American Fisheries Society
Western Division

July 16, 2020

U.S. Environmental Protection Agency, Region 10
Attn: Columbia and Lower Snake River Temperature TMDL
1200 Sixth Avenue, Suite 155
Seattle, WA 98101-3188

Dear Sir or Madam:

On behalf of the 3,000 members of the Western Division of the American Fisheries Society (WDAFS), we respectfully submit the following comments, drafted by a subcommittee of the WDAFS Resource Policy and Environmental Concerns Committee, in response to the draft Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load (TMDL).

WDAFS represents scientists and natural resource managers from the states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; Mexico; U.S. associated entities in the West Pacific Ocean; the Province of British Columbia; and the Yukon Territory in Canada. Our mission is to improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals. Our members represent a tremendous array of fisheries experts involved in all aspects of the fisheries profession and are employed in academia, government agencies, nongovernmental organizations, and private consulting.

WDAFS understands that the TMDL addresses the difficult task of specifying the maximum amount of additional heat pollution (expressed as temperature) that the Columbia and Lower Snake Rivers can receive given that they currently exceed water quality standards. WDAFS' comments focus on the fisheries and aquatic science contained in the draft TMDL, particularly as it relates to the sustainability of fisheries and, in particular, socially and economically important anadromous fisheries. Our review outlines what we deem as useful and noteworthy content, concerns, and questions we wish to see addressed in the final version of the TMDL.

Useful and Noteworthy Content:

First, the WDAFS commends the USEPA for drafting a TMDL that contains six very useful components:

1. It is relatively timely given that the 2019 Biological Opinion on the continued operation of the Federal Columbia River Power System (FCRPS) failed to consider the thermal effects of its dams and reservoirs in a rigorous manner (NMFS 2019).

2. The TMDL offers a fairly thorough assessment of the widespread and severe impairments (Figure 1.1 and Table 3.5) and other thermal concerns on the Columbia and Lower Snake Rivers in the states of Oregon and Washington.
3. Its Appendix G documents the thermal effects of climate change in the FCRPS since the 1970s.
4. By documenting the thermal effects of the FCRPS, it indicates that additional management alternatives need to be strongly considered together to improve the likelihood of survival for salmon and steelhead populations such as irrigation withdrawals, harvest, dam removal, reservoir releases, tributary restoration, and thermal point source management.
5. The TMDL maps the discrepancies in temperature criteria for salmon between Oregon and Washington on the Lower Columbia River, as well as between those two states and Idaho on the Snake River.
6. It lists and maps the major coldwater refuges on the lower Columbia River.

Concerns:

Although we recognize that the TMDL contains many useful elements, the WDAFS also has several major concerns. We provide a comprehensive list of these concerns below, and while we think all of them are important we think the first 7 are the most important:

1. The effects of climate change should be integrated more throughout the TMDL. The climate projections suggest huge challenges of meeting the TMDL with local solutions. Not only will the mainstems (Columbia and Lower Snake Rivers) be affected, but the tributaries and the CWRs currently acknowledged will also be affected by this warming. Although the climate information is presented in Appendix G, the TMDL should better integrate and highlight those risks for management agencies, policy makers and the general public throughout the document.

2. The TMDL omits discussion of other tributary impairments, anthropogenic versus natural heating of tributaries, tributary TMDLs, Cold Water Refuge (CWR) impairments, and corrective actions. Instead, the TMDL focuses narrowly on the mainstem Columbia and Lower Snake Rivers, thereby ignoring the fundamental relationship between mainstem rivers and their entire drainage basins (Colvin et al., 2019).

   The Idaho cold water criteria in the Snake River are a daily maximum (DM) of 22ºC and an average daily maximum (ADM) of 19ºC versus a Washington DM of 19-20ºC and ADMs of 16-17.5ºC and an Oregon DM and ADM of 20ºC. It seems irrational for EPA to allow such wide discrepancies in rivers that cross or share state boundaries, share the same salmon and steelhead populations and life histories, and have similar use designations for salmon and steelhead migration, spawning and rearing. The connection between mainstem rivers and their entire drainage basins needs to be clearly reflected in the final TMDL if temperatures are to be reduced to achieve restoration of sustainable and harvestable wild salmon and steelhead populations in these rivers.

