Draft Water Quality Management Plan – Willamette Subbasins TMDL

Temperature

January 2024

State of Oregon
Department of Environmental Quality

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1. Introduction

DEQ developed this draft Water Quality Management Plan to guide implementation of the temperature Total Maximum Daily Load developed for the subbasins of the Willamette River Basin. DEQ will complete another temperature TMDL rulemaking for the mainstem Willamette and major tributaries following this TMDL. A WQMP is an element of a TMDL, as described by Oregon Administrative Rule 340-042-0040(4)(l), which provides the framework for management strategies to attain and maintain water quality standards and is designed to work in conjunction with detailed implementation plans prepared by responsible persons, including designated management agencies responsible for TMDL implementation.

This Willamette Subbasins temperature WQMP will be proposed for adoption by Oregon's Environmental Quality Commission, by reference, into rule as OAR 340-042-0090(c)(B). This WQMP is intended to provide comprehensive information for implementation of the temperature TMDL, and will be amended, as needed, upon issuance of any future developed or revised TMDLs within the Willamette Basin. Any subsequently amended or renumbered rules cited in this document are intended to apply.

The Willamette River Basin encompasses twelve subbasins. Except for the Yamhill Subbasin, EPA previously approved temperature TMDLs developed by DEQ for the following eleven subbasins by TMDL:

1. Molalla-Pudding Subbasin TMDL (2008)
2. Willamette Basin TMDL (2006)
    - Clackamas Subbasin
    - Coast Fork Willamette Subbasin
    - Lower Willamette Subbasin
    - McKenzie Subbasin
    - Middle Fork Willamette Subbasin
    - Middle Willamette Subbasin
    - North Santiam Subbasin
    - South Santiam Subbasin
    - Upper Willamette Subbasin
3. Tualatin Subbasin TMDL (2001)

This TMDL replaces the temperature TMDLs above except for the Tualatin Subbasin TMDL, which remains effective for temperature and other approved TMDLs. The Tualatin TMDL did not use the natural conditions criteria to develop TMDL allocations; therefore, it is not required to be replaced under the litigation. The Yamhill subbasin will not be covered by this temperature TMDL.

The pending mainstem temperature TMDL rulemaking will cover the mainstem Willamette River and major tributaries following this Willamette Subbasins rulemaking. Therefore, this TMDL applies to all waters of the state in the following subbasins listed in Table 1:

Table 1: Waterbodies included in Willamette Subbasins TMDL

Subbasin	Waterbodies Included
1. Clackamas	All waters of the state in the Clackamas Subbasin except the Clackamas River downstream of River Mill Dam (approximately river miles 0 - 26).
2. Coast Fork	All waters of the state in the Coast Fork Willamette Subbasin except the Coast Fork Willamette River downstream of Cottage Grove Dam (approximately river miles 0- 30) and the Row River downstream of Dorena Dam (approximately river miles 0 -7.5).
3. Lower Willamette	All waters of the state in the Lower Willamette Subbasin except the Willamette River and Multnomah Channel.
4. McKenzie	All waters of the state in the McKenzie Subbasin
5. Middle Fork	All waters of the state in the Middle Fork Willamette Subbasin except the Middle Fork Willamette River downstream of Dexter Dam (approximately river miles 0 - 17) and Fall Creek downstream of Fall Creek Dam (approximately river miles 0 - 7).
6. Middle Willamette	All waters of the state in the Middle Willamette Subbasin expect for the Willamette River, Willamette Slough, Mission Lake, and Lambert Slough.
7. Molalla-Pudding	All waters of the state.
8. North Santiam	All waters of the state in the North Santiam Subbasin except the North Santiam River downstream of Detroit Dam (approximately river miles 0 - 49), and the Santiam River.
9. South Santiam	All waters of the state in the South Santiam Subbasin expect for the South Santiam River downstream of Foster Dam (approximately river miles 0 - 38).
10. Upper Willamette	All waters of the state in the Upper Willamette Subbasin except for the Long Tom River downstream stream of Fern Ridge Dam (approximately river miles 0 - 26), and the Willamette River including the Bonneville Channel, Albany Channel, Curtis Slough, Third Slough, Marshall Slough, Curtis Creek, and Mill Race

The list of waters in Table 1 above is referred to throughout this document as the “Willamette Subbasins”. Section 3 of the Willamette Subbasins Temperature TMDL Rule contains a listing of all the Category 5 temperature impairments from the 2022 Integrated Report. The TMDL Technical Support Document contains a complete listing of all the Assessment Units included in this rulemaking.

1.1 Condition assessment and problem description

The first element of the WQMP according to OAR 340-042-0040(l)(A) is an assessment of water quality conditions in the Willamette Subbasins with a problem description. There are assessment units in the Willamette Subbasins listed as impaired (category 5 or 4A) for temperature in Oregon's 2022 Integrated Report, which was approved by the U.S. Environmental Protection Agency on September 1, 2022.

DEQ must develop TMDLs for pollutants causing temperature impairments of waters within the Willamette Subbasins, as required by Section 303(d) of the federal Clean Water Act. These pollutants are solar radiation and heat from various sources and conditions, which contribute to impairments of the temperature criteria established to support aquatic life beneficial uses.

1.2 Goals and objectives

OAR 340-042-0040(4)(l)(B) requires identification of the goals and objectives of the WQMP. The goal of this WQMP is to provide the framework for implementing this temperature TMDL to achieve and maintain the temperature water quality criteria, including narrative criteria, and meet antidegradation requirements in streams within the Willamette Subbasins. The primary objectives of this WQMP are to describe responsibilities for implementing TMDL management strategies and actions necessary to reduce excess pollutant loads to meet all TMDL allocations, and to provide a strategy to evaluate progress towards attaining water quality standards throughout the Willamette Subbasins.

2. Proposed Management Strategies

The following section presents proposed management strategies, by pollutant source and activity, that are designed to meet the load and wasteload allocations required by the Willamette Subbasins temperature TMDL, as required by OAR 340-042-0040(l)(C).

OAR 340-042-0030(6) defines management strategies as "measures to control the addition of pollutants to waters of the state and includes application of pollutant control practices, technologies, processes, siting criteria, operating methods, best management practices or other alternatives."

2.1 Streamside vegetation management strategies

DEQ's water quality analysis and modeling concluded that streamside vegetation planting and management are the strategies necessary to meet water quality standards in the temperature impaired sections of streams in the Willamette Subbasins project area. This is because streamside overstory vegetation reduces solar radiation loads to streams by providing shade. Protecting and restoring streamside overstory vegetation is essential to achieving the TMDL

surrogate measure of effective shade. More information about the physical and ecological factors affecting effective shade can be found in Section 9.3 of the draft TMDL Technical Support Document.

The primary streamside vegetation planting and management strategies are summarized as follows:

1. **Vegetation planting and establishment**
   This strategy addresses locations that have little or no shade producing overstory vegetation and are therefore important locations for streamside tree and shrub planting projects. These sites may currently be dominated by invasive species.

2. **Vegetation protection (enhancement, maintenance and growth)**
   This strategy addresses streamside areas that have existing vegetation that needs to be protected from removal to maintain current shade levels. In some cases, protection is needed because effective shade can only be achieved with additional growth. Protecting and maintaining existing vegetation ensures that it can grow and mature, enhances vegetation success and survival, and provides for optimal ecological conditions.

3. **Vegetation thinning and management**
   This strategy addresses streamside areas that might need vegetation density reduction to achieve optimal benefits of shade in the long term. Current site conditions at some riparian areas have been shown to be overly dense with trees or dominated by invasive species that inhibit a healthy streamside community and thinning may be an option to promote development of a healthy mature streamside forest. However, it must be ensured that riparian thinning and management actions will result in limited (i.e., quantity, duration, and spatial extent) stream shade loss. TSD Appendix G presents material describing potential shade and temperature impacts resulting from riparian buffer management and actions to limit these effects.

2.2 Flow management strategies

DEQ's modeling and evaluation of water quality data and research (DEQ 2023a) found that water withdrawals decrease the capacity of streams to assimilate pollutant loads. Because temperature is a flow-related parameter, water withdrawals can result in increased pollutant concentrations and warmer stream temperatures. In waterbodies where temperatures are already known to exceed standards, further withdrawals from the stream will reduce the stream's heat capacity and cause greater fluctuation in daytime and nighttime stream temperatures.

Water conservation is a best management practice that directly links the relationship between water quantity and water quality. Leaving water instream functions as a method to protect water quality from flow-related parameters of concern, such as temperature. Under state law, the first person to file for and obtain a water right on a stream is the last person to be denied water in times of low stream flows. Therefore, restoration of stream flows may require establishing instream water rights. One way this can be accomplished is by donating or purchasing out-of-stream rights and converting these rights to instream uses.

2.3 Hydromodification management strategies

Hydromodification refers to alterations of natural hydrological processes which affect characteristics of a waterbody and impact water quality. Examples of hydromodification in streams include human activities such as modifying stream channel morphologic attributes such as width, depth and course, construction and operation of dams and impoundments for flood control, drinking water, recreation, irrigation, and other uses, as well as activities meant to restore and protect streams. These activities can change the loading, timing, and delivery of nonpoint source pollutants, including temperature (EPA, 2007).

Hydromodification activities that alter channel morphology can impact stream temperature (Galli and Dubose, 1990), e.g., wide, shallow streams allow solar radiation to increase stream temperature compared to narrower and deeper channels (Larson and Larson, 1996). Activities that make streams more prone to erosion and sloughing, such as uncontrolled livestock access, can also result in shallower streams and increased stream temperatures. As streambanks erode and slough, sediments can build on the bottom of the stream, which reduces stream depth. In addition, established riparian vegetation is lost, which reduces stream shade (EPA, 2007). Channelization is another hydromodification activity that impacts channel morphology. Channelization disconnects streams from their floodplains through activities such as urban development or road construction. Streams that have been disconnected from floodplains are not able to slow and store floodwaters during the rainy season or recharge groundwater to support summer flows, which can lead to increased summer stream temperatures (EPA, 2017).

Management of hydromodification activities to prevent stream temperature increases can include BMPs for point and nonpoint source discharges like riparian restoration, livestock fencing, flow augmentation, reservoir operations, and projects including channel modifications. Note that permits are often needed to conduct stream restoration work involving removal and fill activities, and to ensure activities occur during the in-water work period to avoid harming fish. In addition, responsible persons, including DMAs need to conduct site-specific evaluations of streams to determine what specific channel modifications are appropriate to meet the desired future condition. For more information about hydromodification sources and impacts, see EPA's, *National Management Measures to Control Nonpoint Source Pollution from Hydromodification*. See also DEQ's study, *Water Temperature Impacts from In-Channel Ponds in Portland Metro and Northwest Region.*

2.3.1 Large dam owners and reservoir management

There are approximately 202 reservoirs located within the Willamette Subbasins temperature TMDL project area that are large enough to require evaluation for dam safety. DEQ compiled this basic list of 202 dams from the U.S. Army Corps of Engineers (USACE) National Inventory of Dams (NID) database and a similar database maintained by the Oregon Water Resources Department (OWRD), dam safety program (see Appendix E). The OWRD prescribes dam safety rules that apply to dams 10 feet or higher, or store 9.2 acre-feet or more (OAR 690-020-0000). "Dam" means a hydraulic structure built above the natural ground line that is used to impound water. Dams include all appurtenant structures, and together are sometimes referred to as "the works". Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals. Where possible, DEQ removed reservoirs from this list that were not relevant to the TMDL, such as treatment lagoons or reservoirs not connected to a waterbody.

Dams of all sizes can increase stream temperatures, depending on factors that include dam and stream characteristics, location, and density of dams in a watershed. For these reasons, DEQ expects all dam owners to manage their reservoirs to meet water quality standards, including standards for temperature. For details on reservoir operator implementation requirements, see Section 5.3.5.

2.4 Summary of nonpoint source priority management strategies

Table 2 includes proven strategies (and practices within the strategies) summarized by pollutant source. These strategies and practices are adapted from published sources. DEQ used the categories and terminology from Oregon Watershed Enhancement Board's Oregon Aquatic Habitat Restoration and Enhancement Guide and Oregon Watershed Restoration Inventory Online List of Treatments. Additional strategies included in Table 2 are supported by Oregon Department of Agriculture, the U.S. Department of Agriculture Natural Resources Conservation Service, Oregon State University Extension Service, Oregon Plan for Salmon and Watersheds, and other publicly available published sources. DEQ identified the strategies in Table 2 as appropriate for the conditions and sources within the subbasins. Therefore, these are considered priority strategies and practices that should receive special focus during TMDL implementation plan development.

DEQ expects that entities identified in Section 5.1 will incorporate strategies and practices listed in Table 2 that are applicable to their jurisdiction in their implementation plans. Implementation plans must include specifics on where and when priority and other strategies and practices will be applied. Implementation plans must also include measurable objectives and milestones for documenting implementation of strategies and practices and gaging their effectiveness. See Section 5.3.2 for location-specific methods for determining where land conditions require restoration, protection and enhancement.

Although not specifically detailed in this WQMP, climate change is another important factor affecting stream temperature. Potential climate change impacts to waterbodies in Oregon may include:

- higher air temperature;
- decreased snowpack leading to less water in reservoirs, streams and groundwater; and
- large-scale wildfires, which can reduce effective shade in streamside areas.

Table 2: Priority temperature management strategies by source

Pollutant	Source or Activity	Management Strategies
Solar Radiation	Insufficient riparian vegetation height, density or width	Streamside tree planting (conifer and hardwood); streamside vegetation planting (shrub or herbaceous cover); streamside vegetation management (invasive thinning, removal or other treatment); voluntary streamside tree retention; streamside invasive plant control; streamside fencing or other livestock streamside exclusion methods; identify and protect cold water refuges

Pollutant	Source or Activity	Management Strategies
		Maintain plants until free to grow; monitor survival rates Develop, update and/or enforce streamside code/ordinance to ensure streamside native vegetation and intact bank conditions are protected or restored following site development; purchase, acquire, designate conservation easements along streamside areas Goal is to increase site effective shade (combination of vegetation height, buffer width and canopy density) through streamside vegetation management strategies using regulatory programs and voluntary activities, including incentive-based projects
	Water withdrawals, flow alteration	Pursue instream water right transfers and leases; water right application reviews; irrigation conservation and management; repair or replace leaking pipes and infrastructure; provide incentives for water conservation; implement water consumption restrictions during the summer months, such as lawn watering
	Channel modification and hydromodification	Conduct whole channel restorations (e.g. enhance channel, wetlands, and floodplain interactions, reduce width to depth channel ratios, bank stabilization, large wood placement, create/connect side channels, etc.); streamside road re-construction/obliteration activities; streamside fencing or other livestock exclusion methods; protect and enhance cold water refuges; develop dam management strategies for temperature; remove in-channel ponds or modify pond structures to reduce temperature increases downstream; and protect areas that don't require restoration actions

2.5 Point source priority management strategies

Point sources may be assigned wasteload allocations and/or other requirements under the TMDL. These point sources are required to have National Pollutant Discharge Elimination System (NPDES) permits for any wastewater discharges. Under federal rules, effluent limits within NPDES permits are required to be consistent with the assumptions and requirements of any available wasteload allocation.

The primary way DEQ addresses numeric wasteload allocations is by including effluent limits in permits (though different mechanisms may be used if they are consistent with the TMDL). There are a number of available pathways that may be used to achieve compliance with these limits and requirements. These include immediate compliance with the limits, the use of compliance schedules, water quality trading, and other pathways allowed under state and federal rules.

3. Timelines for Implementing Strategies

OAR 340-042-0040(l)(D) requires schedules for implementing management strategies including permit revisions, achieving appropriate incremental and measurable water quality targets, implementing control actions and completing measurable milestones. DEQ's water quality permitting program has responsibility for revising permits to comply with TMDLs. Timelines for implementation of management strategies by responsible persons, including DMAs is discussed separately.

3.1 DEQ permit revisions

NPDES permits have five-year terms. Appendix D includes a list of permit holders located within the project area that have NPDES permits, as well as the next expected permit renewal date. DEQ incorporates any required TMDL wasteload allocations into NPDES permits when the permit is renewed.

3.2 Management strategies implemented 2007- 2021 by responsible persons, including DMAs

DEQ uses multiple sources to establish current conditions and track implementation progress in the Willamette Subbasins project area.

One of these sources is the Oregon Watershed Enhancement Board's Oregon Watershed Restoration Inventory which is a repository for watershed restoration activities. OWRI contains project level information from watershed councils, landowners and other groups who have implemented restoration projects to improve aquatic habitat and water quality conditions. Additional stream temperature projects in OWRI that have been implemented in the Willamette Basin include riparian fencing, channel modification, voluntary riparian tree retention, dam management and others. The OWRI database reflects 183 total miles of riparian area planted in the Willamette Basin between 2007 and 2021 including 161.6 miles of conifer and hardwood, 13.9 miles of hardwood and 7.4 miles of conifer.

Another source utilized to track implementation progress is the Willamette Basin Year Five Report which summarizes data and information submitted to DEQ by DMAs. DMA reporting during for the 2013-2018 period documented 17.3 total linear miles of streamside trees planted in the Willamette Basin and 0.7 miles planted in the Molalla-Pudding Subbasin from 2016-2021 where a separate Year Five Report was completed. DEQ did not collect total linear miles of streamside trees planted by DMAs in the 2013 Year Five Report. Additionally, DEQ did not collect information from DMAs on linear feet or acres of streamside land acquisitions, which is an important strategy in protecting water quality.

Note that DEQ did not specifically exclude streamside trees planted in the Tualatin Basin, which is not included in the Subbasins TMDL.

DEQ also utilized effective shade gap modelling to assess current conditions within the project area. Where DEQ completed modeling for this TMDL, effective shade targets were calculated at 25-meter node intervals (Lower Willamette model area) and 200-meter node intervals (Southern Willamette model area) for each waterbody. An effective mean shade was then calculated for DMAs where this modeling occurred, and a shade gap assessment was completed. A shade gap assessment was not completed for all DMAs. For the areas where a shade gap assessment was not completed, effective shade targets are determined through shade curves based on stream site characteristics. The shade gap results for the modeled areas include shade conditions that may have been impacted by streamside planting projects that were completed following the approval of the 2006 Willamette Basin Temperature TMDL.

While DEQ was not able to directly quantify the impact that planting projects documented in OWRI and the DEQ Willamette Basin Year Five Review had on modeled streamside shade gaps, available data demonstrate that the pace and scale of streamside planting will need to increase to meet shade target timelines in Table 3.

3.3 Timeline for implementation of management strategies

This section of the WQMP includes an estimate of the timeline for implementation of management strategies that will be sufficient to support attainment of water quality standards.

For solar radiation, excess pollutant load is identified in radiation units (e.g., langleys/day), whereas effective shade percent is the primary surrogate measure used in this TMDL. DEQ developed timelines to meet water quality standards based on the assumptions that DMAs and other entities will consistently implement the three primary streamside vegetation strategies in Section 2.1 until the streamside vegetation class reaches a mid-seral stage conifer-deciduous mix or equivalent characteristics. For this timeline, DEQ also assumed:

- No measurable existing overstory vegetation is removed, thereby reducing the current shade condition;
- Overstory vegetation grows steadily, consistent with average conifer and deciduous growth curves for this portion of the Willamette Basin; and
- Associated effective shade is produced at a rate commensurate with tree growth without significant disturbance (Means and Helm, 1985).

Significant uncertainty exists in meeting timelines for establishing shade. DEQ completed a shade gap assessment covering approximately 21,483 stream kilometers of the Willamette Subbasins project area. Available information from this assessment shows that, for areas where DEQ modelled current effective shade gaps, 9,607 stream kilometers have between 15 and 100 percent effective shade gap. For this analysis, DEQ assumes that both current effective shade gaps and future implementation rates will be consistent across assessed and non-assessed areas of the Willamette Subbasins.

Estimating timeframes for meeting multiple percent shade targets across the project area is influenced by several factors:

- The project area is large and the percent effective shade targets to be met are developed at a small scale (i.e., 25- and 200-meter increments) or through shade curves.
- A shade gap analysis is unavailable for all streams in the Willamette Basin to gage what percent of streamside areas across the Willamette Subbasins area are not currently meeting effective shade targets.
- DEQ is unable to determine whether the rate of planting that has occurred over the past 16 years would be similar to planting efforts following the adoption of this TMDL.
- DMAs that have a large percentage of private property within their jurisdiction will have challenges in meeting effective shade targets. It will likely take additional time to develop more protective streamside ordinances or regulations, work with landowners, or partner with other organizations to conduct streamside planting and restoration projects in these areas.
- It is unclear how much future planting will be targeted in priority shade gap areas given that some planting projects are more opportunistic in nature.
- The scale of implementation, location, and water quality benefits from future in-stream restoration and flow augmentation projects are unknown.
- The effects of climate change and forest pest impacts on streamside tree species, such as the emerald ash borer, which is now present in Oregon, could result in fewer ash species found in streamside areas.
- The occurrence of natural disturbances, such as wildfires.

DEQ expects responsible persons, including DMAs to consider the timeline projections and interim targets presented below in Table 3 in establishing commitments for streamside planting and protection in TMDL implementation plans. Based on DEQ analysis of the number of stream miles that will need restoration, and the pace of restoration logged in OWRI over the previous years of implementation, restoration will need to occur at an accelerated pace over future years of implementation to meet the targets below. Timelines for attainment of percent cumulative effective shade are generally based on time for trees to grow to heights sufficient to provide effective shade, and in considerations of factors described above. This equates to meeting 10 percent of shade targets across the basin every 10 years beginning in 2030 and meeting all shade targets in 90 years. Meeting shade targets on all waterbodies may not be possible due to factors such as, natural disturbances, the built environment, and private streamside ownership.

