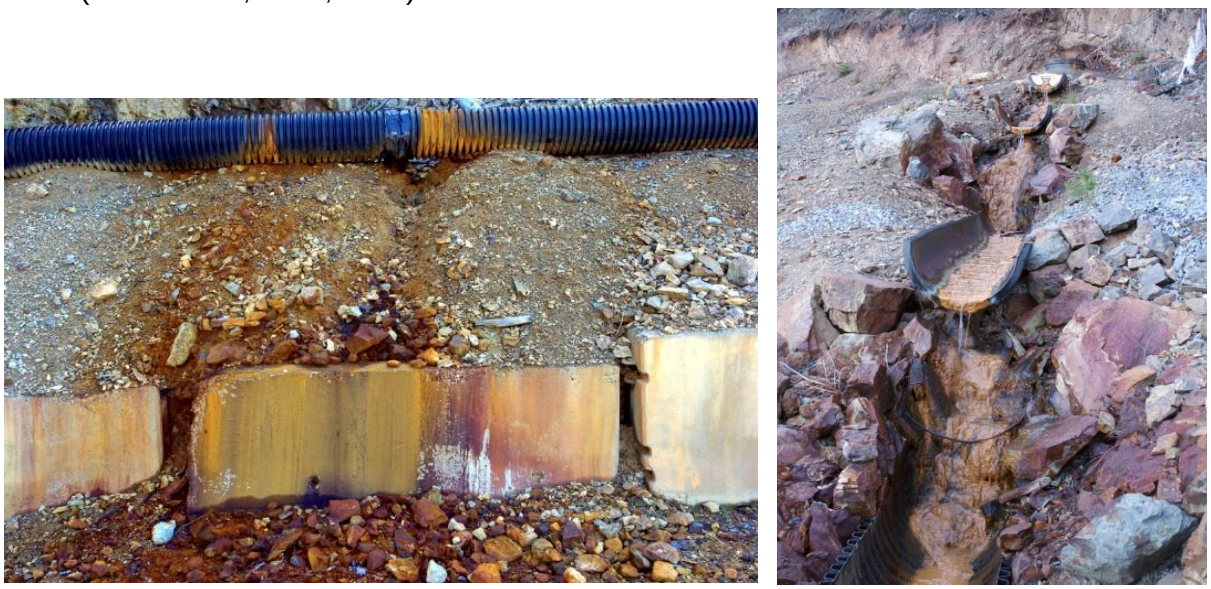
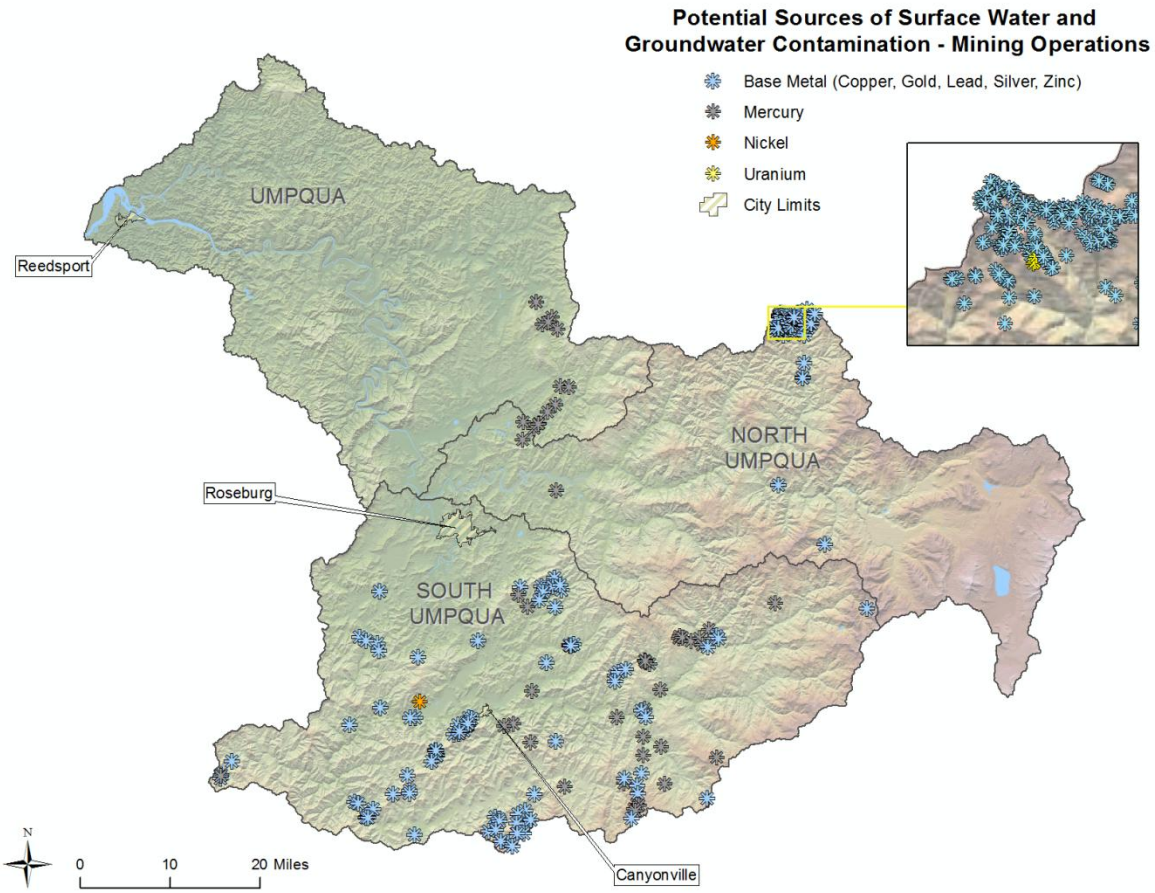


Figure 16: Formosa Mine
An example of acid mine drainage from the former Formosa Mine site, has killed all life in the south fork of Middle Creek.

[26] Ecological Condition of the Estuaries of Oregon and Washington: An Environmental Monitoring and Assessment Program (EMAP) Report (EPA 910-R-06-001) http://www.epa.gov/emap/west/html/docs/CEMAPfinal.pdf

Map 15: Mining Operation in the Umpqua Basin



Geologically, the positioning of metal deposits over millions of years is commonly associated with sulfide minerals that, when exposed to water, can generate highly acidic (low pH) conditions. Acidic waters are highly efficient at stripping metals from veins and disseminated deposits. Drilling, blasting, and the removal of ore create fresh pathways that expose underground deposits to groundwater. On the surface, the material removed from a mine is placed in waste dumps that, if improperly managed, can be exposed to precipitation and surface water. The exposure of both surface and subsurface deposits to water often results in the generation of acid mine drainage, contaminated aquifers, and degraded water quality and aquatic habitat downstream.

RESPONSE

According to the DEQ Environmental Cleanup Site Information database, there are currently 11 mining facilities in various stages of cleanup listed for Douglas County (See Table 16). More information on specific mine sites can be found in Appendix B.

Table 16: Cleanup List for Douglas County

Mine Site	Mineral(s) (operation yield)	Mining Period	Status	Reclamation Work
Glenbrook Nickel Mine (previously Hanna Nickel) [27]	Nickel (1960-1970's: million tons annually)	1954- 1998	No further state action required: Decommissioned mining and smelting in 2000	2003 -Glenbrook received a mine reclamation award.
Formosa (Silver Peak) Mine	Copper and Zinc (1989-1994: 350 to 400 tons per day)	1910 - 1994	Remedial Investigation: 1997 discovered the acid mine drainage control system had failed. Monitoring has indicated that 18 miles of Middle Creek and South Fork Middle Creek have been severely impacted and has killed all life in the south fork of Middle Creek.	EPA superfund site Total cost of cleanup is estimated to range between $3M and $21M.
Levan's Ledge Mine	Pyrite, Chalcopyrite, and Gold.	Dates of production were not documented	Contamination suspected: No data was available to determine actual concentration of metals or processing chemicals. Further action is necessary -preliminary assessment.	It is not currently known if acid mine drainage is present at the site or the impact on the general groundwater quality.
Bonanza	Mercury	Discovered in 1860's - closed 1964	Listed on the Confirmed Release List or Inventory: 2000 EPA identified unsafe levels of arsenic and mercury, confirming that the site posed significant threats to public and environmental health. Bonanza was ranked the second largest	DEQ designated the Bonanza Mine as an Orphan Site in August 2002. Investigation and cleanup will proceed as funding becomes available.

27 www.oregongeology.org/sub/milo/archive/MiningDistricts/DouglasCounty/RiddleDistrict/HannaNickelMine/HannaNickelMineReports.pdf

			producer of mercury in the United States in 1940.	
Umpqua Mine (Buena Vista Mine)	Mercury	1940's	Site Screening Recommended: A site assessment determined that mercury-contaminated soil is present near structures of regional historical significance. Analysis of water quality samples indicated that mercury is being transported off-site.	A preliminary estimate indicates that 50-150 cubic yards of contaminated material will need to be removed, contained, or isolated.
Nonpareil Mine	Mercury	1860's - 1932	Remedial investigation recommended: No evidence of surface water contamination.	This is a low priority for further investigation.
Maude S Mine	No information	No information	Site screening recommended.	No information is available
Elkhead Mine	Mercury	Discovered in 1882- closed 1971	Contamination Suspected: Soil samples need to be analyzed for potential site contaminants, including toxic metals, petroleum, and PCBs.	Prospective purchaser agreement.
Poor Boy Mercury Mine (Monte Carlo Claims)	Mercury	Dates of production were not documented	Site Screening Recommended. Site has not been assessed for potential environmental impacts.	The site is a low priority for further investigation
Gold Bluff Mine	Gold, Silver and Copper (about $70,000 in the 1890's)	1890's	Further action is needed: Site inspections found no evidence of acid mine drainage.	This is a low priority for further investigation.
Nickel Mountain Mine	Nickel	1860's	Site screening recommended	Reclamation conducted by the federal government.

In the Umpqua Basin, three fish consumption advisories for mercury have been issued due to elevated concentrations found in sport-caught fish (Table 17)[28]. The Oregon Health Authority generally issues advisories when the average mercury level of fish in a particular body of water exceeds 0.2 parts per million (ppm) or mg/kg wet tissue for vulnerable populations and 0.6 ppm for non-vulnerable populations. Within the Umpqua Basin, limited testing has been done for mercury in fish tissues and more data is needed. Fish tissue was not collected from the Umpqua Basin during the 2011 toxics monitoring, but fish should be collected in the Umpqua Basin during the next cycle of DEQs toxics monitoring program. The Coastal Environmental Monitoring and Assessment Program collected information about the presence and distribution of toxic compounds in fish in the Umpqua Estuary and median mercury levels were less than 0.2 ppm; the maximum mercury concentration was 0.07 mg/kg wet weight. CEMAP data has not been used for 303(d) listings or TMDLs.

Table 17: Fish Consumption Advisory in Umpqua Basin Lakes

Site Name	Status	Average Hg concentration parts per million (ppm)*
Cooper Creek Reservoir: North Umpqua Subbasin**	Fish consumption advisory issued 2001; 303(d) list - TMDL needed	0.63 ppm
Galesville Reservoir: South Umpqua Subbasin	Fish consumption advisory issued 2001; 303(d) list - TMDL needed	0.69 ppm
Plat I Reservoir: North Umpqua	Fish consumption advisory issued 2000; 303(d) list - TMDL needed	0.48 ppm

* Fish advisory threshold for mercury: 0.2 ppm for vulnerable populations and 0.6 ppm for non-vulnerable populations is the fish consumption advisory as per the Oregon Health Authority

**The city of Sutherlin uses water from Cooper Creek Reservoir for drinking water. Current and historical water testing has not identified mercury as a water contaminant. Mercury in water bodies poses a risk to human health primarily through food-chain exposure and bio-accumulation.

2.4 Water Supply

2.4.1 Public Water Supply: Bacteria, Turbidity, Nitrates, Toxics

In the Umpqua Basin, there are 91 public drinking water systems, also referred to as PWSs. Thirty of these systems are supplied in whole or in part by surface water and serve approximately 80,000 residents of Douglas County. The 61 public water systems in the basin that rely on groundwater serve a total population of approximately 7,000 residents. A complete list of public water systems is provided in Appendix C of this report. This information is based on data provided by Oregon Health Authority (OHA).

It is important to note that public water system compliance data is collected after drinking water treatment, typically at the entry point to the distribution system. Safe Drinking Water Act monitoring data (summarized in

[28] More information on mercury Health Advisories can be found at: http://public.health.oregon.gov/newsadvisories/Pages/RecreationalAdvisories.aspx

Table 18) indicates that 28 water systems served by surface water, and 55 water systems served by groundwater have experienced contamination problems in finished (post-treatment) water. Contaminants of concern include volatile organic compounds, synthetic organic compounds, turbidity, bacteria, disinfection byproducts and sodium. The presence of bacteria in groundwater systems could indicate contamination in the distribution system, inadequate well construction, contamination of well water from land surface activities, or connectivity to surface water.

Many Umpqua Basin public water systems have historic and/or current problems with turbidity in their source water. As shown in Table 18, there are 27 PWSs serving over 50,000 people in the Umpqua Basin that identified turbidity levels above OHA's screening level of 0.3 NTU for treated water (most PWSs are required to have turbidity of <0.3 NTU in treated water prior to distribution (OAR 333-061-0030 (3)).

Table 18: Significant Detections* of Safe Drinking Water Act Monitoring Compounds for Umpqua Basin Public Water Systems

Contaminant	Number of Surface Water System with Detections	Number of Groundwater Systems with Detections
Volatile organic compounds	6	3
Synthetic organic compounds	4	1
Turbidity	27	(one closure)
Bacteria	14	49 (two closures)
Disinfection by products	14	-
Sodium	5	11
Arsenic	-	1
Nitrate	-	1
Sulfate	-	1

* "Significant detections" indicate water quality tests with analytical results greater than the detection limit (for volatile and synthetic organic compounds) or one-half of the maximum allowable contaminant level (for inorganic compounds, arsenic and nitrate). Significant detections are not water quality violations but may require follow-up.

Bacterial contamination (total coliform and *E. coli*) is also a common issue for many surface water PWSs in the Umpqua Basin. From 2008 to 2010, as part of the Safe Drinking Water Act requirements, a number of public drinking water systems with intakes in the Umpqua Basin conducted up to two years of *E. coli* monitoring in the source (raw) water to determine risk from cryptosporidium or other pathogenic microorganisms entering the drinking water supply. Sixteen of these public water systems reported *E. coli* counts over 50 MPN per 100mL during the two-year period (Table 19). EPA used the 50 MPN per 100mL as an informal benchmark by to identify systems with *E. coli* issues. This data is available upon request from DEQ's Drinking Water Protection Program.

Table 19: Number of *E. coli* Detects >50 in Raw Water Collected at Surface Water Intakes (April 2008 - October 2011)

PWS Name	Number of E. Coli Detects >50	Detects/ # of samples collected	Percent > 50 counts/100 ml
Umpqua Basin Water Association	2	2/11	18%
Milo Academy	2	2/26	8%
Tiller Elementary School District	1	1/26	4%
City of Canyonville	5	5/26	19%
City of Glendale	12	12/26	46%
Fir Point Bible Conference	2	2/26	8%
Lawson Acres Water Assoc.	2	2/26	8%
Tri-City JW & SA	11	11/26	42%
Clarks Branch Water Assoc.	2	2/13	15%
Roseburg Forest Products	5	5/26	19%
City of Myrtle Creek	9	9/33	27%
Roberts Creek Water District	2	2/10	20%
Winston-Dillard Water District	3	3/5	60%
City of Elkton	1	1/25	4%
City of Sutherlin	15	15/52	29%
City of Oakland	6	6/11	55%

Elevated turbidity and bacteria requires increased backflushing and additional chemicals in the treatment process, thus increasing overall treatment costs to public water systems and communities. High turbidity and bacteria levels can also be associated with the formation of disinfection byproducts during the drinking water treatment process. Almost half of all Umpqua Basin PWSs supplied by surface water identified significant detections of disinfection byproducts (bromodichloromethane, chloroform, haloacetic acids or trihalomethanes) (see Table 18). Contaminants adsorbed to the surface of entrained particles in turbid water can also pose a threat to drinking water quality.

Harmful algae blooms (HABs) on lakes and rivers within drinking water source areas pose a potential threat to a number of public water systems in the Umpqua Basin, particularly in the South Umpqua subbasin. For more information on HABs in the basin, please see section **2.2.2 Harmful Algal Blooms**.

A number of toxic pollutants including pesticides and heavy metals have been detected in water samples in the Umpqua Basin. The term toxic pollutants refer to substances that are primarily the result of human activities. These pollutants have either been intentionally produced or are formed as by-products from industrial, municipal, or agricultural processes. In addition, metals occur naturally in the earth's crust and enrichment of certain metals in rocks varies based on the makeup and source of the rocks. Some naturally-occurring materials including arsenic, mercury, cadmium, lead, zinc, and copper are also considered toxics[29].

In 2008 and 2010, samples from selected higher risk drinking water sources in the South Umpqua subbasin were collected as part of DEQ and Oregon Health Authority's Drinking Water Source Monitoring Project.

[29] www.deq.state.or.us/lab/wqm/toxics.htm

Higher risk systems were based on a water source's vulnerability to contamination based on: 1) proximity of specific land use activities and potential contaminant sources associated with these activities; 2) known/detected contaminants from existing water quality monitoring data; 3) soil erosion/runoff/permeability potential. A summary of the results is provided in Table 20 and a full report is available at http://www.deq.state.or.us/wq/dwp/monitoring.htm.

Sampling upstream of Riddle's intake on Cow Creek occurred in the spring and fall of 2008, and sampling upstream of the intake for Clarks Branch and Lawson Acres occurred in Fall, 2010. While the data does not reveal high concentrations of contaminants, it does confirm the presence of low levels of pesticides, steroids and hormones (cholesterol, coprostanol, beta-sitosterol, and stigmastanol), phthalates, and occasional pharmaceuticals in source water. These results are consistent with the DEQ Toxics Monitoring Program and provide a basis for prioritizing pollutant reduction strategies for drinking water in the basin. However, more data will be needed to identify the source of these contaminants and develop specific technical assistance and management strategies.

Table 20: Summary of Drinking Water Source Monitoring Project Data for Umpqua Basin Public Water Systems

Subbasin	Watershed	PWS Name	Drinking water source	Detections*	Sample Date
South Umpqua	Clark Branch-South Umpqua River	Clarks Branch Water Asoc.	South Umpqua River	sulfamethoxazole (antibiotic), cholesterol, beta-Sitosterol, stigmastanol, e.coli	Sept. 2010
South Umpqua	Lower Cow Creek	City of Riddle	Cow Creek	DEET (insecticide), atrazine (herbicide), diuron (herbicide), fluometuron(herbicide), diethylphthalate, bis(2-ethylhelxy)phthalate, coprostanol, cholesterol, aluminum, barium chromium, copper, lead, manganese, nickel, zinc, e.coli	May and October 2008
South Umpqua	Lower Cow Creek	Lawson Acres Water	Cow Creek	cholesterol, beta-sitosterol, stigmastanol, copper, e.coli	Sept. 2010

*Source water samples were analyzed for several hundred compounds, including Oregon-specific herbicides, insecticides, pharmaceuticals, volatile organic compounds (including cleaners), fire retardants, polycyclic aromatic hydrocarbons (organic compounds produced as byproducts of fuel burning) and plasticizers. This table lists only the contaminants that were detected. The concentrations of compounds listed were detected at very low levels well below existing standards and guidelines and are well within acceptable limits. OHA and DEQ are using data from this Drinking Water Source Monitoring project to help prioritize the drinking water source areas for other partnership programs. A full report is available at http://www.deq.state.or.us/wq/dwp/monitoring.htm.

RESPONSE

Source Water Assessment reports completed by DEQ and OHA for community public water systems in the Umpqua Basin document the following additional potential sources of contamination to surface water:

- Agricultural-related activities including: concentrated animal feeding operation (CAFO), and grazing animals and chemical applications associated with irrigated and non-irrigated crops
- Forest management activities including roads and harvesting
- Septic systems and wastewater treatment plants

- Transportation-related activities including: stream crossings, high use roadways and corridors, railroads, and runoff from parking lots
- Automotive/fleet services shops and gas stations with associated underground and above ground storage tanks
- Wood/Pulp/Paper Processing and Mills
- High density housing areas

Executive summaries of the individual PWS Source Water Assessment reports are available at http://www.deq.state.or.us/wq/dwp/swrpts.asp.

Data is needed in the Umpqua Basin to help assess whether surface and groundwater sources are being negatively impacted by stormwater and wastewater discharges, biosolids applications, pesticide applications, rural farms, agriculture and forest management practices. Future efforts to help improve drinking water protection include:

- Additional monitoring for toxics in areas upstream from drinking water system intakes
- Identifying the location and extent of existing and future biosolids applications
- Increasing the monitoring of pharmaceuticals, personal care products, and other emerging contaminants in vicinity of high density septic systems, wastewater treatment plant discharges, and biosolids application sites
- Continuing coordination with partnering agencies to address data gaps and share research results, monitoring data, and mapping is recommended.
- Assessing areas where contaminated groundwater may be discharging to surface water

2.4.2 Groundwater: Nitrate, Bacteria, Metals

The primary groundwater quality concerns in the basin are: nitrate and bacteria in valleys and lowlands; arsenic in the Sutherlin, Oakland, Yoncalla, and Elkton area; salts and minerals in tidally influenced areas. Although saltwater intrusion due to over pumping of shallow unconfined aquifers can be problematic in the coastal areas around Reedsport, nonpoint source contamination is the most common threat to domestic well water quality. The most typical sources of nitrate contamination in domestic wells are fertilizers and animal and human wastes. Bacterial contamination of well water is usually indicative of problems with the well construction, while arsenic and mercury contamination are often indicative of a constituent of the native bedrock. Although there have been relatively few groundwater studies in the Umpqua, it is extremely likely, due to geology, that some areas naturally contain elevated levels of arsenic, fluoride, nickel, chromium, iron, and manganese.

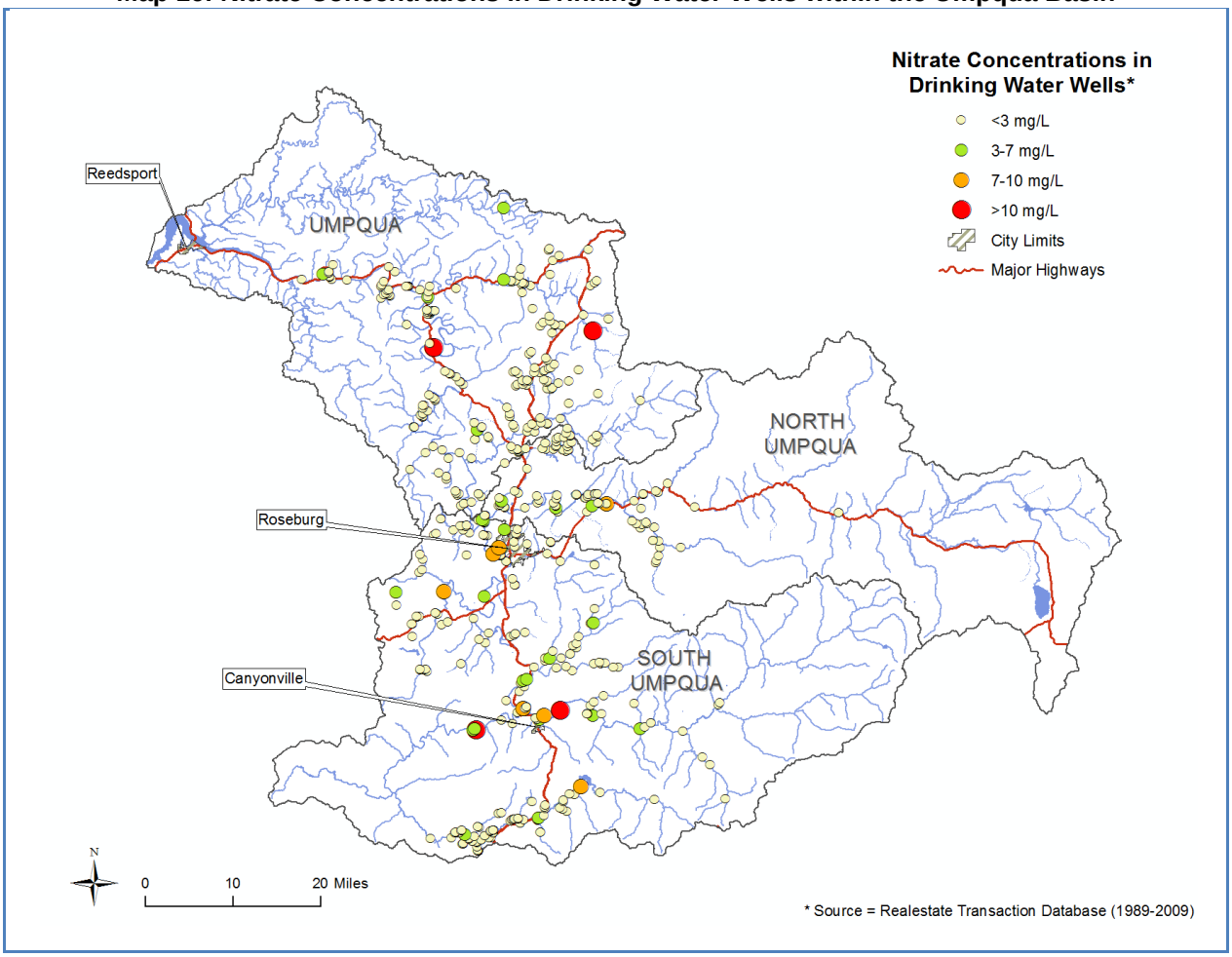
Groundwater is the main source of domestic water for the majority of rural residents of the Umpqua Basin. Although certain areas have been shown to have poor groundwater quantity and quality, water quality data from private drinking water wells is relatively limited. While public water supply systems are required to regularly test for water quality and meet the maximum contaminant level for selected parameters, there are no such requirements for domestic drinking water wells. The only law that requires private well testing and reporting is the real estate transaction law. This law is triggered when property ownership is transferred and requires the sellers to report to the State the water test results for nitrate, arsenic and bacteria[30].

Records from the 1989-2009 real estate transfer database in Douglas County contain water quality data from 719 domestic wells. These data include results from 765 nitrate analyses, 325 arsenic analyses, and 369

[30] http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Monitoring/Pages/dwt.aspx

analyses for bacteria (fecal and e-coli). Based on the results there were 22 wells with nitrate concentrations between 5 and 10 mg/L and four wells with nitrate concentrations that were between 10 and 40 mg/L (see Nitrate Map). EPA has set the nitrate standard for drinking water at 10 mg/L for public water systems. There are no water quality standards for domestic wells.

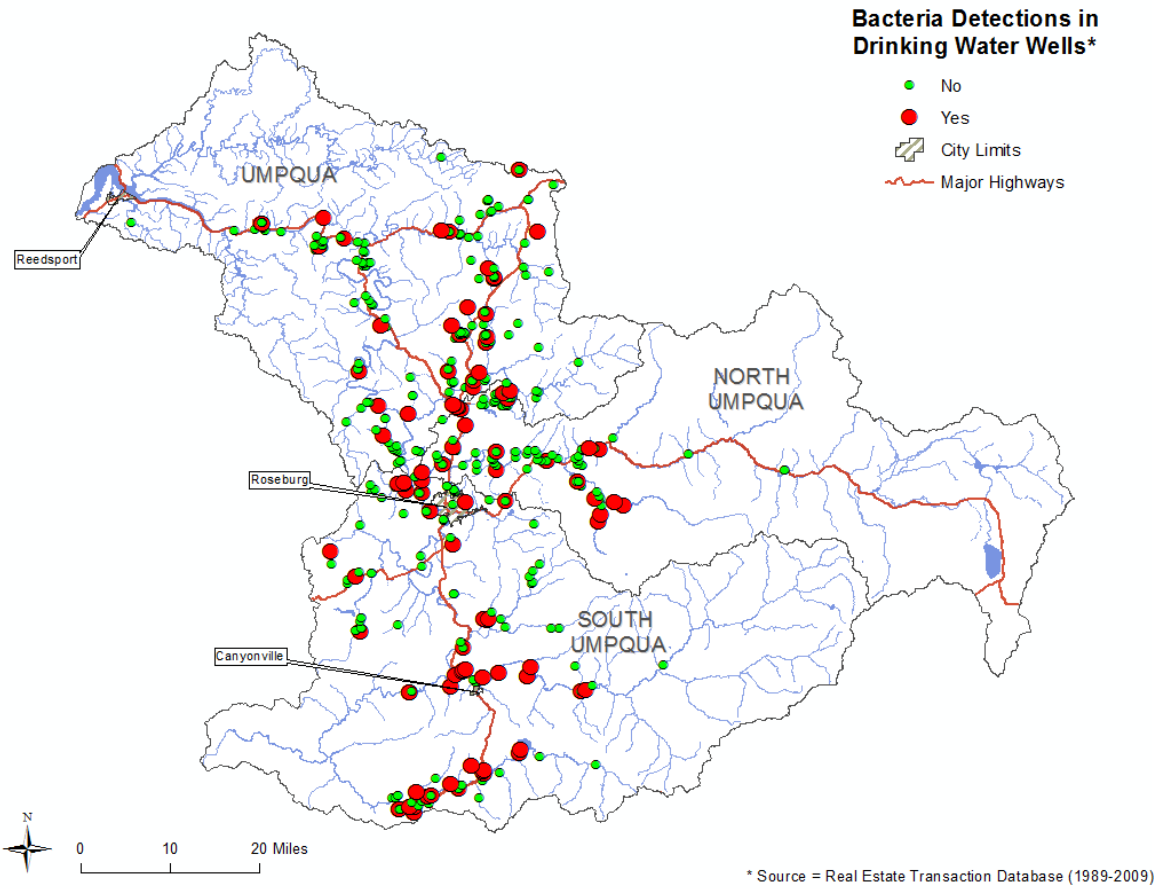
Map 16: Nitrate Concentrations in Drinking Water Wells within the Umpqua Basin



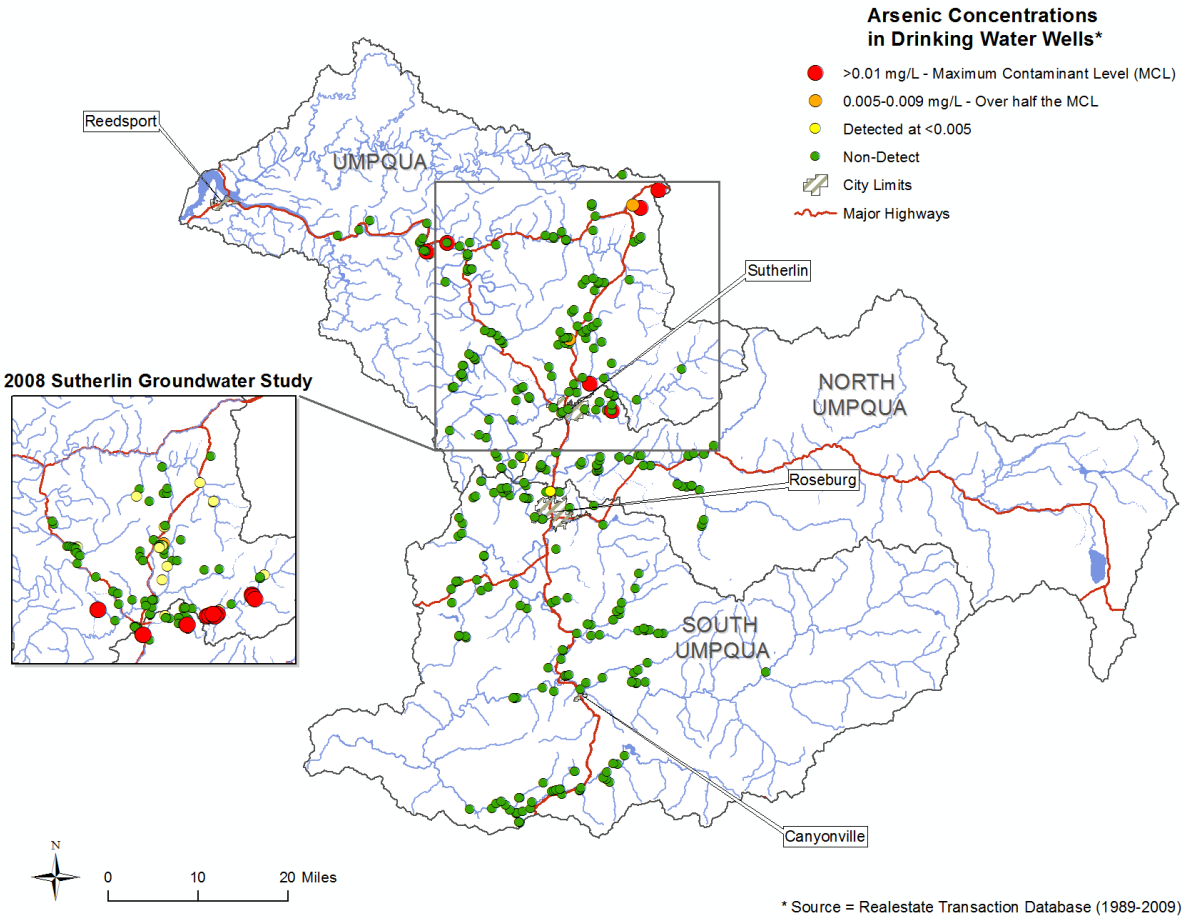
Of the 369 bacteria analyses, 164 indicated a positive test result for total coliform and eight of the wells tested positive for fecal coliform (see Map 17). Out of the 325 water samples tested for arsenic, two results were equal to the drinking water standard of 0.01 mg/L and five were over the standard with a high of 0.309 mg/L. Seven other wells had detectable concentrations less than the maximum contaminant level (MCL) (See Map 18).

Based on real estate transfer data for Douglas County there is little evidence of wide-scale groundwater contamination from non-point sources (bacteria and nitrate) and some indication of natural contamination (arsenic). However, the requirement to test private wells for arsenic at the point of sale is still relatively new (2009), and caution should be employed when looking for representation of the entire basin from the evaluation of the results contained in the limited existing data.

Map 17: Bacteria Detections in Drinking Water Wells within the Umpqua Basin



Map 18: Arsenic Concentrations in Drinking Water Wells Within the Umpqua Basin



Groundwater quantity is a growing concern in the Umpqua Basin and in certain instances groundwater rights are still being granted. During dry water years it is not uncommon for wells to produce less or go dry. Some bedrock aquifers in the basin are unable to provide even 1 gallon per minute and deepening wells may not result in more groundwater being available. In addition, if climate change results in increasing temperatures, groundwater recharge rates may decline. This, in conjunction with increasing rural populations, will likely contribute to less groundwater being available for rural water supplies.

Aquifer storage and recovery, also known as ASR, is a specific type of aquifer recharge practiced with the purpose of both augmenting groundwater resources and recovering the water in the future for various uses. Artificial aquifer recharge is the enhancement of natural groundwater supplies using man-made conveyances such as infiltration basins or injection wells. Due to the natural geology in the Umpqua Basin the future use of ASR to supplement groundwater is minimal. However, additional groundwater studies are needed to confirm the use of ASR, refer to Appendix B for additional information regarding ASR suitability.

Table 21: Aquifer Storage and Recovery Application Status at Specified Locations

Location	Potential ASR Application	Issues
Reedsport	Feasible	Hydraulic connection between surface and groundwater (Quaternary sands and gravels)
Drain	Likely unsuitable	Low yield wells (Tertiary marine sandstone aquifer)
Sutherlin	Likely unsuitable	Aquifer may be unsuitable (Tertiary marine clay and sandstone aquifer)
Roseburg	Feasible	Deeper Eocene marine basalt is ideal for ASR, however, due to the high density of other domestic wells it may be unsuitable.
Myrtle Creek	Likely unsuitable	Low yield wells (granite)
Canyonville	Likely unsuitable	Low yield wells (granite). Pockets of small alluvial aquifers may be suitable.

RESPONSE: Based on previous monitoring, arsenic had shown to be problematic within the Sutherlin area (Map 18). A focused assessment of arsenic concentrations in private well water within the area of concern was conducted in 2008. Based on the study results, 144 wells were sampled, eight had concentrations equal to the maximum contaminant level (0.01 mg/L) and 40 exceeded the maximum contaminant level with the highest recorded at 4.6 mg/L. The remaining 96 wells were non-detect for arsenic. High arsenic concentrations occurred mostly along alluvial floodplains, indicating they were likely derived from mineral laden volcanic materials eroded from locations upstream. Homeowners with high arsenic concentrations were notified and treatment methods were recommended to remedy the problem.

There is a need to correlate the real estate transaction data results with current well water use areas and provide public information to residents whose wells may be impacted. In addition, research on well logs, geology, and agricultural use within Douglas County is needed to more precisely identify areas at risk for high nitrate in groundwater. This information can be used to target rural residential assistance programs operated by OSU Extension and the Douglas and Umpqua Soil and Water Conservation Districts.

2.5 Fish and Aquatic Life

2.5.1 Macroinvertebrate Assemblage

Benthic macroinvertebrates (aquatic insects) live in the water for all or part of their lives, so their distribution, success and survival is related to the water quality. If there is a change in the water quality, for example a

pollutant entering the water or a change in flow or habitat, then the benthic macroinvertebrate community may also change. Therefore, the species richness of a macroinvertebrate community in a waterbody can be used to provide an estimate of waterbody health and is part of the Oregon Plan for Salmon and Watershed monitoring program.[31]

DEQ uses the PREDATOR model to evaluate the health of waterways based on macroinvertebrate observed over expected (O/E) model (Hubler 2008). In this model, macroinvertebrate taxa collected from sample sites (observed) are compared to taxa collected from reference sites (expected). A score or condition of Enriched, Least Disturbed, Moderately Disturbed, or Most Disturbed, is assigned to a site based on the O/E ratio (Table 22). Map 19 shows results from three different sampling projects ranging from 1998 through 2007.

Table 22: O/E Benchmarks for Describing Biological Condition for Predictive PREDATOR Models (MWCF=Marine Western Coastal Forest; WC+CP=Western Cordillera + Columbia Plateau)

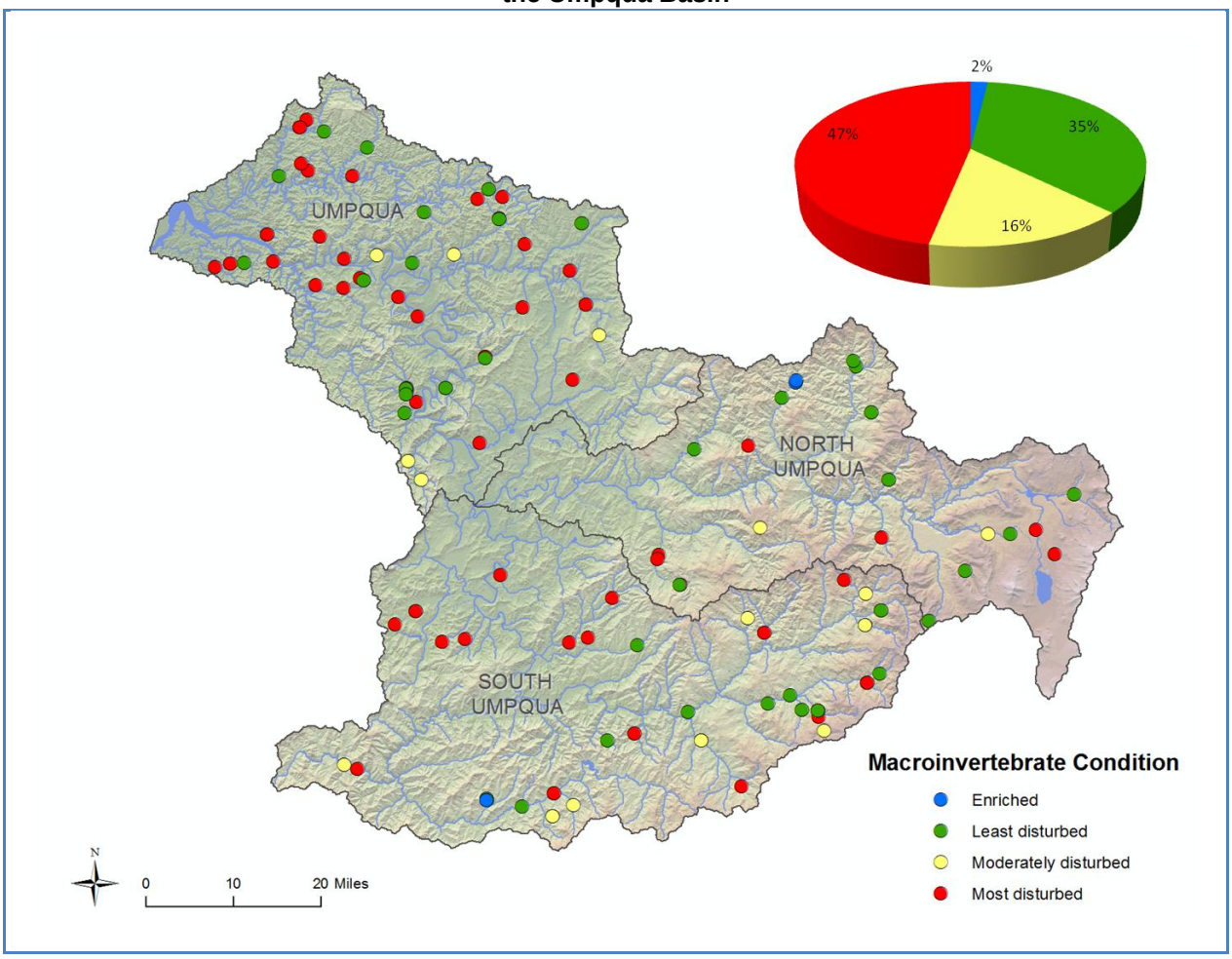
Biological Condition Class	Reference percentile	MWCF		WC+CP	
		O/E	% Common Taxa Loss/Gain	O/E	% Common Taxa Loss/Gain
Most disturbed	≤ 10th	≤ 0.85	≥ 15% loss	≤ 0.78	≥ 22% loss
Moderately disturbed	> 10th to 25th	0.86 - 0.91	9 – 14% loss	0.79 – 0.92	8 – 21% loss
Least disturbed	> 25th to 95th	0.92 - 1.24	0 - 8% loss 0 - 24% gain	0.93 – 1.23	0 - 7% loss 0 - 23% gain
Enriched	> 95th	> 1.24	> 24 % gain	> 1.23	> 23% gain

Of the 158 sites surveyed, 35% were in Least Disturbed conditions. The majority of sites, 47%, were in Most Disturbed conditions. Macroinvertebrate conditions were of the highest quality in the North Umpqua subbasin, with the lowest percentage of sites in Most Disturbed conditions (23%, 6 of 29). The South Umpqua showed 45% (29 of 64) in Most Disturbed conditions. The Umpqua subbasin showed the highest degree of biological disturbances, with 56% (38 of 68) of sites in Most Disturbed conditions.

