



Independent Scientific Review Panel

for the Northwest Power & Conservation Council

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Review of the Grande Ronde Model Watershed Synthesis, 1992-2016

([GRMW Synthesis](#) for project #1992-026-01)



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ISRP Review of the Grande Ronde Model Watershed Synthesis, 1992-2016

Background

In response to the Northwest Power and Conservation Council's October 5, 2018 request, the ISRP reviewed the report *Grande Ronde Model Watershed Synthesis, 1992-2016* ([GRMW Synthesis](#) for project #1992-026-01) and considered the accompanying [cover letter](#) from the GRMW. This report is intended to address a condition that was placed on the project as part of the [June 2017 Council decision](#) regarding the performance review of the Fish and Wildlife Program's Umbrella Habitat Restoration Projects. Specifically, the Council recommended that the GRMW develop a synthesis report that assesses *"whether the actions and associated changes in the physical habitat have contributed to addressing limiting factors ... and addresses, in a manner suited to the role served by this project, ISRP comments and qualifications on M&E and adaptive management [see [ISRP 2017-2](#)]."* The Council's comments on the GRMW project further suggested that content of the GRMW Synthesis reflect that Umbrella Habitat Restoration Projects are habitat implementation projects and not research, monitoring, and evaluation projects (RME). An important expectation of the ISRP was that the GRMW project would rely on and collaborate with other RME experts in the basin to provide an initial evaluation of measurable/observable biological and physical changes and trends that could be related to past restoration actions and/or to inform future actions.¹

The GRMW organized a site visit for the ISRP with the GRMW staff, its partners, and staff of the Council and Bonneville Power Administration (BPA) on October 3-4, 2017. The overall purpose of the site visit was to address the Council's [recommendations](#) and the ISRP's qualifications from the Umbrella Project Review of the performance and effectiveness of the GRMW's project. The ISRP also provided comments on the draft synthesis report outline, shared by the GRMW, and discussed key elements for the preparation of the synthesis. The ISRP impressions of the site visit and comments on the outline were shared with Council's Fish and Wildlife staff in November 2017 ([ISRP 2017-11](#)).

The ISRP's comments below follow the outline of the GRMW Synthesis document. The ISRP understands that the Synthesis Report was submitted as a final report. However, the ISRP believes it should not be considered final, and our review provides numerous comments and suggestions directed at revising the synthesis report and improving project implementation, future plans, and the content of subsequent progress reports.

¹ For instance, to take collaboration beyond information sharing by using available data and conducting analyses that assess progress toward project objectives. In a practical sense, using available information and working with partners (e.g., ODFW, CRITFC) to provide a quantitative assessment of environmental progress and outcomes for the basin. While the ISRP expects some level of monitoring of restoration efforts, this expectation is not the same detail or experimental design expected from research projects.

ISRP Recommendation and Summary Comments

Recommendation: Does Not Meet Scientific Review Criteria

The Synthesis Report of the Grande Ronde Model Watershed (GRMW) clearly describes the history, organization, and number of projects implemented. However, it does not address the primary purpose of the synthesis and the Council's primary directive to provide evidence that *"actions and associated changes in the physical habitat have contributed to addressing limiting factors"* ([June 2017 Council decision](#)). To be clear, the ISRP recommendation of "Does Not Meet" refers only to the Synthesis Report and not the entire program. Most of the Synthesis Report is a simple listing of the categorical actions taken rather than an analysis of whether the actions taken individually or collectively were effective. As well, it does not identify the important lessons learned to improve future project success. The Synthesis Report provides virtually no analyses of either fish or environmental responses to restoration, analyses which were requested by the Council in June 2017, the ISRP review ([ISRP 2017-2](#)), and in at least four previous ISRP reviews over the last 12 years ([ISRP 2006-6](#), [ISRP 2007-12](#), [ISRP 2013-11](#), [ISAB/ISRP 2016-1 Appendix D](#)). This information should have been available since experts from CRITFC, ODFW, NOAA and OSU have conducted analyses and modeling in the watershed. While the GRMW might be successful as a social experiment linking stakeholders, evidence for ecological success is not provided in the GRMW Synthesis.²

