Draft Total Maximum Daily Loads Rule - Upper Yaquina River Watershed - Mid Coast Basin

Bacteria and Dissolved Oxygen

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1. Introduction

DEQ developed this draft Total Maximum Daily Loads rule for the Upper Yaquina River Watershed to address water quality impairments of bacteria and dissolved oxygen. A TMDL is a science-based approach to cleaning up polluted water so that it meets state water quality standards. A TMDL is a numerical value that represents the highest amount of a pollutant a surface water body can receive and still meet the standards.

1.1 TMDL history

These Upper Yaquina River Watershed TMDLs for bacteria and dissolved oxygen are the first to be issued within the Siletz-Yaquina Subbasin of the Mid Coast Basin. DEQ issued a TMDL in 1991 for Clear Lake, within the Siuslaw Subbasin, a neighboring subbasin within the Mid Coast Basin, to protect water clarity and drinking water primarily from phosphorus originating from on-site septic systems and rural residential development. Issuance of these Upper Yaquina River Watershed TMDLs does not impact or represent a revision to this existing Mid Coast Basin TMDL.

1.2 TMDL administrative and public participation processes

Following completion of Oregon Department of Environmental Quality's drafting process, including engagement of a rule advisory committee on the fiscal impact statement and other aspects of the rule, these Upper Yaquina River Watershed TMDLs on bacteria and dissolved oxygen will be proposed for adoption by Oregon's Environmental Quality Commission, by reference, into rule as OAR 340-042-0090(xx). Any subsequently amended or renumbered rules cited in this document are intended to apply.

In addition to seeking input on development of these TMDLs through the rule advisory committee, DEQ convened a local stakeholder advisory committee and conducted 56 meetings with the group and various pollutant-specific technical working groups. The assistance of these groups, along with a 60-day public comment opportunity and public hearing (planned for April-May 2023), fulfills the public participation requirements specified in OAR 340-042-0050. DEQ considered all input received during these public participation opportunities, used input to guide the analyses and preparation of documents, and provided response to comments, which is available on DEQ's website.

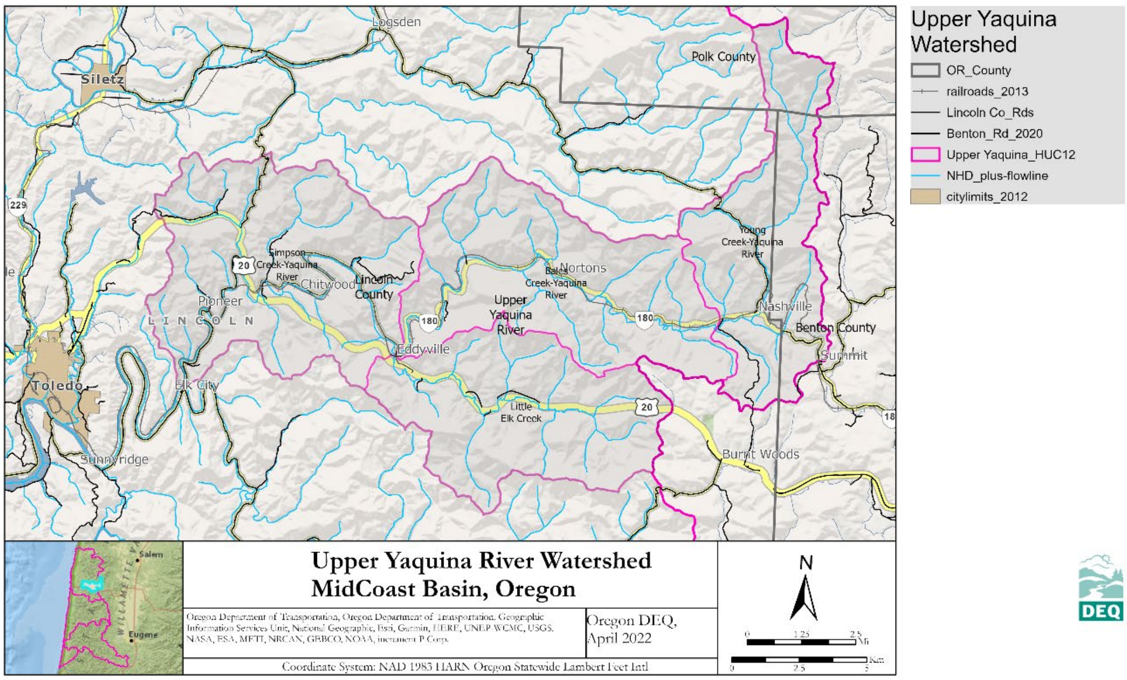
2. TMDL name and location

Per Oregon Administrative Rule 340-042-0040(a), this element describes the geographic area for which the TMDL is developed. This TMDL covers the Upper Yaquina River Watershed (Hydrologic Unit Code 1710020401) and includes all freshwater perennial and intermittent streams in the watershed. The estuarine waters of the watershed, which drains the lowest portions of the Yaquina River to the Pacific Ocean at Yaquina Bay in Newport, were excluded.

Figure 2.0 shows the freshwater portions of the Yaquina River, Little Elk Creek subwatershed and other tributaries to these larger streams.

Located within Oregon's Mid Coast Basin and Siletz-Yaquina Subbasin, the Upper Yaquina River Watershed drains a land area of approximately 83.1 square miles (or 215.2 square kilometers). The majority of the watershed lies in Lincoln County, with a small eastern portion extending into Polk and Benton Counties. Watershed land elevations range from 2,685 feet (or 818 meters) in the northeast, down to approximately 15 feet (or 4.6 meters) above sea level.

Figure 2.0: Upper Yaquina River Watershed



Within the United States Geologic Survey's Hydrologic Unit Code classification system, the Upper Yaquina River Watershed constitutes a 10-digit HUC code (1710020401) and is located within the larger Siletz-Yaquina eight-digit HUC code (17100204). Table 2.0 shows the four smaller subwatersheds captured within the HUC 10 Upper Yaquina River Watershed.

Table 2.0: Upper Yaquina River subwatersheds

HUC12 Code	Subwatershed Name
171002040101	Young Creek-Yaquina River
171002040102	Bales Creek-Yaquina River
171002040103	Little Elk Creek
171002040104	Simpson Creek-Yaquina River

2.1 Climate and hydrology

A Mediterranean climate characterizes the Upper Yaquina River Watershed, with a warm dry season in summer to early fall and a cool wet season in late fall through winter and spring. Average annual temperatures and precipitation vary across elevations at 62.8°F (17.1°C) and 67 inches at low elevations and 41.1°F (5.1°C) and 171 inches near the eastern crest of the watershed. Proximity to the Pacific Ocean buffers temperature fluctuations in the watershed and nearly all precipitation falls as rain. Snowfall can occur at the highest elevations, although a seasonal snowpack does not develop.

Stream flows follow seasonal patterns with high flows coinciding with the winter months and low flows occurring during late summer to early fall. Oregon Water Resources Department databases report 231 surface water withdrawal permits, 21 water storage permits and one groundwater withdrawal permit within the Upper Yaquina River Watershed. As explained in Section 2.3 of the TMDL Technical Support Document, DEQ did not explicitly consider the effects of water storage and withdrawal in modeling the watershed hydrology, but assumed these anthropogenic modifications were embedded in EPA's calibrated hydrologic watershed model (see Section 4.3.1 and Appendix 1 of the TMDL Technical Support Document for model information).

2.2 Land use

DEQ and EPA used land use and land cover data and information from the 2011 National Land Cover Database to conduct modeling and analyses. More information is available in Section 2.1.3 of the TMDL Technical Support Document (DEQ, 2023a). According to the 2011 NCLD, land cover and uses in the Upper Yaquina River Watershed vary with elevation. As shown on Table 2.2 and Figure 2.2, forest and regenerating forest areas are the largest percentage of land area (approximately 86.6%) and occur in upland areas. While rural residential, paved roads and agricultural lands make up only approximately 7.8% of land cover in the watershed, these uses are concentrated in lowland areas, particularly along the mainstem Yaquina River and Little Elk Creek.