   Similarly, the TMDL is limited only to Oregon and Washington; however, most of the Columbia and Snake River flows and thermal loads originate in British Columbia and Idaho. As in Oregon and Washington, much of the thermal loading that occurs in Idaho and British Columbia results from land and water uses and the TMDL should not ignore these upstream sources.

3. We are concerned about further relaxing temperature standards. The TMDL suggests that Washington and Oregon should develop Use Attainability Analyses (UAAs) that would potentially result in injurious designated uses and thermal criteria for salmon and steelhead for at least the Columbia and Lower Snake Rivers. Those UAAs would further lower the likelihood of sustaining, let alone rehabilitating, viable and harvestable salmon and steelhead populations in the basin.

4. We are concerned about the interpretation of the 0.3°C aggregate load allocation being misinterpreted. Different people that reviewed the document had different interpretations of what this aggregate allocation meant. Some thought is was, for example, a per dam allowance, which could result in a cumulative 4.5°C allocation across all dams in the system, which is substantial and doesn't even include the other NPDES and tributary allocations (Table 6-3). The aggregate load allocation should be defined clearly in the front of the TMDL and be periodically repeated in the document as needed to minimize misunderstanding its meaning.

5. No model was provided for estimating the natural, background temperature conditions of the Columbia and Lower Snake Rivers and waters flowing into them. This is a serious oversight given that current temperatures are driven by natural conditions as well as by anthropogenic climate change, land uses, and dams/reservoirs throughout the basin. The rationale for not including a natural condition provision (pg. 11) is not well substantiated. It seems useful to have a reasonable estimate of background (i.e., natural, reference conditions) for temperatures for use as a baseline and an effort should be made to develop one since one does not exist (Hughes et al. 1986; McAllister 2008; Angradi et al. 2009).

6. It is not clear from the information provided that the TMDL presents a heat loading scheme, the negative impacts of which can overcome the limited refuge habitat available. There are 12 primary coldwater refuges that constitute 97% of total CWR habitat in the Lower Columbia River. Of these, 6 are on the Washington side of the Columbia River mainstem and 6 are on the Oregon side. Information provided in the TMDL attests to steelhead seeking CWR habitat when river temperatures exceed 20ºC and fall Chinook when water temperatures exceed 20-21ºC. In the temperature range 20-25º, in addition to the need to seek cold refuge and recover from migration stress, adult salmon encounter incipient lethal temperatures at 21-22ºC (Sockeye and Chinook, respectively). In addition, incipient lethal temperatures occur for juvenile salmonids at 25ºC, and impaired reproductive capacity, bioenergetic depletion, and increased disease-related mortality of adults and juveniles occur at those temperatures as well (McCullough 1999, McCullough et al. 2003). Residence times in refuges can be prolonged because of high migration temperatures. It is helpful to have as much CWR habitat in the system as possible, especially when Columbia River temperatures reach 23ºC during migration. However, it is not clear from information provided that the TMDL presents a heat loading scheme wherein negative impacts can be overcome by the limited refuge habitat available. To use the CWR available during upstream migration, adults must cross the mainstem repeatedly to use them as stepping stones. The spacing of CWRs in relation to travel rates and times between CWRs could easily result in adult body temperatures exceeding safe levels and also result in bioenergetic depletion.

7. The DART monitoring sites at the dams (and therefore the RBM10 model estimates) provide unrepresentative measurements of total river conditions, including nearshore,

dam forebays, and adult fish ladders that salmon must pass through. Water at these river locations is not well mixed and is often much warmer than ambient river temperatures in the summer (Caudill et al. 2013). If temperatures in the mixed and aerated waters near the monitoring sites below dams are not the same as those in surface and slowly flowing waters where many salmon and steelhead migrate, the model may significantly underestimate threats to the fish (Caudill et al. 2013; Keefer and Caudill 2016).

8. Exposure of juveniles to high surface water temperatures was not referenced in the TMDL, but average river temperatures have often resulted in high incidence of disease-caused mortality of juveniles (Maule et al. 1996; McCullough 1999).

