DECISION RATIONALE

Final Revised Willamette Basin Mercury Total Maximum Daily Load

November 29, 2019

This decision rationale documents the U.S. Environmental Protection Agency Region 10 review of, and action on, the *Final Revised Willamette Basin Mercury TMDL* (the 2019 TMDL) [1]. The 2019 TMDL addresses waterbody impairments for mercury in the Willamette Basin. Based on EPA's comprehensive review, the 2019 TMDL does not meet the necessary statutory and regulatory requirements that a TMDL be established at a level necessary to implement, attain and maintain the applicable water quality standards and is therefore disapproved.

Section 303(d) of the Clean Water Act (CWA) identifies the statutory requirements for EPA review of state-submitted TMDLs. EPA's implementing regulations at 40 CFR §130.7(c) provide further detail. Section 130.7(c)(1) provides that each state shall establish TMDLs for the water-quality-limited segments identified by the state as impaired. Oregon has listed all the segments covered by the 2019 TMDL as not meeting Oregon's water quality standards for mercury, promulgated at OAR 340-042-0040(c); OAR 340-041-0033(1); OAR340-0418033(1) Table 30, and OAR 340-041-8033(3) Table 40. EPA previously approved Oregon's impaired waters lists in December 2018 and approved the water quality standards for CWA purposes in 2011. Section 130.7(c)(1) further provides that TMDLs

> "shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. Determinations of TMDLs shall take into account critical conditions for stream flow, loading, and water quality parameters."

Once developed by the state, all TMDLs (including their load and wasteload allocations) must be submitted to EPA for review and approval/disapproval (33 U.S.C. §1313(d)(2); 40 CFR §130.7(d)(1) and (2)).

The Oregon Department of Environmental Quality (ODEQ) released a draft of the 2019 TMDL for public review on July 3, 2019, with a public comment period lasting 63 days and ending on September 6, 2019. ODEQ subsequently finalized and submitted the 2019 TMDL and submission letter to EPA on November 22, 2019.

Based on its review, 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 has determined that the 2019 TMDL as submitted by ODEQ is not established at a level necessary to attain and maintain the applicable water quality standards. This is because the State has not demonstrated that the basin-wide approach, using a single loading capacity for the basin, would result in load and wasteload allocations in all subbasins that will achieve the 2019 TMDL target of 0.14 ng/l total mercury intended to ensure that the fish tissue water quality criterion is met. Therefore, the applicable water quality standard will not be met in every

[1] Final Revised Willamette Basin Mercury Total Maximum Daily Load. Oregon Department of Environmental Quality. November 22, 2019.

subbasin of the Willamette Basin following proposed load reductions. Eight of the seventeen water-quality-limited waters intended to be addressed by the TMDL are located in the three subbasins not attaining standards. EPA's rationale in support of its disapproval decision is presented below.

Table of Contents

Willamette Basin Mercury TMDL

1 Background

The *Final Revised Willamette Basin Mercury TMDL* (2019 TMDL) submitted by the Oregon Department of Environmental Quality (ODEQ) is an update to the original mercury TMDL approved by EPA in 2006. Litigation resulted in a voluntary remand of the 2006 TMDL. On October 4, 2019, the court ordered EPA to approve or disapprove ODEQ's revised mercury TMDL by November 29, 2019.[2] The 2019 TMDL covers mercury-impaired waterbodies in the Willamette River Basin in western Oregon, including 15 waterbody segments listed as impaired for mercury. The basin comprises twelve HUC8 (Hydrologic Unit Code) watersheds (Middle Fork Willamette, 17090001; Coast Fork Willamette, 17090002; Upper Willamette River, 17090003; McKenzie River, 17090004; North Santiam River, 17090005; South Santiam River, 17090006; Middle Willamette River, 17090007; Yamhill River, 17090008; Molalla-Pudding River, 17090009; Tualatin River, 17090010; Clackamas River, 17090011; and Lower Willamette River, 17090012). These impairments are due to mercury loadings predominantly from atmospheric deposition. The Willamette River flows south to north for about 187 miles and passes through Oregon's main population hubs of Eugene, Salem, and Portland, before discharging to the Columbia River. The Multnomah Channel and the Columbia Slough, which drain directly to the Columbia River, are located in the Lower Willamette River watershed and are therefore included in the mercury TMDL. The Willamette Basin drains approximately 11,460 square miles and is home to approximately 70 percent of Oregon's population. See Appendix A of this decision rationale for a map of the basin.

