From: "Croxton, David" <Croxton.David@epa.gov>
To: akol461@ecy.wa.gov
Date: 7/2/2018 5:19:44 PM
Subject: FW: Deschutes TMDL Action Decision Rationale
Attachments: Final EPA R10 Deschutes TMDL decision rationale.pdf

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HI Andrew,

Attached is our decision rationale document for our review letter on the Deschutes TMDL, FYI.
Thanks for the good coordination work with Miranda!
Dave

MEMORANDUM

SUBJECT: U.S. EPA Review of the Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-parameter Total Maximum Daily Load

FROM: Miranda Hodgkiss
Watershed Unit, Office of Water and Watersheds, U.S. EPA Region 10

TO: Administrative File for the Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-parameter Total Maximum Daily Load

DATE: June 29, 2018

This memorandum documents the U.S. Environmental Protection Agency Region 10 review of, and final action on, the *Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-parameter Total Maximum Daily Load* ("TMDL"). The TMDL addresses water body impairments for multiple parameters, which include bacteria, temperature, dissolved oxygen ("DO"), pH, and fine sediment. As such, and as described in more detail below, the Deschutes TMDL is, in fact, a collection of 73 individual TMDLs - one for each of the relevant waterbody-parameter combinations.

The Washington Department of Ecology ("Ecology") released the TMDL for public review on April 13, 2015, with a public comment period lasting 45 days and ending on May 27, 2015. Ecology sent the final TMDL and submission letter to EPA on December 17, 2015. Amendments to portions of the TMDL were submitted to EPA on July 17, 2017 ("2017 submittal").

Based on its review of the final TMDL, the 2017 submittal, and supporting documents, pursuant to Section 303(d) of the Clean Water Act ("CWA"), 33 U.S.C. Section 1313(d), and EPA's implementing regulations at 40 CFR Part 130, EPA finds that it can approve 26 of the submitted TMDLs as meeting the necessary statutory and regulatory requirements. In addition, EPA finds that it must disapprove 37 of the submitted TMDLs as not meeting the necessary statutory and regulatory requirements. EPA also finds that it need not approve or disapprove 10 submitted TMDLs for bacteria because those previously impaired segments are no longer identified as impaired on Washington State's CWA section 303(d) list. The following document presents EPA's rationale in support of those decisions.

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1. Total Maximum Daily Loads Submitted to EPA for Review

On December 17, 2015, the Washington Department of Ecology ("Ecology") submitted ("2015 submittal") the Deschutes River, Percival Creek, and Budd Inlet Tributaries Total Maximum Daily Loads and supporting documentation ("Deschutes TMDL") to Region 10 of the U.S. Environmental Protection Agency ("EPA") for review under Section 303(d)(2) of the Clean Water Act ("CWA"), 33 U.S.C. § 1313(d)(2). The 2015 submittal includes a request for EPA to review TMDLs developed for 73 water segments to address one or more of the following pollutants/parameters: fine sediment, fecal coliform bacteria, water temperature, dissolved oxygen ("DO"), and pH. The 73 water segments correspond to the 2010 303(d) list, which was the most recently EPA-approved 303(d) list at the time of the TMDL submittal. The 2010 303(d) list was approved by EPA on December 21, 2012.

Following submission of the Deschutes TMDL in 2015, Ecology placed eight segments in Category 1 of the 2012 Integrated Report, and two segments in Category 2 of the 2012 Integrated Report **(Table 1)** (Washington Water Quality Atlas, last accessed on 4/20/2018). Ecology submitted the final documentation for the 2012 303(d) list to EPA on June 3, 2016. The 2012 303(d) list was approved by EPA on July 22, 2016. By EPA's approval of the 2012 303(d) list, EPA approved the omission of those ten segments from Category 5 (i.e. the "303(d) list"), as they were instead placed into Categories 1 and 2 of the Integrated Report. These segments, previously identified as impaired for bacteria in the EPA-approved 2010 303(d) list, were included in the 2015 TMDL submittal. Placement of those ten segments in Categories 1 and 2 indicates they are no longer impaired for bacteria and, thus, no longer require a TMDL. Therefore, EPA has determined it is not required to approve or disapprove the bacteria TMDLs submitted by Ecology for those ten segments.

***Table 1**. Current Category 1 and Category 2 water segments from Deschutes TMDL submittal.*

Waterbody	1996 Listing ID[1]	2010 Listing ID	Parameter	2012 Integrated Report Category
Ayer (Elwanger) Creek	WA-13-1015	5849	Bacteria	1
Chambers Creek	WA-13-1014	45560	Bacteria	1
Deschutes River	WA-13-1010	46499	Bacteria	1
		46500	Bacteria	1
		9881	Bacteria	1
	WA-13-1020	46210	Bacteria	1
Percival Creek	WA-13-1012	46103	Bacteria	1
		46108	Bacteria	1
Butler Creek	---	45471	Bacteria	2
Butler Creek, SW F	---	45342	Bacteria	2

[1]The 1996 Listing ID is used for 1998 Settlement Agreement compliance tracking.

EPA has reviewed the TMDLs submitted for the remaining 63 waterbody-pollutant combinations (**Table 2**). The 1996 listing ID number is also provided to track EPA's compliance with the January 6, 1998 Settlement Agreement EPA signed with Northwest Environmental Advocates ("NWEA") and the Northwest Environmental Defense Center ("NEDC"). For purposes of this review and EPA's settlement agreement compliance tracking, EPA counts TMDLs based on the

waterbody identification system used by Ecology to develop the 1996 CWA Section 303(d) list where, generally speaking, each tributary is considered to be one waterbody.

Ecology supplemented its 2015 TMDL submittal with a letter to EPA Region 10, dated July 17, 2017 ("2017 submittal"). The July 2017 submittal supplemented the December 2015 submission by expressing bacteria allocations in daily units and providing an equation that, when used, calculates temperature wasteload allocations for permitted stormwater sources. The July 2017 submittal includes a subset of water segments from the 2015 submittal, impaired by water temperature, fecal coliform bacteria, and fine sediment. These segments are noted by an asterisk in **Table 2**.

In the time between the 2015 TMDL submittal and the 2017 submittal, Ecology updated its segmentation of assessment units to better align with National Hydrography Dataset ("NHD") streams. This resulted in changes to the assessment units and the associated listing IDs. The July 2017 submittal used the new listing IDs. Using crosswalk information provided by Ecology (see Appendix A), EPA determined which listing IDs from the 2015 submittal were assigned daily loads in the 2017 submittal. Ecology did not assign daily loads to Category 1 and Category 2 waters in **Table 1**. They assigned daily loads to all remaining waters listed for bacteria in **Table 2**. Because Ecology has not withdrawn any of the TMDLs submitted in 2015, EPA has reviewed and either approved or disapproved TMDLs for all waterbody-pollutant combinations included in the 2015 submittal, as supplemented by the 2017 submittal, except the ten bacteria segments identified in **Table 1**.

***Table 2**. TMDLs reviewed for temperature, fecal coliform bacteria, DO, pH, or fine sediment impairments within Budd Inlet, Deschutes River, and Percival Creek watersheds.*

Waterbody	1996 Listing ID[1]	2010 Listing ID[2]	Parameter
Adams Creek	---	45462*	Bacteria
		45695*	Bacteria
		50965	pH
Ellis Creek	WA-13-0020	45480*	Bacteria
Indian Creek	WA-13-1300	3758*	Bacteria
		45213*	Bacteria
		46410*	Bacteria
		(74218)*	Bacteria
Mission Creek	WA-13-1380	45212*	Bacteria
		46102*	Bacteria
Moxlie Creek	WA-13-1350	3759*	Bacteria
		3761*	Bacteria
		45252*	Bacteria
		46432*	Bacteria
Schneider Creek	---	45559*	Bacteria
Ayer (Elwanger) Creek	WA-13-1015	5850	pH
		5851	DO
		(73229)	Temperature
Deschutes River	WA-13-1010	10894	DO
		47753	DO
		47754	DO
		6576*	Temperature

Waterbody	1996 Listing ID[1]	2010 Listing ID[2]	Parameter
		7590	Temperature
		48710*	Temperature
		48711*	Temperature
		48712*	Temperature
		48713*	Temperature
		48714*	Temperature
		48715*	Temperature
		48717	Temperature
		48718	Temperature
		9439	Temperature
	WA-13-1020	47756	DO
		6232*	Fine Sediment
		7588	Temperature
		7592	Temperature
		7593	Temperature
		7595	Temperature
		48720	Temperature
		48721	Temperature
		48724	Temperature
		48726	Temperature
Huckleberry Creek	WA-13-1024	3757	Temperature
Lake Lawrence Creek	---	47696	DO
Reichel Creek	WA-13-1022	3763*	Bacteria
		45566*	Bacteria
		47714	DO
		48666	Temperature
Spurgeon Creek	WA-13-1016	46061*	Bacteria
Tempo Lake Outlet	---	48696	Temperature
Unnamed Spring to Deschutes River	---	48923*	Temperature
Black Lake Ditch	---	47761	DO
		47762	DO
		50990	pH
		48733	Temperature
		48734	Temperature
		48735	Temperature
Percival Creek	WA-13-1012	48085	DO
		48086	DO
		42321	Temperature
		48249	Temperature
		48727	Temperature
		48729	Temperature

[1]The 1996 Listing ID is used for 1998 Settlement Agreement compliance tracking.
[2] Listing IDs correspond to the 2010 303(d) list, except those in parentheses, which are from the 2012 303(d) list. The Listing IDs noted with an asterisk are segments that Ecology included in its 2017 submittal letter.

2. Watershed Overview and Background

This TMDL is the first phase of a multi-phase process to address water quality impairments for waters flowing into south Puget Sound. The watershed addressed by this TMDL includes the

Deschutes River, Percival Creek, and Budd Inlet Tributaries, and it is situated within the boundaries of Thurston and Lewis Counties, Washington (**Figure 1**). The watershed includes the major cities or towns of Olympia, Lacey, Tumwater, and Rainier. The Deschutes River originates in heavily forested regions of the Bald Hills and flows northward to Capitol Lake and eventually to Budd Inlet. Capitol Lake was formed in 1951 as an impoundment of the Deschutes estuary to create a reflecting pool for the State Capitol building. Ecology has identified Capitol Lake as impaired by excessive phosphorus (since 1996) and fecal coliform bacteria (since 1998) by placing those waterbodies on its 303(d) list. Segments of Budd Inlet are listed on Ecology's 303(d) list as impaired by multiple pollutants, including some pollutants identified in the Deschutes TMDL, such as fecal coliform bacteria (since 2008) and DO (since 1998). Ecology initially planned to submit a TMDL addressing impairments in both freshwater (Deschutes and Capitol Lake) and marine (Budd Inlet) water quality limited segments. According to Ecology, due to the complexities of the impairments, it decided to split the TMDL into phases, focusing first on the rivers upstream of Capitol Lake and Budd Inlet. Ecology has not yet completed the second non-riverine phase of the TMDL. In the 2017 submittal, Ecology indicated it will send a draft of the marine Budd Inlet TMDL to EPA in 2020, and it anticipates submitting the final Budd Inlet TMDL to EPA for review in 2021. Ecology has not yet indicated when it will address water quality impairments specific to Capitol Lake.

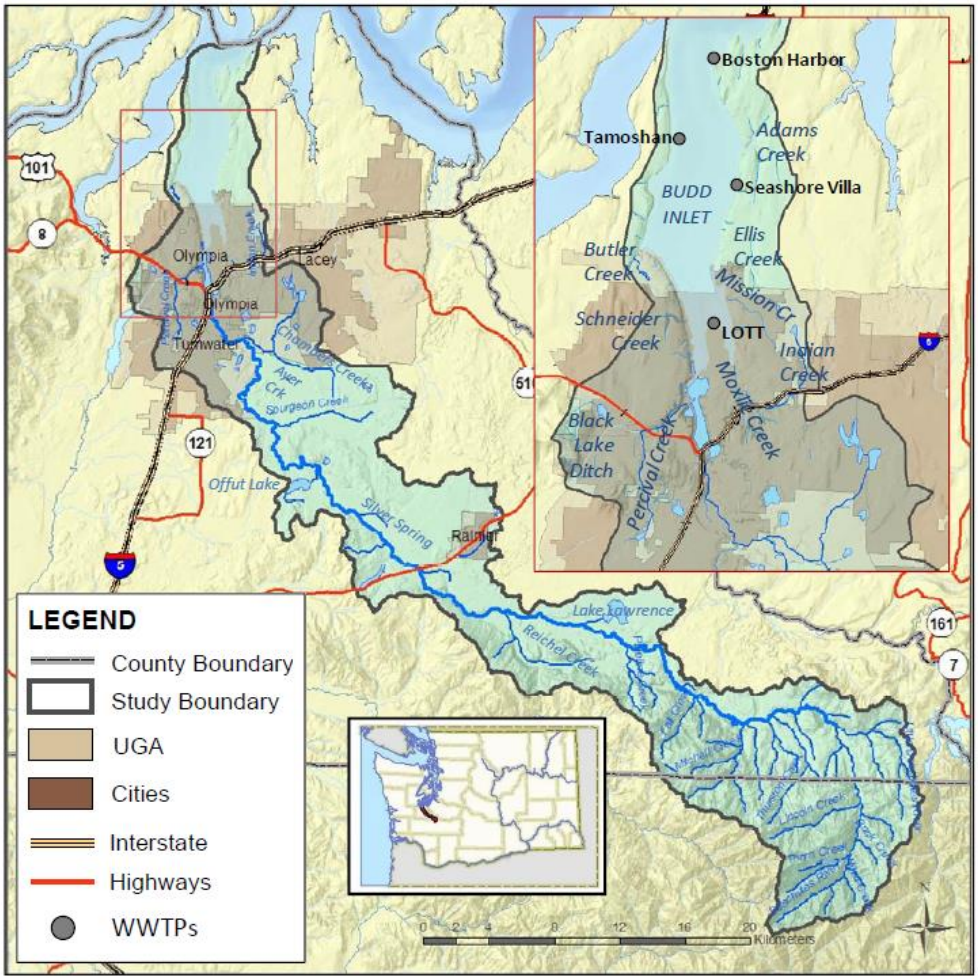

***Figure 1**. Study area for Deschutes TMDL (from WQSF p. 6).*

Ecology developed or referenced multiple technical documents in preparing the Deschutes TMDL. These reports are summarized and abbreviated as follows:

- The Water Quality Improvement Report (WQIR) and Implementation Plan (Wagner and Bilhimer, 2015). The WQIR is the primary TMDL submittal document and references other relevant documents. Unless otherwise stated, references to the Deschutes TMDL relate to information contained in the WQIR.

- Total Maximum Daily Load Technical Report - Water Quality Study Findings (WQSF) (Roberts et al., 2012). The WQSF documents modeling approaches, load capacities, and analytical results for the Deschutes TMDL. These results include temperature, DO, and pH simulation output from the QUAL2Kw and GEMSS models, as well as a summary of bacteria reductions and sediment budget studies.

- Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-Parameter Total Maximum Daily Load Transmittal Letter (2015 Submittal). Letter from Heather Bartlett, Ecology Water Quality Program Manager to Dan Opalski, EPA Region 10 Office of Water Director.

- Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-Parameter Total Maximum Daily Load Clarification Letter (2017 Submittal). Letter from Heather Bartlett, Ecology Water Quality Program Manager to Michael Lidgard, EPA Region 10 Office of Water Director.

3. Clean Water Act Requirements for Total Maximum Daily Load Action

Under § 303(d)(2) of the CWA, EPA is charged with reviewing and approving or disapproving state-developed TMDLs. EPA's regulations at 40 CFR § 130.7(d)(2) provide that EPA's approval or disapproval of TMDLs shall be based on requirements of the CWA as described in 40 CFR § 130.7(c). EPA's "Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992" summarizes the applicable statutory and regulatory requirements relating to TMDL review and approval/disapproval (EPA 2002). In addition to the 2002 EPA guidelines, EPA has issued other documents that informed its review of the Deschutes TMDL, including but not limited to:

- Draft Guidance for Water Quality-based Decisions: The TMDL Process, 1st and 2nd Edition (EPA 1991, 1999).
- Considerations for the Development of Multijurisdictional TMDLs [Draft for Review] (EPA 2012).
- Establishing TMDL Daily Loads in Light of the Decision by the US Court of Appeals for the DC Circuit in *Friends of the Earth Inc. v. EPA et al., No. 05-5015* (April 25, 2006) and Implications for NPDES Permits (EPA 2006).
- Options for Expressing Daily Loads in TMDLs (EPA 2007).

In conducting its review of the Deschutes TMDL, EPA examined Ecology's submittal to ensure that it included the following elements and that the submittal was consistent with CWA § 303(d) and the applicable TMDL regulations.

- Submittal Letter
  A TMDL transmittal should explicitly state that submitted TMDL(s) are final and are to be reviewed by EPA under § 303(d) of the CWA (EPA 2002 p. 6).

- Scope
  Submitted TMDLs should identify the waterbody as it appears on the applicable 303(d) list and specify the pollutant for which the TMDL is being established (EPA 2002 p. 1).

- Source Analysis
  The TMDL should include a description of the point and nonpoint sources of the pollutant of concern, including magnitude and location of the sources. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Source analysis information is necessary for EPA's review of the load and wasteload allocations which are required by regulation (EPA 2002 p. 1-2).

- Public Participation – The TMDL submittal should document the state's efforts to ensure full and meaningful public participation in its development, including a summary of significant comments and the state's responses to public comments (EPA 2002 p. 5). TMDL regulations require that each state/tribe must subject TMDL calculations to public review (40 CFR § 130.7(c)(1)(ii)).

- Water Quality Standards
  The TMDL submittal must include a description of the applicable state/tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy (EPA 2002 p. 2; 40 CFR §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulations at 40 CFR §§ 130.2 and 130.7 (EPA 2002 p. 2). TMDLs are to be established at levels necessary to attain and maintain applicable narrative and numerical water quality standards (40 CFR § 130.7(c)(1)). For certain settings or contexts, it may be appropriate to evaluate spatial changes in pollutant concentration and assimilative capacity to assess attainment of downstream water quality standards (EPA 2014a; EPA 2012; 40 CFR §§ 122.4(d) and 131.10(b)). Protection of downstream water quality standards assures that upstream actions will be conducted in manners that meet downstream water body criteria.