Table 2.2: Land cover/use areas and percentages in the Upper Yaquina River Watershed

Land Cover/Land Use	Total Area (acres)	Percent of Total Area (%)
Evergreen Forest	16,187	30.42
Mixed Forest	13,797	25.93
Shrub/scrub	13,776	25.89
Developed, Open Space	3,649	6.86
Herbaceous	2,466	4.63
Deciduous Forest	2,338	4.39
Woody Wetlands	307	0.58
Hay/Pasture	247	0.46
Barren Land	224	0.42
Developed, Low Intensity	125	0.24
Emergent Herbaceous Wetlands	71	0.13
Developed, Medium Intensity	11	0.02
Cultivated Crops	9	0.02
Open Water	5	0.01
Total	**53,212**	**100.00**

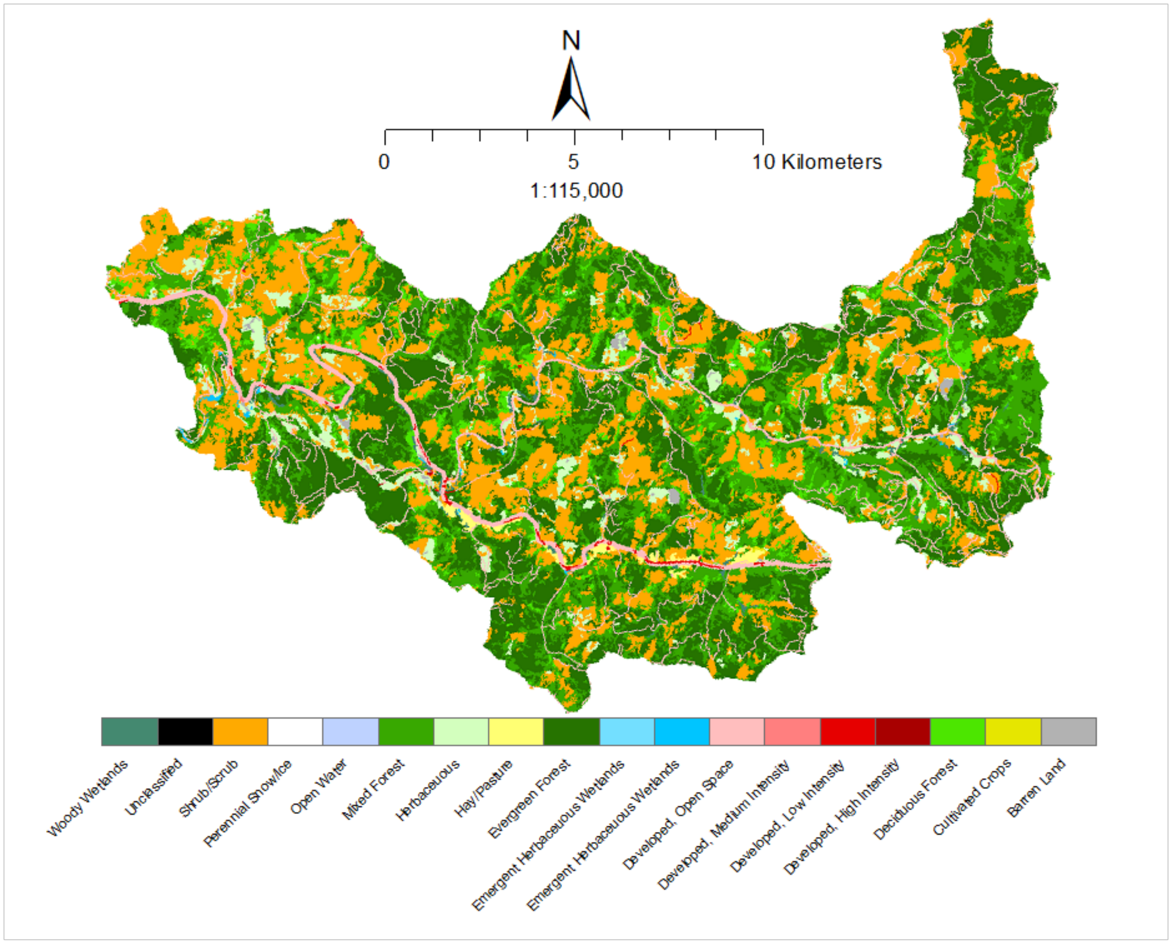


Figure 2.2: Land cover/use in the Upper Yaquina Watershed in 2011

3. Pollutant identification

As stated in OAR 340-042-0040(4)(b), this element identifies the pollutants causing water quality impairments that are addressed by these TMDLs. The associated water quality standards and beneficial uses are identified in Section 4.

As explained below, the pollutants addressed by the dissolved oxygen TMDL are solar radiation and phosphorus, with the respective surrogate measures of effective shade and total phosphorus concentration. The pollutant addressed by the bacteria TMDL is E. coli.

The tables and figures in this section present stream and watershed assessment units within the watershed that were listed as impaired for bacteria and dissolved oxygen on Oregon's 2022 Clean Water Act Section 303(d) List (as part of Oregon's Integrated Report), which was approved by the Environmental Protection Agency on September 1, 2022. Status category designations are prescribed by Sections 305(b) and 303(d) of the Clean Water Act. Assessment

units listed in Category 5 (designated use is not supported or a water quality standard is not attained) require development of a TMDL.
DEQ's evaluations include data and information collected within the Upper Yaquina River Watershed spanning two decades and includes consideration of impairment history documented in the EPA-approved 2012 and 2018/2020 Integrated Reports. Tabulated comparisons and explanations are provided in Section 3 of the TMDL Technical Support Document (DEQ, 2023a). These TMDLs were developed to be implemented to achieve attainment of the applicable water quality criteria to support the associated beneficial uses, as specified in Section 4 of this document.

DEQ developed these TMDLs to address Category 5 listed assessment units and to protect all other assessment units and assessment categories, including "unassessed." The allocations, including surrogate measures, and implementation framework apply year-round or at critical times to all freshwater perennial and intermittent streams in the watershed, as described in Sections 5, 8 and 9 of this document. The implementation framework is presented in the Upper Yaquina River Watershed TMDLs Water Quality Management Plan and includes implementation activities and timeframes to improve water quality, as well as measures of success.

DEQ considered how downstream impairments could be affected by implementation of these TMDLs. While the TMDLs did not quantify load reductions to downstream tidally influenced and estuarine areas, DEQ determined that implementation of the allocations in freshwater portions of the watershed is anticipated to reduce loads of bacteria and pollutants affecting dissolved oxygen reaching the upper estuary. Additional information is available in Section 3.3 and its subsections in the TMDLs Technical Support Document (DEQ, 2023a).

3.1 Dissolved oxygen impairments and surrogate measures

As explained in Section 3.3.1 of the TMDL Technical Support Document (DEQ, 2023a), Table 3.1 (below) presents the relevant dissolved oxygen impairments and assessment units for which DEQ developed this TMDL. The extent of assessment units for all Category 5 dissolved oxygen listings are mapped in Figure 3.1.