9. The TMDL provides insufficient assessment of the effects of irrigation withdrawals and returns, despite their effects on the volume of water in the mainstems and ground water, as well as how return flows could either warm or cool the mainstems, depending on how and when that water is returned. The single evaluation done on Banks Lake does not constitute a complete analysis of the impact of irrigating 6.5 million acres of land in the Columbia River basin. Groundwater pumping from aquifers bordering the mainstem (National Research Council 2004) may be significantly depleting cold water entry into the river. Current water withdrawals in July on the Columbia River average 6.8–8.6% of mean flows. Under minimum July flows, the proportion of water withdrawal climbs to 16.8%. Under proposed increases in withdrawals, this would increase to about 21% of total flow (National Research Council 2004). Given that return flows are likely much warmer during the high withdrawal periods, the lack of analysis of this impact is a major oversight.

   Burns et al. (2012) evaluated 60,000 wells in the Columbia Plateau Regional Aquifer System (CPRAS), which covers an area of about 44,000 mi^2 in Oregon, Washington, and Idaho. This study found very rapid declines in groundwater levels throughout this region, which have resulted in reduced groundwater flows toward the Columbia and Snake Rivers. This great reduction in cold groundwater inflow to the mainstems would likely impair river temperatures and eliminate river margin cold refuges. This impact was not modeled in the TMDL. WDOE’s groundwater mapping and monitoring service (https://apps.ecology.wa.gov/eim) reveals extensive pumping of groundwater from aquifers adjoining the Columbia River and in its tributary watersheds.

10. A total maximum daily load (TMDL) is expected to set load reductions of that pollutant that are needed to limit its pollution sources through wasteload allocations from point sources and load allocations from diffuse sources. The TMDL does this in a very cursory manner. Instead, it leaves allocations up to the States, which were unable to establish temperature TMDLs for the Columbia and Lower Snake Rivers in the first place—let alone waste loads. To sustain salmon and steelhead, the EPA must play a much greater role with the FCRPS because three States and British Columbia have failed to manage their thermal loadings.

11. The TMDL is exclusively focused on peak summertime temperatures. This certainly is biologically significant with respect to adult migration of sockeye, steelhead, Chinook, and downstream juvenile migration. However, pre-spawning and spawning temperatures tend to be overlooked in the TMDL.

For example, the RBM10 current temperatures for Hanford Reach is 18.76ºC, whereas the RBM10 free-flowing temperature is 17.26ºC (Appendix D, Table 3-6). It had already been noted that temperatures delivered from Canada have been elevated (3.2ºC in August, and 2.2ºC in September). Even by October when substantial numbers of fish are migrating, the average temperature in the Columbia River under current conditions is 2.68ºC warmer than under the free-flowing scenario. Fig 6-4 highlights these high fall water temperatures. This indicates that fall Chinook currently are undergoing pre-spawning and spawning at temperatures significantly exceeding free-flowing norms. Protection of the entire life cycle is critical in terms of setting standards as well as in creating a TMDL that protects the beneficial uses.

12. The purpose of a TMDL is to limit heat loads so as to meet acute impacts, not just average or chronic impacts. The draft TMDL gives very little consideration to impacts on the temporal or spatial distribution of water temperature and the probabilities of having multiple annual events in a series that could affect salmon populations through acute impacts. Probabilities of co-occurring high air temperature and low river flows would lead to variations in level of biological impact. In addition, the variations in flows and temperatures as boundary conditions should be explored for biological impact. For example, the ability of Dworshak Dam to counteract the warming that is produced in the lower Snake River seems to be taken as a constant. Alternative dam operations to counteract drought and low Dworshak Reservoir levels so as to manage river temperatures should be described. Impacts tend to be smoothed out by use of monthly averages. Management of loads to not produce acute impacts is as important as avoidance of chronic impacts. Greater frequency of acute temperatures, such as those observed in 2015 (Isaak et al. 2018), emphasizes that heat loading in the TMDL must also account for maximum temperatures and not just average conditions.

    Oregon promotes maintenance of the “natural thermal pattern” (NTP) in temperatures (p. 9). Oregon needs to ensure that diel thermal exposure during migration does not impair salmon migration or survival if daily minima are increasing as well as maxima. Oregon’s temperature standard includes the goal of maintaining an NTP. However, the DART data for The Dalles Dam 5-day average daily (5DAD) temperature for the period 1995-2020 show a prolonged period of 5DAD temperature from July-September starting with years 2013-2019. The EPA TMDL was only based on years 2011-2016. The years 2013-2016 showed extensive periods in July and August where temperatures exceeded criteria at Bonneville Dam (Appendix B, p. 35) by 2-3ºC. If the TMDL were to include years 2017-2019, it would incorporate several years in which temperatures have been so extreme that interference with migration, metabolic stress, reproductive success, and increased incidence of disease are likely to have cause increased mortality (McCullough 1999, McCullough et al. 2003).