  In some situations, a TMDL pollutant can be expressed in terms of a surrogate target for ease of implementation. The surrogate should have a quantifiable relationship with the pollutant (EPA 1999).

- Analytical Framework
  The linkage analysis facilitates the evaluation of management options that will achieve water quality standards based on necessary load reductions. The link between water

quality standards and loading rates can be established through a range of techniques from the use of qualitative assumptions backed by sound scientific justification to the use of sophisticated modeling techniques. The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulations at 40 CFR §§ 130.2 and 130.7 (EPA 1999; EPA 2002).

- Loading Capacity
  A TMDL must identify the loading capacity of a waterbody for the applicable pollutant. (33 U.S.C. § 1313(d)(1)(C); 40 CFR § 130.2(e)). A loading capacity is defined as "[t]he greatest amount of a pollutant that a water can receive without violating water quality standards" (40 CFR § 130.2(f)). The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 CFR §130.2(i)). TMDLs and associated load and wasteload allocations must include a daily time increment. (EPA 2007; EPA 2006).

- Wasteload Allocations
  A TMDL must include wasteload allocations ("WLAs"), which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 CFR §§ 130.2(h) and 130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit. TMDLs and associated WLAs must include a daily time increment. They may also contain other appropriate temporal expressions that may be useful to implement the relevant water quality standard (EPA 2007; EPA 2006; EPA 2002).

- Load Allocations
  A TMDL must include load allocations ("LAs"), which identify the portion of the loading capacity attributed to existing and future nonpoint sources and/or to natural background sources (40 CFR § 130.2(g)). LAs may range from reasonably accurate estimates to gross allotments. TMDLs and associated LAs must include a daily time increment. They may also include other appropriate temporal expressions that may be useful to implement the relevant water quality standard (EPA 2007; EPA 2006).

- Margin of Safety
  A TMDL must include a margin of safety ("MOS") to account for any lack of knowledge concerning the relationship between load and WLAs and water quality (CWA § 303(d)(1)(C); 40 CFR § 130.7(c)(1); EPA 2002).

- Seasonality and Critical Conditions

  TMDLs must take into account seasonal variation and critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity (40 CFR § 130.7(c)(1); EPA 2002; EPA 1999; EPA 1991).

- Reasonable Assurances
  When a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System ("NPDES") permit provides reasonable assurance that the WLAs contained in the TMDL will be achieved. This is because effluent limits in a permit must be consistent with "the assumptions and requirements of any available [WLA]" in an approved TMDL (40 CFR § 122.44(d)(1)(vii)(B)). In a water impaired by both point and nonpoint sources, where the WLA is based on an assumption that nonpoint source load reductions will occur, reasonable assurance that the nonpoint source reductions will occur must be explained (EPA 2002; EPA 1999; EPA 1991).

4. Factual Basis and Rationale for Approval and Disapproval Actions on Deschutes River, Percival Creek, and Budd Inlet Tributaries Total Maximum Daily Loads

After a full and complete review of the Deschutes TMDL and in accordance with Section 303(d)(2) of the CWA, 33 U.S.C. § 1313(d)(2), and 40 CFR § 130.7, EPA is taking the following actions on 63 TMDLs submitted by Ecology on December 17, 2015:

- EPA approves 26 TMDLs for temperature.[1]
- EPA disapproves 37 TMDLs for fecal coliform bacteria, temperature, DO, pH, and fine sediment.

EPA is approving those submitted TMDLs that meet the requirements of the Clean Water Act and EPA's implementing regulations. EPA is disapproving those submitted TMDLs that do not meet the requirements of the Clean Water Act and EPA's implementing regulations. Sections 4.1 – 4.6 present the factual basis and rationale supporting EPA Region 10's actions approving or disapproving individual waterbody-parameter TMDL combinations within the Deschutes TMDL.

4.1. General Review Elements

The factual basis and rationale for EPA's approval and disapproval actions is contained within Section 4 of this document, with subsections focused on each of the parameters: bacteria (Section 4.2), temperature (Section 4.3), DO (Section 4.4), pH (Section 4.5), and fine sediment (Section 4.6). There are a few elements of Ecology's TMDL submission, however, that are identical for each of the waterbody-parameter pairs. Those elements are discussed in this section.

4.1.1. Submittal Letter

The Deschutes TMDL submitted by Ecology includes a request for review "pursuant to 40 CFR § 130.7 and Section 303(d) (1) of the Clean Water Act (CWA)."

[1] For the purposes of tracking EPA's compliance with the 1998 settlement agreement, EPA also counts TMDLs based on the waterbody identification system used by Ecology to develop the 1996 CWA Section 303(d) list; using this counting system, EPA is approving four TMDLs.

EPA finds the Deschutes TMDL submittal letter is consistent with applicable guidelines because it states that submitted TMDL(s) are final and are to be reviewed by EPA under § 303(d) of the CWA. (See EPA 2002 p. 6.)

4.1.2. Scope

The 2015 Deschutes TMDL submittal identifies water segments included on the EPA-approved 2012 303(d) list and specifies the parameters for which the Deschutes TMDL is being established (pp. 5-8). See **Table 2** for the list that EPA is evaluating.

EPA finds the Deschutes TMDL scope is adequately defined consistent with applicable guidelines because it identifies the waterbodies as they appear on the applicable 303(d) list and specifies the parameters for which the TMDL is being established. (See EPA 2002 p. 1.)

4.1.3. Source Analysis

The Deschutes TMDL is situated within a mixed land use setting and features a combination of urban and rural pollutant sources (WQIR p. 21). Lack of riparian vegetation, deteriorating sewer infrastructure, domestic animals, septic systems, fertilizers, recreational users, road building, and natural phenomena contribute to water quality impairments (WQSF p. xxii). Pollutant sources and categories described by Ecology in the Deschutes TMDL are summarized by EPA in **Table 3**.

Ecology identified several regulated sources of pollutants within the Deschutes TMDL (WQIR pp. 23 and 50-51). The locations of permitted facilities and boundaries are depicted in **Figure 2**.

Permitted facilities are categorized and enumerated as follows (WQIR pp. 50-51):

- 9 industrial stormwater general permits;
- 7 sand and gravel general permits;
- 5 municipal stormwater permits; and
- Numerous (25+) construction general permits as of August 30, 2013.

EPA has reviewed the source analysis information contained in the Deschutes TMDL, which identifies all potential sources of nonpoint pollution and permitted point source facilities.

EPA concludes Ecology has thoroughly identified and described all point and nonpoint sources of impairment in the watershed, as well as their locations and magnitude where possible, consistent with applicable guidelines and requirements.

***Table 3**. Impairment sources and processes within the Deschutes TMDL watersheds.*

Parameter	Potential Sources	Reference	Parameter Reduction Summary
Temperature	- Reduced riparian shade - Reduced streamflows - Stormwater runoff - Channel modification - Upstream lakes or wetlands	WQSF (pp. 31-32) WQIR (pp. xvi-xvii)	LA reductions in shortwave radiation (solar load) assigned to non-point sources. To be achieved through riparian restoration.
Fecal Coliform Bacteria	- Municipal wastewater collection system - Private wastewater treatment and septic systems - Domestic pet waste - Livestock, dairies - Birds, wildlife	WQSF (pp. 32-33) WQIR (pp. xvii-xviii)	LAs expressed as daily loads and as a percent reduction for non-point sources. WLAs for permitted point sources. Most permitted point sources will be required in their NPDES permits to meet the existing numeric criteria at the point of discharge.
DO and pH	-Reduced shade (higher temperatures) -Elevated nutrients -Elevated organic matter -Upstream wetlands -See also bacteria sources	WQSF (pp. 34-35) WQIR (pp. xviii-xix)	LA reductions in shortwave radiation (solar load) for non-point sources. To be achieved through riparian restoration. LA reductions in nitrogen and phosphorus for non-point sources upstream of Offutt Lake.
Fine Sediment	-Landslides -Road building -Timber harvest -Residential development -Flow regimes (bank erosion, scouring) -Agriculture	WQSF (pp. 35-36) WQIR (pp. xix-xx)	An LA of 21% reduction in fine sediment volume for non-point sources. A WLA of zero for permitted discharges.

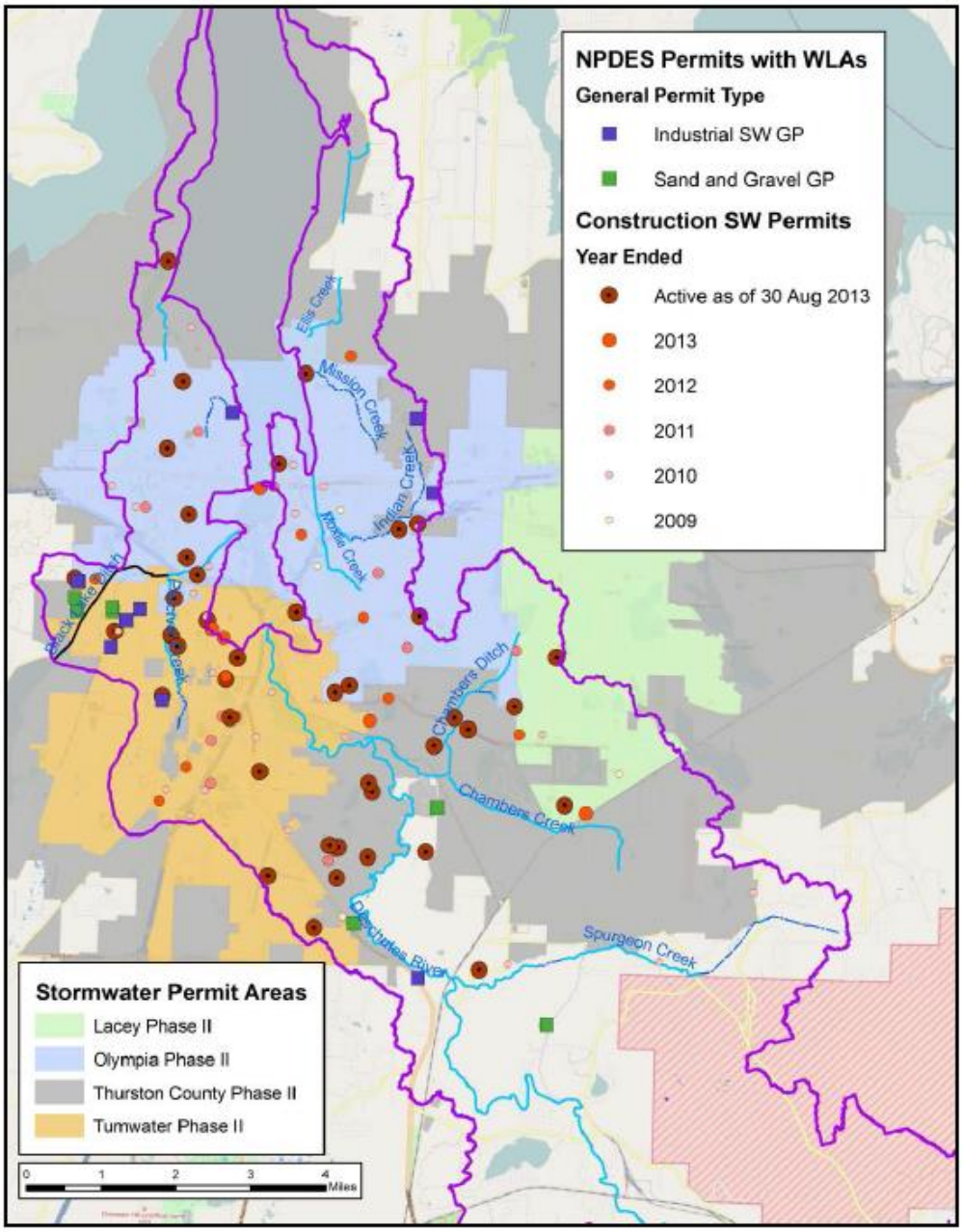

Figure 2. *Permitted facilities within Deschutes TMDL watersheds (from WQIR p. 23).*

4.1.5. Public Participation

For TMDL development, Ecology follows the public participation process described in a Memorandum of Agreement ("MOA") between Ecology and EPA ("MOA between the U.S. EPA and Ecology regarding the Implementation of Section 303(d) of the Federal Clean Water Act," October 29, 1997"). The public participation process outlined in the MOA includes the following activities:

(1) Involving interested stakeholders in (a) priority setting for TMDL development; (b) discussions on water quality problems associated with the TMDL; and (c) development of the TMDL schedule.
(2) TMDL development which meets the minimum federal requirements at 40 CFR Part 25.4 for public involvement. This means all information used in the development of a TMDL is available to the public, a public notification of no less than 30 days, consultation with interested parties before making decision (i.e. via public meetings or advisory groups), and providing open information on legal proceedings.
(3) Providing a responsiveness summary to public comments.
(4) Encouraging other public process methods.

In line with its public participation process, Ecology, along with Thurston County, has convened regular watershed advisory group meetings since 2009 to discuss development of this TMDL[2]. A summary of the advisory group meetings is provided in the 2015 submittal, pages 139-151. Advisory (public) group meetings in the watershed, as well as direct mailing, news releases, and advertisements in local newspapers were all used to involve stakeholders, including federal agencies, state agencies, tribes, citizens, cities, counties, private industries, and non-profit organizations in the development and results of this TMDL effort (see WQIR Appendix B for more information). The proposed TMDL was presented to the public and a public comment period of 45 days was convened for the TMDL from April 13, 2015, through May 27, 2015. The state provided adequate responses to all comments received during the public comment period (WQIR Appendix F).

EPA concludes the initial 2015 TMDL submittal has met public participation requirements because it was subject to public review consistent with Washington's public participation process, and it adequately describes the State's public participation process.

The 2017 submittal includes new calculations that have not undergone public review or public notice. These new calculations include daily bacteria loads for each waterbody, and are based on a critical flow that was not in the 2015 submittal. The calculations also distribute the bacteria loading capacity among point and non-point sources.

As such, EPA concludes that the new daily load calculations and distributions of bacteria loads contained in the July 2017 submittal have not met public participation requirements because the calculations were not subject to public review.

[2] Active participants of the watershed advisory group (who attended three or more meetings) included the WA State Dept. of Agriculture, Black Hills Audubon Society, Capitol Lake Improvement and Protection Association, Deschutes Estuary Restoration Team, WA State Dept. of Ecology, WA State Dept. of Enterprise Services, U.S. EPA, WA State Dept. of Fish and Wildlife, WA State Dept. of Health, City of Lacey, Little Hollywood Blog, LOTT Clean Water Alliance, WA State Dept. of Natural Resources, City of Olympia, Port of Olympia, Olympia Yacht Club, Pacific Shellfish Institute, People for Puget Sound, Puget Sound Partnership, South Puget Environmental Education Clearing House, Squaxin Island Tribe, Thurston Conservation District, Thurston County, Thurston County Storm & Surface Water Advisory Board, Thurston Public Utility District, WA State Dept. of Transportation, City of Tumwater, Washington Stormwater Center, Weyerhaeuser, WSU Thurston Extension Office, and multiple private citizens. A complete list of attendees, along with attendance record, is provided in Table 48 of the WQIR (pp. 145 – 151).

The 2017 submittal also includes two clarifications for the temperature WLAs for permitted stormwater systems within the TMDL boundary. These clarifications do not change the underlying temperature allocations provided in the 2015 submittal, which provide that all discharges from point sources shall not raise the receiving waterbody temperature by more than 0.3 C due to the combined effects of all human activities. The first clarification consists of an equation which provides stormwater dischargers a way to calculate a numeric daily temperature value consistent with the underlying temperature allocations. The second clarifies that, in in addition to the temperature value derived from that equation, stormwater discharges may also not exceed the applicable temperature numeric water quality standard found in WAC 173-201A.

Therefore, EPA concludes the temperature WLA clarifications in the July 2017 submittal do not need to undergo additional public review because, even though they were not subject to public review, they merely clarify but do not change the underlying temperature allocations provided in the 2015 submittal. Because the 2017 clarification did not change the 2015 temperature WLA, no additional public review is needed.

4.2. Review of Fecal Coliform Bacteria TMDLs

4.2.1. Applicable Water Quality Standards

The Deschutes River, Deschutes River tributaries, and tributaries to Budd Inlet are designated for Primary Contact Recreation ("PCR") as described in WAC-173-201A-200 (WQIR Table 5, pp. 10-11). Criteria for PCR specified at WAC-173-201A-200, Table 200 (2)(b) consist of geometric mean threshold (Part 1) and percent excursion allowance (Part 2) applied independently as follows and described on page 15 of the TMDL:

> Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL (Part 1), with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL (Part 2).

Based on the information submitted by Ecology, EPA concludes the Deschutes TMDL, as supplemented by the 2017 submittal, adequately identifies the applicable bacteria water quality standards.

4.2.1.1. Downstream Water Quality Standards

Capitol Lake and Budd Inlet are downstream waters that share similar impairments or stressor processes (e.g., human-caused eutrophication) with water segments included in the Deschutes TMDL. More specifically, Capitol Lake is impaired by excessive phosphorus and bacteria while Budd Inlet is impaired by low DO and elevated bacteria. In addition, Washington water quality standards require upstream actions to be conducted in manners that meet downstream water body criteria. The standards also require that the most stringent water quality criteria apply where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses and at the boundary between water bodies protected for different uses.

The water quality standards language in WAC 173-201A-260(3)(b)-(d) states:

> "(b) Upstream actions must be conducted in manners that meet downstream water body criteria. Except where and to the extent described otherwise in this chapter, the criteria associated with the most upstream uses designated for a water body are to be applied to headwaters to protect nonfish aquatic species and the designated downstream uses.
> (c) Where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses, the most stringent criterion for each parameter is to be applied.
> (d) At the boundary between water bodies protected for different uses, the more stringent criteria apply."

Therefore, in reviewing the Deschutes TMDL it is appropriate for EPA to determine if the upstream segment Deschutes TMDLs, which EPA considers to be "upstream actions": (1) identify downstream water quality standards, and (2) establish WLAs and LAs in such a way to support attainment of applicable downstream water quality standards. In this section, we list applicable downstream water quality standards and compare them to those upstream standards used in developing the Deschutes TMDL. Applicable downstream water quality standards are summarized by EPA in **Table 4**.

An itemized identification of the more stringent of the upstream and downstream water quality standard pairs pursuant to WAC 173-201A-260(3)(d) was not presented by Ecology in the Deschutes TMDL. **Table 5** presents EPA's comparison of those upstream and downstream WQS consistent with WAC 173-201A-260(3)(d).