The GRMW has been important in catalyzing an initially discordant community around the recovery of fish and in implementing a large number of cooperative restoration actions. The GRMW has revised assessments and plans as new information and ideas became available. For instance, completion of the Atlas is a significant accomplishment, one proven useful as a spatial framework for tracking the cumulative number and distribution of GRMW actions for the Grande Ronde Basin. It has also been useful for prioritizing treatments based on biological priorities and likelihood of habitat benefits. The full potential of the Atlas will not be realized unless it is used as a tool to aid in conducting landscape analyses of the environmental outcomes of projects (individually and/or collectively) or for quantifying the relative proportion of major habitat types and conditions that have been treated by habitat restoration actions.

Over a decade ago, the ISRP's 2006 review of the project ([ISRP 2006-6](#)) asked for a very similar type of synthesis report, which the ISRP evaluated in a follow-up review ([ISRP 2007-12](#)). Although the ISRP found the FY 2007-09 proposal "fundable" with an excellent record of success in coordination and project implementation, the recommendation was qualified because an adequate summary of project effectiveness and monitoring was not provided. Specifically, the ISRP called for *"a report presenting quantitative and qualitative results to date pertaining to the effectiveness of the projects under their domain, a general summary and conclusions about overall project effectiveness, and the application of the results to management."* The ISRP concluded that additional monitoring and evaluation (M&E), including

² In the future, a more formal analysis and subsequent discussion of the GRMW as a social experiment would be of value to all involved.

an improved biological assessment for fish, was warranted and felt that it would likely lead to improved adaptive management. These long-standing concerns with reporting, monitoring, ecological evaluation, and adaptive management were repeated through the Geographic, Critical Uncertainties, and Umbrella Project reviews (respectively, [ISRP 2013-11](#), page 260; [ISAB/ISRP 2016-1 Appendix D](#), page 288; [ISRP 2017-2](#), page 33).

The recent ISRP evaluation ([ISRP 2017-11](#)) identified the same basic issues. As a result, the ISRP requested that a Synthesis Report be produced to address the following eight points. The current Synthesis Report falls far short of expectations on many of these points:

- a. *Summary of actions' success*: There is no comprehensive summary of the success of actions, organized by environmental objectives, conducted by the GRMW during 25 years of funding. Numbers of projects for specific types of restoration actions are listed but outcomes are not summarized. The GRMW does not show what has been accomplished – in terms of addressing limiting factors or changes in environmental conditions – by the various types of restoration activities undertaken in either quantitative or qualitative terms beyond simple enumeration. Evaluation is limited to basic implementation monitoring, normally expected as a minimum for habitat projects. Additionally, criteria for determining the success of actions are not provided, and the proponents do not identify which restoration actions were successful or unsuccessful, nor do they discuss why. This concern relates to “Lessons Learned” under point “c” below.
- b. *Empirical evaluations of effectiveness*: The GRMW does not provide empirical evaluations of the effectiveness of the restoration actions in addressing limiting factors or achieving environmental objectives. They do not examine if collective restoration actions (by type and landscape scale) contributed to measurable changes in physical habitat, especially those elements of physical habitat believed to be limiting target populations. In other words, the report lacks a detailed evaluation of program effectiveness in addressing limiting factors for those projects (alone or in combination) where empirical data are sufficient to support such analyses.
- c. *Lessons learned*: The Synthesis does not summarize lessons learned for past habitat restoration actions, whether successful or not.³ However, the synthesis did discuss some organizational and administrative lessons learned.
- d. *Quantitative, time-sensitive objectives*: The GRMW did not attempt to establish quantitative objectives, with explicit timelines, for program (watershed and subbasin scale) and project scale activities described in the Umbrella Report. Neither did they

³ The proponents may wish to examine two documents from the Columbia Basin summarizing lessons learned by the [Expert Regional Technical Group](#) and [ISEMP \(2003-2011\)](#). More recent reports on lessons learned may be available from the project leads for those efforts.

do so for newly funded projects. Previously, the ISRP had suggested that these objectives could be used to define the expected level of implementation, effectiveness, or responses by aquatic habitat conditions and target populations, which would have been a welcome addition to the Synthesis Report.