Table 3.1: Dissolved oxygen impairments and status on Oregon's 2022 Integrated Report - Upper Yaquina River Watershed

Assessment Unit Name, Description and Identification Number	Approximate Assessment Unit Length (Miles)	2022 Assessment Category	Parameter-Period
Yaquina River Little Yaquina River to Little Elk Creek OR_SR_1710020401_02_105951	16.03	Category 5	Dissolved Oxygen-Spawning
Yaquina River Little Yaquina River to Little Elk Creek OR_SR_1710020401_02_105951	16.03	Category 2	Dissolved Oxygen-year- round
Yaquina River Little Elk Creek to Sloop Creek OR_SR_1710020401_02_105953	9.50	Category 5	Dissolved Oxygen-Spawning
Yaquina River Little Elk Creek to Sloop Creek OR_SR_1710020401_02_105953	9.50	Category 3	Dissolved Oxygen-year- round

Assessment Unit Name, Description and Identification Number	Approximate Assessment Unit Length (Miles)	2022 Assessment Category	Parameter-Period
Little Elk Creek Headwaters to confluence with Yaquina River OR_SR_1710020401_02_105950	3.39	Category 5	Dissolved Oxygen-Spawning
Little Elk Creek Headwaters to confluence with Yaquina River OR_SR_1710020401_02_105950	3.39	Category 3	Dissolved Oxygen-year- round
Young Creek-Yaquina River HUC12 (1st through 4th order streams) OR_WS_171002040101_02_106126	83.7	Unassessed	Dissolved Oxygen – year- Round

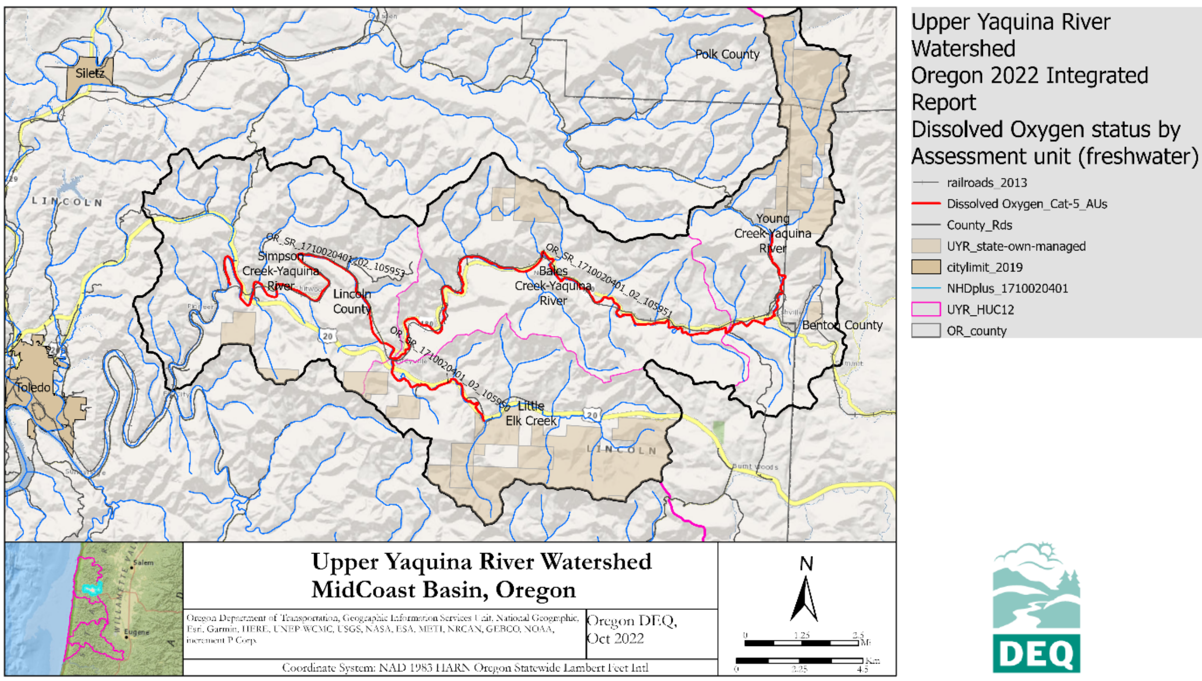


Figure 3.1: Dissolved oxygen-impaired freshwater assessment units in Oregon's 2022 Integrated Report - Upper Yaquina River Watershed

Water column dissolved oxygen levels reflect the effects of physical, chemical and biological factors. Low dissolved oxygen levels occur in streams because of factors that affect the exchange of oxygen between the atmosphere and water column, production of oxygen through the biological process of photosynthesis, and the consumption of oxygen by chemical and biological processes in the water column and stream bottom.

Based on analysis of available data, DEQ identified the need to control the loading of the pollutants solar radiation and phosphorus, in order to meet criteria for dissolved oxygen levels during critical periods in the Yaquina River.

Surrogate measures are defined in OAR 340-042-0030(14) as "substitute methods or parameters used in a TMDL to represent pollutants." In accordance with OAR 340-042-0040(5)(b), DEQ used effective shade as a surrogate measure for solar radiation and measured concentrations of total phosphorus as a surrogate for phosphorus loads in determining nonpoint source loading capacities and load allocations for this dissolved oxygen TMDL.

Effective shade is a combination of topographic and vegetative shading that blocks direct exposure of the stream to the sun. Effective shade was estimated along the mainstem Yaquina River between stations 34454-ORDEQ and 11476-ORDEQ, as shown on Figure 4.3.1 in the TMDL Technical Support Document. Phosphorus was measured as the mean of total phosphorus concentrations at DEQ ambient station 11476-ORDEQ during medium to low flows from mid-July to mid-November. Flow categories are defined in Table 2.3 of the TMDLs Technical Support Document.

3.2 Bacteria impairments

Table 3.2 (below) presents the relevant bacteria assessment units and water quality impairment status for which DEQ developed this TMDL. The extent of assessment units for both assessment categories are presented in Figure 3.2. The status and recent changes are further explained in Section 3.3.2 of the TMDLs Technical Support Document (DEQ, 2023a).

Table 3.2: Water quality assessment unit status for E. coli bacteria in the Upper Yaquina River Watershed from Oregon's 2022 Integrated Report

Assessment Unit Name, Description and Identification Number	Pollutant	2022 Status
Yaquina River Little Yaquina River to Little Elk Creek OR_SR_1710020401_02_105951	E. coli	Category 5
Yaquina River Little Elk Creek to Sloop Creek OR_SR_1710020401_02_105953	E. coli	Category 2

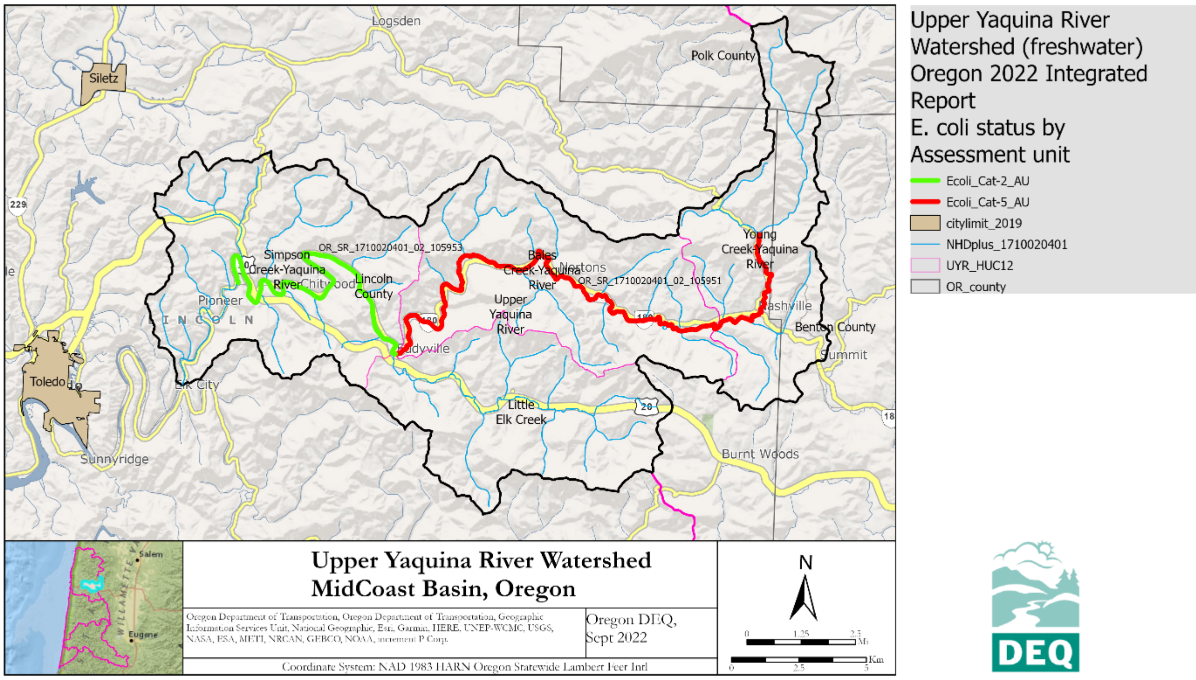


Figure 3.2: E. coli freshwater assessment units and status on Oregon's 2022 Integrated Report - Upper Yaquina River Watershed

4. Water quality standards and beneficial uses

As stated in OAR 340-042-0040(4)(c), this element identifies the beneficial uses in the basin, specifying the most sensitive beneficial use, and the relevant water quality standards established in OAR 340-041-0202 through 340-041-0975.