EPA finds Ecology adequately identified or referenced all relevant downstream bacteria water quality standards in the WQSF (pp. 13-22). EPA's assessment of the protectiveness of the TMDLs for the upstream segments of the Deschutes TMDL relative to downstream WQS consistent with WAC 173-201A-260(3)(b) is assessed in the loading capacity section (Section 4.2.3) below.

***Table 4**. Bacteria water quality standards for downstream waters.*

Capitol Lake Water Quality Standard*	Budd Inlet Water Quality Standard**
Extraordinary Contact Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 mL (Part 1), with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100 colonies / 100 mL (Part 2).	Primary Contact Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL. Secondary Contact Enterococci organism levels must not exceed a geometric mean value of 70 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 208 colonies/100 mL. Shellfish Harvesting Fecal coliform must not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

*Capitol Lake is identified in the WQSF report (see page xxi) as Lake Class and is therefore also assigned designated uses of core summer salmonid habitat and extraordinary contact recreation per WAC-201A-600(1)(a)(ii).
**See WQSF page 14 for locations where specific designated uses apply in Budd Inlet.

***Table 5**. Comparison of upstream-downstream bacteria criteria.*

Upstream Designated Use	Downstream Designated Use	EPA Comments*
Adams Creek Primary Contact	Budd Inlet South Puget Sound Secondary Contact and Shellfish	Water quality criteria for upstream **is less stringent than downstream**. Shellfish geometric mean is 14 col./100 mL compared to freshwater primary contact of 100 col./100 mL as fecal coliform. Comparison to secondary contact is unclear as indicator organism is dissimilar.
Ellis Creek Primary Contact	Budd Inlet & South Puget Sound Secondary Contact & Shellfish	Water quality criteria for **upstream is less stringent than downstream.** Shellfish geometric mean is 14 col./100 mL compared to freshwater primary contact of 100 col./100 mL as fecal coliform. Comparison to secondary contact is unclear as indicator organism is dissimilar.
Indian Creek Primary Contact	Inner Budd Inlet Secondary Contact	Relationship between upstream and downstream water quality criteria not clear as indicator organism is dissimilar. However, primary contact infers a lower allowed illness rate (more protective) than secondary.

Upstream Designated Use	Downstream Designated Use	EPA Comments*
Mission Creek Primary Contact	Inner Budd Inlet Secondary Contact	Relationship between upstream and downstream water quality criteria not clear as indicator organism is dissimilar. However, primary contact infers a low allowed illness rate (more protective) than secondary.
Moxlie Creek Primary Contact	Inner Budd Inlet Secondary Contact	Relationship between upstream and downstream water quality criteria not clear as indicator organism is dissimilar. However, primary contact infers a lower allowed illness rate (more protective) than secondary.
Reichel Creek Primary Contact	Deschutes River Primary Contact	Water quality criteria for upstream and downstream waters are the same.
Schneider Creek Primary Contact	Inner Budd Inlet Secondary Contact	Relationship between upstream and downstream water quality criteria not clear as indicator organism is dissimilar. However, primary contact infers a lower allowed illness rate (more protective) than secondary.
Spurgeon Creek Primary Contact	Deschutes River Primary Contact	Water quality criteria for upstream and downstream waters are the same.
*EPA evaluates protectiveness of the loading capacity relative to downstream water quality criteria in Section 4.2.3.1.		

4.2.2. Analytical Framework

Ecology calculated the reduction in bacteria densities (col./100 mL) necessary to meet applicable water quality standards using a detailed data collection program to characterize bacteria levels spatially and seasonally (WQIR p. 27 and pp. 43-44). Bacteria reduction factors are calculated from comparisons between monitoring data and water quality standards criteria. The 2017 submittal provides supplemental calculations which quantify daily loadings for bacteria, using revised water quality targets that achieve Part 2 of the bacteria standard. EPA concludes the analytical framework implemented by Ecology to calculate the bacteria reduction factors and daily loads needed to meet applicable WQS is reasonable because: (1) bacteria is treated as a conservative pollutant thereby generating a conservative loading capacity target; (2) a data driven approach reduces uncertainties associated with modeling; and (3) Ecology's data sources and calculations are transparent and easy to follow.

Based on the information submitted by Ecology, EPA finds that Ecology adequately described the analytical approach for bacteria in the 2015 Deschutes TMDL submittal, as supplemented by the July 2017 submittal.

4.2.3. Loading Capacity

In the 2015 Deschutes TMDL submittal, the bacteria loading capacities for all segments listed in **Table 2** are expressed as the concentration (in col./100 mL) needed to meet Parts 1 and 2 of the

applicable numeric water quality standards (WQIR p. 43). The July 2017 submittal includes an aggregate loading capacity for each waterbody listed in **Table 2** expressed as daily loads (as cfu/day) based on meeting the most stringent (i.e., Part 1 or Part 2) water quality criterion assigned to the waterbody.

*EPA finds that Ecology's 2015 submittal, as supplemented by its July 2017 submittal, adequately identified bacteria load capacities expressed as daily loads for all segments listed in **Table** **2**. However, as described in Section 4.1.5, the daily load capacities expressed in the July 2017 submittal have not yet met public participation requirements.*

*Thus, EPA finds the bacteria loading capacity element of the Deschutes TMDL insufficient for all water segments listed in **Table** **2**.*

4.2.3.1 Considering Loading Capacities for Downstream Waters

Upstream and downstream criteria pairs are listed and described in Section 4.2.1.1. **Table 5** identifies two upstream-downstream waterbody pairs where the downstream water quality criterion is more stringent than the criterion applicable to the adjacent upstream waterbody. The loading capacities for these segments are not protective of downstream uses, as explained further below:

- <u>Adams Creek (upstream) and Budd Inlet north of Priest Point Park (downstream)</u>
  Loading capacities and bacteria reductions specified for Adams Creek target freshwater bacteria standards that are less stringent than shellfish criteria that apply to Budd Inlet at the point of confluence (WQSF p. 98). Locations in inner and outer Budd Inlet are impaired by elevated bacteria levels.

- <u>Ellis Creek (upstream) and Budd Inlet north of Priest Point Park (downstream)</u>
  Loading capacities and bacteria reductions specified for Adams Creek target freshwater bacteria standards that are less stringent than shellfish criteria that apply to Budd Inlet at the point of confluence (WQSF p. 98). Locations in inner and outer Budd Inlet are impaired by elevated bacteria levels.

*EPA finds that bacteria TMDLs were developed in a manner that meets downstream water quality criteria for all segments listed in **Table** **2**, except for Adams Creek and Ellis Creek.*

4.2.4. Wasteload Allocations

The 2015 Deschutes TMDL includes WLAs expressed as water quality standards applied "end-of-pipe." As such, a concentration-based WLA is assigned to each permit type, which includes three general permits, one municipal stormwater permit (for the Washington State Department of Transportation), and four Phase II MS4 permits. The MS4s are also assigned location-specific percent reduction targets from current conditions (WQIR pp. 53-54 and Figure 18). The 2017 submittal includes aggregate bacteria WLAs expressed as daily loads for each water segment. The aggregate WLA applies to all current and future point sources discharging to a particular segment. Most of the permits within the Deschutes watershed are for sources of stormwater, with

the exception of the Sand and Gravel general permit. In guidance, EPA has encouraged states to disaggregate the WLA for stormwater when possible; however, EPA has acknowledged that it may be difficult to obtain enough information and data to do so (EPA 2014a). Given the lack of data to quantify individual WLAs, EPA finds the aggregate WLA acceptable. Also, the percent reduction implementation targets assigned to the MS4 permittees provide a clear, measurable goals that can be implemented in those permits.

EPA finds that in the 2015 Deschutes TMDL submittal, as supplemented by the July 2017 submittal, Ecology adequately identified bacteria WLAs as daily loads for all water segments listed in ***Table*** **2**. *However, as described in Section 4.1.5, the load capacities and daily loads from the July 2017 submittal have not yet met public participation requirements.*

Thus, EPA finds the bacteria WLA element of the Deschutes TMDLs insufficient for all water segments listed in ***Table*** **2**.

4.2.5. Load Allocations

The 2015 Deschutes TMDL includes concentration-based LAs expressed as the water quality standards (WQIR p. 64). Percent reductions from current conditions are also provided for different zones throughout the watershed (WQIR Figure 25, p. 65). The 2017 submittal includes bacteria LAs in daily loading units for each water segment.

EPA finds that in the July 2017 submittal, Ecology adequately identified bacteria LAs as daily loads for all segments listed in ***Table*** **2**. *However, as described in Section 4.1.5, the load capacities and daily load calculations provided in the July 2017 submittal have not yet met public participation requirements.*

Thus, EPA finds bacteria LA element of the Deschutes TMDL insufficient for all water segments listed in ***Table*** **2**.

4.2.6. Margin of Safety

Ecology proposes an implicit MOS for all bacteria water segments based on conservative assumptions used in the TMDL calculations. These include using the 90th percentile of fecal coliform concentrations (higher than average concentrations), and assuming in the calculations that there is zero bacterial die-off during travel in the water column. The assumptions provide a more conservative (i.e. stringent) target than would be calculated if no conservative assumptions were used. EPA agrees with Ecology that these factors combine to yield conservative assumptions to account for uncertainty between the calculated loadings and water quality outcomes.

EPA finds that conservative assumptions used in determining bacteria load capacities represent an appropriate implicit MOS.

4.2.7. Seasonality and Critical Conditions

The 2015 Deschutes TMDL was based on data collected in all seasons and under different flow conditions. Monthly or twice-monthly grab samples were collected along the mainstem and from tributaries from July 2003 through December 2004. Storm and dry-weather monitoring was conducted at 25 locations to help isolate bacteria sources. All data was collected under a Quality Assurance (QA) Project Plan reviewed by Ecology, EPA Region 10, and the Squaxin Island Tribe, and local stakeholders. In addition, fecal coliform loads included in the 2017 submittal were calculated based on a 30-day unit area low flows from USGS Gage 12080010 Deschutes River at E Street Bridge at Tumwater, WA. The low flow was calculated with StreamStats using water years 1991-2016. This low flow calculation accounts for the critical conditions where bacteria concentrations are expected to be highest, because a lower flow leads to less assimilative capacity for the pollutant. In calculating the load capacities in the 2017 submittal, Ecology considered data collected in all seasons and different flow conditions.

EPA concludes that Ecology considered seasonal variation and critical conditions in developing bacteria TMDLs.

4.2.8. Reasonable Assurance

Implementation measures needed to reduce bacteria to meet the TMDL allocations are referenced by non-point and point source category in the Deschutes TMDL (WQIR pp. 113-130). Roles and responsibilities for implementing such measures are described throughout the implementation plan. Permit limits that implement TMDL WLAs and implementation measures provide reasonable assurances for point sources. Several activities to reduce nonpoint sources of bacteria are proposed in WQIR Tables 23 – 42. Some activities have already begun, including but not limited to: (1) LOTT Clean Water Alliance working with Lacey, Olympia, Tumwater, and Thurston County to convert OSS in high density areas to the sewer system; (2) multiple pet waste reduction programs; (3) Thurston County's oversight of all septic systems larger than 3,500 gallons per day and tracking/repairing of failing systems; (4) stormwater management BMPs; (5) oversight from Washington State Department of Health for both large and small on-site sewage systems; and (6) Washington State Department of Agriculture to evaluate the overall facility and manure management for operational dairies. A target date of 2030 is proposed by Ecology for achieving fecal coliform water quality goals (WQIR pp. 87 and 133). Where possible, Ecology has provided schedules and funding sources for achieving restoration goals. A list of possible funding sources is provided in Table 46 of the WQIR. The Deschutes TMDL also includes performance measures and targets in Table 45 of the WQIR. EPA concludes that this detailed information provides stakeholders with the tools necessary to move forward with remedying sources of bacteria pollution. This provides a reasonable level of assurance, along with stated adaptive management principles in the WQIR, that TMDL targets can be met.

EPA finds the Deschutes TMDL provides reasonable assurance that bacteria LAs can be achieved.

4.2.9. Summary of Action

EPA is disapproving all 17 bacteria TMDLs included in the 2015 & 2017 submittals.

***Table 6**. Summary of EPA action on bacteria TMDLs.*

Waterbody	1996 Listing ID	2012 Listing ID	Parameter	EPA Action
Adams Creek	---	45462	Bacteria	Disapproval
		45695	Bacteria	Disapproval
Ellis Creek	WA-13-0020	45480	Bacteria	Disapproval
Indian Creek	WA-13-1300	3758*	Bacteria	Disapproval
		45213*	Bacteria	Disapproval
		46410*	Bacteria	Disapproval
		74218*	Bacteria	Disapproval
Mission Creek	WA-13-1380	45212*	Bacteria	Disapproval
		46102*	Bacteria	Disapproval
Moxlie Creek	WA-13-1350	3759*	Bacteria	Disapproval
		3761*	Bacteria	Disapproval
		45252*	Bacteria	Disapproval
		46432*	Bacteria	Disapproval
Schneider Creek	---	45559*	Bacteria	Disapproval
Reichel Creek	WA-13-1022	3763*	Bacteria	Disapproval
		45566*	Bacteria	Disapproval
Spurgeon Creek	WA-13-1016	46061*	Bacteria	Disapproval

*Disapproval due to lack of meeting public participation requirements for newly submitted supplemental information and calculations in the 2017 submittal.

Rationale supporting these actions is summarized below.

- EPA is disapproving bacteria TMDLs for 14 segments within reaches of Indian Creek, Mission Creek, Moxlie Creek, Schneider Creek, Reichel Creek, Spurgeon Creek, and Percival Creek identified in **Table 6** with an asterisk. EPA finds that, as supplemented by the 2017 submittal, TMDLs for these waters are established at levels that will attain applicable water quality standards (40 CFR § 130.7(c)(1)). EPA also finds that, as supplemented by information contained in the 2017 submittal, these TMDLs satisfy the requirements of CWA § 303(d) and EPA's applicable regulations at 40 CFR § 130.7. However, EPA disapproves the bacteria TMDLs for these waters because Ecology did not satisfy public participation requirements per 40 CFR § 130.7(c)(1)(ii) for the new TMDL calculations contained in the 2017 submittal.

- EPA is disapproving bacteria TMDLs for three segments within reaches of Adams Creek and Ellis Creek identified in **Table 6**. TMDLs for these waters are disapproved for the following reasons:

    1) TMDL load capacities for these segments are based on achieving a bacteria criterion that is less protective than the adjacent downstream (Budd Inlet) bacteria criterion that protects shellfish designated uses. Per WAC 173-201A-260(3)(b-d), the more stringent criterion applies. Therefore, these TMDLs: (1) do not implement Ecology's applicable water quality standard for protecting downstream uses, and (2) are not constructed to attain and maintain applicable water quality standards as required by 40 CFR § 130.7(c)(1).

4.3. Review of Temperature TMDLs

4.3.1. Applicable Water Quality Standards

Aquatic life uses and temperature criteria for waters in the Deschutes TMDL are listed in **Table 7** (WQIR pp. 10-13). In addition, numeric temperature criteria along the Deschutes River are depicted in **Figure 3** (WQIR p. 11). The water quality standards for temperature consist of both numeric criteria and natural condition criteria (NCC). The standards recognize that waters supporting the same uses display thermal heterogeneity – some are naturally cooler and some are naturally warmer. In the Deschutes TMDL, Ecology cites natural condition provisions at WAC 173-201A-260(1)(a) that state (WQIR p. 12):

> "It is recognized that portions of many water bodies cannot meet the assigned criteria due to the natural conditions of the water body. When a water body does not meet its assigned criteria due to natural climatic or landscape attributes, the natural conditions constitute the water quality criteria."

Thus, natural conditions constitute water quality criteria when non-attainment is due to natural processes in the waterbody. Additional information can be found in EPA guidance (EPA 2015, EPA 2005, Davies 1997).

The NCC limits additional warming due to human activities. The combined effects of all human activities considered cumulatively must not increase the temperature of the water body by more than a 0.3°C (0.54°F) (WAC 173-201A-200(1)(c)(i)). Ecology also defines a "measurable" temperature change as a temperature increase of 0.3 C or greater (WAC 173-201A-320(3)(a)). Ecology requires that compliance must be assessed against criteria that limit the incremental amount of warming of otherwise cool waters due to human activities WAC 173-201A-200(1)(c)(ii).

Based on the information submitted by Ecology, EPA concludes the Deschutes TMDL adequately identifies the applicable temperature water quality standards.

***Table 7**. Temperature water quality standards for the Deschutes TMDL.*

Waterbody Group	Designated Aquatic Life Use	Temperature Criteria
Deschutes River and its tributaries from mouth to and including tributary from Offutt Lake	Salmonid Spawning, Rearing, and Migration	The highest 7-DADMax* temperature must not exceed 17.5ºC more than once every 10 years on average [WAC 173-201A-200] <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(c)(i)] Combined effects of all human activities must not cause more than a 0.3ºC increase above natural conditions.
Deschutes River and its tributaries upstream of the Offutt Lake tributary to the national forest boundary	Core Summer Salmonid Habitat	The highest 7-DADMax* temperature must not exceed 16ºC more than once every 10 years on average. <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(c)(i)]

Waterbody Group	Designated Aquatic Life Use	Temperature Criteria
		Combined effects of all human activities must not cause more than a 0.3ºC increase above natural conditions.
Percival Creek and Black Lake Ditch	Core Summer Salmonid Habitat	The highest 7-DADMax* temperature must not exceed 16ºC more than once every 10 years on average. <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(c)(i)] Combined effects of all human activities must not cause more than a 0.3ºC increase above natural conditions.
Tributaries to Budd Inlet	Salmonid Spawning, Rearing, and Migration	The highest 7-DADMax* temperature must not exceed 17.5ºC more than once every 10 years on average. <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(c)(i)] Combined effects of all human activities must not cause more than a 0.3ºC increase above natural conditions.

*The '7-DADMax' is the highest allowable 7-day average of the daily maximum temperatures.