Table 3: Projected timelines to meet percent shade targets in the Willamette Subbasins TMDL in 10-year increments

Assessment Year	Percent Cumulative Shade Targets Met in Willamette Subbasins
2030	10%
2040	20%
2050	30%
2060	40%
2070	50%
2080	60%
2090	70%
2100	80%
2110	90%
2120	100%

4. Attaining Water Quality Standards

Based on the TMDLs analyses, achieving the excess load reductions identified will result in attainment. Each management strategy identified in this WQMP and in responsible persons' implementation plans represents part of a system of measures and practices that collectively reduce pollutant loads and improve water quality.

4.1 How management strategies support attainment of water quality standards

OAR 340-042-0040(l)(E) requires an explanation of how implementing the proposed management strategies will result in attainment of water quality standards.

DEQ identified priority implementation management strategies and specific practices in Table 2 and Section 2.1. DEQ expects these strategies and practices to increase site effective shade and address the excess solar radiation and shade deficits calculated along streams within the Willamette Subbasins (see Section 8 of the TMDL Rule). DEQ focused on the three vegetation strategies described in Section 2.1 to estimate reasonable timelines for achieving surrogate effective shade targets in Table 3, and by extension solar radiation load reductions to meet temperature water quality standards.

DEQ developed site-specific effective shade targets and effective shade curves to meet temperature load allocations in the TMDL Rule (Section 9 in the TMDL Rule). Shade curves identify the relationship between stream width, orientation, and effective shade for specific streamside vegetation types. Effective shade curves are applicable to any stream that does not have site specific shade targets. Effective shade curves represent the maximum possible effective shade for a given vegetation type.

Landowners, foresters, restoration professionals and horticulturists have expertise and experience needed to develop site-specific planting prescriptions that will ensure that the best combination of streamside species are planted. These site-specific planting prescriptions will typically contain a higher diversity of shrub and overstory species than the vegetation types used in developing the shade curves. The overall goal is to establish and protect streamside vegetation to meet shade targets established for that site. Maintenance activities, such as removal of invasive species and watering newly established trees and shrubs will be important for trees to become fully established (free to grow).

In addition to streamside shading strategies, significant water quality benefits can be achieved through implementation of stream restoration and flow augmentation management strategies.

4.2 Timelines for attaining temperature water quality standards

OAR 340-042-0040(I)(F) requires an estimated timeline for attaining water quality standards through implementation of the TMDL, WQMP and associated TMDL implementation plans. Based on DEQ's source assessment and TMDL analyses (Section 7.2 in the TSD), nonpoint sources contribute nearly all of the excess solar radiation pollutant loading associated with temperature impairments in the Willamette Subbasins TMDL. Therefore, it is critical for nonpoint sources to make timely progress toward reducing anthropogenic pollutant loads to meet the TMDL load allocations.

The TMDL calculates NPS load allocations using a percent effective shade surrogate. Therefore, estimated timelines to meet water quality standards are primarily based on streamside planting activities, although stream channel restoration and increasing instream flows would also improve stream temperature conditions. Based on the timeline to meet effective shade targets shown in Table 3, temperature water quality standards for the Willamette Subbasins will be met by 2120. The wide uncertainty associated with this date stems from unknowns related to current conditions, the potential for natural disturbances and the pace of future restoration activities. Achieving the identified timelines for cumulative effective shade and resulting water quality benefits will require active participation from all responsible persons, including DMAs, within the basin.

5. Implementation Responsibilities and Schedule

5.1 Identification of implementation responsibility

OARs 340-042-0040(4)(I)(G) and 340-042-0080(1) require identification of persons, including Designated Management Agencies, responsible for implementing management strategies and preparing and revising implementation plans.

OAR 340-042-0030(2) defines Designated Management Agency as a federal, state or local governmental agency that has legal authority over a sector or source contributing pollutants and is identified as such by DEQ in a TMDL.

The TMDL rule provides numerous mentions of the term 'responsible person' with associated requirements. OAR 340-042-0025(2) indicates that responsible sources must meet TMDL load allocations through strategies developed in implementation plans. OAR 340-042-0030(9) defines 'reasonable assurance' as a demonstration of TMDL implementation by governments or individuals. OARs 340-042-0040(4)(I)(G) requires identification of persons, including DMAs, responsible for developing and revising implementation plans. OAR 340-042-0040(4)(I)(I) requires a schedule for submittal and revision of implementation plans by responsible persons, including DMAs. OAR 340-042-0080(4) reiterates the requirement for persons, including DMAs, responsible for development, submittal and revision of implementation plans, along with the required elements of those plans. For purposes of this Willamette Subbasins WQMP, for

implementation of the temperature TMDLs, 'responsible person' is defined as any entity responsible for any source of pollution addressed by the TMDL.

Responsible persons including DMAs are organized by DMA type in the following subsections. These persons are responsible for developing or revising implementation plans and implementing management strategies to achieve the TMDL allocations. A complete list of responsible persons including DMAs for the Willamette Subbasins Temperature TMDL is in Appendix A. There are 137 responsible persons including cities, counties, federal and state agencies, and other entities.

Appendix A is not an exhaustive list of every individual that bears responsibility for improving water quality in the Willamette Subbasins. It may be necessary for all people that live, work and recreate in the basin to take steps to reduce pollution and protect or restore water quality to attain standards and designated beneficial uses.

All responsible persons, including DMAs, except those identified in Table 4, are required to develop, submit, implement and revise, as needed, an implementation plan specific to the Willamette Subbasins TMDL. As required in OAR 340-042-0080(4)(a)(A)-(E), implementation plans must include:

- Management strategies that the entity will use to achieve load allocations and reduce pollutant loading;
- Timeline for strategy implementation and a schedule for completing measurable milestones;
- Performance monitoring and a plan for periodic review and revision of implementation plans; and,
- Any other analyses or information specified in the WQMP.

Figure 1 and Figure 2 show which DMAs have the highest percentage of acres in the Subbasins Temperature TMDL, and the percent of DMA acres that are within 150 feet of a stream. Appendix A contains jurisdictional acres associated with many DMAs, however, that information was not available for all responsible persons or DMAs. Appendices B and C contain further information divided by subbasin and show jurisdictional area of each DMA by subbasin and within 150 feet of a stream.

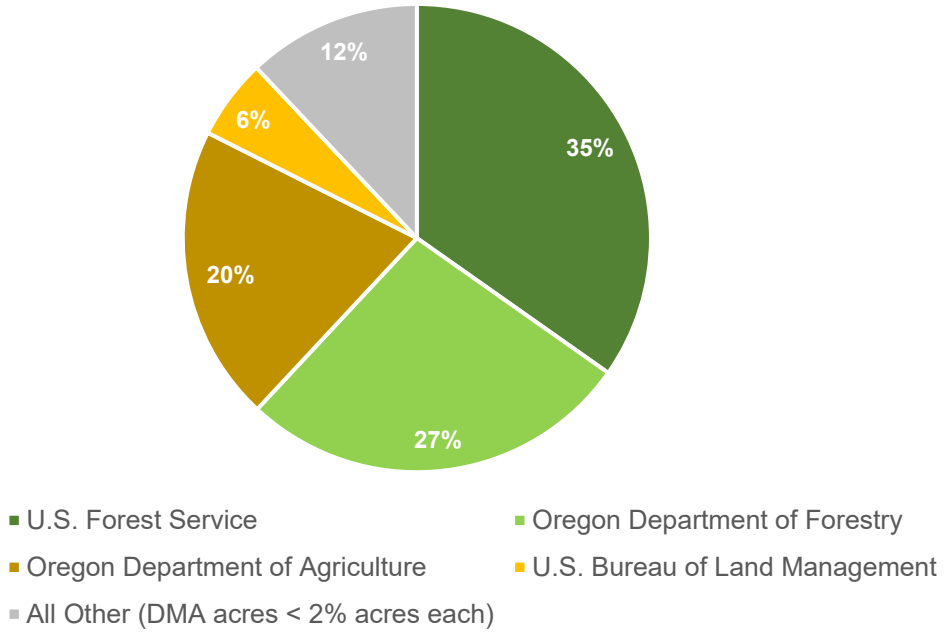


Figure 1: Percent Estimated Acres Owned or Managed by Responsible Persons Including DMAs in Willamette Subbasins TMDL

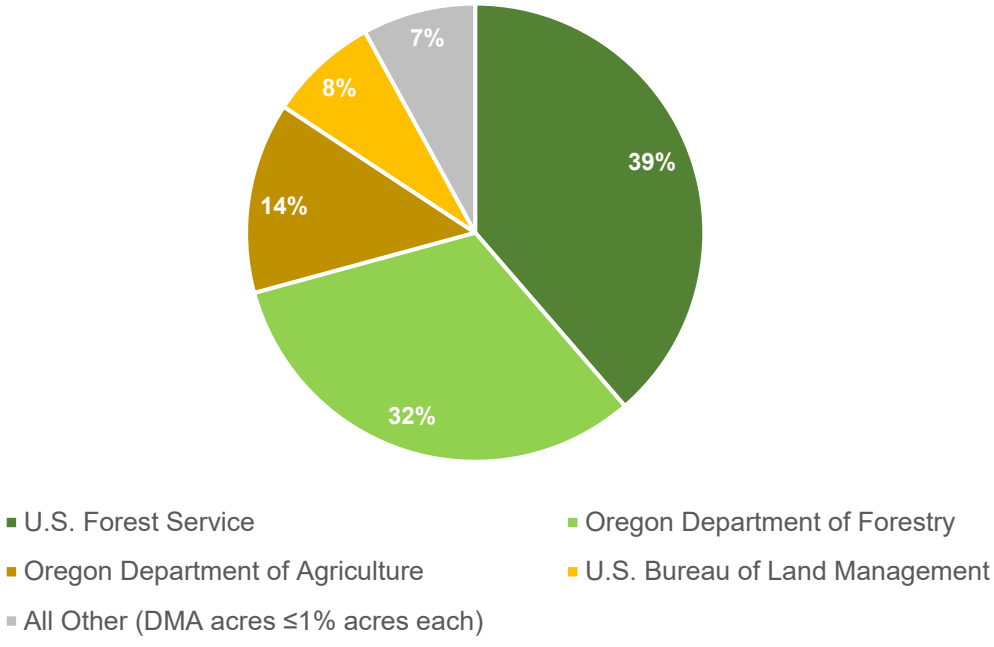


Figure 2: Percent Estimated Acres Owned or Managed by Responsible Persons Including DMAs 150 Feet from Stream Centerline

5.1.1 Responsible persons including DMAs not required to develop a TMDL implementation plan

Some responsible persons, including DMAs will not be required to submit implementation plans at this time for the following reasons:

(1) DMA does not have ownership or jurisdiction over land management activities within the streamside area, and so are unable to implement actions identified in Table 2 in this WQMP; or

(2) DMA has limited streamside area under its jurisdiction.

Table 4 identifies the entities that are named as responsible persons and DMAs in this TMDL that are not required to develop and submit an implementation plan at this time. DEQ may require implementation plans from these entities in the future if ownership or jurisdiction of streamside areas increases, or other data or information indicates a TMDL implementation plan is needed to achieve temperature allocations and shade targets identified in this TMDL. DEQ may revise the WQMP or issue individual orders to notify them of the required schedule for submitting an implementation plan.

Table 4: List of Responsible Persons including Designated Management Agencies for which no TMDL implementation plan is required at this time.

No.	Responsible Person and Designated Management Agency	DMA Type
1	Tualatin	City
2	Curry County	County
3	Lincoln County	County
4	Washington County	County
5	Bonneville Power Administration	Federal
6	Pacific Power and Light	Private Utility
7	Portland Terminal Railroad Company	Railroad
8	Vennel Farms Railroad Company	Railroad
9	Willamette Shore Trolley	Railroad
10	Oregon Pacific Railroad	Railroad
11	BNSF Railway	Railroad
12	Central Oregon & Pacific Railroad	Railroad
13	TriMet	Railroad
14	Willamette Valley Railway	Railroad
15	Albany & Eastern Railroad	Railroad
16	Port of Coos Bay	Railroad
17	Portland & Western Railroad	Railroad
18	Union Pacific Railroad	Railroad
19	Ash Creek Water Control District	Responsible Person
20	East Valley Water District	Responsible Person
21	Santiam Water Control District	Responsible Person
22	West Labish Water Control District	Responsible Person
23	Palmer Creek Water District Improvement Co.	Responsible Person
24	G A Miller Drainage District No 1	Responsible Person
25	Sidney Irrigation District	Responsible Person
26	Hawn Creek District Improvement Co.	Responsible Person
27	Creswell Water Control District	Responsible Person
28	Creswell Irrigation District	Responsible Person

No.	Responsible Person and Designated Management Agency	DMA Type
29	East Valley Water District	Responsible Person
30	Fertile Improvement District	Responsible Person
31	Grand Prairie Water Control District	Responsible Person
32	Junction City Water Control District	Responsible Person
33	Lacomb Irrigation District	Responsible Person
34	Lake Labish Water Control District	Responsible Person
35	Muddy Creeks Irrigation Project	Responsible Person
36	Multnomah County Drainage District	Responsible Person
37	North Lebanon Water Control District	Responsible Person
38	Peninsula Drainage District #1	Responsible Person
39	Peninsula Drainage District #2	Responsible Person
40	Sauvie Island Drainage Improvement Company	Responsible Person
41	Scappoose Drainage Improvement Company	Responsible Person
42	Oregon Department of Environmental Quality	State
43	Oregon Department of State Lands	State
44	Oregon Department of Geology and Mineral Industries	State

5.2 Existing implementation plans

OAR 340-042-0040(l)(H) requires identification of any source or sector-specific implementation plans available at the time of TMDL issuance. Following the issuance of the 2006 Willamette Basin and 2008 Molalla-Pudding TMDLs and WQMPs, DEQ required responsible persons, including DMAs, to develop implementation plans that included specific management strategies and best management practices to meet load allocations for temperature. Reporting requirements for many of these entities included an annual progress report and a comprehensive assessment of activities every five years. For information on each DMA, including which DMAs are existing DMAs, Appendix A. DEQ notes that not all existing DMAs have DEQ-approved TMDL implementation plans. Existing DMAs will need to update their current implementation plans for temperature to ensure any new requirements in this WQMP are met.

In addition, certain statewide rules, programs and management plans for forestry and agriculture are intended, in part, to reduce or control nonpoint sources of pollution. The programs described in OAR 340-042-0080(2)&(3), respectively, represent existing implementation plans for non-federal forest and agricultural lands, and their sufficiency is discussed below.

5.2.1 Oregon Department of Forestry: Adequacy of Forest Practices Act to meet TMDL load allocations

Waterway protection measures were established in 1994 for state and private forest practices in Oregon, as codified in Oregon Revised Statutes 527.610 through 527.992, Oregon's Forest Practices Act (OAR 629-600 through 629-665) and Oregon's Plan for Salmon and Watersheds (Executive Order 99-01). As provided in ORS 527.770, forest operations conducted in accordance with the Forest Practices Act and other voluntary measures are generally considered to be in compliance with water quality standards. However, as provided in OAR 340-

042-0080(2), revisions to the Forest Practices Act rules may be required when DEQ determines that these rules are not adequate to implement load allocations in an approved TMDL. Periodic revisions to these rules occurred between the 1990s through 2022, with studies by ODF and DEQ showing that the rules adopted prior to 2022 were not adequate to meet the Oregon temperature criterion for protecting cold water. DEQ determined in this TMDL that the generally applicable Forest Practices Act rules in effect prior to 2022 were not adequate to implement the TMDL load allocations for excess solar radiation loading on small and medium fish-bearing streams to meet the temperature criteria. More information is provided in the TMDL Technical Support Document.

With the publication of the Private Forest Accord Report and subsequent passage of Senate Bill 1501, 1502 and HB 4055, Forest Practices Act rule revisions were adopted by the Board of Forestry in October 2022 and additional amendments are anticipated through 2025. Implementation of these rules, which include increased riparian widths and additional tree retention, may be effective at meeting shade allocations. In addition, as revised rules become effective, implementation of more stringent measures to protect water quality on private forestlands are anticipated to be applied, including in the Willamette Subbasins. These rules are not expected to result in after-the-fact restoration of riparian areas harvested under previous rules. Therefore, effective shade is likely to be deficient for those riparian areas adjacent to small and medium salmon, steelhead and bull trout streams that were harvested prior to implementation of the new rules. The trajectory for providing future riparian shade on these streams is highly variable because it is based on the rules in effect at the time of harvest and the date of replanting. Multiple years will be needed for potential water quality improvements to be realized so that DEQ can evaluate adequacy of the revised rules in meeting the load allocations and surrogate measures required by the Willamette Subbasins temperature TMDL.

For these reasons, ODF is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval.

As agreed, in the 2021 Memorandum of Understanding between DEQ and ODF, DEQ will work with ODF to identify additional regulatory or non-regulatory measures that could be implemented by rule revisions, stewardship agreements, incentive programs or other means to provide reasonable assurance of achieving TMDL solar radiation load allocations. Collaboration on these additional measures will occur during development of ODF's implementation plan.

5.2.2 Oregon Department of Agriculture: Adequacy of agricultural water quality management programs in attaining TMDL load allocations and effective shade surrogate measures

The Oregon Legislature passed the Agricultural Water Quality Management Act in 1993, which directed Oregon Department of Agriculture to adopt rules as necessary and to develop plans to prevent water pollution from agricultural activities (ORS 568.900 to 568.933 and ORS 561.191 and OAR chapter 603, divisions 90 and 95). Subsequently, ODA worked with Local Advisory Committees and Soil and Water Conservation Districts to develop Agricultural Water Quality Area Rules and Area Plans for 38 watershed-based management areas across the state.

The Willamette Subbasins TMDL includes eight ODA Agricultural Water Quality Management Areas that each have an Area Plan (TSD, Section 11). DEQ participates in ODA's Area Plan review process by providing water quality status and trends for each management area, as well

as assessments of land conditions, agricultural activities and implementation gaps that likely contribute to water quality impairments. The Area Plans for the eight management areas included in this TMDL were reviewed by DEQ within the last three years, however not all reviews resulted in Area Plan revisions.

Willamette Basin streams continue to be identified as impaired on Oregon's Section 303(d) list for temperature in part due to the lack of adequate streamside vegetation in agriculturally influenced streamside areas (Section 9.1.2.1.1). DEQ's assessments of Area Plans identified protecting, maintaining and establishing streamside vegetation as a high priority to achieve TMDL load allocations. However, ODA's Area Plans lack specific measurable goals related to streamside conditions that will achieve TMDL shade measures.

The agricultural Area Rules and Area Plans that regulate and guide streamside management in the Willamette Subbasins TMDL project area do not identify quantitative targets for effective shade based on site specific factors, including stream width or orientation. DEQ also notes the disparity between ODA's implementation of their Area Rules for "site capable vegetation" in streamside areas and the streamside conditions needed to meet effective shade targets in this TMDL. ODA has not demonstrated that voluntary landowner implementation of Area Plans will bridge the gap between current conditions and what is needed to meet TMDL allocations.

DEQ concluded that current Ag WQ program Area Rules combined with implementation of Area Plans' voluntary measures are not adequate in all locations to provide the streamside vegetation requirements and targets that are necessary to meet TMDL effective shade targets, load allocations and temperature water quality standards. Therefore, ODA is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval.

5.2.3 U.S. Bureau of Land Management: Adequacy of streamside management strategies in attaining TMDL load allocations and effective shade surrogate measures

Streamside vegetation on BLM managed lands in the Willamette Subbasins are currently managed based on BLM's Northwestern and Coastal Oregon Resources Management Plan (BLM, 2016).

Table 5 provides a summary of the riparian buffer distance for different types of waterbodies. BLM calls these areas riparian reserves. The reserve distance is defined based on the site-potential tree height. The site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site class. BLM states that site-potential tree heights generally range from 140 feet to 240 feet, depending on site productivity. Within the riparian reserve clearcut harvesting is prohibited. Some tree removal or thinning activities are allowed based on certain circumstances such as to protect public safety, or to keep roads and other infrastructure clear of debris. Tree removal for yarding corridors, skid trails, road construction, stream crossings and road maintenance or improvement are allowed where there is no operationally feasible and economically viable alternative. On fish bearing streams and perennial streams, between 0 and 120 feet slope distance there is no thinning except for treatments related to sudden oak death or for individual tree cutting or tipping that achieve restoration or habitat enhancement objectives. On intermittent, non-fish bearing streams, the same management strategy is applied but only from 0 to 50 feet.

Table 5: Summary of BLM riparian reserve buffer distance for different waterbody features

Feature	Riparian Reserve Distance measured as slope distance
Fish-bearing streams and perennial streams	One site-potential tree height distance from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels, whichever is greatest, on each side of the stream
Intermittent, non fish-bearing streams	Class I and II subwatersheds: One site-potential tree height distance from the ordinary high water line on each side of the stream
	Class II subwatersheds: 50 feet from the ordinary high water line on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area; where there is stable area between such unstable areas and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area
Lakes, natural ponds and reservoirs > 1 acres, and wetland > 1 acres	100 feet extending from the ordinary high water line
Natural ponds < 1 acres, wetlands < 1 acres (including seeps and springs), and constructed water impoundments (e.g. canal ditches and pump chances) of any size	25 feet extending from the ordinary high water line

DEQ's finds that BLM's streamside vegetation management strategies on fish-bearing streams, perennial streams and intermittent, non-fish bearing streams in Class III subwatersheds are adequate and will likely lead to achievement of the TMDL load allocation and effective shade targets. Riparian reserves located on intermittent, non-fish bearing streams in Class I and Class II subwatersheds may not be adequate to achieve the load allocation or effective shade targets. At these locations thinning is authorized between 50 and 120 feet slope distance. The thinning must maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average. Thinning at these levels within 120 feet slope distance from the stream may reduce effective shade and contribute to stream warming. The amount of effective shade reduction and temperature response will depend on the thinning intensity and spacing of thinning treatments (Roon et al 2021).