    It is stated in the TMDL (p. 22) that temperature exceedances decline significantly in the Lower Snake River in September, whereas criteria are exceeded virtually continuously in August. For temperatures to decline to reach appropriate spawning temperatures in the fall Chinook spawning period, it is important to follow a natural pattern of decline so that adults do not accumulate lethal temperature loads during holding and gamete maturation periods. Biologically meaningful coldwater refuges have not been identified for the Snake River in the fall Chinook spawning period area. The natural thermal regime and potential of multiple occurrences of acute temperature impacts to fish should have been included.

13. Effluents should not be assumed to be benign simply if they match an overheated ambient river temperature. It appears that the TMDL assumes that the Portland sewage treatment plant releases a constant temperature discharge all year (Table 6-12). It is not stated what the discharge temperature is in July, August, and September. Also, the ability of this discharge to heat the Columbia River during these months depends upon the temperature differential between the river and the sewage flow (gpm) and temperature. Discharging heated effluent into a river that is already overheated may not produce much additional heating, but it certainly does not provide a cooling effect. The ability of any discharge to heat the mainstem should be compared to the temperature of the river at its historical, baseline flow (i.e., compared to the temperature target for that location along the river). The effluent target temperature should be equal to the river target temperature or less. Likewise, in tributaries, point source and non-point source temperatures entering tributaries should not exceed the temperatures set as water quality standards after mixing for those stream segments and should be less so to meet water quality standards at the downstream extent of each thermal zone (e.g., 16, 18, or 20ºC).

    Oregon's Division 41 temperature standards state: "Following a temperature TMDL or other cumulative effects analysis, waste load and load allocations will restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after complete mixing in the water body, and at the point of maximum impact." Temperatures already exceed criteria significantly in many locations and months. It is also conceded that dams produce cumulative temperature increases.

14. There is a small amount of topographic shading that occurs in the mid-Columbia reaches that is not accounted for. In Rocky Reach alone, Dr. Scott Wells estimated using CE-QUAL-W2 modeling that topographic shading could result in a maximum temperature impact on the Columbia River of 0.06ºC (S. Wells, Portland State University, personal communication). By ignoring this small but physical source of cooling by its use of RBM10 EPA, in effect, the TMDL reserves this as a further thermal load to be filled by heat inputs.

15. EPA (2002) showed using field data in Lake Roosevelt that "the reservoir does stratify under certain circumstances and that downstream temperatures can be affected significantly by withdrawing water from various levels of the reservoir." A different result was produced by BOR (2018) in which it claimed that despite the reservoir being deep and a "storage reservoir," it behaved more like a run-of-river reservoir and didn't produce reliable stratification. However, the BOR report notes that at times data at and below 240 feet from the forebay surface might not be available and there may be questions about the reliability of the data. This analysis also was based on only one USGS sensor. Consequently, it seems that there remain significant questions about an ability to use deep-water releases to cool the Columbia River downstream in summer.

Questions:

It would be helpful if the TMDL contained answers to the following questions to help readers interpret the document and take meaningful action to reduce thermal pollution in the Columbia and Lower Snake rivers:

1. Neither EPA nor the States have attempted to model tributary water temperature inputs after restoration of floodplains, channel width, hyporheic flows, historic channel structure (pools, LWD), or historic streamflows. Therefore, why does the TMDL suggest allowing further increases in tributary temperatures over the current criteria?

2. Why was a natural condition model not developed for this TMDL as has been done for others? Page 11 states that such a functional model does not exist, and therefore one was not used. However, one could have been developed in anticipation of this TMDL, especially given the level of impairment and the importance of these rivers to socially and economically important anadromous fisheries.

3. Why does the TMDL not outline a plan for collecting much-needed temperature data moving forward? The TMDL relies heavily on modeled as opposed to *in situ* temperatures throughout both rivers, and it is unclear how representative the temperature data used in the models is given that they are associated with dams in well-mixed zones. The consequences of this are unknown. A clear temperature data collection plan is needed. Both could be outlined in the TMDL.