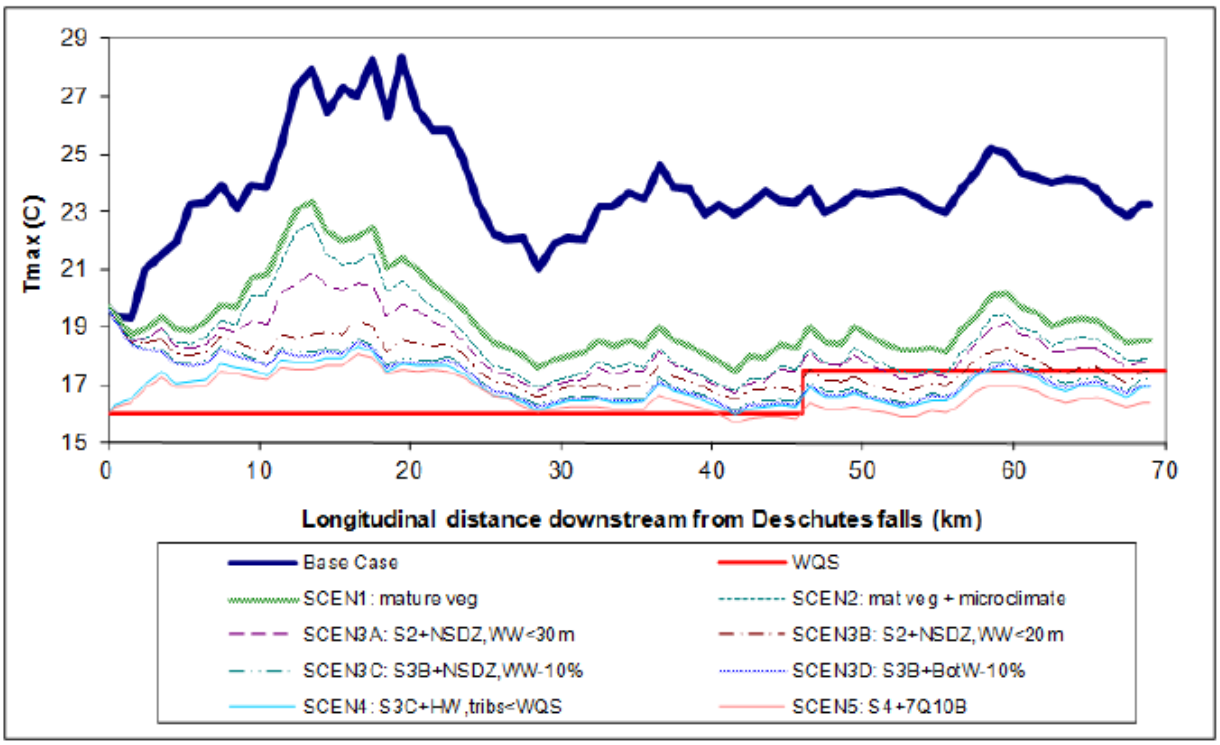

***Figure 3**. Water temperature simulation results along the Deschutes River mainstem (from WQIR p. 40).*

4.3.1.1. Downstream Water Quality Standards

As explained further in Section 4.2.1.1, Washington water quality standards require upstream actions to be conducted in manners that meet downstream water body criteria. In this section, we list applicable downstream water quality standards and compare them to those standards used in developing the Deschutes TMDL. Applicable downstream water quality standards are summarized by EPA in **Table 8**. **Table 9** presents EPA's comparison of those upstream and downstream WQS consistent with WAC 173-201A-260(3)(d).

EPA finds Ecology adequately identified or referenced all relevant downstream temperature water quality standards in the WQSF (pp. 13-22). EPA's assessment of the protectiveness of the TMDLs for the upstream segments of the Deschutes TMDL relative to downstream WQS consistent with WAC 173-201A-260(3)(b) is assessed in the loading capacity section (Section 4.3.3) below.

***Table 8**. Water temperature water quality standards for downstream waters.*

Capitol Lake Water Quality Standard*	Budd Inlet Water Quality Standard**
Human actions considered cumulatively may not increase the 7-DADMax temperature more than 0.3°C (0.54°F) above natural conditions.	Excellent Aquatic Life 16ºC as 1-DMax Good Aquatic Life 19ºC as 1-DMax Human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F).

*Capitol Lake is identified in the WQSF report (see p. xxi) as Lake Class and is therefore also assigned designated uses of core summer salmonid habitat and extraordinary contact recreation per WAC-201A-600(1)(a)(ii).
**See WQSF page 14 for locations where specific designated uses apply in Budd Inlet

***Table 9**. Comparison of upstream-downstream water temperature criteria.*

Upstream Designated Use	Downstream Designated Use	EPA Comments
Upper Deschutes River Core Summer Salmonid Habitat	Downstream Deschutes River Salmonid Spawning, Rearing, and Migration	Ecology applied natural condition provision associated with both uses.
Downstream Deschutes River Salmonid Spawning, Rearing, and Migration	Capitol Lake Core Summer Salmonid Habitat	Ecology applied natural condition provision associated with both uses.
Huckleberry Creek Core Summer Salmonid Habitat	Upper Deschutes River Core Summer Salmonid Habitat	Designated uses are the same.
Reichel Creek Core Summer Salmonid Habitat	Upper Deschutes River Core Summer Salmonid Habitat	Designated uses are the same.
Tempo Lake Outlet Salmonid Spawning, Rearing, and Migration	Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Designated uses are the same.

Upstream Designated Use	Downstream Designated Use	EPA Comments
Unnamed Spring to Deschutes R. Salmonid Spawning, Rearing, and Migration	Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Designated uses are the same.
Black Lake Ditch Core Summer Salmonid Habitat	Capitol Lake Core Summer Salmonid Habitat	Ecology applied natural condition provision associated with both uses.
Percival Creek Core Summer Salmonid Habitat	Capitol Lake Core Summer Salmonid Habitat	Ecology applied natural condition provision associated with both uses.
Ayer Creek Salmonid Spawning, Rearing, and Migration	Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Designated uses are the same.
*EPA evaluates protectiveness of the loading capacity relative to downstream water quality criteria in Section 4.3.3.1.		

4.3.2. Analytical Framework

Temperature linkage analyses in the Deschutes River, Percival Creek, and Black Lake Ditch were supported by one or more of the following models:

- QUAL2Kw is a one-dimensional, steady-state freshwater stream model that includes a diurnal heat budget. The model simulates diurnally varying water temperatures in response to heat budget components such as advection, incoming shortwave radiation, reflected outgoing shortwave radiation, latent heat exchange, and sediment interactions. QUAL2Kw includes sediment-water layer fluxes of water and heat to simulate the effect of hyporheic interaction. The model was applied to critical period conditions in late summer.

- GEMSS, used for Capitol Lake, is a dynamic model that simulates continuous changes in hydrodynamics and water quality with a time step that varied between 10 seconds and 6 minutes in our applications. The three-dimensional model grid for the TMDL analysis has 19 layers below a horizontal datum starting at 6 meters (m) above mean lower low water (MLLW). The top 10 layers each have a thickness of 1 m, while the rest of the layers are 2 m graduating to 3 m thick in the deepest layers. The conditions in Budd Inlet and Capitol Lake are dynamically calculated and updated every time step in response to dynamic changes in boundary conditions such as tides, meteorology, river flows and loads, and wastewater flows and loads.

- Shade.xls was adapted from a program originally developed by the Oregon Department of Environmental Quality (ODEQ). The program uses topographic elevations and current or potential vegetation characteristics (height, type, and density) perpendicular to the channel to calculate solar radiation attenuation through the canopy. Model output includes percent shade by stream reaches and by hour of the day for a specific day of the year. This was used as input to QUAL2Kw.

- TTools is an ArcView extension originally developed by ODEQ to quantify stream channel characteristics, topographic details, and vegetation characteristics for shade and

temperature model development. Topography and vegetation height were developed from LiDAR data provided by the Puget Sound LiDAR Consortium. Current vegetation height was verified with field observations. Results from TTools were used along with Shade.xls as inputs to the QUAL2Kw model.

To determine the NCC for temperature for the Deschutes TMDL, Ecology calculated the system potential water condition. System potential is not defined in Ecology's water quality standards, but in the TMDL it is described as the best conditions that can be achieved in the Deschutes River without human influences (WQIR p. 32). Ecology assessed system potential conditions differently in the Deschutes River mainstem compared to tributaries (Percival Creek and Black Lake Ditch), as explained in the following paragraphs.

In the Deschutes River mainstem, stream temperature was modeled explicitly using QUAL2Kw with stream shading inputs from Shade.xls and TTools. Application of the QUAL2Kw model to the Deschutes River allows explicit simulation of water quality in response to changes in shading, channel geometry, baseflow, nutrients, dam configuration, and other factors. Application of these models with respect to configuration, topology, process, calibration, and prediction is described throughout the WQSF. EPA finds the modeling conducted for the Deschutes River mainstem is reasonable because:

- Models include heat budget and riparian shading processes that are published in the scientific literature;
- Models are transparent and reproducible. That is, User Manuals or operating notes are available that describes the scientific basis for model algorithms, the source code is accessible, and a given set of inputs generate a given set of outputs;
- Models output water quality concentration data that can be related to the water quality standard. Use of site-specific information, such as hydroclimatic and water quality data, in the Deschutes TMDL increases the accuracy that management scenarios will meet water quality standards; and
- Model outputs follow behavior that is consistent with established physical, chemical, and biological laws. For example, increasing vegetation density and height results in greater stream shade. More shade then reduces incident solar shortwave radiation which then lowers water temperatures (see Scenario 1, WQSF p. 133).

The QUAL2Kw water quality model predicts system potential water temperatures for the Deschutes River mainstem. This predicted natural condition is a system-wide average maximum temperature of 16.6°C (WQIR p. 40). This corresponds to modeling Scenario 5 in **Figure 3**, which incorporates the following stream improvement measures (WQIR p.42):

- Mature vegetation;
- Improved microclimate;
- Reduced channel width; and
- Improved headwater temperatures;
- Flow restoration

The system potential temperature is representative of the natural condition because it incorporates all of the elements that would be expected in a fully restored stream environment – full, mature vegetation, restored channel complexity, and more inflow from groundwater, among other things. **Figure 3** shows the natural condition is at times warmer than the applicable numeric water quality criterion, and at other times cooler than the criterion.

For Percival Creek and Black Lake Ditch, Ecology used Shade.xls and TTools to quantify shade improvements expected from restoring riparian vegetation to natural conditions (WQIR Appendix E; WQSF pp. 140-143). QUAL2Kw was not used to explicitly simulate temperature, in Percival Creek and Black Lake Ditch. Rather, Ecology's analytical approach relies on the assumption that restoring mature riparian vegetation, along with other implementation measures, will result in temperatures that achieve the targeted system potential condition. EPA believes this is a reasonable approach because summer stream temperature increases due to the removal of riparian vegetation is well documented, and riparian shade has been found to control the stream heating caused by solar radiation (Stohr et al., 2011). It follows that the restoration of riparian vegetation has the potential to cause significant improvement in stream temperature through increased shade and microclimate effects, and has been identified as the most significant management step in improving stream temperature (Stohr et al., 2011). Modeling for the Deschutes mainstem demonstrates this scenario. Ecology developed site-specific shade curves that estimate the decrease of incident shortwave radiation (W/m^2) for each stream based on the natural vegetation for that area, stream aspect, and bankful width.

This analytical approach is often used by Ecology and other state agencies when developing temperature TMDLs in tributaries because shade-loss is typically the most significant source of temperature impairment in these smaller reaches. Also, the data needed to calibrate a water quality model is often not available for small streams. The EPA finds this analytical approach to be an acceptable methodology for quantifying the allocations for the tributaries (and the improvements that are needed) because Ecology considered the unique characteristics of each stream for all loading capacity calculations.

EPA finds the State's analysis reasonable because, as explained in this memo and in the TMDL, the daily heat loads, as well as shade targets, were developed to meet water quality standards that protect the beneficial uses in the Deschutes watershed and are consistent with the State's water quality standards at WAC 173-201A.

Based on the preceding information, EPA concludes Ecology adequately described the analytical framework, and used appropriate methods for determining the system potential conditions for temperature for the Deschutes River, Percival Creek, and Black Lake Ditch.

Ecology did not conduct any modeling or perform shade calculations for the remaining reaches impaired for temperature and identified in **Table 2**.

Thus, EPA finds the analytical framework for temperature TMDL development absent for the following segments impaired by water temperature:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.3. Loading Capacity

Ecology identified load capacities for the Deschutes River mainstem, Percival Creek, and Black Lake Ditch. Load capacities for these three waters are expressed as surrogate measures (**Table 10**). Ecology did not develop load capacities for the remaining segments identified in **Table 2**.

Table 10*. Summary of proposed temperature surrogate.*

Parameter	Surrogate or Implementation Target	Comments
Temperature	Surrogate: Shortwave Radiation (W/m^2) Surrogate: Effective Shade (%)	Ecology proposes to restore riparian corridor to natural vegetation levels. Shade improvements are expected to reduce incident shortwave radiation. All other processes being equal or static, reductions in shortwave radiation are expected to lower temperature in addition to other heat budget processes. (See WQIR pp. 39-43 and Appendix E)

Ecology proposed water temperature loading capacities for the Deschutes River, Percival Creek, and Black Lake Ditch as follows:

- Deschutes River – Loading capacities for temperature in the Deschutes River watershed are expressed as solar radiation heat loads based on achieving system potential vegetation and channel restoration (WQIR p. 39).

  System potential shade is represented by mature vegetation at maximum density that would naturally occur in the Deschutes River. The maximum tree height was assumed to be 50 meters, based on the tallest existing vegetation in the system. This was assumed to occur within 100 meters to either side of the near-stream disturbance zone (NSDZ).

  As depicted in **Figure 3**, Ecology simulated water temperature scenarios corresponding to multiple management and restoration measures (WQIR p. 40). For Scenario 5, which corresponds to the targeted natural condition, these measures include increasing shade, improving microclimate, restoring channel morphology, decreasing headwater and tributary temperatures, and restoring flows. The factor that had the most impact on reducing temperature was increased shade (4.5^{o}C decrease), followed by restoring channel morphology through reduced channel widths (1.3^{o}C decrease). Improved

microclimate, reduced headwater and tributary temperatures, and restored flows would lead to an additional 1.4°C decrease in temperature combined.

As Ecology notes in the Deschutes TMDL, riparian shade "would substantially reduce peak temperatures below the lethality limit" (WQIR p. 61). The prescribed heat loads based on system potential vegetation, along with recommendations for channel width improvements, would achieve a 5.8°C decrease in system-wide temperatures. The remaining temperature reductions needed can be achieved through additional measures identified in the TMDL, such as including restoration of natural flows, cooler headwater and tributary temperatures, and the microclimate improvements that will happen when riparian conditions are restored.

- Percival Creek and Black Lake Ditch – Loading capacities for temperature throughout the Percival Creek and Black Lake Ditch system are expressed as solar radiation heat loads based on achieving system potential riparian vegetation (WQIR p. 42-43 and Appendix E). The vegetative type was determined primarily based on soil types (WQIR p. 42). Wetland soils were assumed to support vegetation up to 10 meters in height, while the remaining maximum vegetation height was set to 40 meters, the tallest vegetation currently present (WQSF p. 140). For these systems, Ecology assumed that if naturally existing shade and vegetation are present along the stream, the stream temperature is natural and consistent with water quality standards even if the numeric temperature criteria are exceeded. EPA finds these assumptions adequate, because the establishment of full riparian shade will decrease water temperatures, limit exposure to warmer temperatures, and help create the thermal diversity that supports salmonids.

EPA finds that Ecology adequately identified temperature loading capacities for the Deschutes mainstem, Percival Creek and Black Lake Ditch.

Ecology did not propose water temperature loading capacities for the remaining reaches impaired for temperature and identified in **Table 2**.

Thus, EPA finds that Ecology did not identify temperature load capacities for the following water segments impaired by temperature:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.3.1. Considering Loading Capacities for Downstream Waters

Upstream and downstream criteria pairs are listed and described in Section 4.3.1.1. **Table 9** identifies upstream-downstream waterbody and criteria pairs. NCC provisions are associated with the designated uses for all upstream and downstream segments; thus, the loading capacities for these segments are protective of downstream uses.

EPA finds that temperature TMDLs for the Deschutes River, Percival Creek, and Black Lake Ditch were developed in a manner that meets downstream water quality criteria.

EPA finds that Ecology did not identify load capacities for the following segments impaired by water temperature; thus, consideration of downstream water bodies cannot be evaluated for these water bodies:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.4. Wasteload Allocations

In the 2015 Deschutes submittal, Ecology assigns a combined temperature WLA for all point sources, rather than assigning individual WLAs. The same WLA provision is assigned to all point sources, which is that all discharges "shall not raise the receiving water body temperature by more than 0.3°C due to the combined effects of all human activities" (WQIR pp. 51-57 and Appendix C).

In the July 2017 submittal, Ecology provides clarifying information regarding the temperature WLA for stormwater sources. The equation does not change the underlying WLA contained in the 2015 Deschutes TMDL; thus, it does not require additional public notice. The 2017 submittal includes an equation which provides stormwater dischargers a way to calculate a numeric a daily temperature value for the allowed water temperature increase from point sources. This temperature value is consistent with the underlying temperature allocations provided in the 2015 submittal, which is that all discharges from point sources shall not raise the receiving waterbody temperature by more than 0.3°C due to the combined effects of all human activities. The 2017 submittal also clarifies that in addition to the allowed 0.3°C increase above background temperature, stormwater discharges may also not exceed the numeric water quality standard of 17.5°C. As appropriate and common conversion factors are applied, daily heat energy units (such as total kilocalories/day) can be readily derived from the WLA equation in the 2017 submittal.

In the Deschutes TMDL, the LA is designated as the shade resulting from full mature riparian vegetation (WQIR p. 61). This is equivalent to the loading capacity value described on pages 39-42 of the WQIR; thus, the LA doesn't allow for additional heat loading by other sources. EPA finds Ecology's decision to limit the impact of stormwater to an immeasurable increase in temperature (i.e. up to 0.3°C)[3] to be reasonable because the summer critical period, when temperature impairments are most likely to occur, also corresponds with the time period when precipitation is the lowest.

[3] Measurable increases in temperature are defined in Washington State Department of Ecology's water quality standards as 0.3°C or greater (WAC 173-201A-320(3)(a)).

For the reasons discussed above, EPA finds that Ecology adequately identified temperature WLAs as daily loads for the Deschutes River, Percival Creek, and Black Lake Ditch.