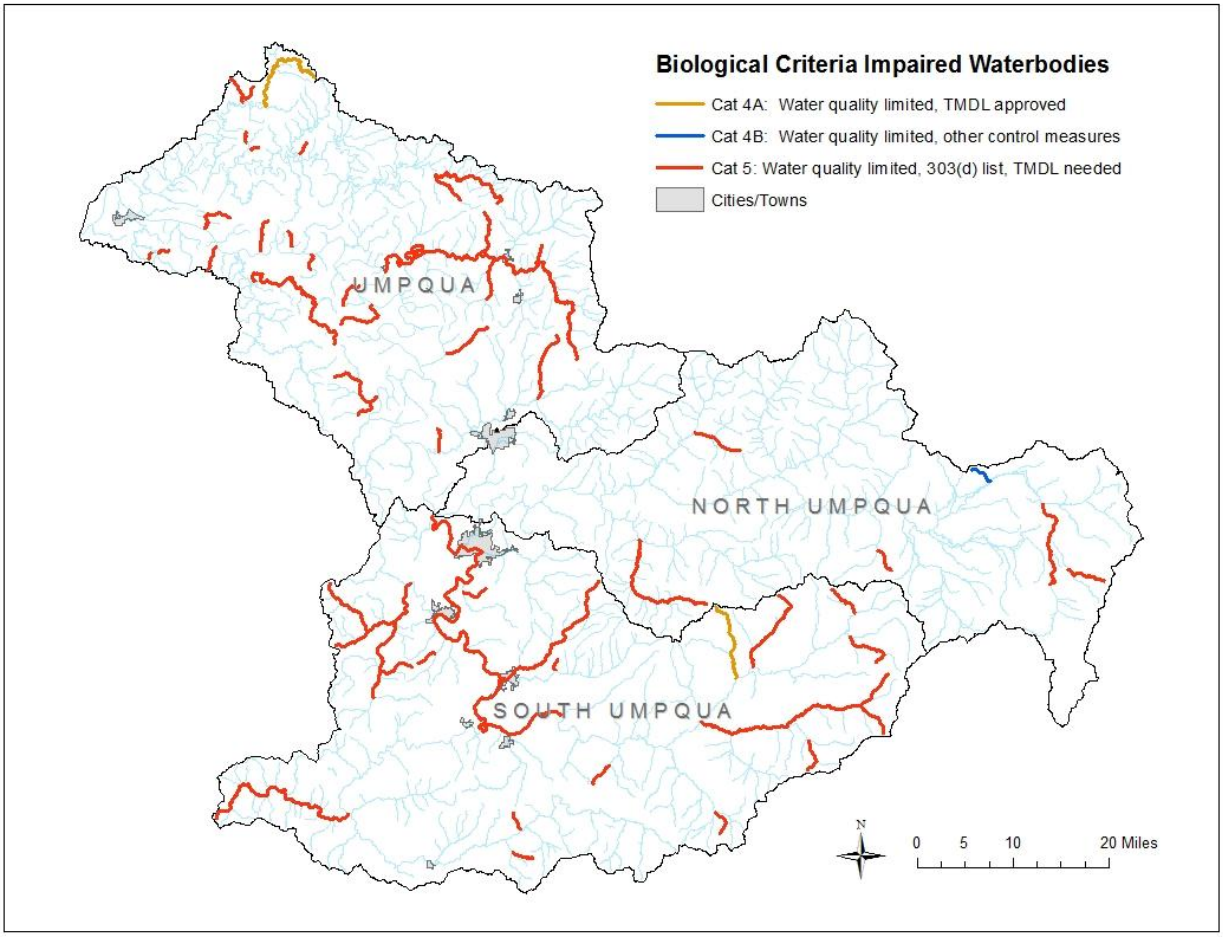
Stressor ID models (Huff et al. 2006) of the macroinvertebrate assemblages were used to identity which non-point source stressors, temperature or excess fine sediments, were most often related to poor biological conditions (as measured by PREDATOR). Assemblages were dominated by macroinvertebrates with tolerances to high levels of fine sediments at 57% of sites in the Umpqua Basin. A slightly lower percentage of sites, 52%, were dominated by macroinvertebrates with tolerances to high water temperatures.

[31] http://oregonexplorer.info/umpqua/AssessingConservationOregonCohoSalmon

Map 19: Locations and Condition Classes of Macroinvertebrate Assemblages at 158 Wadeable Stream Sites in the Umpqua Basin



Map 20: Biological Criteria Impairments in the Umpqua Basin



RESPONSE: There are 56 individual biological criteria impairments listed on the 2010 Water Quality Assessment in the Umpqua Basin (Map 20). Macroinvertebrates are good indicators of biological integrity and watershed health. For this reason, 47 segments were added to the 2010 Integrated Report by EPA based on DEQs PREDATOR model findings. The pollutant causing the impairment for these listings needs further investigation. However, temperature and sedimentation are both limiting factors in the Umpqua Basin. Improvements in habitat and flow conditions will also benefit biological communities.

The 2006 Umpqua Basin TMDL addressed seven stream segments listed for biological criteria. The TMDL did not impose additional Wasteload and Load Allocations for biological criteria but identified the established Wasteload and Load Allocations for temperature and where appropriate other water quality standards such as pH, dissolved oxygen, bacteria and nutrient (using riparian shade and other appropriate treatments) to restore the condition of the biological communities in the listed reaches.

2.5.2 Toxics

In addition to naturally occurring toxics, thousands of toxic chemicals are in products that individuals and businesses use daily. Old chemicals that may not be used today but are stored in homes, schools and businesses also pose risks. Whether used in their raw form or in products, these chemicals can be released

into Oregon's air, water and land as toxic pollutants in a variety of ways. Once in the environment, toxic pollutants can adversely affect the health of people and other living organisms.

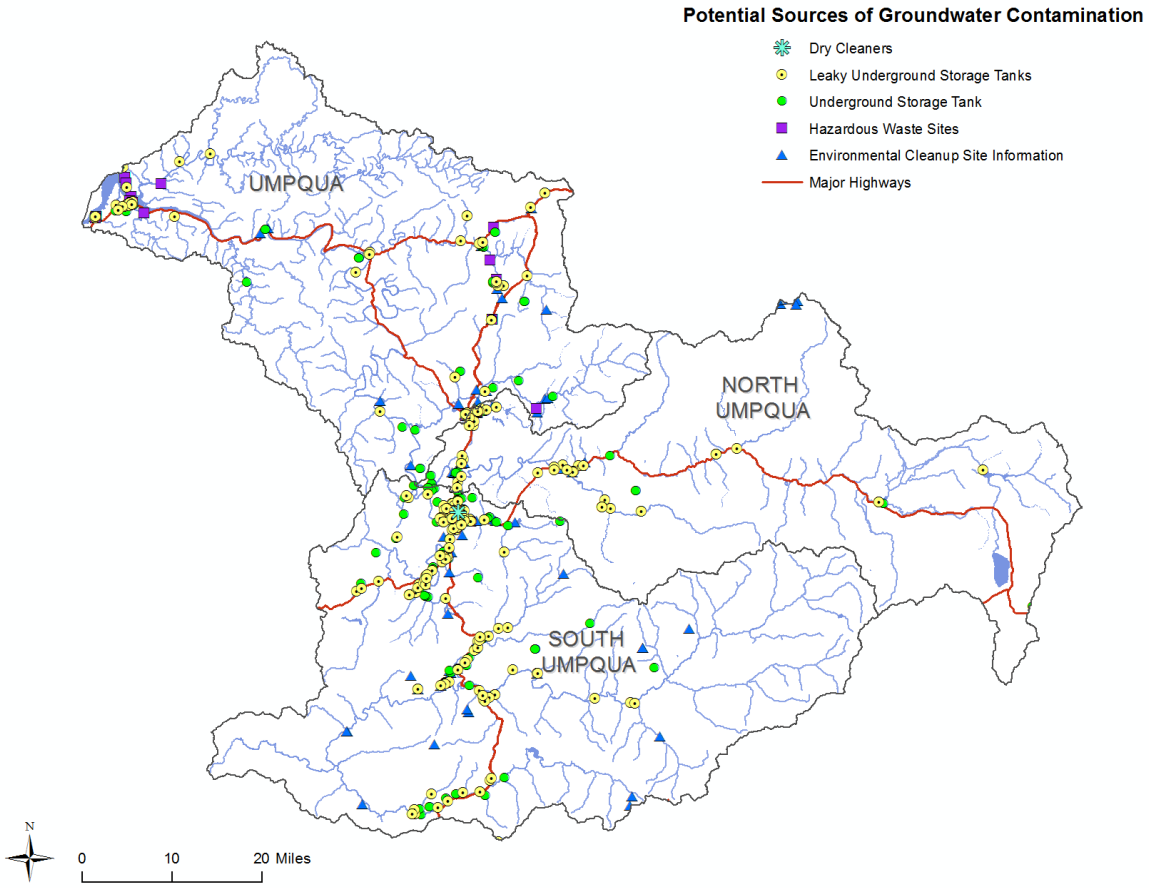
Stormwater runoff, industrial processes and consumer products are all potential pathways for metals to enter the environment. Metals such as copper and lead may reach the environment from cars; silver, which is found in x-rays and photography, jewelry and electronics; and arsenic used in some pesticides and semi-conductors. Atmospheric deposition from coal-burning and other activities is a major source of mercury, but it is also found in dental amalgams and is naturally occurring.

Industrial chemicals known as polychlorinated biphenyls or PCBs were historically used as an electrical insulating fluid; old transformers and capacitors are a common source of PCBs. Additional applications included adhesives, sealants, paints and pesticides. The United States banned the manufacture and use of PCBs because of their persistence in the environment, toxicity to humans, and possible links to cancer, Similar to legacy pesticides, PCBs persist in the sediment of aquatic systems and bioaccumulate in organisms, thus posing a risk to humans through fish consumption. Improper disposal of transformers and other PCB-containing items has contributed to the continued presence of PCBs in the environment.

Flame retardants or polybrominated diphenyl ethers (PBDEs) are chemicals which are added to a variety of products. Prevalent in items such as laptops, automobiles, furniture and textiles, these chemicals tend to leach out of these products and enter the environment. Similar in structure to PCBs, they persist in the environment and tend to bioaccumulate in organisms. Concern over the potential toxicity of this group of chemicals prompted several states and countries to pass legislation banning their manufacture and use.

Combustion byproducts include polycyclic aromatic hydrocarbons (PAHs). These combustion byproducts make their way into the aquatic environment through a variety of routes. Since these chemicals are a product of automobile combustion, forest fires and incineration of industrial and municipal wastes, air deposition is a major source. Another large source is stormwater runoff, especially from urban and impervious surfaces. This group also includes the family of chemicals known as dioxins and furans. These chemicals are not produced intentionally but rather are a byproduct of industrial activities (paper bleaching, industrial production) and fossil fuel combustion from sources such as incineration, wood stoves and forest fires. These chemicals persist in the environment, bioaccumulate in organisms, and are toxic to humans and wildlife.

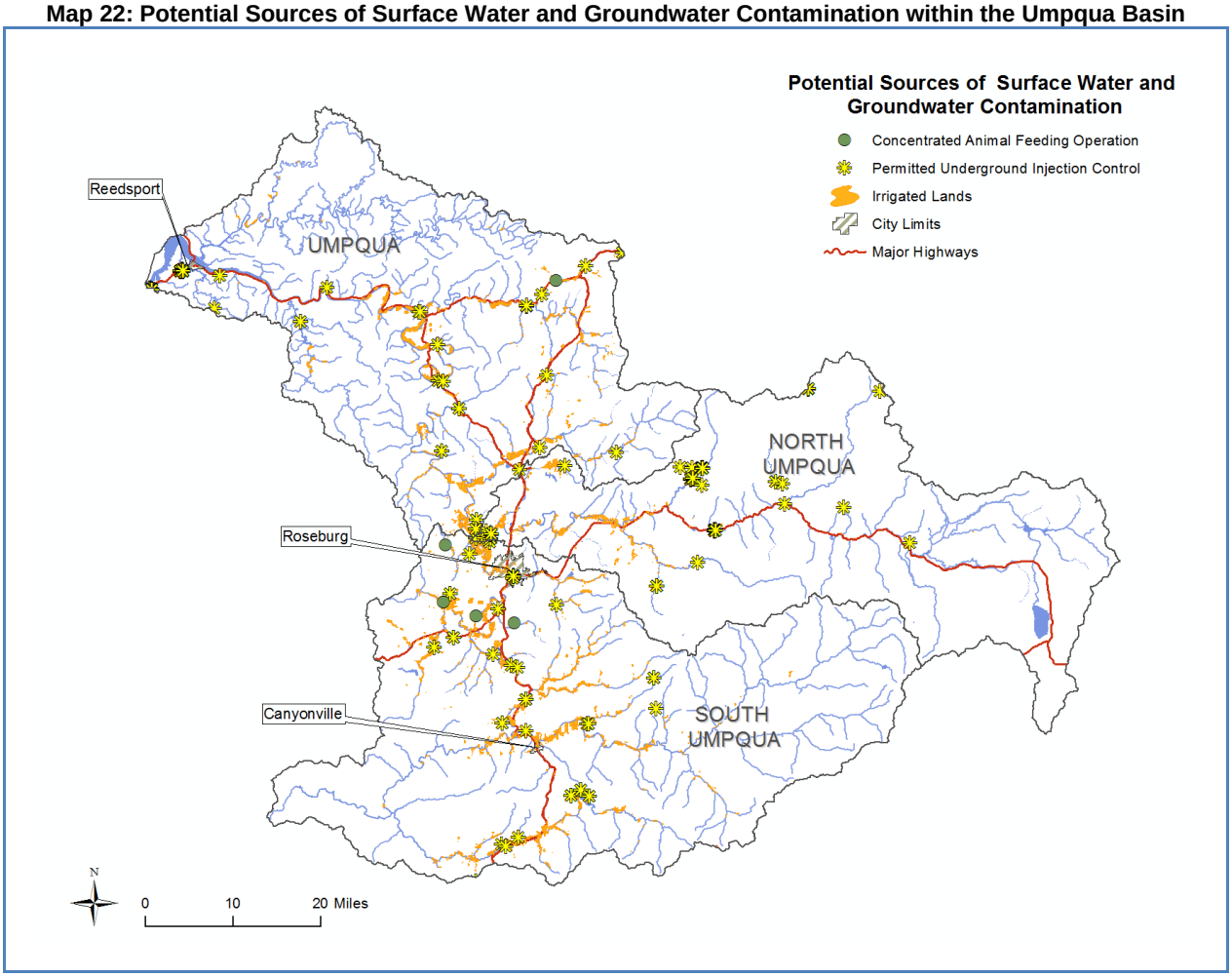
Map 21: Potential Sources of Surface Water and Groundwater Contamination within the Umpqua Basin



Current-use pesticides are used on agricultural lands, public right-of-ways, managed forest areas and residential properties. Detections of this group of chemicals are common in the Toxics Monitoring Program. Research indicates current-use pesticides may affect salmon and other fish species.

Legacy pesticides are pesticides that have been banned from use in the United States. However, these chemicals continue to be used in other parts of the world. These chemicals often bind to sediment, thus runoff from historically treated areas conveys these chemicals to aquatic systems. In addition, these compounds bioaccumulate in organisms, posing a risk to wildlife and human health.

Map 22: Potential Sources of Surface Water and Groundwater Contamination within the Umpqua Basin



RESPONSE

In the summer of 2011, DEQ's Toxics Monitoring Program collected water and sediment samples from four sites within the Umpqua Basin (Map 23) and assessed seven major categories of toxics[32]. Sampling events occurred in May, August, and November of 2011 and sediment samples were collected at three locations. Sediment samples are currently in the process of being analyzed. Fish tissues were not collected as part of this study but should be included in future monitoring events. The lower river portion (west of the crest of the Coast Range) was not included during these events, as the estuary and lower river is being evaluated as part of the coastal monitoring work being completed in 2013. A more comprehensive evaluation of the basin is warranted to fully understand the occurrence of toxics.

[32] www.deq.state.or.us/lab/wqm/toxics.htm

Map 23: Sample Locations within the Umpqua Basin

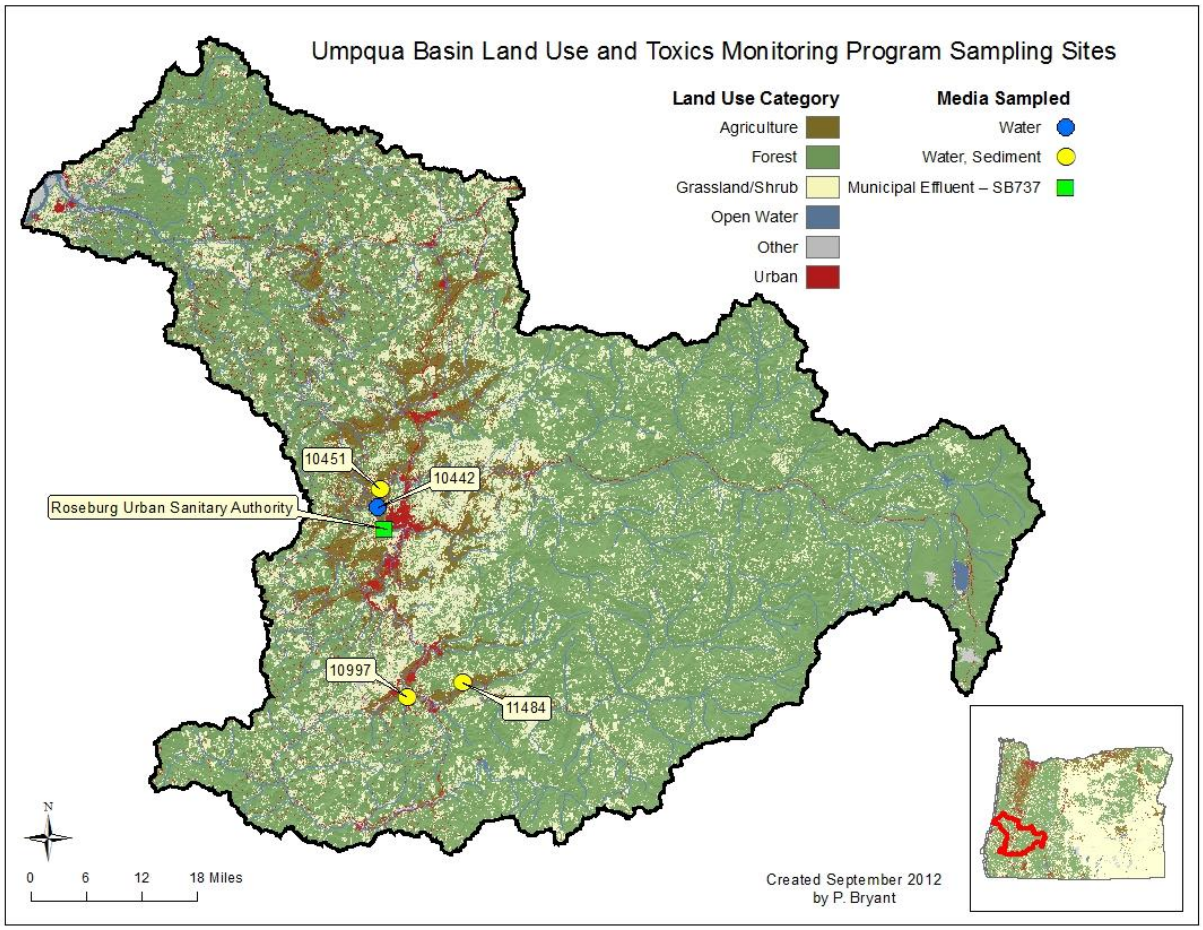


Figure 17 shows the number of detections of each class of chemical by basin. The Umpqua Basin toxics monitoring resulted in fewer number of detections for current use pesticides and consumer products, compared to more heavily populated and cultivated areas in the state. Since the inception of the program the target analyte list has changed over time. Therefore, if chemicals were detected in one basin and not another, they may be present but were not analyzed for in initial sampling. This mainly applies for what is classified as industrial chemicals, flame retardants, and legacy pesticides.

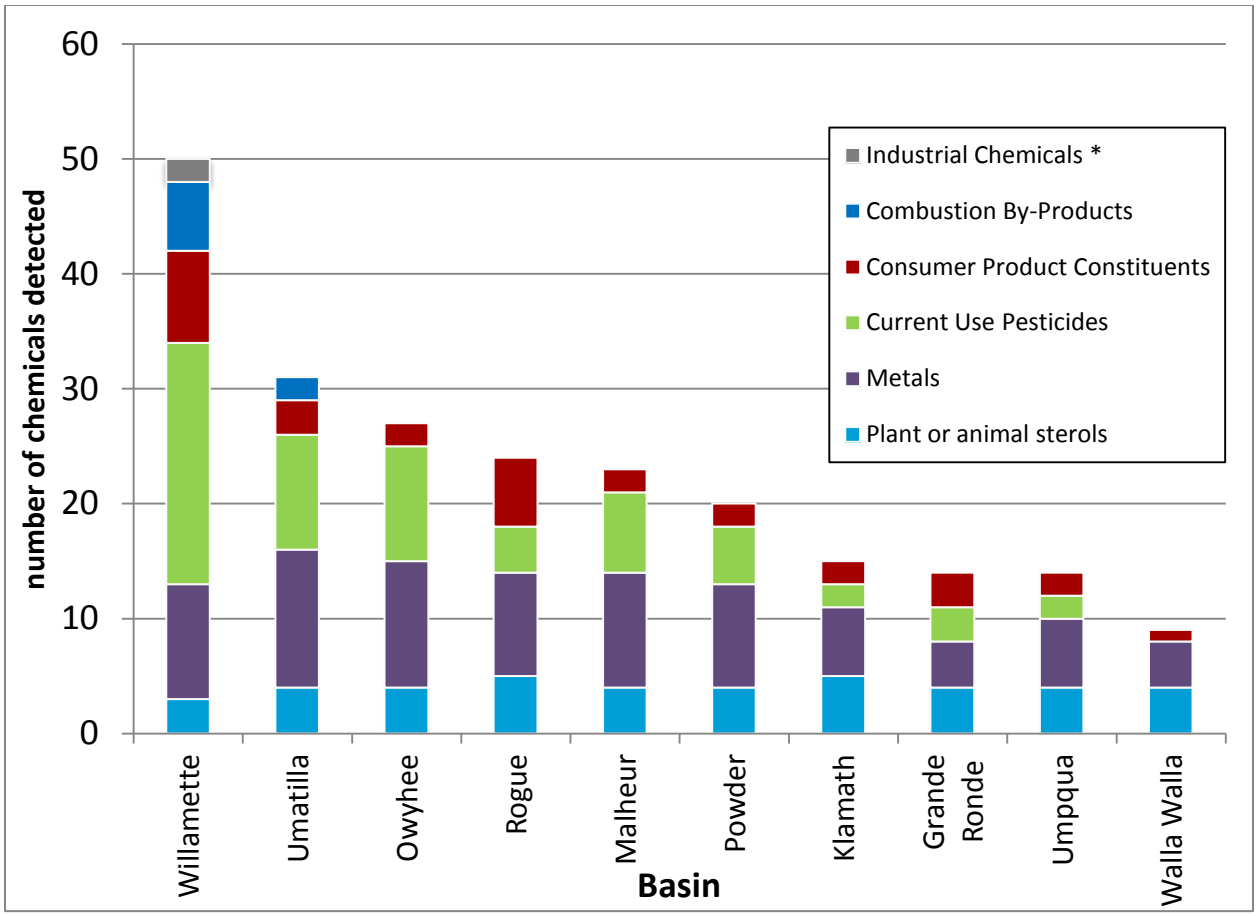


Figure 17: Number of Toxic Chemicals Detected by Basin

In general, the number and concentrations of chemicals detected in the Umpqua Basin was low. The herbicides diuron and sulfometuron-methyl were detected at two locations. These herbicides do not have associated water quality criteria, however, there are established benchmark levels for the protection of aquatic life[33]. Concentrations of the herbicides detected were below established benchmark values. Sulfamethoxazole, a common antibiotic, was found at one site. DEET, an insect repellant, was detected at all sites sampled. Detected metals included arsenic, chromium, iron, and nickel. All detections were below the established water quality criteria. This study was a small snapshot in time, matrix, and geography.

In addition to surface water and sediment sampling, wastewater has also been tested to evaluate the presence of toxic chemicals. In a 2010 DEQ study to characterize wastewater effluent, effluent samples were collected twice from major wastewater treatment facilities in Oregon. This study included one treatment plant in the Umpqua Basin, Roseburg Urban Sanitary Authority (RUSA). Effluent samples were analyzed for 118 persistent priority pollutants pursuant to Senate Bill 737[34]. Overall, the number of detections of priority persistent pollutants was low. In total, the detection of 11 priority persistent pollutants occurred in RUSA's effluent. No measured levels of these pollutants exceeded the corresponding initiation levels that would require a pollution reduction plan, except cholesterol and coprostanol, two commonly occurring animal-based steroids.

[33] www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmar

[34] More information on Senate Bill 737 can be found at: www.deq.state.or.us/wq/SB737/index.htm.

At a February 2011 meeting, the Environmental Quality Commission passed a temporary rule to suspend municipalities' requirement to develop reduction plans for cholesterol and coprostanol, after considering the following: 1) Pollution Prevention is the primary focus of SB 737 and these pollutants are naturally-occurring byproducts of human digestion and are not amenable to pollution prevention; 2) toxicity estimates used to set plan initiation levels are not corroborated by scientific literature; and 3) DEQ also considered treatment, and determined that it is not cost-effective for cholesterol or coprostanol.

Table 23 summarizes all detections (including priority persistent pollutants, known as P3) from SB 737 sampling of RUSA's wastewater effluent and the Toxics Seasonal water quality sampling (three sampling events in 2011 occurring in spring, summer, and fall). Many of the same chemicals measured in DEQ's toxics monitoring program were also measured in the 2010 wastewater sampling. For the Umpqua Basin, detections of DEET, sulfamethoxazole, hormones, as well as metals occurred in both the wastewater sampling and the toxics monitoring program sampling.

Table 23: Composite Summary of SB 737 and Toxics Monitoring Chemicals Detected by Category

Effluent samples were analyzed for 118 persistent priority pollutants. Only detected analytes are displayed.
Bold analytes are P3 Listed pollutants**.**
Gray shading indicates chemical was not included in the Toxics Monitoring suite of chemicals.

Category	Individual analytes (bold analytes are P3 listed pollutants)	SB 737 Monitoring Roseburg Urban Sanitary Authority (RUSA)	Toxics Monitoring North Umpqua at Garden Valley Road (Roseburg)	Toxics Monitoring South Umpqua at Days Creek Cutoff Road (Canyonville)	Toxics Monitoring South Umpqua at Melrose Road	Toxics Monitoring Cow Creek at mouth
	LASAR #	**11545**	**10421**	**11484**	**10442**	**10997**
Consumer Product Constituents	1 4 dichlorobenzene	X				
	bis(2-ethylhexyl) phthalate	X				
	Carbamazepine	X				
	Codeine	X				
	DEET	X	X	X	X	X
	Diphenhydramine	X				
	sulfamethoxazole	X			X	
	venlafaxine	X				
Current use pesticides	2 4-DB	X				
	Azobenzene	X				
	Diuron				X	X

	Sulfometuron-Methyl				X	
	Triclopyr	X				
Chlorinated phenols (used as pesticides, in synthesis of pesticides, but may also be formed during disinfection by chlorination of wastewater)	**2,4,6-Trichlorophenol**	**X**				
	2 4-Dichlorophenol	X				
	2 6-Dichlorophenol	X				
Flame retardants	PBDE-17	X				
	PBDE-28	X				
	PBDE-47	**X**				
	PBDE-49	X				
	PBDE-66	X				
	PBDE-71	X				
	PBDE-99	**X**				
	PBDE-100	**X**				
	PBDE-138	X				
	PBDE-139	X				
Metals	Antimony	X				
	Arsenic	**X**	**X**	**X**	**X**	
	Barium	X	X	X	X	X
	Copper	X				
	Lead	**X**				
	Manganese	X	X	X	X	X
	Methyl Mercury	**X**				
	Nickel	X			X	X

	Zinc	X	X			
Sterols (plant & animal), Hormones	**Beta-sitosterol**	**X**	**X**	**X**	**X**	**X**
	Cholesterol	**X**	**X**	**X**	**X**	**X**
	Coprostanol	**X**	**X**	**X**	**X**	**X**
	Estrone	X				
	Stigmastanol	**X**	**X**	**X**	**X**	**X**
Industrial chemicals	1 2-dichlorobenzene	X				
Total # of P3 Listed Pollutants Detected		11	5	5	5	4
Total # of Pollutants Detected		39	9	8	12	9

2.5.3 Temperature

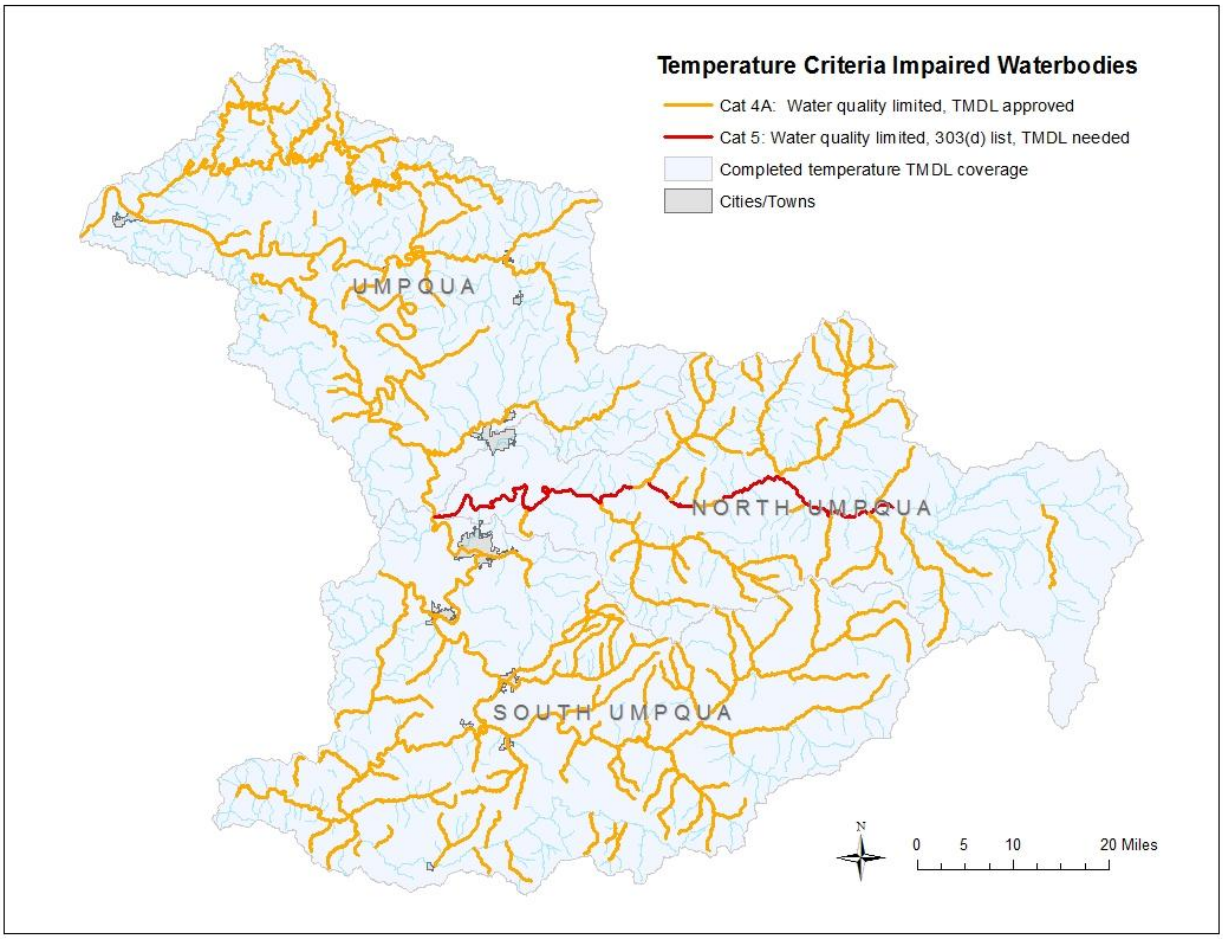
Temperature problems occur throughout the Umpqua Basin. As noted in the previous macroinvertebrate section: 52% of sites were dominated by macroinvertebrates with tolerances to high water temperatures. Salmonids and some amphibians are highly sensitive to temperature. Oregon's water temperature criteria employ a logic that relies on using salmonids' life cycles as the indicator. Temperatures which protect these indicator species will also protect other species. Excessive summer water temperatures reduce the quality of rearing and spawning habitat for chinook and coho salmon, steelhead and resident trout. Potential thermal pollutants identified include human-caused increases in solar radiation due to changes in riparian vegetation, warm water discharges due to dams, waste water treatment facilities, flow modification and irrigation management.

RESPONSE: There are 177 individual temperature impaired waterbodies on the 2010 Water Quality Assessment in the Umpqua Basin (Map 24). Some streams may have more than one temperature listing and more than one reach listed. For example, Calf Creek in the North Umpqua River subbasin is listed for exceeding the summer rearing criteria *and* the spawning criteria.

Two separate temperature TMDLs have been developed for the Umpqua Basin: Little River TMDL (2001) and the Umpqua Basin TMDL (2006), addressing the majority of temperature impaired streams, with the exception of spawning period temperature criteria downstream of hydroelectric projects. Because the modeling for the Umpqua temperature TMDLs did not simulate conditions in the spawning season, spawning criteria impairments were not directly addressed. However, because the load allocations in the TMDL are set to restore system potential shade levels in all streams, streams impaired for temperature during the spawning season due only to nonpoint sources will attain the temperature criteria. Additional work is needed to address three spawning listings on waterbodies affected by dams or point sources, including the PacifiCorp hydroelectric project in the North Umpqua River.

The TMDL allocations take the form of numeric loads as well as percent effective shade targets and site-specific channel width targets, with minimum flow limits on the North Umpqua River hydroelectric project issued under the 401 Certification. Local watershed councils, soil and water conservation districts, PacifiCorp, state agencies and federal agencies are developing and implementing restoration plans to improve riparian habitat and meet the effective shade targets and flow limits.

Map 24: Temperature Impaired Waterbodies in the Umpqua Basin

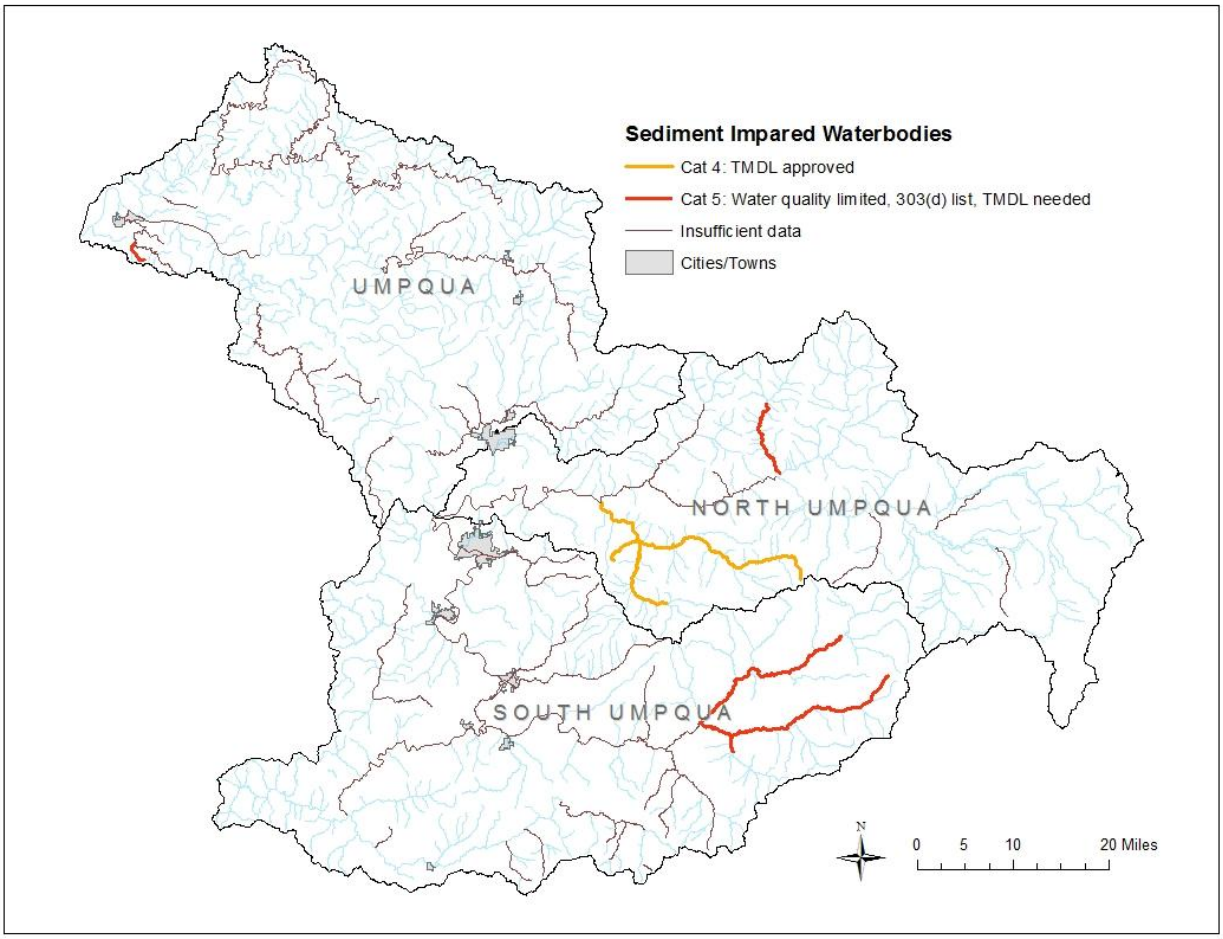


2.5.4 Sedimentation/Turbidity

Previous assessments by the US Forest Service and DEQ have shown that sediment and turbidity are negatively affecting certain beneficial uses, i.e. fish and aquatic life, in portions of the Umpqua Basin. Benthic macroinvertebrates display fine sediment preferences, and these assemblages were dominated by taxa with tolerances to high levels of fine sediments at 57% of sample sites in the Umpqua Basin[35]. DEQ is developing an assessment and analysis methodology for interpreting the narrative sedimentation standard (OAR-340-041-0007(12)). When the methodology and associated guidance is completed, DEQ will establish sedimentation TMDLs (and/or, where applicable, biocriteria or turbidity TMDLs) for those waterbodies on the 303(d) list.

[35] www.deq.state.or.us/lab/techrpts/docs/10-LAB-005.pdf

Map 25: Sedimentation Limited Waterbodies in the Umpqua Basin



Note: "Insufficient data" is a category of the Water Quality Assessment database identifying segments where more data is needed in order to make a determination of water quality impairment. In the Umpqua Basin, all but one of the sedimentation segments categorized as "Insufficient data" were based on DEQ's 1998 Nonpoint Source Assessment. The NPS Assessment established that there were moderate or severe observed impairments, but the supporting data needed to be collected or obtained from partners.

RESPONSE: The Little River Sediment TMDL was approved by EPA in 2002. The Little River TMDL states that sediment delivered to the stream channel above background conditions is attributed mainly to mid-1900s land management practices related to forest harvest in upland and riparian areas and roads utilized to gain access to these areas. The calculated rate of sediment delivery to the stream channel, measured in tons per square mile per year, shows signs of reduction since the most aggressive timber harvest and road building methods have been modified. A load attributed to land management activities has been identified and should be achieved, over time, through hydrologic recovery, controlled management activities in sensitive areas and treatments using contemporary best management practices. TMDL implementation is expected to restore beneficial uses.

Although episodic in nature, there are 5 segments identified on Oregon's 2010 303(d) list as impaired for sedimentation (Map 25). Three of the impairments, located in the South Umpqua, were determined based on United States Forest Service watershed assessment (1995), which reported excessive fine sediments. One listing in the North Umpqua, Canton Creek, is based on a 1995 watershed assessment which reported poor

habitat conditions due to large amounts of fine sediment deposition in the lower portion of the watershed. Wind Creek in the Umpqua subbasin was added to the 303(d) list in 2010 by EPA based on Environmental Monitoring & Assessment Program data results from 2001.

DEQ expects some decrease in sedimentation as a result from the implementation of temperature and bacteria TMDLs in the Umpqua Basin. Properly functioning riparian vegetation buffers filter sediment from upslope sources, stabilize streambanks from erosion as well as provide stream shade. However, best management practices for agricultural lands, timber operations, and construction projects need to be implemented and maintained in order to maintain soils onsite.

DEQ convened a workgroup to review the turbidity water quality standard in 2010 in order to determine whether to revise the current standard to reflect different water bodies or conditions (such as precipitation)[36]. No final action has been identified or taken as a result of that review and the existing standard is in effect.