4. Why does the TMDL not incorporate the TMDLs of all tributaries to the Columbia and Snake rivers, including the Middle Snake River? Why are these not mentioned? Will, for example, Idaho be accountable to deliver water to Washington waters in the Snake River so that its water temperature standards are met? TMDL Table 6-20 shows that 13 of 20 of the Columbia River principal tributaries do not have TMDLs completed. This is essential if management plans are going to be able to assist in meeting mainstem Columbia River temperatures. It took 20 years for EPA to assume its role in developing a mainstem TMDL. How will EPA insure that necessary tributary TMDLs will be developed?

5. Waste Load Allocations (WLAs) were calculated based on available data, but in many cases temperatures and volumes of discharges are not known. How will this necessary information be collected in the near future and how will it be factored into revisions to the TMDL and its WLAs?

6. What options are built into the TMDL to control Columbia and Snake River temperatures for migration in the July-September period? Will a natural thermal pattern, such as that used in Oregon, be produced by reducing water temperatures in September according to a natural pattern leading to fall Chinook spawning?

7. Why was the TMDL only based on years 2011-2016, when data from the years 2017-2019 also appear to be available and include additional warm periods? Provide a stronger justification for omitting recent years.

8. Is average water temperature the right metric, or should the TMDL focus on bigger temperature differentials in smaller locations in Cold Water Refuges as stepping stones

(or both)? How often did cold water refuges not meet standards, and if this happened, were the areas still designated as CWRs? Should the TMDL suggest incentives for creating additional, spatially-distributed coldwater refuges? There is an absence of CWRs above John Day Dam, and the TMDL should provide guidance on how to develop CWRs, such as by obtaining ground water rights that would then allow greater ground water releases to the rivers.

9. Why does the draft TMDL give very little consideration to impacts on the temporal or spatial distribution of water temperature and the probabilities of having multiple annual events in a series that could affect salmon populations? Probabilities of high air temperature and low river flows would lead to variations in level of biological impact, and variations in flows and temperatures should be explored as boundary conditions. For example, the ability of Dworshak Dam to counteract the warming that is produced in the lower Snake region seems to be taken as a constant. Alternate river operations to counteract drought and low Dworshak Reservoir levels so as to manage river temperatures should be described. Impacts tend to be smoothed out by use of monthly averages. The purpose of a TMDL is to limit heat loads so as to meet acute impacts, as well as average or chronic impacts. Management of loads to not produce acute impacts is as important as avoidance of chronic impacts. Greater frequency of acute temperatures as found in 2015 (Isaak et al. 2018) emphasizes that heat loading in the TMDL must also account for maximum temperatures.

10. Why does the TMDL not suggest general guidance on actions, perhaps in a separate section, for temperature reduction in the Columbia and Lower Snake rivers and their upstream tributaries? What might these options be? Appendix F to the TMDL states that it is unlikely that tributary restoration will occur to the extent that temperature reductions will be significant. Why? It also states that additional rehabilitation and mitigation options will be required. There are, in fact, science-based temperature reducing practices such as: limit water withdrawals, implement irrigation efficiencies (e.g., reduce use of center-pivot systems that increase evaporation), and use deep-water returns that cool water as opposed to open return ditches that flow directly into receiving waters; use deep-water (versus nearshore) returns for point sources to reduce thermal plumes injurious to migrating fish; reduce upstream heat sources (British Columbia and Idaho); require tertiary treatment of all point sources, including stormwater, to reduce the non-thermal stressors to thermally stressed salmon and steelhead (Yeakley et al. 2014); revegetate tributary riparian canopies to reduce their temperatures by 0.5ºC (Gregory et al. 1991; FEMAT 1993; McAllister 2008; Fuller et al. 2018); and address non-mixed stressful or lethal temperatures at or near fish ladders, dams, and other structures. Actions could also include developing hypolimnetic release capabilities during critical migration periods for storage reservoirs (Brownlee, Dworshak, Roosevelt) as has been done for Upper Willamette River storage reservoirs. The lag times between recognizing the thermally-caused loss of salmon populations, analyzing the use of these reservoirs for thermal maintenance, building a physical structure, implementing new flow releases, and measuring population recovery are so prolonged that this TMDL should already be laying out these details. The TMDL should also provide a vehicle for summarizing the cumulative proposed outputs of tributary TMDLs, their adequacy, and missing TMDLs and types of analyses based on current knowledge.

Thank you for the opportunity to review and comment on the draft Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load.

Regards,

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