EPA finds that Ecology did not identify load capacities for the following segments impaired by water temperature; thus, consideration of wasteload allocations cannot be evaluated for these water bodies:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.5. Load Allocations

As mentioned in the previous section, the LA is equivalent to the loading capacity for the temperature TMDLs (WQIR p. 61). For all waterbodies in the Deschutes TMDL, allocations are developed such that, when implemented, the waterbodies are expected to attain either the numeric and/or the natural conditions. EPA regulations at 40 CFR § 130.2(i) allow TMDLs to be expressed in terms of mass per time, toxicity, or other appropriate measures. Ecology has determined that heat from human-caused increases in solar radiation is the major source of temperature impairments and provided daily heat load allocations (Watts/ m^2) in the Deschutes TMDL. Ecology also developed system potential shade targets as an aid for implementation; shade targets are useful in translating solar radiation loads into streamside vegetation objectives.

Appendix E of the Deschutes TMDL identifies LAs for the Deschutes River, Percival Creek, and Black Lake Ditch expressed as solar radiation reduction (W/m^2) and increase in effective shade. The Deschutes River LA also assumes that channel width reduction goals will be implemented (WQIR p. 63 and Table E-4).

In the TMDL, Ecology explains that establishing a forested stream-side vegetation corridor with native plants at least 75 feet wide on perennial streams is essential for implementing the TMDL (with a 35-foot buffer on constructed ditches and intermittent streams). Ecology also notes that some of its funding programs require larger buffers, and that it will encourage implementation actions that restore minimum buffers and preserve existing buffers larger than 75 feet.

EPA finds that Ecology adequately identified temperature LAs for the Deschutes River, Percival Creek, and Black Lake Ditch in Appendix E, and that implementation of those LAs is expected to result in attainment of applicable water quality standards. EPA finds Ecology's LAs to be adequate because Ecology has prescribed the establishment of full riparian shade in the riparian zones adjacent to the temperature impaired streams; in addition, the identification of specific width reduction goals for the Deschutes River will help restore the natural condition of the Deschutes River.

EPA finds that Ecology did not identify load capacities for the following segments impaired by water temperature; given that the load allocation for temperature is equivalent to the load

capacity, EPA finds that Ecology did not identify temperature LAs for the following segments impaired by water temperature:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.6. Margin of Safety

Ecology proposes an implicit MOS due to conservative QUAL2Kw model assumptions. These include the very low likelihood that 7Q10 flows, 90th percentile air temperatures, zero cloud cover, and zero wind speed would occur at the same time. Uncertainty in the calculations was also reduced in the application of TTools and Shade.xls for the Deschutes River, Percival Creek, and Black Lake Ditch, because they were verified and adjusted based on in-situ estimates from Hemi-View photos (WQIR pp. 27-28; WQSF p. 107-108). EPA agrees with Ecology that these factors combine to yield conservative assumptions to account for uncertainty between the calculated loadings and water quality outcomes.

EPA finds the implicit MOS appropriate for the Deschutes River, Percival Creek, and Black Lake Ditch.

EPA finds that Ecology did not identify load capacities or LAs for the remaining reaches; thus, an MOS cannot be evaluated the following segments impaired by water temperature:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.7. Seasonality and Critical Conditions

Current levels of water temperature vary throughout the year and exceed water quality standards during select time periods in the summer months. Ecology accounted for these variances in modeling scenarios for water temperature, which used 7Q10 flows from USGS for the period 1991-2001, 90th percentile peak air temperatures, cloud cover of zero, and wind speeds of zero to represent worst-case assimilative capacity conditions. The 7Q10 flow represents the lowest one-week average flow with a recurrence interval of 10 years. This is a good representation of critical conditions for temperature, because negative temperature impacts occur when there is less in-stream flow. The 90th percentile of peak air temperatures are typical temperatures that would be experienced in the summer, when temperature impairments are the worst. Assuming zero cloud cover and zero wind speed allows for no cooling from shade or wind flow. After review of the available data, EPA finds reasonable Ecology's conclusion that hydroclimate

variables considered above represent worst-case conditions with respect to seasonal variation measured or expected to occur within the Deschutes River and nearby riverine systems.

EPA finds that Ecology adequately addressed seasonality and critical conditions for temperature TMDLs developed for the Deschutes River, Percival Creek, and Black Lake Ditch.

EPA finds that Ecology did not identify load capacities or LAs for the remaining reaches; thus, consideration of seasonality and critical conditions cannot be evaluated for the following segments impaired by water temperature:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.8. Reasonable Assurance

Implementation measures needed to improve water temperature are referenced by non-point and point source category in the Deschutes TMDL (WQIR pp. 113-130). Roles and responsibilities for implementing practices are described throughout the implementation plan. Permit limits that implement TMDL WLAs and implementation measures provide reasonable assurances for point sources. Several activities to improve temperature are proposed in WQIR Tables 23 – 42. Table 23 includes implementation recommendations for increasing groundwater flows, reducing withdrawals, and enhancing groundwater recharge, and it identifies priority areas for riparian and channel restoration (WQIR pp. 114-115). These implementation recommendations are consistent with the modeling scenario representing system potential temperature for the Deschutes River. A target date of 2065 is proposed by Ecology for achieving restored canopy cover and water quality standards for temperature (WQIR pp. 87, and Table 45 on p. 133). The Deschutes TMDL also includes schedules for individual restoration actions, monitoring plans and adaptive management activities considered in response to data collection, and TMDL funding processes and programs (WQIR pp. 116-130; 134-136; and Table 46). In addition, current restoration activities are outlined in Table 18 of the Deschutes TMDL (Grants and Loans), including numerous riparian restoration projects (e.g. 1800 feet of riparian plantings on Black Lake Ditch in the city of Olympia). EPA believes this detailed information and the identified actions help inform stakeholders about how they can work together to make improvements to water temperature in the Deschutes River watershed.

EPA finds reasonable assurances are provided that water temperature LAs will occur for the Deschutes River, Percival Creek, and Black Lake Ditch.

EPA finds that Ecology did not identify load capacities or LAs for the remaining reaches; thus, reasonable assurances cannot be evaluated for the following segments impaired by water temperature:

- *Ayer Creek;*
- *Huckleberry Creek;*
- *Reichel Creek;*
- *Tempo Lake Outlet; and*
- *Unnamed Spring to Deschutes River.*

4.3.9. Summary of Action

EPA is taking the following actions (**Table 11**) on 31 water temperature TMDLs included in the 2015 submittal as follows:

- Approval of 26 segments; and
- Disapproval of 5 segments.

Table 11. *Summary of EPA action on water temperature TMDLs.*

Waterbody	1996 Listing ID	2012 Listing ID	Parameter	EPA Action
Ayer (Elwanger) Creek	WA-13-1015	73229	Temperature	Disapprove
Deschutes River	WA-13-1010	6576	Temperature	Approve
		7590	Temperature	Approve
		48710	Temperature	Approve
		48711	Temperature	Approve
		48712	Temperature	Approve
		48713	Temperature	Approve
		48714	Temperature	Approve
		48715	Temperature	Approve
		48717	Temperature	Approve
		48718	Temperature	Approve
		9439	Temperature	Approve
	WA-13-1020	7588	Temperature	Approve
		7592	Temperature	Approve
		7593	Temperature	Approve
		7595	Temperature	Approve
		48720	Temperature	Approve
		48721	Temperature	Approve
		48724	Temperature	Approve
		48726	Temperature	Approve
Huckleberry Creek	WA-13-1024	3757	Temperature	Disapprove
Reichel Creek	WA-13-1022	48666	Temperature	Disapprove
Tempo Lake Outlet	---	48696	Temperature	Disapprove
Unnamed Spring to Deschutes River	---	48923	Temperature	Disapprove
Black Lake Ditch	---	48733	Temperature	Approve
		48734	Temperature	Approve
		48735	Temperature	Approve

Percival Creek	---	42321	Temperature	Approve
		48249	Temperature	Approve
		48727	Temperature	Approve
		48729	Temperature	Approve

Rationale supporting these actions is summarized below.

- EPA is approving water temperature TMDLs for 26 segments situated along the Deschutes River, Percival Creek, and Black Lake Ditch identified in **Table 11**. EPA finds that pursuant to Section 303(d) of the Clean Water Act, 33 U.S.C. Section 1313(d), and EPA's implementing regulations, at 40 CFR Part 130, the TMDL satisfies the statutory and regulatory requirements for TMDLs.

- EPA is disapproving water temperature TMDLs for five segments within reaches of Ayer Creek, Huckleberry Creek, Reichel Creek, Tempo Lake Outlet, and Unnamed Spring to Deschutes River identified in **Table 11**. EPA is disapproving these waters pursuant to Section 303(d) of the Clean Water Act, 33 U.S.C. Section 1313(d), and EPA's implementing regulations, at 40 CFR Part 130, because Ecology's submittal does not quantify loadings for the aforementioned segments, as required by 40 CFR § 130.2 and 40 CFR § 130.7.

4.4. Review of Dissolved Oxygen TMDLs

4.4.1. Applicable Water Quality Standards

Aquatic life uses and DO criteria for waters in the Deschutes TMDL are listed in **Table 12** (WQIR pp. 16-17). In addition, numeric DO criteria along the Deschutes River are depicted in **Figure 4**. The Deschutes TMDL also has a map of designated uses for specific stream reaches (WQIR Figure 3, p. 11). The water quality standards for DO consist of both numeric criteria and natural condition criteria ("NCC"). The standards recognize that waters supporting the same uses display some natural variability in DO levels. The NCC applies when a water body's natural DO level is lower than the numeric value. In the Deschutes TMDL (WQIR p. 12), Ecology cites natural condition provisions at WAC 173-201A-260 (1)(a) that state:

> "It is recognized that portions of many water bodies cannot meet the assigned criteria due to the natural conditions of the water body. When a water body does not meet its assigned criteria due to natural climatic or landscape attributes, the natural conditions constitute the water quality criteria."

Thus, natural conditions constitute water quality criteria when non-attainment is due to natural attributes of the waterbody. Additional information can be found in EPA guidance (EPA 2015, EPA 2005, Davies 1997).
The NCC also limits the allowance for additional warming due to human activities. The combined effects of all human activities must not cause more than a 0.2 mg/L decrease of DO.

Based on the preceding information, EPA concludes that the Deschutes TMDL adequately identifies the applicable DO water quality standards.

***Table 12**. DO water quality standards for the Deschutes TMDL.*

Waterbody Group	Designated Aquatic Life Use	DO Criteria
Deschutes River and its tributaries from mouth to and including tributary from Offutt Lake	Salmonid Spawning, Rearing, and Migration	The lowest 1-day minimum oxygen level must not fall below 8.0 mg/L more than once every 10 years on average. [WAC 173-201A-200] <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(d)(i)] Human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L.
Deschutes River and its tributaries upstream of the Offutt Lake tributary to the national forest boundary	Core Summer Salmonid Habitat	The lowest 1-day minimum oxygen level must not fall below 9.5 mg/L more than once every 10 years on average. [WAC 173-201A-200] <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(d)(i)] Human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L.
Percival Creek and Black Lake Ditch	Core Summer Salmonid Habitat	The lowest 1-day minimum oxygen level must not fall below 9.5 mg/L more than once every 10 years on average. [WAC 173-201A-200] <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(d)(i)] Human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L.
Tributaries to Budd Inlet	Salmonid Spawning, Rearing, and Migration	The lowest 1-day minimum oxygen level must not fall below 8.0 mg/L more than once every 10 years on average. [WAC 173-201A-200] <u>Natural Condition Criteria</u> [WAC 173-201A-200(1)(d)(i)] Human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L.

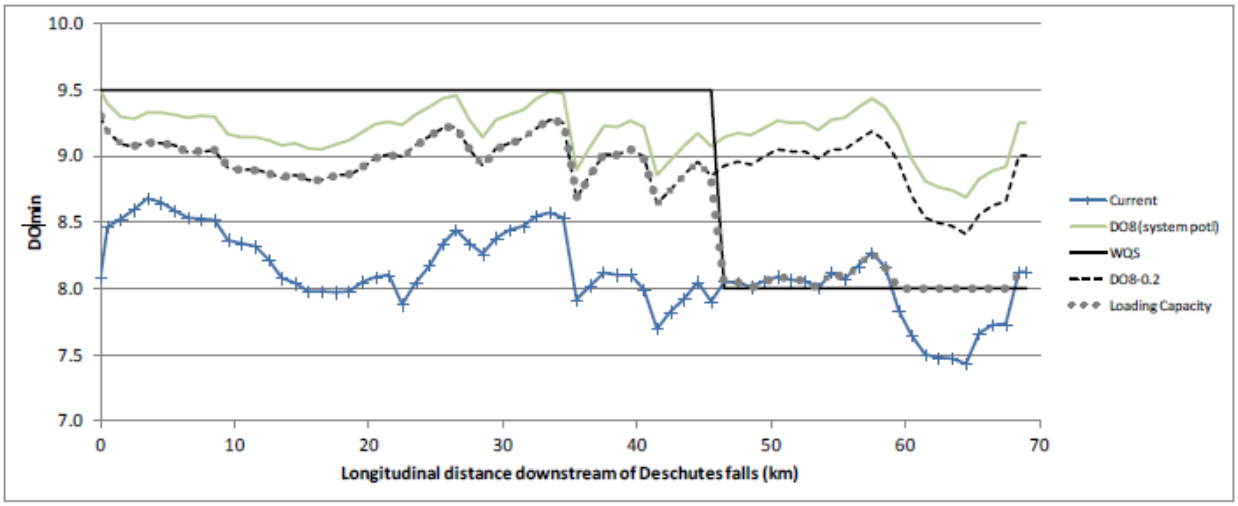

Figure 4. *DO simulation results along the Deschutes River mainstem (from WQIR p. 44).*

4.4.1.1. Downstream Water Quality Standards

As explained further in Section 4.2.1.1, Washington water quality standards require upstream actions to be conducted in manners that meet downstream water body criteria. In this section, we list applicable downstream water quality standards and compare them to those standards used in developing the Deschutes TMDL. Applicable downstream water quality standards are summarized by EPA in **Table 13** and **Table 14** below. **Table 15** presents EPA's comparison of those upstream and downstream WQS consistent with WAC 173-201A-260(3)(d).

EPA finds Ecology adequately identified or referenced downstream DO water quality standards in the WQSF (pp. 13-22). EPA's assessment of the protectiveness of the TMDLs for the upstream segments of the Deschutes TMDL relative to downstream WQS consistent with WAC 173-201A-260(3)(b) is assessed in the loading capacity section (Section 4.4.3) below.

Table 13. *DO water quality standards for downstream waters.*

Capitol Lake Water Quality Standard*	Budd Inlet Water Quality Standard**
Human actions considered cumulatively may not decrease the DO concentration more than 0.2 mg/L below natural conditions.	<u>Excellent Aquatic Life</u> 6.0 mg/L as lowest 1-Day Minimum <u>Good Aquatic Life</u> 5.0 mg/L as lowest 1-Day Minimum human actions considered cumulatively may not cause the D.O. of that water body to decrease more than 0.2 mg/L.

*Capitol Lake is identified in the WQSF report (see p. xxi) as Lake Class and is therefore also assigned designated uses of core summer salmonid habitat and extraordinary contact recreation per WAC-201A-600(1)(a)(ii).
**See WQSF page 14 for locations where specific designated uses apply in Budd Inlet.

***Table 14**. Nutrients water quality standards for downstream waters.*

Capitol Lake Water Quality Standard*	Budd Inlet Water Quality Standard**
Nutrient criteria to protect aesthetics at WAC-201A-230. 20 ug/L as action level phosphorus.	Not available

*Capitol Lake is identified in the WQSF report (see p. xxi) as Lake Class and is therefore also assigned designated uses of core summer salmonid habitat and extraordinary contact recreation per WAC-201A-600(1)(a)(ii).
**See WQSF page 14 for locations where specific designated uses apply in Budd Inlet.

***Table 15**. Comparison of upstream-downstream DO criteria.*

Upstream Designated Use	Downstream Designated Use	EPA Comments
Ayer Creek Salmonid Spawning, Rearing, and Migration	Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Designated uses are the same.
Upper Deschutes River Core Summer Salmonid Habitat	Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Applicable numeric criterion and simulated natural condition in Upper Deschutes River is more protective (stringent) than criteria or targets applied downstream.
Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Capitol Lake Core Summer Salmonid Habitat	Human actions considered cumulatively may not decrease the DO concentration more than 0.2 mg/L below natural conditions. Ecology assessed compliance with Capitol Lake water quality standard in the WQSF (see WQSF pp. 203-212). **Nutrient load reductions were determined necessary to meet DO standards in Capitol Lake** (WQSF p. 212).
Lake Lawrence Creek Core Summer Salmonid Habitat	Upper Deschutes River Core Summer Salmonid Habitat	Designated uses are the same.
Reichel Creek Core Summer Salmonid Habitat	Upper Deschutes River Core Summer Salmonid Habitat	Designated uses are the same.
Black Lake Ditch Core Summer Salmonid Habitat	Capitol Lake Core Summer Salmonid Habitat	Designated uses are the same.
Percival Creek Core Summer Salmonid Habitat	Capitol Lake Core Summer Salmonid Habitat	Designated uses are the same.

*EPA evaluates protectiveness of the loading capacity relative to downstream water quality criteria in Section 4.4.3.1.

4.4.2. Analytical Framework

DO linkage analyses in the Deschutes River, Percival Creek, and Black Lake Ditch were supported by one or more of the following models:

- QUAL2Kw is a one-dimensional, steady-state freshwater stream model that includes a diurnal heat budget. The model simulates diurnally varying water temperatures in response to heat budget components such as advection, incoming shortwave radiation, reflected outgoing shortwave radiation, latent heat exchange, and sediment interactions.

QUAL2Kw includes sediment-water layer fluxes of water and heat to simulate the effect of hyporheic interaction. The model was applied to critical period conditions in late summer.

- GEMSS, used for Capitol Lake, is a dynamic model that simulates continuous changes in hydrodynamics and water quality with a time step that varied between 10 seconds and 6 minutes in our applications. The three-dimensional model grid for the TMDL analysis has 19 layers below a horizontal datum starting at 6 meters (m) above mean lower low water (MLLW). The top 10 layers each have a thickness of 1 m, while the rest of the layers are 2 m graduating to 3 m thick in the deepest layers. The conditions in Budd Inlet and Capitol Lake are dynamically calculated and updated every time step in response to dynamic changes in boundary conditions such as tides, meteorology, river flows and loads, and wastewater flows and loads.