For these reasons, BLM is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval.

5.2.4 U.S. Forest Service: Adequacy of streamside management strategies in attaining TMDL load allocations and effective shade surrogate measures

Streamside vegetation on USFS lands in the Willamette Subbasins currently managed based on Northwest Forest Plan (USFS and BLM 1994). As part of the plan, the Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems, including salmon and steelhead habitat on federal lands managed by USFS. Maintaining and restoring water quality is one of the stated objectives of the Aquatic

Conservation Strategy. These aquatic ecosystems and the streamside adjacent areas are called riparian reserves. Many of the reserve distances are defined based on the site-potential tree height. The Northwest Forest Plan states a site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site class. The following is a description of the riparian buffer distance for different types of waterbodies. The text was extracted from USFS and BLM (1994), Attachment A, Standards and Guidelines, Section C, pages C-3- through C-31.

> **Fish-bearing streams** - Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest.
>
> **Permanently flowing nonfish-bearing streams** - Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream channel), whichever is greatest.
>
> **Constructed ponds and reservoirs, and wetlands greater than 1 acre** - Riparian Reserves consist of the body of water or wetland and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the wetland greater than 1 acre or the maximum pool elevation of constructed ponds and reservoirs, whichever is greatest.
> *Lakes and natural ponds* - Riparian Reserves consist of the body of water and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greatest.
>
> **Seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas** - This category applies to features with high variability in size and site-specific characteristics. At a minimum, the Riparian Reserves must include:
>
> - The extent of unstable and potentially unstable areas (including earthflows),
> - The stream channel and extend to the top of the inner gorge,
> - The stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation, and
> - Extension from the edges of the stream channel to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.

DEQ's finds that USFS's streamside vegetation management strategies on fish-bearing streams, perennial streams non-fish bearing streams, constructed ponds and reservoirs, lakes and natural ponds, and wetlands greater than 1 acre are adequate and will likely lead to achievement of the TMDL load allocation and effective shade targets. Vegetation management strategies on intermittent streams, and wetlands less than one acre may not be adequate to achieve the load allocation or effectives shade targets.

For these reasons, USFS is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval.

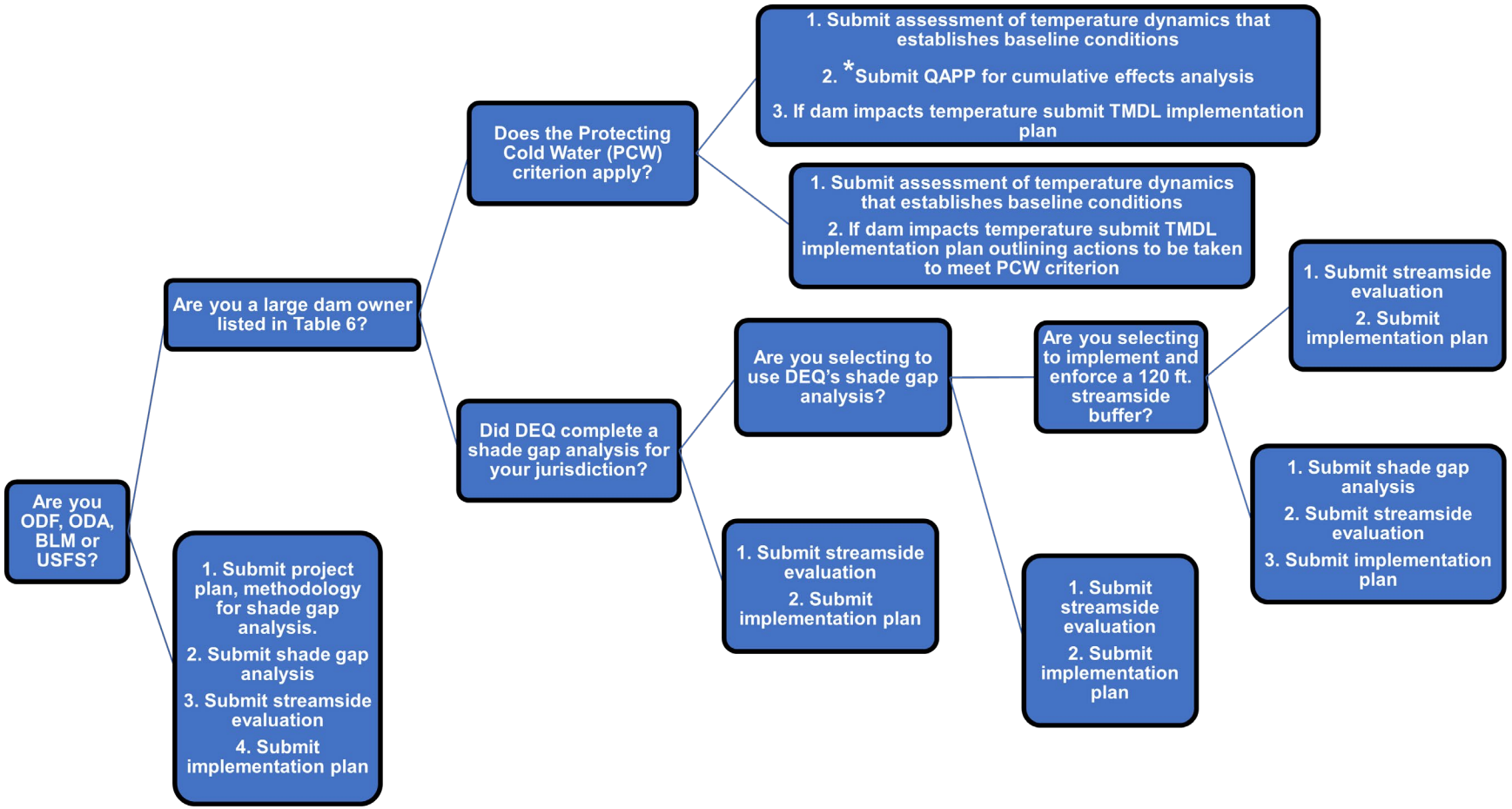
5.3 Implementation plan requirements

Appendix A lists the responsible persons including DMAs that are required to submit an implementation plan. As required in OAR 340-042-0080(4)(a)(A)-(E), implementation plans must include:

- Management strategies that the entity will use to achieve load allocations and reduce pollutant loading;
- Timeline for strategy implementation and a schedule for completing measurable milestones;
- Performance monitoring and a plan for periodic review and revision of implementation plans; and,
- Any other analyses or information specified in the WQMP.

The following subsections provide detail on each component required by this WQMP that must be included in implementation plans. Some implementation plan requirements vary depending on the responsible person or DMA. Figure 3 is provided to help responsible persons and DMAs determine the information and analyses they are responsible for submitting to DEQ. DEQ will work with each entity required to develop a TMDL implementation plan to ensure that all required elements are included with sufficient detail for their plan to be approved on the schedule required in Section 5.3.6.

Figure 3: Decision support tree to help identify information and analyses requirements for different responsible persons and DMAs.



*See Section 5.3.5.1 Monitoring requirements for dam owners

5.3.1 Management strategies

Responsible persons including DMAs in Appendix A that are required to develop a TMDL implementation plan must include applicable priority management strategies from Table 2. Other practices and actions appropriate for activities and landscape conditions specific to the entities' pollutant sources or source sectors should also be included. Implementation plans must identify all streamside areas or streamside activities within a responsible person's or DMA's jurisdiction or responsibility.

5.3.2 Streamside evaluation

Responsible persons including DMAs that are required to submit an implementation plan must complete a streamside evaluation. The streamside evaluation will use a review of current conditions to support implementation measurable objectives and milestones. The streamside evaluation must be included in the TMDL implementation plan. Entities that have a DEQ shade gap analysis, and entities that must complete a shade gap analysis (see Section 5.3.4), must account for the shade gap analysis results in their streamside evaluation. The streamside evaluation must also include, and take into account the following data and information:

a. Quantify the streamside area in acres that needs enhancement (e.g., areas that do not currently meet shade targets, are comprised of non-native vegetation, need additional planting)
b. Quantify the streamside area in acres that may not need action beyond protection.
c. Quantify the streamside area in acres where physical constraints exist (e.g., buildings) that preclude implementation of vegetation management strategies that provide stream shade.
d. Quantify the streamside area in acres where jurisdictional constraints (e.g., private ownership) limit implementation of vegetation management strategies that provide stream shade.
e. Opportunities that may exist to address constraints to implementing vegetation management strategies that provide stream shade.
f. Any areas within your jurisdiction where there is the potential to implement best management practices such as in-stream restoration, flow augmentation projects, experimental temperature management techniques, as well as enhancing and protecting cold water refuges.
g. An evaluation of the data from (a-f) to prioritize implementation.

DEQ acknowledges that factors such as climate change and local geology, geography, soils, climate, legacy impacts, wildfires and floods may hinder achieving the target effective shade. Where natural disturbances have occurred, DEQ expects responsible persons, including DMAs to assess these areas for streamside restoration following an event.

The streamside evaluation must be completed according to the timeline assigned in Table 7. The streamside evaluation will be utilized during the five-year review (see Section 5.3.8.2) to help assess progress in meeting implementation timelines, milestones, and measurable goals in subsequent five-year implementation cycles.

5.3.3 120-foot slope streamside buffer as an alternative to a streamside shade gap analysis

The responsible persons and DMAs that are required to complete a shade gap analysis and those that choose not to use DEQ's shade assessment (where available) for their streamside evaluation (Section 5.3.4) may instead choose to establish and protect overstory, woody vegetation within a 120-foot slope width buffer zone from the stream bank. The buffer zone must be established through development of enforceable ordinances or regulations. The literature review presented in TSD Appendix I indicates that potential stream shade loss associated with a 120-foot buffer will not cause stream temperature increases for most waterbodies. For this option, responsible persons, including DMAs, must ensure that any activity occurring within this 120-foot slope buffer would result in limited stream shade reduction and ensure that stream shade targets are still achieved at that location following management actions. Entities that choose this option must also complete a streamside evaluation (Sec. 5.3.2).

5.3.4 Streamside shade gap analysis requirements

DEQ conducted a vegetation height and shade gaps analysis within approximately 150 feet of modeled waterbodies in the Lower Willamette (partial analysis completed) and Southern Willamette Subbasins, as detailed in Tables 9.5 and 9.6 in the TMDL Rule. This analysis calculates the gap between current effective shade (i.e., assessed) versus the target effective shade. Where DEQ calculated a shade gap analysis, DEQ averaged the percent shade gap across all waterbodies within a DMA's jurisdiction. DEQ will provide the site-specific shade results upon request. Where DEQ was unable to conduct a shade gap analysis, shade curves were developed (Figures 9.1-9.22 in the TMDL Rule) to allow users to find target percent effective shade values for streams based on several stream characteristics. Unlike the shade gap analysis, shade curves do not calculate current effective shade.

5.3.4.1 Streamside shade gap analysis methods for responsible persons and DMAs

If DEQ has provided a shade gap analysis for a jurisdiction, then DMAs must either use DEQ's analysis to inform their streamside evaluation (Sec. 5.3.2), or location specific methods to assess the current effective shade within their jurisdiction and whether effective shade allocations along Willamette Subbasins assessment units are met. These methods are described below.

1. Measure current effective shade at the stream surface using monitoring equipment, such as the Solar Pathfinder™, or using a hemispherical camera system and imagery analysis software.
    - Determine vegetation type, canopy density, stream width and stream orientation.
    - Compare current effective shade results to either target effective shade from DEQ's shade gap analysis, or to the target percent effective shade values derived from the shade curves in the TMDL to assess the percent effective shade gap.
    - Entities choosing to use this methodology must submit their assessment strategy to DEQ for approval. Assessments should conform to guidelines outlined in OWEB's Water Quality Monitoring Technical Guidebook (OWEB, 2000)
2. Conduct modeling using the Heat Source model (as used in this TMDL).
3. Another method approved by DEQ through the TMDL implementation plan approval process

A project plan which includes a description of the assessment methodology must be submitted to DEQ for review and approval according to the timeline assigned in Table 7. Method documentation for Solar Pathfinder™ can be accessed at

https://www.solarpathfinder.com/pdf/pathfinder-manual.pdf and in OWEB's Addendum to Water Quality Monitoring Technical Guide Book, Ch. 14: https://www.oregon.gov/oweb/Documents/Stream-Shade-Canopy-Cover-WQ-Monitoring-Guidebook-addendum-ch14.pdf .

5.3.4.2 Shade gap analysis requirements for ODF, ODA, BLM and USFS

Together, the ODF, ODA, BLM, and USFS either manage or regulate 93 percent of the land area within 150 feet of streams within the Willamette Subbasins project area (Figure 2). Increasing shade on streams within the extensive areas within their jurisdictions is important to achieving the surrogate shade measures of this TMDL. Therefore, ODF, ODA, BLM and USFS must complete a streamside evaluation (section 5.3.2) as well as a shade assessment for streamside areas within their jurisdiction. The assessment must use location-specific methods as given in Section 5.3.4.1 for determining whether effective shade allocations along the temperature impaired Willamette Subbasins assessment units are met. A shade assessment is not needed for those areas where DEQ has completed a shade gap analysis, or for areas where DEQ has determined the management strategies are sufficient (see Sections 5.2.1 and 5.2.4). A project plan which includes a description of the assessment methodology must be submitted to DEQ for review and approval according to the timeline assigned in Table 7.

5.3.5 TMDL implementation plan requirements for dam owners

Given the large number of dams across the Willamette Basin, DEQ is not focusing implementation requirements on dams owned and operated by individuals or businesses. Additionally, DEQ is not requiring reservoir management plans for dams that are operated to manage seasonal flow to sustain ecological benefits associated with wetlands and marshes. These individual, business, and ecological entities comprise only about 1.2% of the reservoir storage capacity in the Willamette Basin. DEQ encourages partnerships between DMAs and individual dam operators within their jurisdictions to evaluate ways in which these dams could be managed to reduce temperature impacts.

In nearly all cases, large dam owners that are a public utility, or a local, state, or federal government agency, are required to monitor and potentially develop TMDL implementation plans that include reservoir-specific management strategies to mitigate temperature increases that happen between the inflow and outlet of the dam. DMAs must identify specific measurable objectives with milestones and associated implementation timelines for implementing these strategies. The requirements in sections 5.3.2 and 5.3.4 also apply to those areas where dam owners have jurisdiction over the management of streamside vegetation. See Table 6 below for a list of dams and dam owners that are responsible for developing a monitoring plan and may be required to develop a TMDL implementation plan. See Appendix E for the entire list of dams in the Willamette Subbasins project area.

Table 6: Large dam owners responsible for monitoring and that may be required to submit an implementation plan that includes reservoir management strategies.

No.	Dam Name	Owner	Reservoir Storage (ac-ft)
1	Plywood Products Reservoir	City of Adair Village	39
2	North Fork	City of Corvallis	305
3	Mercer	City of Dallas	1,550
4	Binford Dam	City of Gresham	30
5	Silver Creek	City of Silverton	2,500
6	Salmonberry Reservoir	City of St. Helens	61
7	Carmen Diversion	Eugene Water and Electric Board	260
8	Leaburg	Eugene Water and Electric Board	345
9	Leaburg Canal and Forebay	Eugene Water and Electric Board	459
10	Smith	Eugene Water and Electric Board	17,530
11	Trail Bridge	Eugene Water and Electric Board	2,263
12	Walterville Forebay	Eugene Water and Electric Board	275
13	Walterville Storage Pond	Eugene Water and Electric Board	345
14	Faraday Diversion	Portland General Electric Company	1,200
15	Faraday Forebay	Portland General Electric Company	550
16	Harriet Lake	Portland General Electric Company	400
17	North Fork	Portland General Electric Company	18,630
18	River Mill	Portland General Electric Company	2,300
19	Timothy Lake	Portland General Electric Company	69,000
20	Big Cliff Dam	USACE - Portland District	5,930
21	Blue River Dam	USACE - Portland District	89,000
22	Cottage Grove Dam	USACE - Portland District	50,000
23	Cougar Dam	USACE - Portland District	220,000
24	Detroit Dam	USACE - Portland District	455,000
25	Dexter Dam	USACE - Portland District	29,900
26	Dorena Dam	USACE - Portland District	131,000
27	Fall Creek Dam	USACE - Portland District	125,000
28	Fern Ridge Dam	USACE - Portland District	121,000
29	Foster Dam	USACE - Portland District	61,000
30	Green Peter Dam	USACE - Portland District	430,000
31	Hills Creek Dam	USACE - Portland District	356,000
32	Lookout Point Dam	USACE - Portland District	477,700

5.3.5.1 Monitoring requirements for dam owners

The nature of dam and reservoirs is to alter solar radiation flux and seasonally increase surface temperatures compared to free-flowing stream segments. Increased temperatures may lead to violations of water quality temperature standards and impact aquatic life. Water released from the hypolimnion of stratified reservoirs may cool downstream reaches during the summer leading to attainment of water quality standards. In the fall, a reservoir may become isothermal and contribute to stream warming downstream of the reservoir.

Section 9.1.4.1 of the TMDL rule identifies a temperature surrogate measure target for dam and reservoir operations. Attainment of this target requires assessment of temperatures up and downstream of the dam and reservoir.

Dam owners in Table 6 will collect temperature data and potentially assess temperature dynamics associated with their dam and reservoir operations using a mechanistic model,

empirical model, and/or analysis of continuous temperature data collected upstream, downstream, and in the reservoir. The assessment shall include:

(1) Collection of continuous temperature data to characterize reservoir inflow and outflow temperatures;
(2) Reservoir temperature profiles to characterize timing and extent of thermal stratification, and
(3) Collection of reservoir water level fluctuations and outflow rates

All data collected from items 1-3 will be submitted to DEQ or available in an online publicly accessible database. These data will establish baseline conditions for use in adaptive management and will inform evaluations of site-specific approaches to reduce temperature impacts. DEQ recommends dam owners develop a mechanistic or empirical model allowing prediction or comparison of inflow temperature to outflow temperatures. This will provide invaluable information on effective management strategies to reduce temperature. Responsible persons, including DMAs may also be required to submit a TMDL implementation plan that includes specific measurable objectives with milestones and an associated implementation timeline for implementing best management practices that address any altered temperature regimes observed downstream from reservoirs.

The “protecting cold water” criterion in OAR 340-041-0028(11) applies to waters of the state that have summer seven-day-average maximum ambient temperatures that are colder than the biologically based criteria. With some exceptions, these waters may not be warmed cumulatively by anthropogenic point and nonpoint sources by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the colder water ambient temperature. Reservoir operators on reaches where protecting cold water apply must meet the cold water criterion. Additional information on protecting cold water is found in the TMDL Rule (Section 9.1.4.1).

For reservoirs on reaches where DEQ has determined that protecting cold water does not apply, operators are required either to ensure that discharges meet the temperature target surrogate measure (TMDL Rule Section 9.1.4.1) or complete a DEQ approved cumulative effects analysis to demonstrate that releases of temperatures that exceed the biologically based numeric criteria during some periods would not contribute to cumulative warming above water quality standards at downstream locations. Reservoir operators who choose to complete a cumulative effects analysis to demonstrate that their releases would not contribute to cumulative warming above water quality standards will be required to submit a QAPP to DEQ for review and approval that outlines which dataset and cumulative effects approach will be used to assess impacts of their releases.

If DEQ determines sufficient data is available to demonstrate that stream temperature does not increase from upstream of dam to downstream of dam, then the reservoir operator may not be required to develop a TMDL implementation plan for dam management.

5.3.6 Timeline and schedule

Each implementation plan must include a commitment to enact specific management strategies on a reasonable timeline, including a schedule for meeting measurable milestones to demonstrate progress. To meet the intent of this requirement and be useful for the requirement

to track and report progress, entities should develop management strategies using the SMART elements: Specific, Measurable, Achievable, Relevant, Time-bound (Doran, 1981).

Timelines and milestone schedules should be informed by the Streamside Evaluation, as described in Section 5.3.2 above, and should consider all relevant factors of an entity's specific situation. The due dates and timelines for specific information and analyses discussed in Sections 5.3.2 and 5.3.4 are shown in Table 7 below. DMA timelines in TMDL implementation plans that differ from timelines stated below must be approved by DEQ.

Table 7: Due dates for implementation plans, information and analyses.

Requirement	Due Date / Timeframe
TMDL implementation plan (Appendix A)	18 months after EQC adoption of Willamette Mainstem TMDL*
Streamside Evaluation (Sec. 5.3.2)	18 months after EQC adoption of Willamette Mainstem TMDL
Project plan and description of the assessment methodology to be used to complete a shade gap analysis (Sec. 5.3.4)	18 months after EQC adoption of Willamette Mainstem TMDL
Streamside shade gap analysis (Sec. 5.3.4) and updated streamside evaluation **OR** **120 ft. streamside buffer that establishes and protects overstory, woody vegetation (sec. 5.3.3)**	Four years after implementation plan submission deadline
Reservoir operators named in Table 6 (Sec. 5.3.5)	Submit a Quality Assurance Project Plan for temperature monitoring for each reservoir 18 months after EQC adoption of Willamette Mainstem TMDL. Following the temperature assessment, the DMA will consult with DEQ on a timeframe for submitting a cumulative effects analysis, or TMDL implementation plan as needed.
***The Willamette Mainstem TMDL is a separate temperature TMDL to be developed and approved following the Willamette Subbasins TMDL.	

