Ecology's Response to Dispute Claims: Pend Oreille Temperature TMDL

Items SCL-1 & PUD-1: Maximum surface temperatures are not representative.

Each TMDL study is unique. TMDL development using a water quality model requires decisions on how to process and interpret the output from the model. These decisions center on the issue of how to combine (aggregate) data over time and space to be most representative of environmental conditions within the watershed. Data aggregation decisions are made on a case-by-case basis because each study is unique. The best method to examine water quality depends on a variety of factors such as the pollutant of concern, the applicable water quality criterion, the type of water-body, model output complexity, and margin of safety, among others.

TMDLs consider critical conditions to ensure protection of beneficial uses. In the Pend Oreille River temperature TMDL, Ecology decided not to aggregate modeled temperatures through the water column (for example, applying a water column averaging method such as the flow-weighted average). Aggregation would have reduced the resolution of the TMDL in identifying temperature variations and, therefore, minimize potential exceedances of the criteria and impairments to beneficial uses

TMDLs determine compliance with water quality standards. The special temperature criterion for the Pend Oreille River is a one-day maximum, requiring the use a maximum temperature to assess compliance. The temperature criterion is a threshold value that should not be applied as a water body average. Therefore, Ecology chose not to apply an averaging metric such as a flow-weighted average in the TMDL.

Ecology consistently stated its position on the use of the daily maximum temperature. Seattle City Light (SCL) and the Pend Oreille Public Utility District (PUD) have objected to the use of the maximum temperature since reviewing an August 2007 draft of the TMDL. Ecology has consistently explained its rationale for analyzing the maximum temperatures on the following occasions:

- June 26, 2007 letter to Barbara Greene from James Bellatty
- Dec. 13, 2007 meeting at the SeaTac Marriott
- Feb. 25, 2008 Watershed Advisory Group meeting in Newport
- May 12, 2008 meeting at the Spokane Airport Ramada Inn
- Sept. 16 2010 meeting with SCL and the PUD at Ecology's Eastern Regional Office (a hand out explaining the rationale was given to them during the meeting)

Ecology reviewed the use of the daily maximum temperature, in consideration of the PUD and SCL position. On May 7, 2008, Ecology held an internal peer review meeting between Water Quality and Environmental Assessment program staff. During this meeting, staff confirmed the application of the daily maximum temperature as the most appropriate temperature metric, consistent with the Pend Oreille River's special temperature criteria.

Petitioners' assertion that the TMDL analysis approach does not represent the river and the dominant aquatic habitat:

Temperature sampling and model development followed guidelines. The general temperature criteria include guidelines for taking temperature measurements and monitoring samples to represent the dominant aquatic habitat. The criteria stipulates that samples should not be taken at the water surface. The surface of the water is defined in Ecology's *Standard Operating Procedure for Manually Obtaining Surface Water Samples* as the top fifteen centimeters, or six inches. The one-meter deep cells used in the model extend beyond this depth. (The model used by the TMDL calculates average temperature within each cell, which extends from stream bank to stream bank, downstream for about a hundred meters, and one meter deep.) Conducting the TMDL analysis using one-meter-deep cells from the surface is consistent with Ecology's general approach to developing TMDLs. In addition, because modeling for TMDLs must consider critical conditions, assumptions made for modeling are not necessarily the same as those used for monitoring. Therefore, Ecology does not agree with the petitioners' assertions that the agency is not complying with the temperature criteria requirements.

The temperature criteria require a comparison between natural and existing conditions throughout the water column. The Pend Oreille River special temperature condition specifies that the natural temperature condition (i.e. prior to hydro-electric power generation, point source discharge, and reduction in riparian vegetation) be used as a reference for comparison to current (existing) temperatures conditions. However, the Box Canyon and Boundary dams have fundamentally changed the hydraulics of the Pend Oreille River in comparison to what occurred naturally. Currently, depending on location, water depths in the river vary significantly from what occurred naturally with the greatest changes occurring in the forebays of the Box Canyon and Boundary facilities.