1.1 Segments Covered by the TMDL

Impaired waterbodies addressed in the 2019 TMDL include the entire mainstem Willamette River, major tributaries of the Willamette River, small creeks and canals, two reservoirs, and the Multnomah Channel. Eight of the impaired waterbody listings addressed in the 2019 TMDL were included in the 2006 TMDL; seven are subsequent listings. Impairments are identified in Section 4 of the 2019 TMDL. Waterbodies addressed by this TMDL and their locations within the subbasins and Willamette Basin are included in Appendix B of this decision rationale.

2 Applicable Water Quality Standards & Numeric Targets

In accordance with Section 303(d) of the CWA and EPA's implementing regulations at 40 CFR §130.7(c)(1), EPA has reviewed the Applicable Water Quality Standards identified and Numeric Targets developed by ODEQ and submitted to EPA for review.

2.1 Beneficial Uses

Water quality standards are adopted to protect the beneficial uses of waters of the state. Beneficial uses are presented for each impaired waterbody in Table 4-1 and discussed in Section 2 of the 2019 TMDL. Those uses include Fish and Aquatic Life, Wildlife and Hunting, and Fishing (fish consumption); the Fishing Use applies to the entire mainstem Willamette River and the major tributaries. The 2019 TMDL is written to the most sensitive beneficial use—fishing. Section 2 of the 2019 TMDL states that fish

[2] *Northwest Environmental Advocates v United States Environmental Protection Agency*, No. 3:12-cv-01751-HZ (D. Or., Oct. 4, 2019).

consumption advisories based on mercury concentrations in bass and northern pikeminnow fish tissue were first issued for the Willamette River in 1997 and remain active.

2.2 Applicable Criteria

Applicable water quality standards applied in the 2019 TMDL are presented in Section 3 of the 2019 TMDL and are summarized below. In 2011, EPA approved all of these criteria for Clean Water Act purposes.

- Toxic Substances Narrative. Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife or other designated beneficial uses (OAR 340-041- 0033).
- Aquatic Life Numeric Criteria. Levels of toxic substances in waters of the state may not exceed the applicable aquatic life criteria as defined in Table 30 under OAR 340-041-8033. The Table 30: Mercury (total) freshwater aquatic life chronic criterion is 0.012 µg/L.
- Antidegradation. Further degradation will be prevented by following Oregon's Antidegradation Policy (OAR 340-041-0004) that provides the requirements for making decisions when considering any increases in mercury load to streams and rivers in the Willamette Basin that ODEQ has authority to regulate.
- Total Mercury Target in the Water Column. The Human Health Numeric Criteria is based on a methylmercury (MeHg) fish tissue concentration. Total mercury (THg) supplies the pool of mercury available for methylation and is a useful measure of mercury sources in the Willamette Basin. ODEQ related the dissolved methylmercury in fish tissue in different fish species to total mercury concentrations in the water column to establish a total mercury water column target of 0.14 ng/l. See section 6.1.2 of the TMDL and Section 4 of the Technical Support Document for more background. Human Health Numeric Criteria. The criteria for waters of the state listed in Table 40 under OAR 340-041-8033 are established to protect Oregonians from potential adverse health effects associated with long-term exposure to toxic substances associated with consumption of fish, shellfish and water. The Table 40: Methylmercury fish tissue criterion is 0.04 mg/kg wet weight. This criterion protects fishing, which was determined to be the most sensitive beneficial use. The 2019 TMDL water quality targets are based on achieving compliance with this numeric water quality criteria.