- Shade.xls was adapted from a program originally developed by the Oregon Department of Environmental Quality (ODEQ). The program uses topographic elevations and current or potential vegetation characteristics (height, type, and density) perpendicular to the channel to calculate solar radiation attenuation through the canopy. Model output includes percent shade by stream reaches and by hour of the day for a specific day of the year. This was used as input to QUAL2Kw.

- TTools is an ArcView extension originally developed by ODEQ to quantify stream channel characteristics, topographic details, and vegetation characteristics for shade and temperature model development. Topography and vegetation height were developed from LiDAR data provided by the Puget Sound LiDAR Consortium. Current vegetation height was verified with field observations. Results from TTools were used along with Shade.xls as inputs to the QUAL2Kw model.

In the case of these DO TMDLs, low DO is an impairment being caused by a pollutant. Low DO levels can be a result of reduced shade and high nutrient loads that encourage plant growth (WQSF p. 34). Ecology found that reducing nutrient inputs would result in increased minimum DO levels (WQSF p. 161). A TMDL for DO should be written to address the DO impairment, but pollutant loadings need to be developed for the cause of low DO, not DO itself.

To determine what the NCC for DO is for the Deschutes TMDL, Ecology calculated the system potential condition. System potential is not defined in Ecology's water quality standards, but in the TMDL it is described as the best conditions that can be achieved in the Deschutes River without human influences (WQIR p. 32). Ecology assessed natural or system potential conditions differently in the Deschutes River mainstem compared to the tributaries, as explained in the following paragraphs.

In the Deschutes River mainstem, DO concentrations were modeled explicitly using QUAL2Kw with stream shading inputs from Shade.xls and TTools. DO levels in Capitol Lake resulting from nutrient inputs from the Deschutes River and surrounding tributaries were simulated using GEMSS. Application of the QUAL2Kw model and GEMSS to the Deschutes River and Capitol Lake allows explicit simulation of water quality in response to changes in shading, channel

geometry, baseflow, nutrients, dam configuration, and other factors. Application of these models with respect to configuration, topology, process, calibration, and prediction is described throughout the WQSF. EPA finds the modeling conducted for the Deschutes River mainstem is reasonable because:

- Models include heat budget and riparian shading processes that are published in the scientific literature;
- Models are transparent and reproducible. That is, User Manuals or operating notes are available that describes the scientific basis for model algorithms, the source code is accessible, and a given set of inputs generate a given set of outputs;
- Models output water quality concentration data that can be related to the water quality standard. Use of site-specific information, such as hydroclimatic and water quality data, in the Deschutes TMDL increases the accuracy that management scenarios will meet water quality standards; and
- Model outputs follow behavior that is consistent with established physical, chemical, and biological laws. For example, increasing vegetation density and height results in greater stream shade. More shade then reduces incident solar shortwave radiation which then lowers water temperatures (see Scenario 1, WQSF p. 133).

The QUAL2Kw water quality model was used to predict system potential DO concentrations for various management scenarios (**Figure 5**). In the modeling analysis, Ecology concluded that much of the Deschutes River upstream of Offutt Lake (located at river kilometer RK 46) may not achieve applicable numeric minimum DO criteria under system potential conditions (WQIR pp. 44-45). The predicted natural condition is a system-wide average minimum DO of 9.19 mg/L. This corresponds to modeling Scenario DO8 in **Figure 4**, which incorporates the following stream improvement measures (WQIR pp. 44-45):

- Mature vegetation;
- Improved microclimate;
- Reduced channel width;
- Improved headwater temperatures;
- Headwaters meeting applicable DO criteria; and
- Nutrients in tributaries and groundwater set to estimated natural conditions.

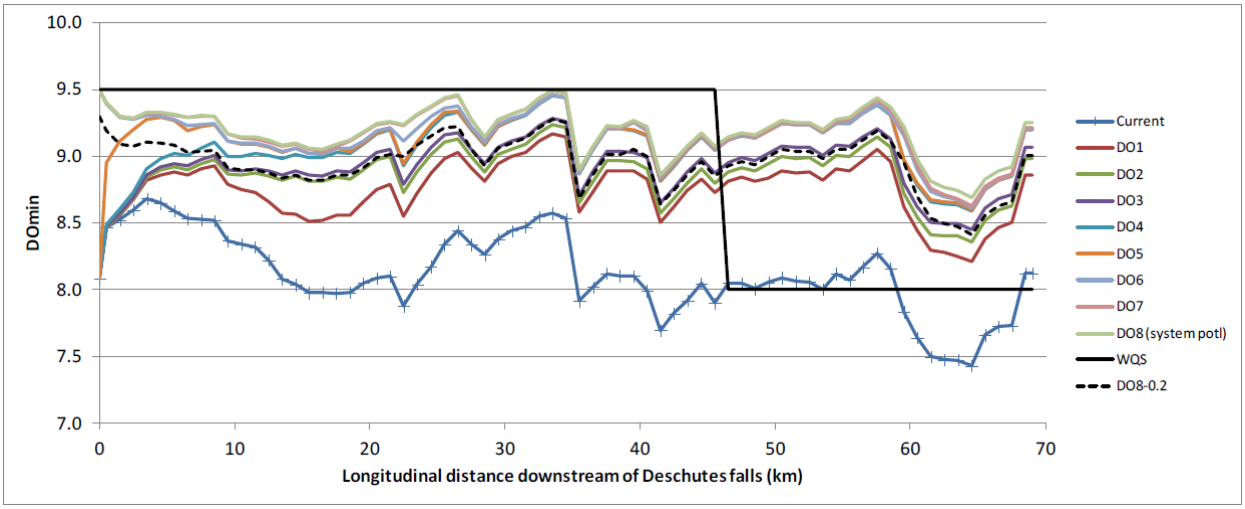

***Figure 5**. Predicted daily minimum DO in the Deschutes River for various management sccenarios (from WQIR p. 162).*

Ecology concluded through model sensitivity analyses that these stream improvement measures adequately accounted for human-caused DO reductions in the Deschutes River. EPA finds this conclusion reasonable because the scenario incorporates all of the elements that would be expected in a fully restored stream environment with little to no nutrient impacts, including full, mature vegetation, restored channel complexity, improved temperatures, and nutrients reduced to natural background levels. **Figure 4** shows the natural condition is at times below the applicable numeric water quality criterion, and at other times above (i.e. meeting) the applicable numeric water quality criterion.

For Percival Creek and Black Lake Ditch, Ecology used Shade.xls and TTools to quantify shade improvements expected from restoring riparian vegetation to natural conditions (WQIR Appendix E; WQSF pp. 140-143). QUAL2Kw was not used to explicitly simulate DO in Percival Creek and Black Lake Ditch. Rather, Ecology's analytical approach relies on the assumption that decreased temperatures resulting from mature riparian vegetation would improve DO due to saturation effects and decreased primary productivity (WQSF p. 171). Ecology used solar radiations loads based on system potential vegetation as surrogates for meeting the natural condition in the tributaries (WQIR p. 46). As stated on page 175 of the WQSF, the solar radiation loads are based on the same effective shade calculated for the tributary temperature analysis. The WQSF also recommends implementing activities that decrease loads and concentrations of DO to natural levels, as well as evaluating nutrient load reductions (p. 176). As explained further in Section 4.4.3, the analytical method used for the tributaries is inadequate, as there are other potential causes of low DO which are unaccounted for, including anthropogenic sources of biochemical oxygen demand (BOD) and nutrients. These sources would need to be incorporated into the analysis to better represent the conditions under which system potential DO concentrations could be achieved.

Based on the preceding information, EPA finds the analytical framework adequate for DO TMDL development for the Deschutes River.

EPA finds the analytical framework inadequate for DO TMDL development for Percival Creek and Black Lake Ditch.

Ecology did not conduct any modeling or perform shade calculations for the remaining reaches impaired for DO and identified in ***Table 2****. Thus, EPA finds the analytical framework absent for the following segments impaired by DO:*

- *Ayer Creek;*
- *Lake Lawrence Creek; and*
- *Reichel Creek.*

4.4.3. Loading Capacity

Ecology identified load capacities for the Deschutes River and Percival Creek. The Deschutes TMDL does not explicitly identify a loading capacity for Black Lake Ditch or any other tributaries, and instead only mentions the Percival Creek loading capacity (WQIR p. 46). The Deschutes TMDL assigns loading capacities to achieve system potential DO concentrations for these two waters. The loading capacities are expressed as surrogate measures - effective shade and solar radiation heat load based on system potential vegetation (**Table 16**).

Table 16*. Summary of proposed DO surrogate.*

Parameter	Surrogate or Implementation Target	Comments
DO	Surrogate: Shortwave Radiation (W/m^2) Surrogate: Effective Shade (%)	In addition to nutrient LAs in selected reaches, Ecology proposes to restore riparian corridor to natural vegetation levels. All other processes being equal or static, reductions in shortwave radiation are predicted to reduce algal photosynthesis and subsequently increase daily DO minimums. (See WQIR p. 17 and WQSF p. 158 for surrogate discussion.)

Ecology proposes loading capacities for the Deschutes River and Percival Creek as follows:

- Deschutes River Mainstem - Loading capacities for the Deschutes River are expressed in multiple ways throughout the Deschutes TMDL and supporting documentation. First, the TMDL indicates that Scenario DO8 from the QUAL2Kw modeling is the loading capacity for the Deschutes River (WQIR p. 44). The QUAL2Kw model scenario provides a system potential DO concentration assuming best conditions achievable (WQIR p. 44). Ecology applies the system potential DO concentration on portions of the reach where it is below the numeric criterion (upstream of Offutt Lake). Ecology applies either the current DO concentration or the numeric criterion (whichever is higher) where the system potential is above the numeric criterion (downstream of Offut Lake). This is illustrated by **Figure 4**.

Second, in the WQSF, the loading capacity is referenced as solar radiation heat loads based on system potential vegetation, improved channel conditions, improved DO in tributaries and headwaters, and reductions in nutrient inputs (WQSF p. 158). Heat loads for the Deschutes River are provided in Appendix E of the WQIR. These are the same loads used for the loading capacity for temperature, and they are based on shade provided by fully restored and mature riparian vegetation. These heat loads do not incorporate all of the implementation measures under Scenario DO8, particularly improved DO in tributaries and headwaters and reductions in nutrient inputs. Thus, for reaches where the system potential DO concentration is applied (upstream of Offutt Lake), the prescribed heat loads will not attain the targeted water quality standard. For those reaches, anticipated restoration of riparian vegetation corresponds to Scenario DO1 and a projected daily average DO minimum of 8.74 mg/L (WQSF p. 163 and Table 29). This does not attain the modeled system potential DO minimum of 9.19 mg/L.

For reaches downstream of Offutt Lake, the targeted water quality condition is either the current DO concentration or the numeric DO criterion (whichever is higher, i.e. more stringent). Prescribed heat loads based on restoration of riparian vegetation (corresponding to Scenario DO1) result in a higher DO concentration than the loading capacity for these reaches (see **Figure 4**). Thus, the heat load will attain the targeted DO water quality standard for downstream reaches.

- Percival Creek – The loading capacity in the Percival Creek watershed is expressed as solar radiation heat loads based on system potential vegetation (WQIR p. 46). In other words, it is assumed that if naturally existing shade and vegetation are present along the stream, the stream DO levels will reflect the stream's natural condition. However, there are other potential causes of low DO which are unaccounted for in the TMDL using this approach, including anthropogenic sources of biochemical oxygen demand (BOD) and nutrients. In the absence of calculating load capacities (and assigning load allocations) for nutrients and BOD, it is reasonable to assume that the water quality standards for DO may not be attained, even when system potential vegetation is achieved. The WQIR does not explicitly identify a loading capacity for Black Lake Ditch, or any other tributaries.

EPA finds that Ecology did not adequately develop a loading capacity that accounts for all potential causes of low DO for the upper Deschutes River (upstream of Offutt Lake); thus, EPA cannot assess whether the River (upstream of Offutt Lake) will meet modeled natural DO conditions for those reaches of the Deschutes mainstem.

EPA finds that the loading capacity will attain the targeted numeric criterion or current condition for the lower Deschutes River (downstream of Offutt Lake); thus, EPA finds that Ecology developed an adequate loading capacity for the lower Deschutes River.

EPA finds that Ecology did not adequately identify all potential causes of low DO and account for them in the loading capacity developed for Percival Creek; thus EPA cannot assess whether Percival Creek will meet DO water quality standards.

EPA finds that Ecology did not identify load capacities for the following segments impaired by DO:

- *Ayer Creek;*
- *Lake Lawrence Creek;*
- *Reichel Creek; and*
- *Black Lake Ditch.*

4.4.3.1. Considering Loading Capacities for Downstream Waters

Upstream and downstream criteria pairs are listed and described in Section 4.4.1.1. **Table 15** identifies one upstream-downstream waterbody pair where the downstream water quality standard is more stringent than the criterion applied in the adjacent upstream waterbody (lower Deschutes River and Capitol Lake). As explained further below, the loading capacity for both the upper and lower Deschutes River segments are not protective of downstream uses.

<u>Upper Deschutes River (upstream) and Lower Deschutes river (downstream)</u>
Above Offutt Lake in the upper Deschutes River, LAs for nutrients (dissolved inorganic nitrogen and orthophosphate) were provided. However, Ecology did not provide nutrient loading capacities or WLAs (WQIR p. 70). The LAs are an estimate of the natural condition for the two parameters. The natural nutrient concentrations were estimated from median concentrations from a hydrogeology study (Sinclair and Bilhimer, 2007, as referenced on p. 66 of the WQSF). The LAs are not intended to address DO impairments in the lower portions of the Deschutes River (below Offutt Lake) or Capitol Lake. The WQIR states that the LAs may be adjusted in a subsequent Phase II TMDL to meet water quality standards in Capitol Lake and Budd Inlet (WQIR p. 70).

<u>Lower Deschutes River (upstream) and Capitol Lake (downstream)</u>
The DO concentrations targeted for the lower reaches of the Deschutes River (downstream of Offutt Lake, see **Figure 4**) were either: (1) set equal to current DO concentrations or (2) set equal to the numeric DO criteria that protect Salmonid Spawning, Rearing, and Migration (8.0 mg/L as daily minimum) (see explanation in previous Section 4.4.3). The downstream DO criterion that applies to Capitol Lake (Lake Class) requires that "Human actions considered cumulatively may not decrease the DO concentration more than 0.2 mg/L below natural conditions." Compliance with Capitol Lake DO criteria was assessed using the GEMSS model as described in pages 205-212 of the WQSF. In the WQSF, Ecology concluded that the combined effects of current nonpoint and point sources result in lower-than-criteria DO levels in Capitol Lake and that nutrient reductions are necessary for the applicable criterion to be achieved. (WQSF p. 212). Rather than assign nutrient load reductions, Ecology has calculated solar radiation heat loads resulting from full riparian shade to address the DO impairment. EPA notes that downstream of the lower Deschutes River, Capitol Lake is impaired by excessive phosphorus concentrations and experiences seasonal nuisance algal blooms. Reductions in phosphorus inputs to Capitol Lake are needed to achieve applicable aesthetic nutrient criteria (20 µg/L). Controlling nutrients, specifically phosphorus, is a common management measure to improve DO concentrations in freshwater systems, including those in other Washington TMDLs.

Absent a nutrient loading cap for inputs from the lower Deschutes River into Capitol Lake, there is little reason to expect nutrient reductions needed in Capitol Lake will occur. Ecology also did not provide a linkage analysis to demonstrate that upper Deschutes River LAs would result in the nutrient load reductions deemed necessary to reduce DO in Capitol Lake (WQSF p. 212). Also, Ecology did not assess the loading capacity of either the Deschutes River or Capitol Lake for nutrients, nor did Ecology address point source inputs of nutrients (as they failed to provide WLAs for nutrients). Therefore, from a loading perspective, the Deschutes DO TMDL was not established in a manner that reduces downstream eutrophication impacts and meets downstream DO criteria.

EPA concludes the Deschutes DO TMDL was not set at a level necessary to meet downstream DO criteria in Capitol Lake.

4.4.4. Wasteload Allocations

In the Deschutes TMDL, Ecology assigns a combined DO WLA for all point sources, rather than assigning individual WLAs. The same WLA provision is assigned to all point sources, which is that all discharges "shall not cause a greater than 0.2 mg/L decrease [in DO concentration] in the receiving water due to the combined effects of all human activities" (WQIR pp. 51-57 and Appendix C).

The QUAL2Kw water quality model, as described in the WQSF document, only includes nonpoint sources as contributors of pollutants which cause low DO. This includes inputs from tributaries and groundwater, as well as riparian disturbance and oxygen solubility related to water temperature. The model does not simulate the effects of point sources, including stormwater related discharges. Additional modeling is needed that accounts for the effect of other oxygen demanding or influencing pollutants coming from the omitted point sources, such as BOD and nutrients. This is especially important given the non-conservative nature of DO, and the localized impacts that point sources can have. Absent such additional modeling, it is unclear whether point sources have been given an appropriate portion of the loading capacity or whether their pollutant contributions would lead to no more than a 0.2 mg/L decrease in instream DO levels.

Given the lack of modeling, or other appropriate approach, to quantify point source contributions of oxygen demanding or influencing pollutants in the Deschutes River or its tributaries, EPA finds that Ecology did not adequately identify WLAs for the Deschutes River or Percival Creek that are protective of applicable water quality criteria for DO.

EPA finds that Ecology did not identify load capacities for the following segments impaired by DO; thus, consideration of wasteload allocations cannot be evaluated for these water bodies:

- *Ayer Creek;*
- *Lake Lawrence Creek;*
- *Reichel Creek; and*
- *Black Lake Ditch.*

4.4.5. Load Allocations

The LA for protecting DO water quality standards is expressed in two ways. First, it is expressed as a combination of solar radiation heat load resulting from restored riparian shade (the same shade calculations as for the temperature TMDLs). This LA is included in Appendix E for the Deschutes mainstem, Percival Creek, and Black Lake Ditch. It is also equivalent to the heat loading capacity described in Section 4.4.3. Second, the LA is also expressed as daily loads of dissolved inorganic nitrogen and orthophosphate. This LA is found on page 70 of the WQIR, and only applies to the Deschutes River upstream of Offutt Lake. The TMDL also references additional implementation measures that could improve minimum DO concentrations, such as channel improvements and improvements in headwater and tributary temperatures.