During the summer critical period, when daily maximum temperatures exceed 20°C, the maximum water depth in the Box Canyon forebay is approximately 30 meters (100-feet) while the maximum depth in the Bounday forebay is about 70 meters (225-feet). Prior to the dams, maximum water depths, through these reaches, were in the 10s of feet. With the shallower depths, the natural condition water column was completely mixed with uniform temperatures. In comparison, the increased depths and water storage that characterize the existing condition has led to slight differences between the surface and bottom temperatures. Therefore, Ecology could not reasonably compare of the entire column of the reservoir to the natural condition of a shallower river. In addition, the use of flow-weighted average temperatures to assess existing temperature conditions exploits the slightly cooler lower water column temperatures to potentially obscure the impacts of warmer surface waters, particularly in the forebays. Washington's water quality standards discourage this approach.

For these reasons, Ecology does not agree that a flow-weighted average provides a more accurate and reliable representation of the river and aquatic habitat. Aquatic habitat encompasses the entire water column and the TMDL must include a margin of safety to ensure for the protection of these habitats. Using maximum temperatures in the water column is more conservative and, protective, thereby creating a margin of safety.

Petitioners' assertion that flow-weighted averages have been used for other hydropower projects:

Analysis approach is site specific. There is no single modeling approach or set of assumptions that have been applied to temperature assessments in recent 401 certifications for FERC hydro-electric dams. As mentioned earlier, TMDL modeling decisions are made on a case-by-case basis. Modeling decisions for TMDLs take into account the specific criteria and standards that apply to the given situation, the hydrologic features of the area, and other relevant information specific to the project.

SCL and the PUD pointed to the Rocky Reach 401 Certification as an example of where volume-weighted averages were used to determine temperature compliance. Rocky Reach is located on a part of the Columbia River that has a temperature criteria based on Class A waters. When EPA approved the 2003 water quality standards, the standards for Class A waters became the seven-day average of the daily maximum of 17.5^{o}C degrees Celsius. There is not a special temperature condition on this part of the Columbia River as there is for the Pend Oreille River. Ecology staff reviewed the modeled results and the assumptions that went into the Rocky Reach model and determined that it was reasonable to use when issuing a 401 certification for that project. EPA has not completed the temperature TMDL for the Columbia River. The Rocky Reach 401 certification states that if the resulting TMDL is more protective of temperature, such provisions would supercede any conflicting provisions in the 401 certification.

Petitioner's assertion that data are not representative per the Data Credibility Act:

The data used for the TMDL are credible. The Data Credibility Act pertains to water quality monitoring and the resulting data quality. Ecology staff collected temperature data consistent with the Pend Oreille River temperature quality assurance project plan (QAPP) (see Item PUD-4). Staff reviewed the results for data quality consistent with the QAPP.

Petitioner's assertion that modeling inconsistencies are not addressed in the TMDL:

With the exception of the forebays, the Pend Oreille River is generally well-mixed. In the Box Canyon and Boundary dam forebay reaches, temperatures at the bottom of the reservoir are slightly cooler (less than 1°C) than the surface. However, the lengths of the forebay reaches combined represent only four miles of the 72 miles of the river. The remaining 68 river miles are generally well-mixed. The TMDL does state that water from the deeper and slightly cooler part of the reservoir is passed through Box Canyon Dam and has a cooling effect on the Metaline river reach.

Temperature patterns within the study area are discussed in the TMDL. As mentioned in the TMDL, Ecology believes that the increased warming in the Skookum Reach is due to the inundation of an extensive backwater side channel occurring between river miles 74 and 76. A forward-looking infrared (FLIR) survey of the Pend Oreille River conducted on August 16, 2001 by Watershed Science, LLC determined the temperature of the side channel to be at 27.3^{o}C; about 3.4^{o}C warmer than the main river channel. In the TMDL analysis, temperature-modeling scenario 4.0 ran the model with the downstream hydroelectric facility removed (Box Canyon) to

examine the effect of the facility on the existing temperature condition. The results of that scenario for the Box Canyon reaches showed that with the removal of both the Box Canyon facility and its associated backwater effect, this side channel no longer functioned as a source, or location, for water heating.

Item SCL-2: The second part of the temperature criteria [t=34/(T+9)] does not apply to the TMDL.

Part 2 of the special temperature criteria for the Pend Oreille River is an essential component of assessing potential impairment. Ecology sought legal counsel through the state Attorney General's Office for interpreting this part of the special temperature condition, outlined in Table 602. Appendix F of the TMDL provides the Attorney General position.