Turbidity Rule (OAR 340-041-0036)

Turbidity (Nephelometric Turbidity Units, NTU): No more than a 10 percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities, and which cause the standard to be exceeded, may be authorized provided all practicable turbidity control techniques have been applied and one of the following has been granted:

1. Emergency activities: Approval coordinated by the Department with the Oregon Department of Fish and Wildlife under conditions they may prescribe to accommodate response to emergencies or to protect public health and welfare;
2. Dredging, Construction or other Legitimate Activities: Permit or certification authorized under terms of section 401 or 404 (Permits and Licenses, Federal Water Pollution Control Act) or OAR 14l-085-0100 et seq. (Removal and Fill Permits, Division of State Lands), with limitations and conditions governing the activity set forth in the permit or certificate.

2.5.5 Dissolved Oxygen/pH/Nutrients/Aquatic Weeds and Algae

Fish and other aquatic organisms rely on dissolved oxygen, also referred to as DO, in water to sustain life. As dissolved oxygen drops to low enough levels, it can result in fish kills. Dissolved oxygen levels are affected by temperature, algae growth, nutrients, flow and other factors. During the summer period, periphyton and other algae growth leads to low dissolved oxygen concentrations and high pH. Periphyton growth is encouraged by nitrogen, phosphorus and thermal loading. Additionally, thermal loading leading to increased stream temperature exacerbates impairments by decreasing the amount of oxygen dissolved in water and increasing the pH. Stream temperature has a significant impact on the dissolved oxygen level in a stream in two ways. As stream temperatures increase, the amount of oxygen that can remain dissolved in water decreases. The decay of organic matter also puts a demand on dissolved oxygen. Preventing large shifts in dissolved oxygen throughout the day will stabilize pH as well.

RESPONSE: In the 2010 Water Quality Assessment, DEQ has identified 17 stream segments impaired by dissolved oxygen, 23 segments impaired by pH, one segment impaired by phosphorus, and two segments on

[36] www.deq.state.or.us/wq/standards/docs/Turbidity/10-WQ-022.pdf

the South Umpqua impaired by aquatic weeds and algae (Map 26) (these listings do not include harmful algae bloom listings).

Nutrient enrichment, organic solids, and/or temperature impairments are the underlying causes for most of the Umpqua Basin's impairments for dissolved oxygen, pH, and aquatic weeds algae. The Little River Watershed TMDL (2001) addressed pH problems and identified a strong correlation between elevated pH values and stream temperatures. Load allocations to address pH apply the temperature allocations of percent effective shade. Nutrient levels were found to be below detection levels. However, as noted by Carpenter, Anderson, and Jones (2013), nutrient uptake by algae can reduce ambient nutrient concentrations to levels that are below laboratory detection limits. The presence and abundance of algae or biomass may be a more accurate indication of nutrient enrichment than water-column nutrient concentrations. Findings from USGS's report "Water Quality and Algal conditions in the North Umpqua River, Oregon, 1995-2007, Including their Response to Diamond Lake restoration" should be reviewed by DEQ and used to better address nutrient loading.

The Umpqua Basin TMDL (2006) addressed 21 pH, 6 dissolved oxygen, and 1 phosphorus impairments. Load and wasteload allocations were established for phosphorus, volatile and organic solids, biochemical oxygen demand, and heat load allocations identified in the temperature TMDL. There were insufficient data to address fall-winter-spring dissolved oxygen conditions in Calapooya Creek.

Modeling results for the Umpqua Basin TMDL (2006) indicated that the nutrient assimilation capacity of some streams, particularly the South Umpqua, is very low, and excess nutrients were fueling the growth of periphyton and other algae. Increased periphyton and algae growth decreases dissolved oxygen and increases pH. Elevated stream temperatures exacerbated the problem. Both nonpoint and point sources contribute nutrients, but streams with wastewater treatment plants typically show the most impact, particularly in the late summer and fall.

In the South Umpqua, there are five waste water treatment plants that discharge effluent to the river and, prior to recent treatment plant upgrades, contributed approximately 96 percent of the inorganic phosphorus loading during low-flow conditions. Although treatment plants are moving forward with plant upgrades, the implementation of phosphorus limits has been delayed because permit renewals are on hold while DEQ determines how to proceed with a recent court decision on the state's water quality standard for temperature. Table 24 summarizes the current status of wastewater treatment plants in the South Umpqua.

Table 24: South Umpqua Wastewater Treatment Plant Status

Facility	Phosphorus WLA - reduction needed	Permit status - phosphorus WLA Issued	Facility's status – planning, construction or upgrade	Construction completion date	Alternative treatment method	Current Monitoring obligation
RUSA	Yes	Delayed while DEQ evaluates court decision on temperature standard	Construction Complete. Using natural treatment system to reduce discharge through evapotranspiration, remove phosphorus through soil adsorption, and cool effluent through evaporation and subsurface discharge.	May 2011	Discharge to natural treatment system only.	No phosphorus limits. However, they are monitoring per settlement agreement.
Winston-Green	Yes	Delayed while DEQ evaluates court decision	Construction Complete.	2013		No phosphorus limits. Monitor total phosphorus

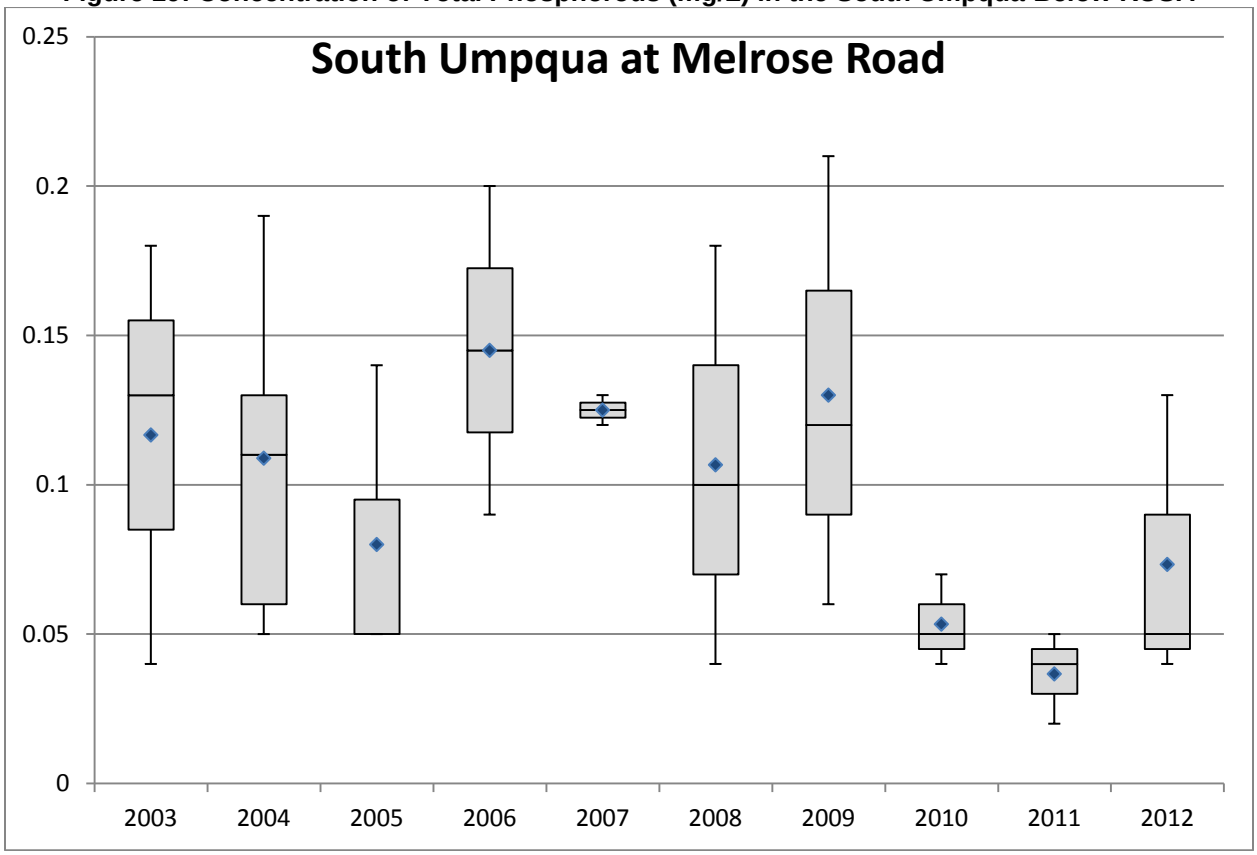
		on temperature standard				weekly (May 1 – Oct 31)
Myrtle Creek	Yes	Delayed while DEQ evaluates court decision on temperature standard	Construction Complete.		Uses golf course during most of summer, but discharges in May and October.	No phosphorus limits. Monitor total phosphorus weekly (May 1 – Oct 31)
Canyonville	Yes	1/3/2012	Phase 1 engineering complete. Construction planned for 2014.			Monitor total phosphorus weekly (May 1 – Oct 31)
Riddle	Yes	Delayed while DEQ evaluates court decision on temperature standard.	Construction complete.			No phosphorus limits. Monitor total phosphorus weekly (May 1 – Oct 31)
Glendale	No	12/1/2011	Can meet TP WLA without upgrade. However, upgrade needed to remove SSOs, treat wet weather flows, treat biosolids, and update plant equipment. Planning complete. Seeking funding.	NA		No phosphorus limits. Monitor total phosphorus weekly (May 1 – Oct 31)
Tiller	No	12/28/2011	Can meet WLA without upgrade.	NA		Monitor total phosphorus monthly (May 1 – Oct 31)

Based on the TMDL assessment, the largest contributor of phosphorus loading was Roseburg Urban Sanitary Authority (RUSA), which contributed approximately 73 percent of the entire inorganic phosphorus loading to the South Umpqua River. In order to meet the assigned wasteload allocation of 3.4 lbs/day of total phosphorus, which represents a 97 percent decrease in phosphorus, RUSA chose to install a natural treatment system for treated wastewater. This option cost one-third the price of a conventional treatment system. The natural treatment system land applies treated wastewater to a combination of wetlands, enhanced pre-existing wetlands, farm lands, and forested areas to treat the effluent from RUSA's dry weather flow. The natural treatment system functions through soil reactions, plant uptake, and nutrient storage[37]. Based on data collected as part of DEQ's ambient monitoring sites, total phosphorous levels in the South Umpqua are declining both above and below the wastewater treatment plant. However, the overall declining trend is much stronger below RUSAs natural treatment system indicating the system is effective at removing total phosphorous. Based on visual observations by the community, the amount of periphyton and algae downstream of the treatment plant decreased in 2012.

[37] www.oracwa.org/a-acwa-awards.html

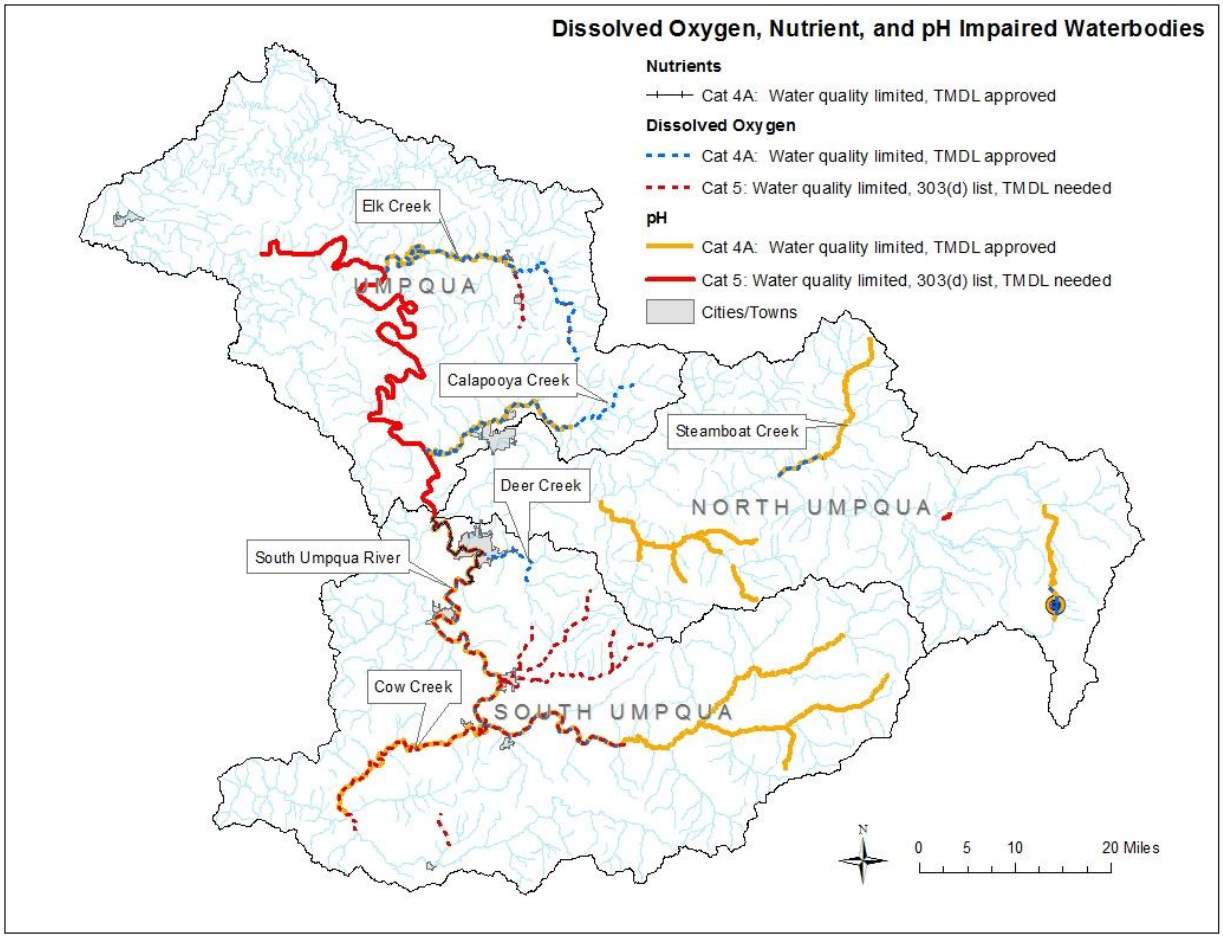
Figure 18: South Umpqua near Round Prairie
Photo credit Partnership for the Umpqua Rivers

Figure 19: Concentration of Total Phosphorous (mg/L) in the South Umpqua Below RUSA



Prior to TMDL implementation, wastewater treatment plants in the South Umpqua River provided approximately 85 percent of the total phosphorus and ammonia loading while only 5 percent of the flow. Treatment plants have undergone significant upgrades that have reduced nutrient loading. DEQ expects to see improvements as a result of implementing the Temperature TMDLs. Future assessments are needed to evaluate stream segment improvements.

Map 26: Nutrient, Dissolved Oxygen, and pH Limited Waterbodies in the Umpqua Basin



2.5.6 Flow/Habitat

There are 134 flow and habitat modification impairments identified in the 2010 Water Quality Assessment (Map 27). In 2002, it was determined that flow and habitat modifications are not pollutants and therefore TMDLs do not apply. However, flow volume and river morphology directly impact water quality and pollutant concentration levels. DEQ expects to see some improvements to flow and habitat as a result of implementing the current TMDLs, and implementation plans should be designed to help to address these factors.

RESPONSE: DEQ's current process to promote flow protection and habitat restoration relies on voluntary measures and community initiative. The direct regulation of flow is not under the jurisdiction of DEQ but is addressed through Oregon Water Resources Department. DEQ and OWRD are currently collaborating to

develop strategies to address the influence of water quantity on water quality, through an Integrated Water Resources Strategy[38].

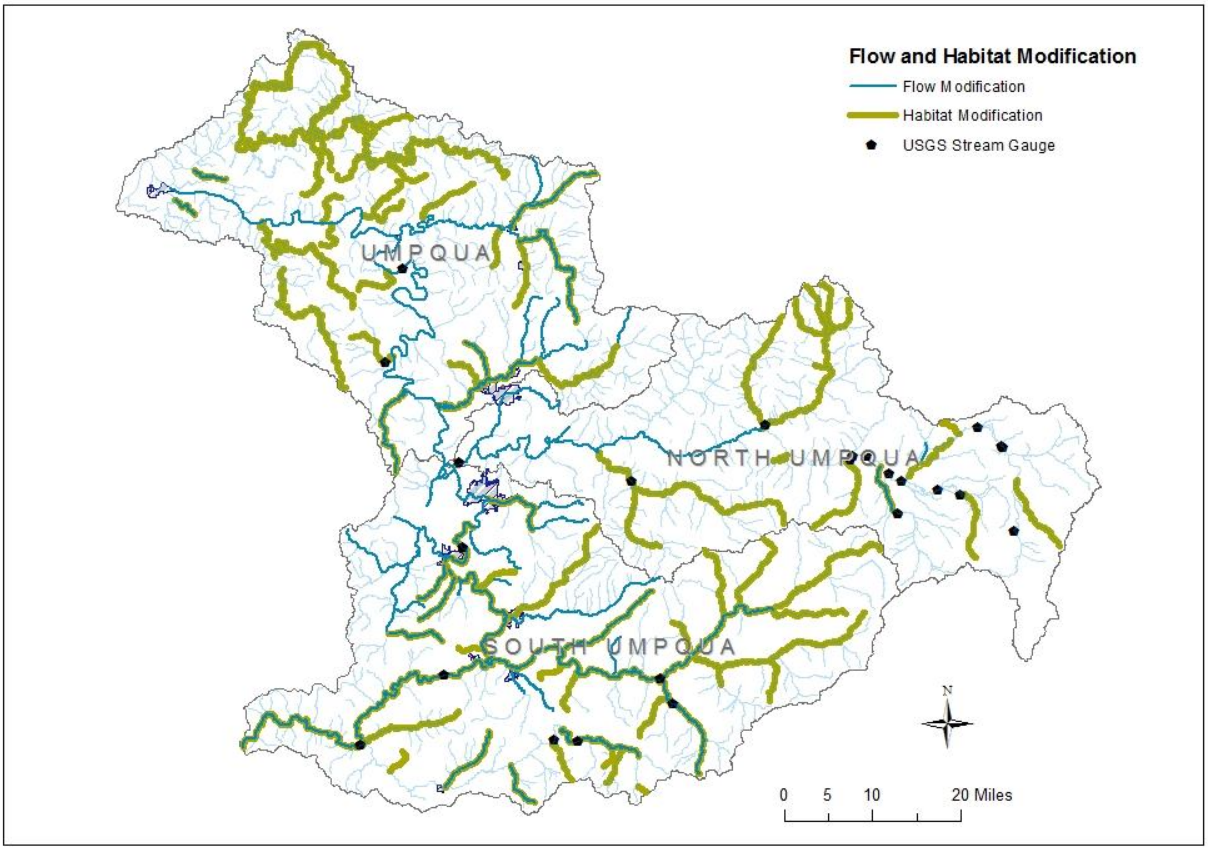
As of November 2013, OWRD records contained 127 instream water rights in the Umpqua Basin. Many of these instream rights originated as minimum perennial streamflows established in the Umpqua Basin Program (OAR 690-516-0010). These minimal perennial streamflows were intended to support aquatic life. The minimum perennial streamflows were converted to instream water rights in order to allow for more effective regulation. The converted minimum flows (now instream rights) have 1958, 1974 and 1983 priority dates. Subsequently, ODFW has applied for additional instream water rights in the basin. Moving forward, DEQ should evaluate the role instream water rights and other tools to help meet water quality standards by maintaining flows.

Currently, the flow data collection network is minimal in the Umpqua Basin. Based on the United States Geological Survey,[39] 24 stream gauges are located in the Umpqua Basin, as shown on Map 28. Seven of these gauges include water quality parameters, ranging from dissolved oxygen, temperature, pH, and/or turbidity. Douglas County, PacifiCorp, Umpqua National Forest, and the BLM currently support some continuous water quality monitoring. DEQ and OWRD should work with other basin partners towards installing continuous monitors for flow and water quality parameters in additional waterways of concern.

Hydroelectric projects are a contributing factor to flow and habitat in the North Umpqua. PacifiCorps and other smaller hydro-projects have developed management plans to mitigate habitat and flow modifications in the North Umpqua. As part of the PacifiCorp relicensing, a Settlement Agreement was developed to prescribe measures deemed necessary for the protection of ecological resources affected by the project. Various federal and state agencies comprise the advisory group and developed protection, mitigation, and enhancement measures. Maintaining minimum instream flows, as well as managing the facilities in a manner that maintains or improves water quality, are key actions associated with DEQ's 401 Program.

[38] www.oregon.gov/OWRD/Pages/law/Integrated_Water_Supply_Strategy.aspx
[39] http://waterdata.usgs.gov/or/nwis/rt

Map 27: Flow and Habitat Impaired Waterbodies in the Umpqua Basin



3. Water Quality Action Plan

3.1 Purpose

The Oregon Department of Environmental Quality is undertaking a Watershed Approach to assist in managing water quality in the State of Oregon. A key component of this approach is an action plan that can be used along with an assessment of the status of water quality (Status Report) in the adaptive management of the water quality within a geographic area. This Action Plan identifies potential actions and highlights opportunities for the alignment of DEQ water quality programs. The intent of this document is to help guide DEQ's water quality management in the Umpqua Basin for the next five years: 2014–2019. Periodic updates are expected as part of the adaptive management process. The next major update is anticipated in 2019.

DEQ's Water Quality program's primary functions and program activities have been grouped into the major categories shown in Table 25. Each category is described in more detail on the following pages followed by identified action items and opportunities for alignment with other programs and partners. Action items, alignment opportunities and partnerships are assembled in an Action Plan Summary Table located in Appendix A: Identified Actions and Primary Programs. Actions in Appendix A are grouped by how soon the actions should be implemented.

Table 25: Water Quality Programs and Activities

- Water Quality Standards
- Water Quality Assessment
- Total Maximum Daily Loads
- Wastewater Control – Point Source Program
- Stormwater
- Pretreatment Program
- Biosolids Program
- Underground Injection Control
- 401 certification – Hydroelectric Certification
- 401 certification – Removal/Fill Certification
- Onsite septic systems
- Water reuse
- Confined Animal Feeding Operations
- Compliance and Enforcement
- Groundwater Program
- Drinking Water Program
- Water Quality Monitoring
  - TMDL Monitoring
  - Ambient Monitoring Network
  - National Aquatic Resource Surveys
  - Oregon Beach Monitoring Program
  - Biomonitoring
  - Toxics Monitoring Program
  - Senate Bill 737
  - Harmful Algae Bloom
  - Compliance Monitoring
  - Volunteer Monitoring
- Financial and Technical Assistance
  - Clean Water State Revolving Fund Loan Program
  - Section 319 Grants - Nonpoint Source

3.2 Goals

The goal of the Umpqua Basin Water Quality Action Plan is to identify water quality program priorities and identify actions to address existing problems and prevent future water quality related problems within the Umpqua Basin. An additional goal is to facilitate the alignment of water quality programs within the DEQ as articulated in the 2011-2013 DEQ Agency Request Budget.

- Align water quality monitoring to basin needs
- Align individual NPDES permit issuance to the basin plans
- Align TMDL development and implementation to the basin plans
- Align nonpoint source implementation work to priorities in the basins
- Align groundwater protection work with needs outlined in the basin plans
- Align drinking water protection work with needs outlined in the basin plans

3.3 Summary of Water Quality Resource Concerns by Geographic Area

The following tables summarize the status of surface and groundwater related resources in the Umpqua Basin, as identified through existing data or information, knowledge of DEQ staff, or from local stakeholders. It represents a compilation of the data and information presented in this status report and is meant to be used in identifying and prioritizing actions within the Umpqua Basin. Site specific data is available through DEQ[40], and more detailed watershed information can be found in the Partnership for the Umpqua Rivers Watershed Assessments[41].

Table 26: General Surface Water Quality by Subbasin

Surface Water	Bacteria	Biological Stressors Harmful Algae Blooms	Temperature	Dissolved Oxygen	Nutrients, pH Chlorophyll a	Altered Hydrology	Habitat Modification	Sediment / Turbidity	Toxics: Emerging Contaminants Pharmaceuticals, PCPs	Toxics: Metals	Toxics: Arsenic	Toxics: Mercury	Toxics: Pesticides
South Umpqua													
North Umpqua													
Umpqua													

Table 27: General Groundwater Quality by Subbasin

Groundwater	General Quality	Quantity	Nitrate	Bacteria	Pesticides	Volatile and Synthetic Organic Compounds	Arsenic	Nickel	Lead	Fluoride
South Umpqua										
North Umpqua										
Umpqua										

	Multiple areas not consistently meeting water quality standards; generally poor condition, **substantial** concern for water quality.
	Some areas not consistently meeting water quality standards, **moderate** concern for water quality.
	Most areas meeting water quality standards; Generally good condition, **low** concern for water quality.
	Unknown condition or lack of data

[40] http://deq12.deq.state.or.us/lasar2/
[41] http://www.oregon.gov/OWEB/docs/pubs/rest_priorities/umpquaactionplan.pdf

3.4 General Priorities in the Umpqua Basin

The Umpqua Basin Status report identified a number of water quality resource needs that can be used to establish initial priorities for the basin. Actions specific to address these priority concerns in areas of geographic focus will be identified as the Watershed Approach continues through sub-program discussion and discussions with permittees, TMDL Designated Management Agencies (DMAs), and stakeholders in the basin. Discussions will also include an identification of subprogram and partnership alignment opportunities that will serve to increase the effectiveness and efficiency of any actions taken.

General Priorities:

- Work with partners to implement action plans to address nutrients, aquatic weeds, dissolved oxygen and pH impairments throughout the Basin
- Work with partners to implement action plans to address temperature basin-wide. Where possible these actions should additionally address flow modification, habitat modification and sedimentation;
- Work with partners to implement action plans to address bacteria in the South Umpqua Basin and Umpqua Basin tributaries
- Work to measure the effectiveness of our actions
- Monitor the conditions and extent of harmful algae blooms across the basin in both rivers and lakes, evaluating potential sources
- Assess current status of mines and remediation actions
- Monitor for toxics to include surface waters, drinking source water protection, groundwater, and fish tissue
- Work with permittees and/or DMAs to develop and implement effective water quality management plans or implementation plans

3.5 Water Quality Standards

Establishing water quality standards is at the core of DEQ's water quality activities. The Water Quality program establishes standards to protect beneficial uses of water, such as water supply, aquatic life, fishing (consumption) and recreation and also acts to restore water to the standards that support those uses. Water quality standards and assessments program activities include:

- Conduct standards reviews and rule revisions to establish and update scientifically based water quality standards
- Identify water bodies not meeting water quality standards
- Develop policy, guidance, and procedures documents for implementing standards

Reviews and rule revisions

Turbidity

DEQ is in the process of reviewing the water quality standard for turbidity based on the best available science regarding the effects of turbidity on beneficial uses, aquatic life and public domestic water supply in particular. DEQ will also address a number of issues that have made it challenging to implement the current turbidity standard across all of DEQ's water quality programs, such as a better definition of allowances for the duration and frequency of exceedances that would violate the standard. Turbidity issues exist in the Umpqua Basin, but DEQ is unable to successfully identify and implement objectives for water quality due to a lack of turbidity assessment tools and clear instream targets. Given current resource uncertainties, DEQ does not have a timeline for when the turbidity rule revisions will be completed.

Sedimentation

DEQ has no formally documented strategy for assessing or responding to suspended and bedded sediment concerns. Sedimentation issues exist in a number of Umpqua Basin watersheds, but DEQ is unable to successfully identify and implement objectives for water quality due to a lack of sedimentation assessment tools and clear instream targets. Presently, a narrative sediment standard exists with no documented implementation method, which has led to a lack of certainty regarding how to apply the standard in the context of beneficial uses.

Even so, the evaluation of biological conditions in relation to sediment impairment has been a useful tool. For example, the Macroinvertebrate Section (2.5.1) of this document identifies sediment as a primary biological stressor. In addition, methods to evaluate embedded sediment conditions are being considered in support of the development of a more robust sediment strategy.

Action 1: Continue to provide regional input during the development of an implementation plan or Internal Management Directive for any new or revised standards. This is an opportunity for regional needs to be included and aligned.

Action 2: Develop more effective turbidity and sedimentation standards and implementation methods. Identify funding for support of sediment assessment tools and strategies and develop, adopt and implement a better way to assess sedimentation and determine impairment.

Action 3: Work to better define and refine the distribution of the beneficial uses of resident trout and other sensitive aquatic species.

Alignment Opportunities: Regional staff will work with standards section staff to evaluate data needs related to sedimentation and explore data collection opportunities using proposed methodologies for stream condition assessment as potential models for agency use, e.g. biologically derived sediment targets, Relative Bed Stability and/or other available methods. Regional staff will work with other programs and stakeholders to determine potential causes and treatments of sediment impairments. Interests may include DEQ (Standards and Assessment, Permitting, Monitoring, TMDLs, Nonpoint source, and 319 programs), ODA, Drainage Districts, OWEB, NRCS, EPA, USFS, ODF, BLM, ODFW and others.

3.6 Water Quality Assessment

DEQ is required to assess the level at which Oregon's water quality supports beneficial uses. DEQ prepares an Integrated Report for submission to EPA that meets the requirements of the federal Clean Water Act (CWA) for Section 305(b) and Section 303(d). CWA Section 305(b) requires a report on the overall condition of Oregon's waters. CWA Section 303(d) requires identifying waters that do not meet water quality standards, for which a TMDL needs to be developed.

Integrated Report Alignment

There is an opportunity to more closely align the assessment described by the Integrated Report database and basin assessments through a watershed approach. The components of the watershed approach include Basin Assessments and Action Plans, which will be reviewed every five years. A May 5, 2009 EPA memorandum articulates support for a watershed approach:

> "The rotating basin approach as an effective tool for States to make water quality assessment determinations and manage their water quality programs. In this approach, available assessment

resources are concentrated or targeted in defined watersheds for a specified period of time, thus allowing for data to be collected and assessed in a spatially and temporally "focused" manner. Over time, every portion of the state is targeted for monitoring and assessment (often over a four or five year period). States using a rotating basin approach may consider explaining in their data solicitation that a special emphasis is being placed on obtaining and considering data and information from the basin of interest, but that data and information from outside of the basin may also be considered for water quality assessments, NPDES permitting decisions, TMDL development, compliance monitoring, etc."

Action 1: DEQ's 2010 Integrated Report included updates for aquatic weeds and algae (harmful algal blooms), turbidity (source drinking water), and biocriteria. EPA added waters to the 2010 303(d) list for a number of pollutants and should be reviewed and addressed by TMDL staff, as appropriate.

Action 2: Better define and account for "insufficient data" versus "potential concern" listings. Information included in the 1988 NPS Assessment was evaluated in the development of the 1994 303(d) list. In many instances, anecdotal concerns were identified related to a given parameter, but no supporting data was available. Where no data exists, it is recommended that these segments be identified as areas of potential concern. Data may be available for segments identified as having "insufficient data," but the available data do not meet minimum requirements required by the Integrated Report. Segments in this category may represent areas that attain criteria or where available data may indicate the potential for a water quality problem. Where these small datasets indicate water quality problems exist, emphasis should be placed on building a dataset of sufficient size to allow the characterization of water quality conditions, at least for priority pollutants.

Action 3: Nonpoint source/TMDL staff should apply assessment benchmarks for parameters with narrative criteria. The water quality assessment program should develop approaches to address sedimentation and nutrient loading.

Alignment Opportunity: TMDL/nonpoint source, point source, and lab staff should work with the water quality assessment program to secure all available water quality data for the next Integrated Report. Regional staff will work with other programs and stakeholders to refine the distribution of salmonids and other sensitive aquatic species. This is important in areas where fish passage projects have been completed, such as the North Umpqua.

3.7 Total Maximum Daily Loads

A TMDL is the calculated pollutant amount that a waterbody can receive and still meet Oregon water quality standards. When TMDLs are implemented it is expected that the waterbody would achieve water quality standards due to reduction of pollutant loads from human activities, which include both point sources and non-point sources.

3.7.1 Umpqua Basin TMDLs

The Umpqua Basin TMDLs were issued by DEQ on October 31, 2006 and approved by U.S. EPA on April 13, 2007. The Umpqua Basin TMDL includes the following:

- **139 Temperature**: basin wide thermal load allocations for temperature in all perennial streams, with the exception of spawning season temperature listings in waterbodies impacted by dams or point sources.

- **18 Bacteria**: wasteload allocations and load allocations were issued and approved for fecal bacteria impaired segments.
- **14 pH**: Modeling indicated that under natural conditions pH exceeds the water quality criterion in the Calapooya and S. Umpqua. In cases where the natural pH values exceed the numeric criterion in the standard, the natural values replace the criterion. It is expected that many streams will meet pH criterion by meeting the temperature TMDL allocation for shade and reduction in volatile solids through the bacteria TMDL. Allocations to point and nonpoint sources were developed for phosphorus to meet the dissolved oxygen and pH standards. The Diamond Lake TMDL addressed pH impairment by reducing the fish biomass.
- **5 Dissolved Oxygen**: It is expected that many streams will meet dissolved oxygen criterion by meeting the temperature TMDL allocation for shade and reduction in volatile solids through the bacteria TMDL. Allocations to point and nonpoint sources were developed for phosphorus, biological oxygen demand, and organic solids to meet the dissolved oxygen and pH standards.
- **3 Aquatic Weed**: Increased inorganic phosphorus and total phosphorus from wastewater treatment plants and nonpoint sources resulted in excessive algae growth in the South Umpqua. Explicit phosphorus allocations were assigned to point sources by month and nonpoint sources. The Diamond Lake TMDL addresses excess nutrients and excessive algal growth by reducing the fish biomass.
- **1 Chlorophyll a**: Explicit phosphorus allocations were assigned to point sources by month and nonpoint sources in the South Umpqua.
- **1 Phosphorus**: Explicit phosphorus allocations were assigned to point sources by month and nonpoint sources in the South Umpqua.
- **7 Biocriteria listed segments** (from the 1998 assessment cycle) in the South Umpqua subbasin were addressed by DEQ in the 2006 TMDLs by implementing the allocations for temperature and other water quality-limiting parameters, and identifying the roles of improvements in stream habitat and flow conditions. EPA did not, however, approve TMDLs for these biocriteria segments in 2007.

3.7.2 Little River TMDL

Temperature, pH, and sedimentation TMDLs were developed for the Little River Watershed in 2001. The federal government is the primary landowner in the Little River Watershed with resource lands managed by the Umpqua National Forest and the Roseburg District Bureau of Land Management (BLM) for timber production and recreation. The remaining land is owned/ managed by private timber companies and agricultural and rural residential landowners. The Little River TMDL includes the following:

- **Temperature**: Load allocations for nonpoint sources are based on percent effective shade. A wasteload allocation in the form of a limit on the maximum temperature of the effluent was developed.
- **pH**: Exceedances of the pH standard were linked to photosynthetic activity of benthic algae. Load allocations for pH apply the temperature TMDL allocations of percent effective shade. Assessment revealed that nutrient levels were below detection levels at most monitoring locations and a strong correlation existed between elevated pH values and stream temperature.
- **Sedimentation:** The nonpoint source load allocation was expressed in tons of sediment per square mile per year.

3.7.3 TMDL Implementation-Basin wide

Under Oregon's program, TMDL implementation plans rely on cooperation among landowners and land managers within defined geographic areas, such as a river basin, or governmental jurisdictions, such as a

County. Local watershed councils, soil and water conservation districts, local governments or other organizations serve as community-based coordination points for implementation. The TMDL program is part of DEQ's commitment to The Oregon Plan for Salmon and Watersheds, which is designed to maintain and restore the healthy function of Oregon's natural aquatic systems. By cooperatively developing TMDLs with other state and federal agencies, DEQ provides needed scientific information for understanding water quality problems and guidance for developing successful management plans.

To date, the majority of designated management agencies (DMAs), with jurisdiction over nonpoint source pollution sources in the Umpqua Basin, have submitted implementation plans as required by OAR 340-042-0080 (Table 28). These plans describe actions to meet load/ wasteload allocations and/or reduce their sector or activity contribution to water quality impairments. DEQ's review indicates that these plans vary in their detail and most should be updated to reflect current information and activities.

For agricultural land use activities, implementation plans are developed through the Oregon Department of Agriculture's (ODA) Water Quality Management Program Area Rules and Plans. On state and private forestlands, the Oregon Department of Forestry (ODF) is the DMA for providing water quality protection through the Forest Practices Act and long range management plans. In the urban and rural residential landscape, local governments have been identified as the DMAs and take the lead in developing TMDL implementation plans. The US Forest Service (USFS) and the Bureau of Land Management (BLM) develop water quality restoration plans for lands under their jurisdiction. In the Umpqua Basin, no individual private landowners were assigned load/ wasteload allocations.

Table 28: Status of DMA Implementation Plans as of 2013

DMAs and Responsible Participants	Little River (2001)	Umpqua Basin (2006)	Date submitted	Date approved	Annual Report(s)
Oregon Department of Environmental Quality	In place	In place	Ongoing		
Oregon Department of Forestry (ODF)	In place	In place (FPA & Rules)	Ongoing	OAR designates the Forest Practices Act (FPA) as the IP for ODF/Forestry	
Oregon Department of Agriculture WQ Mgt Program Umpqua Basin Area Rules and Plans	In place	In place (2010 version) Reviewed in 2012 by ODA, DEQ and the LAC	Ongoing	OAR designates the WQ Mgt Program Umpqua Basin Area Rules and Plans as the IP for ODA/ Agriculture	Biennial reviews and updates are conducted by ODA w/LAC & DEQ input
Oregon Department of Transportation (ODOT)	In place	In place (Statewide NPDES MS4 storm water management	Ongoing		

DMAs and Responsible Participants	Little River (2001)	Umpqua Basin (2006)	Date submitted	Date approved	Annual Report(s)
		permit)			
Oregon Water Resources Department (OWRD)	Identified as a DMA	Not identified as a DMA	Status uncertain	No formal approval	No formal approval
U.S. Forest Service - Umpqua National Forest (WQRP)	In place	Submitted	4/30/2008 Diamond Lake FEIS (2004) Record of Decision (ROD)and plans	No formal approval	Annual monitoring reports
Oregon Department of Fish & Wildlife (ODFW)	N/A	Memorandum of Agreement following Diamond Lake FEIS (2004) (ROD)	Diamond Lake Management Plan Oregon Department of Fish and Wildlife Umpqua Watershed September 2009	DEQ did not formally approve the Management Plan, but the MOA outlines the process	Annual management & monitoring summaries are prepared and shared
Bureau of Land Management (BLM)	In place	Submitted	4/3/2008 (Swiftwater Area) 1/9/2009 (Coos Bay District)	No formal approval	No formal approval
Douglas County	These land uses are not present in this area	Not submitted			
Canyonville		Submitted	~ 10/21/2008	No formal approval	None
Drain		Submitted	10/24/2008	No formal approval	None
Elkton		Submitted	Undated	No formal approval	None
Myrtle Creek		Submitted	10/23/2008	No formal approval	None
Oakland		Submitted	Undated	No formal approval	None
Reedsport		Submitted	9/28/2008	No formal approval	None
Riddle		Submitted	10/23/2008	No formal approval	None
Roseburg		Submitted	10/8/2008	No formal approval	None
Sutherlin		Submitted	10/31/2008	No formal approval	None
Winston		Submitted	Undated	No formal approval	None
Yoncalla		Submitted	11/18/2008	No formal	None

DMAs and Responsible Participants	Little River (2001)	Umpqua Basin (2006)	Date submitted	Date approved	Annual Report(s)
				approval	

3.7.4 TMDLs and Related Work for 2014-2019

Action 1: Regional Coordination. Increase regional coordination between the designated management agencies, DEQ, Tribal nations and other partners and stakeholders to achieve the greatest water quality improvement. For the Umpqua Basin TMDLs, there has been minimal regional coordination among DEQ TMDL program and the DMAs since 2008. DEQ's Umpqua Basin Coordinator position has not been fully staffed since late 2009 and DEQ's presence in the Basin has therefore been inconsistent. Most DEQ TMDL/NPS staff time has been spent responding to Harmful Algae Blooms events, water quality complaints and working with partners to develop and implement specific grant funded monitoring or restoration projects, rather than reviewing and updating DMA's implementation plans.

TMDL staff should review DMA's TMDL implementation progress and assess whether the first five years of TMDL implementation were focused on assessments and prioritization of projects, revisions to ordinances and codes, and the development of public outreach programs. On the ground restoration projects and specific conservation actions should increase for the following five year phase of implementation.

Action 2: Regional WQ Staff Collaboration. Continued collaboration is needed between the permit program/point source staff and TMDL/NPS staff. Implementing a TMDL often includes revising industrial and municipal wastewater permits in order to incorporate revised permit limits based on TMDL derived wasteload allocations. This coordination is critical in the South Umpqua subbasin, where municipal point sources were identified as significant sources of nutrients and were assigned wasteload allocations. In some cases, wasteload allocations required significant WWTP facility upgrades over multiple years. Tracking these improvements and monitoring data is critical to understanding the impacts on the water body.

Additional coordination with State Revolving Fund (SRF) staff will help ensure that the most important water quality improvements can be funded and completed in a reasonable timeframe, including use of the Sponsorship Option where available. Regional TMDL/NPS staff and stormwater staff will also need to collaborate in order to evaluate the effectiveness of stormwater control measures incorporated into TMDL Implementation Plans for those areas not covered by NPDES Phase II stormwater requirements.

Action 3: Implementation Plan Tracking and Monitoring. As the TMDL implementation activities in the Umpqua Basin move forward, DEQ's focus must shift to working with DMAs to ensure that implementation plans are developed, effectively implemented, reviewed and adapted as necessary over time. Review and possible modifications to implementation plans are expected to occur on an annual basis, while comprehensive reviews of the TMDLs are expected to occur approximately five years after the final approval of the TMDLs, or whenever deemed necessary by DEQ. As noted in Action 1, DEQ has not been able to fully track the status of implementation plans and actions identified in those plans. To date, few if any annual reports have been submitted to DEQ by the local government DMAs. DEQ will work with municipal governments to review and update/revise implementation plans to address impairments and to standardize reporting format to reflect actions taken.

Most significantly, Douglas County has not submitted an implementation plan as of the date of publication for this document. The County has jurisdiction over a number of land use activities that could affect water quality including zoning, building permits and land use compatibility statements (LUCS), as well as direct authority for on-site wastewater permits, public works, county roadways and right-of-ways. DEQ's priority for DMAs should be to engage the County in development of a meaningful and effective implementation plan.