- e. *Threats to project success:* The Synthesis Report includes a limited discussion of how issues such as climate change and the proliferation of toxic chemicals will be addressed and integrated into an effective, forward-looking program. It contains very abbreviated sections on non-native species, upland conditions, and ever-increasing agricultural water demands, topics which did not utilize information readily available for the basin.⁴

- f. *Vision for future activities:* The ISRP recognizes that the GRMW Synthesis Report provides a basic outline for adaptive management and public involvement that could serve as a starting point for establishing a functioning adaptive management process. The Synthesis Report describes a general vision of future activities, but it does not explicitly identify desirable and achievable environmental conditions in the Grande Ronde basin for the next 20-30 years. The ISRP was expecting to see spatially-explicit, desired landscape and resource conditions, and plans for addressing limiting factors and achieving desired conditions. This is especially important since umbrella projects are expected to use a science-based assessment and project prioritization process to identify future projects. The ISRP also expected that the vision for the next 20-30 years would be used in an initial attempt to articulate specific quantitative objectives and integrated actions at the watershed and subbasin scales, a process for adaptive management and public involvement, and a description of how the mix and dynamics of the administrative, scientific, and technical personnel (including both GRMW staff and collaborators) will collectively achieve anticipated endpoints.

- g. *Assessment for cumulative effects of actions:* The GRMW does not provide an outline for a scientifically objective procedure to assess whether the collective effects of past and proposed actions are likely to achieve desired future conditions. While the Atlas helps prioritize future restoration actions, it could be enhanced to

⁴ For instance, the discussion of upland issues and treatments needed to achieve long term watershed scale restoration is limited and very incomplete (i.e., road networks). As one suggestion, a meaningful discussion about upslope conditions as they affect riparian/instream conditions and how they intend to prioritize and integrate upland restoration and management to help achieve long term watershed and subbasin habitat objectives would have been appreciated.

provide a road map for reducing the extent and consequences of limiting factors and for achieving desired future landscape conditions.⁵

- h. *Use of scientific methods in future actions:* The Synthesis Report generally discusses how scientific methods, as well as emerging or evolving concepts, will be incorporated into future actions. The narrative, however, lacks sufficient detail for adequate scientific evaluation.

In summary, there is a major discrepancy between what the Synthesis Report provides and what the ISRP expected in terms of a focus on measurable results achieved over the last 25 years. A more quantitative synthesis is possible and needed to provide program evaluation and information to improve long term effectiveness.

The Cover Letter and the Synthesis Report clearly indicate that drafting the report was a task assigned to an individual technical writer. The technical writer summarized information provided by GRMW staff and cooperators, including information presented during the State-of-the-Science Meeting in April 2017. While this is a step forward and the technical writer developed a coherent and concise report, the report does not represent a collective effort by the lead restoration practitioners and researchers to assess the effectiveness of GRMW's restoration actions or to summarize what was learned, thereby providing steps that could be used for achieving future project and program improvements. The ISRP views the GRMW discussions and group meetings as essential. However, these meetings, by themselves, do not provide needed systematic evaluations of the restoration actions in the Grande Ronde subbasin, one of the Fish and Wildlife Program's major habitat projects.

Although one may question whether the ISRP and the Council are placing unreasonable expectations on the GRMW, the ISRP believes that the GRMW has access to the data and expertise to produce an acceptable synthesis. Specifically, experts with CRITFC, ODFW, NOAA and OSU have conducted analyses and modeling that could have provided the information needed to partially evaluate restoration effectiveness and identify lessons learned in the Grande Ronde. The ISRP has previously urged the GRMW to work collaboratively with cooperators who have the analytical skills to synthesize results and demonstrate the potential benefits of actions at a landscape scale, and who have already provided several excellent examples for specific portions of the basin.⁶ The ISRP suggests that a proportion of the GRMW funds be dedicated to funding collaborators to work on synthesis analyses. Although the GRMW staff and major cooperators appear to be collaborating on some aspects of restoration implementation and planning, they also need to collaborate to produce a landscape-level

⁵ There are examples of cumulative effects analyses for the Columbia Basin that the proponents should consult (e.g., Upper Columbia River, Kootenai, and Columbia River estuary projects. See also: Reid 1998, Steel et al 2017).