3 ODEQ's TMDL Development Approach

3.1 Analytical Framework

Sections 5 and 6 of the 2019 TMDL summarize the analytical approach for calculating the mercury load capacity required to achieve the methylmercury fish tissue criterion of 0.04 mg/kg. Mercury sources were linked to total mercury water column concentrations and fish tissue methylmercury concentrations with three integrated models—a Food Web Model (FWM), a Mercury Translator Model (MTM), and a Mass Balance Model (MBM)—in a model linkage analysis (Section 5.2 of the 2019 TMDL).

These three models were also used in the development of the 2006 TMDL and were updated for the development of the 2019 TMDL to incorporate new data as described briefly in the 2019 TMDL, and in depth in the Technical Support Document (Appendix A of the 2019 TMDL).

ODEQ used the FWM and MTM to calculate the water column total mercury concentration target necessary to achieve the 0.04 mg/kg fish tissue target in the most sensitive higher tropic level fish species—the Northern Pikeminnow. The Northern Pikeminnow was chosen as the target species because it is the most efficient bioaccumulator of mercury of the species included in the analysis, and thus the most sensitive species for development of the associated water column target. Using the FWM and MTM, ODEQ established that a total mercury water column concentration of 0.14 ng/l is necessary to achieve the mercury fish tissue criterion in the Northern Pikeminnow. Using the water column target total mercury concentration of 0.14 ng/l, ODEQ concluded that the basin-wide loading capacity of mercury designed to achieve applicable water quality standards for the Willamette Basin is 43.36 g/day.

ODEQ calculated a median total mercury concentration to represent the existing mercury water column concentration throughout the Willamette Basin. ODEQ calculated basin-wide median total mercury concentrations with (1.6 ng/l) and without (1.2 ng/l) the Coast Fork HUC8 data because the Coast Fork mercury concentrations are higher than any other subbasin. ODEQ chose to use the median total mercury concentration of 1.2 ng/l (excluding the Coast Fork data) to represent the existing total mercury water column condition of the Willamette Basin.

ODEQ quantified the point and nonpoint sources contributing mercury to the stream network using the MBM. ODEQ determined the excess load as the difference between the loading capacity (43.36 g/day) and the existing load (361 g/day) computed from total mercury median concentration monitoring data in the basin. ODEQ calculated an excess load of 318 g/day for the Willamette Basin, requiring a basin-wide load reduction of 88%.

3.2 Median Total Mercury Concentration by Subbasin

Figure 7-1 in the 2019 TMDL (figure below) presents boxplots of observed total mercury concentrations at the subbasin level that were used in the draft 2019 TMDL issued for public comment, along with the calculated basin-wide median total mercury concentration of 1.2 ng/l. The boxplots are based on data collected by various entities from 2002 to 2017. This figure shows three subbasins—Coast Fork (17090002), Tualatin (17090010), and Lower Willamette (17090012)—with an observed median concentration above the basin-wide median of 1.2 ng/l. This figure shows that applying an 88% reduction basin-wide will not achieve the water column target in those subbasins. ODEQ subsequently located and incorporated additional water column monitoring data from 2017 through 2019 for the Tualatin and Lower Willamette HUC8s (not shown in the figure below). These additional data reflect current conditions and result in median concentrations that are lower, but still above the basin-wide median of 1.2 ng/l.