EPA finds the combination of a heat load and nutrient loads for the upper Deschutes River (upstream of Offutt Lake) provides an adequate LA that accounts for all nonpoint sources of low DO; thus, EPA finds that Ecology adequately identified LAs for the upper Deschutes River.

EPA finds the LA for the lower Deschutes River (downstream of Offutt Lake), which is the same as the solar radiation heat loading capacity described in Section 4.4.3, will attain the targeted numeric criterion or current condition as demonstrated through the water quality model outputs; thus, EPA finds that Ecology adequately identified LAs for the upper Deschutes River.

EPA finds that the LA for Percival Creek and Black Lake Ditch, which is the same as the solar radiation heat loading capacity described in Section 4.4.3, does not adequately identify and account for all potential causes of low DO; thus EPA cannot assess whether the LAs for Percival Creek and Black Lake Ditch are protective of applicable water quality criteria for DO.

EPA finds that Ecology did not identify LAs for the following segments impaired by DO:

- *Ayer Creek;*
- *Lake Lawrence Creek; and*
- *Reichel Creek.*

4.4.6. Margin of Safety

Ecology proposes an implicit MOS due to conservative QUAL2Kw model assumptions. These include the very low likelihood that that 7Q10 flows, 90th percentile air temperatures, zero cloud cover, and zero wind speed would occur at the same time. Uncertainty in the calculations was also reduced in the application of TTools and Shade.xls for the Deschutes River, Percival Creek, and Black Lake Ditch, because they were verified and adjusted based on in-situ estimates from Hemi-View photos (WQIR pp. 27-28; WQSF p. 107-108). EPA agrees with Ecology that these factors combine to yield conservative assumptions to account for uncertainty between the calculated loadings and water quality outcomes.

EPA finds the implicit MOS appropriate for the Deschutes River and Percival Creek.

EPA finds that Ecology did not identify a load capacity for Black Lake Ditch; thus, an MOS cannot be evaluated for that segment.

EPA finds that Ecology did not identify load capacities or LAs for the remaining reaches; thus, an MOS cannot be evaluated the following segments impaired by DO:

- *Ayer Creek;*
- *Lake Lawrence Creek; and*
- *Reichel Creek.*

4.4.7. Seasonality and Critical Conditions

Current levels of DO vary throughout the year and do not meet water quality standards during select time periods in the summer months. Ecology accounted for these variabilities in modeling scenarios for DO, which used 7Q10 flows from USGS for the period 1991-2001, 90th percentile peak air temperatures, cloud cover of zero, and wind speeds of zero to represent worst-case assimilative capacity conditions. The 7Q10 flow represents the lowest one-week average flow with a recurrence interval of 10 years. This is a good representation of critical conditions for DO, because negative DO impacts occur when there is less in-stream flow. The 90th percentile of peak air temperatures are typical temperatures that would be experienced in the summer, when temperature impairments are the worst. These high temperatures can negatively impact the amount of DO in the water column. Assuming zero cloud cover and zero wind speed allows for no cooling from shade or wind flow. After review of the available data, EPA agrees with Ecology that hydroclimate variables considered above represent worst-case conditions with respect to seasonal variation measured or expected to occur within the Deschutes River and nearby riverine systems.

EPA finds that Ecology adequately addressed seasonality and critical conditions for DO TMDLs developed for the Deschutes River and Percival Creek.

EPA finds that Ecology did not identify a load capacity for Black Lake Ditch; thus, consideration of seasonality and critical conditions for DO TMDLs cannot be evaluated for that segment.

EPA finds that Ecology did not identify load capacities or LAs for the remaining reaches; thus, consideration of seasonality and critical conditions cannot be evaluated the following segments impaired by DO:

- *Ayer Creek;*
- *Lake Lawrence Creek; and*
- *Reichel Creek.*

4.4.8. Reasonable Assurance

Implementation measures needed to improve DO concentrations are referenced by non-point and point source category in the Deschutes TMDL (WQIR pp. 113-130). Roles and responsibilities for implementing practices are described throughout the implementation plan. Permit limits that implement TMDL WLAs and implementation measures provide reasonable assurances for point sources. Several activities to improve DO concentrations are proposed in WQIR Tables 23 – 42.

Table 23 includes implementation recommendations for managing nutrient application and improving flows, and it identifies priority areas for riparian and channel restoration (WQIR pp. 114-115). These implementation recommendations are consistent with the modeling scenario representing system potential DO for the Deschutes River. A target date of 2065 is proposed by Ecology for achieving restored canopy cover and water quality standards for DO (WQIR pp. 87, and Table 45 on p. 133). The Deschutes TMDL also includes schedules for individual restoration actions, monitoring plans and adaptive management activities considered in response to data collection, and TMDL funding processes and programs (WQIR pp. 116-130; 134-136; and Table 46). In addition, current restoration activities are outlined in Table 18 of the Deschutes TMDL (Grants and Loans), including reclaiming water in Tumwater to divert nitrogen, public outreach programs to reduce fertilizer application, and a number of revegetation projects. EPA concludes that this detailed information and the identified actions sufficiently inform stakeholders about how they can work together to make improvements to DO in the Deschutes River watershed.

Where EPA finds the LAs developed by Ecology to be adequate (Deschutes River mainstem), EPA finds reasonable assurances are provided that DO LAs will be met.

EPA finds the LAs developed by Ecology to be inadequate for Percival Creek and Black Lake Ditch; thus, because the LAs cannot be evaluated to determine if they are protective of DO water quality standards, reasonable assurances that DO LAs will be met for those segments also cannot be evaluated.

EPA finds that Ecology did not identify load capacities or LAs for the remaining reaches; thus, reasonable assurances cannot be evaluated for the following segments impaired by DO:

- *Ayer Creek;*
- *Lake Lawrence Creek; and*
- *Reichel Creek.*

4.4.9. Summary of Action

EPA disapproves all 11 DO TMDLs included in the 2015 submittal.

Table 17*. Summary of EPA action on DO TMDLs.*

Waterbody	1996 Listing ID	Current Listing ID	Parameter	EPA Action
Ayer (Elwanger) Creek	WA-13-1015	5851	DO	Disapprove
Deschutes River	WA-13-1010	10894	DO	Disapprove
		47753	DO	Disapprove
		47754	DO	Disapprove
	WA-13-1020	47756	DO	Disapprove
Lake Lawrence Creek	---	47696	DO	Disapprove
Reichel Creek	WA-13-1022	47714	DO	Disapprove
Black Lake Ditch	---	47761	DO	Disapprove
		47762	DO	Disapprove
Percival Creek	WA-13-1012	48085	DO	Disapprove
		48086	DO	Disapprove

The rationale supporting these actions is summarized below.

- EPA is disapproving DO TMDLs for five segments within reaches of Ayer Creek, Lake Lawrence Creek, Reichel Creek, and Black Lake Ditch identified in **Table 17**. EPA is disapproving TMDLs for these waters because Ecology's submittal did not quantify loadings for the aforementioned segments. Thus, the submittal does not include fundamental TMDL components as defined in 40 CFR § 130.2 and 40 CFR § 130.7.

- EPA is disapproving DO TMDLs for four segments situated along the Deschutes River identified in **Table 17**. TMDLs for these waters are disapproved for the following reasons:

    1) The loading capacity was not established at levels necessary to attain downstream DO water quality standards or reduce nutrient inputs causing eutrophication impairments of Capitol Lake (WQSF pp. 205-212). Per WAC 173-201A-260(3)(b), TMDLs must be established in a manner that meets downstream water body criteria (i.e., DO criteria and lake phosphorus criteria in Capitol Lake). These TMDLs: (1) do not implement Ecology's applicable water quality standard for protecting downstream uses, and (2) are not constructed to attain and maintain applicable water quality standards as required by 40 CFR § 130.7(c)(1).

    2) For reaches of the Deschutes River upstream of Offutt Lake, the TMDL submittal does not demonstrate that the loading capacity will achieve the natural condition criteria, which is the water quality target of the TMDL. The natural condition criteria correspond to Scenario DO8 and a daily average DO minimum of 9.19 mg/L (WQIR p. 44; WQSF p. 163 and Table 29). The surrogate loading capacity is the heat load and effective shade resulting from restoring riparian vegetation. The simulated DO profile and resulting average daily minimum DO corresponding to the surrogate loading capacity is not explicitly identified for the modeled reaches of the Deschutes. However, restoration of riparian vegetation corresponds to Scenario DO1 and a daily average DO minimum of 8.74 mg/L (WQSF p. 163 and Table 29). Thus, it appears as though the loading capacity aims to achieve this condition. Without clear identification of the linkage between the loading capacity and the water quality target, EPA cannot assess: (a) if the assigned loading capacity results in attainment of applicable water quality standards as required by 40 CFR § 130.7(c)(1), (b) if the TMDL provides adequate reasonable assurance, and (c) if application of the natural condition criteria in the TMDL is consistent with Washington water quality standards at WAC 173-201A-260.

    3) Ecology did not quantify the effects of oxygen demanding or influencing pollutants from point sources, particularly BOD and nutrients. Without such a linkage, EPA cannot determine whether the WLAs assign an appropriate

portion of the loading capacity to point sources as defined by 40 CFR § 130.2(h).

- EPA is disapproving DO TMDLs for two segments in Percival Creek identified in **Table 17**. TMDLs for these waters are disapproved for the following reasons:

    1) The surrogate loading capacity for DO in the Percival Creek watershed is expressed as the solar radiation heat loads based on system potential vegetation (WQIR p. 46). The 2015 TMDL does not provide scientific evidence that implementation of system potential vegetation will result in attainment of applicable DO criteria. Other causes of low DO, like anthropogenic sources of BOD and nutrients, would need to be accounted for. Thus, without modeling to demonstrate that the water quality target could be met, EPA concludes that the Percival Creek DO TMDL is not established at levels necessary to attain and maintain applicable water quality standards according to 40 CFR § 130.7(c)(1).

    2) Ecology did not quantify the effects of oxygen demanding or influencing pollutants from point sources, particularly BOD and nutrients. Without such a linkage, EPA cannot determine whether the WLAs assign an appropriate portion of the loading capacity to point sources as defined by 40 CFR § 130.2(h).

4.5. Review of pH TMDLs

4.5.1. Applicable Water Quality Standards

Aquatic life uses addressed by the Deschutes TMDL have been identified in previous sections of this document. pH criteria (WAC-173-201A-200, Table 200 (1)(g)) that apply to these uses are described in the Deschutes TMDL (WQIR p. 18). pH criteria are expressed as two independent ranges. To achieve pH criteria, two conditions must be satisfied. First, ambient pH must be maintained within a broad range of 6.5 to 8.5 Standard Units (SU) (Part 1). Second, human-caused variation within the above range must be less than either 0.2 SU or 0.5 SU, depending on the designated use (Part 2).

<u>Core Summer Salmonid Habitat</u>
pH must be kept within the range of 6.5 to 8.5 SU, with a human-caused variation within the above range of less than 0.2 units.

<u>Salmon and Trout Spawning, Rearing, and Migration</u>
pH must be kept within the range of 6.5 to 8.5 SU, with a human-caused variation within the above range of less than 0.5 units.

Based on the preceding information, EPA concludes the Deschutes TMDL adequately identifies the applicable pH water quality standards.

4.5.1.1. Downstream Water Quality Standards

As explained further in Section 4.2.1.1, Washington water quality standards require upstream actions to be conducted in manners that meet downstream water body criteria. In this section, we list applicable downstream water quality standards and compare them to those standards used in developing the Deschutes TMDL. Applicable downstream water quality standards are summarized by EPA in **Table 18** below. **Table 19** presents EPA's comparison of those upstream and downstream WQS consistent with WAC 173-201A-260(3)(d).

EPA finds that Ecology adequately identified or referenced downstream pH water quality standards in the WQSF (pp. 13-22). EPA's assessment of the protectiveness of the TMDLs for the upstream segments of the Deschutes TMDL relative to downstream WQS consistent with WAC 173-201A-260(3)(b) is assessed in the loading capacity section (Section 4.5.3) below.

***Table 18**. pH water quality standards for downstream waters.*

Capitol Lake Water Quality Standard*	Budd Inlet Water Quality Standard**
See Core Summer Salmonid Habitat in section 4.5.1	Excellent Aquatic Life pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.5 units. Good Aquatic Life Same as Excellent Aquatic Life

*Capitol Lake is identified in the WQSF report (see p. xxi) as Lake Class and is therefore also assigned designated uses of core summer salmonid habitat and extraordinary contact recreation per WAC-201A-600(1)(a)(ii).
**See WQSF page 14 for locations where specific designated uses apply in Budd Inlet.

***Table 19**. Comparison of upstream-downstream pH criteria.*

Upstream Designated Use	Downstream Designated Use	EPA Comments
Adams Creek Salmonid Spawning, Rearing, and Migration	Budd Inlet – South Puget Sound Excellent Aquatic Life	Downstream pH criteria has a smaller allowable range. *Note*: the Deschutes TMDL did not calculate loadings for Adams Creek.
Ayer Creek Salmonid Spawning, Rearing, and Migration	Lower Deschutes River Salmonid Spawning, Rearing, and Migration	Designated uses are the same.
Black Lake Ditch Core Summer Salmonid Habitat	Capitol Lake Core Summer Salmonid Habitat	Designated uses are the same.

*EPA evaluates protectiveness of the loading capacity relative to downstream water quality criteria in Section 4.5.3.1.

4.5.2. Analytical Framework

The Deschutes TMDL does not include loading capacities for the three waterbodies impaired for pH – Adams Creek, Ayer Creek, and Black Lake Ditch (WQIR p. 46). Thus, there is no analytical framework to evaluate for any of the segments listed in **Table 2** as impaired for pH.

The TMDL did conduct a pH linkage analysis for the Deschutes River, using the same modeling tools and approaches as were used for temperature and DO, and as explained in Sections 4.3.3 and 4.3.4. The TMDL also calculated solar radiation heat loads (based on shade from mature vegetation) to address pH in Percival Creek (WQIR p. 46). These heat loads are the same as the ones developed to address both temperature and DO impairments. However, neither of these waters are identified as impaired for pH on the most recently EPA-approved 2012 303(d) list (according to Department of Ecology's Water Quality Atlas, accessed 4/25/2018). Thus, the analytical framework does not need to be evaluated for those segments.

EPA finds the analytical framework absent for all segments impaired by pH and identified in ***Table*** **2**.

4.5.3. Loading Capacity

As explained in Section 4.5.2, The Deschutes TMDL does not include loading capacities for Adams Creek, Ayer Creek, and Black Lake Ditch. The Deschutes TMDL did set loading capacities to address pH for the Deschutes Mainstem and Percival Creek, neither of which are identified as impaired for pH. Thus, the loading capacity does not need to be evaluated for those segments.

EPA finds that Ecology did not develop load capacities for any segments impaired by pH and identified in ***Table 2****.*

4.5.3.1. Considering Loading Capacities for Downstream Waters

Upstream and downstream criteria pairs are listed and described in Section 4.5.1.1. However, Ecology did not identify load capacities for pH-impaired segments in the Deschutes TMDLs.

Thus, EPA cannot evaluate whether loading capacities were established in a protective manner of downstream water bodies.

4.5.4. Wasteload Allocations

As described in Section 4.5.3, Ecology did not identify load capacities for segments impaired by pH.

Thus, EPA cannot evaluate WLAs for pH-impaired waters identified in ***Table*** **2**.

4.5.5. Load Allocations

As described in Section 4.5.3, Ecology did not identify load capacities for segments impaired by pH.

Thus, EPA cannot evaluate LAs for pH-impaired waters identified in ***Table*** **2**.

4.5.6. Margin of Safety

As described in Section 4.5.3, Ecology did not identify load capacities for segments impaired by pH.

Thus, EPA cannot evaluate the MOS for pH-impaired waters identified in ***Table*** **2**.

4.5.7. Seasonality and Critical Conditions

As described in Section 4.5.3, Ecology did not identify load capacities for segments impaired by pH.

Thus, EPA cannot evaluate seasonality and critical conditions for pH-impaired waters identified in ***Table*** **2**.

4.5.8. Reasonable Assurance

As described in Section 4.5.3, Ecology did not identify load capacities for segments impaired by pH.

Thus, EPA cannot evaluate reasonable assurance for pH-impaired waters identified in ***Table*** **2**.

4.5.9. Summary of Action

EPA disapproves all three pH TMDLs included in the 2015 submittal, which includes Adams Creek, Ayer Creek, and Black Lake Ditch identified in **Table 20**.

Table 20*. Summary of EPA action on pH TMDLs.*

Waterbody	1996 Listing ID	Current Listing ID	Parameter	EPA Action
Adams Creek	--	50965	pH	Disapprove
Ayer Creek	WA-13-1015	5850	pH	Disapprove
Black Lake Ditch	--	50990	pH	Disapprove

EPA is disapproving these waters because the 2015 Deschutes TMDL did not quantify loadings or fundamental TMDL components such as loading capacity as defined in 40 CFR § 130.2 and 40 CFR § 130.7.

4.6. Review of Fine Sediment TMDL

4.6.1 Applicable Water Quality Standards

Washington State's narrative toxics and aesthetics criteria are specified at WAC-173-201A-260(2) (WQIR p. 18):

Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause

acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health.

To develop this TMDL, Ecology translated those narrative criteria into targets for fine sediment. Ecology determined that a TMDL target of 12% embedded fine sediment (EFS) would achieve the narrative criteria (WQIR p. 18). As rationale for this target, Ecology cites the Washington Forest Practices Board which associated a 12% EFS with a 'Good Habitat' rating (WQIR p. 18). Most use attainment thresholds summarized or referenced by EPA in Suspended and Bedded Sediment Guidance (EPA 2003) are greater than 12%. Thus, EPA thinks it is reasonable for Ecology to expect that a 12% EFS target would be protective of the designated uses in the Deschutes River, and concludes that Ecology correctly identified appropriate fine sediment targets to protect the narrative criteria.

In addition to the applicable narrative toxics and aesthetics criteria identified in the Deschutes TMDL, Ecology identifies aquatic life turbidity criteria as a permitting target (WQIR Appendix C). As a result, Ecology used the turbidity criteria to establish turbidity targets for point source dischargers.

Based on the preceding information, EPA concludes the 2015 Deschutes TMDL adequately identifies the applicable narrative water quality standards for protection of aquatic life designated uses impaired by sediment.