Action 4: Diamond Lake Monitoring. Identify resources to continue monitoring efforts for Diamond Lake. Primary DMAs and DEQ are currently not able to provide the amount of funding that is necessary to continue the level of water quality monitoring that is needed at Diamond Lake. DEQ, ODFW and the USDA Umpqua National Forest should continue to collaborate to identify funding sources for water quality assessment and monitoring. Collaboration efforts should also include developing a current implementation plan that includes specific actions, benchmarks, and timelines for each action.

Action 5: Effectiveness Monitoring. Effectiveness monitoring is needed in the Umpqua Basin to ensure that implementation actions are improving water quality and will achieve beneficial uses. EPA has developed guidance for measuring effectiveness on the 6th field (12 digit HUC) scale. As noted in Action 2, DEQ has not been able to fully track the status of implementation, including most monitoring activity, with the exception of the water quality monitoring conducted by the Partnership for the Umpqua Rivers (PUR). DEQ should work with primary DMAs in order to design and implement effectiveness monitoring plans.

Action 6: State and Federal Lands. DEQ should work with federal land managers to assess the extent of implementation monitoring. It may be possible to obtain information from federal landowners on the status and trends of shade, e.g. via monitoring associated with the implementation of federal Forest Plans or local District projects. Status of shade targets on private or other non-federal lands is unknown at this time.

The United States Geological Survey has studied water quality and algal conditions in the North Umpqua River before, during, and after the 2006 rotenone treatment of Diamond Lake. The USGS study also evaluates the effect of other land management activities on water quality. USGS findings should be reviewed by DEQ and used to better address nutrient loading in the North Umpqua.[42]

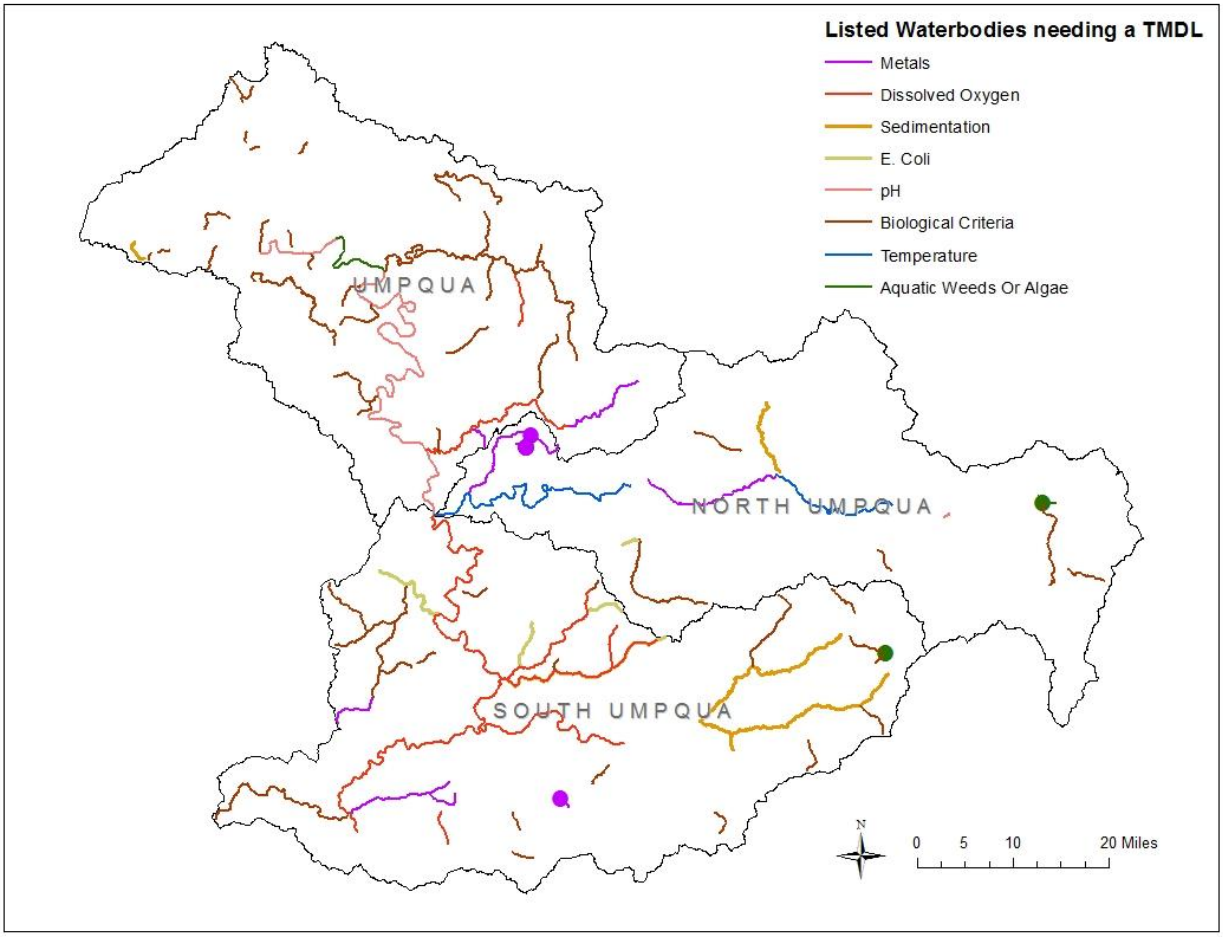
Action 7: Addressing the existing Category 5/303(d) Listed Parameters. In the Umpqua Basin, there are multiple 303(d) listings that need to be addressed from the 1998-2010 assessment cycles, either by TMDLs or other Plans, e.g. Category 4b plan.

Action 8: LiDAR data is needed for a large portion of the Umpqua Basin[43]. Excessive sedimentation, turbid waters biological criteria impairments and elevated stream temperatures are water quality concerns in the Umpqua Basin. Minimizing anthropogenic sources that contribute to excessive sediment and stream warming is a high priority. One of the major obstacles for identifying potential sources is the lack of accurate or reliable maps of landslides, roads, and stream networks in some areas. It is difficult to accurately determine the height and condition of vegetation over large areas without significant on-the-ground effort and access to private lands. LiDAR technology and data provide efficient means to collect accurate data for the identification and mapping of landslides, unmaintained roads, and vegetation attributes across all land uses and ownership class.

[42] http://or.water.usgs.gov/proj/N_Umpqua/

[43] Current LiDAR coverage here's what is available: http://www.oregongeology.org/pubs/ldq/Lidar_Series_Index_Map_SC_11-18-09.pdf

Map 28: Streams Needing TMDLs based on 2010 Integrated Report



a) **Spawning Season Temperature:** Heat Source modeling for the 2006 Umpqua Temperature TMDL did not simulate conditions in the spawning season for the North Umpqua; therefore spawning criteria impairments were not directly addressed. Certain segments require additional data and/or analysis to determine thermal load allocations. The North Umpqua spawning season temperature & flow data were collected in 2009, and the data is ready to be reviewed and potentially used in a Heat Source or similar model. Completing a temperature TMDL analysis of the spawning season in waterbodies affected by dams or point sources is a priority for the North Umpqua. Waterbodies identified as spawning areas in exclusively nonpoint source impacted streams are addressed by the 2006 Temperature TMDL, because load allocations are set to restore system potential shade levels in all streams of the Umpqua Basin.

b) **Dissolved Oxygen and pH:** There are 11 dissolved oxygen Category 5 303(d) listed segments not yet addressed by a TMDL. Ten of these segments were added to the 303(d) list by EPA in the 2010 Assessment cycle. Certain segments require additional data and/or analysis in order to perform source assessment and determine appropriate load allocations. There are two Category 5 303(d) listed segments for pH not yet addressed by a TMDL.

c) **Aquatic Weeds and Algae:** Investigative studies are needed in order to provide support for aquatic weeds and algae TMDLs, or the equivalent for listed waterbodies. These studies would also help to address pH and dissolved oxygen impairments. Certain segments require additional data and/or analysis to perform source assessment and determine appropriate load allocations. Five new aquatic weeds and algae impairments due to harmful algal blooms were added to the 303(d) list in 2010. A subbasin-scale harmful algal bloom strategy and monitoring approach needs to be implemented in order to address these additional listings. DEQ is working with PUR to develop a locally based harmful algal bloom surveillance program using Section 319 grant funds, but funding is not secure beyond summer 2014.

d) **Toxics:** TMDLs (or other plans) need to be developed for toxic substance impairments. There are 32 stream segments in the Umpqua Basin on the Category 5 303(d) list for toxic substances, many of which are elemental metals. These criteria are established to: protect surface water for aquatic life use; allow Oregonians to consume fish and shellfish; provide for use of state waters as a drinking water supply without adverse health effects (Table 20 Toxic Substance[44]). Additional toxics monitoring work is needed to address the numerous (323) Category 3 (insufficient data) segments. Certain segments require additional data and/or analysis to perform source assessment and determine appropriate load allocations, but this work is not likely to be initiated for several years.

e) **Sediment and Biological Criteria:** In the 2010 Assessment cycle, EPA added 45 biocriteria impairments/segments to Category 5 for the Umpqua Basin, resulting in 52 303(d) biocriteria listings totaling 409.5 river miles. DEQ is conducting an evaluation of the potential stressors affecting macroinvertebrate condition, including temperature and fine sediment, in order to develop TMDLs or other plans to address these impairments. Addressing the biological criteria impairments added to the 303(d) list in 2010 in the Umpqua is a priority. Further guidance for interpretation of the sedimentation narrative standard and for developing numeric targets may be needed before a TMDL (or other plan) can be developed. In some cases, additional assessment work may also be needed to determine the spatial or temporal extent of the biocriteria impairments or perform source assessments.

f) **Chlorine and Total Dissolved Gas:** DEQ should evaluate if chlorine and total dissolved gas criteria are being met by other pollution control plans, e.g., FERC licensing and water quality certification.

g) **Bacteria:** DEQ should collect additional data and perform source assessment analysis for the seven Category 5 303(d) listed segments.

Alignment Opportunity: Planning for and completion of Action items #1-7 above will require the alignment between the TMDL program and several other programs, including the point source program, lab, SRF, and several other programs. Ongoing collaboration will be required with a wide variety of state and federal entities to refine a regional implementation strategy and identify both timelines and the 'best bang for the buck' actions.

Special attention will be needed to assure that DEQ's subprogram planning and implementation efforts are sufficient to meet the Coastal Zone Management Act requirements and Oregon's Coastal Nonpoint Pollution Control Program. In order for Oregon to receive full CNPCP approval from EPA and NOAA, DEQ must commit to developing Implementation Ready TMDLs and Implementation Plans for state and private forestry lands using BMPs addressing riparian protections, landslide-prone areas, and "legacy" roads. Oregon has committed to update or revise the temperature, bacteria, and sediment TMDLs for the CNPCP area including the Umpqua Basin "Implementation Ready -TMDLs" by June 2021.

[44] www.deq.state.or.us/wq/standards/docs/Table2033A33B.pdf

3.8 Waste Water Control – Point Source Program

3.8.1 Industrial and Domestic Wastewater Permitting

DEQ's wastewater management program issues water quality permits to regulate and minimize adverse impacts of pollution to Oregon's waters. DEQ administers two types of water quality permits to regulate sources of wastewater: Federal National Pollutant Discharge Elimination System permits or State Water Pollution Control Facilities permits developed by DEQ. The type of permit issued depends on what is discharged and where the discharge goes.

Industrial and domestic wastewater permitting sub-programs carry out the following four activities: issue discharge permits that adequately evaluate and limit pollution to prevent an impact on receiving waters and the beneficial uses of those waters (drinking, swimming, fishing, aquatic habitat, etc.), inspect facilities and review monitoring results, take prompt and appropriate enforcement actions when violations occur, provide essential technical assistance for facility owners and operators to help assure ongoing compliance at minimum expense to permit holders.

3.8.2 Water Pollution Control Facility (WPCF)

The WPCF permit is a state permit required for discharges of wastewater to the ground or via evaporation; discharge to waters of the state is not allowed. WPCF permits are issued for land irrigation of wastewater, seepage or evaporation wastewater lagoons and onsite sewage disposal systems using a drainfield. The primary purpose of a WPCF permit is to prevent discharges to waters of the state and to protect groundwater from contamination. This permit is also used to prevent nuisance conditions such as odors and mosquitoes.

3.8.3 National Pollution Discharge Elimination System (NPDES)

The NPDES permit is a requirement of the Federal Water Pollution Control Act (Clean Water Act) and Oregon law. DEQ has been delegated authority from the EPA to issue these permits. NPDES permits are required for "point source" discharges of pollutants to surface waters. The term "point source" refers to a natural or human-made conveyance such as pipes culverts, ditches, catch basins or any other type of channel that discharges to surface waters. NPDES permits are issued for wastewater discharges from sewage treatment plants, pulp and paper mills, and other types of businesses. NPDES permits also are used to cover point source discharges to stormwater sewer conveyance systems.

NPDES permits include limits and other requirements necessary to comply with water quality standards for clean water. An NPDES permit typically specifies an acceptable level of a pollutant or pollutant parameter in a discharge (for example, a certain level of bacteria). The permit also specifies required treatment technologies. Often in combination with the treatment 'best management practices' (such as screens or site maintenance to capture large debris) are also included in the permits.

3.8.4 Permit Classifications

NPDES and WPCF permits are also classified as "general-industrial, domestic or stormwater" or "individual-industrial, domestic or stormwater". "Domestic" refers to sewage and wastewater treatment plants, as well as other systems designed to treat wastewater that is primarily composed of human sewage. "Stormwater" means stormwater runoff and drainage. "Industrial" refers to all other wastewater or combinations of wastewaters.

3.8.4.1 General Permits

A "general permit" is used to cover a category of similar activities and discharges, rather than a specific site. A general permit is issued once and then assigned to the permittees. General NPDES permits must be renewed for continuation of coverage every five years. Any facility that qualifies for a general NPDES permit may be "assigned" the permit during that five-year period. General WPCF permits must be renewed for continuation of coverage every 10 years. WPCF general permits are generally valid for 10 years and must be assigned during that 10-year period. General permits cannot be modified and will only be issued for facilities that are able to meet the requirements set forth in the desired permit, and therefore do not need an individual permit. In addition, these permits usually require less oversight by DEQ.

The DEQ water quality program utilizes four different WPCF and 12 different NPDES general permits in the Umpqua Basin. As of July 2013, there were 129 facilities covered under general permits within the Umpqua Basin: 28 in North Umpqua Subbasin, 77 in South Umpqua Subbasin, and 24 in Umpqua Subbasin (Table 29). These permits regulate land application of wastewater for such discharges as boiler blowdown, non-contact cooling water, wash water from vehicle and equipment cleaning, seafood processing, petroleum hydrocarbon cleanups, etc.

Approximately 60 percent of these general permits are for stormwater discharges to surface waters from construction and industrial activities and municipalities. Almost 60 percent of these general permits cover activities in the South Umpqua Subbasin, which coincides with the most populated area (the city of Roseburg) in the Umpqua River Basin. Some of the DEQ general permits are administered by partner agencies such as ODA for Confined Animal Feeding Operations (CAFO) GEN08 permits, and Oregon Department of Geology and Minerals Institution (DOGAMI) for gravel mining GEN 10 and 12A permits. These partner agencies have the regulatory jurisdiction for permit oversight.

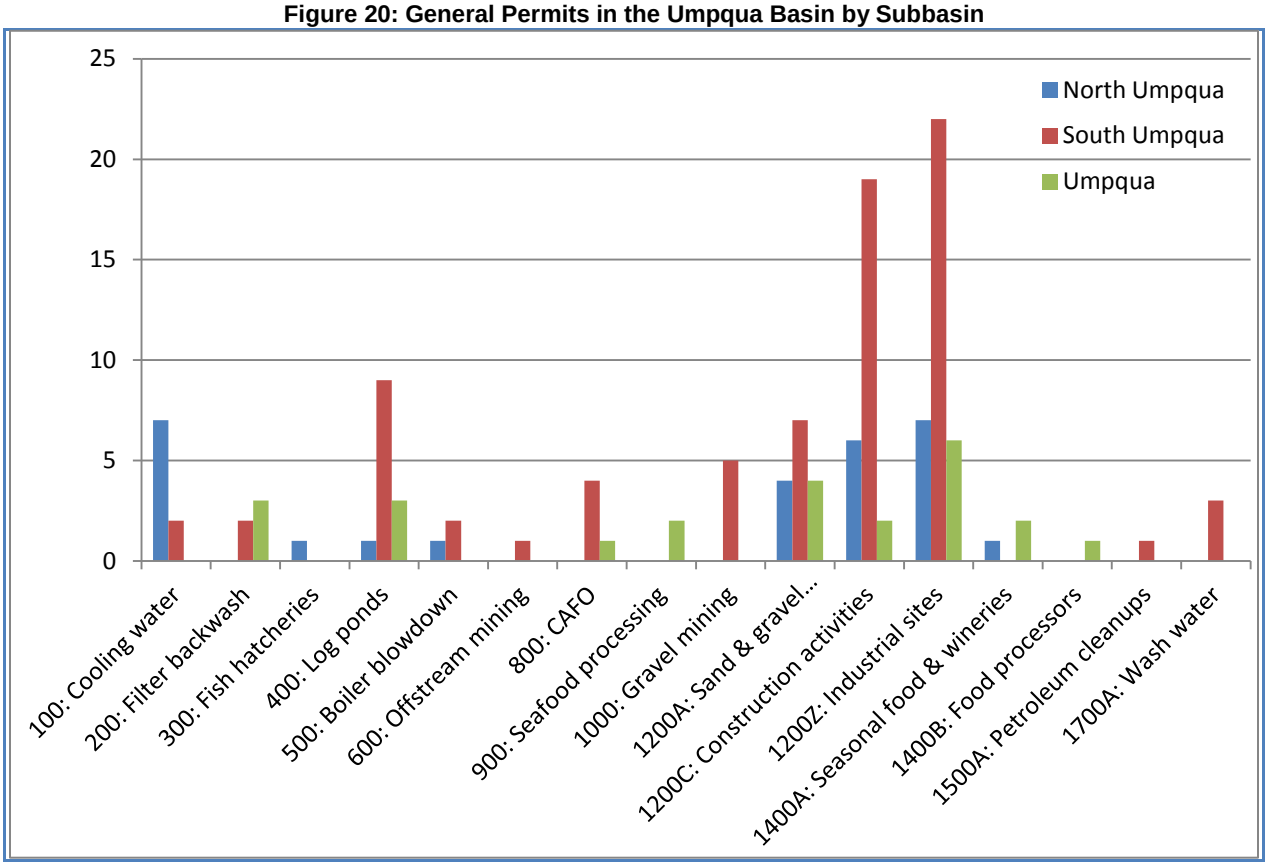
Table 29: Umpqua Basin – General Permits

General Permit	Permit Description	Count	Permit Type
100	Industrial Wastewater; Cooling water	9	NPDES
200	Industrial Wastewater; Filter backwash	5	NPDES
300	Industrial Wastewater; Fish hatcheries	1	NPDES
400	Industrial Wastewater; Log ponds	13	NPDES
500	Industrial Wastewater; Boiler blowdown	3	NPDES
600	Industrial Wastewater; Off stream mining	1	WPCF
800	Confined Animal Feeding Operation	5	NPDES
900	Industrial Wastewater; Seafood processing	2	NPDES
1000	Industrial Wastewater; Gravel mining	5	WPCF
1200A	Stormwater; Sand & gravel	15	NPDES
1200C	Stormwater; Construction activities	27	NPDES
1200Z	Stormwater; Industrial sites	35	NPDES
1400A	Industrial Wastewater; Seasonal food & wineries	3	WPCF

General Permit	Permit Description	Count	Permit Type
1400B	Industrial Wastewater; Food processors	1	WPCF
1500A	Industrial Wastewater; Petroleum cleanups	1	NPDES
1700A	Industrial Wastewater; Wash water	3	NPDES
		129	total

Note: Other general permits that are issued in the Umpqua that are not required to provide locations include: 700PM - Suction dredges. General permits issued by DEQ but not present in the Umpqua Basin include: 1300J - Oily stormwater runoff, oil/water separator, 1900J - Non contact geothermal. 1200COLS, 2100J and 2200J.

Figure 20: General Permits in the Umpqua Basin by Subbasin



3.8.4.2 Individual Permits

Individual permits cover a specific site discharge and activity such as municipal sewage or industrial wastewater treatment facilities, and require more detailed assessment before issuance. Individual NPDES permits are usually issued for a period of five years. Permits must be reassessed for continuation of coverage at renewal. Individual permits often require more frequent monitoring by the permittee to assure that permit

limitations and treatment requirements are being met, as well as monitoring for a greater variety of pollutants to confirm that water quality is adequately protected. Individual permits are also classified as major or minor.

DEQ currently utilizes 17 different WPCF and 20 different NPDES individual permits in the Umpqua River Basin to regulate land application and surface water discharges of industrial and domestic treated wastewater, respectively. This summary does not include onsite permits information. Table 30 summarizes the number of permitted facilities by general major and minor category or class in each of the three subbasins and includes details on permittee names and cities. Over 78 percent of these individual permits are for domestic sewage wastewater disposal and treatment; over 80 percent of the individual domestic permits cover activities in the Umpqua and South Umpqua Subbasins, which coincides with the most populated areas within the Umpqua River Basin. There are no individual NPDES stormwater permits issued to sources in the Umpqua Basin.

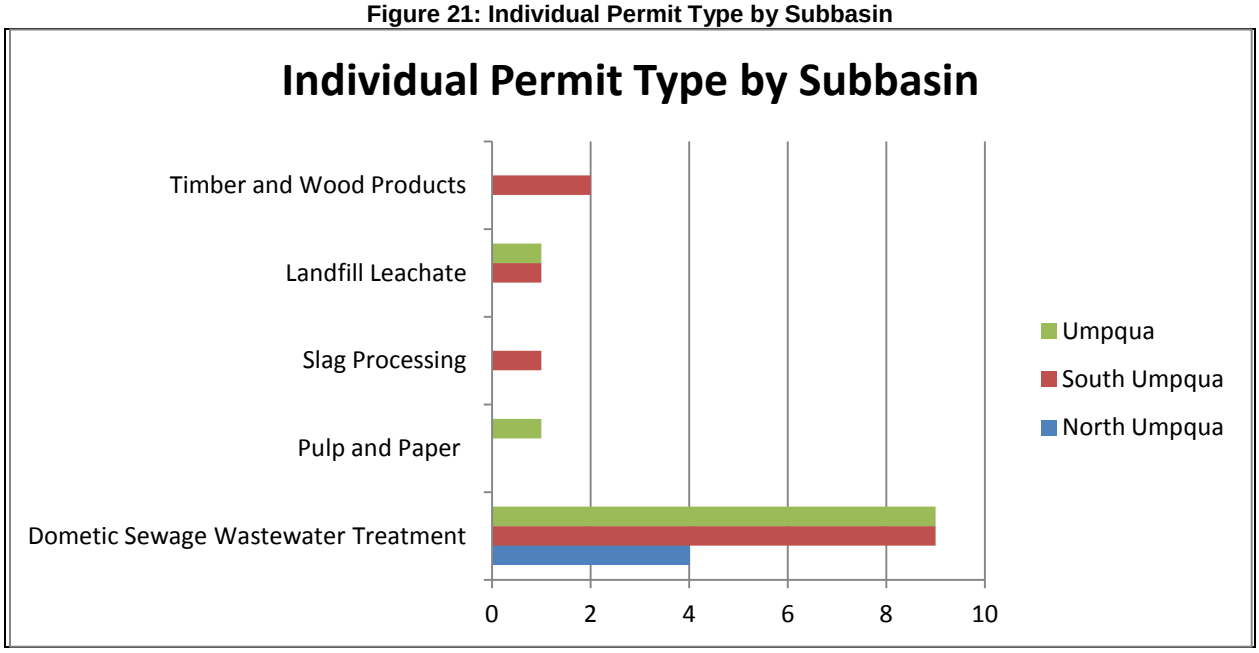
Table 30: Details of Permittee Names and Cities in the Umpqua Basin

File #	Permittee Name	City	Class	Type	Permit Status	Permit Renewal
	INDIVIDUAL PERMITS - NORTH UMPQUA					
33743	GLIDE-IDLEYLD SANITARY DISTRICT	Roseburg	Minor	Domestic	Expired/Ext.	2016
90964	USFS - UMPQUA NATIONAL FOREST; WOLF CREEK CIVILIAN CONSERVATION CENTER	Glide	Minor	Domestic	Current	2016
90927	USFS - UMPQUA NATIONAL FOREST; DIAMOND LAKE STP	Diamond Lake	N/A	Domestic	Current	2016
109363	HEARD FARMS	Roseburg	N/A	Domestic	Current	2021
	INDIVIDUAL PERMITS - SOUTH UMPQUA					
76771	R.U.S.A. ROSEBURG STP	Roseburg	Major	Domestic	Expired/Ext.	2016
59643	MYRTLE CREEK STP	Myrtle Creek	Minor	Domestic	Expired/Ext.	2016
98400	WINSTON-GREEN WWTF	Roseburg	Minor	Domestic	Expired/Ext.	2016
13745	CANYONVILLE STP	Canyonville	Minor	Domestic	Current	2016
33733	GLENDALE STP	Glendale	Minor	Domestic	Current	2016
75227	RIDDLE STP	Riddle	Minor	Domestic	Expired/Ext.	2016

File #	Permittee Name	City	Class	Type	Permit Status	Permit Renewal
90944	USFS - UMPQUA NATIONAL FOREST; TILLER RANGER STATION STP	Tiller	Minor	Domestic	Current	2016
36535	GREEN DIAMOND SAND PRODUCTS	Riddle	Minor	Industrial	Current	2016
107108	ROSEBURG LANDFILL LEACHATE TREATMENT SYSTEM	Roseburg	Minor	Industrial	Expired/Ext.	2016
105306	HOOVER TREATED WOOD PRODUCTS, INC.	Winston	Minor	Industrial	Expired/Ext.	2016
56976	MILO ACADEMY, INC.	Days Creek	N/A	Domestic	Current	2021
64718	ODOT - COW CREEK REST AREA, DOUGLAS COUNTY	Glendale	N/A	Domestic	Current	2016
100167	D. R. JOHNSON LUMBER CO. - RIDDLE SITE	Riddle	N/A	Industrial	Current	2016
	INDIVIDUAL PERMITS - UMPQUA					
86662	SUTHERLIN STP	Sutherlin	Minor	Domestic	Expired/Ext.	2018
10696	BRANDY BAR LANDING,INC.	Reedsport	Minor	Domestic	Expired/Ext.	2018
25282	DRAIN STP	Drain	Minor	Domestic	Expired/Ext.	2018
62855	OAKLAND STP	Oakland	Minor	Domestic	Expired/Ext.	2018
74319	REEDSPORT STP	Reedsport	Minor	Domestic	Expired/Ext.	2018
98090	WINCHESTER BAY STP	Winchester Bay	Minor	Domestic	Expired/Ext.	2018
73705	RICE HILL EAST LAGOON	Rice Hill	Minor	Domestic	Expired/Ext.	2013
75064	RICE HILL WEST LAGOON	Yoncalla	Minor	Domestic	Expired/Ext.	2013

File #	Permittee Name	City	Class	Type	Permit Status	Permit Renewal
99492	YONCALLA STP	Yoncalla	Minor	Domestic	Expired/Ext.	2013
42188	I P GARDINER PAPER	Gardiner	Major	Industrial	Current	2018
103982	REEDSPORT LANDFILL	Reedsport	Minor	Industrial	Expired/Ext.	2018

Figure 21: Individual Permit Type by Subbasin



As of August 2013, there is one expired individual NPDES permit in the North Umpqua Subbasin, six expired individual NPDES permits in the South Umpqua Subbasin and 10 expired individual NPDES permits in the Umpqua Subbasin. The permittees all submitted renewal applications. Expired permits have been administratively extended until DEQ takes action on the renewal applications. The permit renewal schedule is shown in Table 30 above. DEQ intends for permits to be issued on the watershed cycle. Permits in the North and South Umpqua Subbasins are scheduled for renewal during 2016. Umpqua Subbasin permits are scheduled for renewal either during 2013 or 2018.

If water quality problems associated with point sources are identified, permit writers will include permit conditions to collect the needed information to determine the contribution from the specific point sources. Currently, additional water quality monitoring data is required from major facilities (Roseburg) for toxic parameters. If the point source is not able to immediately meet its permit requirements, a compliance schedule may be included in the permit. Fifteen NPDES permits in the Umpqua Basin currently contain Schedule C compliance schedules for administrative purposes, but only the Tiller Ranger Station permit contains a timeline for compliance with a water quality limiting parameter. Permits must also be written to comply with the wasteload allocations and requirements of TMDLs as they are issued. Unresolved litigation is currently preventing the development or renewals of some permits in Oregon.

Action 1: Staff Collaboration. Continued collaboration is needed between point source permit writers and the TMDL group as implementing a TMDL often includes revising industrial and municipal wastewater permits to incorporate revised permit limits based on TMDL derived wasteload allocations. Stormwater permit writers and the TMDL group need to collaborate on the basin scale to identify noncompliant facilities and coordinate inspections to ensure permit compliance and provide technical assistance. TMDL staff and NPDES MS4 Phase II stormwater staff also need to collaborate to evaluate the effectiveness of stormwater control measures incorporated into TMDL Implementation Plans for those areas not covered by NPDES MS4 Phase II stormwater requirements. Staff collaboration is also needed to minimize duplication between NPDES MS4 Phase II requirements and TMDL requirements.

Action 2: Guidance Documents. A statewide low impact development guidance document is needed to assist stormwater program staff and TMDL staff in evaluating and/or selecting LID techniques. Collaboration is needed between regional stormwater program and headquarters staff to develop guidance documents for the following topics: Background determination, zinc, mass load calculation, tier II, and UICs.

Action 3: Data Collection. If water quality problems associated with point sources are identified, permit writers will include permit conditions to collect the needed information to determine the contribution from the specific point sources.

Action 4: Permit Renewal. As permits are renewed, permits writers should review available data, including DMRs, to determine if additional monitoring or permit conditions are required prior to the renewal of these permits and to ensure that monitoring aligns with impairments identified in the basin. When designing monitoring plans for permit compliance, permit writers should review and identify TMDL point source requirements and water quality data gaps. A WQ Assessment classification for a stream as “Insufficient data” or “Potential concern” for any pollutant or beneficial use should trigger the alignment of the monitoring plans (project or basin specific) to address those data needs.

Action 5: Toxics Constituent Education Plan. Continue to work with entities as they conduct source assessments and additional monitoring. Municipalities may use the 2010 SB 737 effluent results now to identify potential problems and consider changing local limits for their industrial dischargers or source reduction strategies.

Alignment Opportunity: Action items above will require the alignment of the nonpoint source, point source, SRF programs, laboratory staff, groundwater and drinking water programs and others.

3.9 Stormwater Program

NPDES permits are required for point sources. A point source is a natural or human-made conveyance of water through such things as pipes, culverts, ditches, catch basins, or any other type of channel, which are often associated with construction and industrial sites. Stormwater runoff (rain or snow melt) migrates from a site through a “point source” either directly or through storm drainage and often conveys pollutants that could adversely affect water quality.

A municipal separate storm sewer system (MS4) is a conveyance or system of conveyances, e.g., roads with drainage systems, municipal streets, catch basins, curbs, gutters, manmade channels or storm drains owned or operated by a governmental entity that discharges to waters of the State. Sources that need to obtain an MS4 permit are classified as either "Phase I" or "Phase II". Phase I MS4s are those with populations greater

than 100,000, while regulated Phase II (or "small") MS4s serve populations less than 100,000 located within Census Bureau-defined Urbanized Areas. Federal regulations also provide EPA and the states the discretion to require other MS4s outside of Urbanized Areas to apply for a permit. There are currently no MS4 municipal stormwater permits in the Umpqua Basin.

Action 1: DEQ will continue to work with communities to address stormwater issues and coordinate with the Underground Injection Control program to achieve compliance with UIC rules and also meet surface water quality goals such as possible TMDL load allocations.

Action 2: The TMDL program will consider using stormwater flow as a surrogate measure for TMDL loading capacity. EPA highlights the National Research Council 2009 Urban Stormwater Report's recommendation for using flow, or a surrogate such as impervious cover, as a measure of stormwater loading since it is a more straightforward way to regulate stormwater contributions to waterbody impairment. As per EPA, this is consistent with TMDL regulations specifying that TMDLs can be expressed in terms of mass per time, toxicity or other appropriate measure. The link between the surrogate parameter and the documented impairment must be demonstrated, however.

Action 3: DEQ will designate NPDES MS4 coverage for unpermitted stormwater sources when a TMDL approach is less effective. EPA recommends including more flexible language in a TMDL for stormwater sources that may be required to obtain a NPDES permit in the future. For example, a TMDL writer should include language in the TMDL that a stormwater source is under a load allocation contingent upon the source remaining unpermitted, but the load allocation would become a wasteload allocation if the source were required to obtain a NPDES permit. The purpose of this flexible TMDL language is to ensure water quality based effluent limits in a NPDES permit of the newly permitted source are consistent with the requirements of the TMDL's allocation to that source.

Alignment Opportunity: Stormwater staff will provide assistance to TMDL nonpoint source program staff as they work with urban areas to integrate stormwater measures into implementation plans for those areas that are not covered by NPDES Phase II stormwater requirements.

3.10 Pretreatment Program

The National Pretreatment Program is a cooperative effort of federal, state, and local regulatory environmental agencies established to protect water quality. The U.S. Environmental Protection Agency has delegated DEQ the authority to approve pretreatment programs at the local level and oversee state-wide pretreatment activities. The communities approved to implement the pretreatment program have the legal authority to issue industrial user permits, conduct inspections of industrial and commercial sources, sample industrial discharges and enforce regulations. These programs also routinely perform self monitoring to ensure the protection of worker safety, sewage treatment plant operations, and water quality.

Objectives of the pretreatment program:

- Protect publicly owned treatment works (POTW) from pollutants that may cause interference with sewage treatment plant operations.
- Prevent introducing pollutants into a POTW that could cause pass through of untreated pollutants to receiving waters.

- Manage pollutant discharges into a POTW to improve opportunities for reuse of POTW wastewater and residuals (sewage sludge).
- Prevent introducing pollutants into a POTW that could cause worker health or safety concerns, or that could pose a potential endangerment to the public or to the environment.

Oregon has about 25 approved programs that oversee more than 300 industrial users. There is one pretreatment program in the Umpqua Basin associated with RUSAs operations (Table 31). Regulatory oversight of industrial sources by approved programs includes formal permitting, compliance monitoring (routine compliance inspections and sampling), and enforcement. Many pretreatment programs work effectively with industrial users to reduce contaminants in the waste stream through voluntary pollution prevention efforts.

Table 31: Pretreatment Communities in the Umpqua Basin

EPA Permit Identifier	Name	City	Permit Renewal Date
OR0031356	Roseburg Urban Sanitary Authority (RUSA)	Roseburg	Expired/Extended 2016

Action 1: Continue to review and approve pretreatment programs at the local level and oversee state-wide pretreatment activities.

Alignment Opportunity: The pretreatment program participates in the development of the toxics strategy, which includes evaluating opportunities for the pretreatment program to address and contribute to reduction of priority toxic pollutants. As DEQ develops specific strategies and increased protections related to emerging contaminants, the pretreatment program may be a valuable tool to reach “up the pipe” with Best Management Practices and/or local limits as part of a source reduction strategy to address newly identified toxic pollutants of concern.

3.11 Biosolids Program

Biosolids are the nutrient-rich organic solids that are derived from the treatment of domestic wastewater at municipal wastewater facilities. The organic matter, nitrogen and phosphorus, as well as numerous micronutrients, present in biosolids enhance intensively-managed agricultural soils as well as degraded soils. Biosolids act as a slow-release fertilizer, which improves plant growth, while reducing the use of conventional fertilizers in agricultural operations. The high organic matter content in biosolids enhances soil water holding capacity and improves microbial activity. Overall, biosolids improve soil quality by enhancing soil functions, such as cycling nutrients, regulating water, and filtering potential pollutants. The results of biosolids land applications include healthier crops with better drought resistance, fewer pollutants leaching to groundwater and surface water, and less erosion and sediment runoff to surface waters.

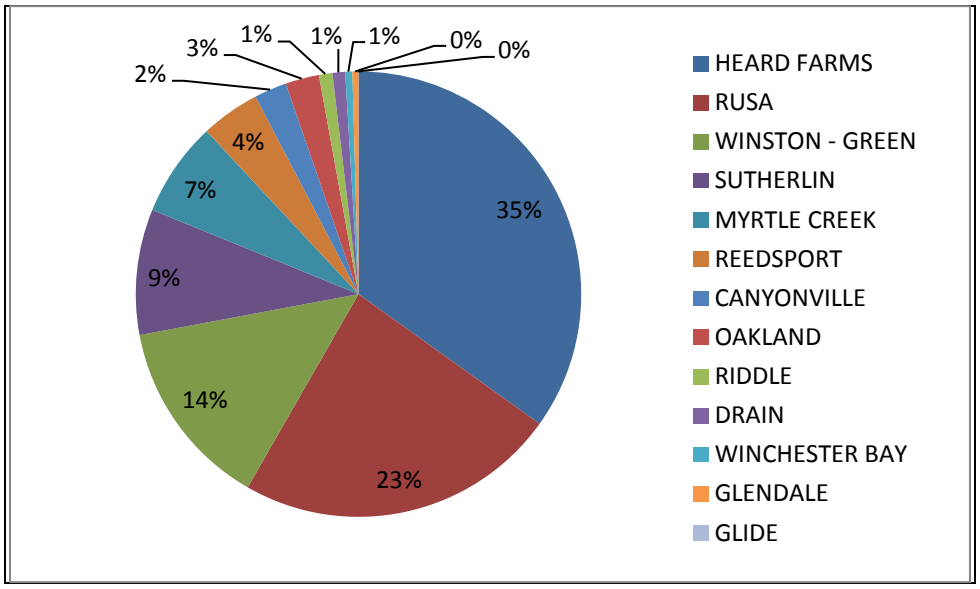
The DEQ Biosolids program regulates wastewater solids and domestic septage that has undergone sufficient treatment to allow its beneficial use as a soil amendment or fertilizer through land application. Biosolids are regulated through NPDES or WPCF water quality permits issued by DEQ. Prior to land application, biosolids

are analyzed for nutrients, pathogens, metals and stability. For land application, the concentrations of nine metals must be below federal and state biosolid ceiling limits; pathogens must be reduced; and the biosolids stabilized to reduce odors, i.e., vector attraction reduction or VAR.

Biosolids contain significant concentrations of organic nitrogen and may not be applied at rates that exceed the Oregon State University Fertilizer Guide agronomic requirements for cultivated crops. Land application activities are described in biosolids management plans, and site authorization letters that are reviewed and approved by DEQ. DEQ requires wastewater treatment facilities to monitor and report on biosolids activities.

Statewide, 95 percent of biosolids are beneficially reused as a soil amendment or fertilizer. In 2012, approximately 1,234 dry tons of biosolids were generated from twelve Douglas County municipal wastewater treatment facilities and Heard Farms, a private wastewater facility that processes septage, biosolids, and other approved domestic wastes (Figure 22). Oakland, Riddle, Sutherlin, and Winchester Bay transferred a total of 102 dry tons of biosolids to Heard Farms in 2012. Heard Farms land applied 446 dry tons of biosolids, or 35 percent of the total biosolids in the Umpqua Basin, in 2012. Roseburg Urban Sanitation Authority is the second largest biosolids producer in the basin, land applying 299 dry tons in 2012.

Figure 22: Sources of Biosolid Generation by Percentage in the Umpqua Basin



Action 1: Continue to require monitoring and reporting on biosolids activities; review monitoring results; take prompt and appropriate action when potential issues arise; provide technical assistance for facility owners and operators when needed. Coordinate with wastewater treatment facilities and identify opportunities for the beneficial reuse of biosolids generated in the Umpqua Basin.

Action 2: Biosolids program work with Oregon Department of Agriculture and OSU extension staff to develop advanced best management practices for CAFO waste and biosolid waste management and develop a research forum on determining nitrogen loading rates that are protective of groundwater and surface water.

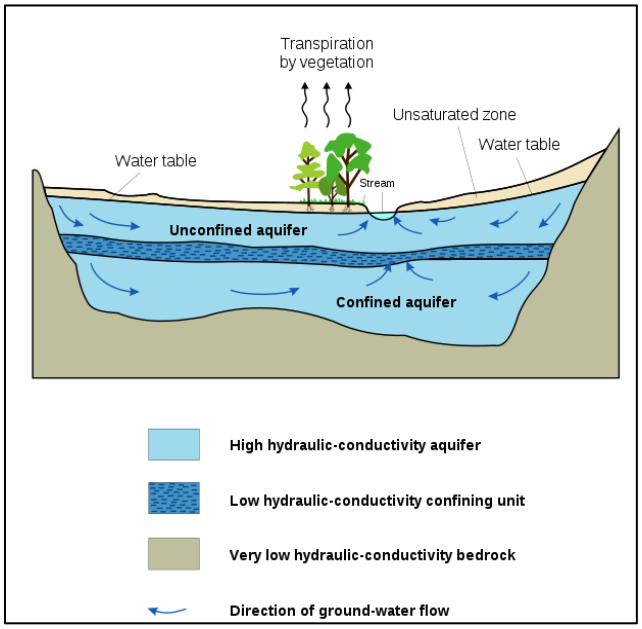
Alignment Opportunity: Work with wastewater facilities, communities, and land owners to recognize environmental benefits of biosolids programs. Identify potential reuse locations in the geographic area of the

wastewater treatment facilities. Biosolids program may provide assistance to the drinking water program, groundwater program, nonpoint source program, and ODA in order to minimize negative water quality impacts.