4.1 Beneficial uses and water quality standards

Tables 4.1.a and 4.1.b identify the designated beneficial uses of Mid Coast Basin surface water and the applicable numeric and narrative water quality standards and antidegradation rule and policy addressed by these TMDLs, as well as indicate the most sensitive beneficial uses related to each standard.

As explained in Section 3 of the Upper Yaquina TMDL Technical Support Document and Section 4 of this document, elevated E. coli bacteria loads impair the most sensitive beneficial use (water contact recreation) in freshwaters. E. coli bacteria impairments are addressed by this TMDL to support water contact recreation.

Table 4.1.a: Mid Coast Basin designated beneficial uses (OAR 340-041-0220 Table 220A)

All Streams and Tributaries Thereto
Public Domestic Water Supply
Private Domestic Water Supply
Industrial Water Supply
Irrigation
Livestock Watering
Fish and Aquatic Life
Wildlife and Hunting
Fishing
Boating
Water Contact Recreation
Aesthetic Quality
Hydropower

In addition to the broad beneficial uses for the Mid Coast Basin listed above, aquatic life uses designated in OAR-340-041-0220, Figures 220A and 220B, to be protected for the Upper Yaquina River Watershed are: salmonid spawning periods between October 15th to May 15th of each year and the cold-water aquatic life period of May 16th to October 14th.

Table 4.1.b: Applicable water quality standards and most sensitive beneficial uses

Parameter	Citation	Summary of Applicable Standards	Applicable Water	Most Sensitive Beneficial Use
Bacteria	OAR 340-041-009(1)(a)	(A) 90-day geometric mean (of 5 or more samples) of 126 E. coli organisms per 100 mL (B) No single sample may exceed 406 E. coli organisms per 100 mL	Fresh water	Water contact recreation
Dissolved Oxygen	OAR 340-041-0016(1) and Figure 220B	(a) Not less than 11.0 mg/L, or 9.0 mg/L if spatial median of intergravel DO is 8.0 mg/L or greater (b) Not less than 95% of saturation, where conditions of barometric pressure, altitude and temperature preclude attainment of 11.0 mg/L or 9.0 mg/L (c) Spatial median of intergravel DO not below 8.0 mg/L	Designated spawning areas and periods	Fish and aquatic life (Salmon and steelhead spawning and Salmon and trout rearing and migration)
	OAR 340-041-0016(2) and Table 21	Absolute minimum not less than 8.0 mg/L Not less than 90% of saturation, where conditions of barometric pressure, altitude and temperature preclude attainment of 8.0 mg/L	Salmon and trout rearing and migration and	

Parameter	Citation	Summary of Applicable Standards	Applicable Water	Most Sensitive Beneficial Use
		Not below 8.0 mg/L as a 30-day mean minimum, 6.5 mg/L as a 7-day mean minimum and 6.0 mg/L as an absolute minimum, with adequate information and DEQ discretion	cold water areas	
	Antidegradation OAR 340-041-0004 and 40 CFR 131.12(a)(2)	(3)(d) Up to 0.1 mg/L DO decrease from up-to down-stream ends of a reach, if no adverse impacts to threatened or endangered species, does not require antidegradation review	All streams	
		(9)(a)(D)(iii) DEQ may use its discretion to calculate a TMDL WLA for 30-day or 7-day means that results in no measurable reduction in DO, defined as 0.10 mg/L from a single source and 0.20 mg/L for all anthropogenic activities in a water quality limited segment		
Statewide Narrative Criteria	OAR 340-041-0007(1)	The highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious factors at the lowest possible levels.	All waters of the state	Fish and aquatic life

4.2 Impairment impacts in the aquatic environment

As shown in Tables 3.1 and 3.2, measurements of E. coli, fecal coliform and dissolved oxygen have been observed in Upper Yaquina River Watershed streams that do not meet Oregon water quality criteria intended to protect human health and the environment. As noted in Table 4.1b, these impairments threaten or impair multiple beneficial uses.

4.2.1 Dissolved oxygen in the aquatic environment

Dissolved oxygen needs to be maintained at sufficient levels to ensure reproduction, survival and growth of many important aquatic species, including resident and anadromous trout and salmon. Frequent, extensive, or prolonged periods of low DO levels displaces, harms or kills many of these species and can further degrade water quality by facilitating the release of nutrients, metals (e.g., mercury), and metalloids (e.g., arsenic) from sediments to waterbodies. For trout and salmon, DO physiological requirements in the water column vary according to time of year and life cycle stage. Oregon water quality standards include numeric criteria for DO that address these varying requirements over the course of the year (OAR-340-041-0016). Additional information is provided in Section 3.1 of the TMDL Technical Support Document (DEQ, 2023a).

4.2.2 Bacteria in the aquatic environment

E. coli and fecal coliform bacteria are two groups of fecal indicator bacteria, which are measured to assess fecal contamination of a waterbody. The E. coli criterion is established to protect the beneficial use of human contact of waters for recreational purposes (water contact recreation) with respect to potential exposure to pathogens found with bacteria in fecal material. Recreational use not only includes swimming but any activity that could result in ingestion of water, such as: fishing, through contact of hands with water; any water sports; children playing along the banks or shores; and others. Recreational use of fecal contaminated waters can lead to mild to severe illnesses in humans.

Water with high levels of fecal contamination can also pose disease risks to livestock and wildlife. Infections like Johne's disease are caused by ingestion of bacteria in manure of infected animals, which serves as an ongoing reservoir of the bacteria. The disease reduces weight gain in cattle, can be fatal and leads to wasting symptoms in deer. Fecal contamination of irrigation water also raises the risk of produce crop contamination.

5.0 Seasonal variation and critical conditions

Per OAR 340-042-0040(4)(j) and 40 Code of Federal Regulation130.7(c)(1), TMDLs must also identify any seasonal variation and the critical conditions of each pollutant, if applicable.

5.1 Dissolved oxygen critical conditions

DEQ evaluated ten years (2006-2016 water years) of dissolved oxygen data to define critical periods for DO impairments, beginning with the year-round application of cold-water aquatic life and the seasonal period of salmonid spawning (October 15th through May 15th).
DEQ determined late summer (late-July through mid-September) to be the critical period for cold water aquatic life criteria. This is due to large daily fluctuations in DO concentrations and saturations caused by conditions allowing high biological activity that both produces (during daylight) and consumes dissolved oxygen.

DEQ determined early fall (mid-October through mid-November) to be the critical period for salmonid spawning DO criteria. This is due to late summer conditions extending into the early fall. However, as stream flows increase due to significant precipitation from fall storms entering the region from the North Pacific Ocean, DO conditions within coastal freshwater systems of the region switch to reflect equilibrium with temperature and DO levels in regional groundwater. Information presented in Section 4 of the TMDL Technical Support Document (DEQ, 2023a) suggest that once this change occurs, DO levels meet the spawning criteria for DO levels in the Upper Yaquina River.

5.2 Bacteria critical conditions

Seasonal variations are observed in the hydrologic conditions of the Upper Yaquina River Watershed as wet conditions and high flows during the late fall through spring and drier conditions with low flows in the summer through early fall. As detailed in Section 5 of the TMDL Technical Support Document (DEQ, 2023a), DEQ captured these variations in the load duration curves and time-series plots analyses and identified critical conditions for bacteria as the summer through early fall period, during which higher bacteria concentrations and lower flows are observed. Application of specific management strategies year-round will achieve the maximum reductions for critical conditions, as well as other times where exceedances of the single sample maximum criterion have been observed.