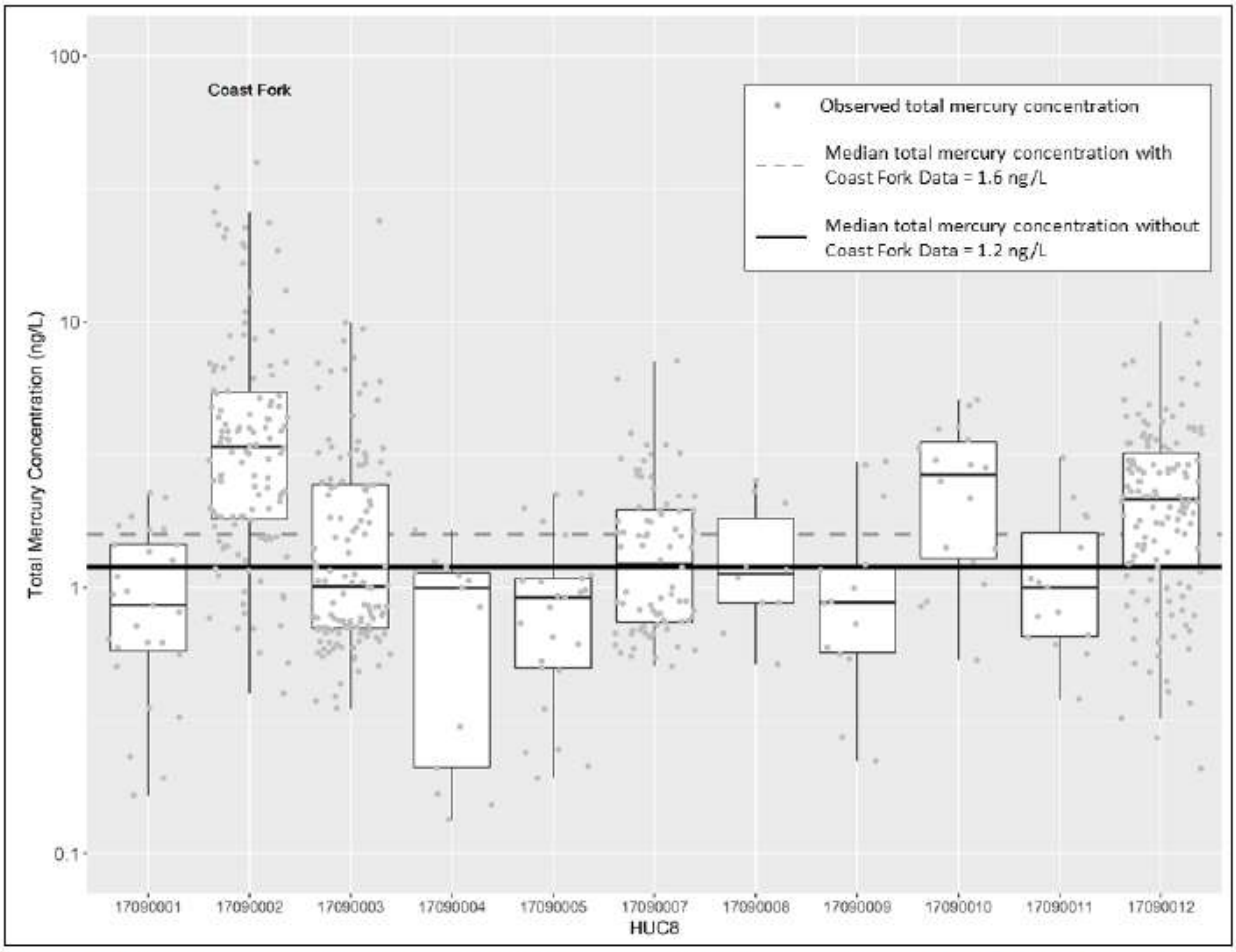


Figure 7-1. Boxplots of observed total mercury concentrations by HUC8 (See Table 1-2) and medians of entire data sets with data from Coast Fork and without.

3.3 Load Allocations

Table 10-1 in the 2019 TMDL (table below) displays ODEQ's calculations of the existing loads by nonpoint source and point source sector, along with the percent load reductions and load allocations required to meet the total mercury water column target and associated total mercury load capacity of 43.36 g/day[3] presented in the TMDL.