5.3.7 Reporting of performance monitoring and plan review and revision

5.3.7.1 Reporting on performance monitoring

Each implementation plan must include a commitment to prepare annual reports on performance monitoring and a date by which they will be submitted to DEQ. These reports must

include implementation tracking for each of the identified management strategies, progress toward timelines and measurable milestones specified in the implementation plan, and evaluation of the effectiveness of the strategies.

DMAs should track and report implementation actions including the number, type and location of projects, best management practices, education activities, or other actions taken to improve or protect water quality. Most DMAs will track implementation actions they are directly responsible for completing, and some may need to track and report on actions that they implement through their support of other land managers, e.g., private landowners.

Oregon Watershed Restoration Inventory Reporting Requirement

Projects designed to control thermal pollution that use practices listed in OWEB's OWRI Online List of Treatments must be reported once by DMAs to the OWRI database (OWEB 2023, OWEB 2023a) upon project completion. DEQ utilizes OWRI's database to track statewide and other watershed-scale size implementation activities for various reporting requirements. Responsible persons, including DMAs must also include BMP implementation activities in annual reports to DEQ to document progress and track actions over time.

Documenting restoration activities in other publicly accessible databases is allowable when approved by DEQ.

Adaptive Management

Implementation plans must include a commitment to use adaptive management to evaluate the effectiveness of implementation activities in improving streamside conditions including stream shade. Annual reports must summarize the status and results of these evaluations on the relevant time scale. At a minimum, reports in year five must summarize implementation and effectiveness over the preceding four years.

5.3.8 Implementation plan review and revision

Implementation plans must be reviewed by each responsible person and DMA, revised to incorporate lessons learned, and approved by DEQ every five years. At a minimum, plans must be revised to reflect updated timelines for the continuation of implementation activities for the next five years. DEQ will use implementation and effectiveness evaluations from annual reports for this review. If implementation plan revisions are needed to correct deficiencies or otherwise ensure the plan is effective following the year five review, DEQ will identify a date for submission of the revised plan for DEQ approval.

5.3.9 Public involvement

As required in OAR 340-042-0040(I)(L), implementation plans prepared by designated management agencies must include a plan to involve the public in implementation of management strategies. Public engagement and education must be included to meet this requirement.

5.3.10 Maintenance of strategies over time

As required in OAR 340-042-0040(I)(M), implementation plans prepared by responsible persons, including designated management agencies, should include discussion of planned efforts to maintain management strategies over time.

5.3.11 Implementation costs and funding

As required in OAR 340-042-0040(I)(N), this section provides a general discussion of costs and funding for implementing management strategies. Implementation of management strategies to reduce or prevent pollution into waters of the state may incur financial capital or operating costs. These costs vary in relation to pollutant sources and loading, proximity to waterways and type or extent of preventative controls already in place. Certain management practices, such as preventative infrastructure maintenance, may result in long-term cost savings to responsible persons, including DMAs, or landowners.

OAR 340-042-0040(I)(N) also indicates that sector-specific or source-specific implementation plans may provide more detailed analyses of costs and funding for specific management strategies in the plan. DEQ requires each DMA to provide a fiscal analysis of the resources needed to develop, execute and maintain the programs and projects described in implementation plans to the extent that these costs can be accounted for or estimated. DEQ recommends that all responsible persons prepare the following level of economic analysis:

- Staff salaries, supplies, volunteer coordination and regulatory fees
- Installation, operation and maintenance of management measures
- Monitoring, data analysis and plan revisions
- Public education and outreach efforts
- Ordinance development (if needed to implement a management strategy)

This analysis should be in five-year increments to estimate costs, demonstrate sufficient funding is available to begin implementation and identify potential future funding sources to sustain management strategy implementation.

There are multiple sources of local, state and federal funds available for implementation of pollutant management strategies and control practices. Table 8 provides a partial list of financial incentives, technical assistance programs, grant funding and low interest loans for public entities and with principal forgiveness available in Oregon that may be used to support implementation of assessment, pollution controls and watershed restoration actions or land condition improvements that improve water quality in the Willamette Basin. Soil and water conservation districts and watershed councils are additional resources that may support responsible persons and DMAs in implementation of pollutant management strategies and control practices through the programs listed in Table 8.

Table 8: Partial list of funding programs available in the Willamette Subbasins

Program	General Description	Contact
Clean Water State Revolving Fund	Loan program for below-market rate loans for planning, design, and construction of various water pollution control activities.	DEQ
Conservation Reserve Enhancement Program (CREP)	Provides annual rent to landowners who enroll agricultural lands along streams. Also cost-shares conservation practices such as riparian tree planting, livestock watering facilities, and riparian fencing.	NRCS
Conservation Reserve Program (CRP)	Competitive CRP provides annual rent to landowners who enroll highly erodible lands. Continuous CRP provides annual rent to landowners who enroll agricultural lands along seasonal or perennial streams. Also cost-shares conservation practices such as riparian plantings.	NRCS
Conservation Stewardship Program (CSP)	Provides cost-share and incentive payments to landowners who have attained a certain level of stewardship and are willing to implement additional conservation practices.	NRCS
Emergency Watershed Protection Program (EWP)	Available through the USDA-Natural Resources Conservation Service. Provides federal funds for emergency protection measures to safeguard lives and property from floods and the products of erosion created by natural disasters that cause a sudden impairment to a watershed.	NRCS
Emergency Forest Restoration Program (EFRP)	Available through the USDA-Natural Resources Conservation Service. Helps owners of non-industrial private forests restore forest health damaged by natural disasters.	USDA
Oregon 319 Nonpoint Source Implementation Grants	Fund projects that reduce nonpoint source pollution, improve watershed functions and protect the quality of surface and groundwater, including restoration and education projects.	DEQ
Environmental Quality Incentives Program (EQIP)	Cost-shares water quality and wildlife habitat improvement activities, including conservation tillage, nutrient and manure management, fish habitat improvements, and riparian plantings.	NRCS
Agriculture Water Quality Support Grant	Provides capacity to support voluntary agricultural water quality work in small watersheds and to meet the goals of the Agricultural Water Quality Management Area Plans and the SIA initiative.	ODA
Agricultural Conservation Easement Program (ACEP)	Provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.	NRCS
Federal Reforestation Tax Credit	Provides federal tax credit as incentive to plant trees.	Internal Revenue Service
Grassland Reserve Program (GRP)	Provides incentives to landowners to protect and restore pastureland, rangeland, and certain other grasslands.	NRCS
Landowner Incentive Program (LIP)	Provides funds to enhance existing incentive programs for fish and wildlife habitat improvements.	U.S. Fish and Wildlife Service

Program	General Description	Contact
Oregon Watershed Enhancement Board (OWEB)	Provides grants for a variety of restoration, assessment, monitoring, and education projects, as well as watershed council staff support. 25 percent local match requirement on all grants.	OWEB
Oregon Watershed Enhancement Board Small Grant Program	Provides grants up to $10,000 for priority watershed enhancement projects identified by local focus group.	OWEB
Partners for Wildlife Program	Provides financial and technical assistance to private and non-federal landowners to restore and improve wetlands, riparian areas, and upland habitats in partnership with the U.S. Fish and Wildlife Service and other cooperating groups.	U.S. Fish and Wildlife Service
Public Law 566 Watershed Program	Program available to state agencies and other eligible organizations for planning and implementing watershed improvement and management projects. Projects should reduce erosion, siltation, and flooding; provide for agricultural water management; or improve fish and wildlife resources.	NRCS
Resource Conservation & Development (RC & D) Grants	Provides assistance to organizations within RC & D areas in accessing and managing grants.	Resource Conservation and Development
ODF Small Forestland Investment in Stream Habitat (SFISH) Grants	Provides funding for Small Forestland Owners (SFO's) to improve road conditions and stream crossings as part of forest operations.	ODF
State Forestation Tax Credit	Provides for reforestation of under-productive forestland not covered under the Oregon Forest Practices Act. Situations include brush and pasture conversions, fire damage areas, and insect and disease areas.	ODF
Forest Stewardship Program	Provides cost share dollars through USFS funds to family forest landowners to have management plans developed.	ODF
Western Bark Beetle Mitigation	ODF administers a cost share program for forest management practices pertaining to bark beetle mitigation for forest health and is funded through the USFS.	ODF
State Tax Credit for Fish Habitat Improvements	Provides tax credit for part of the costs of voluntary fish habitat improvements and required fish screening devices.	ODFW
Wetlands Reserve Program (WRP)	Provides cost-sharing to landowners who restore wetlands on agricultural lands.	NRCS
Wildlife Habitat Tax Deferral Program	Maintains farm or forestry deferral for landowners who develop a wildlife management plan with the approval of the Oregon Department of Fish and Wildlife.	ODFW
Funding Resources for Watershed Protection and Restoration	EPA's Funding Resources for Watershed Protection and Restoration (EPA, 2023) contains links to multiple funding sources	Various

5.4 Schedule for implementation plan submittal

OAR 340-042-0040(4)(l)(I) specifies that the WQMP contain a schedule for submittal of implementation plans. As stated in OAR 340-042-0080(4)(a), entities identified in the WQMP with responsibility for developing implementation plans are required to prepare and submit an implementation plan for DEQ approval according to the schedule in the WQMP.

Within 18 months of EQC adoption of the Willamette Basin mainstem TMDL (planned for February 2025), persons, including DMAs, responsible for developing implementation plans must submit implementation plans to DEQ for review and approval. OAR 340-012-0055(2)(e) identifies failure to timely submit or implement a TMDL implementation plan, as required by DEQ order or rule, as a Class II violation. OAR 340-012-0053(1) identifies failure to report by the reporting deadline, as required by DEQ order or rule, as a Class I violation.

Should a sector or sector-wide DMA fail to submit an approvable TMDL implementation plan or fail to timely implement, DEQ may pursue enforcement under OAR 340-012-0055(e) or identify individual sources (landowners/operators) as persons responsible for developing and implementing TMDL implementation plans to address the load allocations relevant for the sector. DEQ may revise the WQMP or issue individual orders to identify additional responsible persons and notify them of the required schedule for submitting source-specific implementation plans.

Following the issuance of this TMDL and WQMP, DEQ may determine that nonpoint source implementation plans are not necessary for certain entities identified in the WQMP based on available information or new information provided by those entities. For these entities, DEQ will provide a written determination for why a plan is not required. This determination could be based on a variety of factors, such as inaccurate identification within the geographic scope of the TMDLs, or documentation that an entity is not a source of pollution or does not discharge pollutants to a waterbody within the geographic scope of a TMDL.

Once approved, DEQ expects implementation plans to be fully implemented according to the timelines and schedules for achieving measurable milestones specified within the plans. Implementation plans must be reviewed and revised as appropriate for DEQ approval every five years and submitted on the date specified in DEQ’s approval letter for an implementation plan.

6. Monitoring and Evaluation of Progress

OAR 340-042-0040(4)(l)(K) requires that the WQMP include a plan to monitor and evaluate progress toward achieving the TMDL allocations and associated water quality standards for the impairments addressed in the TMDL. Additional objectives of monitoring efforts are to assess progress towards reducing excess pollutant loads and to better understand variability associated with environmental or anthropogenic factors. This section summarizes DEQ’s approach, including the required elements of identification of monitoring responsibilities and the plan and schedule for reviewing monitoring information to make TMDL revisions, as appropriate.

There are two fundamental components to DEQ's approach to monitoring and evaluating TMDL progress:

1. Tracking the implementation and effectiveness of activities committed to by responsible persons in DEQ-approved implementation plans, and
2. Periodically monitoring the physical, chemical and biological parameters necessary to assess water quality status and trends for the impairments that constitute the basis for this TMDL.

All responsible persons, including DMAs are responsible for tracking the implementation and effectiveness of their actions and meeting milestones where established. Progress in implementing streamside actions prioritized through the streamside evaluation, as well as other restoration efforts to improve stream temperature (e.g. channel morphology and stream flow restoration, protection and enhancement of cold water refuges, etc.) will form the basis against which implementation progress will be assessed. Although DEQ encourages responsible persons including DMAs to conduct physical, chemical or biological monitoring to better evaluate how implementation actions may impact water quality conditions, DEQ is only requiring the DMAs listed under section 6.1 to conduct water column monitoring associated with this TMDL.

With input from partners, DEQ will develop overarching water column sampling and analysis plans to finalize the first iteration of the Willamette Basin Temperature Monitoring Strategy after the issuance of the Willamette Mainstem Temperature TMDL and WQMP. DEQ will continue to work with partners to implement the sampling and analysis and periodically refine the strategy as needed.

6.1 Persons responsible for water quality monitoring

Section 5.1 identifies responsible persons, including Designated Management Agencies that are responsible for developing TMDL implementation plans and implementing the management strategies described on the timelines committed to in approved plans. Section 5.3 details the content required in implementation plans and annual reports, as well as the schedules for their submittal.

DEQ is requiring ODA, ODF, BLM, and USFS to undertake monitoring actions in areas within their jurisdiction or ownership to help determine the status of instream water quality and landscape conditions associated with water quality. These four agencies have jurisdiction over approximately 93% of streamside areas in the Willamette Subbasins TMDL. For this reason, DEQ considers it appropriate for these large agencies to collaborate with DEQ on the Monitoring Strategy. DEQ encourages and invites other DMAs to collaborate with DEQ on collecting water quality data, especially DMAs that have been collecting temperature data as part of TMDL implementation or other related programs.

This effort will be iterative, beginning with review of existing data and monitoring locations, then adjusted as needed to improve understanding of current water quality status and develop a temperature trend monitoring network. DEQ expects to refine this monitoring strategy over time and modify as necessary.

The objectives for monitoring and assessment will be described in DMA implementation plans and will include, but are not limited to:

1. Provide information necessary to determine locations for applying management strategies or to assess the effectiveness of those strategies.
2. Refine information on source-specific or sector-specific pollutant loading.
3. Provide information necessary to demonstrate progress towards meeting load allocations.
4. Provide information used to identify roles and participate in collaborative effort among responsible persons to characterize water quality status and trends.
5. Provide information integral to an adaptive management approach to inform and adjust management strategies over time.

Environmental media and water column monitoring activities conducted by ODA, ODF, BLM, USFS, or other DMAs to meet TMDL objectives, data collection and management must be performed in adherence to Quality Control procedures and Quality Assurance protocols established by DEQ, U.S. EPA or other appropriate organizations. This requirement will be met through developing or adapting Quality Assurance Project Plans or project-specific Sampling and Analysis Plans, and submitting to DEQ for review and approval based on a schedule determined by DEQ once development of the Monitoring Strategy has been initiated. ODA, ODF, BLM, USFS or other DMAs can also agree to participate in a collaborative monitoring plan under an umbrella QAPP. DEQ staff will coordinate QAPP development with ODA, ODF, BLM, and USFS upon request in advance of submission. Resources for developing quality assurance project plans and sampling and analysis plans are available on DEQ's water quality monitoring website (DEQ, 2023).

At a minimum, ODA, ODF, BLM, and USFS must acknowledge in their implementation plans their responsibility in collaborating with DEQ to develop the Willamette Basin Temperature Monitoring Strategy. DEQ encourages these agencies to begin evaluating their existing temperature monitoring networks, if any, and explore opportunities to establish future long-term monitoring sites. Data collected by DMAs participating in the monitoring strategy must be in a format accessible to DEQ.

6.2 Plan and schedule for reviewing monitoring information and revising the TMDL

DEQ recognizes that it will take time before management practices identified in a WQMP are fully implemented and effective in reducing and controlling pollution. DEQ also recognizes that despite best efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL. Such events include, but are not limited to, floods, fire, insect infestations and drought. In addition, DEQ recognizes that technology and practices for controlling nonpoint source pollution will continue to develop and improve over time. DEQ will use adaptive management to refine implementation as technology, and knowledge about these approaches progress.

Adaptive management is a process that acknowledges and incorporates improved technologies and practices over time to refine implementation. A conceptual representation of the TMDL adaptive management process is presented in Figure 4.

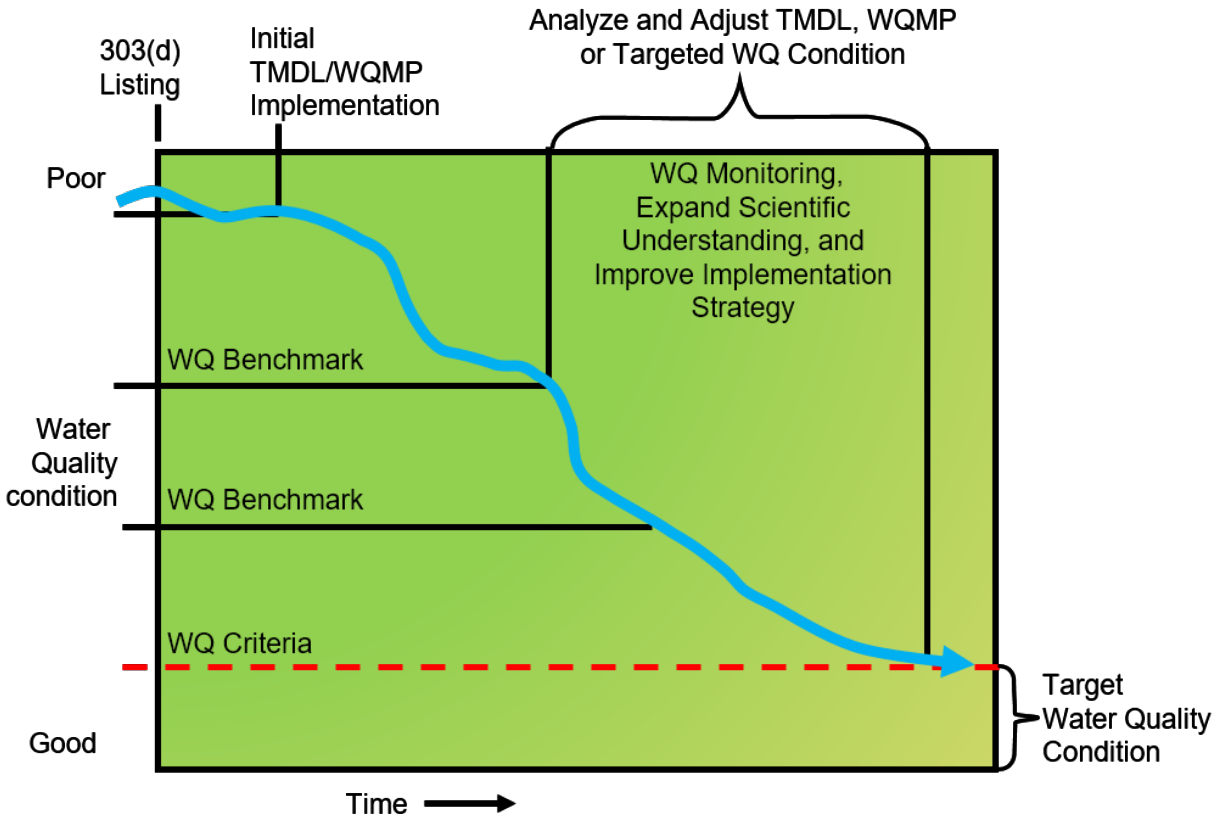


Figure 4: Conceptual representation of adaptive management

DEQ considers entities complying with DEQ-approved TMDL implementation plans to be in compliance with their respective requirements contained in the TMDLs. The annual reports and Year Five Reviews submitted to DEQ by each of the responsible persons, including DMAs, in the Willamette Basin will be evaluated individually and collectively. DEQ will use this information to determine whether management actions are supporting progress towards TMDL objectives, or if changes in management actions and/or TMDLs are needed.

DEQ will review annual reports, participate with responsible persons, including DMAs, in review of monitoring information, and participate in implementing the Willamette Basin Monitoring Strategy.

Every five years, DEQ will collectively evaluate annual reports and all available monitoring data and information to assess progress on meeting the goals of the TMDLs and WQMP.

- DEQ will require responsible persons including DMAs to revise their implementation plans to address deficiencies where DEQ determines that implementation plans or effectiveness of management strategies are inadequate.
- DEQ and partners will revise sampling and analysis plans or other aspects of the Monitoring Strategy where progress toward meeting Monitoring Strategy objectives is not being made.
- DEQ will consider TMDL revisions if DEQ's evaluation of water monitoring data and supporting information indicate that the TMDL load allocations for a given pollutant-impairment are insufficient to meet state numeric criteria or narrative criteria, or insufficient to protect the designated beneficial uses.

- DEQ will follow all public participation requirements, including convening a local technical or rulemaking advisory committee to provide input on TMDL revisions per OAR 340-042-0040(7).

7. Reasonable Assurance of Implementation

OAR 340-042-0030(9) defines Reasonable Assurance as “a demonstration that a TMDL will be implemented by federal, state or local governments or individuals through regulatory or voluntary actions including management strategies or other controls.” OAR 340-042-0040(4)(l)(J) requires a description of reasonable assurance that management strategies and sector-specific or source-specific implementation plans will be carried out through regulatory or voluntary actions. As a factor in consideration of allocation distribution among sources, OAR 340-042-0040(6)(g) states that “to establish reasonable assurance that the TMDL’s load allocations will be achieved requires determination that practices capable of reducing the specified pollutant load: (1) exist; (2) are technically feasible at a level required to meet allocations; and (3) have a high likelihood of implementation.” This three-point test is consistent with EPA past practice on determining reasonable assurance in the Chesapeake Bay TMDL (EPA, 2010) and supports federal antidegradation rules and Oregon’s antidegradation policy (OAR 340-041-0004).