⁶ For example, regional information demonstrates that some spring Chinook salmon and steelhead populations in the Grande Ronde basin are experiencing density dependent growth and survival, and potentially will benefit from habitat restoration (Zabel and Cooney 2013).

synthesis of the program’s actions. At present, their synthesis efforts remain fragmented and incomplete. Other umbrella habitat restoration projects, such as the Upper Columbia Programmatic Habitat Program and Columbia River Estuary Habitat Restoration Program, have developed landscape-level analyses of ecological conditions and the degree to which their restoration actions have addressed limiting factors at subbasin scales (e.g., Upper Columbia Salmon Recovery Board, Habitat Report, 2014).

The ISRP believes that the GRMW and its partners need a specific project deliverable and adequate time and financial resources to provide an ecological assessment requested by the Council, using existing data and analyses. If BPA and the Council agree on the importance of a synthesis of *“whether the actions and associated changes in the physical habitat have contributed to addressing limiting factors”* ([June 2017 Council decision](#)), specific guidance on deliverables and adequate funding to synthesize available information will be required.

ISRP Comments on Major Sections of the Synthesis Report

Synthesis Introduction and Brief Geography and History of the Subbasins (pages 3-30)

The Introduction starts off strongly by stating that the GRMW had proposed in 1996 to test the hypothesis that a *“diverse citizen-based group can motivate fellow citizens and move forward with watershed restoration programs that measurably improve water quality, fish habitat and [the] local economy,”* and had identified a single measurable objective.⁷ The proponents do not provide evidence that the hypothesis was evaluated or that the *“measurable”* objective was either quantified or met.

The purpose of the Synthesis document is stated at the end of the second paragraph: *“to summarize the **work completed** by the GRMW to date, placing the work within the context of the evolution of the organization, planning documents, and research.”* This purpose is much narrower than suggested by the ISRP ([ISRP 2017-2](#)) and the Council ([June 2017 Council decision](#)). Also, *“work completed”* is not the same as reporting on how effectively the project has contributed to addressing limiting factors, which was the Council’s directive.

The Introduction would have been greatly improved had the proponents outlined how they were planning to address the ISRP and Council concerns (i.e., *“whether the actions and associated changes in the physical habitat have contributed to addressing limiting factors ... and addresses, in a manner suited to the role served by this project, ISRP comments and qualifications on M&E and adaptive management [see [ISRP 2017-2](#)].”*

The Introduction states that the GRMW completed 248 projects with funding of \$32 million over its 25-yr history. This is substantially less than the total funding expended for restoration in

⁷ The “[a]dministration and development of watershed plans and projects to restore watershed function and improve salmonid production while maintaining a vigorous natural resource-based economy”

the basin over the 25-yr period, especially when funds from other cooperators are included (e.g., US Forest Service, NOAA). Relevant to the question surrounding resource availability for synthesis analysis, the ISRP was surprised to see the relative amount invested in projects compared to the total administrative funding for the GRMW. Later in the Program Evolution section, the report states that administrative costs average 36% of total annual budgets. A more detailed and comprehensive description of the allocation of funds for different types of restoration actions and administration would be useful, though not as important as the synthesis of the ecological outcomes of the program at a landscape scale.

[GRMW Development, Program Evolution, and Atlas Development \(pages 31-49\)](#)

There has been enormous time, energy, and financial resources committed to bringing partners together in the subbasin, and this section highlights how far the GRMW has come in this regard. The ISRP recognizes this as an important outcome of the GRMW and the Council's investment. The report thoroughly summarizes the GRMW's institutional evolution over the years.