The memo from the Attorney General's Office in Appendix F defines "T" as the background temperature measured at a point unaffected by the discharge. The memo goes on further to state "Since you are developing a TMDL that evaluates the impact of several point and nonpoint 'discharges' the most logical point to evaluate 'T' is at a point unaffected by the discharges within the scope of the TMDL (i.e. the most upstream discharge)." In applying "T" to this TMDL, Ecology determined that because the Pend Oreille River is affected by discharges from dams in Washington and Idaho, the most appropriate representation of the unaffected river was to use the modeled natural temperature condition. This approach is consistent with part 1 of the criteria, which specifies the use of the natural condition as the reference to assess whether existing temperatures result in impairment. Using the modeled natural condition to define "T" also adds a margin of safety to the TMDL.

Item SCL-3: The part 1 load allocation for the Boundary forebay does not factor in effects from Box Canyon Dam.

Allocations reflect common temperature influences. Ecology did consider the effect of Box Canyon on temperature conditions in the Boundary reservoir reaches (Metaline, Slate, Boundary forebay, and Boundary tailrace). As stated on page 43 of the TMDL, "Considering the whole temperature profile, both Metaline and Slate are now cooler than the natural condition by approximately 0.1^{o}C (Table 6). [This is due to the selective withdrawal of deeper, colder, water present in the Box Canyon forebay that is discharged, following power generation, to the Boundary reaches.] However, much of this cooling effect is lost by the Boundary forebay reach with, existing temperatures exceeding the natural temperature condition by an average of 0.22^{o}C." This warming is due to Boundary Dam's influence. The facility's influence on existing temperatures was further indicated by a model scenario which examined the change in temperature based on its absence.

SCL's dispute cites the last paragraph on page 62 of the TMDL as evidence of Box Canyon's effect on temperature conditions in the Boundary reaches. However, the last sentence of the

previous paragraph states "the daily maximum temperatures in the Boundary forebay reach are affected by the Boundary facility and, with its absence, maximum temperatures decline by about 0.3^{o}C…" Therefore, both Box Canyon and Boundary dams impact temperatures in the Boundary reservoir reaches.

The loading capacity of the river is natural conditions + 0.3^{o}C. Ecology staff determined that the largest amount of the incremental increase allowance (0.3^{o}C) that could be equally divided and still leave a reasonable reserve was 0.24^{o}C (resulting in 0.06^{o}C reserve). Because both dams impact temperatures in the Boundary reservoir reaches, the 0.24^{o}C was split evenly between the PUD and SCL. SCL's proposal to assign it a 0.24 ^{o}C load allocation would result in exceeding the 0.3^{o}C incremental increase allowance. (0.24 ^{o}C for SCL + 0.12 ^{o}C for the PUD + 0.06^{o}C for the reserve = 0.42^{o}C; this amount is greater than the loading capacity.)

The summer critical period allocation is based on the amount of heating in the forebay of Boundary Dam. Any effect from Box Canyon Dam during the summer dissipates by the Slate river reach, upstream of the Boundary forebay, which is why the allocation cannot be additive. The maximum temperature difference during the summer in the forebay between the natural and existing conditions is 1.0^{o}C (see Table 6 on page 41 of the TMDL). Since Boundary Dam was allocated 0.12^{o}C above natural conditions, this is equal to a 0.88^{o}C temperature reduction.

Item PUD-2: The TMDL lacks a clear plan for judging success of implementation measures

The Implementation Strategy in the draft TMDL is a general overview of what will be done to reduce temperatures and is not intended to provide information about specific actions. A more specific monitoring plan can be included in the implementation plan. Ecology will develop the implementation plan with help from the stakeholders once EPA approves the TMDL.

However, in the TMDL's Implementation Strategy, the Monitoring Progress section discusses three types of monitoring to evaluate success:

1. Each year, Ecology will track implementation measures (to be included in the implementation plan) that are initiated and completed. This information will allow Ecology to evaluate the amount of work and progress that is occurring toward reducing temperatures.

2. Organizations that install measures or complete activities are responsible for monitoring them to determine their impact on water temperature. So, if SCL or the PUD were to install a log jam, they would need to monitor before and after the log jam is in place to determine if that log jam helped cool the water temperature. Success would occur if the measure implemented actually results in a temperature decrease. This monitoring would provide clear and timely measures of success.

3. To determine TMDL effectiveness, Ecology identified 11 sites that the PUD, or SCL should monitor. Ecology will use data from the sites to update the model on the river. Ecology will update the model after the PUD and SCL complete several measures and as resources allow. The model is needed to determine compliance because the allocations allow a temperature increase above natural conditions. Natural conditions can only be assessed using the model.

Item PUD-3: The TMDL establishes temperature goals that are unachievable by any reasonable means.

Specific implementation measures are identified after EPA approves the TMDL. This assertion is premature since Ecology has not yet had discussions on what would go into the Implementation Plan for the Pend Oreille TMDL. This step occurs after EPA approves the TMDL. The TMDL does include an implementation strategy to provide a general overview of what will be done to reduce temperatures. The strategy is not intended to provide information about specific actions each organization will take. Specific actions will be included in the implementation plan, such as who will do what, by when, and where. Ecology will develop the implementation plan with help from the stakeholders once EPA approves the TMDL.

Ecology relies on stakeholders such as the Pend Oreille PUD to propose implementation measures because of their knowledge of the watershed. In two meetings with the PUD and SCL prior to the TMDL's public comment period (08/18/10 and 09/16/10), Ecology staff committed to meeting with the PUD and the Kalispel Tribe after the TMDL is approved to discuss possible implementation measures.

The TMDL's implementation strategy states that Ecology will rely upon the dam compliance schedule in the 401 certification to meet the allocations in the forebays. This rule, found in WAC 173-201A-510(5), allows the PUD and SCL to develop a water quality attainment plan to achieve compliance with the TMDL.

Item PUD-4: The TMDL does not take into account normal water temperatures, flows, seasonal variation, and existing sources of heat required by 33 U.S.C. 1313(d)(1)(D).

Study period environmental conditions were considered. Ecology collected temperature data in 2004 using methods documented in the quality assurance project plan (Ecology, 2004). According to the Temperature Monitoring Results report (Appendix C in the TMDL), the data quality was good and monitoring results met the project objectives.

Ecology is required to assess critical conditions when establishing TMDLs. EPA Region 10's TMDL Review Guidelines describe critical conditions as the combination of flow, temperature,

etc. “that result in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence.” Appendix D of EPA’s Guidance for Water Quality-Based Decisions: the TMDL Process (2007) advocates using a “reasonable worst-case condition” to characterize critical conditions. The document sites a 7-day low flow that occurs once in 10 years (7Q10 flow) and high temperatures as an example of a worst-case condition.

Portland State University modeled Pend Oreille River temperatures for 2004 and 2005 to determine which year represented a more critical condition year. Flow levels during the summer of 2004 were below average, with the daily average flows for June and July at the 13th and 29th percentiles based on the 55-year record. Flow levels for the same period in 2005 were observed at the 29th percentile. Air temperatures were warmer during the summer months in 2004 in comparison to 2005 with daily average temperatures exceeding the 90th percentile, based on observations from the 1996-2009 period, 24 days or 26 percent of the time. In comparison, the summer of 2005 was cooler, with only 3 days (3% of the days) exceeding the 90th percentile based on the same record. The combination of lower flow conditions and warm air temperatures led to more elevated water temperatures in 2004 in comparison to 2005. The TMDL allocations are based on 2004 conditions because it represents a more critical condition than 2005.

Seasonal variation in the TMDL is represented because Ecology established a summer and fall critical period, and evaluated the contribution of heat from the various sources during each critical period.

<u>The use of daily maximum temperatures is consistent with the special temperature condition for the Pend Oreille River.</u> The standard for the Pend Oreille River is a daily maximum, so the TMDL analysis focused on daily maximum temperatures. Since the river is well-mixed, warmest temperatures typically occur within the top one meter, but not always. Conducting the TMDL analysis using one-meter-deep cells at the surface is consistent with Ecology’s general approach to developing TMDLs. Because modeling for TMDLs must consider critical conditions, assumptions made for modeling are not necessarily the same as those used for monitoring.

<u>The TMDL showed that the Box Canyon Project increases temperatures beyond the criteria</u>. The TMDL report discusses the dam’s contribution to increased warming of the Pend Oreille River on pages 42 and 61through 62 .