The Clean Water Act section 303(d) requires that a TMDL be “established at a level necessary to implement the applicable water quality standard.” Federal regulations define a TMDL as “the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background” [40 CFR 130.2(i)]. For TMDL approval, EPA guidance documents and memos on the TMDL process requires determinations that allocations are appropriate to implement water quality standards and reasonable assurance that nonpoint source controls will achieve load reductions, when WLAs are based on an assumption that nonpoint source load reductions will occur (EPA, 1991, 2002 and 2012).

Although TMDL implementation is anticipated to improve rather than lower water quality, federal antidegradation rules at 40 CFR 131.12(a)(2), require states to “assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and cost-effective and reasonable best management practices for nonpoint source control,” when allowing any lowering of water quality.

When a TMDL is developed for waters impaired by point sources only, the existence of the NPDES regulatory program and the issuance of NPDES permits provide the reasonable assurance that the wasteload allocations in the TMDL will be achieved. That is because federal regulations implementing the Clean Water Act require that water quality-based effluent limits in permits be consistent with “the assumptions and requirements of any available wasteload allocation” in an approved TMDL [40 CFR 122.44(d)(1)(vii)(B)].

Where a TMDL is developed for waters impaired by both point and nonpoint sources, it is the state’s best professional judgment as to the three-point test in OAR 340-042-0040(6)(g) on reasonable assurance that the TMDL’s load allocations will be achieved.

Where there is a demonstration that nonpoint source load reductions can and will be achieved; a determination that reasonable assurance exists and allocation of greater loads to point sources is appropriate. Without a demonstration of reasonable assurance that relied-upon nonpoint source reductions will occur, reductions to point sources wasteload allocations are needed.

The Willamette Basin TMDLs were developed to address both point and nonpoint sources with load reduction allocations proportional to estimated source contributions and in consideration of opportunities for effective measures to reduce those contributions. There are several elements that combine to provide the reasonable assurance to meet federal and state requirements, including for antidegradation. Education, outreach, technical and financial assistance, permit administration, permit enforcement, responsible person's implementation and DEQ enforcement of TMDL implementation plans will all be used to ensure that the goals of this TMDL are met.

7.1 Accountability framework

Reasonable assurance that needed load reductions will be achieved for nonpoint sources and antidegradation requirements and narrative water quality criteria will be met is based primarily on an accountability framework incorporated into the WQMP, together with the implementation plans of persons responsible for implementation. This approach is similar to the accountability framework adopted by EPA for the Chesapeake Bay TMDL, which was adopted in 2010 (EPA, 2010). Figure 5 presents the accountability framework elements, which are intended to work in concert to demonstrate reasonable assurance of implementation.

Figure 5: Representation of the reasonable assurance accountability framework led by DEQ

Pollutant reduction strategies are identified in Section 2 and more specific strategies, practices and actions will be detailed in each required implementation plan, to be submitted per the timelines in Section 5.4. These strategies and actions are comprehensively implemented through a variety of regulatory and non-regulatory programs. Many of these are existing strategies and actions that are already being implemented within the watershed and demonstrate reduced pollutant loading. These strategies are technically feasible at an appropriate scale to meet the allocations. A high likelihood of implementation is demonstrated because DEQ reviews the individual implementation plans and proposed actions for adequacy and establishes a monitoring and reporting system to track implementation and respond to any inadequacies. In Oregon, forestry and agricultural related nonpoint source best management strategies are actualized through implementation of state Forest Practices Act and agricultural Water Quality Management Area Plans and Rules. In Sections 5.2.1 and 5.2.2 DEQ determined that ODF and ODA must also develop and implement TMDL implementation plans that describe strategies specific to the Willamette River Subbasins. This adds to the accountability for implementation of cost-effective and reasonable best management and further assures that antidegradation requirements and narrative criteria will be met.

Approximately 135 responsible persons, including Designated Management Agencies in Appendix A are responsible for implementation of pollutant reduction strategies. General timelines, milestones and measurable objectives are identified in Sections 3 and 4.2,

respectively. More specific timelines, milestones and measurable objectives will be specified in each required implementation plan. These elements support timely action by both DEQ and persons/agencies responsible for implementation so that enforcement and adaptive management actions can be triggered and evaluation of attainment of TMDL goals occurs.

DEQ periodically reviews reporting by persons and agencies responsible for implementing pollutant reduction strategies to track the management strategies being implemented and evaluate achievements against established timelines and milestones.

Following up on reviews to track progress of implementation plans, DEQ will take appropriate action if the DMAs or responsible persons fail to develop or effectively implement their implementation plan or fulfill milestones. DEQ's actions can include enforcement or engagement in voluntary initiatives. DEQ uses both, as appropriate within the process, to achieve optimal pollutant reductions. In some cases, DEQ will also take enforcement actions where necessary based on authorities listed in Section 8 or raise the issue to the Environmental Quality Commission as provided in OAR 340-042-0080.

DEQ tracks water quality status and trends concurrently with implementation of management strategies. DEQ relies on a system of interconnected evaluations, which include DMAs meeting measurable objectives, effectiveness demonstration of pollutant management strategies, accountability of implementation, periodically assessing progress on Oregon's Nonpoint Source Program Five-Year Plan Goals (approved by EPA), discharge monitoring and instream monitoring. DEQ also periodically evaluates water quality data collected through ambient and specific monitoring programs, including monitoring plans developed specifically for the Willamette Basin, as presented in Section 6. The *Assessment and Monitoring Strategy to Support Implementation of Mercury Total Maximum Daily Loads for the Willamette Basin* is one such plan, which was developed in partnership with EPA. DEQ regularly prepares Status and Trends reports and conducts water quality assessments on status of all waterways in Oregon every two years, as required by the Clean Water Act for submittal to EPA for approval as DEQ's Integrated Report. Together, these data and evaluations allow refinement of focus on specific geographic areas or discharges and appropriate implementation of adaptive management actions to attain, over time, the objectives of the TMDL.

7.2 Reasonable assurance conclusions

DEQ's implementation approach is multi-faceted and requires many targeted management practices across the entire basin to reduce anthropogenic pollutants, regardless of source origination.

The management strategies and practices that must be employed to reduce excess solar radiation loading are spatially distributed and involve multiple responsible persons. Also, highly variable lag times are anticipated following the establishment of shade-producing vegetation to decrease solar radiation reaching streams. For these reasons, there is some uncertainty about the pace of achieving the needed reductions necessary in the Willamette Subbasins to attain water quality criteria. DEQ's WQMP addresses this uncertainty by including an extensive monitoring, reporting, and adaptive component that is designed to match the accountability framework used by EPA in its Chesapeake Bay TMDL (2010).

The rationale described in this document stems from robust evaluations, implements an accountability framework and provides opportunities for adaptive management to maximize pollutant reductions. In addition, DMAs and other groups have been continuing to implement on-the-ground actions since the establishment of the 2006 Willamette Basin Temperature TMDL. Together this approach provides reasonable assurance to meet state and federal requirements, including for antidegradation, and attain the goals of the TMDL.

8. Legal Authorities

As required in Oregon Administrative Rule 340-042-0040(4)(l)(O), this section cites legal authorities relating to implementation of management strategies.

Clean Water Act, Section 303(d)

The DEQ is the Oregon state agency responsible for implementing the Clean Water Act in Oregon. Section 303(d) of the 1972 Federal Clean Water Act as amended requires states to develop a list of rivers, streams and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. These waters are referred to as “water quality limited.” Water quality limited waterbodies must be identified by the EPA or by a state agency which has this authority. In Oregon, the responsibility to delegate water quality limited waterbodies rests with DEQ and DEQ’s list of water quality limited waters is updated every two years. The list is referred to as the 303(d) list. Section 303 of the Clean Water Act further requires that TMDLs be developed for all waters on the 303(d) list. The Oregon Environmental Quality Commission granted DEQ authority to implement TMDLs through OAR 340-042, with special provisions for agricultural lands and nonfederal forestland as governed by the Agriculture Water Quality Management Act and the Forest Practices Act, respectively. The EPA has the authority under the Clean Water Act to approve or disapprove TMDLs that states submit. When a TMDL is officially submitted by a state to EPA, EPA has 30 days to take action on the TMDL. In the case where EPA disapproves a TMDL, EPA must issue a TMDL within 30 days. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to describe a strategy for reducing water pollution to the level of the load allocations and waste load allocations prescribed in the TMDL, which is designed to restore the water quality and result in compliance with the water quality standards. In this way, the designated beneficial uses of the water will be protected for all users.

Endangered Species Act, Section 6

Section 6 of the 1973 federal Endangered Species Act, as amended, encourages states to develop and maintain conservation programs for federally listed threatened and endangered species. In addition, Section 4(d) of the ESA requires the National Marine Fisheries Service to list the activities that could result in a “take” of species they are charged with protecting. With regard to this TMDL, NMFS’ protected species are salmonid fish. NMFS also described certain precautions that, if followed, would preclude prosecution for take even if a listed species were harmed inadvertently. Such a provision is called a limit on the take prohibition. The intent is to provide local governments and other entities greater certainty regarding their liability for take.

NMFS published their rule in response to Section 4(d) in July of 2000 (see 65 FR 42421, July 10, 2000). The NMFS 4(d) rule lists 12 criteria that will be used to determine whether a local program incorporates sufficient precautionary measures to adequately conserve fish. The rule provides for local jurisdictions to submit development ordinances for review by NMFS under one, several or all of the criteria. The criteria for the Municipal, Residential, Commercial and Industrial Development and Redevelopment limit are listed below:

1. Avoid inappropriate areas such as unstable slopes, wetlands, and areas of high habitat value;
2. Prevent stormwater discharge impacts on water quality;
3. Protect riparian areas;
4. Avoid stream crossings – whether by roads, utilities, or other linear development;
5. Protect historic stream meander patterns;
6. Protect wetlands, wetland buffers, and wetland function;
7. Preserve the ability of permanent and intermittent streams to pass peak flows (hydrologic capacity);
8. Stress landscaping with native vegetation;
9. Prevent erosion and sediment run-off during and after construction;
10. Ensure water supply demand can be met without affecting salmon needs;
11. Provide mechanisms for monitoring, enforcing, funding and implementing; and
12. Comply with all other state and federal environmental laws and permits.

Oregon Revised Statute Chapter 468B

DEQ is authorized by law to prevent and abate water pollution within the State of Oregon. Particularly relevant provisions of this chapter include:

ORS 468B.020 Prevention of pollution

(A) Pollution of any of the waters of the state is declared to be not a reasonable or natural use of such waters and to be contrary to the public policy of the State or Oregon, as set forth in ORS 468B.015.

(B) In order to carry out the public policy set forth in ORS 468B.015, the Department of Environmental Quality shall take such action as is necessary for the prevention of new pollution and the abatement of existing pollution by:

a) Fostering and encouraging the cooperation of the people, industry, cities and counties, in order to prevent, control and reduce pollution of the waters of the state; and

b) Requiring the use of all available and reasonable methods necessary to achieve the purposes of ORS 468B.015 and to conform to the standards of water quality and purity established under ORS 468B.048.

ORS 468B.110 provides DEQ and the EQC with authority to take actions necessary to achieve and maintain water quality standards, including issuing TMDLs and establishing wasteload allocations and load allocations.

NPDES and WPCF Permits

DEQ administers two different types of wastewater permits in implementing Oregon Revised Statute (ORS) 468B.050. These are: the NPDES permits for waste discharge into waters of the United States; and Water Pollution Control Facilities permits for waste disposal on land. The NPDES permit is also a federal permit and is required under the Clean Water Act. The WPCF permit is a state program.

401 Water Quality Certification

Section 401 of the CWA requires that any applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the state must provide the licensing or permitting agency a certificate from DEQ that the activity complies with water quality requirements and standards. These include certifications for hydroelectric projects and for 'dredge and fill' projects. The legal citations are: 33 U.S.C. 1341; ORS 468B.035 – 468B.047; and OAR 340-048-0005 – 340-048-0040.

USACE Dam Operation and Management

In association with other federal statues, including House Document No. 531 Volume V, the River and Harbor Act, the Flood Control Act, and the Water Resources Development Act, the USACE is charged with operating its projects in compliance with the federal Clean Water Act, and in accordance with all federal, State, interstate and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water quality pollution as per Title 1 Section 313 (33 U.S.C. 1323).

Oregon Forest Practices Act

The Oregon Department of Forestry is the designated management agency for regulating land management actions on non-federal forestry lands that impact water quality (ORS 527.610 to 527.992, and OAR 629 Divisions 600 through 665). The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 625, 630, and 635-660, which describe best management practices for forest operations. The Oregon Environmental Quality Commission, Board of Forestry, DEQ, and ODF have agreed that these pollution control measures will primarily be relied upon to result in achievement of state water quality standards. Statutes and rules also include provisions for adaptive management that provide for revisions to FPA practices where necessary to meet water quality standards. These provisions are described in ORS 527.710, ORS 527.765, OAR 629-035-0100, and OAR 340-042-0080.

Agricultural Water Quality Management Act

The Oregon Department of Agriculture is responsible for the prevention and control of water pollution from agricultural activities as directed and authorized through the Agricultural Water Quality Management Act, adopted by the Oregon legislature in 1993 (ORS 568.900 to ORS 568.933). It is the lead state agency for regulating agriculture for water quality (ORS 561.191). The Agricultural Water Quality Management Plan Act directs the ODA to work with local communities to develop water quality management plans for specific watersheds that have been identified as violating water quality standards and have agriculture water pollution contributions. The agriculture water quality management plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct the problems. Water Quality

area rules for areas within the Willamette Basin include OAR 603-095-2100 to 1160, OAR 603-095-2300 to 2360, OAR 603-095-2600 to 2660, and OAR 603-095-3700 to 3760.

Local Ordinances

Local governments are expected to describe in their implementation plans their specific legal authorities to carry out the management strategies necessary to meet the TMDL allocations. If new or modified local codes or ordinances are required to implement the plan, the DMA will identify code development as a management strategy. Legal authority to enforce the provisions of a city's NPDES permit would be a specific example of legal authority to carry out specific management strategies.

9. References

DEQ. 2014. Willamette Basin Five Year Review. https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Implementation.aspx

DEQ. 2022. Water Quality Status and Trends. https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx

DEQ. 2022. EPA approved Integrated Report. https://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx

DEQ. 2023. Willamette Subbasins Interactive Map. https://www.oregon.gov/deq/wq/Documents/map_Willamette_Subbasins.html

DEQ. 2018. Oregon Nonpoint Source Pollution Program 2017 Annual Report. Oregon Department of Environmental Quality. July 2018.

DEQ. 2023a. Draft Willamette Subbasins TMDL Technical Support Document. Oregon Department of Environmental Quality.

DEQ. 2023b. Draft Willamette Subbasins Temperature TMDL. Oregon Department of Environmental Quality.

DEQ. 2023c. Volunteer Monitoring Resources webpage. https://www.oregon.gov/deq/wq/Pages/WQ-Monitoring-Resources.aspx. Accessed January 20, 2023.

DEQ. 2023d. Water Temperature Impacts from In-Channel Ponds in Portland Metro and Northwest Region.

Doran, George T. 1981. There's a S.M.A.R.T. way to write management's goals and objectives. Management Review. 70. Pages 35-36. https://community.mis.temple.edu/mis0855002fall2015/files/2015/10/S.M.A.R.T-Way-Management-Review.pdf. Accessed January 20, 2023.

EPA. 1991. Guidance for Water Quality-based Decisions: The TMDL Process. EPA/440/4-91-001. Washington, D.C.

EPA. 2002. Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992. May 20, 2002.

EPA. 2007. National Management Measures to Control Nonpoint Source Pollution from Hydromodification. EPA 841-B-07-002. National Management Measures to Control Nonpoint Source Pollution from Hydromodification (epa.gov)

EPA. 2008. Handbook for Developing Watershed Plans to Restore and Protect Our Waters. US Environmental Protection Agency. https://nepis.epa.gov/Exe/ZyPDF.cgi/P1002U9R.PDF?Dockey=P1002U9R.PDF.

EPA. 2010. Chesapeake Bay TMDL. December 29, 2010. https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document.

EPA. 2012. Supplemental Information for Reviewing Reasonable Assurance in TMDLs. Office of Wetlands, Oceans and Watersheds. February 15, 2012.

EPA. 2017. Causal Analysis/Diagnosis Decision Information System (CADDIS): *Vol. 2: Sources, Stressors, and Responses - Temperature*. https://www.epa.gov/caddis-vol2/temperature

EPA. 2023. Funding Resources for Watershed Protection and Restoration webpage. https://www.epa.gov/nps/funding-resources-watershed-protection-and-restoration. Accessed January 20, 2023.

EPA and DSL. 2020. Stream Function Assessment Methodology. US Environmental Protection Agency and Oregon Department of State Lands. https://www.oregon.gov/dsl/WW/Pages/SFAM.aspx.

Galli J., and R. Dubose. 1990. Thermal Impacts Associated with Urbanization and Stormwater Management Best Management Practices. Metropolitan Washington Council of Governments, Department of Environmental Programs, Washington DC.

Larson, L.L., and S.L. Larson. 1996. Riparian Shade and Stream Temperature: A Perspective. Rangelands, 18(4):149-152.

NRCS. 2009. Stream Visual Assessment Protocol Version 2. National Biology Handbook. Subpart B – Conservation Planning. Part 614. US Department of Agriculture – Natural Resources Conservation Service. December 2009. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_042678.pdf.

Oregon Plan for Salmon and Watersheds. 1999. Oregon Aquatic Habitat Restoration and Enhancement Guide. Restoration_Enhancement_Guide.pdf (oregon.gov)

OWEB. 2004. Riparian Assessment Framework – The Oregon Plan for Salmon and Watersheds. Oregon Watershed Enhancement Board. https://digital.osl.state.or.us/islandora/object/osl:16642/datastream/OBJ/view.

OWEB. 2023. Oregon Watershed Restoration Inventory. https://www.oregon.gov/oweb/data-reporting/Pages/owri.aspx. Accessed March 15, 2023.

OWEB. 2023a. Oregon Watershed Restoration Inventory Online. https://apps.wrd.state.or.us/apps/oweb/owrio/default.aspx. Accessed March 15, 2023.

BLM (U.S. Department of the Interior, Bureau of Land Management). 2016. *Northwestern & Coastal Oregon record of decision and resource management plan.*

USFS and BLM (U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management). 1994. *Record of decision for amendments to Forest*

Service and Bureau of Land Management planning documents within the range of the northern spotted owl.

Roon D.A., Dunham J.B., Groom J.D. 2021. Shade, light, and stream temperature responses to riparian thinning in second-growth redwood forests of northern California. *PLoS ONE* 16(2):e0246822

Appendix A: Proposed list of responsible persons including designated management agencies

No.	Designated Management Agencies/Responsible Persons	DMA Type	Total Acres in Subbasins	Acres 150ft from stream	DMA/RP Status	TMDL Plan Needed?
1	Adair Village	City	483	55	existing	yes
2	Albany	City	11,237	1,041	existing	yes
3	Aumsville	City	788	103	existing	yes
4	Aurora	City	315	45	existing	yes
5	Brownsville	City	834	96	existing	yes
6	Canby	City	3,185	122	existing	yes
7	Coburg	City	653	68	existing	yes
8	Corvallis	City	14,020	1,508	existing	yes
9	Cottage Grove	City	2,403	127	existing	yes
10	Creswell	City	1,432	114	existing	yes
11	Dallas	City	3,998	757	existing	yes
12	Detroit	City	661	132	existing	yes
13	Donald	City	283	18	existing	yes
14	Dundee	City	848	33	existing	yes
15	Estacada	City	1,434	207	existing	yes
16	Eugene	City	31,614	3,019	existing	yes
17	Fairview	City	1,773	343	existing	yes
18	Falls City	City	787	241	existing	yes
19	Gates	City	399	106	existing	yes
20	Gervais	City	308	19	existing	yes
21	Gladstone	City	1,578	30	existing	yes
22	Gresham	City	11,952	1,594	existing	yes
23	Halsey	City	259	36	existing	yes
24	Happy Valley	City	7,402	1,508	existing	yes
25	Harrisburg	City	826	98	existing	yes
26	Hubbard	City	444	29	existing	yes
27	Idanha	City	530	147	existing	yes
28	Independence	City	1,908	165	existing	yes
29	Jefferson	City	529	77	existing	yes
30	Johnson City	City	43	13	existing	yes
31	Junction City	City	1,992	280	existing	yes
32	Keizer	City	4,298	171	existing	yes
33	Lake Oswego	City	5,807	962	existing	yes
34	Lebanon	City	4,306	383	existing	yes
35	Lowell	City	534	76	existing	yes

No.	Designated Management Agencies/Responsible Persons	DMA Type	Total Acres in Subbasins	Acres 150ft from stream	DMA/RP Status	TMDL Plan Needed?
36	Lyons	City	544	56	existing	yes
37	Mill City	City	526	52	existing	yes
38	Millersburg	City	2,804	401	existing	yes
39	Milwaukie	City	3,241	284	existing	yes
40	Molalla	City	1,642	74	existing	yes
41	Monmouth	City	1,462	135	existing	yes
42	Monroe	City	342	23	existing	yes
43	Mt. Angel	City	677	18	existing	yes
44	Newberg	City	3,692	312	existing	yes
45	Oakridge	City	1,241	153	existing	yes
46	Oregon City	City	6,437	440	existing	yes
47	Philomath	City	1,597	165	existing	yes
48	Portland	City	73,674	9,339	existing	yes
49	Salem	City	31,373	2,942	existing	yes
50	Sandy	City	1,768	197	existing	yes
51	Scappoose	City	2,098	212	new	yes
52	Scio	City	262	40	existing	yes
53	Scotts Mills	City	225	46	existing	yes
54	Silverton	City	2,455	597	existing	yes
55	Springfield	City	10,323	1,004	existing	yes
56	St. Helens	City	1,973	368	new	yes
57	St. Paul	City	184	6	existing	yes
58	Stayton	City	1,923	241	existing	yes
59	Sublimity	City	595	25	existing	yes
60	Sweet Home	City	3,441	616	existing	yes
61	Tangent	City	2,230	252	existing	yes
62	Troutdale	City	1,214	166	new	yes
63	Tualatin	City	401	7	existing	no
64	Turner	City	911	124	existing	yes
65	Veneta	City	1,658	207	existing	yes
66	West Linn	City	4,335	629	existing	yes
67	Westfir	City	192	68	existing	yes
68	Wilsonville	City	4,869	420	existing	yes
69	Woodburn	City	3,596	276	existing	yes
70	Benton County	County	27,798	3,456	existing	yes
71	Clackamas County	County	79,838	13,597	existing	yes
72	Columbia County	County	15,374	3,409	new	yes
73	Curry County	County	3	0.5	new	no
74	Lane County	County	121,090	19,240	existing	yes

No.	Designated Management Agencies/Responsible Persons	DMA Type	Total Acres in Subbasins	Acres 150ft from stream	DMA/RP Status	TMDL Plan Needed?
75	Lincoln County	County	89	43	new	no
76	Linn County	County	35,141	5,962	existing	yes
77	Marion County	County	43,290	5,978	existing	yes
78	Multnomah County	County	4,089	1,170	existing	yes
79	Polk County	County	20,855	4,029	existing	yes
80	Washington County	County	2,130	156	new	no
81	Yamhill County	County	10,131	1,355	new	yes
82	Bonneville Power Administration	Federal	1,018	252	new	no
83	U.S. Bureau of Land Management	Federal	351,837	110,202	existing	yes
84	U.S. Fish and Wildlife Service	Federal	10,912	1,568	existing	yes
85	U.S. Forest Service	Federal	2,201,208	549,814	existing	yes
86	US Army Corps of Engineers	Federal	29,289	5,884	existing	yes
87	Pacific Power and Light	Private Utility	35	1	new	no
88	Eugene Water and Electric Board	Public Utility	not assessed	not assessed	existing	yes
89	Portland General Electric	Public Utility	not assessed	not assessed	new	yes
90	Albany & Eastern Railroad	Railroad	304	52	new	no
91	BNSF Railway	Railroad	148	9	new	no
92	Central Oregon & Pacific Railroad	Railroad	182	32	new	no
93	Oregon Pacific Railroad	Railroad	44	2	new	no
94	Port of Coos Bay	Transportation	315	57	new	no
95	Portland & Western Railroad	Railroad	1,898	261	new	no
96	Portland Terminal Railroad Company	Railroad	0.1	0.1	new	no
97	TriMet	Railroad	102	38	new	no
98	Union Pacific Railroad	Railroad	3,788	630	new	no
99	Vennel Farms Railroad Company	Railroad	2	0.2	new	no
100	Willamette Shore Trolley	Railroad	6	1	new	no
101	Willamette Valley Railway	Railroad	255	51	new	no
102	Ash Creek Water Control District	Responsible Person	not assessed	not assessed	new	no
103	Creswell Water Control District	Responsible Person	not assessed	not assessed	new	no
104	Creswell Irrigation District	Responsible Person	not assessed	not assessed	new	no
105	East Valley Water District	Responsible Person	not assessed	not assessed	new	no
106	East Valley Water District	Responsible Person	not assessed	not assessed	new	no

No.	Designated Management Agencies/Responsible Persons	DMA Type	Total Acres in Subbasins	Acres 150ft from stream	DMA/RP Status	TMDL Plan Needed?
107	G A Miller Drainage District No 1	Responsible Person	not assessed	not assessed	new	no
108	Grand Prairie Water Control District	Responsible Person	not assessed	not assessed	new	no
109	Hawn Creek District Improvement Co.	Responsible Person	not assessed	not assessed	new	no
110	Junction City Water Control District	Responsible Person	not assessed	not assessed	new	no
111	Lacomb Irrigation District	Responsible Person	not assessed	not assessed	new	no
112	Lake Labish Water Control District	Responsible Person	not assessed	not assessed	new	no
113	Muddy Creeks Irrigation Project	Responsible Person	not assessed	not assessed	new	no
114	Multnomah County Drainage District	Responsible Person	not assessed	not assessed	new	no
115	North Lebanon Water Control District	Responsible Person	not assessed	not assessed	new	no
116	Palmer Creek Water District Improvement Co.	Responsible Person	not assessed	not assessed	new	no
117	Peninsula Drainage District #1	Responsible Person	not assessed	not assessed	new	no
118	Peninsula Drainage District #2	Responsible Person	not assessed	not assessed	new	no
119	Santiam Water Control District	Responsible Person	not assessed	not assessed	new	no
120	Sauvie Island Drainage Improvement Company	Responsible Person	not assessed	not assessed	new	no
121	Scappoose Drainage Improvement Company	Responsible Person	not assessed	not assessed	new	no
122	Sidney Irrigation District	Responsible Person	not assessed	not assessed	new	no
123	West Labish Water Control District	Responsible Person	not assessed	not assessed	new	no
124	Metro (Portland Metropolitan Government)	Special District	not assessed	not assessed	existing	yes
125	Water and Environment Services	Special District	not assessed	not assessed	existing	yes
126	Department of Geology and Mineral Industries	State	2,055	258	existing	no
127	Oregon Department of Agriculture	State	1,296,218	191,934	existing	yes
128	Oregon Department of Environmental Quality	State	0	0	existing	no
129	Oregon Department of Fish & Wildlife	State	10,080	1,359	new	yes
130	Oregon Department of Forestry	State	1,721,083	456,567	existing	yes
131	Oregon Department of State Lands	State	336	37	existing	no

No.	Designated Management Agencies/Responsible Persons	DMA Type	Total Acres in Subbasins	Acres 150ft from stream	DMA/RP Status	TMDL Plan Needed?
132	Oregon Department of Transportation	State	30,997	4,856	existing	yes
133	Oregon Parks and Recreation Department	State	19,440	3,219	existing	yes
134	Port of Columbia County	Transportation	619	71	new	yes
135	Port of Portland	Transportation	5,497	556	existing	yes

Appendix B: Acres of jurisdiction, by HUC, within 150 ft of stream centerline for each DMA

Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
Molalla-Pudding Subbasin - HUC 17090009					
Oregon Department of Forestry	State	207,747	56,523	47	37
Oregon Department of Agriculture	State	237,200	35,970	30	42
U.S. Bureau of Land Management	Federal	54,013	16,403	14	10
Marion County	County	19,780	2,733	2	4
Clackamas County	County	11,823	2,594	2	2
Oregon Parks and Recreation Department	State	9,197	2,073	2	2
City of Silverton	City	2,455	597	0	0
City of Salem	City	3,245	388	0	1
City of Woodburn	City	3,596	276	0	1
City of Molalla	City	1,642	74	0	0
City of Canby	City	1,081	65	0	0
City of Scotts Mills	City	225	46	0	0
City of Aurora	City	315	45	0	0
City of Hubbard	City	444	29	0	0
Willamette Valley Railway	Railroad	196	25	0	0
City of Gervais	City	308	19	0	0
City of Mt. Angel	City	677	18	0	0
Union Pacific Railroad	Railroad	276	18	0	0
Portland & Western Railroad	Railroad	51	2	0	0
Oregon Pacific Railroad	Railroad	41	2	0	0
City of Donald	City	70	0	0	0
Oregon Department of Fish and Wildlife	State	215	0	0	0
Middle Willamette Subbasin - HUC 17090007					
Oregon Department of Agriculture	State	265,372	28,059	48	58
Oregon Department of Forestry	State	40,322	12,637	21	9
Clackamas County	County	20,406	3,678	6	4
City of Salem	City	27,830	2,539	4	6
Polk County	County	11,325	1,982	3	2
Marion County	County	18,823	1,805	3	4

Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
U.S. Bureau of Land Management	Federal	3,787	1,380	2	1
Yamhill County	County	10,131	1,355	2	2
City of Dallas	City	3,998	757	1	1
U.S. Fish and Wildlife Service	Federal	5,092	549	1	1
Oregon Department of Transportation	State	4,810	546	1	1
City of Wilsonville	City	4,869	420	1	1
U.S. Forest Service	Federal	1,033	363	1	0
City of Newberg	City	3,692	312	1	1
Oregon Parks and Recreation Department	State	3,699	263	0	1
City of Keizer	City	4,298	171	0	1
City of Independence	City	1,908	165	0	0
Washington County	County	2,094	152	0	0
City of West Linn	City	2,191	146	0	0
City of Stayton	City	1,200	146	0	0
City of Turner	City	911	124	0	0
City of Monmouth	City	1,433	120	0	0
City of Aumsville	City	788	103	0	0
Union Pacific Railroad	Railroad	251	68	0	0
City of Canby	City	2,102	57	0	0
Portland & Western Railroad	Railroad	524	49	0	0
City of Dundee	City	848	33	0	0
Willamette Valley Railway	Railroad	59	26	0	0
City of Donald	City	213	18	0	0
City of Tualatin	City	327	7	0	0
Oregon Department of Fish and Wildlife	State	357	7	0	0
City of St. Paul	City	184	6	0	0
Bonneville Power Administration	Special District	22	5	0	0
Oregon Department of Geology and Mineral Industries	State	329	4	0	0
TriMet	Special District	10	1	0	0
City of Gladstone	City	20	0	0	0
North Santiam Subbasin - HUC 17090005					
U.S. Forest Service	Federal	293,610	92,924	61	60
Oregon Department of Forestry	State	94,279	33,282	22	19

Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
Oregon Department of Agriculture	State	57,498	13,009	9	12
U.S. Bureau of Land Management	Federal	20,455	7,860	5	4
Marion County	County	4,648	1,433	1	1
U.S. Army Corps of Engineers	Federal	4,060	1,192	1	1
Linn County	County	3,607	760	0	1
City of Idanha	City	530	147	0	0
City of Detroit	City	661	132	0	0
City of Gates	City	399	106	0	0
City of Stayton	City	723	96	0	0
Oregon Department of Geology and Mineral Industries	State	420	83	0	0
City of Jefferson	City	529	77	0	0
City of Lyons	City	544	56	0	0
Bonneville Power Administration	Special District	153	42	0	0
Union Pacific Railroad	Railroad	61	31	0	0
Oregon Department of Fish and Wildlife	State	419	26	0	0
Albany & Eastern Railroad	Railroad	94	16	0	0
Portland & Western Railroad	Railroad	12	3	0	0
Pacific Power and Light	Private Utility	1	0	0	0
Jefferson County	County	0	0	0	0
South Santiam Subbasin - HUC 17090006					
Oregon Department of Forestry	State	310,035	98,310	44	47
Oregon Department of Agriculture	State	113,371	25,977	12	17
U.S. Bureau of Land Management	Federal	59,501	21,584	10	9
Linn County	County	13,621	3,121	1	2
City of Sweet Home	City	3,441	616	0	1
Oregon Department of Transportation	State	1,519	467	0	0
U.S. Army Corps of Engineers	Federal	1,068	252	0	0
City of Lebanon	City	1,762	230	0	0
Oregon Parks and Recreation Department	State	254	77	0	0
Oregon Department of Geology and Mineral Industries	State	107	25	0	0
Oregon Department of Fish and Wildlife	State	41	19	0	0

Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
Pacific Power and Light	Private Utility	1	0	0	0
Bonneville Power Administration	Special District	0	0	0	0
Upper Willamette Subbasin - HUC 17090003					
Oregon Department of Forestry	State	419,332	84,984	43	35
Oregon Department of Agriculture	State	497,249	68,015	34	41
U.S. Bureau of Land Management	Federal	48,530	14,527	7	4
Lane County	County	50,389	7,237	4	4
U.S. Forest Service	Federal	14,684	4,164	2	1
Benton County	County	27,798	3,456	2	2
City of Eugene	City	30,202	2,873	1	3
Linn County	County	17,912	2,081	1	1
Polk County	County	9,530	2,048	1	1
City of Corvallis	City	14,020	1,508	1	1
U.S. Army Corps of Engineers	Federal	11,988	1,363	1	1
Oregon Department of Transportation	State	7,953	1,092	1	1
U.S. Fish and Wildlife Service	Federal	5,696	957	0	0
City of Millersburg	City	2,804	401	0	0
Oregon Parks and Recreation Department	State	3,247	377	0	0
City of Springfield	City	5,302	339	0	0
Oregon Department of Fish and Wildlife	State	2,551	292	0	0
City of Junction City	City	1,992	280	0	0
City of Tangent	City	2,230	252	0	0
City of Falls City	City	787	241	0	0
City of Veneta	City	1,658	207	0	0
City of Philomath	City	1,597	165	0	0
Portland & Western Railroad	Railroad	989	132	0	0
City of Harrisburg	City	826	98	0	0
City of Brownsville	City	834	96	0	0
City of Coburg	City	653	68	0	0
Port of Coos Bay	Transportation	315	57	0	0
City of Adair Village	City	483	55	0	0
Union Pacific Railroad	Railroad	719	39	0	0
City of Halsey	City	259	36	0	0

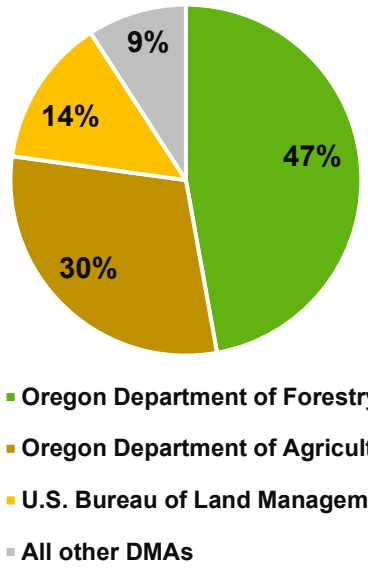
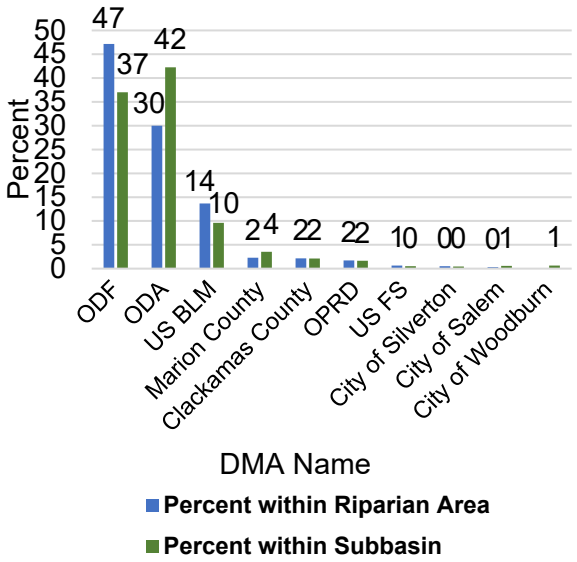
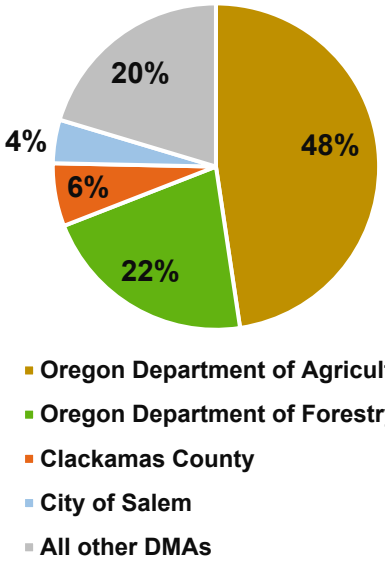
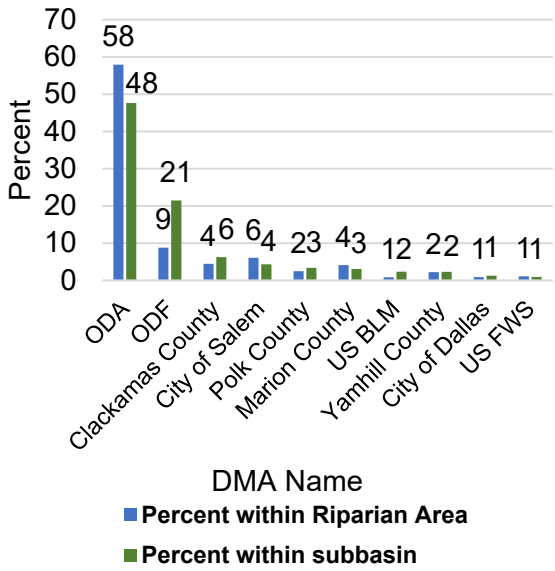
Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
Bonneville Power Administration	Special District	118	35	0	0
City of Monmouth	City	29	15	0	0
Oregon Department of Geology and Mineral Industries	State	231	13	0	0
Albany & Eastern Railroad	Railroad	46	7	0	0
Pacific Power and Light	Railroad	24	0	0	0
Vennel Farms Railroad Company	Railroad	2	0	0	0
City of Sodaville	City	182	0	0	0
Central Oregon & Pacific Railroad	Railroad	22	0	0	0
U.S. Department of Agriculture	Federal	43	0	0	0
Clackamas Subbasin - HUC 17090011					
U.S. Forest Service	Federal	413,482	87,423	71	68
Oregon Department of Forestry	State	74,558	18,900	15	12
Oregon Department of Agriculture	State	37,321	5,806	5	6
Clackamas County	County	33,208	5,442	4	6
Oregon Department of Transportation	State	1,630	367	0	0
City of Estacada	City	1,434	207	0	0
Oregon Parks and Recreation Department	State	1,179	203	0	0
U.S. Fish and Wildlife Service	Federal	124	62	0	0
Union Pacific Railroad	Railroad	28	14	0	0
Marion County	County	40	7	0	0
City of Gladstone	City	878	5	0	0
City of Oregon City	City	878	0	0	0
Bonneville Power Administration	Special District	209	0	0	0
City of Portland	City	6	0	0	0
Wasco County	County	247	0	0	0
Coast Fork Willamette Subbasin - HUC 17090002					
Oregon Department of Forestry	State	198,134	49,040	46	46
U.S. Forest Service	Federal	86,827	27,997	26	20
Lane County	County	31,815	4,863	5	7
Oregon Department of Transportation	State	1,535	164	0	0
City of Creswell	City	1,432	114	0	0
Oregon Parks and Recreation Department	State	523	42	0	0

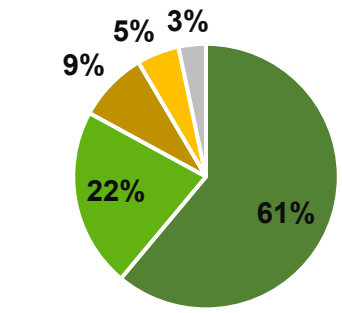
Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
Central Oregon & Pacific Railroad	Railroad	160	32	0	0
Bonneville Power Administration	Special District	42	24	0	0
Oregon Department of Fish and Wildlife	State	3	3	0	0
Pacific Power and Light	Private Utility	2	0	0	0
Oregon Department of State Lands	State	3	0	0	0
U.S. Army Corps of Engineers	Federal	2	0	0	0
U.S. Department of Agriculture	Federal	1	0	0	0
Mckenzie Subbasin - HUC 17090004					
U.S. Forest Service	Federal	545,195	123,717	60	64
Oregon Department of Forestry	State	210,320	58,662	28	25
Lane County	County	20,905	3,670	2	2
Oregon Department of Agriculture	State	16,823	3,268	2	2
U.S. Army Corps of Engineers	Federal	2,356	717	0	0
City of Springfield	City	3,809	456	0	0
Oregon Department of Transportation	State	1,864	281	0	0
City of Eugene	City	601	94	0	0
Oregon Parks and Recreation Department	State	86	29	0	0
Oregon Department of State Lands	State	66	9	0	0
Bonneville Power Administration	Special District	22	6	0	0
Oregon Department of Fish and Wildlife	State	5	1	0	0
Linn County	County	1	0	0	0
U.S. Department of Agriculture	Federal	19	0	0	0
Union Pacific Railroad	Railroad	2	0	0	0
Lower Willamette Subbasin - HUC 17090012					
Oregon Department of Forestry	State	57,427	16,392	35	22
City of Portland	City	73,669	9,339	20	29
Oregon Department of Agriculture	State	27,227	5,148	11	11
Columbia County	County	15,374	3,409	7	6
Clackamas County	County	14,401	1,884	4	6
U.S. Bureau of Land Management	Federal	6,432	1,636	3	2

Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
City of Gresham	City	11,952	1,594	3	5
Multnomah County	County	4,089	1,170	2	2
Oregon Department of Fish and Wildlife	State	6,491	1,010	2	3
City of Happy Valley	City	3,188	712	2	1
Oregon Department of Transportation	State Agency	5,141	678	1	2
Port of Portland	Transportation	5,536	556	1	2
City of West Linn	City	2,144	483	1	1
City of St. Helens	City	1,973	368	1	1
City of Fairview	City	1,773	343	1	1
City of Milwaukie	City	3,241	284	1	1
City of Scappoose	City	2,098	212	0	1
City of Troutdale	City	1,230	166	0	0
Oregon Department of Geology and Mineral Industries	State	967	134	0	0
Portland & Western Railroad	Railroad	323	75	0	0
Union Pacific Railroad	Railroad	560	71	0	0
Oregon Parks and Recreation Department	State	495	46	0	0
TriMet	Special District	92	36	0	0
City of Gladstone	City	679	25	0	0
City of Wood Village	City	563	18	0	0
City of Johnson City	City	43	13	0	0
BNSF Railway	Railroad	148	9	0	0
Washington County	County	35	4	0	0
Willamette Shore Trolley	Railroad	6	1	0	0
City of Canby	City	2	1	0	0
Curry County	County	3	0	0	0
Pacific Power and Light	Private Utility	7	0	0	0
Oregon Pacific Railroad	Railroad	3	0	0	0
Portland Terminal Railroad Company	Railroad	0	0	0	0
Middle Fork Willamette Subbasin - HUC 17090001					
U.S. Forest Service	Federal	688,782	143,011	75	79
Oregon Department of Forestry	State	108,936	27,839	15	12
U.S. Bureau of Land Management	Federal	24,864	8,621	5	3
Lane County	County	17,982	3,469	2	2

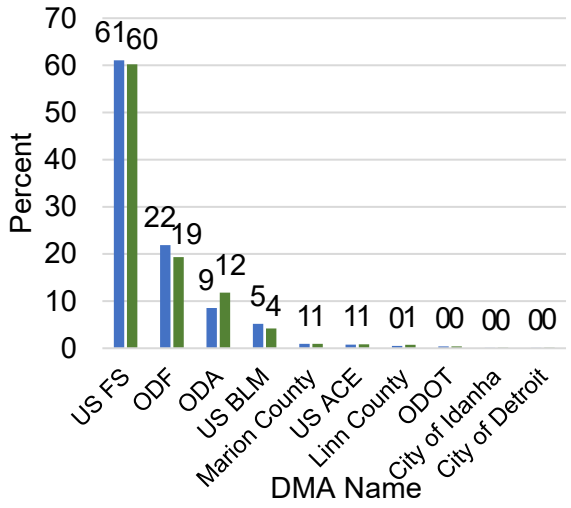
Landowner or Jurisdiction	DMA Type	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline	Percent within 150 feet from a stream centerline	Percent within subbasin
U.S. Army Corps of Engineers	Federal	9,815	2,360	1	1
Oregon Department of Transportation	State	2,422	418	0	0
Union Pacific Railroad	Railroad	1,891	389	0	0
City of Springfield	City	1,212	209	0	0
City of Oakridge	City	1,241	153	0	0
Oregon Parks and Recreation Department	State	577	78	0	0
City of Lowell	City	534	76	0	0
City of Westfir	City	192	68	0	0
U.S. Department of Agriculture	Federal	36	16	0	0
Oregon Department of State Lands	State	45	8	0	0
Bonneville Power Administration	Special District	25	8	0	0

Appendix C: Graphs showing designated management agency jurisdiction by subbasin and within 150 feet of a stream

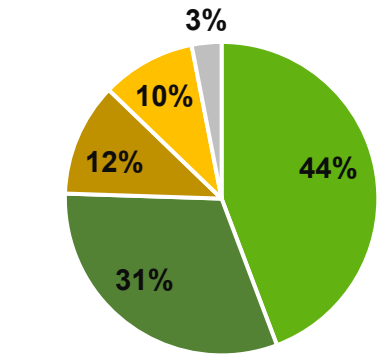
Percent of jurisdiction within 150 feet of stream center line	Percent of jurisdiction in subbasin compared to percent of jurisdiction within 150 feet of stream center line
Molalla-Pudding Subbasin – HUC 17090009	
	
Middle Willamette Subbasin – HUC 19070007	
	
North Santiam Subbasin – HUC 17090005	



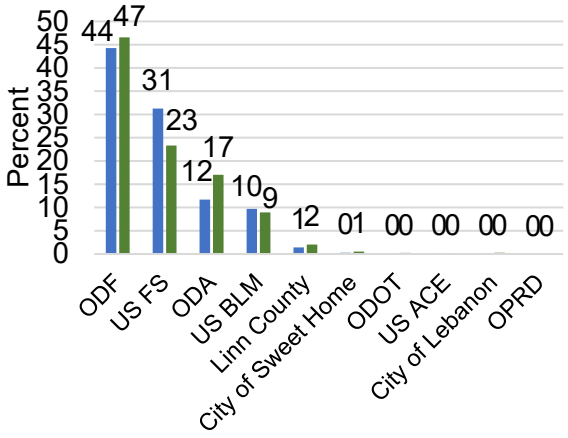
- U.S. Forest Service
- Oregon Department of Forestry
- Oregon Department of Agriculture
- U.S. Bureau of Land Management
- All other DMAs



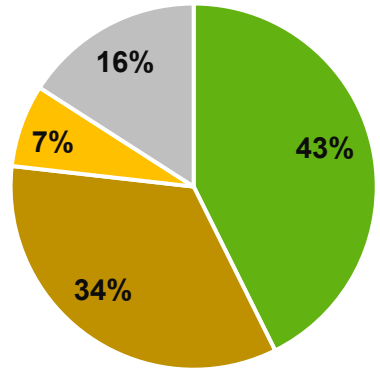
South Santiam Subbasin – HUC 17090006



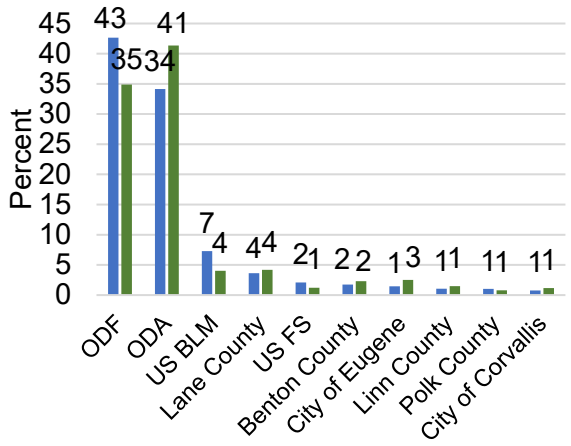
- Oregon Department of Forestry
- U.S. Forest Service
- Oregon Department of Agriculture
- U.S. Bureau of Land Management
- All other DMAs



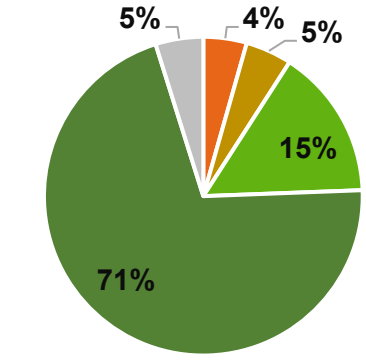
Upper Willamette Subbasin – HUC 17090003



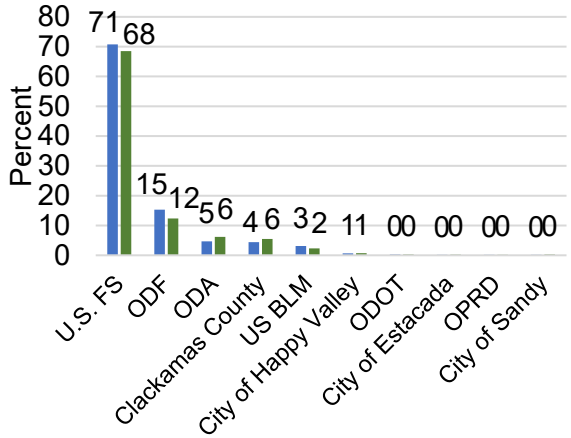
Oregon Department of Forestry
Oregon Department of Agriculture
U.S. Bureau of Land Management
All other DMAs



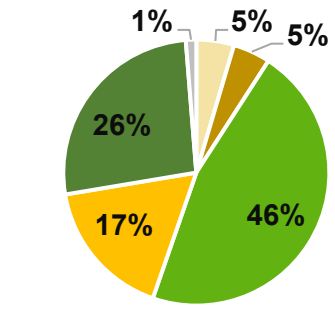
Clackamas Subbasin – HUC 17090011



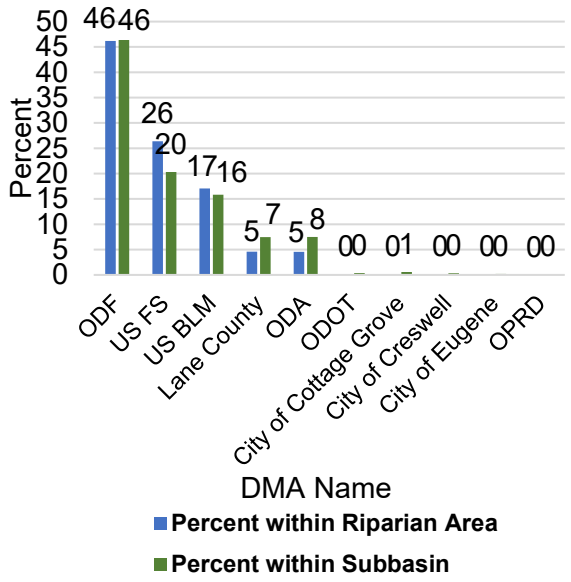
Clackamas County
Oregon Department of Agriculture
Oregon Department of Forestry
U.S. Forest Service
All other DMAs



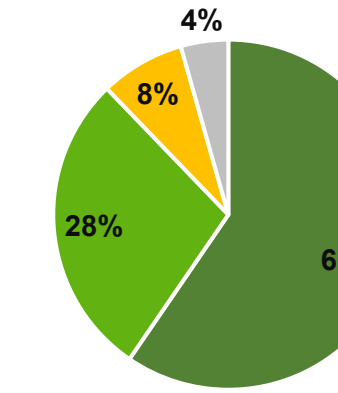
Coast Fork Willamette Subbasin – HUC 17090002



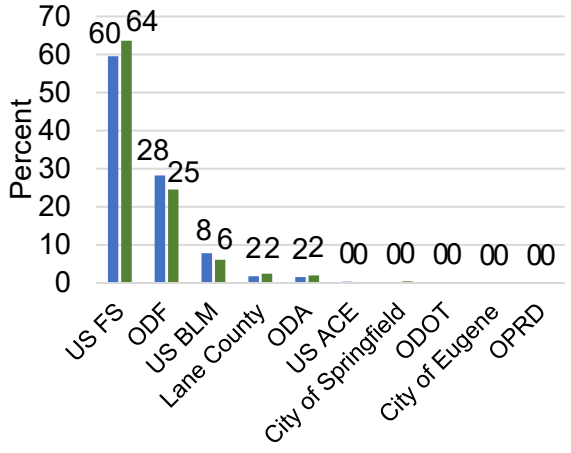
- Lane County
- Oregon Department of Agriculture
- Oregon Department of Forestry
- U.S. Bureau of Land Management
- U.S. Forest Service
- All other DMAs



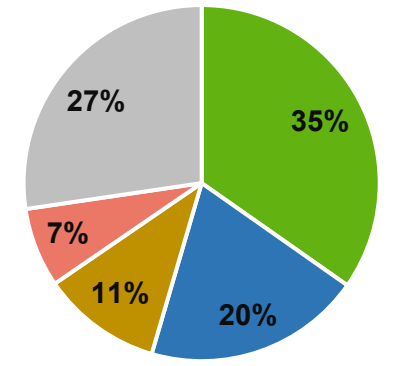
Mckenzie Subbasin – HUC 17090004



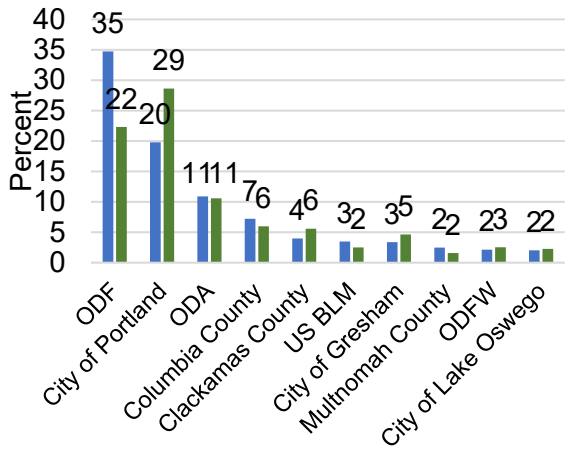
- U.S. Forest Service
- Oregon Department of Forestry
- U.S. Bureau of Land Management
- All other DMAs



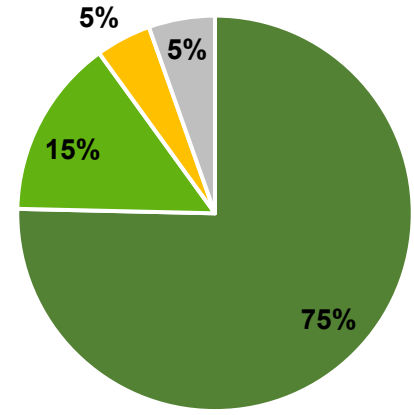
Lower Willamette Subbasin – HUC 17090012



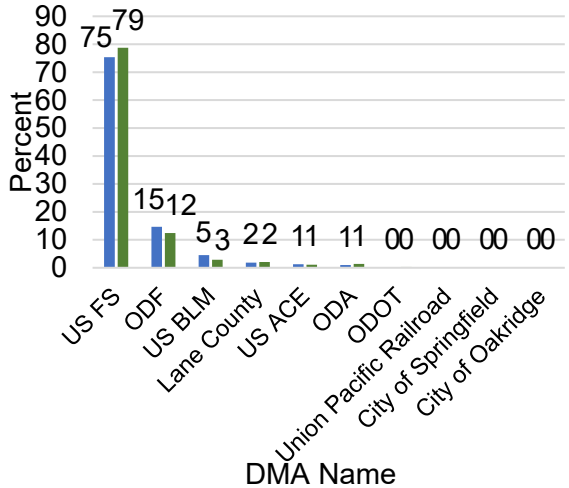
- Oregon Department of Forestry
- City of Portland
- Oregon Department of Agriculture
- Columbia County
- All other DMAs



Middle Fork Willamette Subbasin – HUC 17090001



- U.S. Forest Service
- Oregon Department of Forestry
- U.S. Bureau of Land Management
- All other DMAs



Appendix D: NPDES Permit Issuance Dates

Permit Type	Planned Issuance Date	Legal Name	Common Name	WQ File No.	Permit No.	EPA No.
NPDES-IW-B21	2026	J.H. Baxter & Co., Inc.	J.H. Baxter & Co., Inc.	6553	102432	OR0021911
NPDES-IW-B21	2026	Mcfarland Cascade Pole & Lumber Company	Mcfarland Cascade Pole & Lumber Co	54370	102392	OR0031003
NPDES-IW-B20	2024	Arauco North America, Inc	Duraflake	97047	100668	OR0000426
NPDES-IW-B20	2025	Kingsford Manufacturing Company	Kingsford Manufacturing Company - Springfield Plant	46000	102153	OR0031330
NPDES-IW-B20	2026	Murphy Company	Murphy Veneer, Foster Division	97070	101777	OR0021741
NPDES-IW-B19	2024	Hull-Oakes Lumber Co.	Hull-Oakes Lumber Co.	107228	101466	OR0038032
NPDES-IW-B19	2025	Sanders Wood Products, Inc.	RSG Forest Products - Liberal	72596	100929	OR0021300
NPDES-IW-B19	2027	Seneca Sawmill Company	Seneca Sawmill Company	80207	101893	OR0022985
NPDES-IW-B17	2027	Oregon Department of Fish & Wildlife	ODFW - Marion Forks Hatchery	64495	101917	OR0027847
NPDES-IW-B17	2023	USDOI; Fish & Wildlife Service	USFW - Eagle Creek National Fish Hatchery	91035	101522	OR0000710
NPDES-IW-B16	2024	Arclin U.S.A. LLC	Arclin	16037	101235	OR0021857
NPDES-IW-B16	2025	Blount, Inc.	Blount Oregon Cutting Systems Division	63545	101162	OR0032298
NPDES-IW-B16	2025	Boeing Company, The	Boeing of Portland - Fabrication Division	9269	101761	OR0031828
NPDES-IW-B16	2026	Columbia Helicopters, Inc.	Columbia Helicopters	100541	101906	OR0033391
NPDES-IW-B16	2027	Eugene Water & Electric Board	EWEB Carmen-Smith	28393	101329	OR0000680
NPDES-IW-B16	2024	Georgia-Pacific Chemicals LLC	Georgia-Pacific Chemicals LLC	32864	101474	OR0002101
NPDES-IW-B16	2025	Georgia-Pacific Chemicals LLC	GP Millersburg Resin Plant	32650	102603	OR0032107

Permit Type	Planned Issuance Date	Legal Name	Common Name	WQ File No.	Permit No.	EPA No.
NPDES-IW-B15	2027	Fujimi Corporation	Fujimi Corporation - SW Commerce Circle	107178	103033	OR0040339
NPDES-IW-B15	2025	Oregon Department of Corrections	ODC - Oregon State Penitentiary	109727	101619	OR0043770
NPDES-IW-B15	2024	Port of Portland & Co-Applicants	Portland International Airport	107220	101647	OR0040291
NPDES-IW-B15	2027	SFPP, L.P.	SFPP, L.P.	103159	103042	OR0044661
NPDES-IW-B15	2023	Sunstone Circuits, LLC	Sunstone Circuits	26788	101015	OR0031127
NPDES-IW-B15	2027	Valley Landfills, Inc.	Coffin Butte Landfill	104176	101545	OR0043630
NPDES-IW-B10	2027	Arclin Surfaces, Inc.	Arclin	81714	101544	OR0000892
NPDES-IW-B08	2026	Oregon Metallurgical, LLC	ATI Albany Operations	64300	102223	OR0001716
NPDES-IW-B05	2026	JLR, LLC	JLR, LLC	32536	101253	OR0001015
NPDES-IW-B04	2023	Foster Poultry Farms, Inc.	Foster Farms	97246	101590	OR0026450
NPDES-IW-B04	2023	Norpac Foods, Inc.	Norpac Foods - Brooks Plant No. 5	84791	100907	OR0021261
NPDES-IW-B04	2024	Norpac Foods, Inc.	Norpac Foods-Plant #1, Stayton	84820	101265	OR0001228
NPDES-DOM-Db	2025	Alpine County Service District	Alpine Community	100101	101923	OR0032387
NPDES-DOM-Db	2026	Aumsville, City of	Aumsville STP	4475	101784	OR0022721
NPDES-DOM-Db	2027	Aurora, City of	Aurora STP	110020	101772	OR0043991
NPDES-DOM-Db	2027	Brownsville, City of	Brownsville STP	11770	102206	OR0020079
NPDES-DOM-Db	2025	Corvallis MHC LLC	Knoll Terrace MHC	46990	102611	OR0026956
NPDES-DOM-Db	2027	Creswell, City of	Creswell STP	20927	101639	OR0027545
NPDES-DOM-Db	2027	Diamond Hill L.L.C.	Sherman Bros. Trucking	36646	101557	OR0021954
NPDES-DOM-Db	2026	Gervais, City of	Gervais STP	33060	101665	OR0027391
NPDES-DOM-Db	2025	Halsey, City of	Halsey STP	36320	101297	OR0022390
NPDES-DOM-Db	2027	Junction City, City of	Junction City STP	44509	102396	OR0026565
NPDES-DOM-Db	2026	Lane Community College	Lane Community College	48854	102116	OR0026875
NPDES-DOM-Db	2023	Molalla, City of	Molalla STP	57613	101514	OR0022381

Permit Type	Planned Issuance Date	Legal Name	Common Name	WQ File No.	Permit No.	EPA No.
NPDES-DOM-Db	2027	Philomath, City of	Philomath WWTP	103468	102060	OR0032441
NPDES-DOM-Db	2026	Scio, City Of	Scio STP	79633	101503	OR0029301
NPDES-DOM-Db	2027	Tangent, City of	Tangent STP	87425	102247	OR0031917
NPDES-DOM-Db	2025	Veneta, City of	Veneta STP	92762	102480	OR0020532
NPDES-DOM-Db	2024	Water Environment Services	Wes (Boring STP)	16592	100968	OR0031399
NPDES-DOM-Db	2025	Willamette Leadership Academy	Willamette Leadership Academy	34040	101441	OR0027235
NPDES-DOM-Da	2025	Coburg, City of	Coburg Wastewater Treatment Plant	115851	102979	OR0044628
NPDES-DOM-Da	2026	Estacada, City of	Estacada STP	27866	101542	OR0020575
NPDES-DOM-Da	2025	Falls City, City of	Falls City STP	28830	101808	OR0032701
NPDES-DOM-Da	2027	Hubbard, City of	Hubbard STP	40494	101640	OR0020591
NPDES-DOM-Da	2025	Lakewood Homeowners, Inc.	Lakewood Utilities, Ltd	96110	101781	OR0027570
NPDES-DOM-Da	2027	Mt. Angel, City of	Mt. Angel STP	58707	101802	OR0028762
NPDES-DOM-Da	2027	Oakridge, City of	Oakridge STP	62886	102443	OR0022314
NPDES-DOM-Da	2023	Sandy, City of	Sandy WWTP	78615	102492	OR0026573
NPDES-DOM-Da	2026	US Forest Service	Timberlake STP	90948	101498	OR0023167
NPDES-DOM-Da	2027	Westfir, City of	Westfir STP	94805	100811	OR0028282
NPDES-DOM-C1a	2023	Dallas, City of	Dallas STP	22546	101518	OR0020737
NPDES-DOM-C1a	2026	Silverton, City Of	Silverton STP	81395	101720	OR0020656
NPDES-DOM-C1a	2025	Woodburn, City of	Woodburn WWTP	98815	101558	OR0020001
GEN03	2024	Oregon Department of Fish & Wildlife	ODFW - Roaring River Hatchery	64525		
GEN03	2024	Oregon Department of Fish & Wildlife	ODFW - Willamette Fish Hatchery	64585		
GEN01	2023	Americold Logistics, LLC	Americold Logistics, LLC	87663		
GEN01	2023	First Premier Properties	Spinnaker Ii Office Building	110603		
GEN01	2023	Forrest Paint Co.	Forrest Paint Co.	100684		
GEN01	2023	Herbert Malarkey	Malarkey Roofing	52638		

Permit Type	Planned Issuance Date	Legal Name	Common Name	WQ File No.	Permit No.	EPA No.
		Roofing Company				
GEN01	2023	Holiday Retirement Corp	Holiday Plaza	108298		
GEN01	2023	Hydro Extrusion Portland, Inc.	Hydro Main Plant	3060		
GEN01	2023	Miller Paint Co Inc	Miller Paint Company	103774		
GEN01	2023	Owens-Brockway Glass Container Inc.	Owens-Brockway Glass Container Plant	65610		
GEN01	2023	PCC Structurals, Inc.	PCC Structurals, Inc. - (SSB) Small Structurals Bus. Ops.	71920		
GEN01	2023	Sundance Lumber Company, Inc.	Sundance Lumber Company, Inc.	107401		
GEN01	2023	Ventura Foods, LLC	Ventura Foods, LLC	103832		

Appendix E: List of Large Reservoirs in the Willamette Subbasins TMDL Project Area

DEQ compiled this list of 202 dams located within the Willamette Subbasins temperature TMDL project area from the U.S. Army Corps of Engineers National Inventory of Dams (NID) database and a similar database maintained by the Oregon Water Resources Department, dam safety program (i.e. large dams 10 feet or higher, or store 9.2 acre-feet or more (OAR 690-020-0000)). DEQ requires the 32 bolded dams in the table below to conduct monitoring related to temperature. Depending on analytical or modeling results, reservoir owners or operators may be required to develop a TMDL plan for temperature.