The sections on Development of the GRMW and Program Evolution are useful descriptions of the history and modifications of the program through time. The description of the initial organization, program requirements, and choice of EDT analysis provides valuable insights into the framework used as the program developed. The section on the development of the GRMW is nicely organized and documents, with references, the progress from early disagreements about strategy (assessment vs immediate action) toward a science-based system of prioritization targeting limiting factors. The section on Program evolution also provides useful details about the history of financial support and administration. It describes a landscape framework that is not readily apparent in other GRMW reports. However, the overview of public outreach in the final paragraphs is very limited. It would have been useful to include a quantitative summary of activities, analysis of trends (e.g., participation), and some discussion of lessons learned.

The key objective of this Synthesis was to quantify how effectively projects since 1992 have addressed limiting factors (i.e., implying beneficial changes to salmon habitat), and the development and use of an adaptive management process that efficiently informs project directions and priorities. The development of the Atlas is a step in the right direction, but the Atlas also needs to assess the effectiveness of restoration efforts that address limiting factors and for planning future restoration actions.

The report provides literature to justify the principles upon which the Atlas assumptions are based (pages 44-45), though it is not clear when/if those assumptions will be periodically revisited. Ideally, these assumptions could be proposed as a set of hypotheses that would be evaluated over time with data through an adaptive management process. To date, the Atlas process has helped to transition GRMW efforts from opportunistic activities to a more strategic process, one which prioritizes locations and treatments for future work. Unfortunately, it appears that the Atlas is currently used primarily as an accounting tool for mapping locations of restoration projects and representing basic landscape features (e.g., stream networks, ownerships, vegetation, etc.). The Atlas could provide a spatial context for the evaluating

ecological outcomes, but there is no indication of efforts to develop that capacity.

Summary and Review of Restoration Actions (pages 50-87)

The ISRP found the summary of restoration actions to be scientifically incomplete. The ISRP ([ISRP 2017-2](#); [2017-11](#)) had suggested a quantitative focus on what has been achieved, a discussion of why some actions succeeded and others failed, and an empirical evaluation of effectiveness based on measurable changes in physical habitat.⁸ Instead, the authors have only tabulated restoration actions by restoration treatment type and location within each watershed. The GRMW generally describes how the treatment types, locations, and cost of restoration actions changed over successive periods guided by the 1994 Action Plan, the 2004 Subbasin Plan, and the Atlas. These comments are insightful about their programmatic history, but they do not respond to the Council's request to assess the degree to which their actions have addressed limiting factors or lessons learned over the life of the program.

Anticipating this shortcoming, the proponents state *"Offering an analysis of the effectiveness of the Grande Ronde Model Watershed's projects is beyond the scope of this analysis."* This statement acknowledges that the Synthesis Report does not address either the directive from the Council or several of the ISRP's recommendations for a quantitative synthesis ([ISRP 2017-2](#)). It is concerning that overall conclusions about effectiveness were not drawn from quantitative results from studies presented at the State-of-the-Science meeting on 4 October 2017 (e.g., by Ted Sedell, Casey Justice, Seth White and Tom Cooney) and from the M.Sc. thesis by Greg Bengé. The ISRP notes that some of these results are included in later sections in the context of concerns about the future, but we believe that they could have been more thoroughly synthesized as a set of lessons learned.

The Summary and Review of Restoration Actions is a ledger of the number and type of projects implemented over the history of the GRMW. It does not provide a synthesis of ecological outcomes from those efforts or the impacts of the program on addressing limiting factors, nor does it indicate how such an analysis is going to be achieved in the future. The ISRP disagrees that the weaknesses and variability of past measurements make such analysis impossible. The syntheses and lifecycle models of Catherine Creek and the upper Grande Ronde by CRITFC demonstrate what is possible. These habitat projects faced the same challenges as the GRMW, and they successfully analyzed the progress and effectiveness of their restoration actions.