6.0 Water quality data evaluation overview

6.1 Dissolved oxygen evaluation approach

Individual or combinations of physical, chemical and biological factors control DO levels in streams and rivers. As summarized in Figure 6.1, DEQ used linked mechanistic water quality and watershed models to determine important linkages of various factors to DO levels, identify potential pollutant sources and estimate loading capacities and allocation scenarios. DEQ used a Hydrologic Simulation Program-Fortran or HSPF watershed model and a QUAL2Kw water quality model to estimate watershed loads of nutrients (nitrogen and phosphorus), the direct input of solar radiation to the river, and properties of channel form that can influence physical exchange of DO with the atmosphere. To further evaluate solar radiation heat inputs along the Upper Yaquina River, DEQ used LiDAR data to characterize vegetation and topography conditions, along with the Heat Source model to calculate effective shade (the amount of solar flux blocked by vegetation and topography) and the fraction of the stream channel exposed to the sky.

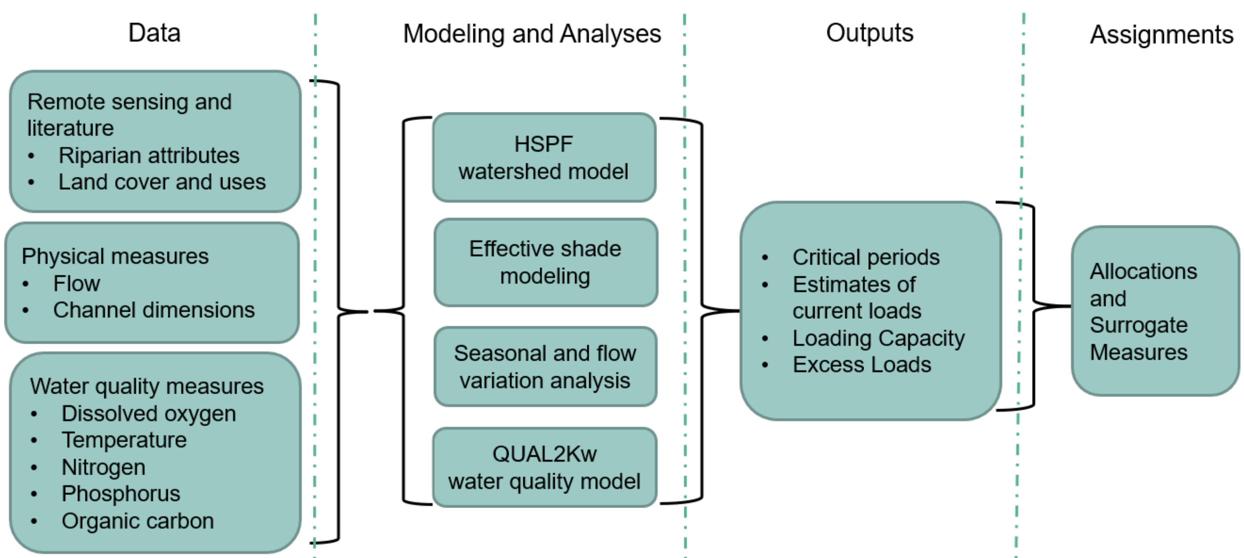


Figure 6.1: Schematic summarizing dissolved oxygen analytical approach

Based on these analyses, DEQ determined that solar radiation and phosphorus were the two primary pollutants contributing to exceedances of the cold water and salmonid spawning criteria for dissolved oxygen in the Upper Yaquina River. DEQ used effective shade as a surrogate measure for solar radiation and measured total phosphorus concentrations as a surrogate measure for phosphorus loads. Additional information on the dissolved oxygen related analyses is provided in Section 4 of the TMDL Technical Support Document (DEQ, 2023a).

6.2 Bacteria evaluation approach

DEQ used EPA's flow-based load duration curve method to determine pollutant loading capacity, assess current conditions and calculate the necessary pollutant reductions to comply with Oregon's bacteria water quality criteria, as summarized in Figure 6.2. The approach allows comparison of observed bacteria loads to water quality criteria under various flow categories and seasonal conditions and can be used to help target appropriate water quality restoration efforts.

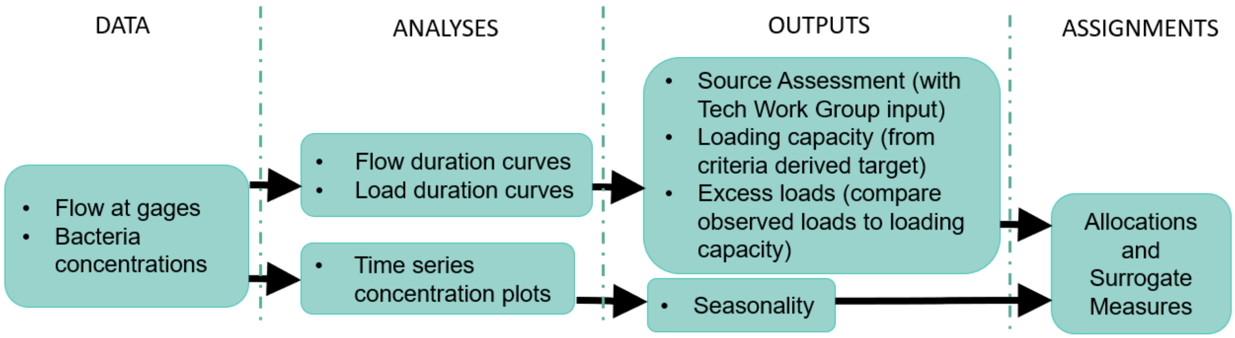


Figure 6.2: Schematic summarizing bacteria analytical approach

DEQ used the following simplified flow categories to describe the range of potential flow conditions with common intervals of exceedance probability: High (0% to 10%); Medium-High (10% to 40%); Medium (40% to 60%); Medium-Low (60% to 90%); and Low (90% to 100%), as defined in Table 2.3 of the TMDL Technical Support Document.

DEQ developed load duration curves for specific reaches within the watershed by multiplying estimated stream flows by: 1) the E. coli water quality criterion concentration to determine loading capacity; and, 2) measured E. coli concentrations to determine observed loads. Excess loads are indicated by the differences between loading capacities and observed loads and are expressed as reductions needed at specific reaches. DEQ linked potential point and nonpoint sources of bacteria that could influence stream bacteria concentrations during differing hydrologic conditions using area land use information and local, specific knowledge provided by members of the local technical working group. Additional information on bacteria analyses is provided in Section 5 of the TMDL Technical Support Document (DEQ, 2023a).

7.0 Pollutant sources or source categories

As noted in OAR 340-042-0040(4)(f) and OAR 340-042-030(12), a source is any process, practice, activity or resulting condition that causes or may cause pollution or the introduction of pollutants to a waterbody. This section identifies the various pollutant sources and estimates, to the extent existing data allow, the significance of pollutant loading from existing sources.

Specific sources are described below and are subsequently assigned allocations of the loading capacities. Sources of pollutants to streams include both point and nonpoint sources. OAR 340-045-001(17) defines point source as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.” OAR 340-41-0002 (42) defines nonpoint sources as “diffuse or unconfined sources of pollution where wastes can either enter, or be conveyed by the movement of water, into waters of the state.” Nonpoint sources are greater contributors of impairing pollutants in the Upper Yaquina River Watershed than point sources.

By definition (OAR 340-042-0030(1)), background sources include all sources of pollution or pollutants not originating from human activities. Background sources may also include anthropogenic sources of a pollutant that DEQ or another Oregon state agency does not have authority to regulate, such as pollutants emanating from another state, tribal lands or sources otherwise beyond the jurisdiction of the state.

7.1 Sources of pollutants affecting dissolved oxygen

While dissolved oxygen is not itself a pollutant, DO levels that are below Oregon’s water quality criteria in streams impact beneficial uses, including aquatic life. DO concentration and saturation levels are influenced by many direct and indirect factors. The evaluations summarized in Section 6.2 and fully documented in Section 4 of the TMDL Technical Support Document, identifies DO-influencing variables and processes.

7.1.1 Nonpoint sources affecting dissolved oxygen

DEQ’s modeling and analyses (DEQ, 2023a) conclude that nonpoint and background sources contribute virtually all excess phosphorus and excess solar radiation inputs that negatively impact dissolved oxygen levels in the Upper Yaquina River Watershed.

The nonpoint sources with primary influence on dissolved oxygen criteria excursions in the watershed are associated with agricultural, forestry and transportation sectors and include:

- Phosphorus
  - in manure directly deposited in water, and
  - in runoff that contacts manure from livestock management areas; and,
- Increased solar radiation inputs in
  - areas associated with transportation corridors (streamside facilities and rights-of-way associated with ODOT highways, county roads and railroad tracks) and
  - agricultural, rural residential and forestry land uses where streamside vegetation does not provide sufficient shade.

To a lesser extent, the following nonpoint and background sources also affect dissolved oxygen in the Upper Yaquina River Watershed:

- Phosphorus inputs from failing septic systems on rural residential lands;
- Pesticide applications (glyphosate) for silvicultural operations;
- Geologic weathering;
- Atmospheric deposition; and,
- Fine sediment from sources including road runoff and soil and bank erosion.

7.1.2 Point sources affecting dissolved oxygen

There is only one point source permit in the watershed, which is the NPDES Municipal Separated Storm Sewer (MS4) Phase 1 permit (EPA # ORS110870, DEQ #101822) held by the Oregon Department of Transportation, covering stormwater discharges from highways. Although nutrients could be entrained in highway (or roadway) stormwater, these would not originate from ODOT highway (or county roadway) operations and are not anticipated to be consistently measurable. Highway or roadway stormwater discharges are not pathways to increased solar radiation to streams. Therefore, any potential pollutants in highway (or roadway) stormwater discharges are not expected to impact the factors leading to depletion of instream DO.

7.1.3 Background sources affecting dissolved oxygen

DEQ distinguished background sources from the largest contributors of phosphorus. However, these other sources, including phosphorus in road runoff, remain lumped with background. Phosphorus background sources are detailed in Section 4.5.5.1 of the TMDL Technical Support Document (DEQ, 2023a) and include weathering and erosion of parent geologic material and a minor contribution from atmospheric deposition.

Background solar radiation load corresponds to solar inputs under site potential vegetation conditions. In keeping with the definition of background sources in OAR 340-042-0030(1), actions to implement the pollutant load allocations will be focused on sources arising from human activities.

7.2 Bacteria sources

There are a variety of potential anthropogenic-influenced sources of fecal contamination to Upper Yaquina River Watershed surface waters. Each source contributes different amounts of potential fecal contamination, based on prevalence of the activities, size of the land area on which the activities occur, locations of activities in relation to surface water and pollutant transport mechanisms.

7.2.1 Bacteria nonpoint sources

Nonpoint sources of bacteria in the Upper Yaquina River Watershed include activities associated with the agricultural sector, residential land use and wildlife. As detailed in Section 5.5 of the TMDL Technical Support Document (DEQ, 2023a), DEQ's analyses concluded that the primary anthropogenic sources of the bacterial load to streams in the watershed involve livestock management (pasture runoff and livestock direct access to streams) and, to a lesser extent, poorly functioning or failing septic systems.

7.2.2 Bacteria point sources

As noted in Section 7.1.2, there is only one permitted point source discharge within the Upper Yaquina River Watershed, which is the NPDES MS4 Phase 1 permit (EPA # ORS110870, DEQ #101822) held by ODOT and is applied statewide. Stormwater discharges from highways to waters of the state are permitted following collection, treatment and conveyance. Highway stormwater discharges occur most frequently during the rainy season of October through April and are considered to have a minimal potential for generating bacteria, though background sources of bacteria may be present in stormwater conveyed by the system.

7.2.3 Bacteria background sources

As detailed in Section 5.5 of the Upper Yaquina TMDL Technical Support Document, wildlife represent the background sources of bacteria in the watershed. DEQ solicited local knowledge within the watershed, which suggested elk as a potential source contributing background bacteria loads. However, large resident elk populations are not known to inhabit the watershed and no specific locations or behavior of elk were identified as major source contributions. Background bacteria sources are, therefore, considered minor and DEQ did not attempt to separate background from anthropogenic sources in the load duration curve analyses. Rather, background sources were included with all nonpoint sources of bacteria in the analyses. As such, background sources are included in surface water runoff transported to streams from land uses including forests, pastures and rural residential.

8.0 Loading capacity and excess load

Summarizing OAR 340-042-0040(4)(d) and 40 CFR §130.2(f), loading capacity is the amount of a pollutant or pollutants that a waterbody can receive and still meet water quality standards. In accordance with OAR 340-042-0040(4)(e), the excess load calculation evaluates, to the extent existing data allow, the difference between the actual pollutant load in a waterbody and the loading capacity of that waterbody.

8.1 Dissolved oxygen loading capacity and excess load

Loading capacities and excess loads of the pollutants (solar radiation and phosphorus) that impair dissolved oxygen during the critical period (Mid-July to mid-November) and critical flows (medium to low), shown in Table 8.1a, were determined using the calibrated linked HSPF-QUAL2Kw model. DEQ systematically varied the modeled parameters to determine the reductions in phosphorus and solar load needed to achieve the cold-water aquatic life and salmonid spawning criteria. The required reductions were calculated using the dissolved oxygen criterion for cold water aquatic life in the Yaquina River; additional modeling shows that these reductions are sufficient for meeting salmonid spawning DO criterion during the critical period (DEQ, 2023a). Excess loads for the Yaquina River are the difference between the existing loads of phosphorus or solar radiation and the loading capacities of phosphorus or solar radiation for the modeled river reach, presented in Figure 4.3.1 in the TMDL Technical Support Document.

Table 8.1a: Yaquina River loading capacities and excess loads of solar radiation and phosphorus

Pollutant	Loading Capacity	Excess Load	Reduction Needed
Solar Radiation	8,197,207,223 kcal/day	25,957,846,948 kcal/day	76%
Phosphorus	2.13 lbs/day	2.16 lbs/day	50%

For the modeled reach of the Yaquina River, DEQ used surrogate measures to express loading capacities. For solar radiation, the surrogate measure is effective shade modeled out to a 131-foot distance away from the center of the river on both banks (approximately 100-feet on each bank after accounting for stream width). For phosphorus loads, the surrogate measure is total phosphorus mean concentration measured at station 11476-ORDEQ from mid-July to mid-November during medium to low flow duration intervals. Table 8.1b presents the current conditions, including a margin of safety, and loading capacities for the dissolved oxygen surrogates. This comparison indicates the need for an increase in effective shade (in order to decrease solar radiation loads) and a decrease in total phosphorus concentrations, in order to attain instream DO criteria.

Table 8.1b: Yaquina River dissolved oxygen loading capacity by surrogate measures

Pollutant	Surrogate Measure	Current conditions surrogate	Loading capacity surrogate
Solar Radiation	Percent effective shade from 100-foot distance on both banks	45%	87%
Phosphorus	Total phosphorus mean concentration at Station 11476-ORDEQ during medium to low flow duration intervals mid-July to mid-November	19 µg/L	10 µg/L

For the unmodeled sections of the Yaquina River (within Assessment Units 10591 and 10593) and Little Elk Creek (Assessment Unit OR_SR_1710020401_02_105950), the loading capacity for solar radiation is based on effective shade curves for site potential vegetation developed for the watershed. Effective shade curves and tables are found in Section 4.5.2 of the TMDL Technical Support Document (DEQ, 2023a). Location-specific loading capacities and excess loads of solar radiation (need for increased effective shade) can be determined using active channel width, stream aspect and site potential vegetation characteristics (height and density) (DEQ, 2023a).

For unmodeled freshwater streams in the watershed, the phosphorus loading capacity can be calculated by multiplying the target total phosphorus mean concentration (10 µg/L) by flow (L/s) and by a conversion factor (0.000190479) to compute total phosphorus in pounds/day. This calculation can be used in loading comparisons among subwatersheds and for evaluating whether there are trends in total phosphorus loads.

8.2 Bacteria loading capacity and excess load

Section 5.4 of the Upper Yaquina River Watershed TMDL Technical Support Document presents modeled estimations of the amount of E. coli bacteria that the Upper Yaquina River Watershed streams can receive and still meet water quality standards. Table 8.2 presents a summary of E. coli loading capacities across the flow exceedance probability ranges based on Oregon Water Resources Department gaging station ID 14306030.

Table 8.2: Upper Yaquina River Watershed bacteria loading capacity at varying flow conditions and excess load

Flow Category and Exceedance Probability Range	High Flows 0%-10%	Medium-High Flows 10%-40%	Medium Flows 40%-60%	Medium-Low Flows 60%-90%	Low Flows 90%-100%
Mean Daily Flow Ranges (cubic feet per second)	578 to 6960	142 to 577	54.7 to 141	9.4 to 54	1.3 to 9.3
E. coli Loading Capacity (organisms/day)	6.32×10^{13}	5.46×10^{13}	1.16×10^{13}	4.71×10^{12}	4.14×10^{11}

Excess Load (Reduction Needed)	83%

DEQ evaluated the excess load of E. coli in the Upper Yaquina River Watershed by determining percent reductions needed in E. coli loads measured at each monitoring station to achieve the above loading capacity. Reduction percentages ranged from 0% to 83% and DEQ chose the maximum reduction needed to incorporate an additional implicit margin of safety. Therefore, the excess load of E. coli is expressed as an 83% reduction needed in the watershed.

9.0 Allocations, reserve capacity and margin of safety

OAR 340-042-0040(4)(g)(h)(i) and (k) [and 40 CFR 130.2(h) and (g) and 130.7(c)(2)] respectively define the required TMDL elements of apportionment of the allowable pollutant load: point source wasteload allocations; nonpoint source load allocations; margin of safety; and, reserve capacity. Collectively, these elements add up to the maximum load of a pollutant that still allows a waterbody to meet water quality standards. OAR 304-042-0040(5) and (6) describe the potential factors of consideration for determining and distributing these allocations of the allowable pollutant loading capacities. Water quality data analysis must be conducted to determine allocations, potentially including statistical analysis and mathematical modeling.

9.1 Allocations for dissolved oxygen

Table 9.1a presents the maximum direct solar radiation that the Yaquina River can receive from its headwaters at the confluence with the Little Yaquina River to Sloop Creek and still meet the dissolved oxygen criteria. These allocations are distributed among the known nonpoint sources in the watershed, in consideration of the percentage of contribution and reductions needed. The solar radiation allocation in Table 9.1a applies to approximately 21 miles of the mainstem Yaquina River within the QUAL2Kw model extent between stations 34454-ORDEQ and 11476-ORDEQ (assessment units OR_SR_1710020401_02_105951 and OR_SR_1710020401_02_105953), which is impaired (category 5) for dissolved oxygen, from mid-July to mid-November for flow duration interval categories that range from medium to low flows. See Figure 4.3.1 and Section 2.3 of the TMDL Technical Support Document (DEQ, 2023a) for the extent of the modeled reach and the description of flow categories.

Table 9.1a: Solar radiation load allocations within the QUAL2Kw model extent – Yaquina River

Nonpoint Sources	Solar Radiation Loading Capacity: 8,197,207,223 kcal/day				
	Existing Load (kcal/day)	Relative Contribution to Total Load	Percent Reduction Needed	Load allocation (kcal/day)	Relative Allocation of Loading Capacity
Insufficient height and density of riparian vegetation	34,155,033,534	100%	76%	8,197,207,223	100%
Reserve Capacity				0	0%

Margin of Safety				Implicit	
TOTALS		100%		8,197,207,223	100%

As shown in Table 8.1b, the surrogate measure allocation of effective shade for the modeled reach of the mainstem Yaquina River is 87%.

Table 9.1b presents the surrogate measure allocations of effective shade, expressed as a percentage, for achieving the solar radiation allocations on the unmodeled sections of the Yaquina River (approximately 4.5 miles within assessment units 10591 and 10593) and Little Elk Creek (Assessment Unit OR_SR_1710020401_02_105950), as well as any assessment units proposed for Category 5 in future Integrated Reports.

Site specific factors needed to use Table 9.1b include the site potential vegetation types, assuming 90% canopy density (shown in Table 4.5.2 of the TMDL Technical Support Document), and the stream width and stream orientation. These surrogate measure allocations were derived from the model used to simulate the effective shade results in Section 4.5.2, Figures 4.5.2a-h of the TMDL Technical Support Document (DEQ, 2023a). Reductions in effective shade caused by natural disturbance are not considered a violation of the TMDL.

Table 9.1b: Percent effective shade load allocations to achieve the solar radiation reductions in unmodeled areas, assuming 90% canopy density – Yaquina River and Little Elk Creek

Stream Width (ft)	Deciduous			Coniferous			Mixed		
	Stream Orientation			Stream Orientation			Stream Orientation		
	North-South	NW-SE or NE-SW	East-West	North-South	NW-SE or NE-SW	East-West	North-South	NW-SE or NE-SW	East-West
10	95%	95%	97%	97%	97%	98%	96%	96%	98%
20	90%	88%	92%	94%	94%	96%	93%	92%	95%
30	85%	82%	88%	92%	91%	95%	90%	88%	92%
40	81%	76%	81%	90%	88%	93%	87%	83%	89%
50	78%	72%	73%	88%	85%	91%	84%	79%	86%
60	75%	68%	65%	86%	82%	89%	82%	76%	81%
70	72%	65%	58%	84%	80%	86%	79%	74%	75%
80	69%	62%	53%	83%	78%	83%	77%	71%	70%
90	66%	60%	49%	81%	76%	80%	75%	69%	66%
100	64%	57%	45%	80%	74%	76%	74%	67%	62%

Table 9.1.c presents the maximum amount of phosphorus that the Yaquina River can receive, in combination with the solar radiation allocation in Table 9.1a, and still meet the dissolved oxygen criteria. These allocations are distributed among the known point and nonpoint sources in the watershed, in consideration of the percentage of contribution and reductions needed. The surrogate measure for demonstrating that phosphorus allocations are met is an instream total

phosphorus mean concentrations at 10 μg/L or less during July 15th through November 15th at flows equal to or less than 141 cfs at Oregon Water Resources Department gaging station ID 14306030.

Table 9.1c: Phosphorus allocations – Upper Yaquina River Watershed

Sources		Phosphorus Loading Capacity: 2.13 pounds/day				
		Existing Load (pounds/day)	Relative Contribution to Total Load	Percent Reduction Needed	Allocation (pounds/day)	Relative Allocation of Loading Capacity
Nonpoint source and background LAs	Livestock manure	2.46	57%	50%	1.21	56%
	Runoff from roadways, silviculture and background*	1.80	42%	50%	0.88	41%
	Failing septic systems	0.03	1%	50%	0.01	1%
Point source WLAs	ODOT MS4 stormwater permit	0**	0%**	0**	0.01	1%
Reserve Capacity					0.02	1%
Margin of Safety					Implicit	
TOTALS			100%		2.13	100%
Notes:* Background includes atmospheric deposition, soil leaching and erosion and wildlife; **Highway stormwater captured in Roadways nonpoint source; LA = Load Allocation; WLA = Wasteload Allocation						

For unmodeled freshwater streams in the watershed, the phosphorus allocations can be calculated by multiplying the target total phosphorus mean concentration (10 μg/L) by stream flow (L/s) and by a conversion factor (0.000190479) to compute total phosphorus in pounds/day.

9.1.1 Dissolved oxygen reserve capacity

DEQ did not identify any projected needs for reserve capacity of solar radiation or total phosphorus due to future growth and new or expanded sources. DEQ reserved zero percent of loading capacity for solar radiation because the expectation for future development in the watershed will not include exemptions from riparian vegetation restoration practices. DEQ designated one percent of total phosphorus loading capacity for reserve capacity with the expectation that future development and discharges within the watershed will adhere to management practices designed to prevent excess total phosphorus loading to surface waters.

9.1.2 Dissolved oxygen margin of safety

As required by OAR 340-042-0040(4)(i), this element explains how a margin of safety was derived and incorporated into the TMDL to account for uncertainty in available data or in the magnitude of effects that management will have on reducing pollutant loads. DEQ used an implicit margin of safety by incorporating conservative assumptions about calibration data and model processes, instead of explicitly varying loads by a fixed percentage. Conservative assumptions DEQ used within the calibrated HSPF-QUAL2Kw model to base calculations for loading capacity and excess loads included:

- Decreased effective shade by 20 percent
- Increased Manning's n (channel roughness coefficient) by 20 percent

- Increased all inorganic and organic nitrogen and phosphorus concentrations by 20 percent.

These modeling assumptions simulate higher pollutant loading and transport in the TMDL for solar radiation and phosphorus than simulated with measured data. As a result, less solar radiation and phosphorus are allowed to be contributed to the river system, which translates to higher reduction requirements.

DEQ determined that meeting loading capacity for solar radiation or total phosphorus loads individually would meet minimum DO criteria for cold water and salmonid spawning. As an additional margin of safety, DEQ requires that loading capacities for solar radiation and total phosphorus loads are both met to ensure that DO criteria are attained and maintained.

9.2 Allocations for bacteria

Tables 9.2a and 9.2b present the maximum E. coli loads that Upper Yaquina River Watershed streams can receive and still meet the bacteria criteria distributed among the known point and nonpoint sources in the watershed, after accounting for reserve capacity and an explicit margin of safety. Background sources were not able to be separated from other human caused nonpoint sources. However, in keeping with the definition of background sources in OAR 340-042-0030(1), actions to implement the load allocations will be focused on sources arising from human activities. Bacteria allocations are the amount allowed from each source, expressed as both:

- A percentage of the loading capacity presented in Section 8.2 above; and,
- The load of organism per day represented by the loading capacity percentage at varying flow conditions.

Table 9.2a: Bacteria allocations by sources as percentage of loading capacity at varying flow conditions - Upper Yaquina River Watershed

Sources		Relative Allocation of Load Capacity	
		Low Flows	**All Other Flows**
Nonpoint source and background LAs	Runoff in contact with failing septic systems and livestock grazing areas, livestock and wildlife in and around streams	90%	89%
Point source WLAs	ODOT MS4 Stormwater Permit	0%	1%
Reserve Capacity		0%	0%
Margin of Safety		10%	10%
	TOTALS	100%	100%
Notes: LAs = Load Allocations; WLAs = Wasteload Allocations			

Table 9.2b: Bacteria allocations by sources as daily loads at varying flow conditions - Upper Yaquina River Watershed

Flow Category	High Flows	Medium-High Flows	Medium Flows	Medium-Low Flows	Low Flows
Flow Exceedance Range	0%-10%	10%-40%	40%-60%	60%-90%	90%-100%
Source	Allowable Daily E. coli Loads (organisms/day)				
Nonpoint and Background	5.63×10^{13}	4.86×10^{13}	1.03×10^{13}	4.20×10^{12}	3.73×10^{11}
Point (ODOT MS4)	6.32×10^{11}	5.46×10^{11}	1.16×10^{11}	4.71×10^{10}	0
Reserve Capacity	0	0	0	0	0
Margin of Safety	6.32×10^{12}	5.46×10^{12}	1.16×10^{12}	4.71×10^{11}	4.14×10^{10}

9.2.1 Bacteria reserve capacity

DEQ did not identify any projected needs for reserve capacity of bacteria due to future growth and new or expanded sources. DEQ reserved zero percent of the bacteria loading capacity. Future permitted sources may discharge effluent containing fecal bacteria at concentrations in compliance with water quality standard criteria (see Table 4.1.1b), which does not constitute a lowering of bacterial water quality.

9.2.2 Bacteria margin of safety

As required by OAR 340-042-0040(4)(i), this element explains how a margin of safety was derived and incorporated into the TMDL to account for uncertainty in available data or in the actual effect controls will have on loading reductions and receiving water quality. For bacteria in the Upper Yaquina River Watershed, DEQ used both explicit and implicit margins of safety. As shown in Tables 9.2a and 9.2b, a value of 10 percent was explicitly applied in the TMDL calculation. In addition, the following conservative analytical assumptions were included to incorporate an implicit margin of safety. DEQ used reasonable maximum scenarios for each part of the analysis to ensure that estimated loads would be higher than actual loads encountered most of the time. For instance, DEQ assumed that all source bacteria reach the streams, rather than using known die-off of bacteria. DEQ also chose to calculate reductions needed to meet the single sample maximum criterion for all stream flow conditions. Because differing sources contribute differing magnitudes of bacteria during differing flow conditions, DEQ chose to use the maximum observed concentration to calculate reductions needed across all flow categories and then chose the maximum reduction across all areas. This approach ensures additional reductions are applied to sources contributing during flows other than those associated with the maximum observed concentration.

10.0 Water Quality Management Plan

As described in OAR 340-042-0040(4)(l)(A)-(O), an associated WQMP is an required element of a TMDL and must include the following components: (A) Condition assessment and problem description; (B) Goals and objectives; (C) Proposed management strategies design to meet the TMDL allocations; (D) Timeline for implementing management strategies; (E) Explanation of how TMDL implementation will attain water quality standards; (F) Timeline for attaining water quality standards; (G) Identification of persons, including Designated Management Agencies, responsible for TMDL implementation; (H) Identification of existing implementation plans; (I) Schedule for submittal of implementation plans and revision triggers; (J) Description of reasonable assurance of TMDL implementation; (K) Plan to monitor and evaluate progress toward achieving TMDL allocations and water quality standards; (L) Plan for public involvement in TMDL implementation; (M) Description of planned efforts to maintain management strategies over time; (N) General discussion of costs and funding for TMDL implementation; and, (O) citation of legal authorities relating to TMDL implementation.

DEQ sought and considered input from various persons, including DMAs responsible for TMDL implementation and other interested stakeholders, and prepared the Upper Yaquina River Watershed WQMP as a stand-alone document. DEQ intends to propose the draft WQMP as an element of the Upper Yaquina River Watershed TMDLs for adoption as rule by the Oregon Environmental Quality Commission. Add link to draft WQMP and eventual rule citation.

11.0 Reasonable Assurance

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." 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. 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. And 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 and guidance on determining reasonable assurance and supports federal antidegradation rules and Oregon's antidegradation policy (OAR 340-041-0004).

The Upper Yaquina River Watershed TMDLs were developed for waters impaired by nonpoint sources and much less significantly by point sources. Load reduction allocations were assigned proportional to estimated source contributions and in consideration of opportunities for effective measures to reduce those contributions. It is the state's (and, with TMDL approval, EPA's) best professional judgment as to a reasonable assurance determination that the TMDL's load allocations will be achieved and antidegradation requirements will be met. DEQ employs a six-point accountability framework for reasonable assurance of implementation, as detailed in DEQ's Water Quality Management Plan for the Upper Yaquina River Watershed.

Pollutant reduction strategies are identified in DEQ's WQMP, and more specific strategies will be detailed in each required implementation plan, to be submitted per the timelines in the WQMP. 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 at some locations within the subbasin and demonstrate reduced pollutant loading. These strategies are technically feasible at an appropriate scale in order 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.

The reasonable assurance definition cited above recognizes that the TMDL allocations can be achieved through regulatory or voluntary actions. However, achieving the TMDL allocations are a requirement of responsible persons, including Designated Management Agencies. Therefore, preparing and implementing approved implementation plans is required as demonstration of enacting the WQMP, achieving TMDL allocations and providing reasonable assurance for the TMDL.

The rationale described in the Upper Yaquina River Watershed TMDLs Rule, Technical Support Document and WQMP stems from robust evaluations, implements an accountability framework and provides opportunities for adaptive management to maximize pollutant reductions. Together these documents provide evidence of an approach that provides reasonable assurance to meet state and federal requirements, including for antidegradation, and attain the goals of the TMDLs.

12.0 References

DEQ. 2023a. Draft Upper Yaquina River Watershed TMDLs Technical Support Document. Oregon Department of Environmental Quality.

DEQ. 2023b. Draft Upper Yaquina River Watershed Water Quality Management Plan. Oregon Department of Environmental Quality.