3.12 Underground Injection Control

An underground injection control (UIC) system is designed to discharge or distribute fluid below the ground surface. The DEQ UIC program goal is to protect aquifers from contamination due to underground injection activity. The UIC began in 1974 under the Safe Drinking Water Act. Oregon DEQ operates this program under the authority of the Underground Injection Control rules (OAR Chapter 340, Division 44). In accordance with these rules, UICs are not allowed to discharge directly into an aquifer. Groundwater is especially sensitive to contamination and in many cases is the sole source of public and private drinking water. All groundwater aquifers in Oregon are considered suitable as drinking water. Groundwater pollutants can also enter lakes, streams, wetlands and springs. UICs need to be carefully managed so as not to release waste contaminants directly into the ground and over time pollute groundwater.

The most common UIC systems in Oregon are stormwater drywells. Drywells are often used to manage runoff from roads, roofs, and other impervious surfaces. Best management practices are used to eliminate the pollution of stormwater or treat it prior to discharge. Industrial facilities may also seek approval to discharge process wastewater to sumps, drywells, trench drains, septic tanks and drainfields, which can all be classified as UICs. Approval depends on the type of waste and the level of pre-treatment prior to subsurface discharge. Other reasonable options, such as storage in a holding tank pending disposal at an approved receiving facility, are preferred.



A total of 123 UICs in the Umpqua Basin were recorded in the DEQ UIC database as of July 2013. Many are septic systems and graywater sumps at campgrounds and RV parks. More information can be found on the DEQ UIC website: http://www.deq.state.or.us/wq/uic/uic.asp.

Action 1: Coordination of the permit programs (NPDES, WPCF and UIC) to bring the basin UICs into compliance with state and federal regulations. There are a number of educational opportunities that could be pursued with municipalities about UICs, stormwater and infrastructure needs (especially in high risk areas), financial assistance programs (State Revolving Funds), and program rules and enforcement.

Action 2: Surface water quality goals favor the reduction of rapid rises and falls in flow caused by storm water discharges as well as reduction of pollutants such as sediment, bacteria and nutrients. DEQ UIC Program staff should develop a guidance document to assist cities in developing cost–effective UIC improvements so stormwater is managed without increasing surface water discharge while protecting groundwater.

Alignment Opportunity: UIC and NPS staff to coordinate with stormwater staff to develop a stormwater management guide and pursue outreach, education, and financing opportunities with assistance from the SRF program. NPS program can also assist with outreach in the Umpqua Basin.

3.13 401 Certification

Section 401 of the federal Clean Water Act requires that any federal license or permit to conduct an activity that may result in a discharge to waters of the United States must first receive a Water Quality Certification from the state in which the activity will occur. DEQ 401 program staff evaluates project proposals for potential impacts to water quality and beneficial uses. Certifications may be: 1) issued for the project as proposed, 2) issued with conditions intended to eliminate or minimize impacts, 3) denied, or 4) waived if DEQ takes no action within one year of receiving the request for a 401 certification. The majority of applications receive 401 certifications with conditions. Most 401 certification requests come to DEQ through either the Federal Energy Regulatory Commission (FERC) process for **hydroelectric projects**, or through US Army Corps of Engineers (USACE) **404 permits for removal and fill activities.**

3.13.1 Hydroelectric Projects

Oregon is a national leader in hydroelectric energy production. The state produces nearly 15 percent of all hydropower in the nation and ranks second only to Washington in annual hydroelectric production. In 2010, conventional hydroelectric projects in Oregon produced nearly 32 million mega watt hour of electricity representing 58 percent of all electricity generated by the state.

The OWRD indicates there are currently more than 150 hydroelectric projects in Oregon. Of these, 70 are licensed by the FERC, the federal agency responsible for oversight of larger, grid-connected facilities. FERC issues licenses to hydro facilities for terms ranging from 30 to 50 years. OWRD also reports more than 70 small-scale hydro projects in Oregon which do not require a FERC license.

Water Quality Impacts Caused By Hydroelectric Facilities

Hydroelectric facilities can negatively impact water quality and aquatic resources in several ways. For example, water diversions to power canals reduce instream flow which may reduce the assimilative capacity of the stream to maintain temperature, dissolved oxygen, and other parameters at levels needed to support aquatic life. Impoundments on streams can lead to thermal stratification, dissolved oxygen deficits, harmful algal blooms, pH excursions, and habitat alteration including barriers to native fish migration and loss of spawning gravel recruitment. Releases from powerhouses may also cause air entrainment at levels harmful to fish and may represent false attraction leading to migratory delay and injury.

The way hydro facilities operate can also directly affect water quality. Projects operated as “peaking facilities” generate electricity in response to changing load demand. Peaking operation causes changes in river stage, or “ramping”, which may increase turbidity, soil erosion, and fish stranding, and reduce habitat complexity near river margins.



Image: Soda Springs Dam and fish viewing window

PacifiCorp Energy: North Umpqua Hydroelectric Project

OWRD reports seven hydroelectric projects in the Umpqua Basin (Table 32). The largest of these is the North Umpqua Hydroelectric Project (FERC No.1927) owned and operated by PacifiCorp Energy. The 194 megawatt facility is located on the North Umpqua River and two of its tributaries, the Clearwater River and Fish Creek. The project was completed in 1956 and includes eight powerhouses, three reservoirs, and four forebays.

Table 32: Hydroelectric Projects in the Umpqua Basin

Project Name	Owner	OWRD File	FERC Project	Expiration	Primary Stream	Receiving Stream	Rated Power (kW)
Toketee, Soda Springs	PacifiCorp	HE 23	1927	11/1/2038	North Umpqua	North Umpqua	91,559
Lemolo	PacifiCorp	HE 21	1927	11/1/2038	North Umpqua	North Umpqua	76,335
Fish Creek	PacifiCorp	HE 20	1927	11/1/2038	Fish Creek	North Umpqua	13,217
Clearwater	PacifiCorp	HE 19	1927	11/1/2038	Clearwater River	North Umpqua	51,546
	Ronald H. Lizotte	HE 257	-	-	Francis Creek	South Umpqua	4.1
Galesville	Douglas	PC 875	7161	5/31/2034	Cow Creek	South	2,412

	County Public Works					Umpqua	
	Richard Jones	HE 556	-	-	Unnamed trib to Cow Creek	South Umpqua	2.7

Like many large hydro facilities, the North Umpqua Hydroelectric Project was constructed and licensed before enactment of landmark environmental legislation such as the Clean Water Act and measures to improve fish passage. Before the project was relicensed in November 2003, PacifiCorp along with state and federal agencies including DEQ entered into a Settlement Agreement which prescribes measures deemed necessary for the protection of ecological resources affected by the project. Parties to the settlement developed protection, mitigation, and enhancement (PME) measures to satisfy the management goals of the Settlement Agreement. Management goals and representative PMEs are summarized in Table 33.

Table 33: PacifiCorp Settlement Agreement: Management Goals and Associated Protection, Mitigation, and Enhancement Measures

Environmental Process	Management Goal	Protection, Mitigation, and Enhancement Measures
Fluvial Geomorphic Process	Maintain and/or restore the geomorphic processes under reference conditions	Gravel augmentation: placement of spawning gravel below Soda Springs dam Large Woody Debris (LWD) Passage: Develop plans for LWD passage at Soda Springs and Slide Creek dams
Aquatic and Riparian Habitat Connectivity	Maintain ecological processes and habitat in condition sufficient to support interconnected and well-distributed populations of native species in the North Umpqua River watershed.	Clearwater River Reconnection: Reestablish flows between the lower Clearwater River with the North Umpqua Amphibian Access: Provide access for amphibian movement above and below Stump Lake Dam on the Clearwater River Aquatic Reconnections: Restore connectivity of tributaries intercepted by power canals by providing flows across or underneath flumes and canals. Culvert Replacement: Remove or replace improperly sized culverts to improve aquatic connectivity.
Instream Flows	Maintain minimum flows	Minimum Instream Flows: Maintain minimum flows

Environmental Process	Management Goal	Protection, Mitigation, and Enhancement Measures
and Ramping	necessary to sustain well-connected and functional riparian and aquatic habitats.	in Project bypass reaches to maintain support for aquatic environment Lemolo Powerhouse Discharge: Redirect powerhouse discharge from the North Umpqua River to Toketee Lake to mitigate for ramping effects Ramping: Maintain ramping within limits prescribed in the Settlement Agreement
Water Quality	Manage the hydroelectric facilities in a manner that maintains and/or improves water quality in the watershed, meet water quality standards and antidegradation requirements, and protect beneficial uses.	CWA Section 401 Water Quality Certification: Implement the conditions contained in the CWA Section 401 water quality certification dated June 2002 TMDLs: Load allocation assigned to the Project is equivalent to maintaining the minimum instream flows as described in the CWA Section 401 water quality certification
Anadromous Fish Passage and Off-Site Mitigation	Provide volitional upstream and downstream passage for native anadromous fish populations.	Soda Springs Dam: Provide upstream and downstream passage at Soda Springs Dam Slide Creek: In lieu of providing passage at Slide Creek Dam, PacifiCorp shall provide mitigation measures to benefit migratory fish populations per Oregon Department of Fish and Wildlife. Fish Creek: Install fish screen at Fish Creek diversion to reduce entrainment in power canal.

Action 1: Continue DEQ work to ensure that operation of hydroelectric facilities meets Oregon water quality standards. Section 401 of the federal Clean Water Act (33 USC §1251, et. seq.) authorizes states to determine if a project will comply with water quality standards before a federal agency can issue a permit or license to a project which will cause a discharge to waters of the state. DEQ uses this authority to place conditions on hydro operations in a manner deemed necessary to ensure water quality standards are met. DEQ also works with Water Resources Department to develop conditions for the water right to maintain water quality protections for smaller projects which do not require a Federal Energy Regulatory Commission license.

Action 2: OWRD may issue water rights for minor hydroelectric projects, those with relatively small turbines (generating less than 100 theoretical horsepower). To approve an application, OWRD must first find that the project will meet applicable resource protection standards given in OAR 690 Division 051, including water quality. OWRD consults with state resource agencies, including DEQ, to make this determination. DEQ should continue to evaluate proposed minor hydroelectric projects to condition the water right as necessary to ensure compliance with applicable water quality standards.

Action 3: Currently, DEQ 401 Hydro staff prioritize reviews or site visits to small hydropower projects based on project location, potential to affect water quality, and existing workload. The 401 Hydro program does not maintain a central file of small hydro project reviews; information resides in individual staff electronic and paper files. The 401 Hydro program should consider developing a screening tool for small hydro project review, instituting centralized record keeping, and notify or consult with appropriate Basin Coordinators and Integrated Water Resources Specialist when applications are received. The screening tool would help staff prioritize review and further investigation of small hydropower projects and would consider characteristics of the project such as impoundment, potential flow reduction, cumulative effects, and alteration of hydrologic function or sediment budget. Copies of DEQ's review or additional investigation should be stored in a regional or central 401 hydro project file.

Action 4: DEQ 401 staff should monitor and support actions, such as collection of water quality monitoring data under the water quality protection, mitigation, and enhancement measures of the Settlement Agreement, to assure continued operation of the project will not violate Oregon water quality standards. Regional 401 Coordinators should work with DEQ lab staff to ensure 401 water quality data is included in the states database. PacifiCorp's 401 hydropower project involves an ongoing water quality monitoring program in the North Umpqua. This monitoring data should be collected and included in DEQ's database in order to fill a DEQ data gap in the North Umpqua.

Alignment Opportunity: DEQ headquarters staff should support regional 401 staff through continued training and technical support. Regional 401 staff should notify or consult with appropriate Basin Coordinators and Integrated Water Resources Specialists when applications are received and to share water quality data. Regional 401 Coordinators and DEQ lab staff need to coordinate to ensure 401 water quality data is included in the states database.

3.13.2 Removal/Fill Certification

A proposal to conduct work in waterways or wetlands requires a Joint Permit Application submitted to both the Army Corps and the Department of State Lands. These agencies process the applications separately. The Army Corps determines if an application may result in a discharge and requires a permit, and, if so, what kind of permit the project requires, e.g., Nationwide Permit, Regional General Permit, or Individual Permit. Nationwide permits carry pre-negotiated 401 conditions that protect water quality. DEQ, Army Corps and other parties review and renegotiate nationwide permit conditions every five years. Individual permits require a project-specific 401 water quality certification. Since 2000, approximately 134 removal and fill projects have been considered for 401 water quality certification in the Umpqua Basin (Table 34).

Table 34: Number of Individual Removal Fill Permits by Subbasin

Subbasin	Bank stabilization, Erosion and flood control	Commercial, Industrial, Residential development, Gravel extraction, Public facilities	Fish Habitat Enhancement	Outfall, sewer line, dam, pond, replacement or repairs	Road and Bridge Construction, Culvert installation/ replacement	Number of Projects
Umpqua River	3	15	--	24	--	42
North Umpqua	2	7	7	7	2	25
South Umpqua	5	40	3	13	6	67
Total by project description	10	62	10	44	8	134

Table 34 does not capture Nationwide permits. In the previous decade, developers, local governments, utilities and other entities have completed dozens of Nationwide-permitted removal/fill projects in the Umpqua Basin. Typically, DEQ does not keep track of these projects, because they do not require individual water quality certifications. The majority of the Army Corps Nationwide-permitted projects fall under "discharge of fill material" into a waterbody or wetland and involve the following activities:

- Industrial, residential, commercial development
- Road and bridge construction and maintenance
- Ecological Restoration, channel restoration and fish passage
- Dredging

Nineteen commercial gravel extraction applications were reviewed, 13 in the South Umpqua and six in the main stem Umpqua. Of these, six of the applications were denied or withdrawn. There were also seven annual maintenance dredging projects in the Umpqua River (mainly for navigation within the tidal reaches). In response to concerns related to on-going gravel removal and maintenance dredging projects, the U S Geological Service (USGS)[45] has completed studies to demine the potential sediment delivery regimes for the Umpqua Basin and the extent of alteration of the physical and biological systems in response to alteration of these regimes.

Action 1: DEQ will continue to coordinate with Department of State Lands and USACE on removal/fill projects needing 401 certification and applicable stormwater NPDES permits.

Action 2: 401 Program will coordinate with Army Corps to obtain Nationwide permit information, and initiate tracking at the subbasin level by activity for "discharge of fill material" for miles of channel restoration and fish passage. Utilize this information for subbasin effectiveness measures.

[45] More information on USGS Gravel Transport Study can be found at: http://pubs.usgs.gov/sir/2011/5041/pdf/sir20115041.pdf

Alignment Opportunity: 401 staff will coordinate with lab staff to ensure 401 water quality data is included in DEQs database. Permit and nonpoint source programs to utilize 401 water quality data to identify areas where water quality may be impacted and may be used as part of an effectiveness monitoring program.

3.14 Onsite Septic Systems

Over 30 percent of Oregonians currently treat wastewater from their homes and businesses through the use of onsite septic systems; the majority of these systems serve residential properties. Douglas County has a contract with the DEQ to perform services related to septic systems in the County. One hundred eleven onsite permits were issued in Douglas County in 2012, which includes 43 repairs and 13 renewals. DEQ and its contract agents also ensure that septic tank pumpers have the necessary equipment to safely pump and transport septage. In addition, DEQ certifies and licenses installers, pumpers, and maintenance providers, and reviews and approves products such as septic tanks, alternative treatment technologies, and alternative drainfield products.

The onsite program is funded by fees charged by the program for services provided, and these fees must cover the costs of issuing permits and evaluating sites for potential septic approvals. Douglas County has a code enforcement officer who investigates and enforces onsite sewage violations and who is funded out of the County general fund. This funding difference allows Douglas County to be more effective than DEQ in investigating and resolving health hazard issues such as surfacing sewage from onsite septic systems. Complaint response is evaluated on an individual complaint basis and, in 2012 Douglas County responded to 72 complaints and 52 of these complaints were valid.

Most lending institutions require that a property's septic tank be pumped prior to sales. Conclusions drawn from examination of the septic tank alone are not necessarily representative of the system as a whole and cannot provide information about the level of treatment provided by the system. DEQ does not currently require existing system inspections to evaluate ongoing onsite system function at the time of sale of real property. Without careful maintenance, septic systems can fail resulting in polluted streams and groundwater. Treatment failure can also occur when the system components reach the end of their design life and begin to degrade. For instance, steel septic tanks installed in the 1970s have most likely rusted through and are no longer water tight. In addition, soils in the drainfield can become clogged over time and become less effective at treating wastewater. This degradation is why repair areas for drainfields are identified during the site evaluation process for new systems. Many landowners do not realize the value of these repair areas and often conduct incompatible activities in the area such as building a driveway or garage or confining livestock.

Coastal Zone Onsite Requirements for Onsite

Oregon's federally designated Coastal Zone encompasses almost all of Oregon watersheds that drain to the Pacific Ocean. The entire Umpqua Basin is within the Coastal Zone. The Oregon Legislature established the Oregon Coastal Conservation and Development Commission whose report and recommendations form the backbone of the four Coastal Statewide Planning Goals. Within this zone, the Oregon Coastal Management Program applies to the land and water areas, except for those lands owned by the federal government or those held in trust under Tribal jurisdiction.

In order to approve Oregon's Coastal Nonpoint Pollution Control Program (CNPCP), NOAA and EPA have required DEQ to develop rules to implement actions addressing existing onsite system maintenance. Onsite

systems that appear to be functioning properly may still be adversely impacting water quality. DEQ is currently implementing an education and outreach program through the real estate industry in support of system inspection at the time of sale. DEQ's ability to manage existing onsite system maintenance should improve as DEQ implements the new Coastal Zone requirements but only to the extent that system-based inspections are implemented, and maintenance and repairs or replacement are completed.

Action 1: Education and Outreach. The toxics section of this document discusses municipal effluent pollutant test results for emerging contaminants, pharmaceuticals and personal care products. Additional information should be collected to characterize the potential pollutant loads from septic systems discharge to groundwater. Education and outreach about onsite systems should include discussion about these contaminants. Proper disposal options should be investigated and publicized (waste pick up events, drug turn in locations, etc). Continue to act as an information resource promoting individual landowner education and outreach. Work with citizens who own and manage an onsite septic system to assure they are knowledgeable about their treatment system, repair needs, and the importance of repair area protection.

Action 2: Funding Assistance. The primary obstacles for voluntary septic system inspections are system owners' concerns about the costs of system repairs, as well an inaccurate understanding about the need for system maintenance and repairs. The need for funding assistance and incentive is clear and efforts to access the State Revolving Fund for support have been unsuccessful. Allowing not-for-profit entities to be eligible applicants could help facilitate leveraging of multiple funding sources to address onsite system repairs and upgrades.

DEQ introduced Senate Bill 83 in 2011 which would have resulted in returning fines for onsite septic system violations to the program to fund training, education and outreach, repair or replacement of failing septic systems, and for working with communities on area-wide septic system problems. This bill was sent to committee and did not move forward. DEQ will continue to seek opportunities for funding assistance to help landowners to maintain, manage, and upgrade onsite systems as needed.

Action 3: Special Projects. DEQ could also consider the implementation of a special project if the level of public health concern warrants that action. A special project could provide for resources and geographic focus to evaluate the conditions of septic systems in a certain area. DEQ will support viable area wide solutions such as connection to sewer or development of decentralized wastewater treatment options.

Action 4: Inspection and Maintenance Program. Policy package #120 was approved by the Legislator and allowed DEQ to hire a temporary employee to work with the Oregon real estate professionals. Outreach was directed to encourage participation in a voluntary septic system inspection program at time of sale for residential properties. Changes to the Onsite fee schedule were adopted by the EQC and became effective January 2, 2014. Fees were increased in order to continue the current level of oversight and technical assistance to contract counties, such as Douglas County.

Action 5: Permit Database. DEQ should consider developing an onsite system database and mapping tool that is publicly available. The tool would allow DEQ to evaluate high priority locations for special projects and respond to water quality concerns that may be associated with aged, non-functioning systems.

Alignment Opportunity: DEQ lab to collect and provide bacteria and nutrient data to help focus and support education and outreach efforts. NPS/TMDL and Onsite staff will align surface water quality data with onsite program priorities in order to identify areas where septic systems adversely impact water quality. NPS/TMDL staff will continue to follow progress in the development of tracking techniques, which have the potential to better define the sources of bacterial loads.

3.15 Water Reuse

DEQ encourages water reuse as a strategy for protecting Oregon's water resources. Water reuse means using water again that has been previously used for another purpose. Reusing water reduces the demand to use potable water for uses such as irrigation, which don't require highly treated water. Water reuse can effectively improve water quality by reducing the discharge of pollutants to water bodies and reducing withdrawals from surface water sources. Water reuse for non-potable purposes allows individuals, municipalities, and industrial facilities to use lower quality water sources for beneficial purposes. DEQ encourages three general categories of water reuse: graywater, recycled water, and industrial wastewater.

Graywater refers to water from showers, baths, bathroom sinks, kitchen sinks and laundries. Graywater can be reused for limited activities, such as subsurface irrigation with minimal treatment. In August 2011, the Oregon Environmental Quality Commission adopted administrative rules (OAR 340-053) for graywater reuse and disposal systems. Under the new rules, most individual homeowners and small businesses can reuse graywater by obtaining a WPCF general permit from DEQ.

Recycled water refers to treated effluent from a municipal wastewater treatment facility. Oregon's administrative rules (OAR 340-055) identify four classes, or levels of treatment, of recycled water that can be reused for specific beneficial purposes (Class A, B, C, and D). Class A water is the most highly treated and disinfected; Class D recycled water is the least treated and disinfected. DEQ regulates recycled water use through a wastewater treatment facility's WPCF or NPDES permit. DEQ works with the Oregon Health Authority and Oregon Water Resources Department on the permitting of this practice. DEQ staff also work with municipal facilities to ensure proper operation and management of wastewater treatment facilities that pursue water reuse. Facility permits require management plans for water reuse and must submit an annual report on recycled water use to DEQ. Over 120 (or greater than one-third) of Oregon's municipal wastewater treatment facilities are permitted to operate a recycled water use program. Most recycled water is used for irrigation of crops and golf courses. In response to growing interest in sustainable water management, DEQ has issued three permits for three urban facilities to treat and reuse water onsite, including uses such as toilet and urinal flushing, evaporative cooling, and landscape irrigation.

Permitted sources that recycle treated effluent in Umpqua Basin are listed below:

Drain: Center Pivot system, Class C
Oakland: Wheel Line system, Class C
RUSA: Drip surface land system, nutrient removal
Sutherlin: Fixed in ground sprinkler system golf course, Class C

Industrial wastewater refers to treated effluent from an industrial process or manufacturing. An example of industrial wastewater is water derived from the processing of fruit, vegetable, or other food products. DEQ regulates industrial water reuse through both general permits and facility-specific individual permits. Facility permits require management plans for water reuse. In addition to a number of individual permits issued for industrial water reuse, DEQ currently regulates more than 175 food processing facilities through general permits, which allow the reuse of industrial process waters for irrigation purposes.

Action 1: DEQ began accepting graywater permit applications in the spring of 2012. Water reuse staff should notify nonpoint source/TMDL and Integrated Water Resources staff of new graywater permits issued in the Umpqua Basin.

Action 2: DEQ Wastewater Permitting staff will coordinate with wastewater treatment facilities and other interested stakeholders and continue exploring opportunities for improving water quality through recycled water and industrial water reuse. DEQ will coordinate with permittees on improved annual reporting of water reuse activities.

Alignment Opportunity: Water Reuse staff can work with the groundwater and nonpoint source programs to provide outreach to local communities, building authorities, graywater system designers and graywater users to ensure systems are operated and maintained to protect water quality.

3.16 Confined Animal Feeding Operation (CAFO)

Confined Animal Feeding Operations are registered to the Oregon CAFO general (NPDES) permit and are managed by Oregon Department of Agriculture. Permit conditions ensure no discharge of fecal bacteria or nutrients under normal conditions. There are currently five active CAFO permits in the Umpqua Basin. Four are in compliance with all of the permit requirements, and one is implementing an animal waste management plan that will bring it into compliance with all permit conditions. Each permitted CAFO receives a routine inspection from the area Livestock Water Quality Inspector at least once a year. During this inspection, the operator and inspector discuss the operation and review required plans and records. The inspector views the entire operation to assure compliance with permit terms and water quality rules and laws. Inspection reports detail permit compliance in the following areas: permitted number of animals, animal confinement requirements, manure and silage containment requirements, manure application requirements, and record keeping. Problems in any of these areas including incomplete record keeping can result in the issuance of a water quality advisory or a notice of noncompliance (NON). When a discharge occurs or where there is a potential for a discharge to occur, ODA may take samples of the effluent to determine bacterial concentrations. Surface water quality samples are taken when visual or anecdotal evidence of discharge is present. Two of the NONs issued in the Umpqua Basin have recorded the release of bacteria exceeding the state surface water standard for *E. coli* establishing the potential for CAFOs to impact bacteria levels in the Umpqua River. In the event a violation is found, the inspector works with the operator to develop a solution to the problem and a schedule to complete the corrective actions. ODA can also issue civil penalties for violations listed in a notice of non-compliance. Only six NONs have been issued to permitted CAFOs in the Umpqua Basin since 2003.

Action 1: DEQ nonpoint source staff to work with ODA to develop advanced best management practices for CAFO waste management that is protective of both surface and groundwater.

Alignment Opportunity: DEQ to collaborate with ODA to provide monitoring data to inform the CAFO program. Investigate opportunities for collaboration between ODA and TMDL outreach activities.

3.17 Compliance and Enforcement

DEQ has a range of compliance and enforcement tools at its disposal including technical assistance, compliance inspections, warning letters, field citations, compliance orders, mutual agreement and orders (MAOs), and formal enforcement actions. DEQ regularly conducts inspections of projects, facilities, permitted entities and their monitoring data to determine compliance with DEQ permits and state laws. DEQ also investigates complaints received from the public and other agencies about possible violations.

When an inspector determines a violation exists or occurred, the inspector determines the appropriate level of enforcement by consulting DEQ's "Enforcement Guidance for Field Staff". The Guidance is organized by

program and subprogram and directs the inspector how to respond to any given violation depending on the circumstances surrounding the violation ,e.g., whether the violation has been repeated in the last 36 months, whether it was beyond the reasonable control of the violator, etc. The purpose of the Guidance is to ensure that DEQ enforcement is consistent and fair, regardless of the region or office where the violation originates.

As an alternative to paying a civil penalty to the state of Oregon's general fund, state law allows respondents to pay up to 80 percent of their civil penalty towards a Supplemental Environmental Project (SEP). An SEP is a project that primarily benefits public health or the environment in the geographic region where the violation took place. Examples of projects include on-the-ground streambank restoration projects, an education pamphlet that informs people of the risks of spreading invasive species, and trash removal. An SEP may be proposed at any time after a Formal Enforcement Action is issued. DEQ does maintain a small list of SEP ideas that includes a list of non-profit groups, watershed councils, and other potential SEP partners that is shared with respondents interested in doing an SEP.

Action 1: Change formal enforcement action case numbers to include a basin identifier so that enforcement efforts within a particular basin are easier to identify and search. Include a field for basin identification in the development of the agency wide Compliance and Enforcement System database.

Action 2: NPS/TMDL and point source staff to develop SEP ideas and SEP partners within a basin in order to facilitate and encourage respondents to perform SEPs. Focus SEP ideas and projects to address basin priorities, e.g., if temperature is a problem, than include tree planting SEPs in the SEP idea list.

3.18 Groundwater Program

Seventy percent of Oregon's people depend on groundwater for their daily water needs via private, public and industrial water wells. Groundwater can travel very slowly, and once contaminated, can be very difficult or nearly impossible to clean up. It is also very expensive to clean up. This contamination affects not only the immediate uses of groundwater, such as drinking water supplies, but may also have pronounced effects on surface water quality. DEQ has primary responsibility for implementing groundwater protection in Oregon. DEQ uses a combination of programs to help prevent groundwater contamination from point and non-point sources of pollution, to clean up pollution sources, and to monitor and to assess groundwater and drinking water quality. DEQ implements some programs though partnerships with the Oregon Health Authority, Oregon Water Resources Department, Oregon Department of Agriculture, Oregon State University and other state, local, and private organizations, businesses and individuals. However, DEQ does not currently have a groundwater quality monitoring program in the Umpqua Basin or groundwater staff assigned to work in the basin. Because of this, a large water quality data gap exists in the Umpqua Basin.

Action 1: DEQ lab to include groundwater monitoring of domestic and public water supply wells as part of the toxics monitoring program for the Umpqua to evaluate the presence and distribution of toxics, both naturally occurring and those that may be human influenced as the result of industrial, municipal, or agricultural processes.

Action 2: DEQ lab, nonpoint source/TMDL, integrated water resources, groundwater, and drinking water staff to design and conduct an outreach and education plan for the basin based on the monitoring results. Present groundwater protection and domestic drinking water information at various residential venues. Provide free

nitrate well water 'screening' that can be used to help determine appropriate locations for additional assessment and technical assistance.

Alignment Opportunity*:* Groundwater staff work with lab staff to develop a groundwater monitoring plan. Align with nonpoint source and drinking water program priorities when developing outreach strategies. Coordinate with point source staff to address septic issues, biosolid application, and graywater concerns.

3.19 Drinking Water Program

The 1996 amendments to the federal Safe Drinking Water Act included funding for public drinking water supply system improvements to meet existing and future human health standards, identify public drinking water supply source areas and inventory potential contamination sources. A primary goal of the amendments was to help reduce the risk of pollution to public water systems, including contamination that could potentially result in loss of the drinking water resource. There are 91 public water systems (serving over 97,000 people) in the Umpqua Basin using surface and groundwater. The DEQ drinking water program prioritizes technical assistance and prevention activities for Umpqua Basin public water systems based on bacteria levels, turbidity, disinfection byproducts, and toxins. Data is needed in the Umpqua Basin to help assess whether surface and groundwater sources are being negatively impacted by stormwater and wastewater discharges, biosolids applications, pesticide applications, agricultural and forest management practices. The Safe Drinking Water Act requires monitoring primarily of finished (post-treatment) water. There is a critical need to collect water quality data for untreated water upstream of drinking water intakes to fully understand impacts and prioritize technical assistance.

Action 1: Address data gaps for locations upstream of drinking water intakes to better characterize likely sources of *E. coli*, sediment, excess nutrients, toxics, and emerging contaminants. Share data with other water quality protection partners and programs in DEQ to tailor technical assistance and management strategies, and avoid duplication of efforts.

Action 2: Develop a plan for installing continuous turbidity monitoring equipment to collect turbidity and total suspended sediment (TSS) data for untreated drinking water at public water systems throughout the basin. These data will better characterize upstream impacts, e.g., from forest management practices, roads, or agricultural land uses, and help prioritize technical assistance and restoration project efforts. DEQ should continue coordination with partnering agencies to share turbidity and TSS data.

Action 3: Determine the location and extent of existing and planned biosolids application sites. Increase monitoring of pharmaceuticals, personal care products and other emerging contaminants in vicinity of high density septic systems and biosolids application sites. Collect data to assess transport of contaminants via groundwater inputs to surface water.

Action 4: Coordinate with DEQ Lab, pesticide stewardship program, toxics coordinator, and basin coordinator to share data on toxics and prioritize location and parameters for toxics monitoring events. In collaboration with staff in programs above, refine communication plan for presenting toxics data to the public.

Action 5: The program will also participate in efforts to develop an agency-wide interactive mapping/analysis tool that fully integrates all of DEQ's water quality related data and information.

Action 6: Continue coordinating with Oregon Health Authority, public water systems, and water quality partners to: (1) monitor and collect data to characterize risk of algal toxins to drinking water and (2) address human activities that contribute to toxic algae bloom formation.

Action 7: Coordinate with basin partners to monitor and collect data that correlates storm events to *E. coli* and turbidity in drinking water. Use these data to prioritize technical assistance and develop appropriate management strategies.

Alignment Opportunity*:* The drinking water protection program should continue collaborating and sharing information with other agency programs including spill response, household hazardous waste collection, environmental cleanup, toxics reduction, water quality permitting, and pollution prevention technical assistance in order to reduce contamination risks to public water supplies. Program staff will coordinate with water quality monitoring specialists to develop a plan to address data gaps mentioned above.

3.20 Water Quality Monitoring

Water quality monitoring and assessment provides the foundation for water quality management actions at DEQ and in coordination with other state and federal natural resource agencies, counties and municipalities. DEQ's water quality monitoring programs work in conjunction with other local and regional monitoring efforts to provide information on the status and trends of water quality in the Umpqua Basin.

Action 1: Improved water quality data management. All programs in water quality would benefit by having any new water quality data regularly and routinely uploaded into an accessible database. By improving data management and accessibility, the best available information can be used by DEQ programs and the public. This will allow the identification of data gaps and completion of monitoring in order to fill data needs prior to a given DEQ action, e.g., permit issuance. Improved data management will facilitate the use of water quality data to guide the establishment of conditions and/or permit limits that will protect beneficial uses.

Action 2: Monitoring plans developed to support a single water quality project should be designed to consider data and information needs for other WQ programs within the basin.

3.20.1 TMDL Monitoring

Monitoring is conducted to determine if water quality supports beneficial uses and if water quality standards are met. Streams that do not meet specific water quality standards are placed on the 303d list and will have TMDLs developed for them. In order to develop TMDLs, studies must be conducted to determine the sources and quantities of pollutants affecting the waterbody and how those vary over time.

Action 1: Collect data to address insufficient data categories in 303(d) list.

Alignment Opportunity: Lab and TMDL staff should work to address insufficient data categories in 303(d) list and collect additional data needed to perform source assessments and determine appropriate load allocations

3.20.2 Ambient Water Quality Monitoring

The ambient water quality monitoring network consists of 131 statewide locations. The network includes 10 sites in the Umpqua Basin that are sampled six times annually for conventional water quality parameters including water temperature, dissolved oxygen, pH, conductivity, turbidity, alkalinity, bacteria, total organic

carbon and nutrients, which include total phosphorus, dissolved orthophosphate, nitrate/nitrite, and ammonia. Information collected at these sites is used to assess general water quality conditions using the Oregon Water Quality Index (OWQI) and to assess the trends at these locations.

Action 1: DEQ will continue to monitor the ambient water quality sites in the basin and update trend reports on an annual basis as resources allow. The DEQ Basin Coordinator and lab staff should work towards integrating the ambient monitoring data into an Umpqua Basin TMDL effectiveness monitoring program with the Partnership for Umpqua Rivers monitoring program.

Action 2: Investigate forming an Umpqua Basin Water Monitoring Council that participates in a broader Oregon Water Monitoring Council. Goals for this group would be to convene various agencies' staff to discuss current status of monitoring efforts, discuss indicators, develop Quality Assurance Project Plans and Sampling and Analysis Plans, fill data gaps, and share information.

Alignment Opportunity: Lab to continue trend analysis and sharing of results with nonpoint source and point source programs. Coordinate with the Umpqua Basin Coordinator, local organizations and agencies to develop a comprehensive volunteer monitoring program that can enhance the ambient monitoring program.

3.20.3 National Aquatic Resource Surveys (NARS)

EPA's National Aquatic Resource Survey (NARS) programs apply a probability or random based monitoring design and select core indicators appropriate for designated beneficial uses. The program is designed to provide EPA with important information about water quality at the national scale and provide important data to determine how to protect, maintain, and restore water quality. EPA has designed a five year rotating schedule around the key aquatic resources.

- National Coastal Condition Assessment
- National Lakes Assessment
- National Rivers and Streams Assessment
- National Wetland Condition Assessment

Probability-based monitoring designs randomly select sites where monitoring will occur and then extrapolates that information to represent the entire resource (Overton et al., 1990). This type of environmental sampling is not designed to be used for site specific assessments, but rather as a tool to define the quality of a larger group of water bodies. DEQ laboratory staff plan to continue monitoring in support of EPA NARS survey programs as resources allow. The National Coastal Conditions Assessment for the Umpqua Basin is presented in Section 2.1.2.

Action 1: Data from these programs should be reviewed for the Umpqua Basin and, where possible, use the information to derive site condition information to guide future monitoring activities in specific areas.

Alignment Opportunity: Lab staff should work with Basin Coordinators to assemble NARS data by basin and discuss how the data may be used to guide future work at DEQ.

3.20.4 Oregon Beach Monitoring Program

The Oregon Department of Environmental Quality partners with the Oregon Health Authority (OHA) to monitor the waters along Oregon's coastline for the presence of fecal bacteria, and reports elevated levels to the public. The monitoring is funded by grants from the U.S. Environmental Protection Agency.

Marine waters are tested for enterococcus bacteria, which indicate the presence of other harmful microbes. Enterococcus is present in human and animal waste and can enter marine waters from a variety of sources such as streams and creeks, storm water runoff, animal and seabird waste, failing septic systems, sewage treatment plant spills, or boating waste.

The beach sampling season runs from Memorial Day in May through Labor Day in September. There is a beach monitoring site located at Umpqua Beach at Winchester Bay. The program provides public notification and issues a water contact advisory when bacteria levels exceed Oregon's recreational water quality criteria of 158 colony forming units (cfu) per 100 milliliters (mL). No exceedances were measured at Umpqua Beach during the 2010 and 2011 beach recreational season.

Action 1: Continue fecal bacteria monitoring at three locations at Umpqua Beach, Winchester Bay. Continue partnering with Oregon Health Authority to notify the public of any health concerns.

Alignment Opportunity: Beach Monitoring Staff should work with Basin Coordinators to identify new sites, if needed, and to identify potential bacteria sources once exceedances are identified.

3.20.5 Biomonitoring

The biomonitoring section of the lab conducts studies to determine the relationship between water quality, habitat conditions and biological condition for macroinvertebrates. In the Umpqua, macroinvertebrate samples were collected at 158 sites on smaller wadeable streams from 1998–2007. Predictive models are used to assess biological conditions and infer the level of impairment. DEQ biomonitoring sites in the Umpqua Basin are presented in Section 2.5.1.

Action 1: Investigate the use of biological assemblages as an element for use in effectiveness monitoring studies. A survey should be repeated once every five years to gain an understanding of trends (improving or declining conditions) in macroinvertebrates.

Action 2: DEQ should work with partners (BLM, Forest Service, PUR and other agencies) to obtain data for future assessments.

Alignment Opportunity: Align biomonitoring work with TMDL effectiveness monitoring. Use biological indexes as the method to indicate change in the watershed conditions and beneficial use support. Lab staff and basin coordinator need to evaluate watershed limiting factors resulting in poor biological conditions.

3.20.6 Harmful Algae Blooms

Waterbodies in the Umpqua Basin which have experienced documented harmful algae blooms are identified in Section 2.2.2. Most HABs monitoring in the Umpqua Basin have been event specific. However, conditions which can produce HABs (stagnant water, high water temperatures, high nutrient levels) are fairly well established. These factors suggest additional surveillance for HABs is needed for source identification. In addition, continued support of focused TMDL implementation monitoring of Diamond Lake is needed in order to understand declining water quality conditions.

Action: Lab and nonpoint source TMDL staff to improve communication with other groups in the Umpqua Basin regarding HABs monitoring efforts.

Action 1: Lab and nonpoint source TMDL staff should support partner efforts in monitoring and identifying HABs and the associated causative and correlative factors.

Alignment Opportunity: Align laboratory, nonpoint source and volunteer monitoring staff to identify high priority HABs project needs and develop a basin wide monitoring plan. DEQ has developed a HAB response. Generic monitoring plans are approved and increased availability of sampling equipment in regional offices, which can support limited sampling efforts when potential HABs are identified.

3.20.7 Toxics Monitoring Program (TMP)

In 2008, DEQ initiated the Toxics Monitoring Program. The goal of the program is to measure and assess the state's surface waters and aquatic resources for the presence of toxic pollutants, and, where possible, identify the sources of the pollutants. The program focuses on measuring chemicals produced intentionally or unintentionally as the result of industrial, municipal, or agricultural processes whose physical and chemical characteristics have been demonstrated to impair the normal functioning of biological systems at low exposure levels. More than 270 pollutants of interest are measured in water, sediments, and/or fish, these include:

- Current-use pesticides including products used by individual consumers as well as commercial applicators
- Consumer product constituents including some over-the-counter pain relievers, prescription antibiotics, and other consumer products such as caffeine - Emerging contaminants i.e., pharmaceuticals, personal care products, and plasticizers ("P3 List").
- Priority pollutant metals including arsenic, chromium, copper, lead and zinc
- Industrial chemicals (PCBs) and combustion byproducts
- Legacy pollutants including banned pesticides such as DDT
- Flame retardants known as PBDEs (polybrominated diphenyl ethers) found in many consumer and industrial items such as laptops, cars, and foam insulation

The concentration and number of pollutants in a basin's waters vary seasonally. Seasonal-use patterns such as spring pesticide applications are important. In addition, hydrologic conditions (wet season versus dry season) contribute to concentration flux. To capture and understand these variables, DEQ lab staff collects water samples during different phases of the hydrologic cycle. Collection of fish and sediment occurs once at selected sites within a basin.

Sites are chosen based on the surrounding land-use, beneficial use, and known historic contamination and other factors. While the primary focus of the program is on surface water and aquatic resources, the program will identify opportunities to work with internal and external stakeholders and partners to also assess groundwater for the presence of organic and inorganic pollutants.

In 2011, DEQ collected water samples from four sites within the Umpqua Basin and sediment samples at three locations. Sediment samples are currently in the process of being analyzed. In general, the number and concentrations of chemicals detected in the Umpqua Basin was low. This study was a small snapshot in time. It should be noted as well that the lower river portion (west of the crest of the Coast Range) was not included during these events because the lower river is being evaluated as part of the coastal work being completed in 2013. A more comprehensive evaluation of the basin is warranted to fully understand the occurrence of toxics pollutants. DEQ Toxics Monitoring sites in the Umpqua Basin are presented in Section 2.4.2.

Action 1: Complete toxics monitoring program analysis and share results with sources, local communities, and partners. Analysis should include determination of risk to public water supplies.

Action 2: Bolster the groundwater monitoring component of the toxics monitoring program in the Umpqua Basin. If funding and partners are available, augment previous work performed by the Drinking Water Protection Program (refer to section 2.4.2).

Alignment Opportunity: Alignment begins with sharing results among point source program, nonpoint source TMDL program, and groundwater and drinking water programs. The toxics monitoring staff and basin coordinator should continue to work with EPA, Oregon Department of Fish and Wildlife and Oregon Health Authority to interpret data and plan to fill data gaps and communicate with the public.