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
1	**Big Cliff Dam**	OR00003	U.S. Army Corps of Engineers	Federal	Hydroelectric	5930
2	**Blue River Dam**	OR00013	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	89000
3	**Cottage Grove Dam**	OR00005	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	50000
4	**Cougar Dam**	OR00015	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	220000
5	**Detroit Dam**	OR00004	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	455000
6	**Dexter Dam**	OR00006	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	29900
7	**Dorena Dam**	OR00008	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	131000
8	**Fall Creek Dam**	OR00007	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	125000
9	**Fern Ridge Dam**	OR00016	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	121000
10	Fern Ridge Dam - Dike 1	OR00016	U.S. Army Corps of Engineers	Federal	unknown	9774

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
11	Fern Ridge Dam - Dike 2	OR00016	U.S. Army Corps of Engineers	Federal	unknown	56647
12	**Foster Dam**	OR00012	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	61000
13	**Green Peter Dam**	OR00010	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	430000
14	**Hills Creek Dam**	OR00014	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	356000
15	**Lookout Point Dam**	OR00009	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	477700
16	Cackler Marsh Dam/Basket Slough - South	OR03834	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	964
17	Dusky Marsh Dam	OR03835	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	299
18	Moffitti Marsh Dam	OR04062	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	184
19	Morgan Brothers Dam	OR00576	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	720
20	Parvipes Marsh Dam	OR04063	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	250
21	Taverner Marsh Dam	OR03852	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	287
22	UPPER DISPLAY POND	OR03774	U.S. Fish & Wildlife Service	Federal	unknown	17.3
23	Findlay Reservoir-Ankeny Natl. Wildlife Refuge	OR00971	U.S. Fish & Wildlife Service	Federal	unknown	9.5
24	Timber Lake	OR00281	U.S. Forest Service	Federal	Recreation	390
25	**Plywood Products Reservoir**	OR02700	City of Adair Village	Local Government	unknown	39
26	**North Fork**	OR00348	City of Corvallis	Local Government	Water Supply	305
27	**Mercer**	OR00524	City of Dallas	Local Government	Water Supply	1550

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
28	**Binford Dam**	OR00725	City of Gresham	Local Government	Irrigation	30
29	Gresham Stormwater Retention Basin (Lagoon)	OR04021	City of Gresham	Local Government	Stormwater Treatment	38
30	Oakridge Mill Log Pond	OR00168	City of Oakridge	Local Government	Other	380
31	Smith-Bybee Lakes	OR00680	City of Portland	Local Government	Fish and Wildlife Pond	4100
32	**Silver Creek**	OR00622	City of Silverton	Local Government	Water Supply	2500
33	**Salmonberry Reservoir**	OR02958	City of St. Helens	Local Government	Water Supply	61.22
34	Three Creeks Natural Area	OR04083	Clackamas Water Environment Services	Local Government	unknown	57
35	Sullivan Pond 3	OR04077	A & D Sullivan Enterprises Inc.	Private	unknown	65
36	Spada Reservoir #1 (Champoeg)	OR00462	A&R Spada Nursery and Farms	Private	Irrigation	329
37	Fisher, James O Reservoir	OR00515	A.F. Grabhorn	Private	Irrigation	36
38	Aamodt Flashboard Dam	OR00645	Aamodt Dairy Inc.	Private	Irrigation	120
39	Stevens	OR03191	Allen E. Stevens	Private	unknown	11
40	Siegmund Parcel No. 1	OR03058	Andrew Seigmund	Private	unknown	25
41	Qualey Reservoir 1	OR02750	Arthur Qualey	Private	unknown	14
42	Zehner	OR03369	Arthur R. Zehner	Private	unknown	14.3
43	Funrue	OR00519	Aurora; Dan Funrue	Private	Irrigation	126
44	Walker (Bryan Creek)	OR00289	Bailey Nurseries, Inc.	Private	Irrigation	209
45	Baker West Nursery Dam	OR03789	Baker West, Inc.	Private	Fish and Wildlife Pond	16.8
46	Barkdoll Dam	OR03803	Barkdol, Inc.	Private	unknown	9.917
47	Sherman Stock Reservoir #2	OR03041	Bart Grabhorn	Private	unknown	14
48	Mompano	OR00500	Beaverlake Owners Assoc.	Private	Other	780

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
49	Elmer Farms Dam	OR03367	Ben Elmer Farms	Private	unknown	28.4
50	Polehn Dam	OR03377	Bernard Vancil	Private	unknown	9.5
51	Beyer Reservoir	OR00476	Beyer Lake, Inc	Private	Irrigation	280
52	Rose Reservoir	OR00708	Bill Rose	Private	Irrigation	550
53	Carroll Reservoir	OR01340	Black Berry Hills Ranch LLC	Private	Irrigation	355
54	Herring Reservoir	OR00821	Bland Herring	Private	unknown	12
55	Robert Kuenzi	OR03998	Bob Simmons	Private	unknown	22
56	Stadeli	OR03394	Brooke Craeger-Stadeli	Private	Irrigation	167
57	Hendrickson	OR03728	Bruce & Gayle Farmer	Private	Recreation	24.5
58	Baker, Er	OR00507	Camp Tillicum	Private	Irrigation	250
59	Orchard Heights	OR03165	Carl R. Staats	Private	unknown	12
60	Hills Reservoir (Polk)	OR01925	Chuck & Maxime Dehn	Private	Irrigation	73
61	Koinenia Lake Dam	OR00621	Cindy Jerger	Private	Irrigation	125
62	Bentz Bros. Pond 3	OR01157	Clint Bentz	Private	unknown	31.7
63	S-M-S No. 1	OR00417	Cody & Barbara Duerst	Private	Recreation	57
64	Meridian Reservoir	OR03725	Columbia Trust Co.	Private	Irrigation	95
65	Eola Hills Reservoir	OR01657	Contact Allen Holstein	Private	Irrigation	37
66	Cooper Creek Vineyards	OR04065	Cooper Creek LLC	Private	unknown	100
67	Porter Cc Reservoir (Clackamas)	OR00644	Dan Myrick	Private	Recreation	80
68	Hays Reservoir	OR01894	Daniel & Stacee Hurst	Private	unknown	25
69	Mt. Pisgah	OR03964	David And Bette Mckibben Trust	Private	unknown	45
70	Neil Creek Reservoir	OR00266	Dean Yeager	Private	Irrigation	81
71	P.M. Delaubenfelds Dam	OR00494	Delaubenfeld And Osu Found	Private	Recreation	130
72	Bottem Reservoir #5	OR03779	Dennis & Judy Bottem	Private	unknown	19.9
73	Murry Pond #3	OR03860	Dennis Bottem	Private	unknown	35.7
74	Hickory Hill Farm	OR00231	Dick Day	Private	Irrigation	65
75	Stewart Reservoir #2	OR03799	Don & Alberta Stewart	Private	unknown	16.6

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
76	Teasel Creek	OR00489	Don Deardorff	Private	Other	90
77	Henderer Reservoir	OR01905	Dorothy Fairchild	Private	unknown	13.9
78	Deardorff, Betty Jane	OR00497	Doubletrees Farms	Private	Other	1300
79	Case Creek Dam 1	OR00504	Douglas & Patricia Krahmer	Private	Irrigation	352
80	Duck Pond Dam	OR03816	Douglas Fries	Private	Recreation	94.6
81	Schewnke	OR00939	Dr. Glenn Schwenke	Private	unknown	10
82	Pettit Reservoir	OR00396	Dr. Virgil E. Pettit	Private	Other	290
83	Abe Ediger Reservoir	OR01009	Dudley And Lauri Walters	Private	Irrigation	85
84	Neil Reservoir	OR02514	E.R. Neil	Private	unknown	9.5
85	Kennel Reservoir	OR00617	Earl Kennel	Private	Irrigation	160
86	Eder	OR03967	Eder Farms Inc	Private	unknown	30.1
87	Kronke	OR03961	Elke Kronke	Private	unknown	14.5
88	Barnes Bros. Reservoir	OR00392	Eric And Pamela Barnes	Private	Irrigation	100
89	Thompson (Benton)	OR00294	Eric Thompson	Private	Recreation	450
90	Peterson, Floyd	OR02665	Erik Rodgers	Private	Recreation	19
91	Fairview Lake	OR03713	Fairview Lake Property Owners Association (FLPOA)	Private	unknown	411
92	Tangen-A. L. Irig Reservoir	OR03256	Flying Feather Orchards, Inc.	Private	unknown	25
93	Ford Farms Reservoir	OR00251	Ford Farms, Inc.	Private	Irrigation	60
94	Silver Falls Log Pond (Marion)	OR00273	Gelco Investment LLC	Private	Irrigation	68
95	Gibson and Gibson Waste Lagoon	OR01793	Gibson & Gibson	Private	unknown	36
96	Whispering Winds	OR00527	Girls Scouts of Oregon & SW Washington	Private	Recreation	100
97	Marcott Reservoir	OR02331	Goldie Marcott	Private	unknown	24.3
98	Circle S Reservoir	OR01383	Gordon and Catherine Tibbitts	Private	unknown	16
99	Lorence Lake	OR00384	Greg & Kara Pilcher	Private	Other	160
100	Skylane Farms Reservoir 3	OR03079	Gregory R & Deborah D Cochell	Private	unknown	13.5

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
101	Mulkey, Gryland Reservoir	OR02485	Gylan Mulkey	Private	Irrigation	50
102	Bryant Dam (Marion)	OR03786	H. Richard Bryant	Private	unknown	27.7
103	Winters (Lower)	OR03764	H.E. Winters Sanders Family Farm LLC	Private	unknown	9.4
104	Kuehne Dam	OR00216	Harold Kuehne	Private	Irrigation	110
105	Golliday, Paul	OR00954	Harold Schipporeit	Private	unknown	13
106	Buche (Clackamas)	OR00766	Harvey Buche	Private	Recreation	81
107	Deep Creek Reservoir	OR01518	Hays/Shainsky and Judas Crop	Private	unknown	10
108	Schindler Reservoir	OR02980	Henry & Albert Schindler	Private	unknown	15
109	Kyllo Reservoir	OR02124	Henry Kyllo	Private	unknown	44
110	Berger Lake	OR01158	Hidden Lakes Recreation Association Attn: Dan Schlottmann	Private	Irrigation	45
111	Hull-Oakes Lumber Company Reservoir	OR01986	Hull-Oakes Lumber Company	Private	unknown	
112	Kreder Reservoir	OR00478	Jack Platt	Private	Irrigation	162
113	Maple Grove	OR03773	Jackson Family Wines	Private	Irrigation	210
114	Payne Lake No. 1	OR02137	James L. Payne	Private	unknown	30
115	River Bend No. 2	OR00434	James L. Payne	Private	Irrigation	50
116	Heater Reservoir #2	OR00729	James M. Heater	Private	Irrigation	42.5
117	Borris Reservoir	OR01234	James Swanek	Private	unknown	22
118	Sherman Stock Reservoir #1	OR03040	Jeff Heller	Private	Irrigation	36
119	Moore-Emory	OR00382	Jerald and Carol Bush	Private	Irrigation	166
120	Isakson Reservoir	OR00674	Jerry Isakson	Private	Recreation	29
121	Mission Creek Dam and Reservoir Company	OR00520	Jerry Mullen	Private	Irrigation	1590
122	Heater Dam	OR01899	Jim Heater	Private	Irrigation	32
123	Evans Pro. Company Sawmill Reservoir	OR00927	Jimmy W. Evans	Private	unknown	11

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
124	Drescher Reservoir	OR01574	John Drescher	Private	Irrigation	21
125	Schwartz Reservoir	OR02978	John Inda	Private	Irrigation	20
126	Jyn Dam	OR03807	Jyn Inc	Private	unknown	13.8
127	Adkins "B" Reservoir	OR03749	Kathryn J Adkins	Private	unknown	12
128	Tribbett Reservoir	OR00687	Kelly Farms	Private	Recreation	31
129	Knudsen Reservoir #2	OR03775	Knudson Vineyards	Private	unknown	11.5
130	Kraemer Farms Dam	OR03781	Kraemer Farms, Inc.	Private	Irrigation	125
131	Waldo Lake	OR00349	Krautmann Family Nursery, LLC	Private	Irrigation	56
132	Westbrook Dam	OR03805	Krautmann Family Nursery, LLC	Private	Fish and Wildlife Pond	141.2
133	Youngblood Dam	OR00811	Kyle R & Lori J Sherman	Private	unknown	30
134	Little Pudding	OR04073	Lake Labish Water Control Dist	Private	unknown	
135	Oswego Lake Dam	OR00237	Lake Oswego Corporation	Private	Hydroelectric	9800
136	Lakewood Estates	OR03731	Lakewood Homeowners, Inc.	Private	unknown	78
137	Lakewood Estates Sewage Lagoon	OR03918	Lakewood Utilities, Ltd.	Private	unknown	17
138	O.E.Loe Dam 2 Porter Place	OR02721	Larie Loe	Private	Irrigation	25
139	Kuenzi, Lee A.	OR03392	Lee A. Kuenzi	Private	unknown	15
140	Ed Zach A	OR01635	Lee Wallace	Private	unknown	33.5
141	Veterans Reservoir	OR00102	Lincoln Memorial Cemetery	Private	Irrigation	18
142	Griffith Reservoir	OR01832	LSH Investments	Private	unknown	45
143	Manton Carl Dam	OR03987	Manton Carl	Private	unknown	11.5
144	Fredericks Pond	OR00620	Maple Leaf Lake Homeowners Association	Private	Irrigation	48
145	Johnson Creek Reservoir (Linn)	OR02051	Marion Cota	Private	unknown	10.5
146	Gehring Reservoir (Towery Dam)	OR00314	Mark Gehring	Private	Irrigation	50
147	Mueller	OR04018	Mark Herkamp	Private	unknown	12.7
148	Mckay Acres Dam	OR00484	Mark Mckay	Private	Irrigation	510

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
149	Peyralans Reservoir	OR02671	Marpol Ridge HOA	Private	esthetics	12
150	Anderson - Roy Reservoir	OR00710	MBK 35803 LLC	Private	Recreation	32
151	Powell Reservoir (Lane)	OR00829	Michael Fix	Private	unknown	24
152	Rogers - Joseph Reservoir	OR00492	Michael P. Warn	Private	Irrigation	40
153	Marx Reservoir #1	OR00389	Mike Sweeney, Cherry Hill Winery	Private	Irrigation	85
154	Helms Reservoir	OR00455	Miller Forests, Inc.	Private	Irrigation	120
155	Marx, Emil #2	OR02340	Mountain Spring Farms, LLC	Private	unknown	35
156	Foster Log Pond	OR00159	Murphy Company Foster Veneer	Private	Other	375
157	Neal Miller	OR03395	Neal Miller	Private	unknown	31.3
158	Haberlach Dam	OR00880	Old North State Trust, LLC	Private	Irrigation	15
159	Fleshman Reservoir 2	OR01722	Orval & Margaret Fleshman	Private	unknown	10.6
160	Forcia and Larsen Log Pond	OR00099	Peggy Kraft, Don Merkle	Private	Other	90
161	Bye Reservoir	OR01317	Perl Bye	Private	unknown	13
162	Zenczak Reservoir	OR03637	Piotr Zenczak	Private	unknown	13
163	**Faraday Diversion**	OR00551	Portland General Electric Company	Private	Hydroelectric	1200
164	**Faraday Forebay**	OR00245	Portland General Electric Company	Private	Hydroelectric	550
165	**Harriet Lake**	OR00546	Portland General Electric Company	Private	Hydroelectric	400
166	**North Fork**	OR00550	Portland General Electric Company	Private	Hydroelectric	18630
167	**River Mill**	OR00552	Portland General Electric Company	Private	Hydroelectric	2300
168	**Timothy Lake**	OR00545	Portland General Electric Company	Private	Hydroelectric	69000
169	Bull Frog Lake	OR01296	Ray Derby, President	Private	unknown	21.5
170	Schaefer, Ray Reservoir	OR03380	Ray Schaefer	Private	Irrigation	18
171	Mitchell - Stanley Reservoir	OR00706	Richard Satnick	Private	Irrigation	42

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
172	Vandecoevering	OR03863	Ron Vandecoevering	Private	Irrigation	87
173	Vaughn Log Gibson Reservoir Pond	OR00198	Rosboro, LLC	Private	Other	132
174		OR00672	Roserock West 2, LLC	Private	unknown	32
175	Cedar Grove Lake	OR01351	Ryan J Dissen	Private	Irrigation	14.2
176	Sandy Farms No. 1-A	OR00709	Sandy Farms, C/O Bob Underwood	Private	Irrigation	49
177	Spring Lake Estates	OR00532	Spring Lake Estates	Private	Recreation	120
178	Delaubenfels	OR03944	Starker Forests, Inc	Private	Irrigation	84
179	Tadmore Lake Dam	OR03252	Steve Ellingboe	Private	unknown	29
180	Alderwood	OR01020	Swanson Bros. Lumber Company	Private	unknown	12
181	Willards Pool	OR00179	Terry Caster	Private	Recreation	680
182	Devers Reservoir 1	OR01538	Todd Bartlem	Private	unknown	9.7
183	FOX NO. 2	OR01756	Tom Fox	Private	unknown	21
184	Fox Reservoir	OR00236	Tom Fox	Private	Irrigation	120
185	Croft	OR00415	Waldensee LLC	Private	Irrigation	137
186	Zielinski Farm Reservoir	OR00711	Wally Zelinski	Private	Irrigation	41
187	Bremer Reservoir	OR01253	Warren W. Bremer	Private	unknown	27
188	Bohemia Pond C	OR02715	Weyerhaeuser Company	Private	unknown	47
189	Day Reservoir	OR03411	William Day	Private	Irrigation	12.2
190	Fry Reservoir	OR01775	William Fry	Private	unknown	15.7
191	Woodburn Nursery	OR03862	Woodburn Nursery And Azaleas, Inc.	Private	Other	40
192	Serres Reservoir	OR03010	Woodburn Organic Farms, LLC	Private	unknown	10
193	**Carmen Diversion**	OR00539	Eugene Water and Electric Board	Public Utility	Hydroelectric	260
194	**Leaburg**	OR00553	Eugene Water and Electric Board	Public Utility	Hydroelectric	345
195	**Leaburg Canal and Forebay**	OR00553	Eugene Water and Electric Board	Public Utility	Hydroelectric	459
196	**Smith**	OR00541	Eugene Water and Electric Board	Public Utility	Hydroelectric	17530

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197	**Trail Bridge**	OR00540	Eugene Water and Electric Board	Public Utility	Hydroelectric	2263
198	Trail Bridge Saddle Dike	OR00540	Eugene Water and Electric Board	Public Utility	Hydroelectric	2263
199	**Walterville Forebay**	OR00600	Eugene Water and Electric Board	Public Utility	Hydroelectric	275
200	**Walterville Storage Pond**	OR00267	Eugene Water and Electric Board	Public Utility	Hydroelectric	345
201	Adair Pond	OR01012	Oregon Dept. of Fish & Wildlife	State	unknown	43
202	Petes Slough	OR00643	Oregon Dept. of Fish & Wildlife	State	Recreation	2000