After 25 years, including development of the Atlas and life-cycle models, it does not seem unreasonable for the GRMW to complete a quantitative analysis of limiting factors and

⁸ For instance, the GRMW did not appear to complete items identified in their January 2018 outline, in particular, Section VIII: Analysis of past restoration actions—empirical evaluation (Seth White, Casey Justice, Ted Sedell), which included riparian condition, woody debris ratio, stream temperature, and aquatic inventories data.

evaluation of the effectiveness of past actions. The proponents point to a graduate student's thesis (Benge 2017) and lifecycle and landscape models of CRITFC as products but do not attempt to develop meaningful syntheses from them. The contrast in the assessment approaches of the GRMW and CRITFC cooperators, and the need for improvement, were noted in the ISRP's Critical Uncertainties Report. As yet, the ISRP does not see evidence of the GRMW developing the technical capacity for analysis and synthesis analysis in house or explicitly engaging in such an assessment with their partners. Other basins in the region have made impressive progress in limiting factors analysis, prioritization of restoration actions, and landscape-level assessment of restoration effectiveness.⁹

The GRMW's Synthesis Report describes the proponent's interpretation of the ISRP's qualification: *"What the ISRP envisioned for the Model Watershed was a data-driven approach to restoration, adjusting dynamically to new information about fish populations and restoration practices through an experimental design."* Following that paragraph, they observe that *"An additional challenge, not mentioned by the ISRP, may be the fundamental shift in the identity of the organization that the adaptive management program requires: from a social experiment to an ecological one."* These are valuable insights and should be the basis for a frank discussion of project evolution and the expertise required for development of future administrative goals and staffing requirements.

Overall, the narrative is too general, and therefore not useful for a scientific review of validity or effectiveness of the major categories of restoration actions. This limitation is highlighted by the fact that meaningful objectives have not been established either for individual projects or broader watershed/landscape desired conditions. Further, no meaningful quantitative data or analyses are provided to assess restoration actions. The underlying assumption seems to be that restoration actions, either individually or collectively, have benefited fish and wildlife through improved environmental conditions. Unfortunately, insufficient evidence was provided to support this assumption.

[Implementing Adaptive Management in the Grande Ronde Basin \(pages 88-98\)](#)

The ISRP is pleased to see that the GRMW has described how an adaptive management (AM) program might be structured and acknowledged the benefits of AM. The risk is that AM will become a process that simply identifies potential projects through their Technical Team and the Atlas, one solely based on a general notion of limiting factors and identified opportunities with willing land owners and land managers. An effective adaptive management process will require analysis of both realized and potential future environmental outcomes of activities which can be used to guide management decisions. Admittedly, the GRMW faces a major challenge in

⁹ Examples include the Upper Columbia Biological Strategy (UCRTT 2014), the Upper Columbia River Integrated Recovery Program Habitat Report (UCSRB 2014), habitat effectiveness analysis (Hillman et al. 2016), the Kootenai River Operational Loss Assessment Tool, the Columbia River Estuary's Resource Inventory Geodatabase, Wind River project, and others.

developing adequate capacity for monitoring and evaluation, especially following termination of CHaMP. The proponents acknowledge that the GRMW now has the lead role in habitat monitoring throughout the Grande Ronde Basin and will work with ODFW toward implementation.

The GRMW could benefit from a Council-sponsored workshop on how to implement an AM approach (see [ISRP 2017-2](#)). Alternatively, the GRMW could retain professional assistance to help shape an AM structure and eventual implementation. While taking steps in the right direction, the GRMW could use sustained engagement of AM experts to speed and more fully develop the process. The ISRP remains concerned, however, that there was no discussion of the analytical and social (decision-making) requirements needed to support effective AM.

The annual State-of-the-Science meeting is proposed as the primary mechanism for evaluation and adjustment during the AM cycle. An extended State-of-the-Science meeting will be scheduled every five years to evaluate outcomes from project implementation in the previous five years. This plan is appropriate in principle, but the lack of evaluation to date does not inspire confidence regarding the effectiveness of these meetings in furthering AM. The ISRP's request for this Synthesis Report was intended to provide a major opportunity for evaluation and adjustment. Full implementation of a functioning AM process will strengthen the design and effectiveness of future actions to address limiting factors.

[Vision for the Future: Research and Restoration, and Synthesis Conclusions \(pages 99-108\)](#)

The life-cycle models for Catherine Creek and the upper Grande Ronde are important outcomes achieved by collaborators (NOAA, CRITFC, ODFW) and the GRMW program. They will be critical for focusing resources on factors that most significantly impact recovery. As well, the life-cycle models demonstrate the critical importance of collecting monitoring and effectiveness data and being able to apply these data to help guide restoration and management activities.

Importantly, the life-cycle models are the types of tools the GRMW has at its disposal through collaboration with its partners. By using them, the GRMW should be able to conduct the assessment of restoration effectiveness and future prioritization that the ISRP has requested. These models provide an opportunity and an analytical tool that many other subbasins in the Columbia River system lack, and that could be used to more extensively and effectively assess the consequences of past and planned restoration actions.

The proponents discuss recent research on challenges associated with climate change and contaminants, and on opportunities to use life-cycle models to evaluate population viability under alternative restoration scenarios. Unfortunately, the section does not include an explicit vision of desired/achievable future conditions or any quantitative objectives with timelines. These are needed at multiple scales: project, watershed, and subbasin.

The vision for the range of challenges in the future is expanding as the GRMW recognizes the overwhelming importance of both existing (e.g., temperature) and new (e.g., contaminants,

climate change) limiting factors affecting restoration effectiveness. The approach for addressing these, however, appears piecemeal and perhaps opportunistic, and no specific details are provided. Unfortunately, the proponents are missing a major opportunity to describe their future directions in addressing limiting factors at the subbasin scale. This could include a preliminary draft of broad scale goals and quantitative objectives for achieving future watershed, habitat, and fish conditions.

The GRMW's Vision for the Future describes some major factors that the ISRP has asked them to address for over a decade. And overall, the ISRP feels that the conclusions in the Synthesis Report provide an honest and self-aware reflection of the challenges and opportunities facing the GRMW, including the need to engage a more challenging group of stakeholders (e.g., crop producers), declining native fish populations, and impending retirements of the project managers and researchers. However, effective scientific (as well as social) integration at the program scale is paramount for success, and the great challenge for the GRMW will be to move toward a more collaborative and integrated data-driven habitat program like those in the Upper Columbia, Okanogan, Kootenai, and Lower Columbia River Estuary. The ISRP appreciated the open dialogue with the GRMW at our October 2017 site visit and the 2018 State-of-the-Science meeting as well as the opportunity for feedback on the draft synthesis outlines. We continue to be available for dialogue to improve our understanding of the GRMW program and to clarify any scientific issues raised in our reviews.

Literature Cited

- Hillman T, P Roni, and J O'Neal. 2016. Effectiveness of tributary habitat enhancement projects. Report to Bonneville Power Administration, Portland, OR.
- Reid, LM. 1998. Cumulative watershed effects and watershed analysis. Pages 476-501, in RJ Naiman and RE Bilby, *River Ecology and Management*, Springer.
- Steel, EA, TJ Beechie, CE Torgersen, and AH Fullerton. 2017. Envisioning, Quantifying, and Managing Thermal Regimes on River Networks. *BioScience* 67:506-522.
- UCRTT (Upper Columbia Regional Technical Team). 2014. A biological strategy to protect and restore salmonid habitat in the Upper Columbia Region. A Draft Report to the Upper Columbia Salmon Recovery Board.
- UCSRB (Upper Columbia Salmon Recovery Board). 2014. Integrated Recovery Program Habitat Report. Upper Columbia Salmon Recovery Board, Wenatchee, WA.
- Zabel R and T Cooney. 2013. Appendix C: Recruits-per-Spawner in Base Versus Current Time Periods—Do they differ? In Appendix C in NOAA Fisheries. 2014. Endangered Species Act Section 7(a)(2) Supplemental Biological Opinion. Consultation on remand for operation of the federal Columbia River power system.
www.westcoast.fisheries.noaa.gov/fish_passage/fcrps_opinion/federal_columbia_river_power_system.html.