3.20.8 Senate Bill 737

The 2007 Oregon Legislature passed Senate Bill 737, which required DEQ to consult with all interested parties by June 2009 to develop a list of priority persistent bioaccumulative toxics (Priority Persistent Pollutant List or P3-List) that have a documented effect on human health, wildlife and aquatic life. The bill required the major municipal wastewater facilities (> 1 million gallons per day) in the state to evaluate the concentration and loading of these pollutants in their effluent. The legislation also required DEQ to develop screening levels or Plan Initiation Levels. If a facility exceeds an initiation level for any P3 pollutant, the facility must develop a Pollution Reduction Plan.

Ultimately, the SB 737 list included 118 chemicals thought to pose the greatest risk to human and environmental health. In 2010, Roseburg Urban Sanitary Authority conducted toxics monitoring of their wastewater treatment plant effluent as required by SB737. The results are described in Section 2.4.2.

Action 1: DEQ lab staff should continue to support RUSAs efforts to comply with SB 737 requirements and source reduction if needed. Complete evaluation of the data gathered during the surface water toxics monitoring project conducted on the Umpqua River. And compare results with the toxics monitoring program to identify watershed priorities for toxics reduction.

Alignment Opportunity: Lab staff, point source program, and nonpoint source TMDL program, groundwater and drinking water program should develop a communication plan for the results and share the results with sources, local communities, and partners.

3.20.9 Compliance Monitoring

Compliance monitoring is required for all individual permits in the basin and for some general permits. Parameters monitored and the frequency of monitoring varies with each individual permit. Key components for compliance monitoring include effluent and mixing zone, far field data to assess effectiveness and data to update permit limits.

Action 1: As permits are renewed, the Permit Section should review monitoring data submitted by permittees with TMDL nonpoint source staff to evaluate whether monitoring aligns with impairments (or significant data gaps) identified in the basin.

Action 2: All compliance monitoring data should be made available to all DEQ staff via an online database.

Alignment Opportunity: Permit staff, standards and assessment, and lab coordinate to evaluate permit monitoring requirements to ensure required monitoring aligns with the basins water quality impairments. Where applicable, TMDL program may coordinate with the permit section and use compliance monitoring data to assess TMDL effectiveness.

3.20.10 Volunteer Monitoring

The Oregon Plan for Salmon and Watersheds, created in the 1990s, engages a broad reach of government agencies, watershed councils, community groups and landowners working together to protect and improve the water quality of Oregon's rivers and streams. A key part of this work is accomplished through DEQ's Volunteer Water Quality Monitoring Program[46]. Since its inception in 1997, the program has assisted more than 50 partner organizations around Oregon to gather environmental data from rivers and streams. The DEQ Laboratory manages the volunteer program and trains and equips community groups to gather data to answer local questions about stream conditions.

The information collected by watershed councils, soil and water conservation districts and others, allows watershed managers to have a better understanding of watershed conditions at the subbasin scale. This information is a valuable resource for land managers and local, county, and state restoration agencies, which make informed decisions in project planning, prioritization and funding based on these data. The Partnership for the Umpqua Rivers has participated in the volunteer monitoring program since 1998 and has been very active in the basin. Recently, the program expanded to include Blue-Green Algae monitoring to track and identify high risk areas for the presence of harmful toxins produced by algae.[47] Map 29 below illustrate the location of sites that have been monitored for water quality in the Umpqua Basin. Map 30 is the monitoring site location with the temperature-only sites removed. Additional grab sample monitoring locations in the North Umpqua and watersheds in the Umpqua are needed to evaluate current water quality conditions throughout the basin.

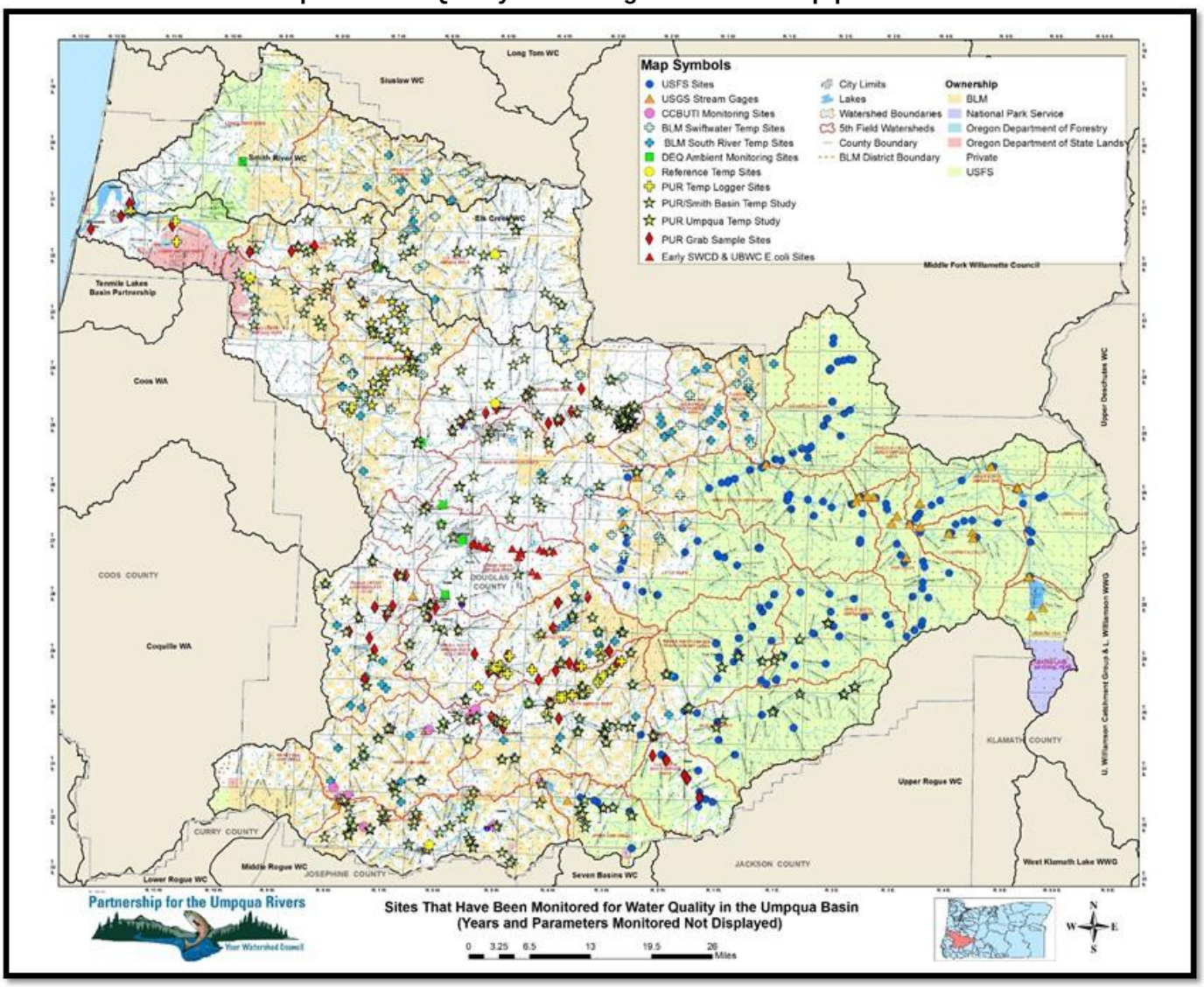
Action 1: Ensure that volunteer monitoring data is submitted, evaluated and entered into an accessible database.

Action 2: DEQ to continue to support partners' volunteer monitoring program to help improve our understanding of watershed processes and inform land managers and local, state, and federal agencies of changing water quality conditions to support land management decisions and restoration actions.

Alignment Opportunity: Continued sharing of volunteer monitoring results with nonpoint source and point source programs. Align with laboratory, drinking water, groundwater, and TMDL staff for project need and effectiveness monitoring.

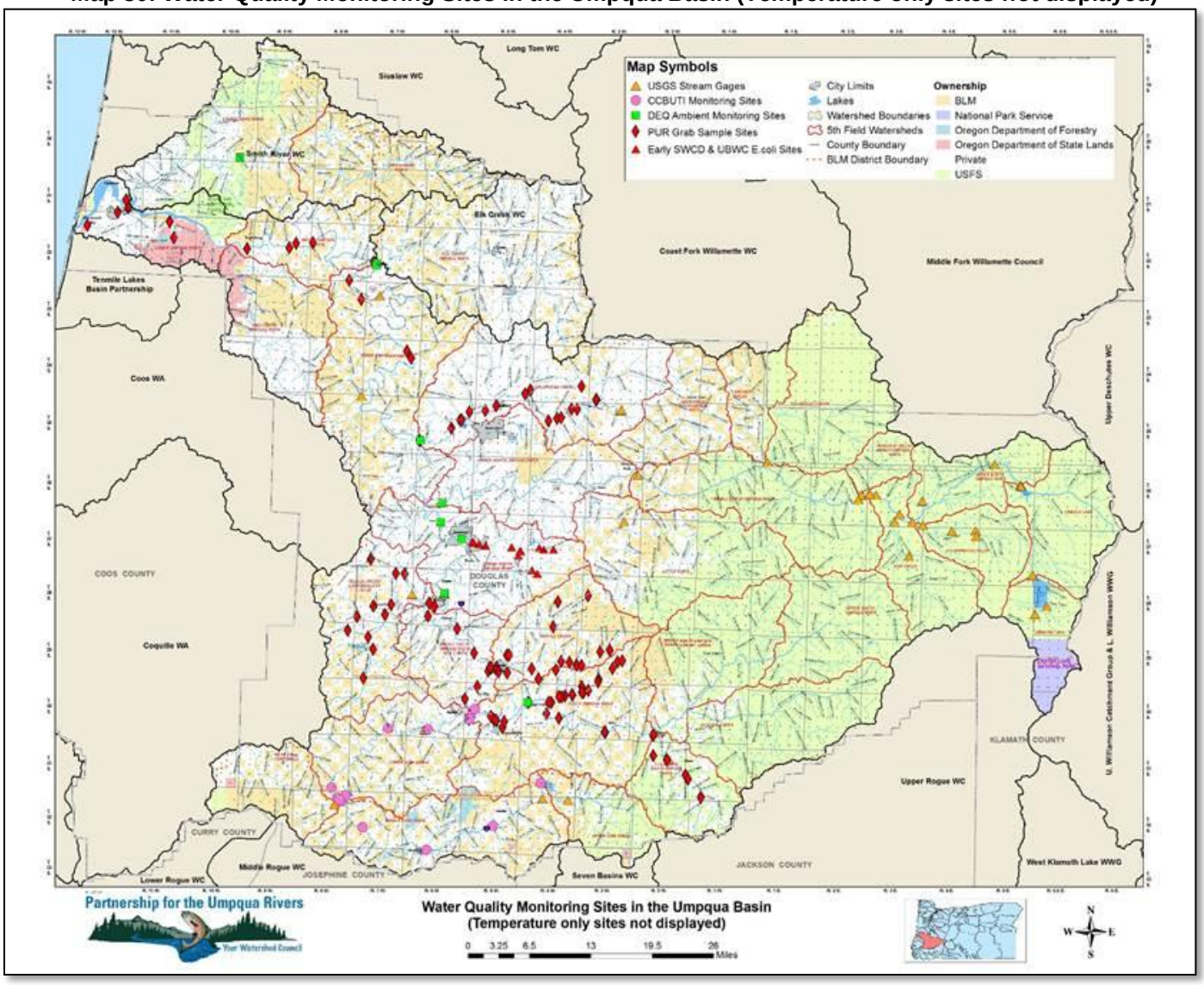
[46] More information on DEQs volunteer monitoring program can be found at: www.deq.state.or.us/lab/wqm/volmonitoring.htm
[47] More information on PURs volunteer water quality monitoring program can be found at: www.umpquarivers.org/about-monitoring/

Map 29: Water Quality Monitoring Sites in the Umpqua Basin



Map courtesy of the Partnership for the Umpqua Rivers

Map 30: Water Quality Monitoring Sites in the Umpqua Basin (Temperature only sites not displayed)



Map courtesy of the Partnership for the Umpqua Rivers

3.21 Financial and Technical Assistance

3.21.1 Clean Water State Revolving Fund Loan program

The Clean Water State Revolving Fund loan program provides low-cost loans for the planning, design and construction of various projects that prevent or mitigate water pollution. DEQ administers the program which is capitalized through federal appropriations. Eligible agencies include Indian tribal governments, cities, counties, sanitary districts, SWCDs, irrigation districts, various special districts and certain intergovernmental entities.

Under a recently revised rule, SRF can fund stormwater infrastructure and planning projects as "stand-alone" projects. Nonpoint source controls can be funded directly via a loan or indirectly via a *Sponsorship Option* to a wastewater treatment plant project. Example eligible nonpoint projects include:

- Stream restoration
- Watershed Council project for riparian restoration/protection
- Riparian buffer protections
- Water conservation projects that reduce thermal loading
- Conservation easements around drinking water sources
- Stormwater facility improvements that incorporate green infrastructure
- Stormwater master planning that includes a site performance standard of mimicking predevelopment hydrology utilizing nonstructural stormwater controls as a first step, and then green infrastructure as a second step
- Local flood projects that incorporate water control facilities (green infrastructure)

There is a Sponsorship Option in the State Revolving Fund Program that will help a municipality fund two projects for the price of one. Using the SRF Program's Sponsorship Option to fund nonpoint source work is possible when a community finances a wastewater treatment project then incorporates a nonpoint source control project (administered directly by the municipality or another entity) within a single SRF loan. When a municipality sponsors a nonpoint source project and incorporates this into their application, it reduces the project's combined (wastewater facility project and nonpoint source project) interest rate such that the payment for the combined project is equal to the payment for the wastewater facility project, or 1 percent, whichever is higher.

When grants are unavailable, an eligible entity should consider seeking an SRF loan given the incentives noted above for the sponsorship option, as well as the subsidies noted below for small communities, and for below market interest rates. Additionally, there is no match requirement for an SRF loan. There are also other incentives to seek a loan particularly for small communities (population < 10,000) below the Oregon Median Household Income such as:

- Subsidization for small, economically disadvantaged communities such as:
    - Principal Forgiveness – small communities at or below OR MHI given priority.
    - Below market interest rates are even lower for small communities making SRF loans an attractive alternative to grants since SRF loans do not require a match. For example, SRF loans for small communities for April-June 2013 are:
        - 5 year planning loan - .93%
        - 10 year design/construction loan 1.12%
        - 15 year design/construction loan 1.31%
        - 20 year design/construction loan 1.49%

- Adjusting the term of your loan (up to 20 years) makes paying for a project more affordable.
- Communities can reduce overall municipal operating cost by funding projects using an SRF loan to generate electricity with solar power and conserve water as well as open another "pot" of money set aside for these types of projects referred to as the Green Project Reserve.

DEQ's review criteria for SRF loan applications are designed to help communities achieve load allocations. DEQ also scores applications higher if they integrate eligible sustainability measures such as energy and water conservation.

State Revolving Funds can also help address private septic system problems in unincorporated areas. The local community loan program can help with this problem. A municipality such as a county could be a recipient of a SRF local community loan and, in turn, provide loans to private property owners to replace their failed septic system. DEQ is looking into strategies to defray the costs of administering a community loan and to reduce the community loan recipient's liability from defaults on local community loans.

Since 1995, DEQ has provided over $34 million in loans to cities within the Umpqua Basin (Table 35). The majority of the loans include upgrades and improvements to wastewater treatment plant construction projects, which are summarized below, and planning loans. SRF loans provided to upgrade wastewater treatment plants and collection systems have resulted in water quality improvements in the Umpqua Basin. However, there is still a large need for financial assistance in the Umpqua Basin to fully achieve water quality standards.

Table 35: Clean Water State Revolving Funds Loans Issued for Construction Projects in the Umpqua Basin since 1995

CWSRF loan Applicants	Date	Loan amount	Project
City of Winston	5/25/2011	$299,544	Parkway Pump Station Upgrades
City of Winston	9/29/1995	$6,816,235	Wastewater Treatment Facility Upgrades
Roseburg Urban Sanitary Authority	9/10/1997	$787,280	Collection System Extension: Diamond Lake Blvd. Extension
City of Canyonville	8/21/1997	$649,108	Wastewater Interim Improvements
City of Myrtle Creek	6/29/2001	$8,775,686	Treatment Plant Upgrade
City of Reedsport	12/17/2004	$12,000,000	Wastewater System Improvements
Winchester Bay Sanitary District	11/23/2005	$2,324,005	Interim for WW System Improvements
City of Riddle	1/6/2006	$788,500	Interim for Collection System Improvements
City of Riddle	2/24/2010	$2,000,000	Wastewater Treatment Improvements

Action*:* Encourage cities to identify a qualifying nonpoint source activity in conjunction with a municipal wastewater project; a combined SRF loan may be available at a substantially discounted interest rate through the Sponsorship Option. The SRF Loan Program with its Circuit Riders is a viable strategy for funding the implementation of management strategies in a DMA's TMDL Plan as well as obtaining hands-on assistance help with implementing select management strategies. SRF is a great vehicle to fund management strategies for a bacteria load allocation.

Action 1: Twenty percent of the loan program's annual capitalization grant is set aside to fund green infrastructure, water or energy efficiency improvements or other environmentally innovative activities. In 2010, $4.6 million was set aside for these "green projects". DEQ's loans can fund both nonpoint source and point source projects. SRF staff will encourage jurisdictions to apply for loans and grants.

Action 2: DEQ's SRF Circuit Riders are available to assist small Designated Management Agencies in developing an asset management plan by inventorying assets, maintenance needs, and expenses and income associated with a wastewater facility. However, DMAs must adopt an action in their TMDL Implementation plans that state they will develop an asset management program. An asset management program will help DMAs plan for infrastructure replacements and improvements at their wastewater facility. SRF staff and NPS/TMDL staff will encourage the use of SRF as part of TMDL implementation and permit renewals.

Alignment Opportunity: The nonpoint source program may be able to work with the SRF program to identify nonpoint source projects that may help SRF recipients qualify for the Sponsorship Option and green infrastructure projects.

3.21.2 Section 319 Grants - Nonpoint source pollution control

DEQ administers the federal Nonpoint Source Implementation 319 Program in Oregon. This program provides federal grant funds under the Clean Water Act's Section 319(h) to address nonpoint water pollution and requires states to have nonpoint source management programs based on assessments of the amounts and origins of nonpoint source pollution in the state.

Through an annual solicitation, DEQ seeks proposals from government agencies, tribal nations and nonprofit organizations to address nonpoint sources of pollution affecting coastal, river, lake, and drinking and groundwater resources in Oregon. Recipients of 319 project grants are required to provide a 40 percent match to the 319 project funds. Matching can be in the form of money and/or services (in-kind).

Approximately $1.156 million of 319 grant funds was allocated to projects in the Umpqua Basin from 2000 - 2012. Approximately 39 percent of the grant funds have focused on restoration and TMDL implementation activities (primarily riparian restoration and pasture management), 37 percent on TMDL development and implementation monitoring and 24 percent on planning and assessment projects.

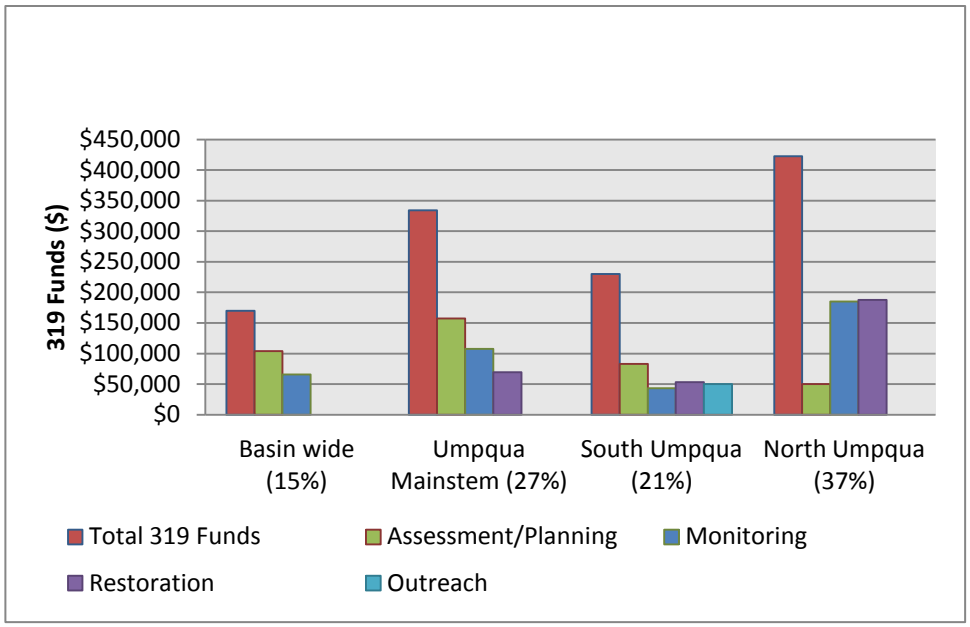
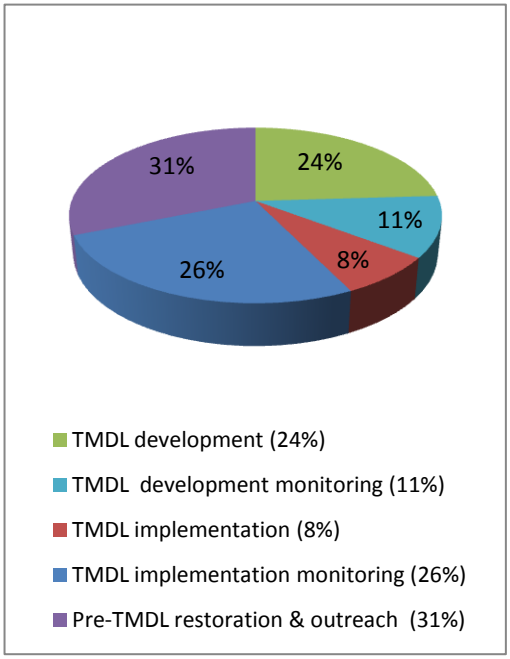


Figure 23: Umpqua Basin 319 Funding by Subbasin and Activity, 2000-2012

Prior to the development of the 2006 Umpqua Basin TMDL, restoration projects focused primarily on riparian restoration and pasture management projects. In 2002, a large culvert replacement project was completed in Cavitt Creek in the North Umpqua. 319 dollars assisted in funding the Umpqua Basin watershed assessments completed by the Partnership for Umpqua Rivers, which were used to inform the Umpqua Basin TMDL. From 2008-2011, grant support partially funded the Diamond Lake Monitoring and modeling effort to examine the effects of the rotenone treatment.

From 2011-2013, 319 grant dollars have been focused on addressing water quality limitations in the South Umpqua, including monitoring harmful algal blooms and outreach programs to landowners.

Figure 24: Umpqua Basin 319 Funds, 2000-2012



Action 1: NPS/TMDL staff and 319 Coordinator will continue to review new 319 grant proposals and develop priorities for funding. DEQ will work with stakeholders in the Umpqua Basin to manage recently funded projects, such as PUR's Harmful Algae Bloom Monitoring project, and to develop proposals for new grant projects which will implement water quality goals for the basin.

Action 2: NPS/TMDL staff will continue to work with other sources of grant funding to leverage resources toward water quality improvement projects. The Oregon Watershed Enhancement Board is the largest source of watershed restoration and enhancement funding in the state of Oregon. DEQ NPS/TMDL regional staff review grant applications in an effort to promote water quality improvements and participate in Regional Review Teams tasked with reviewing funding requests and identifying priority actions.

Table 36: OWEB Restoration Priorities in the Umpqua Basin[48]

	Riparian/Wetland	Upland	Instream & Passage	Other
Umpqua Basin	Reduced warm season stream flows Invasive riparian species	Sediment delivery from forest roads High fire risk	Lack of stream complexity Incomplete information on fish passage issues High stream temperature	Significant hatchery influence in the North Umpqua

Action 3: Priorities for 2014 through 2019 will focus on NPS/TMDL staff and drinking water staff working with basin partners to implement actions that will result in temperature, bacteria and sediment improvements on urban, agricultural and forested lands, as well as addressing storm water issues in urban areas. Priorities also include drinking water source protection, TMDL implementation, and groundwater issues.

Potential Projects:

- Streambank stabilization and riparian vegetation planting projects.
- Fencing and off-stream water development to keep cattle from the direct access to creeks or rivers.
- Develop a basin-wide water quality effectiveness monitoring program.
- Harmful algal bloom investigation: Inventory of existing data, collect and analyze sediment cores, and make recommendations (further study, management related, etc)
- Phosphorous investigation: Conduct soil analysis to evaluate if phosphorous is a limiting element. May lead to a zero phosphorous fertilizer outreach program.
- Septic system maintenance and repair education and outreach program.
- Development of a toxics reduction strategy.

Alignment Opportunity: Align with TMDL water quality implementation plans, water quality management plans, groundwater and safe drinking water programs in the identification of priorities. Evaluate opportunities to align with the State Revolving Funds' green infrastructure and projects.

[48] More information on OWEB Restoration projects in the Umpqua Basin can be found at: www.oregon.gov/OWEB/pages/BiennialReport_0911/umpqua.aspx

Overview of Non-DEQ Water Quality Related Actions and Responsibilities

Table 37: Basin Partners

Partner	Focus Area
Indian Tribes Cow Creek Band of Umpqua Tribe of Indians[49]	Cultural and other natural resource interests. Water quality monitoring. Land management (tribal, trust, fee, and ceded lands) including forest, agricultural and urban landscapes. The Tribe created a Natural Resources Department in 2004 to support these lifeways and to manage, restore, enhance and protect natural resources for future generations of Cow Creek Tribal members. Currently the Tribe's water quality monitoring program works on Tribal lands and has expanded to include monitoring in culturally significant areas within the ancestral territory. In addition, the Tribe is working to develop a toxics monitoring program to study toxins in fish tissues. The Tribe has identified the South Umpqua has a priority watershed for habitat enhancement projects.
Federal Partners	
Bureau of Indian Affairs (BIA)	Administers trust responsibility program, maintains federal government-to-government relationships with recognized Indian tribes, promotes and supports tribal self-determination.
Bureau of Land Management (BLM) United State Forest Service (USFS)	Protects and manages national forests and grasslands in a sustainable manner for multiple-uses. Northwest Forest Plan guides land management. BLM manages O and C Lands. USDA Forest Service, Watershed Condition Class and Prioritization Information: http://apps.fs.usda.gov/WCFmapviewer/
United State Army Corps of Engineers (USACE)	Maintain channels, harbors and waterways for transportation of commerce, support to national security and recreation. Provide technical expertise for sediment characterization, evaluation and management. Participate in water resource development projects (navigation, flood damage, ecosystem restoration). Conduct fill and removal permitting and secure tribal and endangered species act consultations. Reduce flood risks with structural and non-structural measures.
Natural Resource Conservation Service	Work with landowners through conservation planning and assistance to benefit the soil, water, air, plants, and animals and result in productive lands and healthy ecosystems. Provide financial assistance for conservation activities. The NRCS and Local Work Group in Douglas County have identified forest health and invasive plant species on grazing lands as the priority resource concerns. Conservation strategies for the Umpqua Basin focus on pasture health, the goal is to restore pasture health by controlling invasive brush, installation of cross fencing, livestock water systems and implementation of prescribed grazing.

[49] www.cowcreek.com/

<table>
<tr><td>Farm Services Agency</td><td>Serves farmers, ranchers, and agricultural partners through the delivery of effective, efficient agricultural programs (commodity, loan and loan guarantee, conservation, and disaster relief programs). Administers funds for riparian improvements.</td></tr>
<tr><td>National Oceanic and Atmospheric Association, National Marine Fisheries Service (NMFS), United States Fish and Wild life Service (USFWS)</td><td>NMFS and the USFWS implement the Endangered Species Act (ESA). Generally, USFWS manages land and freshwater species, while NMFS manages marine and "anadromous" species.</td></tr>
<tr><td>United States Geological Survey (USGS)</td><td>The USGS is a science organization that provides impartial information on the health of ecosystems and environment, natural hazards, natural resources, impacts of climate and land-use change, and the core science systems that help provide timely, relevant, and useable information.</td></tr>
<tr><td>Environmental Protection Agency (EPA)</td><td>Develop and enforce clean water act (CWA) regulation, provide grant and low interest loan assistance, study environmental issues, sponsor partnerships, provide educate, outreach, and technical assistance, provide CWA delegate oversight</td></tr>
<tr><td colspan="2">State Agencies</td></tr>
<tr><td>Oregon Department of Forestry (ODF)</td><td>Regulate WQ on non-federal forestlands through the Forest Practices Act (FPA). Supervises forest policy in Oregon. Implements the Oregon Plan by promoting private land volunteer enhancement measures. Directly oversees the management of the Elliott State Forest. Monitors and applies adaptive management.

In 2012, approximately 508,368,000 board feet of timber was removed from lands in Douglas County. Timber from federal lands account for 15% of the timber harvest. The remaining timber harvests, 423,430 board feet, are under the authority of ODF.

2012 Douglas County Harvests – volume removed in 1,000s of board feet – Scribner log scale
<table>
<tr><th>Industry</th><th>Other Private</th><th>Native American</th><th>State</th><th>BLM</th><th>USFS</th><th>Other</th><th>TOTAL</th></tr>
<tr><td>389766</td><td>37,355</td><td>0</td><td>2,530</td><td>42,048</td><td>33,890</td><td>2,779</td><td>508,368</td></tr>
</table></td></tr>
<tr><td>Oregon Department of Agriculture (ODA)</td><td>Develop agricultural WQ management (AWQM) plans and enforce rules that address WQ issues on agricultural lands. Conduct WQ education and outreach, select and implements focus area programs, partners with DEQ to identify WQ monitoring needs, applies adaptive management.

ODA collects and evaluates aerial photos of stream segments selected at random along agricultural lands in each management area. ODA first collected aerial photos to evaluate streamside areas in the management area in 2006. The next round of photos were collected in 2012 and will be analyzed for the 2014 Umpqua Basin Biennial Review. Eleven stream segments were assessed. Riparian index scores for these streams ranged from a low of 38 for Marsters Creek to a high of 61 for Fluornoy Creek. Except for Marsters Creek, all of the stream segments had</td></tr>
</table>

	high percentages of trees in the 30 feet bands adjacent to the streams.
Oregon Department of Transportation (ODOT)	WQ protection measures during construction, operation, and maintenance of the state and federal transportation system. Vegetation and sediment management.
Oregon Department of State Lands (DSL) *South Slough National Estuarine Research Reserve (NERRS)*	Jurisdiction over waterways, wetland management and protection, state forestland management. Fill and removal permitting, waterway and grazing leases, natural resource management funding. Partners with NOAA to manage NERRS, a network of estuarine habitats protected and managed for the purposes of long-term research, education, and coastal stewardship.
Oregon Department of Fish and Wildlife (ODFW) Restoration and Enhancement Board (R & E) Oregon Fish and Wildlife Commission	Develop and apply conservation strategy for native fish and wildlife and their habitats. Regulate fishing and hunting activities. Provide technical assistance and funding for fish restoration and enhancement projects.
Oregon State Marine Board (OSMB)	Administers boating safety educational programs, marine law enforcement and improved boating facilities. Establish and enforce statewide boating regulations. Technical training and equipment to marine patrol officers and grants and engineering services to local governments to develop and maintain accessible boating facilities and protect WQ. Actively promotes safe and sustainable boating.
Oregon Department of Geology and Mineral Industries (DOGAMI)	Regulates natural resource extraction (surface mining, oil and gas, and geothermal), implements the federal Clean Water Act General Stormwater Permit and the State Water Pollution Control Facility Permit at aggregate mine sites that utilize upland sources (may include instream sources also).
Oregon Parks and Recreation Department (OPRD)	Public park management and natural resource enhancement.
Oregon Water Resources Department (OWRD)	Administers laws governing surface and groundwater resources. Protects existing water rights, facilitate voluntary streamflow restoration, increase the understanding of the demands on the water resources, provide accurate and accessible water resource data, and facilitate water supply solutions.
Oregon Department of Land Conservation and Development (DLCD)	Provides regional representatives who assist local governments in the implementation of statewide land use planning program by providing technical and educational assistance to local government planners and officials, the general public, and interest groups. Provides financial assistance to urban and rural communities. Administers the Coastal Management Program emphasizing conservation of coastal resources (estuaries, shorelands, beaches and dunes, and ocean resources), provides financial and planning assistance to local governments, implements a coastal hazards and assessment program, supports the Oregon Ocean Policy Advisory Council, maintains an online Oregon Coastal Atlas, and has authority under federal law to review federal programs and activities for consistency with coastal program standards.
Oregon State Police (OSP)	Enforcement of fish, wildlife, and commercial fishing laws, protection of natural resources, enforces boating, livestock and environmental protection laws,

	responds to emergency situations.
Oregon Plan for Salmon and Watersheds	Implementation of voluntary measures to restore native fish populations and aquatic systems, coordinate state, federal, and tribal actions, monitor watershed health, provides scientific oversight through the Independent Multidisciplinary Science Team. Promotes easement programs for wetlands and riparian habitats.
Oregon Watershed Enhancement Board (OWEB)	Implementation of the Oregon Plan for Salmon and Watersheds, provides grants to help Oregonians protect and improve WQ and natural areas, support for watershed council operation.
Entities Managing Corridors	
PacifiCorp, Pacific Power, rail lines, pipeline corridors, other	WQ protection during construction, operation, and maintenance activities. Riparian vegetation and sediment management.
Local Jurisdictions/Governmental Entities	
Cities	Management of lands in direct ownership (parks, city buildings, roads, etc), wastewater, stormwater, and drinking water management, land use and comprehensive planning, and the development and application of local ordinances through education, variance procedures, and enforcement.
Counties	Management of lands in direct ownership (parks, city buildings, roads, etc), stormwater, land use and comprehensive planning, and the development and application of local ordinances through education, variance procedures, and enforcement.
Port Authorities	Management of port facilities (marinas, service and fueling areas, live aboard communities, transient communities, sub tidal ownership, etc.), dredging activities, recreational facilities
Soil and Water Conservation Districts (SWCD)	Serve as Local Management Agencies (LMAs) funded by ODA to conduct outreach and education, provide technical assistance, develop individual farm plans for operations in the planning area, work with landowners to implement management practices, and help landowners secure funding to cost-share WQ improvement practices. There are two SWCDs within the Umpqua Basin. The Douglas SWCD, based out of Roseburg, serves the eastern/inland portion of the Basin. The Douglas Soil and Water Conservation District's Focus Area for 2013-2015 will be located in the Morgan Creek subwatershed (Olalla/Lookingglass watershed, South Umpqua subbasin). The Umpqua SWCD, based out of Reedsport, serves the western/coastal area. Umpqua Soil and Water Conservation District's 2013-2015 Focus Area will be the Otter Slough/Brainard Creek area (Lower Smith River Watershed near the confluence with the Umpqua River).

Special Drainage Districts	Management of conveyance systems designed to enhance drainage and control tidal influences and in some instances salinity (tidegates).
Academia	
Oregon State University (OSU) Extension	Convey research-based knowledge to improve natural resource productivity, WQ, and fishery habitat.
Non Governmental Entities	
Watershed Councils	Locally organized, voluntary, non-regulatory groups established to improve the conditions of watersheds. Widely represent diverse interests in the. Plan watershed protection and restoration strategies in a holistic way. Collaborate to identify issues, promote cooperative solutions, focus resources, agree on goals for watershed protection and enhancement, and foster communication among all watershed interests.
Audubon, The Nature Conservancy, Freshwater Trust, Oregon Trout, and many others	Non-Governmental Organizations focusing activities on WQ protection, enhancement, and restoration.

Umpqua Basin References and Internet Links for More Information:

Barnes & Associates, Inc. 2007. *Umpqua Basin Action Plan June 2007.* Roseburg: Partnership for the Umpqua Rivers.

Carpenter, K.D., Anderson, C.W., and Jones, M.E., 2013, Water quality and algal conditions in the North Umpqua River, Oregon, 1995–2007, including their response to Diamond Lake restoration

Department of Environmental Quality. 1988.*1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution.*

Department of Environmental Quality. 2002. *Total Maximum Daily Load and Water Quality Management Plan. Little River Watershed, North Umpqua Subbasin*

Department of Environmental Quality. 2005. *Assessment Methodology for Oregon's 2004 Integrated Report on Water Quality Status.* DEQ Water Quality Division, August 12, 2005.

Department of Environmental Quality. 2005. *A Strategy for Monitoring Oregon's Waters*. DEQ Laboratory Division, Watershed Assessment Section. September 2005.
http://www.deq.state.or.us/lab/techrpts/docs/WaterMonitoringStrategyFinal.pdf

Department of Environmental Quality. 2005b. *Water Quality Trading Internal Management Directive*.
http://www.deq.state.or.us/wq/trading/trading.htm

Department of Environmental Quality. 2006. *Coastal Environmental Monitoring and Assessment Program, The Condition of Oregon Estuaries in 1999, A Statistical Summary*. DEQ Laboratory Division, Watershed Assessment Section.
http://www.deq.state.or.us/lab/wqm/docs/DEQ04-LAB-0046-TR.pdf

Department of Environmental Quality. 2006. *Total Maximum Daily Load and Water Quality Management Plan.* Umpqua Basin

Department of Environmental Quality. *Oregon's 2010 Integrated Report – Assessment Database and 303(d) List.*
http://www.deq.state.or.us/wq/assessment/2010Report.htm

Department of Environmental Quality. 2010. Turbidity Technical Review. Summary of Sources, Effects, and Issues Related to Revising the Statewide Water Quality Standard for Turbidity.
http://www.deq.state.or.us/wq/standards/docs/Turbidity/10-WQ-022.pdf

Department of Environmental Quality. 2011. *Methodology for Oregon's 2010 Water Quality Report and List of Water Quality Limited Waters.* Portland: DEQ.

Department of Environmental Quality. 2011. Oregon Bacteria Rule: Bacteria Criteria for Marine and Estuarine Waters.
http://www.deq.state.or.us/wq/pubs/imds/BacteriaIMDre11F.pdf

Department of Environmental Quality. 2012. *Drinking Water Source Monitoring Project, Phase I and Phase II (2008-2010). http://www.deq.state.or.us/wq/dwp/docs/SourceMonitoringProjectPhase1and2Rpt.pdf*

Department of Environmental Quality. *Oregon's Source Water Assessment Results and Maps.*
http://www.deq.state.or.us/wq/dwp/results.htm

Department of Fish and Wildlife. 1986. *The Seasonal Occurrence and Distribution of Fish in the Umpqua Estuary, April 1977 through January 1986.* Information Report Number 86-6. https://nrimp.dfw.state.or.us/CRL/Reports/Info/86-6.pdf.

Douglas County Water Resources Program. 2008. *Volume II – Appendix M – Municipal, Rural Domestic, Industrial.*
http://www.co.douglas.or.us/planning/Plan_docs/WtrResc/VolumeIIAppendixM.pdf

Eilers, J.M., Vache, K.B. 2012. *Diamond Lake Assessment & Modeling Project (DAMP). Progress Report to the Oregon Department of Environmental Quality, Partnership for the Umpqua Rivers, and Oregon Department of Fish and Wildlife*.

Gallegos, C.L. 2001. *Calculating Optical Water Quality Targets to Restore and Protect Submersed Aquatic Vegetation: Overcoming Problems in Partitioning and Diffuse Attenuation Coefficient for Photosynthetically Active Radiation*. Smithsonian Environmental Research Center. Estuaries Vol. 24, No. 3, P. 381-397, June 2001.

Geyer, Nancy A. 2003. *Lower South Umpqua Watershed Assessment and Action Plan.* July, 2003. Prepared for the Umpqua Basin Watershed Council, Roseburg, Oregon.

Geyer, N. 2003. *Calapooya Creek Watershed Assessment and Action Plan.* Roseburg: Umpqua Basin Watershed Council.

Geyer, N. 2003. *Middle South Umpqua Watershed Assessment and Action Plan.* Roseburg: Umpqua Basin Watershed Council.

Geyer, N. 2003. *Myrtle Creek Assessment and Action Plan.* Roseburg: Umpqua Basin Watershed Council.

Geyer, N. 2003. *South Umpqua Watershed Assessment and Action Plan.* Roseburg: Umpqua Basin Watershed Council.

Geyer, N. 2003. *Tiller Region Assessment and Action Plan.* Roseburg: Umpqua Basin Watershed Council.

Hayslip, G., L. Edmond, V. Partridge, W. Nelson, H. Lee, F. Cole, J. Lamberson , and L. Caton. 2006. *Ecological Condition of the Estuaries of Oregon and Washington*. EPA 910-R-06-001. U.S. Environmental Protection Agency, Office of Environmental Assessment, Region 10, Seattle, Washington..
http://www.epa.gov/emap/west/html/docs/CEMAPfinal.pdf

Hubler, Shannon. Department of Environmental Quality. 2008. *PREDATOR: Development and use of RIVPACS-type macroinvertebrate models to assess the biotic condition of wadeable Oregon streams (November 2005 models).*. http://www.deq.state.or.us/lab/techrpts/docs/10-lab-004.pdf

Huff, D.D., Hubler, S.L., Pan, Y., Drake, D.L. 2006. *Detecting Shifts in Macroinvertebrate Assemblage Requirements: Implicating Causes of Impairment in Streams.* Oregon Department of Environmental Quality, Laboratory and Environmental Assessment Division, Watershed Assessment Section. Portland State University, Environmental Science and Resources. http://www.deq.state.or.us/lab/techrpts/docs/10-LAB-005.pdf

Long, E.R., D.D. MacDonald, S. L. Smith, and F.D. Calder. 1995. *Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments*. Environmental Management 19(1):81-97.

National Oceanic and Atmospheric Administration. 1999. *Sediment Quality Guidelines developed for the National Status and Trends Program.* http://archive.orr.noaa.gov/book_shelf/121_sedi_qual_guide.pdf

Merrick, L., Hubler, S. Department of Environmental Quality. 2013. *Oregon Water Quality Index Summary Report, Water Years 2002-2011 and 2003-2012.* Laboratory and Environmental Assessment Division.
http://www.deq.state.or.us/lab/wqm/docs/OWQISummary12.pdf

Lyon, S. (2004). *Quality Assurance Project Plan for the Umpqua Basin Watershed Council Volunteer Monitoring Program.* Oregon: Partnership for the Umpqua Rivers.

O'Connor, J.E., Wallick, J.R., Sobieszczyk, Steven, Cannon, Charles, and Anderson, S.W., 2009, Preliminary assessment of vertical stability and gravel transport along the Umpqua River, Southwestern Oregon: U.S. Geological Survey Open-File Report 2009-1010, 40p. http://pubs.usgs.gov/sir/2011/5041/pdf/sir20115041.pdf

Oregon Health Authority. Real Estate Transaction: water test results for nitrate, arsenic and bacteria. http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Monitoring/Pages/dwt.aspx

Oregon Health Authority. Oregon Public Health, Drinking Water Data Online. Retrieved from *http://170.104.63.9/*

Oregon Health Authority. Fish Consumption and Harmful Algae Bloom Advisories. http://public.health.oregon.gov/HealthyEnvironments/Recreation/Pages/fishconsumption.aspx

Oregon State Archives. 2012. *Oregon Historical County Records Guide, Douglas County History*. http://arcweb.sos.state.or.us/pages/records/local/county/douglas/hist.html

Oregon State Archives*. Douglas County*. http://bluebook.state.or.us/local/counties/counties10.htm Douglas County Case Study"

Oregon Water Resources Department. *Water Rights Information System.* http://www.oregon.gov/owrd/pages/WR/wris.aspx

Oregon Watershed Enhancement Board. 2008. *The Oregon Plan for Salmon and Watersheds Biennial Report 2005-2007.* Salem: Oregon Watershed Enhancement Board.

Oregon Water Resources Department. 2009. An Introduction to Oregon's Water Laws, *Water Rights in Oregon. http://www.oregon.gov/owrd/pages/pubs/aquabook.aspx*

Partnership for the Umpqua Rivers. 2012. *Final Report DEQ Grant 013-10 PUR Water Quality Monitoring & Thermal Refugia Investigation.*

Partnership for the Umpqua Rivers. 2010. *Strategic Plan 2011-2014.* Roseburg: Partnership for the Umpqua Rivers.

Raforth, Robert L., Norman, David K., Johnson, Art. 2004. *Third Screening Investigation of Water and Sediment Quality of Creeks in Ten Washington Mining Districts, with Emphasis on Metals.* February 2004. Publication No. 04-03-005. http://www.ecy.wa.gov/biblio/0403005.html

Schropp, Steven J., Windom, Herbert L. 1988. *A guide to the Interpretation of Metal Concentrations in Estuarine Sediments.* Coastal Zone Management Section Florida Department of Environmental Regulation.

Stone, David. and Bress, William. 2007. *Addressing Public Health Risks for Cyanobacteria in Recreational Freshwaters: The Oregon and Vermon Framework.* Integrated Environmental Assessment and Management - Volume 3, Number 1 - pp. 137-143.

Sweet, C.W., Weiss, A., and Vermette, S.J. 1998. *Atmospheric Deposition of Trace Metals at Three Sites Near the Great Lakes.* Water, Air, and Soil Pollution. April 1998, Volume 103, Issue 1-4, PP 423-439.

Sytsma, M., Miller R. 2011. *Diamond Lake Water Quality Assessment, Health Monitoring Index Report.* Prepared for the Partnership for Umpqua Rivers, USDA Umpqua National Forest and the Oregon Department of Environmental Quality.

State of Oregon Department of Geology and Mineral Industries. 1943. Oregon Metal Mines Handbook, Bulletin 14-C, 1943.

Summers, Kevin., Burgan, Barry. 2004. *National Coastal Condition Report II.* U.S. EPA-620/R-03/002. Environmental Protection Agency, Office of Research and Development and Office of Water http://water.epa.gov/type/oceb/2005_downloads.cfm

Sweet C.W. and Prestbo E., 1999. Wet Deposition of Mercury in the U.S. and Canada. Presented at the Air and Waste Management Association "Mercury in the Environment Specialty Conference", September 15-17, 1999, Minneapolis, MN.

Sweet C.W., Prestbo E., and Brunette, R., 2003. Wet Deposition of Mercury in the U.S. and Canada, 1996-2000: Results from the NADP Mercury Deposition Network (MDN). Unpublished Draft Document.

Turner, D., 2010. Remote sensing of chlorophyll *a* concentrations to support the Deschutes Basin lake and reservoir TMDLs, Oregon Department of Environment Quality. Not currently available on the web.

U.S. Census Bureau. County population. Obtained 2013. http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

U.S. Fish and Wildlife Service, Oregon Fish and Wildlife Office. 2013. *Federally Listed, Proposed, Candidate species and Species of Concern Under the Jusrisdiction of the fish and Wildlife Service Which May Occur Within Douglas County, Oregon.* June 15, 2013. http://www.fws.gov/oregonfwo/Species/Lists/

Wallick, J.R., O'Connor, J.E., Anderson, S., Keith, M., Cannon, C., and Risley, J.C. 2011. Channel change and bed-material transport in the Umpqua River basin, Oregon: U.S. Geological Survey Scientific Investigations Report 2011-5041, 112 p. http://pubs.usgs.gov/sir/2011/5041/pdf/sir20115041.pdf

Water Quality Standards. 2010. Retrieved April 23, 2012, from Oregon Department of Environmental Quality: http://www.deq.state.or.us/wq/standards/turbidity.htm#cur

Weisberg, S. B.; Wilson, H. T.; Heimbuch, D. G.; Windom, H. L.; Summers, J. K. 2000. *Comparison of sediment metal:aluminum relationships between the eastern and gulf coasts of the United States.* Environmental Monitoring & Assessment . Apr2000, Vol. 61 Issue 3, p373-385. 13p.

Appendix A: Umpqua Basin Identified Actions and Primary Programs

The following actions were identified by DEQ staff as actions needed to address data gaps, process improvements, meet program needs or further DEQs mission. Action items that are associated with routine program operation are expected to continue and were not included in the action matrix, but described in the action plan. Prioritization and timelines are based on the identified lead water quality subprograms need and workload.

Identified Actions & Primary Programs Lead (L) = responsible for implementing action Team (T) = involvement is required to implement action Consult (X) = decision and/or action will impact the program --- (Note: Continual foundational program activities were not included in the table, refer to the action plan for more information)	**Timeline** C = current Near Term (N) = next 2 yrs Mid Term (M) = 2 - 4 yrs Far Term (F) = 4 - 6 yrs Long-term (LT) > 6 yrs	**Scale** State (St) Basin (Ba) Subbasin (Sub) Watershed (Wa)	**Water quality or process concern**	CWSRF	319	Non-point Source	TMDLs	Drinking Water	Groundwater	Permitting	Industrial Permits	Municipal	Stormwater	Pretreatment	Biosolids	Water Reuse	On-site	UIC	401 hydro	401 dredge/fill	Assessment	Standards	Monitoring	Data Management	OCE	OCO	RST
Education and outreach about onsite systems should include a discussion about toxic contaminants. Proper disposal options should be investigated and publicized (waste pick up events, drug turn in locations, etc.).	C	St	toxics; education			X		X	X								**L**						X				
Continue to act as an information resource promoting individual landowner education and outreach. Work with citizens who own and manage an onsite septic system to assure they are knowledgeable about their treatment system, repair needs, and the importance of repair area protection.	C	St	BacT; nutrients; toxics														**L**										
Develop an onsite system database and mapping tool that is publicly available. The tool would allow DEQ to evaluate high priority locations for special projects and respond to water quality concerns that may be associated with aged, non-functioning systems.	C	St	BacT; nutrients; toxics														**L**							T			
Continue coordinating with OHA, public water systems, and water quality partners to: (1) monitor and collect data to characterize risk of algal toxins to drinking water and (2) address human activities that contribute to toxic algae bloom formation.	C	Ba	HABs (DW; Recreation)			T		**L**															T				
DEQ staff should continue to support RUSAs efforts to comply with SB737 requirements and complete evaluation of the data gathered during the surface water toxics monitoring project conducted on the Umpqua River.	C	Wa	Toxics; DW							**L**		T											T				
Support solutions that address wastewater system overflows. (Ex: DEQ is currently working with Gardiner, Reedsport, and other partners to develop a plan to repair or replace a damaged sewage pipe located near the mouth of the Umpqua River)	C	Ba	bacteria; nutrients; BOD	**L**						T		T															
Encourage SRF loan applicants to identify qualifying nonpoint source activity through the Sponsorship Option. Other water quality programs may be able to identify nonpoint source projects that may help CWSRF recipients qualify for the Sponsorship Option and green infrastructure projects.	C	St	education	**L**		T		T	T	X	X	X															
Continue to set aside a percent of the SRF loan program's annual capitalization grant to fund green infrastructure, water or energy efficiency improvements or other environmentally innovative activities.	C	St	process	**L**																							
Fish migration patterns changed with the improvement of fish passage at Soda Springs Dam. Better define and refine the distribution of the beneficial uses of resident trout and other sensitive aquatic species.	N	Ba	fish use			T																**L**					
Facilitate regional planning, prioritization, and implementation of NPS projects to address TMDL identified water quality impairments through regional coordination between the designated management agencies, DEQ, Tribal nations, Federal partners and other partners and stakeholders.	N	Ba	nps		X	**L**	X	X	X																		
Identify resources to continue monitoring efforts for Diamond Lake; DEQ, ODFW, USDA Umpqua National Forest and Douglas County collaborate to identify funding sources.	N	Wa	funding		X	**L**	X																X				
Work with DMAs to ensure that implementation plans are developed (if not submitted), implemented, effective and adapted as necessary over time.	N	Ba	implementation plans			**L**																	X				
Engage Douglas County in development of a meaningful and effective implementation plan.	N	Ba	implementation plans			**L**																					
Work with federal and state land managers to assess extent of monitoring of implementation activities to meet NPS load allocations.	N	Ba	monitoring			**T**	**L**																	X			
Review USGS's report "Water Quality and Algal conditions in the North Umpqua River, Oregon, 1995-2007, Including their Response to Diamond Lake restoration". Findings should be reviewed by DEQ and used to better address nutrient loading in the North Umpqua.	N	Sub	nutrients; algae			**L**	T																				

Identified Actions & Primary Programs

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A subbasin-scale HABs strategy and monitoring approach needs to be implemented to address the 5 HAB listings because segments require additional data and/or analysis to perform source assessment and determine appropriate load allocations for the development of a TMDL (or other plan).	N	Sub	HABs; TMDL development			X	**L**	T															T				
Collect additional data and develop TMDLs to address the two Category 5 303(d) listed segments for pH.	N	Sub	pH; TMDL development			X	**L**																T				
Collect additional data and/or analysis to perform source assessment/linkage analysis and determine load allocations to address 7 bacteria Category 5 303(d) listed segments.	N	Sub	bacteria; TMDL development			X	T																**L**				
TMDL staff and NPDES Phase II stormwater staff need to collaborate to evaluate the effectiveness of stormwater control measures incorporated into TMDL Implementation Plans.	N	St	stormwater runoff				**L**						T														
A statewide low impact development guidance document is needed to assist stormwater program staff and TMDL staff in evaluating and/or selecting LID techniques.	N	St	stormwater runoff			T	T						**L**														
Collaboration is needed between regional stormwater program and headquarters staff to develop guidance documents for the following topics: Background determination, zinc, mass load calculation, tier II, and UICs.	N	St	stormwater runoff							X			**L**														
As permits are renewed, permits writers should review available data, including DMRs, to determine if additional monitoring or permit conditions are required prior to the renewal of these permits and to ensure that monitoring aligns with impairments identified in the basin.	N	St	monitoring				X			**L**	T	T	T	T	T									X			
Develop, initiate and implement public education program about the connectivity between specific land uses and the impacts on basin resources in cooperation with other state and local agencies.	N	St	education			**L**		T	T								X								T	
Local stakeholder outreach promoting the water reuse program.	N	Sub	education							X						**L**											
Include a field for basin identification in the development of databases.	N	St	database																					**L**			
Determine the location and extent of existing and planned biosolids application sites.	N	Ba	BacT; nutrients; toxics			X		X							**L**												
Coordinate with basin partners to monitor and collect data that correlates storm events to *E. coli* and turbidity in drinking water. Use this data to prioritize technical assistance and develop appropriate management strategies.	N	Wa	bacteria; turbidity			T		**L**															T				
Monitoring plans developed to support a single water quality project should be designed to consider data and information needs for other WQ programs within the basin and the state.	N	St	monitoring			X	X	X	X	X													**L**				
Complete toxics monitoring program analysis and share results with sources and local communities. Analysis should include determination of risk to public water supplies.	N	Ba	Toxics; DW			T		T													T	T	**L**				
Identify high priority HABs project needs and develop a basin wide monitoring plan. DEQ has developed a HAB Strategy that should be implemented or reviewed and revised. Generic monitoring plans are approved and increased availability of sampling equipment in regional offices can support limited sampling efforts when potential HABs are identified.	N	Sub	HABs, DW		T	T	**L**	T															T				
Collaborate to develop a HABs communication strategy for the South Umpqua Basin. Build on existing information.	N	Sub	HABs		X	T	T	**L**															T			T	
Ensure that volunteer monitoring data is submitted, evaluated and entered into an accessible database.	N	St	database																				**L**	T			
SRF staff will provide assistance in developing asset management program.	N	Ba	education	**L**																							
SRF staff and NPS, TMDL and point source staff will encourage the use of SRF as part of TMDL implementation and permit renewals.	N	Ba	education	**L**		T				T																	
Fund/support stream bank stabilization and riparian vegetation planting projects.	N	Ba	temperature; sediment; nutrients; bacteria		T	**L**																					

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Identified Actions & Primary Programs	**Timeline** C = current Near Term (N) = next 2 yrs Mid Term (M) = 2 - 4 yrs Far Term (F) = 4 - 6 yrs Long-term (LT) > 6 yrs	**Scale** State (St) Basin (Ba) Subbasin (Sub) Watershed (Wa)	**Water quality or process concern**	CWSRF	319	Non-point Source	TMDLs	Drinking Water	Groundwater	Permitting	Industrial Permits	Municipal	Stormwater	Pretreatment	Biosolids	Water Reuse	On-site	UIC	401 hydro	401 dredge/fill	Assessment	Standards	Monitoring	Data Management	OCE	OCO	RST
Fund/support harmful algae bloom investigation: Inventory of existing data, collect and analyze a sediment core to evaluate data, and make recommendations (further study, management related, etc).	N	Ba	HABs		T	**L**	T																T				
Fund/support stormwater management planning and controls in urban areas.	N	Ba	urban stormwater	T	T	**L**							T														
Align TMDL water quality implementation plans, water quality management plans, groundwater and safe drinking water programs in the identification of priorities. Evaluate opportunities to align with the SRFs green infrastructure and projects.	N	Ba	prioritization	T	T	**L**	T	T	T																		
Beach Monitoring Staff should work with Basin Coordinators to identify new sites, if needed, and to identify potential bacteria sources once exceedences are identified.	N	Ba	Bacteria, shellfish, recreation			T																	**L**				
Identify adequate TMDL/NPS staffing for Umpqua Basin to ensure 2006 TMDL implementation and coordination of TMDL development for Category 5 listings.	M	Ba	funding			X	**L**																				
Work with DMAs to design and implement a basin wide effectiveness monitoring program in Umpqua Basin to evaluate whether the 2006 TMDL is effectively being implemented.	M	Ba	monitoring		X	**L**	X	X		X									X				T	X			
Complete a temperature TMDL analysis of the spawning season in waterbodies affected by dams or point sources in the North Umpqua.	M	Sub	temperature; TMDL analysis			X	**L**			X									X				T				
Collect additional data for the 11 dissolved oxygen Category 5 303(d) listed segments. Ten of these segments were added to the 303(d) list by EPA in the 2010 Assessment cycle. Certain segments require additional data and/or analysis to perform source assessment and determine appropriate load allocations.	M	Ba	dissolved oxygen; monitoring			X	T																**L**				
Investigative studies into aquatic weeds and nutrients are needed to provide the basis for TMDLs or the equivalent for aquatic weeds and algae listed waterbodies, 5 listings.	M	Ba	aquatic weeds; nutrients; TMDL analysis			X	**L**					X											T				
Track wasteload allocation improvements and monitoring data to understand the impacts on the water column. Particular interest in water quality improvements caused by treatment plant upgrades in the South Umpqua.	M	Ba	WLA			**L**				T	T	T												X			
Address the fifty-two 303(d) Category 5 biological criteria impairments/segments for the Umpqua Basin. Certain segments require additional data and/or analysis to determine the spatial or temporal extent of the impairment or perform a source assessment. (Further guidance for interpretation of the sedimentation narrative standard and developing numeric targets may be needed before a TMDL (or other plans) can be developed).	M	Wa	biological criteria; aquatic Life; sediment turbidity			X	**L**																T				
Evaluate if chlorine and total dissolved gas are being met by other pollution control plans (e.g., FERC licensing and water quality certification).	M	Wa	chlorine; TDG				**L**			X									T				T				
When designing monitoring plans for permit compliance, permit writers should review and identify TMDL point source requirements and water quality data gaps.	M	St	monitoring				X			**L**	T	T	T	T	T												
Designate NPDES coverage for unpermitted stormwater sources (generally Phase II MS4) when a TMDL approach is less effective. Include more flexible language in a TMDL for stormwater sources that may be required to obtain a NPDES permit in the future.	M	St	TMDL development				**L**			T			T														
Pursue education opportunities with municipalities about UICs, stormwater and infrastructure needs (especially in high risk areas), financial assistance programs (SRF), and program rules and enforcement.	M	Ba	urban runoff; education	X						X									**L**								
Prepare and provide guidance on use or alternatives to stormwater UICs to protect surface and groundwater.	M	St	urban runoff						X				X						**L**								

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Copies of DEQ's review or additional investigation should be stored in a regional or central 401 hydro project file.	M	St	record keeping															**L**					X			
Regional 401 Coordinators should work with DEQ lab staff to ensure 401 water quality data is included in the states database. (Ex: PacifiCorp's 401 hydropower project involves an ongoing water quality monitoring program in the North Umpqua. This monitoring data should be collected and included in DEQs database in order to fill a DEQ data gap in the North Umpqua.)	M	St	record keeping															**L**					X			
Work to identify funding assistance and incentive for onsite system maintenance, inspection, repair and/or replacement.	M	St	BacT; nutrients; toxics	T	X	X											**L**									X
Identify water bodies at higher risk from on-site systems, potentially causing a public health concern, and implement special projects to focus resources.	M	Ba	BacT; nutrients; toxics			**L**	T	T	T								T					T				
DEQ to collaborate with the ODA CAFO program to provide monitoring data where available.	M	St	BacT; nutrients; toxics				**L**															T				
Biosolids program work with ODA and OSU extension staff to develop advanced best management practices for CAFO waste and biosolid waste management and develop a research forum on determining nitrogen loading rates that are protective of groundwater and surface water.	M	St	BacT; nutrients; toxics						X					**L**												
Change formal enforcement action case numbers to include a basin identifier so that enforcement efforts within a particular basin are easier to identify and search.	M	St	database																				T	**L**		
Develop Supplemental Environmental Project ideas within the basin in order to facilitate and encourage respondents to perform SEPs. Projects should address basin priorities (e.g. if temperature is a problem, include tree planting SEPs in the SEP idea list).	M	Sub	partners			**L**																		X		
Provide free nitrate well water 'screening' that can be used to help determine appropriate locations t for additional assessment and technical assistance.	M	Ba	nutrients						**L**																	
Address data gaps for locations upstream of drinking water intakes to better characterize likely sources of *E. coli*, sediment, excess nutrients, toxics, and emerging contaminants. Share data with partners and other DEQ programs to tailor technical assistance and management strategies, and avoid duplication of efforts	M	Wa	BacT; nutrients; sediments; toxics			X	X	**L**														T				
Develop a plan for installing continuous turbidity monitoring equipment to collect turbidity for untreated drinking water at public water systems throughout the basin. DEQ should continue coordination with partnering agencies to share turbidity and TSS data.	M	Ba	turbidity			X	X	**L**														T				
Coordinate with DEQ Lab, pesticide stewardship program, toxics coordinator, and basin coordinator to share data on toxics and prioritize location and parameters for toxics monitoring events. Refine communication plan for presenting toxics data to the public.	M	Ba	toxics			T		**L**														T			T	
Improved water quality data management. All programs in water quality would benefit by having any new water quality data regularly and routinely uploaded into an accessible database. By improving data management and accessibility the best available information can be used by DEQ programs and the public. This will allow the identification of data gaps and monitoring to fill data needs to be completed prior to a given DEQ action (e.g. permit issuance). Improved data management will facilitate the use of water quality data to guide the establishment of conditions and/or permit limits that will protect beneficial uses.	M	St	database																				**L**			
Investigate forming an Umpqua Basin Water Monitoring Council that participates in a broader Oregon Water Monitoring Council. Goals of such a group would be to bring everyone together to discuss who is doing what where, discuss indicators, develop QAPP, and SAP's, fill data gaps, and share information.	M	Ba	monitoring			T	T	T	T	T													**L**				

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Team (T) = involvement is required to implement action
Consult (X) = decision and/or action will impact the program

(Note: Continual foundational program activities were not included in the table, refer to the action plan for more information)

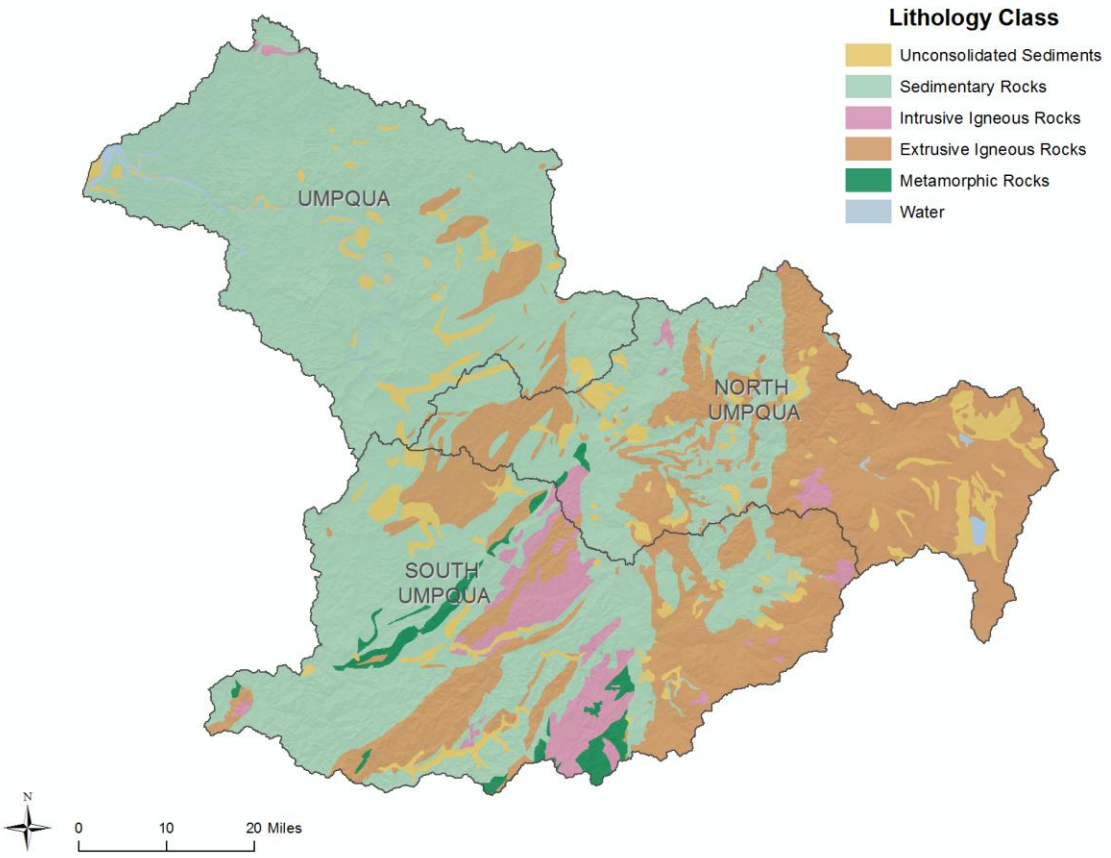
Identified Actions & Primary Programs	**Timeline** C = current Near Term (N) = next 2 yrs Mid Term (M) = 2 - 4 yrs Far Term (F) = 4 - 6 yrs Long-term (LT) > 6 yrs	**Scale** State (St) Basin (Ba) Subbasin (Sub) Watershed (Wa)	**Water quality or process concern**	CWSRF	319	Non-point Source	TMDLs	Drinking Water	Groundwater	Permitting	Industrial Permits	Municipal	Stormwater	Pretreatment	Biosolids	Water Reuse	On-site	UIC	401 hydro	401 dredge/fill	Assessment	Standards	Monitoring	Data Management	OCE	OCO	RST
Continued ambient monitoring trend analysis and sharing of results with nonpoint source and point source programs. Coordinate with the Umpqua Basin Coordinator, local organizations and agencies to develop a comprehensive volunteer monitoring program that can augment the ambient monitoring program.	M	Sub	monitoring			T																	**L**				
The DEQ Basin Coordinator with assistance from lab staff should integrate the ambient monitoring data into an Umpqua Basin TMDL effectiveness monitoring program with the Partnership for Umpqua Rivers monitoring program.	M	Ba	effectiveness monitoring			**L**	X																T				
DEQ staff, point source program, and nonpoint source TMDL program, groundwater and drinking water program should develop a communication plan of the toxics results and share the results with sources and local communities.	M	Ba	toxics; education		T	T	T	T	T	T													**L**			T	
Lab and NPS/ TMDL program to support partner efforts in monitoring and identifying HABs and the associated causative and correlative factors. Includes formal partnerships (e.g., 319 grant projects, OWEB, DWP grants) and as-needed technical assistance.	M	Sub	HABs, DW	X	X	**L**	T	T		X													T				
As permits are renewed, the Permit Section reviews monitoring data submitted by permittees with TMDL staff to evaluate whether monitoring aligns with impairments (or significant data gaps) identified in the basin.	M	Wa	monitoring			T	T			**L**													X				
Point source compliance monitoring data should be available to all DEQ staff via on online database.	M	St	database							T														**L**			
Use compliance monitoring data to assess TMDL effectiveness.	M	Ba	effectiveness monitoring				**L**			T													T	T			
Align volunteer monitoring efforts with laboratory and TMDL staff project needs.	M	Ba	monitoring			T	T																**L**				
Fund/support fencing and off-stream water development to keep cattle from the direct access to creeks or rivers.	M	Ba	bacteria		T	**L**																					
Fund/support a basin-wide water quality effectiveness monitoring program.	M	Ba	monitoring		T	**L**																					
Lab staff should work with Basin Coordinators to assemble NARS data by basin and discuss how the data may be used to guide future work at DEQ.	M	St	landuse			T	X															**L**					
Coordinate with permittees, staff, and other agencies in addressing water quality concerns related to the Pacific Connector Natural Gas Pipeline	M	Ba	Thermal; cumulative effects				T			T		T							T				T			T	**L**
Obtain LiDAR data for the Umpqua Basin to more accurately and efficiently collect surface water flowlines, landslide, road, bare earth elevation and vegetation height data across all land uses and ownership class.	F	Ba	TMDL implementation, thermal, turbidity			T	**L**																				
Develop TMDLs to address the spawning season low dissolved oxygen found in the main stem river and tributaries throughout the Umpqua Basin.	F	Ba	dissolved oxygen; TMDL development			X	**L**																T				
As recommended in the National Research Council 2009 Urban Stormwater Report, the TMDL program will consider using stormwater flow, or a surrogate such as impervious cover, as a measure of stormwater loading since it is a more straightforward way to regulate stormwater contributions to waterbody impairment.	F	St	TMDL development				**L**			T		T															
Consider developing a screening tool for small hydro project review, instituting centralized record keeping, and notify or consult with appropriate Basin Coordinators when applications are received.	F	St	record keeping			T													**L**					X			
Increased monitoring of toxic pollutants (personal care products and other emerging contaminants) in the vicinity of high density onsite and biosolids sites, including assessment of the impacts to surface and groundwater.	F	St	toxics				X	X	X			X	X	X	X	X	X							**L**	X			
Include groundwater monitoring as part of the toxics monitoring program for the Umpqua to evaluate the presence and distribution of toxics, both naturally occurring and those that may be human influenced as the result of industrial, municipal,	F	Ba	toxics						T															**L**				

Identified Actions & Primary Programs Lead (L) = responsible for implementing action Team (T) = involvement is required to implement action Consult (X) = decision and/or action will impact the program --- (Note: Continual foundational program activities were not included in the table, refer to the action plan for more information)	**Timeline** C = current Near Term (N) = next 2 yrs Mid Term (M) = 2 - 4 yrs Far Term (F) = 4 - 6 yrs Long-term (LT) > 6 yrs	**Scale** State (St) Basin (Ba) Subbasin (Sub) Watershed (Wa)	**Water quality or process concern**	CWSRF	319	Non-point Source	TMDLs	Drinking Water	Groundwater	Permitting	Industrial Permits	Municipal	Stormwater	Pretreatment	Biosolids	Water Reuse	On-site	UIC	401 hydro	401 dredge/fill	Assessment	Standards	Monitoring	Data Management	OCE	OCO	RST
or agricultural processes.																												
Design and conduct an outreach and education plan based on groundwater monitoring results. Present groundwater protection and domestic drinking water information at various residential venues.	F	Ba	BacT; nutrients; toxics			T		T	**L**													T			X	
Use raw drinking water turbidity data to better characterize upstream impacts, (e.g. from forest management practices, roads, or agricultural land uses) and help prioritize technical assistance and restoration project efforts.	F	Ba	nps			X	X	**L**														T				
Investigate the use of biological assemblages as an element for use in effectiveness monitoring studies and/or assessment monitoring. Surveys should be repeated at the frequency needed to quantify temporal variability and as an indicator of trends (improving or declining conditions) in the aquatic life use.	F	Sub	effectiveness monitoring; aquatic life			T	T															**L**				
Align biomonitoring work with TMDL effectiveness monitoring. Use biological indexes as the method to indicate change in the watershed conditions and beneficial use support. Lab staff and basin coordinator need to evaluate watershed limiting factors resulting in poor biological conditions. DEQ needs to work with partners (BLM, Forest Service, and other agencies) to obtain data for future assessments.	F	Wa	Aquatic life			X	**L**															T				
Bolster the groundwater monitoring component of the toxics monitoring program in the Umpqua Basin. If funding and partners are available, augmenting previous work performed by the Drinking Water Protection Program.	F	Ba	Toxics; DW			X		T	T													**L**				
Fund/support septic system maintenance and repair education and outreach program.	F	Ba	nutrients; bacteria; education	T	T	T	T	T									**L**									
Develop approaches to address sedimentation and nutrient loading; this may include applying assessment benchmarks for parameters with narrative criteria.	LT	Ba	sediment; nutrients			X	**L**														X	X	X			
Toxics monitoring data assessment is needed to address the numerous (423) Category 3 (insufficient data) segments. Additional monitoring may be needed.	LT	Sub	Toxics			X	T																**L**			
TMDLs (or other plans) need to be developed for toxic substances. There are 32 stream segments in the Umpqua Basin on the Category 5/303(d) list for toxic substances, many of which are elemental metals. Certain segments require additional data and/or analysis to perform source assessment and determine appropriate load allocations.	LT	Sub	Toxics; TMDL development			X	**L**																T			
Direct measurements of toxics affecting shellfish or other invertebrates in Winchester Bay needs to be investigated further.	LT	Sub	Toxics, shellfish			X																	T			
Coordinate with Army Corps to obtain Nationwide permit information, and initiate tracking at the subbasin level by activity for “discharge of fill material” for miles of ecological restoration, channel restoration, and fish passage.	LT	St	habitat																	**L**				X		
Collect data to assess transport of contaminants via groundwater inputs to surface water.	LT	Sub	nutrients; toxics			X	X	X	T					X									**L**				

Appendix B: Umpqua Basin Geology and Groundwater

B.1 Umpqua Basin Geology

Within the Umpqua Basin are located parts of four distinct geomorphic provinces. They include the High Cascades, Western Cascades, Klamath Mountains, and the Coast Range. Each province is characterized by a more or less unique suite of rocks which in turn is responsible for a particular topographic expression, mineral composition, and resultant water quality of an area.



B.1.1 Geology and Water Quality

The mineral composition of a geologic province plays a critical role with water quality of aquifers and associative stream segments of sub-basins. For example, when exposed to precipitation, the marine sediments in the Coast Range will generate significant amounts of very fine grained sediments that can choke gravel beds in streams and clog up drinking water intakes. Similar results can be expected in the upper reaches of the Umpqua Basin where unconsolidated ash and pumice deposits are located. Special care must be employed in these areas to prevent aquatic habitat destruction.

B.1.1.1 Klamath Mountain Terrain

The oldest rocks in the basin are Mesozoic in age (~250 million years) and found in the Klamath Mountains located mostly in the southern part of the basin. They consist primarily of marine sediments and volcanic rocks and have a composite thickness of about six miles.

The rocks of the Klamath Mountain province were developed over 250 million years ago as oceanic island groups (archipelago islands) and oceanic crust. Much of the ocean crust and island mass was then thrusted onto and over the continent and secured with intrusive molten rock (granite) during the process. Based on the number of terranes identified in the Klamath Mountains (a terrane is a rock mass that was formed in one place, became mobile, and then accreted/attached to another terrane by plate tectonics), this activity occurred at least a dozen times over the course of a 100 million years.[50] As such, the geology of the Klamath province has much more in common with Oregon's Blue Mountains and California's Sierra Nevada Mountains than any of the adjacent mountains or provinces.

The processes that led to the creation of the Klamaths also enriched the subsurface with gold, copper, nickel, chromite and other metals. The metal content of the Klamaths has had a significant effect on the geochemistry of the groundwater. Although there have been relatively few groundwater studies in the Klamath Mountain region, a case can be made for the natural groundwater quality of some areas having elevated levels of arsenic, fluoride, nickel, chromium, iron, and manganese.

B.1.1.2 Coast Range

The Umpqua Basin portion of Coast Range is truncated toward the west, but in general follows the ridge lines between the Coos, Coquille, and Rouge River Basins to the south and southwest and the Siltcoos and Siuslaw River sub-basins to the north. Current research indicates the Coast Range (like the Klamath terranes) began as an ocean island chain that collided with North America Plate more than 60 million years ago during the Tertiary period. In the Umpqua Basin, the Coast Range is 30 to 40 mile wide with an average elevation of 1,500 feet.

As inferred above, the Coast Range overlies an active subduction zone called the Juan de Fuca plate. Most of the mountains within the Coast Range are composed of Tertiary pillow basalts and breccias that indicate they were deposited underwater during a period of intensive volcanic activity. The basalts are often rhythmically inter-bedded with seafloor sandstone and siltstone sediments that were then uplifted, contorted, and folded as they collided with the continental plate. These accreted oceanic volcanic sediments, interspersed with the extensive marine sandstones and siltstones, are often contorted and tilted at high angles and in general exceed four miles in thickness. Deltaic deposits are also locally present and Holocene to late Pleistocene age (between 2 million and 10,000 years) dune fields overlie the older marine strata along the coast.

Other geologic features observed are mainly the result of erosion and climate forces that carve steam beds and valleys out of the rock formations during tectonic uplift and sea level fluctuations that occurred during the Pleistocene. As with the older Klamath accreted terranes, the Coast Range composition of pillow basalt flows and inter-bedded marine sediments have a significant amount of brackish material remaining between flow zones and in the sedimentary portions. As such, the groundwater pumped from these zones in some locations can be salty and often unsuitable for domestic consumption.

[50] In Search of Ancient Oregon, Ellen Morris Bishop

Continued geologic activity during the late Pleistocene (150,000 to 12,000 years ago) has led to the development of marine terraces along the Oregon coast. These features provide evidence of historic sea level changes and indicate zones of structural uplift along the coast that is likely the result of continued movement along faults.[i] The western edge of the Coast Range also includes coastal headlands broken with fairly regular distribution of estuaries, shallow bays, beaches, and sand dunes. The main stem of the Umpqua River flows through the Coast Range into broad estuaries,[51] where the saltwater tides often reach 20-30 miles upstream.

The Coast Range Mountains have soils of varying depth, but sometimes the soils are only a thin veneer that may be inches to a few feet in depth. The intense precipitation that occurs in the coastal area often soaks through the soil. The water then encounters a less permeable zone and runs along this layer until it surfaces as natural seeps. In steep terrains, these shallow surface flows often lead to saturated soil slides.

Some formations in the Coast Range contain important source rocks for the production of hydrocarbons. Coal and natural gas deposits were exploited in southern and northern portions of the range, but economic concentrations have yet to be encountered in the Umpqua Basin. Although sub-economic, these deposits, especially when disturbed, can degrade local surface and groundwater quality.

B.1.1.3 Western Cascade Province

The Western Cascade Province is composed of Oligocene through late Eocene (56 to 23 million years) andesitic breccias and fluvial sedimentary rocks. Silica ash-flow tuffs, and lesser amounts of volcanic flow rocks composed of andesitic to basaltic compositions, and Miocene (20 to 5 million years) andesitic flow rocks and lavas are exposed in the headwaters of the North and South Umpqua Rivers. The variable composition between andesite and basalt provides a rough estimate of the amount of continental plate rock that was re-melted with basaltic oceanic plate rock, as the ocean plate subducted beneath the continental plate. The Western Cascade Province extends through the eastern third of the basin and abuts the High Cascade Province.

Comprehensive water quality studies are rare in the province. Even so with the exception of runoff from weakly mineralized zones in the Bohemia Mining district in Lane County, water quality of the Western Cascade Province appears to be exceptionally good. Arsenic concentrations are occasionally detected locally in groundwater, but most often, secondary contaminants (iron and manganese) are a greater concern. The same is true for bacterial impacts, as they are most often local problems associated with failing septic systems.

B.1.1.4 High Cascades Province

The geologically youthful High Cascades Province located to the east of the Western Cascades consists of a series of Plio-Pleistocene (between 5 and 2 million years) flows of basalt and basaltic andesite that are spotted with several late-Pleistocene volcanic peaks and cinder cones. The province is mantled locally in the south with tan to beige colored Holocene ash and pumice deposits derived from the eruption of Mount Mazama at Crater Lake.

[51] A Brief Summary of Oregon Coast Range Geology, Geomorphology, Tectonics, and Climate Geology 4/510: Tectonic Geomorphology, University of Oregon 2008

As with the Western Cascade Province, in-depth water quality studies have not been a focus for this region. The glacially carved basins of the province are littered with numerous fresh water lakes, ponds, and marshes that represent some of the most pristine conditions on the planet. Locally, however, adverse risks to these exceptionally clean waters can result when conventional, large scale septic systems are installed without regard to the unique conditions that have created these high quality waters. As waste water treatment projects are required in the future, they should be designed in accordance with the best available technologies and not rely on dilution to meet water quality standards at the nearest downstream receptor.

B.2 Umpqua Basin Hydrology

The Umpqua Basin covers approximately 4,660 sq mi. Watershed divides that delineate the basin are found at the crest of the High Cascade range to the east, in the Coast Range to the northwest, and Klamath Mountains to the south. The basin is drained by the north and south branches of the Umpqua River, originating near Diamond Lake and then meandering through the basin lowlands to the Pacific Ocean. Major tributaries include Cow Creek, from the south and Calapooya Creek from the east.

The basin varies from alpine conditions in the Cascade Range to extremely moist rain-forest-type conditions in the Coast Range. Annual precipitation ranges between 50 inches at Diamond Lake, to 34 inches at Roseburg, to 80 inches at Reedsport[52]. Runoff from the Cascades and Coast Ranges feeds the rivers year round. Groundwater recharge remains unknown at this time.

B.2.1 Hydrogeologic Units

Major geologic units exposed in the basin, from oldest to the youngest, include older Mesozoic intrusive, metamorphic, and sedimentary rocks, overlain by younger Mesozoic basalt and tuffs, and finally recent alluvial and landslide deposits less than two million years old. The complexity of the Umpqua Basin geology reflects a similarly intricate groundwater system with local pockets of productive aquifers within generally unproductive aquifers. These units are grouped and discussed in the following sections.

B.2.1.1 65 to 200 Million Years (Cretaceous and Jurassic) Klamath Province

The oldest rocks exposed in the Umpqua Basin are Jurassic marine sequences which include metamorphic, volcanic, and sedimentary units **(**Metamorphism is a process that means *change in form*. Metamorphic rocks arise from the transformation of existing rock types that are subjected to heat and pressure causing physical and/or chemical change. The original rock may be sedimentary, igneous or another older metamorphic rock). Metamorphic and sedimentary rocks extend in a northeast trending band west of Myrtle Creek. These units are generally of low permeability. Wells drilled to access these rocks produce yields that can only support small domestic needs. Granitic plutons (a pluton is a body of crystallized intrusive igneous rock) are exposed east of Myrtle Creek and Azalea. In general, water only moves through secondary porosity features such as fractures, joints, and weathered areas in this unit. Most often, granitic intrusions are not likely to support large aquifers due to their low permeability, although locally, testing may reveal small, but exceptionally permeable areas.

[52] Oregon Climate Service

B.2.1.2 2 to 65 Million Years (Tertiary) Marine Sediments

The Coast Range in this area is composed of Paleocene through Miocene marine sequences that are often up to 15,000 feet thick. They range from thin to thickly bedded and are generally composed of sandstone with high amounts of mica and feldspar, volcanic air-fall debris, deep-sea marine basalts, turbidities (deepwater sediments) and deltaic fan deposits. Although wells drilled into these units are capable of supplying domestic or livestock water, they can be brackish and thus, not widely used for large scale municipal or irrigation needs.

B.2.1.3 5 to 34 Million Years (Oligocene and Miocene) Western Cascade Volcanics

The Oligocene through Miocene volcanics generally have low permeabilities with hydraulic conductivities ranging between 0.1 to 10 ft/d. Wells drilled into these formations tend to have low yields. Total thickness of the geologic units probably doesn't exceed five miles.