[3] The 2019 TMDL estimate of the total mercury load capacity was calculated using an outdated estimate of the existing load of 361.3 g/day minus an 88 percent reduction. The existing load estimate was revised to 360.6 g/day based on information received in public comments. Applying an 88% reduction to an existing load of 360.6 g/day would result in a total mercury load capacity of 43.27 g/day.

Table 10-1. Summary of TMDL Components.

Mercury Water Quality Criterion	0.040 mg/kg fish tissue
Total Mercury TMDL Water Column Target	0.14 ng/L
Total Mercury Loading Capacity	43.36 g/day or 15.83 kg/year

SOURCE SECTORS		EXISTING LOADS			ALLOCATIONS			
		g/day	kg/year	Relative Contribution to Total Load	Percent Reduction	g/day	kg/year	Relative Allocation of Load Capacity
NONPOINT SOURCES	**General Nonpoint Source and Background[1]** ***Captures***: Forestry, Agriculture, Water Impoundments, Water Conveyance Entities	341.74[2]	124.82[2]	94.5%[2]	88%[3]	29.68	10.84	68.46%
	Non-Permitted Urban Stormwater				75%	0.65	0.24	1.5%
	Atmospheric Deposition				11%	5.73	1.96	12.38%
	Legacy Metals Mines	4.00	1.46	1.1%	95%	0.22	0.80	0.5%
POINT SOURCES	**NPDES Wastewater Point Source Discharges**	4.44	1.62	1.2%	10%	4.12	1.50	9.5%
	NPDES Permitted Stormwater Point Source Discharges	11.31	4.13	3.2%	75%	2.90	1.06	6.7%
Reserve Capacity		Not Applicable			1%[4]	0.43	0.16	1.0%
Margin of Safety		Not Applicable			Implicit			
TOTALS		**361.49**	**132.03**	**100%**	**NA**	**43.36**	**15.83**	**100%**

Notes:
[1] Combines the following source categories from the TMDL Technical Support Document: Sediment Erosion, Surface Runoff, Groundwater, Atmospheric Deposition to Direct to Streams, Urban DMAs
[2] Existing loads for General Nonpoint Source, Non-Permitted Urban Stormwater and Atmospheric Deposition were calculated in combination, though allocations for these three source categories are assigned separately.
[3] There is an additional 3.5% overall reduction from General Nonpoint Source and Background that results from the 11% decrease in Atmospheric Deposition, which reduces the mercury in precipitation that generates surface runoff. The additional reduction is calculated from the output of the Mass Balance Model.
[4] Reserve Capacity is not allocated as a percent reduction, rather 1 percent of the allocated loading capacity will be reserved for any needed capacity for new or expanded point sources.

4 EPA's Review and Findings

4.1 Statutory and regulatory authority and relevant guidance

Under § 303(d)(2) of the CWA, EPA is charged with reviewing and approving or disapproving state-developed and submitted 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 the statute and 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 Final Revised Willamette River Total Maximum Daily Load, including "TMDLs Where Mercury Loadings are Predominantly from Air Deposition (EPA, 2008)."

4.2 Basin-wide allocations would not result in achieving the TMDL target for all impaired waterbodies.

The use of a large-scale approach in developing mercury TMDLs where mercury loadings are predominantly from atmospheric deposition is supported by EPA and is widely used. Given the challenges with managing impairments caused by atmospheric deposition, in 2008 EPA published detailed guidance to assist states in developing such TMDLs. In developing regional, statewide, or multi-state mercury TMDLs, EPA regulations at 40 CFR 130.7(c)(1) require that:

> *Each State shall establish TMDLs for the water quality limited segments identified in paragraph (b)(1) of this section, and in accordance with the priority ranking. For pollutants other than heat, TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. Determinations of TMDLs shall take into account critical conditions for stream flow, loading, and water quality parameters.*