4.6.1.1. Downstream Water Quality Standards

As explained further in Section 4.2.1.1, Washington water quality standards require upstream actions to be conducted in manners that meet downstream water body criteria. In this section, we list applicable downstream water quality standards and compare them to those standards used in developing the Deschutes TMDL. EPA finds that Ecology adequately identified or referenced downstream water quality standards in the WQSF (pp. 13-22). Applicable downstream water quality standards are summarized by EPA in **Table 21** below. **Table 22** presents EPA's comparison of those upstream and downstream WQS consistent with WAC 173-201A-260(3)(d).

EPA finds Ecology adequately identified or referenced downstream narrative water quality standards in the WQSF (pp. 13-22). EPA's assessment of the protectiveness of the TMDLs for the upstream segments of the Deschutes TMDL relative to downstream WQS consistent with WAC 173-201A-260(3)(b) is assessed in the loading capacity section (Section 4.6.3) below.

***Table 21**. Narrative and turbidity water quality standards for downstream waters.*

Parameter	Capitol Lake Water Quality Standard*	Budd Inlet Water Quality Standard**
Sediment (narrative standard)	See narrative standard at WAC-173-201A-260(2) and nutrient criteria to protect aesthetics at WAC-201A-230.	See narrative standard at WAC-173-201A-260(2).
Turbidity	See Core Summer Salmonid Habitat: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.	Excellent Aquatic Life 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU. Good Aquatic Life Turbidity must not exceed: • 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

*Capitol Lake is identified in the WQSF report (see p. xxi) as Lake Class and is therefore also assigned designated uses of core summer salmonid habitat and extraordinary contact recreation per WAC-201A-600(1)(a)(ii).
**See WQSF page 14 for locations where specific designated uses apply in Budd Inlet.

***Table 22**. Comparison of upstream-downstream narrative and turbidity criteria.*

Parameter	Upstream Water Quality Standard Applied in TMDL	Downstream Water Quality Standard	EPA Comments
Sediment (narrative standard)	Deschutes River WAC-173-201A-260(2)	Capitol Lake WAC-173-201A-260(2)	Water quality criteria for upstream and downstream waters are the same therefore the most stringent criteria between upstream-downstream pairs has been applied.
Turbidity	Deschutes River WAC-173-201A-200, Table 200(1)(e)	Capitol Lake WAC-173-201A-200, Table 200(1)(e)	Water quality criteria for upstream and downstream waters are the same therefore the most stringent criteria between upstream-downstream pairs has been applied.

*EPA evaluates protectiveness of the loading capacity relative to downstream water quality criteria in Section 4.6.3.1.

4.6.2. Analytical Framework

Ecology identified fine sediment target loads and load reductions through sediment budgeting techniques that quantified: (1) bank erosion rates based on LiDAR data; (2) landslide sources based on regional analyses from Weyerhaeuser; and (3) unpaved road sources based on model predictions using the empirical Washington Road Surface Erosion Model (WQIR p. 28). EPA finds that sediment budgeting analyses applied in the Deschutes TMDL are adequately described in the WQSF and companion reports made available to EPA (WQSF pp. 180-182).

Ecology did not provide a linkage analysis to demonstrate that the TMDL target chosen to protect water quality standards (12% EFS) can achieve the assigned loading capacity. To achieve the *in-situ* TMDL target of 12% EFS, the surface fine sediment must be reduced by 30-46%, depending on the location along the Deschutes River (WQSF p. 182). However, the assigned

annual fine sediment loading capacity of 21,615 yd^3/year represents only a 21% reduction from the current load (WQIR p. 47).

Absent a clear linkage or rationale to water quality standards, EPA concludes that Ecology did not include a complete analytical framework for fine sediment.

4.6.3. Loading Capacity

The Deschutes TMDL includes two loading capacities to address the fine sediment impairment for the Deschutes River listed in **Table 2**. First, Ecology develops a fine sediment loading capacity for the entire Deschutes watershed to protect the narrative criteria (WQIR p. 48). Ecology used sediment yield data to estimate current loading from natural sources and unaccounted sources (assuming known human sources are eliminated) to derive a loading capacity of 21,615 yd^3/year (WQIR pp. 46-47). Ecology also targets a loading capacity of attaining a percent deposited fines of less than <12% (WQSF p. 181). Both of these loading capacity expressions are evaluated below.

- <u>Embedded Fine Sediment</u>
  As described in Section 4.6.1, EPA concludes that a 12% embedded fine sediment target is protective of narrative and designated uses. Therefore, load capacities based on this value are established at levels necessary to attain water quality standards.

- <u>Fine Sediment Yield</u>
  As described in Section 4.6.2, there is not an analytical linkage between the embedded fines target of 12% and the sediment yield loading capacity of 21,615 yd^3/yr. To get a sense of the scale of reduction, EPA compared the percent reductions required by both targets, though a direct comparison is not possible since the embedded fines percentage and sediment yield are measures of different parameters. Ecology identified that a percent reduction in deposited fines in the range of 30% - 46% was needed to achieve the *in-situ* target of 12%. The sediment yield target of 21,615 yd^3/yr represents a 21% percent reduction from the current annual mean fine sediment load of 27,315 yd^3/yr (WQIR p. 47). Given these differences, EPA finds it has not been demonstrated that the fine sediment yield loading capacity is established at levels necessary to attain water quality standards.

In the Deschutes TMDL, Ecology includes NPDES targets for turbidity (WQIR Appendix C). These surrogates and implementation targets are listed in **Table 23** and discussed in Section 4.6.4.

*EPA finds that Ecology identified a fine sediment loading capacity for the Deschutes River watershed, which includes one segment, the Deschutes River, impaired by fine sediment and listed in **Table 2**. However, without sufficient linkage between the fine sediment yield loading capacity and the 12% embedded fine sediment target, EPA cannot assess whether such a loading capacity will meet targeted water quality conditions.*

***Table 23**. Summary of proposed fine sediment surrogate.*

Parameter	Surrogate or Implementation Target	Comments
Fine Sediment	Surrogate: Embedded Fine Sediment (%) Surrogate: Volumetric Sediment Yield (yd^3/year) NPDES Target*: Fine sediment and discharges shall not exceed 5 NTU over background when background is ≤ 50 NTU *or* 10% increase in turbidity when background is > 50 NTU	Ecology proposes to apply an embedded fine sediment threshold of 12% to achieve aesthetic criteria. Reductions in volumetric sediment yield from the watershed is proposed to achieve a reduction in EFS. (See WQIR p. 48 for surrogate discussion.)

*Implementation targets may differ slightly between permit types or be absent from the WQIR.

4.6.3.1. Considering Loading Capacities for Downstream Waters

Upstream and downstream criteria pairs are listed and described in Section 4.6.1.1. Numeric turbidity criteria for both the Deschutes River (upstream) and Capitol Lake (downstream) are the same. The Deschutes TMDL documents do not identify Capitol Lake as being impaired by the current sediment loading regime. Therefore, loadings developed to address fine sediment impairments in the Deschutes River should be protective of the downstream uses in Capitol Lake.

EPA finds the sediment TMDL for the Deschutes River was developed in a manner that meets downstream water quality criteria.

4.6.4. Wasteload Allocations

Ecology assigns the entire loading capacity to the LA (WQIR p. 74). Thus, application of the TMDL equation yields a fine sediment WLA of 0 yd^3/day. This is shown in Table 34 of the WQSF (p. 184). However, the Deschutes TMDL then includes turbidity WLAs for point source dischargers, as surrogates for fine sediment (WQIR Appendix C). This is not consistent with a 0 yd^3/day fine sediment WLA.

Given the disparity between the 0 yd^3/day fine sediment WLA and the assignment of non-zero turbidity WLAs to point sources in the Appendix, EPA finds that Ecology did not calculate WLAs that will achieve the fine sediment water quality targets for meeting the narrative aesthetic criteria.

4.6.5. Load Allocations

In the Deschutes TMDL, the LA is set equivalent to the loading capacity of 21,615 yd^3/yr (59 yd^3/day) (WQIR pp. 74-46). Ecology also identifies locations corresponding to percent reductions in embedded fines (WQIR p. 76). However, as concluded in Section 4.6.3, the fine sediment yield of 21,615 yd^3/yr has not been demonstrated as protective of the embedded fines target of 12%.

Thus, EPA finds that Ecology did not adequately identify a fine sediment LA that will achieve the fine sediment water quality targets for meeting the narrative aesthetic criteria.

4.6.6. Margin of Safety

Ecology proposes an implicit MOS for fine sediment based on certain assumptions. These assumptions are listed and evaluated as follows:

- The TMDL reductions were based on meeting good habitat quality conditions for fine sediment in gravels (12% fines) instead of only fair habitat quality (12 to 17% fines). EPA concludes this rationale could be considered a conservative assumption if Ecology determined the "fair range" of embedded sediment also represented full attainment of water quality standards. However, the Deschutes TMDL identifies good habitat conditions as representing water quality standards attainment (WQIR pp. 18-19).

- In addition, LAs were based on the high estimate of sediment budget inputs using the 2-mm threshold. EPA believes additional information is needed to understand how the high estimate of sediment budget inputs represents a conservative assumption that also meets water quality standards and considers critical conditions. More specifically, it is not clear based on the information provided that a greater rather than lesser percent reduction relative to existing conditions would occur.

EPA also notes that Ecology did not provide a quantitative linkage between the targeted embedded fines percentage and the fine sediment loading capacity. Absent that linkage, uncertainty between LAs and water quality is substantial. Given these linkage uncertainties and considerations summarized above, EPA concludes the implicit MOS for fine sediment is not supported by information provided in the Deschutes TMDL.

EPA finds the assumptions used in determining the fine sediment loading capacity for the Deschutes River do not represent an appropriate implicit MOS.

4.6.7. Seasonality and Critical Conditions

Seasonal variation is incorporated into watershed yield sediment loads by the use of long term estimates of natural sediment generation and delivery rates. These rates and loads are developed over the full historic range of seasonal flows, from peak to base flow conditions. Therefore, EPA agrees with Ecology that seasonal variation and critical conditions have been adequately incorporated into the Deschutes TMDL.

EPA finds that Ecology considered seasonal variation in developing the fine sediment TMDL for the Deschutes River.

4.6.8. Reasonable Assurance

As explained in Sections 4.6.4 and 4.6.5, EPA does not find the LA or WLA acceptable for addressing the fine sediment impairment.

*Thus, EPA cannot evaluate reasonable assurance for the fine sediment impaired segment identified in **Table 2**.*

4.6.9. Summary of Action

EPA disapproves the only fine sediment TMDL (Listing ID 6232) included in the 2015 submittal, which is for the Deschutes River mainstem and identified in **Table 24**.

***Table 24**. Summary of EPA action on fine Sediment TMDL.*

Waterbody	1996 Listing ID	Current Listing ID	Parameter	EPA Action
Deschutes River	WA-13-1020	6232	Fine Sediment	Disapprove

EPA is disapproving the TMDL for this waterbody for the following reasons:

1) There is no linkage analysis to demonstrate how the TMDL target chosen to protect water quality standards (12% embedded fine sediment) can be achieved with the assigned loading capacity. Without such a linkage, EPA cannot determine whether the definition of a loading capacity, as defined in 40 CFR § 130.2(f), is met.

2) The assumptions used to calculate the loading capacity for sediment do not provide a sufficient justification for an implicit MOS, particularly due to the lack of quantitative linkage between the TMDL target and loading capacity.

References

Davies, T. 1997. Memorandum to Water Management Division Directors, Regions 1-10 State and Tribal Water Quality Management Program Directors. Establishing Aquatic Life Criteria Equal to Natural Background. Office of Water, Washington DC.

Packman, J., K. Comings, and D. Booth. 1999. Using turbidity to determine total suspended solids in urbanizing streams in the Puget Lowlands: in Confronting Uncertainty – Managing Change in Water Resources and the Environment, Canadian Water Resources Association annual meeting, Vancouver, BC, 27-29. October 1999.

Roberts, M., Ahmed, A., Pelletier, G., and Osterberg. 2012. Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, DO, pH, and Fine Sediment Total Maximum Daily Load Technical Report. Water Quality Study Findings. Washington State Department of Ecology. Olympia, Washington.

Stohr, A., Kardouni, J., Svrjcek, R. June 2011. Snoqualmie River Basin Temperature Total Maximum Daily Load, Water Quality Improvement Report and Implementation Plan. Publication No. 11-10-041. Washington Department of Ecology. Olympia, Washington.

United States Environmental Protection Agency (EPA) 2015. A Framework for Defining and Documenting Natural Conditions for Development of Site-Specific Natural Background Aquatic Life Criteria for Temperature, DO, and pH: Interim Document. EPA 820-R-15-001. Office of Water, Washington DC.

United States Environmental Protection Agency (EPA) 2014a. Protection of Downstream Waters in Water Quality Standards: Frequently Asked Questions. EPA-820-F-14-001. Office of Water. Washington, DC.

United States Environmental Protection Agency (EPA) 2014b. Revisions to the November 22, 2002 Memorandum "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs." Office of Water, Washington, DC.

United States Environmental Protection Agency (EPA). 2012. Considerations for the Development of Multijurisdictional TMDLs. *Draft for Review*. Office of Water, Washington, DC.

United States Environmental Protection Agency (EPA). 2007. Options for Expressing Daily Loads in TMDLs. Office of Water, Washington DC.

United States Environmental Protection Agency (EPA). 2006. Memorandum: Establishing TMDL Daily Loads in Light of the Decision by the US Court of Appeals for the DC Circuit in *Friends of the Earth Inc. v. EPA et al., No. 05-5015* (April 25 2006) and Implications for NPDES Permits. From Benjamin Grumbles to National and Regional Water Division Directors.

US Environmental Protection Agency (EPA) 2005. EPA Region 10 Natural Conditions Workgroup Report on Principles to Consider When Reviewing and Using Natural Conditions Provisions. Office of Water and Watersheds, Seattle, WA.

United States Environmental Protection Agency, 2003 (EPA). 2003. Draft - Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS) – Potential Approaches. A U.S. EPA Science Advisory Board Consultation. Office of Water. Washington, DC.

United State Environmental Protection Agency (EPA). 2002. Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992, May 20, 2002. Office of Water, Washington DC.

United State Environmental Protection Agency (EPA). 1999. Draft Guidance for Water Quality-based Decisions: The TMDL Process (Second Edition). EPA 841-D-99-001. Office of Water, Washington DC.

United State Environmental Protection Agency (EPA). 1992. Memorandum: Favorable Supreme Court Decision Concerning Interstate Water Pollution. From Raymond Ludwiszewski to William Reilly. Office of Water, Washington DC.

United State Environmental Protection Agency (EPA). 1991. Draft Guidance for Water Quality-based Decisions: The TMDL Process (First Edition). EPA 440/4-91-001. Office of Water, Washington DC.

Wagner, L. and Bilhimer, D. 2015. Deschutes River, Percival Creek, and Budd Inlet Tributaries Temperature, Fecal Coliform Bacteria, DO, pH, and Fine Sediment Total Maximum Daily Load. Water Quality Improvement Report and Implementation Plan. Washington Department of Ecology. Olympia, Washington.

Appendix A. Crosswalk of Listing ID changes made from 2010 to 2012 303(d) listing cycle

Waterbody Name	2010 Listing ID	2012 Listing ID Changes[1]	2012 Integrated Report Category[2]	Parameter
Adams Creek	45462		5	Bacteria
	45695		5	Bacteria
	50965		5	pH
Butler Creek	45471	45342	2	Bacteria
Butler Creek, SW F	45342		2	Bacteria
Ellis Creek	45480		5	Bacteria
Indian Creek	3758		5	Bacteria
	45213	3758	5	Bacteria
	46410	3758	5	Bacteria
	---	74218	5	Bacteria
Mission Creek	45212		5	Bacteria
	46102	45212	5	Bacteria
Moxlie Creek	3759		5	Bacteria
	3761		5	Bacteria
	45252	3761	5	Bacteria
	46432	3761	5	Bacteria
Schneider Creek	45559		5	Bacteria
Ayer (Elwanger) Creek	5849		1	Bacteria
	5850		5	pH
	5851		5	DO
	---	73229	5	Temperature
Chambers Creek	45560		1	Bacteria
Deschutes River	46499		1	Bacteria
	46500		1	Bacteria
	9881		1	Bacteria
	10894		5	DO
	47753		5	DO
	47754		5	DO
	46210		1	Bacteria
	6576		5	Temperature
	7590		5	Temperature
	48710	6576	5	Temperature
	48711		5	Temperature
	48712	48711	5	Temperature
	48713		5	Temperature
	48714	48713	5	Temperature
	48715	48713	5	Temperature
	48717		5	Temperature
	48718		5	Temperature
	9439		5	Temperature
	47756		5	DO
	6232		5	Fine Sediment
	7588		5	Temperature
	7592		5	Temperature
	7593		5	Temperature

Waterbody Name	2010 Listing ID	2012 Listing ID Changes[1]	2012 Integrated Report Category[2]	Parameter
	7595	7592	5	Temperature
	48720	9439	5	Temperature
	48721	9439	5	Temperature
	48724		5	Temperature
	48726		5	Temperature
Huckleberry Creek	3757		5	Temperature
Lake Lawrence Creek	47696		5	DO
Reichel Creek	3763		5	Bacteria
	45566	3763	5	Bacteria
	47714		5	DO
	48666		5	Temperature
Spurgeon Creek	46061		5	Bacteria
Tempo Lake Outlet	48696		5	Temperature
Unnamed Spring to Deschutes River	48923	48713	5	Temperature
Black Lake Ditch	47761		5	DO
	47762	47761	5	DO
	50990	50989	5	pH
	48733		5	Temperature
	48734	48733	5	Temperature
	48735	48733	5	Temperature
Percival Creek	46103		1	Bacteria
	46108	46103	1	Bacteria
	48085		5	DO
	48086	48085	5	DO
	42321		5	Temperature
	48249	42321	5	Temperature
	48727	42321	5	Temperature
	48729		5	Temperature

[1]This column displays updated listing IDs for the 2012 303(d) list, approved on July 22, 2016. A blank space indicates that no updates were made. Many listing IDs were combined with, or rolled into, existing listing IDs for the 2012 303(d) list cycle.
[2]Verified using Ecology's Water Quality Assessment search tool, accessed at: https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx