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Subject: Request for input prior to 2nd local advisory group meeting (March 31, 2026)

Dear David,
Thank you for the opportunity to participate in the Water Quality Management Plan (WQMP)– Columbia and Lower Snake Rivers Temperature TMDL process. It is understood that the role of the Local Advisory Group (LAG) is to advise ODEQ on the content and structure of the draft WQMP, and that feedback and recommendations provided by members of the LAG, may be used by ODEQ to modify the draft WQMP that will be open to a formal public comment period later in this process. ODFW, like other LAG member groups, may provide more detailed information and recommendations during the formal public review stage. Therefore, what follows are some key technical concepts for ODEQ's consideration in future framing of the WQMP.

The TMDL process emphasizes aquatic life and system wide consideration of effects associated with temperature in four reservoir and tidal influenced sections of the Columbia River (in Oregon waters). However, the foundational EPA baselines do not seem to fully consider the dynamic life histories of ESA listed salmon and steelhead in the critical habitat of the mainstem Columbia River (specifically RM 0–309). The Columbia Basin Restoration Initiative (CBRI 2023) provided a road map for addressing system wide effects that encompass a life cycle perspective. It is strongly encouraged that this process reviews and incorporates the recommendations of the CBRI (Available here).

Addressing dynamic system effects is essential for managing critical habitats for all native aquatic species, including those not subject to harvest. These considerations are especially important for ESA-listed species in the basin. Recognizing and prioritizing key system dynamics is necessary to sustain and restore healthy, harvestable fish and wildlife populations in Oregon waters.

Managing water temperature is particularly important for ectotherms, like salmon and steelhead, because they rely on the aquatic environment that they inhabit to regulate their metabolism and body temperature (e.g., Block 2024). However, EPA information narrows the ecological significance of mainstem impounded reaches in Oregon's waters to management based on spawning adults. This narrowing of the temperature impacts may be insufficient to cover the broader life history exhibited by salmon and steelhead and other native aquatic species. Critical habitat has replaced, altered or eliminated natural spawning distribution and is difficult to monitor even with contemporary methods. However, impacts associated with altered critical habitat in Oregon waters should not be considered replacement for the historic distribution of managed salmon and steelhead or other native species in this process. I encourage the WQMP include broader consideration of the entire life cycle of ectotherms as it relates to critical habitats requirements.

The already highly altered and impacted fish habitats of the Columbia River System (CRS—specifically RM 0–309), and chronic history of CRS exceedances of water temperature standards is recognized by federal documentation that amplifies temperature risks associated with climate changes (e.g., NOAA Fisheries 2022, Crozier et al. 2020). Therefore, the paucity of alternative options available within the constraints of the existing CRS configurations and authorized purposes, and the emergency conservation status of the fish should not be disputing the relationship of reduced reservoir elevation on surface area and water transit time (WTT) effects. As clarified in NOAA Fisheries (2022), a backdrop of deteriorating environmental conditions increases, not diminishes, the responsibility to do more in the CRS. I encourage the WQMP include some reference to impacts associated with climate change.

Engineered solutions that mechanically regulate temperature at or near the point source (e.g., dam structure, forebay) continue to dominate the alternatives being considered. Greater emphasis is needed on restoring and protecting biological and ecological processes and critical habitats. Return to the River principles (Williams 2005a) encourage prioritizing natural processes when designing management actions that restore natural function.

Evaluating partial drawdown of the John Day reservoir may also support efforts to improve smolt survival through the lower Snake and Columbia rivers (NMFS 2000; Williams et al. 2005b) and could help regulate water temperature. This action should be prioritized for evaluation.

WQMP should consider more than mechanically engineered devices that replace natural function. ODFW support alternatives that emphasize conservation and efficiency improvements (e.g., partial reservoir drawdown, reservoir elevation management, managed aquifer recharge) and is less certain that engineered devices alone should be the primary strategies for temperature management.

The current EPA documentation seems to depend strongly on small tributary information that may not offer the level of management actions needed in larger water bodies like the mainstem Columbia River and Estuary. The five species of salmon that use and depend on Columbia River (RM 0–309) vary considerably in temporal and spatial occurrence (Groot and Margalis 1991; EPA 2003). The full suite of impacts that influence all these species may be needed to explore innovative ways to manage Columbia Basin resources to sustain livable water quality conditions. Lichatowich (1999) emphasized the variable habitats used by adult salmon and steelhead in a generalized river basin emphasizing that life history stages make mainstem habitats more dynamic than just migration corridors. Contemporary counting methods (e.g., adult ladder counts, Passive Integrated Transponder (PIT) Tags infrastructure, Acoustic Telemetry research) confirm a variety of life history tactics being exhibited year round in the

Columbia River mainstem (RM 0–309). Emphasizing how riverine processes can be restored continues to be important consideration when building management plans. Therefore, I would encourage considering the full suite of criteria that impacts the life cycle of salmon, steelhead, and other native aquatic life, rather than focusing on a narrow peak or middle range as is commonly done in federal processes. In achieving this directive, it would be important to also recognize temperature requirements that protect the (entire life cycle or critical habitat use) tails of salmon and steelhead populations.

Recent evaluations have restricted the data used to establish a baseline. Although 2011 RMJOC Climate and hydrology evaluation did not address water temperature directly, the study results suggested that Columbia River Basin annual air temperatures are estimated to rise 1 to 3 degrees Fahrenheit above the selected reference period (1916–2006) by the 2020 period and 2 to 5 degrees Fahrenheit (~1 to less than 3 degrees Celsius) by the 2040 period. However, the duration of the data used to establish a robust baseline comparison did not use a small set of data (1 to 5 years) but instead encouraged broader spatial and temporal representation. It is encouraged that TMDL evaluations return to using as broad a series of data as is available for water temperature criteria development.

Given the time constraints for this response period, I have included two appendices that contain some earlier summaries on cold water augmentation and refuges (Appendix A) and warm water topics (Appendix B) that I was not able to characterize in my response. I believe the content in these appendices could offer additional information appropriate for this process.

I appreciate the opportunity to help inform this effort to build a framework for management strategies that attain and maintain water quality standards while encouraging actions that also sustain and restore healthy and harvestable levels of fish and wildlife in Oregon waters. Please feel free to contact me if you have any questions.

Regards.

Erick S. Van Dyke (ODFW LAG member)

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Appendix A — Cold Water Augmentation Management in CRS Reservoirs

Cold Water Refuge

Cold-water refuge patterns are primarily shaped by natural groundwater exchange, which reduces localized diurnal temperature fluctuations, especially during extended warm periods. Dams can disrupt normal seasonal cooling and inundate alluvial river segments in ways that reduce groundwater exchange (e.g., hyporheic flow) associated with isolated cool-water areas during high-temperature periods (EPA 2003). Reduced flow rates can also delay migration and increase the duration of exposure to elevated water temperatures.

Reservoir cooling patterns may further alter the natural temperature regime of un-impounded rivers (EPA 2003). Thermal stratification creates cooler deep-water layers, which can slow growth rates in juvenile fish.

EPA water-quality standards identify ten actions designed to promote collaborative watershed management:

- Replant native riparian vegetation.
- Install fencing to exclude livestock from streams.
- Establish protective riparian buffer zones.
- Reconnect river channels with their floodplains.
- Restore natural stream meanders.
- Increase instream flow through more efficient water withdrawals.
- Release cold water from stratified reservoirs.
- Lower reservoirs to reduce shallow "overbank" areas.
- Restore natural flow regimes in alluvial river reaches.
- Restore natural diurnal and seasonal temperature patterns.

However, few of these measures directly apply to managing large, impounded river systems. This reflects the fact that most cold-water refuge research has been conducted in less-altered tributary systems where many species of concern originate.

Cool-water Augmentation Sources

High-head dams can provide cool-water inputs during summer when reservoir surface waters warm in large river complexes. Dworshak Dam on the North Fork Clearwater River is a key example. Operated for flood control and hydropower, its deep reservoir (exceeding 100 m) and higher elevation allow for thermal buffering. Data from 2013–2018 show consistent summer thermal stratification (Table 1), with surface warming driven by solar radiation and deep-water temperatures remaining around 4.4–4.5°C at 100 m.

Table 1. Summary of Dworshak Dam forebay and tailwater seasonal average water temperatures 2013–2018.

Dworshak Dam forebay temperature string and tailwater TDG gauge 2013-2018

Season	Average temp 0.5m	Average temp 5.0 m	Average temp 15.0m	Average temp 25.0m	Average temp 35.0m	Average temp 40.0m	Average temp 45.0m	Average temp 50.0m	Average temp 60.0m	Average temp 80.0m	Average temp 100.0m	Average Tailrace temp	Average Forebay elevation (ft)
Winter	5.9	5.9	5.7	5.8	5.5	5.4	5.2	5.1	4.7	4.6	4.4	5.3	1533
Spring	14.0	11.9	7.0	6.3	5.7	5.6	5.6	5.3	5.0	4.7	4.5	5.5	1555
Summer	23.8	22.2	13.0	9.7	8.1	7.6	7.1	6.6	5.6	4.7	4.4	7.6	1561
Autumn	13.3	13.3	13.1	10.8	8.4	7.6	6.8	6.1	4.9	4.5	4.4	9.3	1521
Grand Total	**14.4**	**13.5**	**9.8**	**8.2**	**6.9**	**6.6**	**6.2**	**5.8**	**5.1**	**4.6**	**4.4**	**7.0**	**1543**

* Water temperature strings are measured as depth from the surface, so if pool elevation is lower the probe remains fixed distance from the surface but the turbine intake is closer to the surface. Thus the relationship of forebay temperature depth varies relative to tailwater temperature. Intake at Dworshak can be adjusted within some limits, so may need to identify opeational constraints that influence variability of temp probe if wanting to represent what temperature is passing through turbines/spillway to compare with observed tailrace water temperatures.

Cool water augmentation from Dworshak dam travels approximately 119 rkm upstream before reaching Lower Granite Dam. Released cool water travels down the North Fork Clearwater, mixes with the mainstem Clearwater River, and then with the Snake River near Lewiston. Based on long-term (30-year) water-supply volumes, North Fork Clearwater flows contribute just over one-third of the Clearwater's combined volume at their confluence and roughly one-third of the total Snake River volume at the next major mixing point. The cooler water generally settles below warmer surface layers as it enters Lower Granite Reservoir. While most of the river column equilibrates under non-managed conditions, thermal stratification becomes more pronounced during targeted operations to maintain Lower Granite tailwater temperatures below 18°C (Table 2). Average tailrace temperatures of 18.8°C are achieved with North Fork Clearwater tailrace temperatures averaging 7.6°C.

Table 2. Summary of Lower Granite Dam forebay and tailwater seasonal average water temperatures 2013–2018.

Lower Granite Dam forebay temperature string and tailwater TDG gauge 2013-2018

Season	Average temp 0.5m	Average temp 5.0m	Average temp 15.0m	Average temp 25.0m	Average temp 30.0m	Average temp 35.0m	Average TDG FB temp	Average Tailrace temp	Average Forebay elevation (ft)
Winter	4.3	4.2	4.3	4.2	4.2	4.9	6.4	4.0	736
Spring	12.3	11.8	11.5	11.4	11.4	11.2	11.1	11.1	734
Summer	21.6	20.5	19.2	17.6	17.4	17.1	18.9	18.8	735
Autumn	11.8	11.7	11.6	11.4	11.3	11.7	18.4	11.4	736
Grand Total	**12.9**	**12.4**	**12.0**	**11.4**	**11.4**	**11.9**	**14.6**	**11.4**	**735**

*Water temperature strings are measured as depth from the surface, so if pool elevation is lower the probe remains fixed distance from the surface. Unlike Dworshak the turbine intakes are fix and do not vary. It is not yet identified what factors produce cooler tailrace temperatures than the source forebay in winter. Cool water regulations are specific to periods when tailrace is >18°C, generally Late June-early September.

As water continues downstream through the lower Snake River reservoirs, the cooling benefit diminishes and is largely exhausted before reaching Little Goose Dam (Figure 1). Consequently, maintaining temperatures below 18°C farther downstream is not feasible under current operations. Some stratification persists in Little Goose Reservoir, but by Ice Harbor Dam it is largely lost. For this reason, only the Lower Granite tailwater is currently subject to a temperature limit.

Alternative cool-water sources within the FCRPS are limited. High-elevation tributaries and colder streams lack sufficient volume to cool the lower Snake or lower Columbia River reservoirs, and no other high-head dams are positioned to provide similar thermal benefits. Reducing reservoir surface areas could lessen solar heating but would require major social, political, and economic shifts, making such actions unlikely.

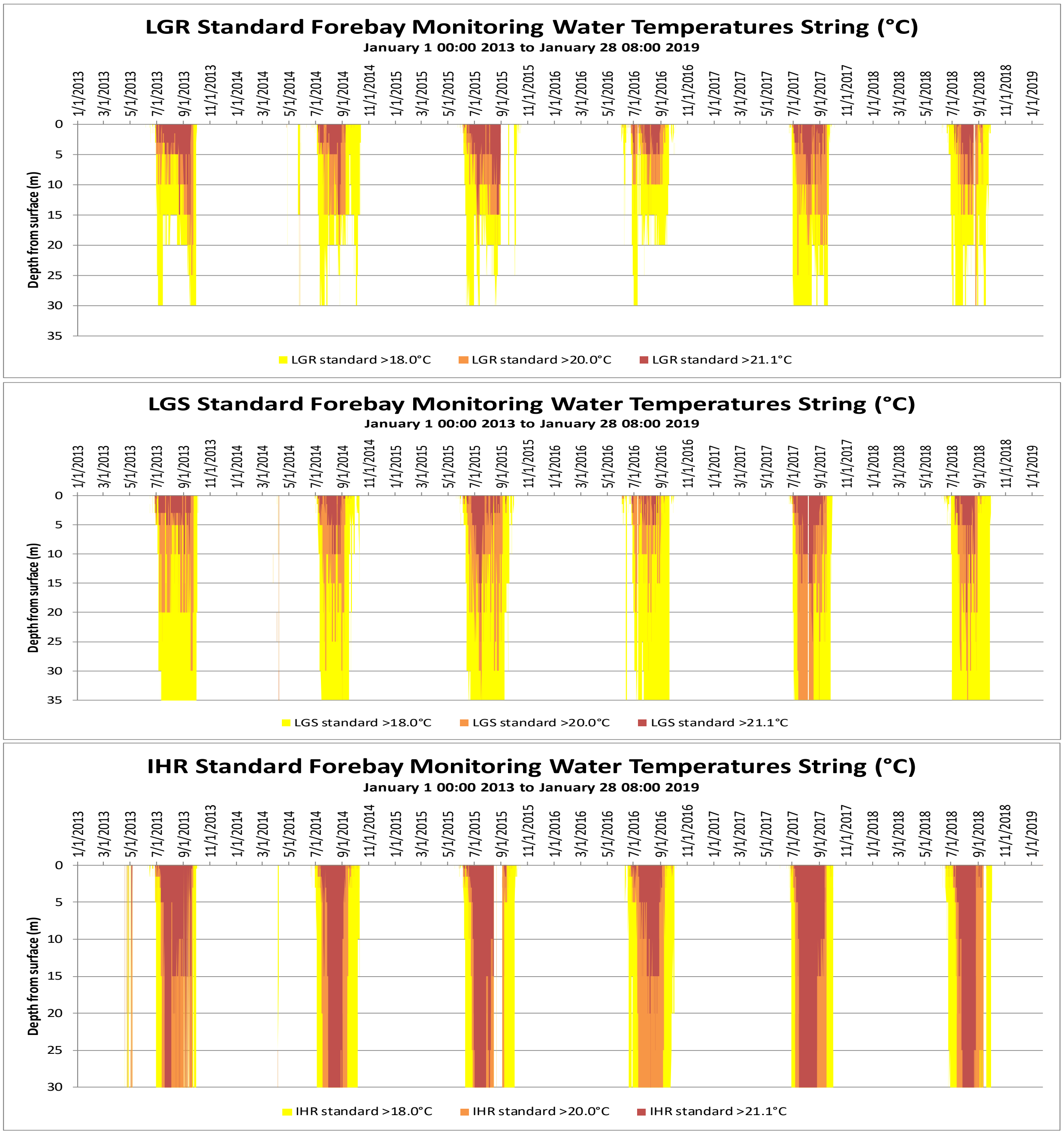

Figure 1. Forebay water temperature profiles for Lower Granite, Little Goose and Ice Harbor dams. White represents depths that water temperature is below standard of 18°C (also No Data), yellow when temperature is >18°C, orange represents >20°C, and red is >21.1°C (lethal temperature for salmon and steelhead). Cool water is provided from Dworshak Dam to meet Lower Granite Tailrace water temperature such that it does not exceed regulatory standard of 18°C.

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Appendix B — Warm water considerations

Warmer water association with variable water temperatures in fish ladders

Caudill et al. (2013) demonstrated differences between main-river and adult ladder temperatures (ΔT) were influential in delaying upstream migration of adult salmon and steelhead. Mean Daily ΔT were <1 C April through Mid-June and were most extreme July-September when water temperatures are regularly more than 18 C. Fish generally had a higher body temperature than the surrounding ladder water temperatures upon exit from the ladder. This impact will generally be more influential during warmer periods that extend beyond thermal tolerance for a species.

Warmer water association with pathogen prevalence

The ability of an organism to cause disease or harm its host has been shown to increase at higher temperatures. Resistance and virulence traits connected to bacterial pathogenicity were more prevalent at increased temperatures (Friman et al. 2011).

Warmer water association with reduced survival and travel time

Crossin et al. (2008) found adult sockeye held in 18 C water were more likely to die in holding and 2-times more likely to develop infection than control and fish held at 10C. Survival to spawning grounds was 35% for fish held in higher water temperature compared to 62% and 68% for control and lower water temperature, respectively. Reproductive-hormone levels and stress measures did not differ between treatments but showed significant correlations with individual travel times.

Warmer water association with reduced survival from handling

Robinson et al. (2013) simulated methods commonly used improve post-release survival prior to release. Survival was higher for fish held in 16 C than survival for fish held in 21 C water. Their ventilation treatments did not affect observed survival of male sockeye, but survival of females appeared to decrease for fish given ventilation assistance. A later study conducted by many of the same researcher’s also found water temperature (13, 16 and 19 C) and sex were identified as factors that best predicted adult sockeye salmon survival 24 and 48 hours after simulated exhaustive exercise and 60 seconds of out of water exposure (Gale et al. 2014).

Warmer water association with predation rate on juvenile salmon and steelhead

Predation rates were predicted to increase as much as 68%–96% between historic warmer periods than cooler periods (Petersen and Kitchell 2001).

Other factors associated with water withdrawals from dams

Construction of large dams has also facilitated massive withdrawals of water for agricultural and municipal purposes. Runoff from these areas increases the concentrations of nutrients, contaminants, and salts in downstream reaches (NRC 1996). These changes in water quality adversely affect the development, growth, health, and survival of salmon (Regetz 2003; Loge et al. 2005). Given this combination of stressors, our analysis likely represents an overly optimistic outlook on the ability of salmon to adapt to the environmental changes imposed by dams.

Water Temperature References

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