EPA's 2008 guidance is consistent with this regulatory requirement. Mercury-impaired waterbodies are located in ten of the twelve subbasins in the Willamette Basin. As described above, using a calculated basin-wide median mercury concentration of 1.2 ng/l as a starting point, ODEQ used a basin-wide approach to establish a single mercury loading capacity for the entire basin. ODEQ calculated that this median concentration must be reduced by 88% in order to achieve the TMDL's total mercury water column target of 0.14 ng/l, and therefore that the current loading must be reduced by 88%. This percentage reduction was applied equally to mercury loading in all subbasins, except the Coast Fork, to derive the TMDL allocations by source category, shown in Table 10-1 above. In the Coast Fork subbasin, which contains significant legacy mining sources, a 95% load reduction from mining sources was provided, along with an 88% reduction to other nonpoint source categories. In the Coast Fork subbasin, the cumulative load reduction, expressed as a percentage across all categories combined, is 93%.

Data show, however, that the observed, existing mercury concentrations in three subbasins exceed the calculated basin wide median of 1.2 ng/l. Using data from the TMDL analysis, and updated concentration data for the Tualatin and Lower Willamette subbasins presented in the 2019 TMDL[4], and applying the percent reductions called for in the TMDL, the resulting total mercury concentration can be calculated, as shown in the table below:

[4] After the public comment period, ODEQ included additional water concentration data for the Tualatin and Lower Willamette subbasins collected during 2012-2019.

Subbasin	Current mercury concentration (ng/l)	% reduction called for in TMDL	Resulting final concentration (ng/l)	TMDL target mercury concentration (ng/l)
Coast Fork	3.39	95% mines 88% other sources	0.24	0.14
Tualatin	1.32	88%	0.16	0.14
Lower Willamette	1.23	88%	0.15	0.14

As demonstrated in the last two columns of the above table, percent load reductions and load allocations established in the TMDL would not achieve the TMDL target in these three subbasins.

EPA raised this concern in its comments on the July 2019 draft TMDL (EPA 2019). ODEQ responded to EPA's comments (ODEQ, 2019; RTC), and included an additional Appendix I in the final TMDL in an attempt to address these concerns. Key points in their response are briefly paraphrased and addressed below:

> ODEQ Position: *Recalculation of existing mercury concentrations in two subbasins (Tualatin and Lower Willamette) lowers the needed percent reductions.*
>
> EPA Response: ODEQ used more recent data in these subbasins to calculate revised existing concentrations, which were found to be lower than those calculated from data used in the draft TMDL. However, the re-calculated existing concentrations (1.32 and 1.23 ng/l, respectively) still exceed the basin-wide median of 1.2 ng/l. Therefore, load allocations in the TMDL will still not achieve the TMDL target in these subbasins (as shown in the table above).
>
> ODEQ Position: *Conservative assumptions ensure TMDL target will be met*.
>
> EPA Response: ODEQ identified certain assumptions used in developing the TMDL and presented these assumptions as "conservative" in an effort to address EPA's concerns. EPA disagrees that reliance on these assumptions will ensure that the TMDL targets are met. Two of ODEQ's assumptions warrant discussion here. First, ODEQ indicates that applying percent reduction goals to "At Source" loads provides a level of conservatism, as compared to applying percent reductions to loads in the stream (Delivered loads) because the At Source loads are higher. We agree that the Delivered loads are less than the At Source loads due to transport losses. These transport losses are accounted for by including a fixed delivery ratio in load modeling. Because the At Source loads and the Delivered loads are linked by a fixed delivery ratio, there is no inherent conservatism in applying percent reductions to the At Source loads compared to the Delivered loads. An 88% reduction in the At Source load will result in, and be equivalent to, reducing the

Delivered load by 88%, even though the magnitude of the loads in these locations is different (EPA Memo, 2019).

A second assumption relied on by ODEQ is that the use of a median fish tissue target (0.14 ng/l) is conservative as compared to the use of a mean fish tissue target (0.23 ng/l). Through use of the Food Web and translator models, both a median (0.14 ng/l) and mean (0.23 ng/l) total mercury concentration target was derived (TSD, Table 4-4). EPA agrees that selection of the median as the target is preferable because mercury accumulation in fish tissue occurs over long-term exposure and the median concentration better depicts long-term exposure concentrations compared to the mean. If a mean target is used, all comparisons would need to be based on the mean, not comparing the mean target to the median water concentrations. However, components of the TMDL (i.e., loading capacities and allocations) must still be established to meet the selected target. EPA cannot consider other possible targets when evaluating if ODEQ's TMDL will achieve the target the State selected.

ODEQ's TMDL, as submitted, does not demonstrate that the instream water quality standards-target for mercury will be met in all of the TMDL's subbasins. ODEQ's calculations show achievement of the instream target would not be met in the following subbasins: Coast Fork (17090002), Tualatin (17090010), and Lower Willamette (17090012). EPA concludes that, based on the instream concentrations and reduction targets selected by ODEQ, the TMDL will not lead to achievement of the applicable water quality standards throughout the basin.

5 EPA Decision

Based on its review of the final 2019 TMDL, 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 has determined that the 2019 TMDL, as submitted by ODEQ, does not demonstrate that the target of 0.14 ng/l total mercury, developed by ODEQ to ensure that the applicable fish tissue water quality criterion, will be met. EPA concludes that applying the basin reductions at a subbasin scale would not result in achieving the TMDL target in 303(d)-listed mercury impaired waters. Accordingly, the 2019 TMDL does not meet the applicable statutory and regulatory requirements and is disapproved by EPA.

6 References

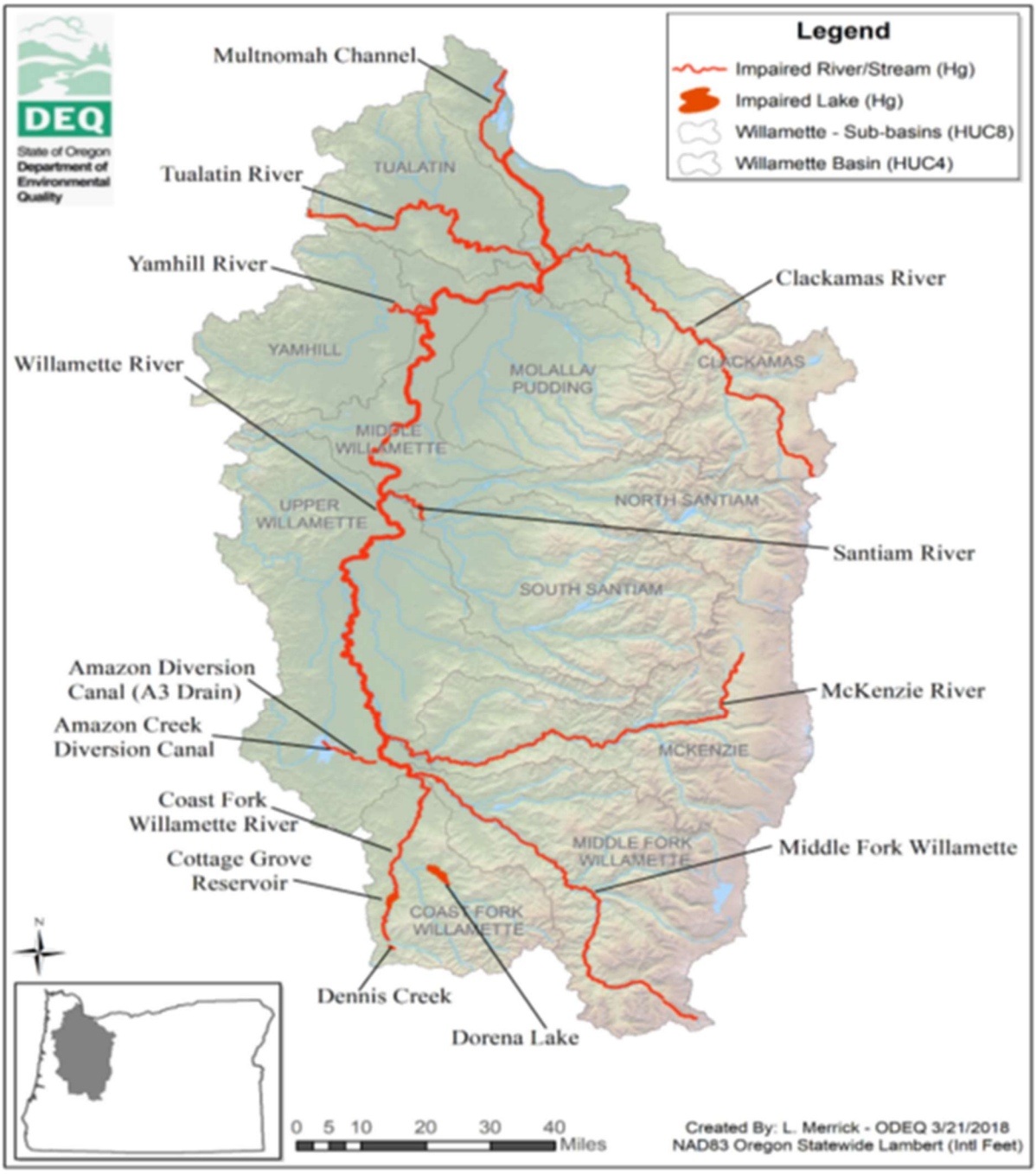
EPA Product by EPA Contractor. 2019. Mercury TMDL Development for the Willamette River Basin (Oregon)- Technical Support Document. (TSD).

EPA. 2019. Memo Administrative File- 2019 Willamette Basin Mercury TMDL. (EPA Memo, 2019).

EPA. 2008. TMDLs Where Mercury Loadings are Predominantly from Air Deposition (EPA, 2008).

ODEQ. 2019. Final Revised Willamette Basin Mercury Total Maximum Daily Load. November 22, 2019. (2019 TMDL)

Appendix A: Willamette River Basin



Appendix B: Waterbody Segments Covered by the TMDL

Name	Miles	HUC8	Affected Use
Amazon Diversion Canal (A3 Drain)	0 to 3.9	17090003	Fish and Aquatic Life
Amazon Creek Diversion Canal	0 to 6.6	17090003	Fish and Aquatic Life
Yamhill River	0 to 11.2	17090008	Fishing Consumption
Coast Fork Willamette/ Cottage Grove Reservoir	28.5 to 31.3	17090002	Fishing (Consumption)
Row River/ Dorena Lake	7.3 to 11.9	17090002	Fishing (Consumption)
Clackamas River	0 to 83.2	17090011	Fishing (Consumption)
Tualatin River	0 to 80.7	17090010	Fishing (Consumption)
Multnomah Channel	0 to 21.7	17090012	Fishing (Consumption)
Middle Fork Willamette River	0 to 82.2	17090001	Fishing (Consumption)
Coast Fork Willamette River	0 to 38.8	17090002	Fishing (Consumption)
Coast Fork Willamette River	31.3 to 38.8	17090002	Fish and Aquatic life; Fishing (Consumption)
McKenzie River	0 to 84.8	17090004	Fishing (Consumption)
Dennis Creek	0 to 1.4	17090002	Fish and Aquatic life;
Santiam River	0 to 26.2	17090005	Fishing (Consumption)
Willamette River	0 to 186.6	17090003 17090007 17090012	Fishing (Consumption)