B.2.1.4 Present to 2 Million Years (Quaternary) Sediments

Erosion of the region by energetic rivers has transported and deposited unconsolidated sediments into the otherwise narrow valleys of the basin. Quaternary alluvial units are widely used by shallow domestic and irrigation wells and represent the most productive aquifers in the basin with hydraulic conductivities ranging from 20 to 600 ft/d. These unconfined aquifers may be useful for Aquifer Storage and Recovery (ASR) in areas with suitable transmissivity, source water quality, and availability. The well density within similar aquifers requires additional scrutiny to assure ASR stored water security due to the potential for discharge into surface water.

B.2.2 Tectonic Structure Influencing Groundwater Flow

Broad tectonic structures in the Umpqua Basin include the Coast Range up-warp where the marine sedimentary sequences referenced earlier have gradually buckled upward in response to the coastal subduction zone. This structural feature likely affects groundwater recharge in the valleys by channeling infiltrated Coast Range precipitation down and toward inland lowlands and coastal valleys.

Faulting in the central part of the basin has resulted in unpredictable groundwater flow patterns, especially between Azalea and Roseburg. Thin bands of metamorphic and sedimentary rocks are truncated by faults and related features. These structural components may function as boundaries in some areas and provide preferential flow paths in others.

B.2.3 Water Availability - Aquifer Storage and Recovery

Site specific investigations are essential to determine if an aquifer recharge project is feasible technically, economically, and environmentally, however initial results indicate few communities possess necessary components for successful ASR projects.

B.2.3.1 Reedsport

Reedsport is the largest coastal town in the Umpqua Basin (~4,300 people (U.S. Census data,2004) and is situated on the Umpqua River. The city holds water rights to 35 cfs (85,645 m^3/d) from Clear Lake which is the

main source for municipal water. A large capacity domestic well was selected to represent aquifer suitability for potential ASR application. The well draws water from Quaternary sands and gravels and based on volumetric analysis, aquifer storage is sufficient to inject up to half of the city's 35 MGD treatment plant capacity for 120 days. Reedsport's location, however, could result in discharge of stored water to the river before it could be used for municipal use. The hydraulic connection between surface and groundwater requires further examination.

B.2.3.2 Drain

Drain, a historic timber community on Elk Creek is located east of the main stem of the Umpqua River. This city of about 1,000 people (U.S. Census data, 2004) currently has 5 cfs (12,235 m^3/d) surface water right from the Bear Creek Reservoir. A low yield well owned by the city draws water from Tertiary marine sandstone aquifer located between 26 and 195 feet below ground surface. Based on specific capacity data from this well, ASR does not appear possible at this location.

B.2.3.3 Sutherlin

Located in the north-central Umpqua Basin, the historic logging town of Sutherlin sits south of the Calapooya Creek. Low permeability Tertiary sediments underlie the town, which currently uses surface water for municipal supply. The city of ~7,300 people (U.S. Census data, 2004) has surface water rights to 4 cfs (9,788 m^3/d) from Calapooya Creek. No municipal wells are present, but based on domestic well production from Tertiary marine clay and sandstone aquifer situated between 19 and 185 feet below ground, transmissivity estimates indicate the aquifer may be unsuitable for ASR production.

B.2.3.4 Roseburg

Roseburg is the largest community (population ~21,000 U.S. Census data, 2004) on the Umpqua Basin and is located on the south Umpqua River. The city has surface water rights and a water treatment plant with a 12 MGD (45,420 m^3/d) capacity. As with Sutherlin, Roseburg municipal water is supplied from surface water, so ASR potential is based on domestic well assessments. Water from the domestic wells was drawn from Tertiary marine sandstone and basalt at depths between 19 and 150 and from Eocene marine basalt at depths between 38 and 350 feet. The shallower wells appeared unsuitable for ASR, however the deeper well calculated values that were ideal for ASR, given other appropriate parameters were met. Volumetric analysis indicated aquifer storage was sufficient to inject up to ½ the treatment plant's capacity for 120 days. The site may be unsuitable, however, due to the high density of other domestic wells that use the same aquifer.

B.2.3.5 Myrtle Creek

The town of Myrtle Creek is situated south of Roseburg, on the South Umpqua River. Originally founded during the gold rush of the 1940's, the town soon transformed into a timber community. Myrtle Creek has surface water rights for 20 cfs (48,940 m3/d) from springs that are tributaries to the Umpqua River (OWRD WRIS, accessed 2007). Population increased from 3,000 to 3,500 between 1994 and 2004 (U.S. Census data, 2004). The city of Myrtle Creek does not own municipal wells, so a domestic well was selected for ASR suitability. The domestic well draws water from 100 to 200 million year old granite at depths from 17 to 100 ft (5 to 30 m) below the surface. When installed, the well yielded 1.5 gpm. Transmissivity estimated from specific capacity is 300 ft2/d (30 m2/day), which implies that Myrtle Creek may not be a likely site for ASR.

B.2.3.6 Canyonville

Located near the southern edge of the Umpqua Basin, the historic settlement of Canyonville sits at the confluence of Canyon Creek and the South Umpqua River. The town was a resting place for settlers moving in

wagons north from Azalea, Oregon, and later served as a supply for gold miners and packers. The town currently has surface water rights to 3 cfs (7,341 m3/d) from Canyon Creek (OWRD WRIS, accessed 2007), and domestic wells provide local water supply. Population decreased from 1,397 to 1,219 between 1994 and 2004 (U.S. Census, 2004). No municipal wells were located by this study.

A domestic well (DOUG 875) utilizes a decomposed Cretaceous and Jurassic granite aquifer (KJg), and most likely represents the local granite weathered to saprolite, which has a higher permeability than the surrounding, less decomposed granite (McFarland, 1983). Open intervals from depths of 57 to 97 ft (17 to 30 m) below the surface yields 5 gpm (27 m3/d; OWRD well log database, 2007). Transmissivity estimated from specific capacity is 300 ft2/d (30 m2/day). This is far below the ideal range of 5,000 to 25,000 ft2/d (465 to 2,323 m2/d) for ASR, and indicates the aquifer may be unsuitable for ASR.

Volumetric analysis indicates the aquifer storage is sufficient to inject ½ of the municipality's surface water right for 120 days. Brown's site rating system finds Canyonville has 64 percent of optimal ASR parameters. Although the site scores well for most factors, the low transmissivity may negate other good results. AR is not likely to succeed in surficial marine sediment aquifers, although small alluvial aquifers along Canyon Creek may be suitable depending on vertical permeability, water quality, and hydraulic connection to surface water.

B.2.4 Landfills

There are 42 permitted landfill facilities in the Umpqua Basin. Thirteen of the landfills have been closed and terminated. Seven of the twelve industrial wood waste and or ash disposal sites are closed and twelve of the facilities are transfer stations that collect municipal type waste and transport them to the Roseburg Landfill. In general, evidence of groundwater impacts from landfills that have conducted groundwater monitoring indicates the impacts are limited to zones around the landfill.

In Riddle, the Roseburg Forest Products (RFP) Industrial landfill receives ash from their mills that operate wood burning boilers located in Dillard, Riddle, and Coquille. The current landfill cell is lined and leachate is collected and treated through evaporation and adsorption into logs by spray application on their log deck. An older ash cell at the facility was not lined to protect groundwater and is currently in the closure process. Although it is likely some contaminants exist at levels greater than the Maximum Contaminant Level (MCL), thus far, groundwater monitoring has not been implemented in the area of the closed landfill.

The RFP Dillard Industrial landfill is composed mostly of ash with some wood waste and is currently undergoing stabilization assessments, as geotechnical monitoring has indicated slope failure is occurring. A new cell is under construction adjacent to the north side of the existing fill. To help stabilize the old cell, ash waste will be removed from the upper portions and placed in the new cell.
The Roseburg Landfill is the only permitted municipal landfill in Douglas County. Groundwater monitoring indicates some constituent levels exceed the maximum contaminant level (MCL), however, the contamination appears to remain near the landfill.

A second municipal landfill located near Reedsport was closed in 1996. Water quality impacts due to spray irrigation of landfill leachate have been diverted by discharging the leachate into the brackish water of Scholfield Creek.

B.2.5 Metal Mining Sites

Based on the Department of Geology and Mineral Industries (DOGAMI) reports, Douglas County has historically been one of the richest mineral producers in the state. Even at low concentrations, some metals are highly toxic to aquatic ecosystems. As such, metal mining activities, by their nature, often have a propensity to generate significant amounts of pollution, if not managed appropriately.

Geologically, the emplacement of metal deposits over millions of years is commonly associated with sulfide minerals that, when exposed to water, can generate highly acidic (low pH) conditions. Acidic waters are highly efficient at stripping metals from veins and disseminated deposits. Drilling, blasting, and the removal of ore create fresh pathways that expose underground deposits to groundwater. On the surface, the sub-economic material removed from a mine is placed in waste dumps that, if improperly managed, can be exposed to precipitation and surface water. Both surface and subsurface deposits exposures to water often result in the generation of acid mine drainage (AMD), contaminated aquifers, and degraded environments downstream.

According to the DEQ Environmental Cleanup Site Information (ECSI) database, there are currently eleven mining facilities in various stages of cleanup listed for Douglas County.

B.2.5.1 Glenbrook Nickel Mine

During the 1960's and 1970's, the Nickel Mountain Mine, located northwest of Riddle yielded more than a million tons of ore annually. Glenbrook Nickel Co. decommissioned its mining and smelting complex in 2000. In 2002, the State of Oregon recognized the outstanding reclamation work done at the Nickel Mountain Mine and nominated the company for a special citation of excellence. In 2003, Glenbrook received a mine reclamation award for restoring the Lower Ore Body side hill cut to a level far exceeding statutory requirements. Reclamation of the 64-acre hill cut has been underway since 1999. Five ponds connected by rock-lined channels were constructed to properly manage perennial water flow on the mountain. Invertebrates, amphibians, and waterfowl have colonized the pond system and renewed wetlands.

B.2.5.2 Formosa (Silver Peak) Mine

The Formosa Mine, also known as the Silver Peak or Silver Butte Mine was discovered in 1910. The mine operated periodically during the 1900s, with the majority of production occurring between 1989 and 1994 under the ownership of Canadian mining company Formosa Explorations Inc. Prior to Formosa's involvement (1926 – 1937), the mine produced over 6,600 tons of ore containing 735,600 pounds of copper, 21,980 ounces of silver, and 490 ounces of gold. Zinc production equaled that of copper, but was not paid for at the time. During Formosa's participation, copper and zinc was reported to have been produced at a rate of 350 to 400 tons per day. When the mine closed in 1994, Formosa backfilled the mine workings with mill tailings, crushed ore, and limestone. Acid mine drainage from the two adits was directed to a talus slope. Approximately 20,000 cubic yards of low-grade ore were placed into a lined cell at the site (referred to as the "encapsulation mound"). After the reclamation was completed, Formosa filed for bankruptcy. In 1997, it was discovered that the acid mine drainage control system had failed, and acidic wastes were discharging to Middle Creek and South Fork Middle Creek.

Middle Creek is a tributary of Cow Creek, which is a source of drinking water for the City of Riddle. The two Middle Creeks are considered habitat for threatened Oregon Coast coho salmon and steelhead. Monitoring has indicated that 18 miles of the two creeks have been severely impacted by acid mine drainage from the Formosa Mine.

In 1999, DEQ began working with the federal Bureau of Land Management to investigate and clean up the site. BLM agreed to conduct a remedial investigation at the site. The remedial investigation was completed in May 2000. After declaring the mine an orphan site by DEQ in 2000, DEQ completed an interim removal action to address the acid mine drainage. The encapsulation mound was capped with a temporary plastic liner. Acid mine drainage from the two adits was routed away from the headwaters of Middle Creek and back to the talus slope. DEQ and BLM completed a Feasibility Statement in January 2005, which recommends a phased cleanup approach beginning with in situ treatment technologies. Total cost of cleanup is estimated to range between $3M and $21M. DEQ and BLM are pursuing various funding sources to begin implementation of cleanup actions, while monitoring the effectiveness of the existing interim removal action.

The site was added to the national priorities list in 2007. The acid rock drainage flowing from the mine and mine materials have severely degraded Middle Creek and the South Fork of Middle Creek, affecting macro-invertebrates, resident fish, coastal steelhead trout, and Oregon coastal Coho salmon. EPA has completed a remedial investigation for Operable Unit 1 of the site. A feasibility study to evaluate cleanup alternatives will be available in 2013.

B.2.5.3 Levan's Ledge Mine

The Levans' Ledge Mine was noted as one of the principal mines of the Silver Peak Mining District in Douglas County. It is about 3.5 miles southwest of Canyonville, Oregon. The elevation is approximately 1,700 feet above sea level. Limited historical and operational history is available for the Levan's Ledge Mine Site. The dates of production were not documented; however, estimates of between $70,000 and $80,000 were reported in the "early days". A stamp mill, with amalgamation plates, was constructed and use at the site [Gold and Silver in Oregon, 1968].

Ore minerals reported to be present at the former Levan's Ledge Mine are pyrite, chalcopyrite, and gold. No data was available to DEQ to determine actual concentration of metals or processing chemicals at the site, or the presence of acid mine drainage.

Surface Water: The area topographic map shows the site likely drains to Jordan Creek which is a tributary to the South Umpqua River approximately 3 miles downstream. According to the Oregon Department of Fish and Wildlife Natural Resources Management Program, Jordan Creek provides habitat for Cutthroat Trout, Coho Salmon and Winter Steelhead. It is not currently known if acid mine drainage is present at the site.

Groundwater: According to the Oregon Water Resources Dept., there are 2 wells north of the site, however, the exact location of the residence(s) associated with these wells is unknown. The current use and status of the wells is unknown and as such, the former mines impact on the general groundwater quality is unknown.

B.2.5.4 Bonanza and Nonpareil Mining area

The Bonanza/Nonpareil mercury mining area lies a few miles east of Sutherlin. It includes a group of five mines along a reverse fault zone. The ore bodies are generally localized in sandstones that are overlain by impervious layer of shale. The Bonanza Mine was by far the largest producer of quicksilver (mercury) in the state with a total of 39, 540 flasks. The deposit was discovered in the 1860's, was mined to a depth of 1,450 feet, and was closed in 1961. The lower levels are flooded.

The Bonanza Mine was operated under various owners until its final closure. The mine was ranked the second largest producer of mercury in the United States for the year 1940. The total mercury production for the mine was recorded at 1,500 tons. The process of extracting mercury from ore at the site included crushing the rock and feeding the crushed ore to the top of a vertical furnace. As the ore moved down into the furnace, it was

heated to vaporize mercury from the rock. The vapors were then condensed in a series of pipes, similar to a radiator, until the mercury dropped out into pans at the bottom of the pipes. Ore exiting the furnace was loaded into cars and carried to the tailings dump.

In a 2000 site investigation, the U.S. Environmental Protection Agency (EPA) identified unsafe levels of arsenic and mercury, confirming that the site posed significant threats to public and environmental health. In September 2000, DEQ retained a state contractor to conduct a Removal Assessment at the site. Over 40 soil samples were collected and analyzed. High levels of mercury (up to 12,000 ppm) and arsenic (up to 300 ppm) were detected throughout the former mill area and along the adjacent hillside, to a depth of 3-4 feet below ground surface (bgs).

Based on these results, DEQ determined that an immediate removal action was necessary to reduce the exposure of area residents to high levels of metals in the soil. In late September, DEQ removed approximately 200 cubic yards of contaminated soil, leaving less than 230 ppm mercury in the remaining, unexcavated soil. DEQ also constructed erosion and runoff controls to minimize the amount of contaminated material washing into Foster Creek. Arsenic and mercury contamination remain in soil and sediments throughout most of the site at levels exceeding health-based standards for residential exposure. The site continues to pose a significant risk to the local residents, and to aquatic organisms in nearby streams that receive runoff from the site. The level of arsenic still present at Bonanza Mine is up to 100 times safe levels for residential exposure. Mercury is present at the mine site at up to 50 times safe levels for residential exposure. Mercury contamination in sediment from nearby Foster Creek is over 100 times above concentrations above which statistically significant biological effects always occur.

DEQ designated the Bonanza Mine as an Orphan Site in August 2002. Investigation and cleanup will proceed as funding becomes available. Weyerhaeuser Company is leading an investigation of tailings from the Bonanza Mine that were used to construct a now-abandoned 17-mile railway grade known as Red Rock Road in the Sutherlin Valley (ECSI #1833). The mine tailings are considered a potential source of low level metal contamination from mercury and arsenic.

B.2.5.5 Elkhead Mine

The former Elkhead Mine is located in the foothills of the Cascade Mountains in the upper portion of the Elk Creek Watershed approximately 7 miles southeast of Yoncalla at an elevation of about 800 to 1,000 feet above mean sea level (amsl). The small community of Elkhead is located 1.5 miles southwest of the site.

Production of mercury at the former Elkhead Mine was conducted using a crushing system, a furnace and condenser. Vaporized mercury was captured in a condenser and concentrated, and stored in flasks. Mercury was then shipped off-site as a commodity to various buyers. Much of the mercury was used as an amalgamation tool at nearby gold mines in the earlier years.

Waste material from the furnace (tailings) was deposited on site, usually at the end of the conveyor from the furnace. Anecdotal evidence suggests that some of the tailings may have been used as aggregate off-site. Historical information suggests that even though the furnace was revamped several times, the furnace location remained the same throughout the years of operation. Tailings were pushed into a ravine at the end of the conveyor and leveled.

During a 1995 assessment conducted by DEQ, several soil samples were collected from the area around the smelter/furnace, the filled ravine, the tailings piles, and roadways around the smelter/furnace. Results for total mercury ranged from 23.2 to 424 mg/kg and were above the EPA residential land use PRG of 23 milligrams

per kilogram (mg/kg). Five soil samples with elevated total mercury concentrations were analyzed for leachable mercury. The results indicated that mercury in soil at the site was unlikely to leach into surface water or groundwater at concentrations of concern.

Surface water samples collected throughout the Elk Creek drainage during low-flow conditions had total mercury concentrations of 0.75 to 3.23 nanograms per liter (ng/L). These concentrations are below the 12 ng/L level established for protection of freshwater aquatic life for long-term (chronic) exposures. The highest concentration was found in Lane Creek upstream of the confluence with the unnamed tributary below the site.

Surface water samples collected during high flow conditions from the same locations as described above had total mercury concentrations of 3.52 to 26.1 ng/L. The highest concentration was detected in the unnamed tributary below the site, which incorporates drainage from the mine.

Fish tissue was analyzed in 1987 and 1992 on various fish species in the watershed, including the drainage above and below the former Elkhead Mine. Mercury levels in fish tissue ranged from 0.045 to 0.70 mg/kg, but it is not possible from these data to determine whether the former Elkhead Mine was the source. Mercury detected in the fish did not exceed the EPA screening value of 0.60 mg/kg or the U. S. Food and Drug Administration action level of 1.0 mg/kg in place at that time. The current EPA screening level for mercury in fish tissue is 0.35 mg/kg.

Other potential sources of contamination at the site could include petroleum products associated with fueling operations for the furnace, PCBs, and other metals, especially arsenic, which is commonly associated with mercury mine sites. Acid-mine drainage is not suspected as a problem at the former Elkhead Mine, due to the reported low sulfide content of the ore. Field inspection and possibly sampling would be necessary to confirm this.

Residences are located at the former Elkhead Mine site and neighboring property. Residents could be exposed to soil through direct contact or incidental ingestion during gardening or other outdoor activities. Mine tailings and soil around the former mill building contain mercury above screening values. There may be other small piles of tailings or exposed soil in the excavations or adit entrances that have elevated concentrations of mercury. Because mercury has been identified in soil at concentrations above screening values for a residential site, this is the pathway of most concern at the former Elkhead Mine.

Surface Water: Drainage from the site is directed to Lane Creek, Elk Creek and eventually the Umpqua River. Site-related surface water contamination (if any) could impact ecological receptors such as fish and wildlife, or humans who consume fish.

Groundwater: Residents at the former Elkhead Mine site and surrounding properties use groundwater for domestic purposes, e.g., drinking, bathing and other uses. Due to the low solubility of mercury, elevated concentrations in groundwater are not expected. Arsenic in groundwater may be of concern, but may or may not be related to activities at the mine (background or natural arsenic concentrations in groundwater may be elevated in the area).

Air: Inhalation of dust from contaminated soils is also a concern. It is possible that much of the contaminated soil is vegetated or partially vegetated, which would limit the potential exposure through this pathway. However, visible dust generated from tailings piles or other known contaminated soil piles can be a significant exposure pathway.

B.2.5.6 Poor Boy Mercury Mine

Also known as the Monte Carlo Claims, the Poor Boy has an open adit, 48 feet in length and is situated immediately adjacent to Forest Service Road 2827. A second adit enters the north bank of Budd Creek near creek level approximately 2000 feet west of the adit along Forest Service Road 2827. The Forest Service was unable to locate this second adit due to extremely heavy vegetation and steep terrain.

B.2.5.7 Gold Bluff Mine

The Gold Bluff Mine was discovered in the 1890's. Mines in the area produced gold, silver and copper. From the literature, H.Q. Brown of Nickel Mountain was the last known operator of the mine and processing mill. The operation reportedly only ran in the 1890's. [Gold and Silver in Oregon, 1968]. The Gold Bluff Mine was a gold, silver and copper mine. From the literature, the ore deposit was a 15-foot, iron-stained, bleached schist zone in foliated greenstone and serpentine with disseminated sulfides. A 50-ton processing mill was erected at the former mine. Total production of approximately $70,000 was reported for Gold Bluff in the 1890's [Gold and Silver in Oregon, 1968].

Widely spread sulphide mineralogy was reported for the site; however, at the time of the inspections, no evidence of acid mine drainage was observed associated with seep waters or Jordan Creek. Also, a 50-ton mill was reported to be located at the former mine; mercury is typically associated with ore processing at mill sites. No data was available for DEQ to determine actual concentration of metals or processing chemicals at the site

Surface Water: The area topographic map shows the site likely drains to Jordan Creek, a tributary of the South Umpqua River. According to the Oregon Department of Fish and Wildlife Natural Resources Management Program, Jordan Creek provides habitat for Cutthroat Trout, Coho Salmon and Winter Steelhead. It is not currently known whether acid mine drainage is present at the site, since the actual mine location was not found; however, if acid mine drainage is present, there is a potential for impact to Jordan Creek.

Groundwater: According to the Oregon Water Resources Department, no domestic wells are located in Section 5 of Township 31 South, Range 5 West. There are two wells listed in Section 32 of Township 30 South, Range 5 West, north of the site; however, the exact location of the residence(s) associated with these wells is unknown. Therefore, the current use and status of the wells are unknown. It is also unknown whether the former mine is impacting the general groundwater quality in the area.

B.2.5.8 Umpqua Mine

The historic Umpqua mine site is located approximately 6 miles north of Tiller, in Douglas County. The site consists of an abandoned mercury mine and processing plant that includes an open adit, wooden hopper, crusher, conveyor belts, rotary furnace, amalgamation plant, & diesel fuel tank, all situated near a tributary to Deadman Creek. The mine last operated in the early 1940s, and produced approximately 9 flasks of mercury. A site assessment determined that mercury-contaminated soil is present near structures of regional historical significance.

Mine waste samples analyzed from several locations within the Umpqua Mine in 1999 exceeded BLM risk management criteria for campers by greater than 20 fold. A preliminary estimate indicates that 50-150 cubic yards of contaminated material will need to be removed, contained, or isolated. Surface waters within the mine site exceeded State of Oregon standards for water and fish ingestion by 13 fold. Analysis of water quality samples indicated that mercury is being transported off-site approx. 400 ft to Stanley Creek, at levels twice the state's chronic standards for protection of aquatic life. Analyses of stream sediment samples indicate off-site

mercury transport 400 feet to Stanley Creek & 800 ft to Deadman Creek, where sediment mercury levels exceed State of Oregon Screening Benchmark Values by 15 fold & 30 fold, respectively. The observed levels of mercury in Stanley and Deadman Creeks could bioaccumulate in resident fish & exceed EPA recommended fish-tissue criterion for methylmercury. This criterion is considered a threshold for protecting human health.

A Brief Summary of Oregon Coast Range Geology, Geomorphology, Tectonics, and Climate
Geology 4/510: Tectonic Geomorphology, University of Oregon 2008

Appendix C: Public Water Supply Systems in Douglas County

Table C.1. Public water systems served by surface water in the Umpqua Basin

Note that Sutherlin's water system is listed more than once since they have intakes in different subbasins/watersheds.

(1) There are a number of independent public water systems that purchase water from the water systems listed and distribute it within their service areas. The total number of "wholesale buyers" is indicated and the wholesale buyer customer populations are included in the total population served

(2) System Type

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

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

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

NP - "State Regulated Water System (NP)" means a public water system, which serves 4 to 14 service connections or serves 10 to 24 people. Monitoring requirements for these systems are the same as those for Transient Non-Community water systems.

Subbasin	Watershed	PWS ID	PWS Name	Drinking Water Source Name	City	Total Population Served (1)	Num of PWSs Served (1)	System Type (2)
North Umpqua	Upper North Umpqua River	01012	PP&L-Toketee Village	Toketee Lake (North Umpqua River)	Idleyld Park	50	1	C
North Umpqua	Middle North Umpqua River	01091	USFS Steamboat Work Center	North Umpqua River	Roseburg	20	1	NC
North Umpqua	Middle North Umpqua River	94179	USFS Horseshoe Bend CG	North Umpqua River	Roseburg	80	1	NC
North Umpqua	Middle North Umpqua River	94508	Susan Creek Mobile Home Park	North Umpqua River	Idleyld Park	20	1	NP
North Umpqua	Little River	94255	Thunder Mountain Mobile Park	Engles River	Glide	20	1	NP
North Umpqua	Little River	01095	USFS Wolf Creek Job Corps	Little River	Roseburg	291	1	C
North Umpqua	Little River	92762	USFS Wolf Creek CG Umpqua NF	Little River	Roseburg	180	1	NC

North Umpqua	Lower North Umpqua River	00326	Glide Water Association	North Umpqua River	Glide	1200	1	C
North Umpqua	Lower North Umpqua River	05082	Lone Rock Court	North Umpqua River	Glide	14	1	NP
North Umpqua	Lower North Umpqua River	00847	City of Sutherlin	Cooper Creek Reservoir	Sutherlin	7995	2	C
North Umpqua	Lower North Umpqua River	00719	Umpqua Basin Water Association	North Umpqua River	Roseburg	8800	1	C
North Umpqua	Lower North Umpqua River	00720	City of Roseburg	North Umpqua River	Roseburg	28800	1	C
South Umpqua	Dumont Creek-South Umpqua River	01092	USFS Tiller Ranger Station	South Umpqua River	Roseburg	34	1	C
South Umpqua	Days Creek-South Umpqua River	00250	Milo Academy	2 intakes: South Umpqua River (06/01-10/31) and Lickey Creek (11/01-05/31)	Days Creek	195	1	C
South Umpqua	Days Creek-South Umpqua River	92139	Tiller Elementary School District #15	South Umpqua River	Days Creek	60	1	NTNC
South Umpqua	Days Creek-South Umpqua River	00169	City of Canyonville	Canyon Creek	Canyonville	1645	1	C
South Umpqua	Middle Cow Creek	00323	City of Glendale	4 intakes: Cow Creek, Section Creek, Mill Creek, Cow Creek (old intake)	Glendale	860	1	C
South Umpqua	Middle Cow Creek	92108	Fir Point Bible Conference	Deeds Creek	Glendale	150	1	NC
South Umpqua	Lower Cow Creek	00706	City of Riddle	Cow Creek	Riddle	2003	2	C
South Umpqua	Lower Cow Creek	00707	Lawson Acres Water Association	Cow Creek	Riddle	75	1	C
South Umpqua	Clark Branch-South Umpqua River	00549	Tri-City JW & SA	South Umpqua River	Myrtle Creek	3500	1	C
South Umpqua	Clark Branch-South Umpqua River	00548	Clarks Branch Water Association	South Umpqua River	Myrtle Creek	140	1	C
South Umpqua	Clark Branch-South Umpqua River	94300	Roseburg Forest Products - Dillard	South Umpqua River	Roseburg	2000	1	NTNC

South Umpqua	Myrtle Creek	00550	City of Myrtle Creek	2 intakes: South Umpqua River and Springbrook Springs A&B	Myrtle Creek	3460	1	C
South Umpqua	Deer Creek-South Umpqua River	00717	Roberts Creek Water District	South Umpqua River	Roseburg	6500	1	C
South Umpqua	Deer Creek-South Umpqua River	00957	Winston-Dillard Water District	South Umpqua River	Winston	8000	1	C
Umpqua	Upper Umpqua River	00276	City of Elkton	Umpqua River	Elkton	197	1	C
Umpqua	Calapooya Creek	00847	City of Sutherlin	Calapooya Creek Non-Pariel	Sutherlin	7995	2	C
Umpqua	Calapooya Creek	00581	City of Oakland	Calapooya Creek	Oakland	954	1	C
Umpqua	Elk Creek	00958	City of Yoncalla	2 intakes: Adams Creek and Wilson Creek	Yoncalla	1095	1	C
Umpqua	Elk Creek	00260	City of Drain	2 intakes: Bear Creek (Whipple Reservoir) and Billy Creek (Emergency)	Drain	1151	1	C

Table C.2. Public water systems served by groundwater in the Umpqua Basin

Notes:

Diamond Lake Lodge (PWS ID 92104) is listed more than once since it has wells/springs in different subbasins/watersheds.

This provides a summary of PWSs that were mapped as part of the Source Water Assessment program. Some NC and NP system types are not included.

(1) There are a number of independent public water systems that purchase water from the water systems listed and distribute it within their service areas. The total number of "wholesale buyers" is indicated and the wholesale buyer customer populations are included in the total population served

(2) System Type

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

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

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

NP - "State Regulated Water System (NP)" means a public water system, which serves 4 to 14 service connections or serves 10 to 24 people. Monitoring requirements for these systems are the same as those for Transient Non-Community water systems.

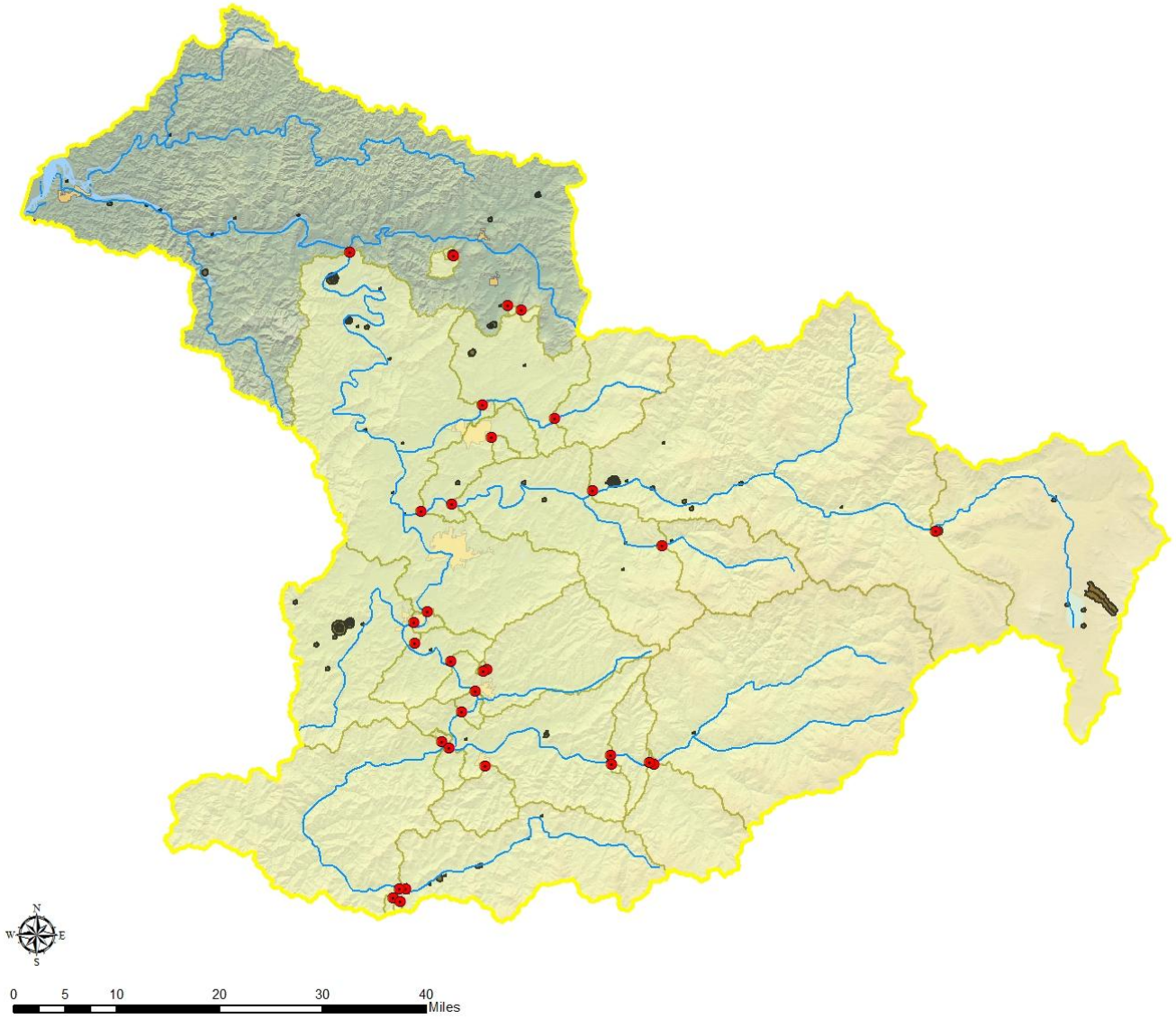
Subbasin	Watershed	PWS ID	PWS Name	City	County	Total Pop Served (1)	Num of PWSs Served (1)	System Type (2)
North Umpqua	Diamond Lake	92104	Diamond Lake Lodge/Resort	Diamond Lake	Douglas	180	1	C
North Umpqua	Diamond Lake	92758	USFS Diamond Lake Rec Area	Roseburg	Douglas	370	1	NC
North Umpqua	Diamond Lake	92869	USFS Thielsen View CG	Roseburg	Douglas	225	1	NC
North Umpqua	Headwaters North Umpqua River	92104	Diamond Lake Lodge/Resort	Diamond Lake	Douglas	180	1	C
North Umpqua	Headwaters North Umpqua River	92119	Lemolo Lake Resort	Idleyld Park	Douglas	100	1	NC
North Umpqua	Headwaters North Umpqua River	92760	USFS Poole Creek Campground	Roseburg	Douglas	160	1	NC
North Umpqua	Little River	90476	Little River Christian Camp	Glide	Douglas	30	1	NC
North Umpqua	Little River	90655	BLM Cavitt Creek Rec Site	Roseburg	Douglas	30	1	NC
North Umpqua	Little River	90898	Douglas Co Parks - Cavitt Creek	Roseburg	Douglas	25	1	NC
North Umpqua	Lower North Umpqua River	00714	Forest Ranch Mobile Park	Idleyld Park	Douglas	92	1	C
North Umpqua	Lower North Umpqua River	90908	Douglas Co Parks - Singleton	Roseburg	Douglas	25	1	NC
North Umpqua	Lower North Umpqua River	92127	Narrows Tavern	Glide	Douglas	45	1	NC
North Umpqua	Lower North Umpqua River	93438	Timber River RV Park	Idleyld Park	Douglas	55	1	NC
North Umpqua	Lower North Umpqua River	93944	Douglas Co Parks - Whis Bnd Picnic	Roseburg	Douglas	100	1	NC
North Umpqua	Lower North Umpqua River	95078	Elk Haven RV Park	Idleyld Park	Douglas	100	1	NC

North Umpqua	Middle North Umpqua River	90895	Douglas Co Parks - Baker	Roseburg	Douglas	100	1	NC
North Umpqua	Middle North Umpqua River	91003	Umpquas Last Resort	Idleyld Park	Douglas	50	1	NC
North Umpqua	Middle North Umpqua River	91026	BLM Susan Creek CG	Roseburg	Douglas	100	1	NC
North Umpqua	Middle North Umpqua River	92135	Steamboat Inn	Steamboat	Douglas	50	1	NC
North Umpqua	Middle North Umpqua River	92761	USFS Bogus Creek CG	Roseburg	Douglas	60	1	NC
North Umpqua	Middle North Umpqua River	93693	BLM Susan Creek Picnic Ground	Roseburg	Douglas	100	1	NC
North Umpqua	Rock Creek	90651	BLM Millpond Rec Site	Roseburg	Douglas	60	1	NC
North Umpqua	Upper North Umpqua River	01094	USFS Toketee Ranger Station	Roseburg	Douglas	150	1	C
North Umpqua	Upper North Umpqua River	94454	Pp&L-Clearwater Village	Idleyld Park	Douglas	25	1	NTNC
South Umpqua	Clark Branch-South Umpqua River	94929	On The River RV Park	Myrtle Creek	Douglas	60	1	NC
South Umpqua	Days Creek-South Umpqua River	00168	Surprise Valley RV Park	Canyonville	Douglas	45	1	NC
South Umpqua	Days Creek-South Umpqua River	92101	Days Creek High/Elem SD 15	Days Creek	Douglas	185	1	NTNC
South Umpqua	Days Creek-South Umpqua River	94675	Tiller Market	Tiller	Douglas	100	1	NC
South Umpqua	Middle Cow Creek	92115	Heaven On Earth	Azalea	Douglas	200	1	NC
South Umpqua	Middle Cow Creek	92123	Meadow Wood RV Park	Cottage Grove	Douglas	28	1	NC
South Umpqua	Middle Cow Creek	92137	Lynns Drive-In	Glendale	Douglas	100	1	NC
South Umpqua	Middle Cow Creek	94521	Superior Lumber #3	Glendale	Douglas	150	1	NTNC
South Umpqua	Middle Cow Creek	95130	Superior Lumber #5	Glendale	Douglas	60	1	NTNC
South Umpqua	Olalla Creek-Lookingglass Creek	00715	Porter Creek Mobile Home Park	Tenmile	Douglas	30	1	C
South Umpqua	Olalla Creek-Lookingglass Creek	05423	Mooney Boy Scout Ranch	Eugene	Douglas	10	1	NC

South Umpqua	Olalla Creek-Lookingglass Creek	93667	Douglas Co Parks - Ben Irving Res	Roseburg	Douglas	165	1	NC
South Umpqua	Olalla Creek-Lookingglass Creek	94505	Tenmile Store	Tenmile	Douglas	200	1	NC
South Umpqua	Upper Cow Creek	94483	Douglas Co Parks - Chief Miwaleta	Roseburg	Douglas	30	1	NC
Umpqua	Calapooya Creek	91101	ODOT HD Cabin Creek Rest Area	Yoncalla	Douglas	1000	1	NC
Umpqua	Calapooya Creek	94692	Lighthouse Center Bakery	Umpqua	Douglas	50	1	NC
Umpqua	Calapooya Creek	94912	Douglas Co Parks - Kanipe Memorial	Roseburg	Douglas	30	1	NC
Umpqua	Elk Creek	90906	Douglas Co Parks - Pass Creek	Roseburg	Douglas	200	1	NC
Umpqua	Elk Creek	92134	Stardust Motel	Florence	Douglas	38	1	NC
Umpqua	Elk Creek	93441	Ranch Restaurant	Oakland	Douglas	100	1	NC
Umpqua	Elk Creek	93442	Ranch Motel	Oakland	Douglas	50	1	NC
Umpqua	Elk Creek	93443	K-R Drive Inn	Sutherlin	Douglas	200	1	NC
Umpqua	Elk Creek	93688	The Trees RV Park	Yoncalla	Douglas	80	1	NC
Umpqua	Elk Creek	94108	Rice Hill Owners Association	Yoncalla	Douglas	90	1	NC
Umpqua	Lower Smith River	94788	Smith River Grocery	Reedsport	Douglas	15	1	NC
Umpqua	Lower Umpqua River	92106	Salbasgeon Inn	Reedsport	Douglas	26	1	NC
Umpqua	Lower Umpqua River	92722	USFS Tyee Cg/Boat Site	Reedsport	Lane	30	1	NC
Umpqua	Lower Umpqua River	94282	Brandy Bar Landing	Reedsport	Douglas	50	1	NC
Umpqua	Mill Creek	90619	BLM Loon Lake Rec Site	North Bend	Douglas	1000	1	NC
Umpqua	Umpqua River-Sawyers Rapids	05967	Sawyers Rapids RV Resort	Elkton	Douglas	50	1	NC
Umpqua	Umpqua River-Sawyers Rapids	90907	Douglas Co Parks - Scottsburg	Roseburg	Douglas	50	1	NC
Umpqua	Umpqua River-Sawyers Rapids	92114	Wells Creek Inn	Scottsburg	Douglas	50	1	NC
Umpqua	Upper Umpqua River	90490	Kellogg Springs Christian Camp	Oakland	Douglas	200	1	NC

Umpqua	Upper Umpqua River	90650	BLM Tyee Rec Site	Roseburg	Douglas	30	1	NC
Umpqua	Upper Umpqua River	90899	Douglas Co Parks - Cleveland Rapids	Roseburg	Douglas	30	1	NC
Umpqua	Upper Umpqua River	90903	Douglas Co Parks - Mack Brown	Roseburg	Douglas	25	1	NC
Umpqua	Upper Umpqua River	95041	The Big K Guest Ranch	Elkton	Douglas	50	1	NC
Umpqua	Upper Umpqua River	95104	Umpqua RV Park	Oakland	Douglas	50	1	NC

Drinking Water Source Areas for Public Water Systems in the Umpqua Basin



* The Drinking Water Source Area (DWSA) delineations define areas that supply the drinking water system.
* For groundwwater this is defined as the area on the surface that overlies that portion of the aquifer that supplies water to a well or spring. DWSAs for wells typically show the 1-, 2-, 5-, and 10- or 15-yr time of travel zones that indicate the amount of time it takes groundwater to move to the wellhead. DWSAs for springs typically show area of short-, intermediate-, and long-term groundwater flow to the spring.
* DWSAs for surface water represents the watershed that supplies the waterbody where the

* This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user.

Legend

- Surface Water Intake
- Major Streams in Umpqua
- Groundwater Drinking Water Source Area
- Surface watershed for GWUDI system
- Surface Water DWSAs
- City Limits (2009)

Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality