Chehalis River Basin Flood Control Zone District

Erik P. Martin, P.E., District Administrator

351 NW North St
Chehalis, WA 98532-1900

May 27, 2020

Diane Butorac
Department of Ecology SEPA EIS Project Manager
SEPA Draft EIS for the Chehalis River Basin Flood Damage Reduction Project
c/o Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, Washington 98101

Re: **Transmittal of Comments of the Chehalis River Basin Flood Control Zone District on the SEPA-Draft Environmental Impact Statement for the Chehalis River Basin Flood Damage Reduction Project.**

Dear Ms. Butorac:

The Chehalis River Basin Flood Control Zone District (District) hereby transmits its comments on the Draft Environmental Impact Statement (DEIS) issued by the Department of Ecology (Ecology) on February 27th, 2020[1], for the Chehalis River Basin Flood Damage Reduction Project (the Project).

The District wishes to acknowledge the efforts of the Ecology staff and their consultants and the Office of the Chehalis Basin (OCB) during preparation of the DEIS. The Project has a long and complex history that has generated any number of difficult – and at times controversial – issues, including the overriding concern over climate change.

[1] The District proposes to construct and operate a Flood Retention Structure on the Chehalis River near Pe Ell, Washington, and to increase the height of a Levee Structure at the Chehalis-Centralia Airport to reduce flood damage from major flood events on the Chehalis River in Southwest Washington. This project is being undertaken in collaboration with the Department of Ecology (Ecology) and the Office of the Chehalis Basin (OCB). Under the State Environmental Protection Act (SEPA), an Environmental Impact Statement (EIS) must be prepared to inform state and local agency decision-makers, the public and affected tribes about such impacts of the proposed project (RCW 43.21C.030; WAC 197-11-360, 400, 402 et seq.).

As the Project sponsor, the District is one of the public agencies that will make ongoing decisions and will rely on the FEIS to inform itself of the consequences of those decisions. The District therefore has a vital interest in the accuracy, completeness and usefulness of the FEIS to making future decisions to move the Project forward and to ensure that the District is able to fully discharge its duty and serve the public interest. Further, the District acknowledges that the DEIS has identified a number of potential environmental impacts, particularly to aquatic resources. The District is already deeply engaged in developing options to mitigate aquatic species and water quality impacts, and we are optimistic that these options can be successful. The District is committed to working with OCB in cooperation with state resource management agencies and several federal agencies to develop a viable, effective response to the impacts.

The District notes at the outset that the benefits of the proposed project are found in the DEIS to be substantially greater than was found by DOE in its 2016 Programmatic EIS. The DEIS identifies 1,280 valuable structures that will be protected from a 100-year modelled flood, a significantly larger number than forecast in the PEIS evaluation of Alternative 1.

The proposed flood retention facility serves a unique purpose and is innovative in its design and operation. It is not a conventional dam for long-term water storage; its purpose is to temporarily store flood waters to prevent recurring flood damage throughout the Chehalis Basin. The proposal is the result of years of state funded research of worldwide engineering concepts to protect communities from flooding while preserving aquatic resources. Unlike typical water storage structures the gates at the bottom of the facility will remain open at all times allowing free flow of the natural river volume except when a major flood event is predicted. With its open gates, the river will allow for fish passage through the gates and maintain the aquatic ecology of the river above the facility. With the threat of a major flood the gates will only be partially closed to allow for a minimal flow and flood waters will be temporarily stored to reduce peak flood flows downstream. This will protect families, communities, businesses and

infrastructure through Pe Ell, Chehalis, Centralia and the surrounding rural areas all the way to Grays Harbor. Immediately after the peak flood flows pass the gates are reopened, the reservoir drained and natural free flow of the river is resumed. Historical records indicate this would occur on average every seven years; computer modeling of the future that considers climate change indicate damaging floods could happen more often.

By far the greatest impact on aquatic species in the upper Chehalis basin identified in the DEIS is due to climate change. The lesser impacts on aquatic species are found to be due to the Project itself. The District has undertaken its review of the DEIS with the issues integral to moving the Project forward in mind. Specifically the District must clearly understand what environmental impacts the Project will be responsible for addressing through avoidance and minimization measures and, after these measures are deployed, mitigation of the remaining impacts. The District and the OCB must assess the benefits of increased flood damage protection created by the Project together with the Project's costs and the effectiveness of addressing the Project's environmental impacts. Simultaneously through the Chehalis Basin Long-term Strategy, the benefits of flood damage reduction including associated environmental mitigation will supplement environmental restoration within the basin to the overall benefit of aquatic species. The District has already advanced its planning to address avoidance, minimization and mitigation in several key aquatic resource areas.

The District has undertaken a detailed review of the DEIS and has prepared a number of comments to improve the focus, accuracy and usefulness of the FEIS for eventual decision making. These comments are incorporated in the attached "Detailed Comments of the Chehalis River Basin Flood Control Zone District Draft Environmental Impact Statement."

In addition to the District's detailed comments, there are two issues of overriding concern as the District attempts to accurately understand the Project's potential impacts. The first is that Project impacts for all aquatic related resources have been integrated with, and not separated from, the effects of ongoing climate

change when described in the DEIS. The second issue is that impacts were determined in many cases without consideration of appropriate avoidance and minimization measures or permitting conditions typically required by state or federal permitting agencies. The District's concerns related to these two issues are discussed in the following sections.

Project impacts and the effects of climate change must be reported separately

Within the Chehalis Basin, climate changes are predicted to affect the timing and increase the intensity of precipitation and flood flows along with causing hotter, drier summers that will negatively affect critical aquatic resources. We believe it is important to understand the effects that climate change will have on the aquatic resources of the Chehalis Basin as the backdrop against which the potential impacts of the Project will occur. It is equally important to understand the degree to which changes in aquatic resources may result from the Project.

It is necessary to pore through multiple appendixes to tease out the data that delineates the No Action Alternative impact of Climate Change as opposed to the specific impacts of the Project on aquatic species.

DOE explained this in response to questions about the DEIS from the Chehalis Basin Board[2]:

> *"for spring-run Chinook salmon in the Above Crim Creek spatial unit in late-century, there was a 97% decrease in estimated abundance under the Proposed Action (Table E-11) and a 87% decrease under the No Action Alternative (Table E-23). Thus, the effect of the FRE facility alone was an additional 10% decrease in the abundance of this species in this spatial unit in this timeframe when compared to the No Action Alternative."*[3]

[2] The Chehalis Basin Board (CBB) oversees the development of the Chehalis Basin long-term strategy for addressing aquatic habitat restoration in the basin and implementation of flood damage reduction measures. At its May 5, 2020, meeting the CBB was briefed on the findings of the DEIS and initiated a series of questions regarding those findings. The OCB responded to those questions in a memorandum to the CBB issued May 31, 2020.

[3] Memorandum from Andrea McNamara Doyle, Director - Office of Chehalis Basin, RE Response to Chehalis Basin Board Questions on the Chehalis River Basin Flood Damage Reduction Project, March 31, 2020, at page 18.

The District acknowledges from the data contained in the DEIS that the Project will have significant impacts during construction and mid-century that must, and will, be addressed through avoidance, minimization and mitigation. The DEIS forecasts an 87% decrease in abundance of spring-run Chinook salmon in this single reach of the river by 2080 due to climate change - without the Project. That is the No Action alternative. The DEIS forecasts that this Project, with no mitigation or avoidance, would add to that climate change decrease, causing the decline to increase from 87% to 97% in that single reach. The DEIS analysis shows that climate change is overwhelmingly the primary contributor to future losses. The lesser contributor is the Project, which has an estimated maximum impact of 10% on spring chinook. All of these projected losses are limited to a single river reach -- one that produces 1-3% of all of the Spring Chinook basin-wide. The contribution of the Project ranges from 0 to 15% at late century for all species in this single reach before considering avoidance, minimization and mitigation. This critical distinction must be clearly described in the FEIS to provide the basis for the avoidance, mitigation and mitigation planning the District must undertake and which will inform its ongoing decisions about the Project. This is but one of a number of examples of the need for the FEIS to disaggregate Project impacts and climate change effects in order for the FEIS to serve as a useful decision-making tool.

Impacts must be assessed using realistic assumptions.

In briefings following release of the DEIS, Ecology staff described that the impact analysis had been designed to use conservative or worst-case assumptions to capture all potential impacts[4]. While it is common in the preparation of an EIS to consider worst-case scenarios, such scenarios must be based on reasonable and realistic assumptions that reflect existing and future conditions, industry best management practices for construction and operation of the proposed project

[4] Briefing by Ecology staff to the Chehalis River Basin Flood Control Zone District supervisors at Chehalis, Washington, April 2, 2020.

and of equal importance conditions that would be imposed by permitting agencies. ***The Project's impacts should not be reported based on assumptions that would not be permitted.***

The DEIS includes assumptions with regard to air emissions, vegetation management, water use, recreation and several other resources that disregard best management practices or fail to recognize permit agency requirements and actual current conditions in the affected project area. For example the DEIS assumes that timber harvested within the temporary inundation area would be burned and not either sold as merchantable lumber or distributed downstream as large woody material for aquatic habitat structure, both of which are realistic uses of the timber. The DEIS estimates that total emissions during construction would be 106,890 metric tons of the greenhouse gas carbon dioxide; elimination of burning would reduce these emissions by approximately 50% to 53,435 metric tons over the 5-year construction period[5]. In another example, the DEIS finds that significant unavoidable impacts would occur to wetlands. Clearly wetland will be affected by the Project, but both federal and state law and regulation require that compensatory mitigation (replacement wetlands) be provided so there could not possibly be a net loss of wetland function or value as a result of construction or operation of the project.

In both cases the DEIS recommends that mitigation plans be developed and negotiated with relevant permitting agencies. However, in many cases the assumptions used ignore well established avoidance, minimization and mitigation requirements, leading to overstating impacts that does not provide a clear perspective for decision makers and the public about the actual expected consequences of implementing the Project. No project would ever be permitted with the types and severity of impacts that are depicted in the DEIS. One of the District's supervisors has said that the District itself wouldn't support the Project if all of the impacts described in the DEIS were to actually occur. A realistic

[5] Appendix A Air Quality and Greenhouse Gas Discipline Report, Proposed Chehalis River Basin Flood Damage Reduction Project SEPA Draft Environmental Impact Statement, February 2020, Page A-24.

assessment of impacts based on practical assumptions is needed to meet the purpose of the EIS, which is to inform decision-makers and the public (WAC 197-11-400 [2]).

While the changes necessary to address these concerns are given in the District's attached detailed comments, we urge Ecology to revise the DEIS to address these two primary concerns as a matter of urgent priority.

In support of the District's review of the DEIS, please find attached the following three documents:

- Comments of the Chehalis River Basin Flood Control Zone District on the SEPA-Draft Environmental Impact Statement for the Chehalis River Basin Flood Damage Reduction Project – This document constitutes the District's detailed comments on the DEIS with specific requests for changes to the DEIS as Ecology prepares the FEIS.
- March 31, 2020, Memorandum to the Chehalis Basin Board from Andrea McNamara Doyle, Director of the Office of the Chehalis Basin. This document, created using input from DOE and WDFW, provides answers to the questions posed by the CBB to the OCB and is incorporated by reference to the District's comments.
- HDR Technical Memorandum - SEPA DEIS Review: FRE Facility Temporary Reservoir Inundation and Vegetation Analysis Clarification – Chehalis River Basin Flood Damage Reduction Project, May 7, 2020. This document provides clarifying information on the assumptions related to vegetation management within the temporary inundation area based on publically available information.

The District wishes to thank Ecology and the OCB for the opportunity to provide these comments on the DEIS, and in the collaborative spirit in which they are provided, we will make our staff and consultants available to clarify or expand on any of the comments provided. Please coordinate any communication to the District to me or Betsy Dillin at the District. Betsy can be reached at Betsy.Dillin@lewiscountywa.gov or (360) 740-1138.

Chehalis River Basin Flood Control Zone District

Erik P. Martin, P.E., District Administrator

351 NW North St
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Respectfully Submitted,

Erik Martin, District Administrator

On behalf of:

Supervisors:

Edna J. Fund, Chair

Robert C. Jackson, Vice-Chair

Gary Stamper, Member

Attachments:

- Comments of the Chehalis River Basin Flood Control Zone District on the SEPA-Draft Environmental Impact Statement for the Chehalis River Basin Flood Damage Reduction Project.

- March 31, 2020, Memorandum to the Chehalis Basin Board from Andrea McNamara Doyle, Director of the Office of the Chehalis Basin.

- HDR Technical Memorandum - SEPA DEIS Review: FRE Facility Temporary Reservoir Inundation and Vegetation Analysis Clarification – Chehalis River Basin Flood Damage Reduction Project, May 7, 2020.

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Comments of the Chehalis River Basin Flood Control Zone District on the SEPA-Draft Environmental Impact Statement for the Chehalis River Basin Flood Damage Reduction Project

27 May 2020

The Washington State Department of Ecology (Ecology) has prepared and issued a Draft Environmental Impact Statement (DEIS) for the proposed Chehalis River Basin Flood Damage Reduction Project (the Project). The DEIS was released for public, agency and tribal reviewed and comment on February 27, 2020. The Chehalis River Basin Flood Control Zone District (the District) which is the sponsoring public agency for the Project submits the following comments to Ecology for consideration during preparation of the Final Environmental Impact Statement (FEIS).

To undertake its responsibilities as the agency with responsibility for the Project, the District requests that a number of revisions be made to the DEIS as it is revised by Ecology to become the FEIS. The District believes that these revisions are necessary to clarify the specific impacts of the project and the alternatives considered and focus the EIS to improve its usefulness for informing tribes, stakeholders and the public and decision-making by the District and other agencies with jurisdiction over the Project. The more significant actions requested by the District are described below and include a statement of the action requested followed by the rationale for the action. The District has also engaged the assistance of qualified technical professionals to review the DEIS and the individual resource reports. The result of their reviews support the actions requested in this letter and are also documented in the attached "DEIS – District Detailed Comments." This table includes references to locations in the DEIS and describes the specific changes and corrections recommended as well as the rationale for each change. The recommended corrections are specific to the DEIS and are not general opinions. We hope that this approach aids Ecology in an efficient process to review comments and prepare the FEIS.

As noted and discussed in the Districts transmittal the integration of climate change effects and climate change effects and the use of unrealistic assumptions in the impact analysis are of significant concern to the District and the District requests that these issues be addressed in the FEIS.

Two documents are attached to and incorporated into these comments. They are Ecology's answers to questions by the OCB Board as noted above and an analysis of reservoir inundation frequency and duration to support the District's request to update certain foundational assumptions in the DEIS analysis.

Issues that the District believes require action on the part of Ecology to prepare the FEIS are discussed in the following section. Also included is a table of detailed recommendations for changes to the DEIS as the FEIS is prepared.

Clarify Project Impacts as Distinguished from the Effects of Climate Change

1 - **Clarify Project Impacts as Distinguished from the Effects of Climate Change**.

To distinguish between climate change effects and potential Project impacts, the District has three requests. The District first requests that a table and/or narrative discussion be included in each of the DEIS resource technical appendices where climate change has been integrated that clearly distinguishes between direct and indirect impacts of the project to that resource and any predicted resource changes that are expected from climate change. Second, the District requests that the resource impact summaries included in Section 5 of the FEIS are revised to describe the differentiated impacts for the Project and the alternatives. Based on information developed during preparation of the DEIS, this should include a description of the intensity, duration and extent of such project impacts. Finally, the District requests that Exhibit S-5 and Exhibit S-6 be updated as appropriate to reflect only impacts resulting from construction and operation of the proposed project and not the combination of project impacts and climate change effects.

The District appreciates the complexity of forecasting the future effects of climate change while simultaneously assessing project impacts. This is particularly critical in the resources sections addressing aquatic habitat, fisheries and water quality. For each of these resources, the DEIS found that significant impacts were likely to occur but did not distinguish how much would occur as the result of climate change and how much would be uniquely associated with construction and operation of the project. Identifying the specific impacts of the proposed action (Washington Administrative Code (WAC) 197-11-752) is necessary to allow the District to assess the mitigation plans called for by Ecology in the DEIS and that may be required by agencies with permitting authority. The District must undertake initial development of these mitigation plans in order to assess the effect on overall project costs and to aid in the development of project permit applications. Without clarifying the distinction between project impacts and the results of climate change, the District cannot reasonably undertake the development of such mitigation plans.

2 - Review *Inaccurate Underlying Assumptions and Revise Impact Assessments Based on More Realistic Assumptions*

The District requests that Ecology review ***all*** underlying assumptions that that were key to findings of significant impact and either 1) revise those assumptions to be consistent with common practices and agency requirements to avoid or minimize impacts (WAC 197-11-440), 2) revise assumptions that reflect conditions that would not be permitted under current law and regulation or, 3) add additional narrative describing the probable range of impacts that may result from more likely reasonable assumptions. The District also requests that the analysis in the DEIS be revised throughout and that the FEIS reflect changes resulting from this review. The following (Table 1) are offered ***as examples*** of the types of reviews that the District requests be undertaken by Ecology for each resource.

Table 1 Review of Assessment Assumptions

Resource	Assumption	Comment
Air Resources Discipline Report	It was assumed that existing vegetation would be removed from the entire inundation and that the resulting material would be burned, leading to significant air emissions and quality impacts.	Best Management Practice to avoid and minimize material disposal will be to sell all merchantable timber or store and release timber to river flows to contribute material to downstream aquatic habitat. Some small- sized slash would be burned under normal forest practices. This is expected to reduce air emissions, particularly green-house gas emissions significantly.
Terrestrial Habitat Discipline Report/ Water Quality Discipline Report	It was assumed that vegetation would be removed from the entire temporary inundation area and that the maximum water surface elevation from all operational events would reach the inundation area limit.	This assumption is overly conservative as demonstrated by an inundation analysis prepared by the District and attached to this comment letter. Using data available to the Ecology EIS team, the District's engineering consultant has calculated and plotted the inundation area and duration for the 5 commonly considered flood events analyzed in the DEIS. This analysis shows the actual inundation time frame for major segments of the inundation area and demonstrates that the maximum area inundated is less than the entire temporary inundation area for most events.
Appendix E3 of Fish Species and Habitats Discipline Report	The 2016/2017 Fish Passage Sub-committee's recommendations regarding run times for salmon, steelhead and other fish species of the Chehalis Basin has been significantly modified in the analysis performed by Ecology. Figure E3-1 of the Table 3.	See Detailed Comment E-3 in Table 3. Changes to the Fish Passage Sub-committee recommendations in the DEIS analysis potentially significantly increase the exposure of migrating fish to less suitable conditions increasing the potential for impacts and reducing fish population density. No justification for changing these

		recommendations has been provided. Given that the Sub-committee represents a credible scientific body with expertise in the subject matter, the DEIS should include commentary justifying these changes conduct a separate analysis to determine the significance of this change.
Recreation Discipline Report	For recreation use, the DEIS assumes that the area upstream of the FRE facility would be permanently lost for recreation use and assigns a finding of significant impact implying that it is currently available for recreation.	See Detailed Comment J-1 in Table 3. The present use of the FRE project area is commercial forestry, and it is closed to public access. The landowner permits very limited access primarily for camping, hiking and hunting by special permit. The DEIS analysis does not properly consider the existing condition as to recreational use.
Wetlands	The DEIS finds that significant, unavoidable impacts would occur to wetlands.	Current federal and state law and regulations require that a project create no net loss to wetlands, thus any wetlands affected by construction and operation of the project must be replaced with equal or greater wetland function and values as a prerequisite to project approval. This assumption should be the basis for any conclusions regarding wetlands which would lead to a reduced finding of wetland impact.

As a public agency, the District has a responsibility to protect the citizens of Lewis County from the significant physical, economic and social effects of major flood events, while simultaneously exercising its duty to protect the environment. This duty is exercised by first avoiding, then minimizing and finally mitigating the environmental effects of its actions. Some assumptions made in the DEIS analysis incorrectly imply that the District would not take these steps. For example in the air resources analysis, the DEIS assumes that all vegetation removed within the proposed flood control inundation area would be burned, releasing combustion emissions to the atmosphere and releasing carbon that has been sequestered in this biomass for many years. Instead the DEIS should have assumed that harvested trees would be sold as merchantable timber or recycled as large woody material for aquatic habitat structure.

To ensure that the FEIS is viewed as a fair and credible analysis of potential project impacts, any assumptions that are not consistent with current permitting agency practices and requirements should be reviewed and revised. This additional context will provide decision-makers, the public and affected tribes with a more realistic understanding of the likely consequences of the project not an unreasonably "worst-case" scenario.

Critical to the analysis of impacts to air quality and greenhouse gas emissions, fish species/habitats and water quality is the management of vegetation within the temporary reservoir inundation area. Ecology used a simplifying assumption that all vegetation within the proposed temporary reservoir inundation area would be removed based on a schematic vegetation management plan included in the Programmatic EIS issued in 2016. To assist Ecology in reviewing their assumptions and revising impact analyses the District as requested its engineering/environmental consultant to assess the frequency, duration and geographic area of inundation by plant community that would occur under the same flood events previously analyzed in the DEIS. This analysis, from previously available data sources and studies is attached as a Technical Memorandum and is provided to assist Ecology to review and clarify the assumptions made for vegetation management and the integrated effects on several key resources.

3 - Provide a Clear, Concise and Equitable Comparison of Alternatives

The District requests that an additional section be added to the DEIS entitled "Comparison of the Proposed Action and Alternatives." This section should include the information described in items 1 and 2 above and would require that the FEIS provide further quantification of impacts as described below.

The District's request for this additional section is twofold. First, SEPA contemplates that a detailed comparison of the proponents proposed action to reasonable alternatives to that action be provided in the DEIS. This requirement is found in WAC 197-11-060(3)(iii); WAC 197-11-440 (5)(b)(ii), (5)(c)(vi)) and (5)(c)(vi). This comparison is central to the purpose of an EIS, which is to inform decision-makers of the consequences of the available choices. As the responsible public agency for the Project, the District must make decisions about the Project with full knowledge of the consequences of those decisions in view of the alternatives available.

To make such an informed comparison, the impacts for both the proposed project and the alternatives include the No Action Alternative should be analyzed and described in a similar level of detail supported by similar quantitative or qualitative methods. The Districts review of the DEIS found that the degree of quantification in the analysis of impacts for the Proposed Action was significantly more detailed than the analysis of the No Action Alternative and the Local Actions Alternative. The result of our review is summarized for the Proposed Action and the No Action Alternative in Table 2 "DEIS Quantification and Differentiation of Impact Analysis by Environmental Resource." While in most resource categories data describing the resource was included, the translation of this data through a set of impact criteria to determine levels of impact significance was not included. Instead, impact determinations were made using professional judgement. Table 2 shows that for the 15 environmental resources considered, quantified impact analysis was documented for only eight resources for the Proposed Action and only one for the No Action Alternative. Yet findings of significant impact were made in most resource categories for the Proposed Action. While professional judgment by seasoned experts must necessarily, play a role in impact assessments, when such judgment is relied upon to make findings of significant impact the logic or basis for that judgment should also be explicitly stated as part of such findings. The District is particularly concerned about the lack of quantified impacts under the No Action Alternative for resources affected by catastrophic flooding. Understanding the consequences of The No Action

Alternative is especially important to the District because it represents continued exposure to the damage and impacts of catastrophic flooding and not simply continuation of a benign condition. While Table 2 only addresses the No Action Alternative, review of the Local Actions Alternative also lacked sufficient detail to support an effective comparison to the Proposed Action.

Table 2.0 DEIS Quantification and Differentiation of Impact Analysis by Environmental Resource

Resource	***Proposed Action***			***No Action Alternative***		
	Impacts Quantified	Impacts Not Differentiated In DEIS document[1]	Impacts Not Quantified	Impacts Quantified	Impacts Not Differentiated In DEIS document[1]	Impacts Not Quantified
Air Quality and GHG	X	X				X
Cultural Resources	X	X				X
Environmental Health & Safety			X			X
Environmental Justice			X			X
Fish Species & Habitats	X	X		X	X	
Earth	X	X				X
Land Use			X			X
Noise and Vibration	X	X				X
Public Services	X	X				X
Recreation			X			X
Tribal Resources	X	X				X
Visual Quality			X			X
Water			X			X
Wetlands			X			X
Wildlife		X				X

Note: 1 – Impacts were not differentiated from Climate Change Effects in the DEIS which is required to identify those impacts the project is responsible for addressing.

4 - Clarify the Degree to which each of the Alternatives Achieves the Purpose and Need of the Proposed Project.

The District requests that the FEIS include report a quantitative analysis of the degree to which the No Action Alternative and the Local Actions Alternative meet the Purpose and Need established by the District for flood damage reduction. WAC 197-11-440(4) requires that a project proponent provide information to describe the Purpose and Need or objective of the proposed action. WAC 197-11-440(5)

(b) requires that alternatives to the proposed action be considered and that "reasonable alternatives shall include actions that could reasonably attain or approximate a proposal's objectives." The District requests that the degree to which the alternatives achieve the quantified objects set forth for the Proposed Action be included in the comparison table described in item 3 above.

The purpose of the alternatives analysis in SEPA is to provide decision-makers with an understanding of the consequences of alternative courses of action. Inherent in this process is the complete delineation of the trade-off that alternatives may present between differing levels of environmental impact and the achievement of the project's objectives.

5 - Clarify that Impacts Predicted to Occur at Mid and Late Century are "Estimated" or "Potential" not Certain Impacts.

In the DEIS some environmental resources, particularly those related to aquatic ecology, were assessed at mid-century or late century based on the results of computer models. The District requests that in the FEIS all such findings include the word "estimated" or "potential." Without this caveat, such statements imply more certainty than is appropriate. The result of modeling analysis for complex ecological systems 30 to 50 years in the future is by its very nature speculative and must be so described.

The District also requests that additional discussion be included in Section 3.4 of the DEIS describing the forecasting error or variability inherent in each model, how that error or variability may compound as models are linked together and what validation of the models, both individually and linked together, was performed to determine the sensitivity of the results used to assess impacts.

The DEIS describes the use of a series of models that are linked together to evaluate the future effects on the aquatic ecosystem. The models include a climate change forecast that predicts changes to the timing and intensity of future precipitation, which in turn is used in models forecasting hydrology (river flows) that provides the basis for further models that estimate the resulting productivity of the aquatic habitat in the Chehalis Basin in terms of fish species populations.

Typically EIS analysis is based the assessment of estimated changes to actual current conditions as represented by empirical data or reasonable approximations of empirical data. Ecology's approach for selected resources was to forecast future conditions (30 to 50 years in the future) as the basis for impact analysis in order to capture the effects of climate change. Computer models were used provide this forecast, but no computer model can completely capture the complexity of natural systems and forecast what future conditions will be with certainty; at best it is an estimate or approximation. This issue is compounded by the long time frame of the future forecast. Each of the linked models used in the analysis has an inherent degree of error or variability in its results, and linking them together as is described in Section 3.4 of the DEIS significantly compounds the error or variability of the result. This phenomenon is unavoidable when using computer models to forecast future conditions, but the description and analysis of the results must necessarily include a description of the likely error or variability. The District does not suggest that the modeling approach be abandoned or that the consideration of climate change is not appropriate. The District does consider that the modeling results

and the impact findings have been given more weight than is appropriate because no reporting of the potential error or variability was given nor was the caveat that the results were estimates of potential impacts provided; instead they were presented as facts.

6 – Additional Recommended Changes to the DEIS during preparation of the FEIS

The District has reviewed the DEIS in detail for technical accuracy and structural consistency. In addition to the comments in the preceding section, Table 3 provides additional technical comments to be considered during preparation of the FEIS.

Table 3 is organized to reflect the overall organization of the DEIS with comments on the Summary Section, main body of the DEIS (Chapters 1-10), Appendices 1-4, and Appendices A-P (Discipline Reports). Comments provided to Appendices A-P focus on specific details of the assumptions, methods, and analysis of impacts for each of the resource areas. The detailed comments provided to Appendices A-P are summarized in the District's comments to Chapter 5 of the main body of the DEIS. Further, the District requests that the corrections to the Project Description in Chapter 2 of the DEIS, and Appendix 1, as detailed in the District's comments are incorporated into the FEIS.

Table 3 District's Comments to SEPA-DEIS

No.	Section	Page #	Quote or Paraphrase from Original DEIS Text	Comments
SUMMARY				
	Summary	NA	Summary Section	The District requests that the Summary Section be revised to conform to the District's comments to the main EIS[1] document. In the following comments, the District has included specific requests that will further inform the analysis of impacts presented in the EIS. The District requests that the Summary Section be revised to accurately describe the updated conclusions in a manner that is consistent with the analysis presented in the main body of the EIS and subsequent Discipline Reports.
	Summary	Exhibit S5	Exhibit S-5: Significant Impacts from the Proposed Project	The District requests a number of changes to assumptions that affect the EIS impact conclusions. The District requests that to the extent impact conclusions are revised, that Exhibit S-5 also be revised to reflect those changes.
	Summary	Exhibit S6	Exhibit S-6: Summary of Significant Impacts and Proposed Mitigation for the Proposed Project	The District requests that Exhibit S-6 of the EIS be revised to reflect an updated impact analysis based on the Districts comments below. The District has detailed specific requests in the following comment table, including a number of changes to the assumptions that affect the EIS impact conclusions that are presented in Exhibit S-6.
DEIS INTRODUCTION				
1-1				No comment.
CHAPTER 2.0: PROPOSED PROJECT DESCRIPTION AND ALTERNATIVES				
2-1	2.3.2.2	14	The EIS states: "Water would flow freely through the outlets up to a rate of 8,500 cfs. For flows over 8,500 cfs, the water would start to pond at the outlet entrances and rise into the reservoir area, but water would continue to flow through the outlets."	The District requests that the EIS be revised to correct the statement to reflect the most recent design of the outlet capacity. The statement "Water would flow freely through the outlets up to a rate of 8,500 cfs. For flows over 8,500 cfs, the water would start to pond at the outlet entrances and rise into the reservoir area, but water would continue to flow through the outlets." is incorrect. The free flow discharge through the outlets occurs through a discharge of up to 12,500 cfs, not 8,500 cfs. The 8,500 cfs value may be an artifact of the earlier FRO design alternative that was supplanted by the current FRE alternative (see FRE Supplement Report, 2018).
2-2	2.3.3	17	The EIS states: "Upstream fish passage would be provided during construction by a temporary trap-and-transport facility, which would include a fish passage barrier (weir) downstream of the tunnel outlet to direct the fish passing upstream into the fish trap."	As described in Comment E-19, the use of a picket weir is not considered to be the likely alternative for fish passage design. As such the District requests that this portion of the DEIS be revised to remove the term "(weir)".

No.	Section	Page #	Quote or Paraphrase from Original DEIS Text	Comments
2-3	2.3.2.2	21	Section 2.3.4 Vegetation Management (general comment)	The District requests that the EIS be revised to reflect the information provided in the HDR Technical Memorandum - SEPA DEIS Review: FRE Facility Temporary Reservoir Inundation and Vegetation Analysis Clarification – Chehalis River Basin Flood Damage Reduction Project, May 7, 2020 (Inundation/Vegetation Analysis) attached to the transmittal letter, and the impact assumptions be re-evaluated based on this refined inundation analysis. As part of preparation of a detailed Vegetation Management Plan the District has prepared a refined analysis of the duration and extent of inundation that would occur in the temporary reservoir when the FRE facility is activated during specific major flood events. This memorandum used hydrologic data considered in the DEIS to map the three key drawdown stages presented in Exhibit 2-6 of DEIS chapter - Initial Reservoir Evacuation; Debris Management/Removal; Final Reservoir Evacuation – for the modeled 10-year and 100-year events and the historic 1996, 2007, and 2009 events. This technical memorandum is provided by the District to clarify the extent and duration of the temporary reservoir flooding and the extent and exposure of vegetation communities to being inundated within the temporary inundation area.
2-4	2.3.2.2	21	The EIS states that trees would be completely cleared from the FRE facility site and construction access areas. In the temporary reservoir area, the Applicant stated that all non-flood-tolerant tree species would be removed from the 405-acre zone where the inundation during FRE facility operation is expected to last 25 days or more.	The District requests that the EIS be revised to reflect the results of the Inundation/Vegetation Analysis provided by the District (see Comment 2-3 above). Specifically, as part of its ongoing revision of the Vegetation Management Plan the District will be refining the tree removal strategy based on the Inundation/Vegetation Analysis. Results of the Inundation/Vegetation Analysis indicate that under current climate conditions only approximately 162 acres will be inundated for 26 days or more under any modeled flood event.
CHAPTER 3.0: EIS ANALYSIS TERMINOLOGY AND APPROACH				
3-1	3.1		Section 3.1, Page 28	The District requests that discussion be added to this section describing the basis for the assumption for the recurring flood scenario including an analysis or evidence that this scenario of recurring events is probable and not speculative (see WAC 197-11-060.)
3-2	3.4	32	Section 3.4 and Exhibit 3-2 Integration of Modeling Results into EIS Analysis (general comment)	The District requests that the EIS accurately characterize the model outputs as “estimates” and describe the strengths and weaknesses of the models used in the analysis of impacts, including a description of model sensitivities and uncertainties. As stated in Section 3.4 of the EIS, several models (climate change, hydrologic, hydraulic, geomorphology, fish populations, and fish life cycle), have been used to inform the impacts analysis. Exhibit 3-2 of the EIS describes the use of these models as sequential in that the results of the models have been used to inform the subsequent models: the

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				climate change model informed the water models (hydrologic/hydraulic), water models informed the geomorphic model, and those results informed the fish population and life cycle models. This has no doubt been a challenging exercise and the qualitative and quantitative analysis is important to aid in the impact findings of the EIS. However, all models have strengths and weaknesses and model results are not intended to be representative fact. Additionally, the use of sequential modeling to arrive at an end product can be rife with cumulative errors if not properly accounted for at each step. The EIS makes little mention of confidence bands around each successive model results, and how successive modeling using those ever-increasing confidence bands addresses potential errors. .Although models provide context to decision making regarding a proposed action, models are inherently a simplified representation of complex systems, and must rely on subjective interpretation of error bounds for their results. When model results are relied upon as fact, this can lead to a misunderstanding of the application of the models in the decision making process. At best, models provide a tool for decision makers to consider an estimate of a range of possible outcomes of a proposed action. The EIS should make clear that impact findings are not necessarily a fact of the proposed project, but an estimate of potential outcomes. The results of the models should only be relied upon to inform a range of possible outcomes, appropriate to the confidence limits associated with the model itself. Furthermore, the successive design and implementation of the modeling effort leads to decreased confidence and increased uncertainty baked into the outputs of the models. For example, there may be a high level of uncertainty and wide confidence intervals associated with the various data inputs and subsequent results of the climate change model. The results of climate change model are subsequently used to inform the rest of the analysis in the EIS. However, the EIS has not made clear how the uncertainty and confidence intervals of the model outputs have been accounted for in the results of all models. The EIS provides description of some of the models in the Discipline Reports however does not provide the appropriate level of description of the models in the main document of the EIS. Decision makers and the public interest rely upon the EIS to inform the decision making process for the proposed action. As such, the EIS should clearly identify in the main document where important details regarding the development and use of models is provided in the EIS document. This information should include:

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				• Provide the methods used to validate each of the models. Were the models validated with in-basin data, regional data, or other sources of comparative data? • A description of the sensitivity of the models • A discussion of confidence limits and the resulting range of error inherent in the modeled results • Each model discussion requires a list of assumptions and data used to inform the model, and the confidence limits about those data and assumptions. The EIS should consider the following points regarding modeling and provide further description of these points to the public and decision makers: • The climate change models used to support the hydrologic and hydraulic modeling of impacts only characterize the worst-case scenario, and apportion the impacts of the project entirely to the limit of the confidence band. The EIS should properly characterize the confidence limits of the climate change model and then apply the results to the hydrologic model. In this example, the EIS may estimate that there may or may not be an increase in rainfall intensity or timing. Similarly, for water temperature modeling and the use of low flow data prescribed by the high end of the climate change model confidence limit (I.e. worst-case), the impact of the project is magnified. In truth, the real answer is somewhere in between the current state and an estimated future projection. The climate change modeling results have applied the worst-case end of the confidence limits throughout this EIS, rather than the mean. • Similarly, the water quality modeling used the high end of the climate change model results as confidence limits rather than the mean, to characterize the impacts of the project. If decision makers and the public are supplied with the confidence limits in a more balanced and appropriate manner, rather than the worst case only, the understanding of potential impacts will likely be results rather than the mean. • Fish population impacts should be characterized as an estimate of the range of possible predicted results, based on a range of water temperature model results, as informed by the range of climate change model results. The EIS presents the impacts of each successive model result at the extreme end of the confidence limit rather than presenting the mean and then applying a confidence band about that mean. Compounding error in the fish population model is the inevitable result. Furthermore, the EIS presents impacts to fish

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				populations with a level of precision that is not supported by the modeling approach (see Comment E-9, E-10).
CHAPTER 4.0: REQUIRED PERMITS AND APPROVALS				
4-1				No comment.
CHAPTER 5.0: IMPACT ANALYSIS, FINDINGS, AND POTENTIAL MITIGATION				
5-1	5.0	-	General comment	Comments provided in subsequent sections of this table are applicable to the specific resource areas summarized in the main body of the EIS and the Summary. All comments presented are applicable to the discussion of impacts found in the technical appendices, main body of the EIS, and EIS summary and the District requests that they be applied consistently.
5-2	5.0		Overarching comment on the Local Actions Alternative	The District requests that the EIS provide sufficient supporting information for analysis of the Local Actions alternative. The level of detail provided for the Local Actions Alternative is not sufficient to allow analysis of the potential impacts associated with implementation of the alternative. The current analysis provided in the EIS is too high level and cursory, and does not provide a basis of comparison to the Proposed Action or No Action Alternative. It is unclear how the Local Actions Alternative would impact future flooding. In Section 2.5 of the main body of the EIS, it states, "These actions could achieve the District's objective to reduce flooding from storms in the Willapa Hills through improving floodplain function, land use management actions, buying out or relocating at-risk properties or structures, improving flood emergency response actions, and increasing water storage from Pe Ell to Centralia." However, in Section 3.3 the EIS states that major and catastrophic floods would continue. There seems to be a disconnect between these two statements. The EIS needs to more clearly disclose how the Local Action Alternative would impact future flooding as well as the adverse and beneficial impacts of the action. The impact discussion is similarly challenged by the lack of information available. For example: • There is no discussion of emergency response impacts, impacts to the public, or plans that would be in place to minimize impacts under the Local Actions Alternative. • The discussion should provide more details on potential wildlife and habitats in the floodplain areas that could be potentially affected.

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				Several of the proposed actions within the Local Action Alternatives would occur in-stream or adjoining riparian corridors. A more accurate statement is that currently there is no way to quantify the ratio of work in non-developed vs developed land to meet the Local Actions Alternative objectives. The District requests that the EIS be revised accordingly.
Section 5.1 - Water				
5-3	5.1	39	Water Key Findings	As further detailed in the comments to Appendix N, the District requests that the analysis provided in the EIS be refined in in ways that are likely to change the impact findings. Specifically: • The description of existing conditions upon which many of the impact conclusions are based is incomplete. The description of existing water quality doesn't provide adequate context for the instances when water quality is not exceeding criteria. • The description of potential impact relies on modeling without acknowledging the margin of error of the model results. • The EIS should clarify the water temperature modeling approach and how the cited water temperature increase in Crim Creek of 2 to 5 C has implemented into the modeling approach. Further, the EIS should include recognition of the water temperatures in other tributaries of the Chehalis mainstem river. The water quality model should then be used to integrate these sources into the range of temperature changes as a result of the proposed project. • The DEIS does not provide a logical basis for the findings of unavoidable significant impact due to changes in Dissolved Oxygen (DO) as described in the main body of the EIS. The supporting water quality modeling results as summarized in Appendix N suggests that no such findings can be made (page N46 of Appx N, Page N65 of Appx N). The DEIS analysis shows that DO violations of the State of Washington water quality standard are as rare and infrequent as to be inconsequential. Please provide further supporting evidence as to why the finding of "significant and unavoidable" is justified or revise the finding to more correctly reflect the analysis described in Appendix N. • The EIS should include a description from the water quality modeling explaining the physical processes represented in the model that result in the increase in turbidity. Review of the description of the model in the DEIS and accompanying Appendix N does not indicate that turbidity is a parameter incorporated into the model output so how was it interpreted from the model? Is the concentration

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				in sediments higher but the mass loading lower due the difference in the inflow versus outflow? If this is the case, the FEIS should include a discussion explaining why there is a difference in both terms of concentration and load.
5-4	5.1.2.1	42 & 47	The EIS states: "Dissolved oxygen is an important measure of water quality because many aquatic species, including fish, need oxygen to survive. Warmer water holds less dissolved oxygen than cooler water, and warming can also increase aquatic species' need for oxygen. Ecology has documented levels of dissolved oxygen below the minimum level in the Chehalis River, especially during the summer. Construction of the FRE facility would reduce dissolved oxygen levels by up to 0.4 milligrams per liter in summer in the temporary reservoir area upstream of the FRE structure and areas downstream. As with temperature, these dissolved oxygen impacts would be greatest near the FRE facility and less farther downstream. […]Operation of the FRE facility would reduce dissolved oxygen levels by up to 0.4 milligrams per liter in summer in the temporary reservoir area and areas downstream. As with temperature, these dissolved oxygen impacts would be greatest near the FRE facility and less farther downstream."	The District requests that the analysis of dissolved oxygen be revised. The statement "Construction of the FRE facility would reduce dissolved oxygen levels by up to 0.4 milligrams per liter in summer in the temporary reservoir area upstream of the FRE structure and areas downstream" represents the results of a dissolved oxygen analysis that only considers water temperature and the relationship between DO and temperature, but does not include the effects of re-aeration arising from cascading flow in the affected reach above the site of the proposed FRE project. These cascades, which will be completely unaffected by the proposed project, serve to rebalance the maximum possible dissolved oxygen level available in the water column to full saturation at ambient temperature and atmospheric pressure. Even in the warmest of water, saturation level of dissolved oxygen is well above a lethal limit for salmonids and other aquatic life, and in this case would be well above the state criteria for compromised conditions for salmonids (lethal DO is below about 4 mg/l. (see Ecology 2002a, 2002b). For example, even in 20°C water, saturation of oxygen is 9 mg/l, well above the lethal limit for DO. In colder water, the saturation level is even higher. Nowhere in the supporting analysis in Appendix N is it mentioned whether the effects of DO reset to full saturation associated with cascading or riffle flow in the stream channel have been considered.
Section 5.2 - Earth				

No.	Section	Page #	Quote or Paraphrase from Original DEIS Text	Comments
5-5	5.2	56	Earth Key Findings	As detailed in the comments to Appendix F below, the District requests that the EIS be revised to correctly characterize the impacts of the proposed project on turbidity and large woody material (LWM) downstream of the FRE facility. The EIS has not provided enough supporting evidence to reduce uncertainty and substantiate the significant impacts determination on presented in Chapter 5.2 - Earth. The District requests that Ecology revisit the analysis of proposed projects impacts on sediment transport and suggests that these impacts should be revised to 'moderate'. Though it is true that there will be some minor impacts to sediment transport processes as a result of implementation of the FRE proposed project, these will be by no means be 'significant'. Since the proposed project does not permanently retain water, and the stream channel will be unaffected for all flows up to the 5- to 7-year recurrence interval event, and the majority of sediment transport will occur over time at flows of recurrence interval closer to 2-year recurrence interval, the data and modeling results do not support this as 'significant'. Furthermore, the EIS has made overly conservative assumptions regarding the reduction of LWM below the FRE facility. LWM up to 3 feet in diameter will pass through the FRE during non-impoundment periods, and LWM will also be reintroduced downstream of the FRE facility as a result of implementation of the Vegetation Management Plan and debris management following inundation events.
5-6	5.2	66	The EIS states: "This reduction in peak flows and corresponding reduction in large wood and sediment transport would impact the creation of habitats that depend on channel-forming processes. This would be a significant adverse impact on aquatic habitat from the FRE facility to the South Fork Chehalis River confluence."	The District requests that the EIS refines the analysis of the project impacts on peak channel forming flows, and revises the following statement that occurs in the Summary Section of the DEIS on page S-8, to more appropriately reflect regional specific sediment transport-related geomorphic processes: "[i]n addition, the Proposed Project would eliminate peak channel-forming flows downstream, reduce input of large woody material, and significantly affect habitat". The definition of channel-forming flows varies by region, and in the Pacific Northwest, it is commonly understood (Montgomery and Buffington 1993, Castro and Jackson 2007, Simon et al. 2007) that the consequential channel forming flow recurrence interval is about 2-years, and that, over time, flows of this recurrence interval are largely responsible for the greatest portion of sediment transport. Larger flows do cause channel changes, but these are usually recognized as of lesser significance compared to small events that are responsible for the majority of sediment transport. The Proposed FRE project will not affect the hydrology for all events of less than approximately 5-year recurrence interval.
Section 5.3 – Fish Species and Habitat				

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5-7	5.3	70	Fish Species and Habitats Key Findings	As described in detail in the comments to Appendix E, the District requests that the analysis of potential impacts to fish and aquatic resources to be included in the FEIS should be refined in several ways, and the impact conclusions revised accordingly. Specifically: • Revise the assumptions used in the DEIS analysis that all trees will be felled and burned within the area of the maximum inundation pool with the information provided by the District in the Inundation/Vegetation Analysis. This analysis, using data available in the project/public record significantly refines the assumptions used in the DEIS regarding the extent and duration of inundation and the aerial extent of vegetation affected of and the potential mitigating effects of a vegetation management plan. • The FEIS should note that District is working with state and federal agencies and basin stakeholders to identify and develop means to avoid, minimize and mitigate impacts described in the DEIS. While the DEIS assumes that this may not be technically feasible the District has identified a significant number of opportunities to implement feasible measures to reduce impacts. • The assumption of the use of a "picket weir" in the design of the temporary fish passage facilities is not correct (see Comment E-19). • Assessments of the effects on species abundance rely on modeling results. Assumptions and inputs are likely overly conservative in some areas and therefore the effects are likely overstated. Furthermore, the effects of the Proposed Action in terms of species abundance are presented with unrealistic precision, providing a false sense of confidence in the results (see Comment 3-2). • The DEIS lacks any discussion in the No Action Alternative (climate change only) of the impact from major flood events to mortality through scour of eggs and exhausting of young fish The FEIS should recognize and describe the effect of major floods on fish resources under existing conditions.
5-8	5.3.2.1	73	The EIS states: "Impacts on aquatic habitat from construction of the FRE facility would primarily result from dewatering and diversion of the river around the construction site and removal of nearly all trees in 600 acres of the temporary reservoir area."	The District requests that the FEIS recognize the updated information provided in the Inundation/Vegetation Analysis and as described in Comments 2-3 and 2-4 above. Trees would be selectively harvested with primary removal limited to certain areas. A robust planting plan would follow conifer removal in specific areas and the area of total tree removal would be less than the maximum inundation pool as noted in Comments 2-3 and 2-4 above.

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5-9	5.3.2.1	77	The EIS states: "During flood retention events, up to 6.4 miles of the Chehalis River upstream of the FRE facility and 847 acres of land would become a temporary reservoir, inundating and reducing habitat quality. Aquatic habitat would be rapidly converted from stream-type to lake-type habitat for up to 35 days with each flood event. This would lead to loss of riparian zone function, elimination of salmon spawning habitat, an increase in deepwater habitat that would be unsuitable for some stream-adapted fish species, an increase in turbidity, a loss of food supply for fish, and a loss of salmonid and other species' eggs due to suffocation."	The main body of the FEIS should describe impacts to habitat from flood retention events in the context of the frequency of such events. The District requests that Ecology revise the DEIS to note that the impacts discussed in this passage, would occur, on average, once every seven years. Further, based on the Inundation/Vegetation Analysis provided by the District, the EIS should refine the discussion of the extent and duration of inundation for various flood levels and the resulting impacts to habitat. Only the largest floods inundate the maximum pool, and this extent of inundation would last for approximately 10 days according to the Inundation/Vegetation Analysis. Please revise the EIS to provide a more precise analysis and discussion of the impacts to the habitat above the propose FRE facility, as it may be the case that the impacts to habitat are less then what is described currently.
5-10	5.3.2.1	78	The EIS states that the subbasin upstream of Crim Creek supports genetically unique populations of salmon and steelhead. The Proposed Project would result in a loss of genetic diversity within and among populations of each species across the Chehalis Basin.	The EIS over-generalizes the genetic uniqueness of salmon and steelhead upstream of Crim Creek. The District requests that Ecology revise the EIS to more closely match the text regarding this subject provided in Appendix E. Brown et al. (2017) found no genetic distinction for Chinook Salmon other than for fish upstream and downstream from the Skookumchuck River. Seamons et al. (2019) found evidence that Coho Salmon upstream from Crim Creek may indeed be genetically distinct from Coho Salmon elsewhere in the Chehalis Basin. Seamons et al. (2017) noted that steelhead from the upper Chehalis River and from the South Fork Chehalis River were similar, and may be distinct from other steelhead. Using different protocols, Seamons et al. (2017) found that steelhead from the upper Chehalis River may even be separate from those in the South Fork; however, they cautioned that low sample sizes require these results to be interpreted with caution. Please revise the main body of the EIS to correspond with the more precise analysis presented in Appendix E.
5-11	5.3.2.1	78	The EIS states: "Reductions in the number of salmon and steelhead from the Proposed Project are significant because they bring population abundances even further below 70% of historical abundance, which is the goal for other recovery plans."	As discussed further in Comment E-14, using recovery plans for listed Puget Sound salmonid populations is not appropriate for non-listed Chehalis Basin populations. The District requests that Ecology remove reference to the recovery goals for Puget Sound Chinook and Steelhead populations, as the recovery goals for those species do not apply to non-listed Chehalis Basin populations. Basin-specific metrics such as species escapement goals for the Chehalis Basin populations would be more appropriate for

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				assessing the impacts of the proposed action and alternatives on fish populations. Please see Comment E-14 for corrections to Appendix E.
Section 5.4 – Wildlife Species and Habitats				
5-12	5.4	86	Wildlife Species and Habitats Key Findings	As described in the comments to Appendix P (Wildlife Discipline Report) below, the assumptions provided in the DEIS to inform the impact analysis for habitat loss for wildlife species are likely over conservative. The District requests that Ecology revise this analysis based on the Inundation/Vegetation analysis provided by the District. The assumptions of habitat loss are incorrect or overestimated, based on treating the entire temporary reservoir as habitat loss as opposed to a more refined analysis that would consider various zones of inundation.
Section 5.5 - Wetlands				
5-13	5.5	97	Wetlands Key Findings	As detailed in the comments below to Appendix O (Wetlands Discipline Report), the impact analysis for wetlands and streams contains inconsistent assumptions and vague definitions for what constitutes an impact. Based on the data and information provided, it is not possible to determine how impacts to wetlands and streams were determined in the DEIS. Furthermore, the DEIS has likely been over conservative in their analysis of impacts due to the construction and operation of the facility, because of the assumptions used in the analysis (see Comments 2-3, 2-4, and comments to Appendix O). The District requests that Ecology reevaluate the conclusions presented in the DEIS based on the comments provided to Appendix O, and revision to the analysis assumptions based on the Inundation/Vegetation Analysis provided by the District.
Section 5.7 – Land Use				
5-14	5.7	113	Land Use Key Findings	The DEIS makes the finding that an inconsistent land use is a significant impact requiring mitigation. Identifying any inconsistent land use change as a significant impact is an overstatement of the potential impacts. Activities that are inconsistent with existing land uses are commonly dealt with during the permitting process as General Plan and zoning implementation processes include provisions for modifications to resolve nonconformance. A more appropriate threshold for determining significance would be to define significance around the potential for a land use change that would be inconsistent with the immediate surrounding land uses. In this case, the potential land use change would not be inconsistent with the surrounding forestry land uses. The District requests that Ecology modify the impact analysis to address these issues. Further, the District requests that the impact determination be

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				modified, as a significant impact is not justified based on the information provided in the DEIS.
Section 5.8 - Recreation				
5-15	5.8	123	Recreation Key Findings	The District requests that Ecology provide additional data to further quantify the level of current use of the study area for recreational purposes by recreational activity type. The significant impact findings on recreational resources should be reviewed and should be based on criteria related to actual recreation use. The EIS provides little information to substantiate the claims of "permanent loss" of 13.8 miles of the Chehalis River for kayaking, and 6.4 miles (12.8 miles of riverbank) for recreational fishing. As the EIS correctly describes private landowners currently restrict access and a permit is required to enter the area which is in commercial forest use. The EIS provides no information as to whether permits are issued to whitewater boaters or recreational fishers and if so, how many are issued for those activities. The impact analysis should consider that the area where the FRE facility and temporary inundation area is to be located is not currently available for public use except by explicit permission of the private landowner (via an entry permit).
Section 5.10 – Environmental Health and Safety				
5-16	5.10	134	Environmental Health and Safety Key Findings	SEPA requires agencies to identify and evaluate the probable impacts associated with an action and not to include in the environmental review impacts that are unlikely or speculative (WAC 197-11-782). Further, just because an issue of concern to the community is not included in an EIS does not mean that it is not relevant to governmental decision-making for a project. The District is focused on all aspects of the project that would affect local communities and the environment including the safety of the FRE. However, The District believes that issues related to dam safety should be considered in the appropriate forum and not in the context of "probable" environmental effects. The DEIS reports that the coincidence of a catastrophic earthquake happening at the same time the FRE was operating during a major flood would be a 1 in 2,500,000,000 chance of occurring; an extremely unlikely event. Therefore the District requests that the conclusion of "significant but unavoidable" impact be removed from the DEIS as in its plain language it implies that it would occur. The facts reported in the DEIS conflict with this finding as well as the DEIS is supposed to focus on probable impacts not extremely unlikely events. (con't)

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				The District is confident in, and intends to rely on, state and federal dam design standards in accordance with the Washington Department of Ecology's Dam Safety Office and regulations (WAC 173-175). These design standards include significant safety factors for design, construction, and operation that exceed the actual expected seismic events that may occur. The FRE will be a concrete structure with rock like strength properties and will able to withstand seismic shaking under the most extreme circumstances. Construction and operation of the FRE will also include programs for notifying downstream communities of dam safety issues and evacuation plans in the case of operational emergencies. These are all normal but important requirements for FRE type structures and will be given the highest priority by The District.
Section 5.11 - Air Quality and Greenhouse Gases				
5-17	5.11	142	The EIS states: "The Applicant has not stated how trees removed from the temporary reservoir would be used. The analysis used a worst case assumption that the removed trees would be burned."	The District is in the process of developing a plan for harvested trees that will include a combination of selling the timber as commercial forest products, and using harvested timber as large wood material below the proposed facility for habitat restoration and enhancement projects. The District agrees to not burn the harvest timber from the inundation zone. The District requests that Ecology revise the analysis to remove the assumption that the District will burn removed trees. Further, the District intends to implement a vegetation management plan prior to construction that would limit the number of trees that would be selectively harvested. The District will work with appropriate entities and consider using the harvested trees for other purposes. The DEIS estimates that 106,890 metric tons of CO_2 emissions would be generated over the course of construction. The District requests that these emissions be reduced by the 53,055 metric tons of emissions that were calculated in the DEIS to result from tree burning. This would result in a more accurate estimate of 53,835 metric tons of CO_2 emissions over the course of construction, or 10,787 metric tons of CO2 emissions during each year of construction. Please see also comments for Appendix A – Air Quality Technical Report.
Section 5.12 – Environmental Justice				
5-18	5.12	146	Environmental Justice Key Findings	The DEIS identifies the presence of environmental justice populations within the study area but does not demonstrate how these populations would be disproportionately impacted in the extremely unlike event of a failure of the FRE while it was being operated. The DEIS findings note that a failure would have high consequences on the "entire study area". A seismic event large enough to cause dam failure while the FRE was operating to reduce flood flows would likely also cause widespread damage to

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				structures and infrastructure throughout the study area impacting all populations not just environmental justice populations. The District requests that Ecology reconsider and revise this conclusion.
Section 5.14 – Public Services and Utilities				
5-19	5.14	156	Public Services and Utilities Key Findings	Only temporary interruption of water service would be permitted by local authorities. The project would not be allowed to move forward if there are unmitigated impacts to the water line. Therefore, the significant adverse impact described to Pe Ell's water service would not be possible. The District is committed to ensuring that the town of Pe Ell has water service. Any impacts to the water line serving the town's water treatment facility will be mitigated in consultation with the town and water utility. As stated the impact determination is misleading, and the District requests that Ecology revise the impact analysis to account for this.
CHAPTER 6.0: CUMULATIVE IMPACTS				
6-1				See comments on Appendix 2.
CHAPTER 7.0: CONSULTATION AND COORDINATION				
7-1				No comments.
CHAPTER 8.0: LIST OF PREPARERS AND CONTRIBUTORS				
8-1				No comments.
CHAPTER 9.0: DISTRIBUTION LIST				
9-1				No comments.
CHAPTER 10.0: EIS MAP BOOK				
10-1				No comments.
APPENDIX 1 – PROJECT DESCRIPTION AND ALTERNATIVES				
APP1-1	2.3.1.3	1-21	The EIS states: "It is assumed a temporary upstream cofferdam would be constructed with RCC behind the temporary berm to an assumed height of 665 feet mean sea level. A smaller downstream cofferdam would be constructed to a height assumed to be 635	The height of the upstream cofferdam will be 465 feet mean sea level, and the height of the downstream cofferdam will be 435 feet mean sea level. The District requests that Ecology correct the EIS to reflect the correct heights of the upstream and downstream cofferdams, and ensure this is change is consistent throughout the EIS.

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			feet mean sea level to protect the construction area on the downstream side."	
APP1-2	2.3.1.4 FRE Facility Operations	1-27	The EIS states: "For flows greater than 8,500 cfs, water ponding would occur at the entrance to the tunnels. The ponding level rises as the flow increases because greater water depth is needed to pass the flow through the tunnels. This is expected to provide small attenuation of the event peak flow."	As described above in Comment 2-1, the statement "For flows greater than 8,500 cfs, water ponding would occur at the entrance to the tunnels. The ponding level rises as the flow increases because greater water depth is needed to pass the flow through the tunnels. This is expected to provide small attenuation of the event peak flow." is incorrect. Open channel flow through the low-level outlet conduits will persist up to about 12,500 cfs, not 8,500 cfs. Ponding above the dam will not occur until open channel flow conditions are subsumed by orifice control conditions occurring at higher flows. This error may be an artifact of the previous FRO alternative hydraulic performance. The District requests Ecology correct the statement to reflect the actual open channel flow through the low-level outlet conduits to be 12,500 cfs.
APP1-3	2.3.3	1-28	The EIS presented the inundation zones as follows: • 10% chance of being flooded in a year (10-year flood); will be under water for 25 days per year when flooded • 5% chance of being flooded in a year (20-year flood); will be under water for 4 days per year when flooded • 1% chance of being flooded in a year (100-year flood); will be under water for 1 day per year when flooded • Less than 1% chance of being flooded in a year (greater than a 100-year flood)	The District requests that the EIS be revised to consider the refinement of inundation mapping included in the Inundation/Vegetation Analysis provided by the District and as discussed in Comment 2-3 and 2-4 above. Refining these assumptions for the inundation zones will likely lessen the conclusions for project impacts to GHGs, cultural resources, fish, earth, water quality, wetlands, and wildlife as discussed in the subsequent comments below to the related EIS Appendices.
APP1-4	2.3.3	1-31	Table 1-4: Expected Vegetation Community Types by Inundation Zone in the Temporary Reservoir	The District requests that elevation and acreage assumptions for Inundation Zones should be revised based on the inundation mapping included in the Inundation/Vegetation analysis provided by the District and as discussed in Chapter 2 comments.
APP1-5	2.3.3	1-33	The EIS states: "Relocate the northwest corner of the levee to avoid interfering with the runway glide path"	In a letter to Ecology, the District confirmed that the proposed action for the airport levee does not include relocating the northwest corner of the airport levee (Please see letter to Ecology dated November 22, 2019). The District requests Ecology strike this

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				statement from the EIS, and verify that the analysis of project impacts for the proposed airport levee height raise has not included the "bumpout" as part of the project description.
APPENDIX 2 – CUMLATIVE IMPACTS ANALYSIS				
APP2-1	2.3, 3.0	2-3, 2-14	Table 2-2: Resources for Which the Proposed Action Potentially Contributes to Cumulative Impacts On page 2-14, the EIS states: This analysis discusses the potential impacts from the Proposed Action that could result in significant adverse impacts and could contribute to cumulative impacts.	Cumulative impacts should consider the potential for impacts more broadly than just those actions that results in significant adverse impacts. If the Proposed Action could result in non-significant adverse impacts then those impacts could still contribute to a cumulative impact when considered with other actions. The District requests Ecology delete the word "significant" from the sentence on 2-14 and from the table.
APP2-2	2-5	2-9	Table 2-6: List of Reasonably Foreseeable Future Actions	The District requests that Ecology revise the table to only include the specific actions that would be considered reasonably foreseeable. Many of the projects listed in this table only exist as planning documents. While they can provide a notion of the trend for regional development only specific project actions should be considered reasonably foreseeable future actions. There is not enough certainty with each of the broader plans to identify reasonably foreseeable actions and the associated potential impacts with those actions.
APP2-3	3.0	All	The EIS references "development"	There are numerous references to development that is expected to increase in urban, agricultural, and rural areas. This type of general development is not explained in the reasonably foreseeable future actions section; therefore, there is no basis to understand the extent or potential impacts associated with hypothetical development. The District requests Ecology delete the conclusions that stem from these projects or provide additional explanation as to what this development refers to.
APP2-4	3.12	2-31	The EIS states its environmental justice conclusions	The District requests Ecology either delete the conclusion or provide additional a basis for the conclusion. There is no analysis in the DEIS to provide that basis for the statement that there would be cumulative disproportionate adverse impacts on environmental justice populations. Development on its own does not equate to an adverse effect to environmental justice populations.
APPENDIX 3 – SCOPING SUMMARY REPORT				
APP3-1				No comments.

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APPENDIX 4 – BIBLIOGRAPHY				
APP4-1				No comments.
APPENDIX A – AIR QUALITY AND GREENHOUSE GASES				
A-1	2.4.2	A18	The EIS state: "Additional considerations include the following: Combustion of felled trees from the temporary reservoir area, if burned"	The District has no plans to burn felled trees; as such, the analysis should be refined to remove this assumption. The District intends to implement a vegetation management plan prior to construction that would limit the number of trees that would be selectively harvested (see Comments 2-3, 2-4). The District will work with appropriate entities and consider using the harvested trees for other purposes including the use of large woody material for instream habitat enhancement or sell it as merchantable timber (see Comment 5-17).
A-2	2.5	A18	The EIS states: "GHG emissions and their resulting concentrations are a global concern and, therefore, are not dependent on local air quality or the proximity of existing sources. Various GHG intensity considerations are proposed in federal and state regulations and guidance. For example, the proposed Washington State Clean Air Rule (Washington Administrative Code [WAC] 173-442) establishes an initial compliance threshold for GHG emissions of 100,000 metric tons of CO2e per year. Similarly, the EPA Tailoring Rule (40 CFR Parts 51, 52, 70 et seq.) applies to sources that emit more than 75,000 short tons of CO2e per year. These standards provide guidance on assessing the significance of various levels of GHG emissions."	The District requests that the calculation of greenhouse gas emissions be revised to remove the assumption that removed vegetation will be burned. When this assumption is removed from the analysis construction emissions are reduced to 10,787 metric tons of carbon dioxide per year (see Comment 5-17) The District also requests that the FEIS include a comparison of the resulting emissions to an established standard for determining that such emissions levels would be considered "significant". At one time, the Washington Department of Ecology had issued guidance with a 25,000 metric ton per year release threshold for determining significance under SEPA. Under this standard the project emissions during construction would be well below the standard. If this standard is not appropriate then the rational for a different standard should be described.
A-3	3.2.1.1.1	A19	The EIS provided Criteria Pollutant Emissions sources.	The District requests that the EIS clarify the list of sources that could contribute to air quality impacts during construction. In Appendix I, the EIS states that "[e]lectrical power for construction could also be provided by on-site diesel-powered generators or by a combination of generators and power lines". In the list of sources that could contribute to air quality impacts during construction presented in Section 3.2.1.1.1, it

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				is not clear that the potential emissions associated with diesel-powered generators used during construction were included in the air emissions analysis.
A-4	3.2.1.1.1	A-24	The EIS states: "To address the potential impacts of GHG emissions from construction and operation of the Proposed Action, mitigation has been added for the Applicant to prepare and implement a GHG Mitigation Plan that mitigates for 100% of the GHG emissions. The plan must be approved by Ecology and must be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options. The measures must achieve emissions reductions that are real, permanent, enforceable, verifiable, and additional. The emissions reductions may occur in Washington State or outside of Washington State, but Washington State projects are preferred and all projects must meet all five criteria (e.g., using internationally recognized protocols)."	The District requests that a citation to the regulatory requirement for 100% mitigation of GHG emissions be provided, or provide the rational for the statement requiring this level of mitigation in the proposed mitigation plan. The District understands the societal benefits of reducing GHG emissions and is committed to minimizing GHG emissions during construction and operation of the facility, and will incorporate into the construction plan, vegetation management plan, and operations plan all reasonable measures to avoid or minimize GHG emissions. Such measures would include but not be limited to reuse instead of avoiding burning any vegetation removal waste materials, minimizing vehicle idling emissions and where practicable the use of onsite internal combustion engines for electrical power generation.
A-5	3.3.1.1	A31	The EIS states: "Likewise, floodplain storage improvements and channel migration protection would also be expected to result in sporadic, localized construction activity over an extended period of time and, therefore, would result in negligible air pollutants and GHG emissions. Consequently, construction activities under the Local Actions Alternative would result be a minor adverse impact with respect to air pollutant and GHG emissions."	The District requests that the EIS provide an equitable level of analysis of the impacts resulting from the Local Actions Alternative as is presented for the Proposed Action. The qualitative level of analysis does not provide for an equitable comparison of the construction impacts as described for the Proposed Action under Section 3.2.1. Without quantification, the District requests that the FEIS should not make a finding of minor adverse impact. There is no quantification of the potential emissions from the activities described. If the Local Actions Alternative is going to be included in the EIS, it should be described and considered in a manner similar to the Proposed Action.

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APPENDIX B – CULTURAL RESOURCES DISCIPLINE REPORT				
B-1	Summary	B-iii	Table B1: Summary of Historical and Cultural Resource Impacts from the Proposed Action.	The District requests three corrections to Table B-1. The table should be updated to identify potential impacts to properties that are eligible for listing in the WHR, the NRHP, and local registers, as these are the historic and cultural resources considered under SEPA. Table B-1 should also specify if 45-LE978 to 45-LE981 are eligible, potentially eligible, or unevaluated resources, in order to clarify their inclusion in the table. Without identification of potential impacts to these resources this assessment is incomplete. The District also requests that the counts for archaeological resources included in Table B-1 be reconciled with information in Section 2.2.5.
B-2	2, 2.3, 2.4	B4, B16, B17	Section 2 – Methodology (General Comment) The EIS states: "Information about cultural resources in the study area was obtained from existing studies, database searches, historical maps, and historical registers. Studies and reports used include the following:" Section 2.4 – Technical Approach (General Comment)	The District requests that additional discussion be included in Section 2 to clarify how the study area was inventoried (i.e., were direct impact areas subjected to a field survey and the rest of the study area inventoried only through existing data). Without a comprehensive discussion of methodology, it is not possible to evaluate whether the impacts have been adequately characterized. The District further recommends that the methodology for identifying historic and cultural resources provided in Section 2.4 be moved to the beginning of Section 2, or summarized at the beginning of Section 2 so the reader can better assess the adequacy of the impacts assessment. The methodology for identifying historic and cultural resources provided in Section 2.4 should be moved to the beginning of Section 2, or summarized at the beginning of Section 2 so the reader can better assess the adequacy of the impacts assessment and whether appropriate mitigation measures have been applied.
B-3	2.4	B18	The EIS states: "A modeled extension of the landscape for the FRE facility and airport levee sites was used for the initial existing conditions cultural resources assessment (Ostrander et al. 2018)."	The District requests that the concept of a "modeled extension of the landscape" be defined and describe how it is used in the analysis.
B-4	3.0	B19	Section 3 – Technical Analysis and Results (General Comment)	The District requests that a discussion of why some resources within the study area are considered for impacts while others are not or will not be impacted should be added to Section 3. This will allow the reader to understand the potential impacts to cultural resources within the study area and impacts on those resources due to construction and operation of the proposed project.
B-5	3.2.1.1.1	B19	Section 3.2.1.1.1 – Flood Retention Expandable Facility (General Comment)	The District requests that Section 3.2.1.1.1 be reviewed to ensure that the term "FRE facility" has been used consistently. In some cases it implies that it only includes the

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				FRE structure in others it also includes the temporary inundation reservoir. The EIS must be reviewed to clarify that the appropriate meaning is given in each case.
B-6	3.2.1.1.1	B19	The EIS states: "Construction-related activities associated with the FRE facility would directly affect four recorded archaeological sites (45-LE978 to 45-LE981)..."	As described elsewhere, there are 13 archaeological sites in the FRE facility area but the DEIS finds that only four of the 13 sites are going to be directly affected. The District requests that the FEIS describe its assumption regarding how the others would be avoided.
APPENDIX C – ENVIRONMENTAL HEALTH AND SAFETY DISCIPLINE REPORT				
C-1	3.2.2.1.1	C12-C16; C25	The following comment covers the text on Pages C12 to C16 and C25 and includes the following notable sections. The EIS states: "The probability of a seismic event with a 2,475-year return period occurring while there is also a full or mostly full reservoir is 0.00000000037 (calculation: 1.11E06 * 3.33E-04 = 3.7E-10). This corresponds to a probability of a 1 in 2,500,000,000 chance of occurrence." "Although the likelihood of a catastrophic FRE facility failure occurring while the temporary reservoir is holding water is extremely low, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts. Therefore, the results of such an event would be considered a **significant and unavoidable adverse impact**." "Compliance with laws and implementation of mitigation measures would reduce impacts related to environmental health and safety. Although the likelihood of a catastrophic FRE facility failure from an earthquake during a time when the reservoir is storing water is extremely low, there are no mitigation measures that could	See Comment 5-16. The District notes that the calculated probability of 1 in 2.5 billion probability of occurrence may be in error and should be corrected to 1 in 2.7 billion probability of occurrence based on the equation given in the DEIS.

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			completely eliminate the possibility of an incident or the resulting impacts. Therefore, the potential for a catastrophic FRE facility failure in the event of an earthquake while the reservoir is full is considered a **significant and unavoidable adverse impact** to people, infrastructure, structures, and the environment downstream."	
APPENDIX D – ENVIRONMENTAL JUSTICE DISCIPLINE REPORT				
D-1	3.2.2.1, 3.2.4	D30, D34	The EIS states on Page D-30: "The probable significant adverse impacts associated with the catastrophic failure of the FRE facility have a very low probability of occurrence, but would have high consequences that would affect the entire study area and would have a significant and disproportionate impact on most of the study area's environmental justice populations." The EIS states on Page D-34: "The likelihood of an FRE facility failure from an earthquake on the CSZ during a time when the reservoir is storing water is extremely low. However, in the event of a FRE facility failure, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts on environmental justice populations."	As discussed in Comment 5-16 and C-1 a catastrophic FRE failure occurring simultaneously with operation of the facility during a flood event is an extremely unlikely event and does not fall within the bounds of probable impacts to be considered in as EIS as defined in SEPA's implementing regulations. However, the DEIS does include findings related to the unlikely potential of such an event and extends those findings to the environmental justice analysis. In that analysis no explicit criteria to determine that the impacts would be felt disproportionately by environmental justice populations were given. The statement correctly notes that a failure would have high consequences on the "entire study area". A seismic event large enough to cause dam failure would be a catastrophic event and would cause widespread damage to structures and infrastructure throughout the region. This implies that the impacts wouldn't be focused on only environmental justice populations. The District requests that the analysis be revised to recognize that such impacts would be felt both by environmental justice populations and equally by the remaining population of the affected area.
APPENDIX E – FISH SPECIES AND HABITATS DISCIPLINE REPORT				
E-1	2.4.2.1	E64	The EIS states: "The modeling of future conditions (mid- and late-century) accounts for projected changes in hydrology (Hill and Karpack 2019) and temperature due to	As discussed in Item #1 preceding this table of detailed comments, the District requests that Ecology should separate the impacts of the Proposed Action from the effects of climate change. This would allow the estimated impacts of the Proposed Action to be evaluated. Inclusion of climate change in all the effects assessments makes it impossible to evaluate the estimated impacts of the Proposed Action alone. This change would substantially reduce the reported impacts on abundance of anadromous

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			climate change (Van Glubt et al. 2017) and several additional factors."	salmonids due solely to construction of the FRE. However, it is unclear if the findings of "significant impact" would change.
E-2	2.4.2.1	E65	The EIS states: "Future hydrologic conditions, incorporating climate change predictions, are modeled that represent projected mid-century and late-century conditions."	The District requests that Ecology separate the effects of the Proposed Action from the effects of climate change. Inclusion of climate change precludes the ability to review and evaluate the effects of the Proposed Action alone on future conditions. While this change would substantially reduce the estimated impacts on abundance of anadromous salmonids, it is unclear at this time if the findings of "significant impact" would change
E-3	2.4.2.3	E79	Table E9: Estimated Fish Passage Survival Rates for the FRE Facility Table E9 provides fish passage survival rates for various species and life stages. It assumes a 0% survival for juvenile salmonids during flood retention events.	The District requests that Ecology provide the basis for assuming that all fish would die, and be more specific in describing why survival is estimated at 0%. This is important because assuming 0% survival of juvenile salmonids moving upstream is overly conservative and may lead to overstating effects. The EIS should provide documentation regarding if these requirements have been vetted with resource agencies and how were they developed. While a change from 0% survival would reduce estimates of mortality, but it is unclear at this time if the finding of "significant impact" would change.
E-4	2.4.2.3	E81	The EIS states on Page E81 that conduits will exceed capacity and surcharge, or backwater, at flows >8,500 cfs. The EIS states on pages E124, E133, and E3-7, the modeled surcharge value is 12,500 cfs.	The District requests that Ecology be consistent throughout and note that the correct value at which surcharge will occur has been calculated to be up to 12,500 cfs. Please see Comment 2-1 above. Furthermore, flows at which surcharge begins has implications to the effects on migrating fish, especially downstream-migrating juvenile salmonids.
E-5	3.2.2.1	E101: E105	The EIS states that there is uncertainty if the implementation of the plans (such as the vegetation management plan) would be technically feasible and economically practicable.	The District requests that Ecology provide supporting documentation describing the basis for the statement that there is uncertainty regarding the technical feasibility and economic practicability of a Vegetation Management Plan. The District is currently developing a comprehensive Vegetation Management Plan for the inundation zone, based on updated inundation mapping (see Inundation/Vegetation Analysis provided by the District). The EIS does not make clear why such a plan would not be feasible. The assessment in the EIS of the effects of construction on aquatic habitats is reasonable; however, the EIS should consider effects of various plans, including the vegetation management plan, rather than repeatedly including a blanket statement that such plans may not be practicable. Further, the EIS should consider that plans such as a Vegetation Management Plan are technically feasible, and may in fact affect the results of the impacts analysis on fish

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				resources. The EIS should be revised to consider that such plans are technically feasible and also consider how those plans may affect the results of the EIS analysis.
E-6	3.2.2.2.1	E107	The EIS states: "Therefore, for juvenile salmonids moving upstream the survival rate is estimated to be 0% (Table E9)."	As noted in Comment E-3, the District requests that Ecology provide the technical basis for assuming that all fish would die, and be more specific in describing why survival is estimated at 0%. A survival rate of 0% for juvenile salmonids moving upstream and encountering a picket weir is overly conservative and results in an over-stating of impacts. Inability to pass further upstream would not result in 100% mortality of juvenile fish. Furthermore, a picket weir is unlikely to be the type of barrier placed downstream of the construction area, as described in Comment E-19. The EIS should be updated to reflect the most likely type of barrier to be used and reasonable (albeit conservative) estimates of survival.
E-7	3.2.2.2.2.1	E107	The EIS states: "WAC 220-660-200 provides that the Applicant should design the weir to ensure continued fish passage for all species present at all mobile life stages and compensatory mitigation may be required if a fish passage structure cannot pass all fish species present at all mobile life stages."	WAC 220-660-200, Section (8)(c) applies to pool-and-weir type fish passage structures, not picket weir barriers. This section does not apply to picket weir barriers, in part, because they are porous, allowing water to pass through, and are thus incapable of "control(ing) the water surface elevation at the weir" (WAC 220-660-200, Section (8)(a)). The sections of WAC 220-660-200 that apply to the temporary trap and transport facility for this project are (4) "Temporary fish passage improvement structure designs," (5) "Fish ladder designs," and (10) "Trap-and-haul operations." "The main goal is to... ensure unimpeded passage of fish at all life stages." The WAC acknowledges that "fish passage improvement structures mainly pass one species or class of fish." (WAC 220-660-200, Section (2)) Passage of all species and life stages is only required for pool-and-weir type passage structures. As such, the District's goal is to pass all species and life stages but focus design of the temporary trap and transport facility on adult salmonids. In our interpretation, this directly matches the requirements and intent of the WAC. The District requests that Ecology revise the DEIS to reflect the correct fish passage technology (per response E19) and related WAC requirements.
E-8	3.2.2.2.2.2	E108	The EIS states: "…injury or mortality could occur if kelts have to pass through debris on diversion tunnel trash racks or become impinged on the temporary picket weir located downstream of tunnel"	The construction diversion tunnel will not have a trashrack nor will a picket weir be used as an upstream barrier for the temporary trap and transport facility. See Comment E-19. The entrance to the construction diversion tunnel is 20-ft-wide by 20-ft-wide and unobstructed by trash racks or other project features. A velocity-type barrier is the anticipated upstream barrier for the temporary trap and transport facility given the range of flow conditions at which the facility must operate. As such, there is no potential for debris impact or impingement on the temporary trap and transport upstream barrier or diversion tunnel trash racks. The District requests that Ecology revise the EIS to reflect that no trashrack would be installed on the construction

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				diversion tunnel and unimpeded flow over a velocity-type barrier at the temporary trap and transport facility.
E-9	3.2.2.2.5.3	E116	The EIS states: "Estimated coho salmon abundance in the Rainbow Falls to Crim Creek Subbasin would decline from a median of 90 fish (7994) prior to construction to 89 fish (84-91) during the 2025 to 2030 construction period, a 1% decrease (Figure E21)."	The District requests that Ecology revise the EIS to state the modeling has shown there to be little to no change in the population abundance of coho salmon in the Rainbow Falls to Crim Creek Subbasin. In this example, reporting exact changes to populations numbers such as a decrease from 90 fish to 89 fish likely represents an over estimate in the precision of modeling results. This difference would not be detectable with any confidence, and would not be biologically meaningful. It is unlikely the modeling approach has produced such exact results within a level of certainty that is acceptable for informing decision-making.
E-10	3.2.2.2.5.3	E116	The EIS states: "EDT model results indicate that construction of the FRE facility would reduce estimated coho salmon abundance from ... 91 to 88 fish (3% decrease) in the Rainbow Falls to Crim Creek Subbasin compared to the pre-construction period (Figure E19)."	As noted in Comment E-9, the District requests that Ecology revise the EIS to characterize the results of the fish population modeling as a trend or a range of impacts, as it is unlikely the modeling approach has produced such exact results within a level of certainty that is acceptable for informing decision making. In this case, the EIS should state the modeling has shown there to be little to no change in the population abundance of coho salmon in the Rainbow Falls to Crim Creek Subbasin.
E-11	3.2.3.1	E121: E130	The EIS states that there is uncertainty if the implementation of the plans (such as the vegetation management plan) would be technically feasible and economically practicable.	See Comment E-5. The assessment in the EIS of the effects of operations on aquatic habitats is reasonable; however, the EIS should consider effects of various plans, including the vegetation management plan, rather than repeatedly including a blanket statement that such plans may not be practicable. Further, the EIS should consider that plans such as a Vegetation Management Plan are technically feasible, and may in fact affect the results of the impacts analysis on fish resources. The EIS should be revised to consider that such plans are technically feasible and also consider how those plans may affect the results of the EIS analysis.
E-12	3.2.3.1.5	E129	The EIS states: "A reduction in the magnitude of flooding reduces the functional extent of the active floodplain (Nilsson and Berggren 2000). Altered hydrology downstream of dams reduces groundwater recharge in riparian areas and can result in a falling groundwater table (Nilsson and Berggren 2000). In floodplains, the main inputs of nutrients, sediment, and organic matter are mainly via surface flow	The District requests that the EIS discuss the potential for large floods to impact survival of eggs and juvenile fish. What the EIS summarizes is correct; however, no mention is made of the potential impact from temporary habitat destruction and resulting mortality from scour, that would be associated with major flood flows under the climate change scenario. The EIS should provide this analysis and reconsider the impacts determination for the No Action Alternative on fish resources.

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			from upstream (Pinay et al. 2002). Flooding distributes marine-derived nutrients from salmon carcasses and fertilizes terrestrial vegetation (Ben-David et al. 1998)."	
E-13	3.2.3.2.1.3	E134	In the section titled Fish Passage Plan, the EIS outlines several measures that should be included in a Fish Passage Plan.	The District requests that the EIS describe how each these measures were derived by citing references or by describing the analytic process used. Please describe if these requirements been vetted with appropriate resource agencies.
E-14	3.2.3.2.2.5	E141	The EIS states: "Abundance: The recent 10-year total run abundance values of salmon and steelhead in the Chehalis Basin are already far below historical values from the early 1900s (Hiss and Knudsen 1993). Specifically, recent abundance vs. historical values range from 23% for spring-run Chinook salmon to 49% for steelhead. This indicates that current basin-wide populations are impaired. Recovery plans for Puget Sound Chinook salmon (NMFS 2006) and steelhead (NMFS 2018) state that population recovery goal targets for natural origin spawners are 70% of historical abundance values. The salmon and steelhead in the two subbasins of the Chehalis River evaluated in this report represent only a fraction of the entire Chehalis Basin population (approximately 1.2% of spring-run Chinook salmon, 3.4% of fall-run Chinook salmon, 2.7% of coho salmon and 15.7% of steelhead; Ronne 2019). However, the expected declines in salmon and steelhead abundance in the two subbasins are significant in that they bring the total abundance even further below the recovery goal target of 70% of historical abundance."	The District requests that the EIS clearly state that the recovery goal of 70% of historical value for natural born spawners is for listed threatened and endangered species only, and that there are not any such listed species in the Chehalis Basin. Furthermore, the EIS references recovery goals for listed Puget Sound salmonid populations. Reference to Puget Sound species is not relevant for non-listed Chehalis Basin populations. The EIS should remove reference to the recovery goals for Puget Sound Chinook and Steelhead populations, as the recovery goals for those species do not apply to non-listed Chehalis Basin populations. Basin-specific metrics determined by WDFW such as species escapement goals for the Chehalis Basin populations would be more appropriate for assessing the impacts of the proposed action and alternatives on fish populations. The EIS should revise its analysis to use the WDFW Greys Harbor and Chehalis Basin escapement goals as the benchmark metric.

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E-15	Appendix E3, Section E3	E3-1	The EIS states: "The FRE facility design incorporates flow velocity and depth through the outlet conduits that mimic the flow velocity and depth occurring through the existing river channel in this reach, although the length of the FRE outlet tunnels is longer than the existing bedrock canyon.	The District requests that the EIS be revised to indicate the existing bedrock canyon is longer than the FRE tunnels. The existing bedrock canyon at the proposed FRE structure site is approximately 450 feet long. The FRE tunnels, shown in Sections 7 and 8 on drawing FRE S7, are about 180 feet shorter than the existing bedrock canyon. As a result, the proposed structure has a shorter distance where river velocities exceed the 2-foot-per-second velocity guidelines compared to the existing natural channel.
E-16	Appendix E3, Section E3	E3-3	Figure E3-1. Anticipated Migration Periods of the Targeted Species and Life Stages	This Table has been changed from the 2016/2017 Fish Passage Subcommittee's recommendation. Run times for some species and life stages show minor changes from that developed by the subcommittee and shown in Figure 2-1 of Appendix G of the June 2017 Combined Dam and Fish Passage Report (HDR 2017) (e.g. - Spring Chinook, Adults Arriving period shortened from ending in mid-October to ending in early-October). However, the run times for other species and life stages were altered significantly from that produced by the Fish Passage Subcommittee and shown in Figure 2-1, Appendix G, of the June 2017 Combined Dam and Fish Passage Report (e.g. - Spring Chinook, Smolt Outmigration was truncated from year-round to March through August). Since the sub-committee was formed, in part, to develop run times for species and life stages, describe in the EIS the reasoning and basis for variations from their conclusions. List the changes to the run times proposed by Ecology in the EIS from that developed by the Fish Passage Subcommittee in 2016/2017. If Ecology prefers the revised table, the District requests that the EIS provide a comparative analysis using the subcommittee's table to determine the effect on the impact determination and species mortality.
E-17	Appendix E3, Section E3	E3-5	The EIS states: "NMFS (2011) states that water velocity in juvenile fish bypass conduits (i.e., channels and pipes) should be maintained between 6 and 12 fps for the entire operational range of bypass flow and must always be greater than 2 fps. If higher velocities are approved by NMFS, special attention to pipe and joint smoothness must be demonstrated by the design. NMFS expects that sediment deposits can	The criteria cited from NMFS (2011) does not apply to the FRE conduits. Chapter 11 of the NMFS (2011) guidelines, cited here, applies to fish bypasses installed at fish screen facilities. The FRE structure is not a fish screen facility nor are fish removed from or bypassed off of the river channel. The FRE conduits are more closely akin to culverts in character, function, and performance. Therefore, WDFW Water Crossing Guidelines are the most applicable design guidance from governing resource agencies. Please refer to 2017 Combined Dam and Fish Passage Report, Appendix G, Section 2.3.1 (HDR 2017). The District requests that the EIS be revised accordingly.

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			accumulate within the bypass system when velocities are less than 2 fps."	
E-18	Appendix E3, Section E3	E3-10	The EIS states: "Temporary trap and transport (T&T) facilities are common to provide fish passage for projects that require extensive in-water work for long duration, such as what will be required for the FRE dam. The temporary T&T facility would be installed and begin operation prior to any other in-water work. The facility would be located far enough downstream of the diversion tunnel outlet such that river flow approaching the facility would be as calm and uniform as practicable. A temporary trap and transport facility would likely consist of a temporary barrier such as picket weirs or an inflatable dam with a fish ladder on the left bank that leads to holding ponds or holding tanks at the top of the bank where they could be easily accessed by transport trucks."	The District requests that the EIS correct the referenced statement. The reference to the fish ladder located on the left bank was a typo in the original report (see HDR 2017). The typo was corrected in the Proposed Flood Retention Dam Construction Supplemental Information document submitted to the Washington state Department of Ecology in September 2019. Please revise the EIS accordingly: *"...A temporary trap and transport facility would likely consist of a temporary barrier such as picket weirs or an inflatable dam with a* fish *ladder on the* ***right*** *bank that leads to holding ponds or holding tanks at the top of the bank where they could be easily accessed..."*
E-19	Appendix E3, Section E3	E3-10	The EIS states: "The inflatable dam would require installing a concrete fish ladder and supplying the ladder with water at all times, making the inflatable dam option challenging from standpoint of both design and cost."	Picket weirs are unlikely to be the selected barrier technology, as they will have worse performance compared to other barrier technologies. The District requests that the EIS be revised to reflect the use of a barrier the would perform better under the required conditions, such as a concrete velocity barrier, instead of a picket weir barrier and revise the assumptions in selecting a velocity barrier over a picket barrier considering the following: • The DEIS indicates a picket barrier was selected based on WDFW's familiarity with the technology, but does not indicate that the hydrologic, environmental, and operational constraints of the site and project were considered in selection of the technology. Include a discussion of the evaluation of the hydrologic, environmental, and operational constraints of the site and project that were considered in selection of the technology for inclusion in the EIS. • Picket weir technology is unlikely to be selected for the barrier for the temporary trap and transport due to its poor fish passage performance. The

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				temporary trap and transport facility will have to operate year-round. High flows, debris, and bedload during the winter months are likely to damage a picket weir barrier, making it ineffective or causing it to be removed during extended periods of the year. Lack of a full barrier for extended periods of time has a substantial negative impact on fish passage performance. A picket weir will also become clogged with debris from the flow moving downstream, thus harming downstream survival of kelts, adult and juvenile salmonids, and resident fish, whereas a velocity barrier will pass all fish species and life stages as well as debris downstream impinged. For these reasons, a channel-spanning velocity barrier is more likely to be the selected barrier technology. A channel-spanning velocity barrier designed to NMFS and WDFW criteria will continue to provide a full, effective barrier during winter months, thus reducing escapement, directing more fish into the fish trap, and improving overall performance of the temporary trap and transport compared to a comparable facility with a picket weir fish barrier. • A picket weir would also require a fish ladder and supplying the ladder with water at all times because the fish trap would have to be located at the top of bank. The reach of river cited for a T&T has tall, steep banks on either side of the river. The traps would have to be located at top of bank to: o Protect the traps from flooding, and thus, loss of fish (decreased performance), o Readily access the fish transport tanks for transport and release upstream, o Accommodate trapping fish at river levels for the full range of fish passage flows, and o Protect the traps, hoisting mechanisms, and other steel and mechanical items from damage from debris, bedload movement, and high flows. • Inflatable dams and other velocity-type barriers have a long history of performance in high flow, high bedload, debris-passing rivers; and are currently designed and installed in such environments throughout the country. For example, USFWS's Quinault Hatchery and WDFW's Voights Creek Hatchery both utilize Obermeyer weir crest gate type barriers and WDFW's Skamania Hatchery utilizes a concrete velocity barrier to prevent upstream migration in conjunction with their fish ladder and trap operations.

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				• The cost to install an inflatable dam or velocity-type barrier with fish trap would be nearly the same as that required to install a picket weir type barrier with fish trap as: o Both barrier types will require a fish ladder and trap/holding facility at the top of bank, and a picket weir will likely require a concrete foundation that spans the width of the river in order to minimize downtime to replace pickets when they are damaged or washed out, similar to an inflatable dam or velocity-type barrier.
E-20	Appendix E3, Section E3	E3-11	The EIS states: "The release site has not been selected but it is assumed that it will be located a short distance above the construction site (within 1 mile of the site). […]Fall-run Chinook salmon will move downstream after release and look for spawning habitat and will encounter the picket weir; therefore, the discussions also considered the availability of spawning habitat downstream of the picket weir."	The District requests that Ecology revise the EIS and EDT model to reflect a more reasonable assumption that fish will be released upstream well above locations where fallback would be expected and that a velocity barrier will be used rather than a picket barrier. Fish are regularly transported long distances upstream to locations where they have the best opportunity to spawn and the least opportunity to fall back downstream. For example, upstream migrants collected at Merwin Dam are transported over 37 miles upstream to locations where they are released back into the Lewis River. While fallback of fish transported upstream is a known potential, state and federal fish biologists would not allow fish to be returned to the river upstream at locations close enough to the project area that the potential for fallback would be significant. In addition, the use of a picket weir is not considered to be the likely alternative for fish passage design, as described in Comment E-19. Please describe how this assumption has been incorporated into the assumptions for fish passage survival, and subsequently applied to the EDT model.
E-21	Appendix E3, Section E3	E3-12	Table E3-4 Estimated Passage Effectiveness for Adult Salmonids Upstream and Steelhead Kelts Downstream During FRE Facility Construction (2025 to 2030)	The District requests that Ecology describe the assumptions, with citations, that have resulted in the numbers for Trapping Efficiency included in Table #3-4. It appears that these numbers are low, perhaps because of the assumption of the use of a picket weir. As described in Comment E-19, the use of a picket weir is not considered to be the likely alternative for fish passage design. As such this, the portion of the DEIS noted here, should be revised accordingly. Additionally the numbers provided in the entire table are lower than the performance and survival estimates developed by the Fish Passage Subcommittee in 2016/2017 for the completed project. Since the sub-committee was formed, in part, to estimate performance and survival for fish passage, describe in the DEIS the reasoning and basis for variations from their conclusions. List the changes to the performance and survival estimates proposed by Ecology in the DEIS from that developed by the Fish Passage Subcommittee in 2016/2017. If Ecology prefers the revised table, provide a

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				comparative analysis using the subcommittee's table to determine the effect on the impact determination and species mortality.
E-22	Appendix E3, Section E3	E3-20	Table E3-6 Target Fish Species and Life Stages Selected for FRO Design	The District requests that Ecology revise the table to break out upstream and downstream species and life stages for the conduits and the Collect, Hold, Transport and Release (CHTR) facility. The FRE conduits and CHTR are designed for different species and life stages. This table does not differentiate the target species and life stages for fish passage via the FRE conduits versus the CHTR. Performance and survival estimates for each species and life stage are provided for both passage facilities, which directly influence the impact determination and mitigation requirements. Differentiating the species and life stages for each passage facility allows for the direct comparison between the species and life stages considered in the design of each facility and each facility's estimated performance and survival for each species and life stage.
E-23	Appendix E3, Section E3	E3-22	The EIS references: Barnard, R., J. Johnson, P. Brooks, K. Bates, B. Heiner, J. Klavas, D. Ponder, P. Smith, and P. Powers, 2013. Water Crossings Design Guidelines. Washington Department of Fish and Wildlife, Olympia, Washington.	The District requests that the EIS be revised to match the format of a state-produced document similar to "WDFW (Washington Department of Fish and Wildlife), 2000. Draft Fishway Guidelines for Washington State." This is a reference to a state design guideline document but listed in the reference section using the format of a published scientific paper.
APPENDIX F – EARTH DISCIPLINE REPORT				
F-1	2.3.1.5	F16	The EIS states: "A non-linear time-history analysis was performed (using EAGD-SLIDE) to evaluate the effects of earthquakes over time."	The District requests that the following text be added to the end of this sentence: "assuming an interface friction angle between the foundation and the base rock of 45 degrees". This additional text will provide important technical definition to the analysis described in this section and is important for understanding how the underpinning analysis was performed.
F-2	2.3.1.5	F16	The EIS states: "This analysis shows sliding of less than 0.05 foot..."	The District requests that the text "Assuming a flexible base," be added to the front of this sentence. This additional text will provides important technical definition to the analysis described in the sentence.
F-3	3.2.1.1	F22	The EIS states: "...(from excavation of overburden and rock in RCC aggregate quarries during construction)."	The District requests that the term "RCC" be removed as this paragraph. The Quarries will provide material for uses in addition to production of RCC.
F-4	3.3	F27	The EIS states: "No adverse impacts on geologic processes from construction or	The District requests that Ecology add impacts from Table F2, such as continuing substantial flood risk due to landslides and erosion, and moderate to minor risk due to slope instability and erosion during construction projects. The EIS has seemingly

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			operation of the Local Actions Alternative are anticipated."	incorrectly characterized the impacts on geologic process from the Local Actions Alternative.
F-5	6.2.2.1.1	F68	The EIS states: "Increased fine sediment input effects would be moderate during all of these time periods (reservoir draining and one or two subsequent intense rainstorm) but could be significant during the latter parts of the reservoir draining period if incoming turbidity levels are low because eroded sediment could exceed 10% of background input. The fine sediment impacts would have a significant adverse impact on turbidity (water quality)."	The EIS has not provided enough supporting information for making the significant adverse impact determination on turbidity (see Comment N-23 below). The District requests that the EIS provide additional information to reduce uncertainty in and substantiate the significant adverse impact determination regarding turbidity. Furthermore, the next paragraph on Page F68 should also be revised since the impact is moderate adverse (as opposed to significant and unavoidable) and mitigation is possible.
F-6	6.2.2.1.5	F79	The EIS states: "Lack of mobilization of the available large wood from the watershed above the FRE facility to the river below would further reduce channel complexity and diversity of the Chehalis River mainstem, particularly between the FRE facility and the South Fork Chehalis River. Operation of the FRE facility would have a significant adverse impact on LWM loading and function."	The significant adverse impact on LWM should be revised to be a moderate impact given that much LWM (up to 3-ft diameter per Section 5.3.3 of the main body EIS) would pass through the FRE during non-impoundment period in contrast to the DEIS assumption that no mobilization of such material would occur. Furthermore, there is reasonable likelihood of successful reintroduction of LWM downstream of the FRE facility following impoundment periods. There is not enough supporting information to substantiate the finding of a significant adverse impact, and the EIS has not considered reasonable measures the District would take to place LWM in downstream reaches. Furthermore, the next paragraph on Page F79 should also be revised since the impact is moderate adverse (as opposed to significant and unavoidable) and mitigation is possible.
F-7	6.2.5	F84	The EIS states: "Water quality exceedances of turbidity in the Chehalis River as the temporary reservoir drains and during subsequent rainstorms"	As commented above (Comment F-6), this should be a moderate impact and therefore, the District requests that this item be removed from this section. Additionally, Page F68 of the EIS states that the turbidity effects during 1-2 subsequent rainstorms would be moderate, not significant as summarized in this section.
F-8	6.2.5	F84	The EIS states: "Reductions in channel-forming processes and large woody material in the Chehalis River to the confluence of the South Fork"	See Comment 5-6 above. The District requests that the analysis of the project impacts on peak channel forming flows be reconsidered. Furthermore, as commented above (Comment F-6), reductions in LWM would be a moderate impact. Therefore the District requests that "and large woody material" be removed from the EIS text.
F-9	6.3.2.1	F85	The EIS finds that direct impacts under the Local Actions Alternative include: changes	The EIS has not correctly characterized the impacts under the Local Actions Alternative. The District requests that the following impacts be considered and included in the

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			to sediment and water input from climate change; adaptation of the Chehalis River to effects of the 2007 flood; reforestation and riparian restoration activities would provide LWM and bank protection; local effects on sediment transport and deposition as a result of constriction removal; and reduction of bank erosion and channel migration potential.	analysis of the Local Actions Alternative: 1) There would be continuing substantial flood risk, 2) Flooding would continue to influence geology and geomorphology, 3) Flood events would continue to cause landslides and erosion.
APPENDIX G – LAND USE DISCIPLINE REPORT				
G-1	3.2.1.1, 3.2.4	G26, G54	The EIS finds that land use changes from commercial forestry to the FRE facility and temporary reservoir would be inconsistent with the current Forest Resource land use and zoning designations. There is uncertainty if mitigation is feasible; therefore, the Proposed Action would have significant and unavoidable adverse environmental impacts on land use. The Applicant may provide mitigation plans as described above. If the agencies determine the plans meet regulatory requirements and implementation is feasible, then the impacts would be addressed as part of the permitting processes.	See Comment 5-14
APPENDIX H – NOISE AND VIBRATION DISCIPLINE REPORT				
H-1				No comments.
APPENDIX I – PUBLIC SERVICES AND UTILITIES DISCIPLINE REPORT				
I-1	3.2.1.1.1	I14	"In accordance with Washington Administrative Code 197-11-440(6)(e) to identify the cost of public service effects, if the entire line requires replacement, the estimated cost is $1,200,000. If the water line requires improvement or relocation,	See Comment 5-19.

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			and the Applicant does not provide funding for this work, this would be a significant adverse impact to Pe Ell's water service."	
I-2	3.2.2.1.1	I16	"The Environmental Health and Safety Discipline Report (ESA 2020a) analyzed the potential for failure of the FRE facility and found that while the probability of a facility breach occurring is extremely low, the probable impacts would be significant and unavoidable."	See Comment 5-19. The District requests that the impacts to public service and utilities that are based on assumptions made in the Environmental Health and Safety Discipline Report be correctly characterized as highly unlikely to occur given the extreme low probability of a potential facility breach (see also Comments 5-16 and C-1). SEPA requires agencies to identify and evaluate the probable impacts associated with an action. As such, impacts associated with failure of the FRE from an earthquake that occurs when the temporary reservoir is full of water should not be disclosed as a potential significant impact. The FRE facility would be designed and regulated in accordance with the Washington Department of Ecology's Dam Safety Office and regulations (WAC 173-175). As such, the EIS correctly describes the infinitesimal probability of a FRE failure under these circumstances as having a 1 in 2.5 billion chance of occurring. This is well outside what would be considered a probable event.
I-3	3.2.2.1.3	I19	"While the Proposed Action would reduce the flood elevations of each major or catastrophic flood at the public service and utility facilities potentially affected by modeled floods, most would still be inundated to some degree. This frequency of flooding would continue to be disruptive or damaging to these facilities, as a single year often is not long enough to repair flood damages. Therefore, a recurring flood scenario would cause disruption and damage that would remain difficult to repair even with the Proposed Action in place."	The District requests that the EIS more explicitly acknowledge the beneficial impacts from implementing the Proposed Action. The preceding bulleted list in this section provides ample evidence that many of the facilities in the study area would experience a beneficial decrease in flood damage. This benefit should be balanced more evenly with the adverse impacts noted in this paragraph. Please revise this paragraph to note that of the 13 facilities listed, 4 facilities would experience no flooding and 8 would experience reductions in the inundation level with the proposed action in place.
APPENDIX J – RECREATION DISCIPLINE REPORT				
J-1	2.2.2	J2 to J12	Section 2.2.2. Description of the Affected Environment for Recreation (general comment)	The District requests that the EIS provide an analysis of current level of use of the river reach for boating and recreational fishing. For example, a review of google search results for 'kayaking in the upper Chehalis River' reveals little information – there are no recent trip reports, guidebooks, or whitewater boating operators that are operating on the upper Chehalis. Regarding the upper reach, the American Whitewater Association (AWA) states that the Chehalis River reach above Pe Ell is "difficult to access

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				due to the need to secure an expensive permit issued by the forest landowner" [AWA 2016]. This statement by AWA demonstrates that conditions other than the proposed project restrict recreational use of this area. Furthermore, private landowners also restrict access for recreational fishing and boating. While it is true that there are boat access points available throughout the Chehalis Basin, however the EIS does not discuss specific boat access points in the upper Chehalis above Pe Ell where users may access the river reach affected by the project. Please provide the specific public access points above Pe Ell where recreational fishing may take place. As Figure J2 correctly shows, none of the identified recreational facilities or access sites are located in the area directly affected by construction of the FRE facility and temporary reservoir. The EIS should provide further qualitative/quantitative analysis regarding the level of use of the specific reach where the FRE facility would be located including recreational survey data, informational interviews with those recreating on the site, and review of permit data and information if available.
J-2	2.2.3.1	J10	The EIS states: "Weyerhaeuser sells recreational access permits for hunting, fishing access, and camping on its lands. The FRE facility site is in the Pe Ell South Permit Area, one of eight Weyerhaeuser permit areas throughout the state. For 2015 to 2016, 550 permits were sold for the Pe Ell South Permit Area. Weyerhaeuser sold all of the motorized and non-motorized permits available for sale in the Pe Ell South Permit Area for the recreation year of August 2018 through July 2019 (Weyerhaeuser 2019). These permits allow access to areas of the Ryderwood and Willapa Hills Game Management Units. The non-motorized permit allows travel by hiking, biking, and horseback riding for day use opportunities. Additionally, this permit provides access to areas with mushrooms, berries, streams with fishing, and populations of elk, deer, and grouse. The motorized permit allows entrance into the permit area with a	The EIS includes the specific number of limited recreational permits sold by Weyerhaeuser for access to the Pe Ell South Permit Area. As noted, the FRE facility and temporary reservoir will comprise a small area in the much larger permit area. The District requests that the EIS consider that the primary uses described (camping, hunting, fishing access) would only be impacted in the immediate areas adjacent to the FRE facility, to a limited extent of the reservoir inundation area, and final quarry location. Importantly, as described above (see J1) the actual level of use for fishing access in this area is not known or described in the EIS, and it should be to accurately understand the impacts to recreational fishing. Furthermore, with the exception of fishing access the uses described here are not water-dependent uses, and it may be inferred that the primary use of the permits issued for access to the Pe Ell South Permit Area are rarely if ever used for white water boating. To substantiate the findings in the DEIS additional information regarding the level of use of listed activities including camping, hunting, and other motorized and non-motorized uses relative to the use of the area for white water boating and recreational fishing should be obtained. Since information on uses of the specific area to be affected (i.e., how much of these land based activities occur in the project area compared to the rest of the management unit) is not provided, the EIS does not have a quantitative basis for the impact findings. Given that the area of the project is small compared to the total area of the South Pe Ell Permit Area, the assessment of impacts may be overstated and are not justified with quantified information.

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			licensed vehicle and offers overnight camping with opportunities to hike, horseback ride, mountain bike, hunt, and fish." "Pe Ell South Permit Area, totaling 98,049 acres, encompasses a much larger area than the FRE facility (34.9 acres) and temporary reservoir area (847 acres)."	
J-3	3.2	J13 to J24	The EIS presents impact conclusions on recreational resources	The District requests that the EIS re-examine the significant impact findings on recreational resources. The EIS provides little to substantiate the claims of "permanent loss" of 13.8 miles of the Chehalis River for kayaking, and 6.4 miles (12.8 miles of riverbank) for recreational fishing. As the EIS correctly describes private landowners currently restrict access and a permit is required to enter the area. The EIS provides no information as too if the permits are issued to whitewater boaters, recreational fishers and if so, how many are issued for those activities. The impact analysis should consider that the area where the FRE facility is not currently available for public use without a permit. As Figure J2 correctly shows, none of the identified recreational facilities or access sites are located in the area directly affected by construction of the FRE facility and temporary reservoir. The EIS should use this map to re-examine the conclusions that the proposed project will result in significant and permanent loss of 13.8 miles of the river reach for whitewater kayaking, and 6.4 miles for recreational fishing. The EIS should use this map, in combination with further qualitative and quantitative data analysis to provide a more acceptable analysis of the impact of the proposed project on recreational resources. Given there is no public access to the site and recreational access is only allowed with a permit from private landowners, any unauthorized access to the river reach is an illegal trespass onto private land. The proposed action would not change this fact. The conclusion should be revised to "no impact" to recreational kayaking and fishing within the specific reaches (13.8 miles for kayaking, and 6.4 miles for recreational fishing). The District is committed to working with the public, public agencies, and private landowners to discuss options for recreational opportunities and enhancements for public use of the area affected by the project. However, since there is no current allowable public use, and the EIS provides no information regarding the level of use for kayaking and fishing, no basis for a mitigation plan is provided.

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				The District requests that the EIS reconsider the significant impact determination on recreational fishing from the operation of the proposed facility due to reducing the number of fish available to be caught in the basin. Given the analysis presented in Appendix E of the EIS, it is reasonable to anticipate impacts to recreational fisheries, however it is likely that the impacts have been overstated and should be revised. In Appendix E, the EIS has concluded that there will be significant impacts to fish populations in the upper Chehalis basin, however as noted in the District's comments to Appendix E, it is likely that some of the assumptions made for this determination are overly conservative, and mitigation would be implemented to minimize stated impacts to fish populations. More importantly, the analysis of impacts to recreational fishing in Appendix J, does not provide any data or information that suggests the loss of fish populations would be significant in the context of recreational fishing throughout the basin. The EIS should be revised to provide a quantitative analysis of the impacts to recreational fishing based on a revised analysis of the impacts to fish populations in Appendix E.
J-4	3.1	J13	The EIS states: "After construction begins, recreation would not be allowed within the FRE facility and temporary reservoir for the life of the facility."	The District requests that the EIS reconsider the statement "for the life of the facility." The assumption is correct that for reasonable safety precautions access to the immediate and adjacent areas of the upper Chehalis River to the construction site would not be permitted during the proposed five-year construction period. However, following construction, when the facility would not be operating to manage a flood event, access to upstream and downstream reaches from the FRE facility may be discussed with all interested recreational stakeholders and recreation uses such as riverbank fishing, and boating may be compatible with the presence of the facility.
APPENDIX K – TRANSPORTATION DISCIPLINE REPORT				
K-1	3.2.1.1	K23	The EIS states: "The creation and use of temporary construction access roads would increase the potential for sediment entry into surface waters and could increase turbidity in surface waters. The introduction of construction vehicles, equipment, and materials would also increase the potential for pollutants (e.g., oil and grease, hydraulic fluids, metals) to enter surface waters through stormwater runoff. As described in the Water Discipline Report, construction	This discipline report describes and analyzes the impacts to the transportation system in the study area. However, this conclusion is related to the effects of transportation on water resources. The District requests that as appropriate, effects on water resources from construction and operation of transportation facilities to support project construction and operation be moved to the water resources section.

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			activities for the FRE facility and temporary reservoir area would be regulated by a Washington Department of Ecology (Ecology) National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit and local land use and development permits issued by Lewis County. Roads constructed, upgraded, or used for the Proposed Action that are not in managed forests would result in moderate to minor adverse impacts."	
K-2	3.2.2.1.3	K44	The EIS provides general impact conclusions around flooding for emergency services and rail and transit.	In the conclusions for rail and transit and emergency services, the District requests that the EIS acknowledge the beneficial impacts from reducing the duration and extent of flooding and related flood damage that would result from the Proposed Action and the continuation of such impacts under the No Action Alternative. As currently stated, the EIS says that there would be no impacts on either emergency response or rail and transit service. The EIS should acknowledge that there would be no adverse impacts on emergency responses or rail and transit service, but that there would be beneficial impacts to both resources from decreases in delays.
APPENDIX L – TRIBAL RESOURCES DISCIPLINE REPORT				
L-1				No comments.
APPENDIX M – VISUAL QUALITY DISCIPLINE REPORT				
M-1	3.2.2.1	M21	The EIS states: "As described in Section 2.4, using the Visual Resources Assessment Procedure for US Army Corps of Engineers (Corps 1988), changes in character, although dominant and contrasting sharply with the existing character of the FRE facility site, would not be significant because a limited number of viewers would experience the contrast."	The District agrees with this finding. However, the technical approach described in Section 2.4 does not clearly state how a limited number of viewers is related to the significance of the impact. Due to the importance of this conclusion and as it contrasts with the conclusions of the Programmatic EIS, the District requests that the relevant supporting text from the Corps guidance should be quoted or summarized in Section 2.4 to support this conclusion.

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APPENDIX N – WATER DISCIPLINE REPORT				
N-1	2.2.2.4	N21	The EIS states: "The most common water quality issues observed in the upper Chehalis Basin are high water temperature, low dissolved oxygen (DO), and fecal coliform bacteria standard exceedances." Furthermore, the EIS states: "The most common water quality issues observed in the upper Chehalis Basin are high water temperature, low dissolved oxygen (DO), and fecal coliform bacteria standard exceedances."	The District requests that the EIS should be changed to delete fecal coliform bacteria from this list based on the information presented in Section 2.2.2.4.5 which states only 5 exceedances of the standard. Further, Ecology's 303d listing of waters of concern does not show impairment for fecal coliform. Therefore, it is not on par with the water quality issues of temperature and DO. The first paragraph of this section suggests implicitly that these non-point sources are pervasive in the Chehalis basin, yet there is only one noted violation of fecal coliform on a single date at the Dryad site, and only 4 violations at the Porter site over the last 15 years. The EIS should be revised to state that "Though not indicated as a systemic water quality issue in the Chehalis Basin, fecal coliform bacteria could be introduced through non-point sources such as ....., or point sources such as ....." This statement suggests that low DO is a common condition found in the upper Chehalis River basin. However, Section 2.2.2.4.3 notes that DO criteria were violated on only three days during the hottest month of the year. These data suggest that is not a 'common' problem based on the information found in section 2.2.2.4 which suggests that it is actually a very rare event. For spatial reference, the FRE facility is located upstream of both locations at approximately river mile 108; Dryad is located at river mile 97.8, and Porter is located at river mile 33
N-2	2.2.2.4	N22	The EIS states: "The major causes of water quality impairment in the upper Chehalis Basin include degraded riparian conditions, failing septic systems, and stormwater runoff from urban areas, agricultural lands, and commercial forestlands."	The sentence of findings about potential impairment and subsequent linkages to causation is inconsistent with other information provided in the DEIS. The District requests that the EIS be changed to delete this sentence because (1) there is no reference or citation, (2) it is not connected to the prior sentence about TMDLs, (3) the authors are making their own conclusions based on conjecture rather than presenting existing conditions or citing documented work of others, (4) failing septic systems is incorrect terminology, (5) language does not align with impairment and 303d listings.
N-3	2.2.2.4.1	N22	The EIS states: "Table N7 Water Quality Index Scores for Water Year 2016 at Dryad and Porter Monitoring Stations…" Figure N9: Water Quality Index Scores	The District requests that the EIS be changed to be consistent with the values shown in Ecology's Freshwater Information Network; the values reported in the DEIS for oxygen, pH, and temperature in Table N7 and Figure N9 are not consistent with Ecology's own information. Table N7 and Ecology's numbers are listed here: • Dryad (EIS 83, 70 ,94, 56, 67, 47, 54, 60) (Ecology FIN 83, 90, 98, 56, 85, 47, 54, 60) • Porter (EIS 80, 91, 85, 57, 63, 42, 45, 60) (Ecology FIN 80, 95, 95, 57, 83, 42, 45, 60)

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N-4	2.2.2.4.1	N23	The EIS states: "As seen in Figure N9, annualized WQI scores based on water year 2016…"	The District requests that the EIS be revised to reference Table N7 which shows the 2016 data when referring to the information presented in Figure N9. As it is currently presented, it is confusing to the reader where the correct information is available for reference. Further, Table N7 should be provided with a citation of source data, either in the figure title or below the table. This applies to all the tables presented in the EIS.
N-5	2.2.2.4.1	N23	The EIS states: "...Dryad station showed good conditions for…"	The District requests that the EIS be amended to list the "good" and "moderate" parameters based on updates to Table N7 (see Comment N-3). Fecal coliform bacteria, oxygen, pH, and temperature should be listed as good and suspended solids, nitrogen, phosphorus, and turbidity should be listed as moderate.
N-6	2.2.2.4.1	N23	The EIS states: "...Porter station showed good conditions for…"	The District requests that the EIS be amended to list the good and moderate parameters based on updates to Table N7 (see Comment N-3). Fecal coliform bacteria, oxygen, pH, and temperature should be listed as good and suspended solids, nitrogen, phosphorus, and turbidity should be listed as moderate.
N-7	2.2.2.4.2	N25	The EIS states: "Monitoring data collected by Ecology and others show that summer water temperatures regularly exceed criteria for designated aquatic life uses in the Chehalis River and its tributaries." And, Table N8: Designated Aquatic Life Uses and Temperature Criteria for Select Chehalis Basin Streams (WAC 173-201A200)	The District requests that the statement as presented in the DEIS be deleted and a more accurate description be provided. The statement as presented is inadequate because (1) it starts the section with a conclusion before presenting any information, (2) "others" is vague and should be listed, and (3) the phrase "its tributaries" is misleading because it suggests every tributary in the watershed exceeds criteria. This conclusion should state where and how frequently any exceedances occurred supported by citations to specific data. Please also revise the EIS to specify which tributaries experienced exceedances of temperature criteria to clarify that exceedances only occur in some tributaries.
N-8	2.2.2.4.2	N26	The EIS states: "...show that from 2001 to 2016,… ...(Figure N10; Ecology 2019a, 2019b)."	Currently, the data presented in Figure N10 for the Dryad station only show data through 2014 (Porter is presented through 2016). The District requests that Ecology provide data through 2016 for Dryad or revise the text referencing the figure to indicate when the data is available. Further, the EIS references on Page N26 should be changed to reference Ecology 2019b, Ecology 2019c because these are likely the intended references.
N-9	2.2.2.4.2	N26	The EIS states: "...annual maximum temperatures and 7-DADMax temperatures for…"	The District requests that the EIS be changed to "...annual maximum temperatures and annual maximum 7-DADMax temperatures for…" to make the information in the EIS consistent with the criteria. The EIS should be updated to describe how these calculations were performed. As currently written, the DEIS could lead to a misstatement of existing conditions and potential impacts.

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N-10	2.2.2.4.2	N26, N27	The EIS states: “In general, the 2013 to 2014 monitoring showed that all stations…" Figure N10: Chehalis River Maximum Water Temperatures	The District requests that the EIS include information from Anchor QEA 2014 regarding when criteria are met. The text currently only presents exceedances. The text should be revised to state: "In reaches and tributaries designated as salmon spawning, rearing and migration habitat, the criterion applies over fall through spring. Over most of this period, the 7-DADMax temperature remained below the applicable criterion." The EIS should be changed from Max. of 7-Day Mean Temperature to the Annual Maximum 7DADMax Temperature to be consistent with the criteria. The EIS should be changed to revise the text and to include additional information to summarize the available data and demonstrate, when, how, and where criteria are met or not met in terms of duration, frequency, and magnitude.
N-11	2.2.2.4.2	N27	Section 2.2.2.4.2 Temperature (general comment)	The District requests that the EIS provide a complete and current description of existing conditions; currently the section references a nearly 2 decades old TMDL. TMDLs are followed by implementation plans, which are included in the reference section, and include actions that have changed conditions since 2001. For example, the 2010 Upper Chehalis River Watershed Multi-Parameter Total Maximum Daily Load: Water Quality Data Review and information from the Chehalis Basin Partnership appear appropriate to cite for a more contemporary assessment of current water quality conditions. This EIS should cite and summarize more current data reports and sources.
N-12	2.2.2.4.3	N28	The EIS states: “Monthly sampling data collected by Ecology from the Dryad station on the Chehalis River (RM 97.8) show exceedances of the daily minimum DO criterion of 9.5 mg/L during the summer…Monthly sampling by Ecology in 2016, 2017, and 2018 identified DO levels in samples collected from the Chehalis River above Pe Ell to be below the 9.5 mg/L criteria on August 31, 2016 (8.9 mg/L and August 15, 2018 (8.9 mg/l).”	The District requests that the EIS provide context for the current presentation of instances when DO criteria are not being met. This could take the form of comparing the given information to the overall percentage of samples taken or how often the criteria is met. Without this context, the information does not provide a full understanding of the existing conditions for DO. The EIS should be changed to recognize the DO TMDL and the existing condition of the river following implementation plans. As noted individual data are available from Ecology’s online Freshwater Information Network, Environmental Information Management System to query the locations cited. The EIS should present a summary of the data including basic statistics including the number of samples, the range, and median values and an assessment of the duration, frequency, and magnitude of deviation from water quality standards. These revisions would provide a more complete understanding of Ecology’s water quality dataset from the Chehalis River.
N-13	2.2.2.4.4	N28	The EIS states: “...adversely affect fish and aquatic habitat in several ways, including by	The District requests that Ecology delete the phrase "reducing the amount of light available for aquatic plants" because the high turbidity levels occur mostly in the spring

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			reducing the amount of light available for aquatic plants…"	during runoff when aquatic growth is low. See reference values and information provided on page N29.
N-14	2.2.2.4.4	N29	The EIS states: "...between the Dryad station (upstream) and Claquato station (downstream)…"	The RM location for Claquato should be included to provide the reader with the geographic context for this station. The District requests that the EIS be revised accordingly.
N-15	2.2.2.4.5	N29	The EIS states: "...non-point sources including failing sewage septic systems, livestock operations, dairy farms, hobby farms, stormwater, and wildlife (Ecology 2004)."	The correct reference is Ecology 2004a. The District requests that the EIS be revised accordingly.
N-16	3.2.1.1.1.2	N44	The EIS states: "Modeling showed that daily maximum temperatures of the Chehalis River could increase by up to 2°C to 3°C in mid- to late-summer in the temporary reservoir footprint relative to the No Action Alternative, exceeding temperature water quality criteria (PSU 2017)."	The District requests the EIS provide further explanation and revision of this critical finding in the FEIS. The District requests that the EIS address the following five issues. First, the reference does not include the quoted statement so it should be removed. Second, the values seem to be inferred from the figures which cannot be read to this level of detail. The model error is 1/2 to 1 C and should be recognized. Third, the EIS should affirm that the modeled conditions actually represent the proposed alternative. Fourth, the DEIS repeats the reference statement that "solar heating is the primary driver of water temperatures" yet the reference recognizes that improved meteorological data are needed to more accurately represent conditions. This qualification of the statement should be added to the EIS. Fourth, the model is of the years 2013-2014. The EIS should include a description of the general hydrological and metrological conditions these years represent and the probability of these conditions occurring and representing the life of the project. Finally, there is no mention of the basic assumptions used in the modeling effort. Without these assumptions, the results are subject to subjective interpretation and would typically be considered unreliable.
N-17	3.2.1.1.1.2	N44	The EIS states: "The modeling showed small (less than 0.2 mg/L) differences for much of the year with larger differences (up to approximately 0.3 to 0.4 mg/L) in summer months (PSU 2017, Figures 203 and 204). This would be a significant adverse impact to surface water quality." "Therefore, the Proposed Action would have significant and unavoidable adverse	The District requests that the EIS be revised to properly represent any values directly or indirectly inferred from the reference similar as was described in Comment N-16 above. The current text and cited references do not provide sufficient information to substantiate this conclusion. While specific comments have been made throughout the section, and there are some potential short-term changes to specific water quality parameters, it is important to note disagreement that the overall conclusion is significant and unavoidable adverse impacts on surface water quality. During the brief periods of project operation, nearly immeasurable differences in specific water quality parameters are possible while the remainder of the time there will be no impact on surface water quality.

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			environmental impacts on surface water quality…"	The District believes a conclusion of moderate to minor adverse impact is more appropriate because the DO existing conditions and standards as described in Section 2.2.2.4.3 are above the criteria and a 0.2 mg/L decrease is allowable. Further, this apparently unsubstantiated impact as noted is identified as 'significant,' yet the existing conditions DO sampling clearly shows that the DO levels observed in the Chehalis River are currently well above criteria established by Ecology for that stream system. The finding that a decrease of 0.2 mg/l is indicative of a 'significant' impact is not consistent with the actual analysis that shows that DO would continue to be above Ecology's criteria.
N-18	3.2.1.1.1.2	N46	The EIS states: "This would be a moderate adverse impact on water quality downstream of the FRE facility site."	The District requests this finding be reconsidered and revised to a minor impact. The analysis provided shows that the difference is within the standard and reaeration in the river would minimize any potential DO depression that occurred during brief water retention in the reservoir. The CE-QUAL-W2 includes options for multiple river and lake reaeration equations based on field and laboratory studies. Limnological principles suggest a river with these characteristics would naturally reoxygenate. The EIS should include consideration of the reaeration processes used and explain why the chosen equation does not provide sufficient dissolved oxygen.
N-19	3.2.1.1.1.2	N46	The EIS states: "The increased water temperatures would exceed water quality standards and result in significant impacts to surface water quality and designated uses of the Chehalis River for salmonid habitat."	The District requests the EIS be revised and suggests that the following statement is more accurate: "...the modeling suggests the potential for water temperatures to increase for short durations with a moderate probability to exceed water quality standards, resulting in potentially minor impacts to surface water quality,…". The phrase in the existing statement that "increased water temperatures AND decreased DO levels..." incorrectly implies that not only is decreased DO inevitable with increasing temperature, but that a reduction in DO resulting from implementation of the FRE project is also individually inevitable. This is not a true statement, as DO levels in the river are always reset to saturation levels (they cannot rise higher than saturation levels) at every location where the flow becomes highly aerated, such as at riffles, drops, and step falls or cascades. These are present throughout most of the upper Chehalis; therefore DO would be reset to ambient saturation level throughout, regardless of implementation of the FRE project or not.
N-20	3.2.2.1.1.2	N63	The EIS states: "Modeling shows that for floods similar to the 2009 flood, water temperature near the surface would exceed the SSIC of 13°C in fall, but would generally	The District requests Ecology revise the statement "would exceed the SSIC of 13°C" to "could exceed." As the EIS describes, since there is no reservoir baseline existing condition there is no basis for comparing modeled predictions and assessing changes in conditions. In addition the EIS should be amended to note that the model could be over-predicting potential water quality changes because the boundary conditions

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			be cooler (less than 10°C) in spring conditions (Anchor QEA 2017b)…" The EIS also states: "Since there is no temporary reservoir at the site currently, there is no baseline from which to evaluate proposed FRE facility operations on reservoir temperatures, in terms of temperature increases relative to state water quality standards."	assumed in the model could be excessively warm as they were based on downstream monitoring stations and may have led to an incorrect finding of significant adverse impact on water quality. The District also requests that the FEIS include a description of the criteria used to establish the level of impact findings.
N-21	3.2.2.1.1.2	N63	The EIS states: "In general, floods that occur earlier in the wet period (October) could be subject to greater solar heating than floods later in the wet period (spring), creating the potential for temporary reservoir and outflow temperatures to exceed the Supplemental Spawning and Incubation Criteria (SSIC) of 13°C that is in effect from September 15 through July 1. Thermal stratification is predicted to be relatively minor for storage during most of the wet period, with stronger stratification predicted for early wet period (October) storage (Anchor QEA 2017b)."	The statement-referenced statement does not comport with the water quality modeling data summary. In the cited reference supporting the water quality modeling, there does not appear to be clearly supportive information that can corroborate the conclusion that October floods resulting in reservoir activation would result in more solar heating than those occurring in the spring. In order to make this statement, there must be modeling data showing that there would be a temperature increase of enough to breach this SSIC limit of 13°C. The EIS does not provide modeling data supporting this statement. The District requests that the assumptions in the EIS be revised accordingly.
N-22	3.2.2.1.1.2	N65	The EIS states: "...therefore would constitute a significant adverse impact on water quality." Separately, the EIS also states: "This would be a moderate adverse impact on water quality..."	The District requests that the FEIS include a description of the criteria used to determine impact levels. The actual difference in the predicted DO changes are minimal as reported in the DEIS yet one is considered significant and one is moderate. The FEIS should describe specifically why the difference in impacts findings is justified. Further, the two parameters are not necessarily linked (I.e. high temperature does not always cause DO to fall below acceptable limits, as noted above).
N-23	3.2.2.1.1.2	N67	The EIS states: "...because the reservoir outflow turbidity would be more than 10% higher than the reservoir inflow turbidity…"	The EIS should include a description in the water quality modeling describing the physical processes represented in the model that result in the increase in turbidity. Since turbidity is not a direct parameter in the model, the FEIS should describe how the turbidity results were interpreted from the model results. If this was due to the concentration in sediments being higher but the mass loading being lower from the

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				difference in the inflow versus outflow the FEIS should describe this. The EIS should explain why there is a difference in both terms of concentration and load.
N-24	3.2.2.1.1.2	N67	The EIS states: "...would exceed water quality standards…"	Water quality standards are comprised of three parts: duration, frequency, and magnitude, and are interpreted based on technical, legal, and Ecology policy and guidance information. The District requests that the EIS be amended to include a summary table that presents the predicted ranges of duration, frequency, and magnitude of exceedances of water quality standards for each parameter and be footnoted as to its basis, for example based on current standards, water quality modeling results, and only technical interpretation based on the scientific language of the standard.
N-25	3.2.2.1.1.2	N67	The EIS states: "Other Surface Water Quality Considerations…", "Lakes and reservoirs that hold water for long periods of time can…"	The District requests that in the FEIS this section be deleted because it is not relevant. The Project description notes that the project will not hold water for long periods of time; water will be retained only temporarily and infrequently, therefore the issues noted are not applicable to this project.
N-26	3.2.2.1.1.2	N63	The EIS states: "When the FRE facility is not storing water and the Chehalis River passes through the facility outlets, daily maximum temperatures of the Chehalis River could increase by up to 2°C to 3°C in mid- to late-summer in the temporary reservoir footprint relative to the No Action Alternative, exceeding temperature water quality criteria (PSU 2017). The increase in water temperatures would result from the loss of tree cover and shading. Additionally, modeling for Crim Creek in the temporary reservoir footprint showed that loss of riparian cover and stream shading associated with the FRE facility is predicted to result in temperature increases of between 2°C and 5°C relative to the No Action Alternative, exceeding water quality criteria (Anchor QEA 2017b). Therefore, the operation of the FRE facility would result in	The description of water temperature modeling conducted for the EIS does not adequately describe how the results from sample areas, such as Crim Creek, may have been used to characterize the whole of the reservoir inundation area. The narrative does not describe if each tributary and the mainstem in the inundation area was modeled individually or collectively to arrive at these conclusions or were the results from Crim Creek alone used to extrapolate results across the inundation area. Using the results from Crim Creek alone could lead to inaccurate results given the widely disparate characteristics of shaded riverine habitat and the effects of such vegetation on smaller tributaries compared to the much wider mainstem channel. The District request that additional information be included in the EIS to accurately and precisely describe how the temperature modelling results were developed, and if results from one tributary (i.e. Crim Creek) were extrapolated to the provide results for the entire inundation area. The District requests clarification of modeling methods and results, and if the water temperature data from Crim Creek of 2 to 5 C as described in the DEIS, has been extrapolated to the inundation area. The EIS should also include recognition of the water temperatures changes in other tributaries and the Chehalis mainstem, if they were indeed determined. The water quality model should then be used to integrate these sources into the range of temperature changes for the project. The EIS includes individual statements about impacts rather than a holistic viewpoint of potential changes in water quality. Examples such as this extrapolation from a single location and

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			a significant adverse impact on water quality."	a single parameter to statements about the operation of the FRE facility as significantly adverse are likely incorrect.
N-27	3.2.2.1.1.2	N64 and N65	Section 3.2.2.1.1.2 of the EIS provides a discussion regarding Dissolved Oxygen (DO) (general comment).	See Comments N-18 and N-19. The District requests that the EIS be revised to include a more appropriate analysis of dissolved oxygen concentrations that has not been oversimplified and reflects the outcomes predicted by the water quality modeling, and recognize standard dissolved oxygen principles such as reaeration. Over simplifying the complexity of dissolved oxygen dynamics to water temperature casts doubt on the efficacy of using water quality models to simulate the actual interrelationships. This simplification results in an impact conclusion of significant adverse impact on water quality, which is an overstatement of the impact predicted by the water quality model and the actual impact expected based on scientific conceptual models of dissolved oxygen.
N-28	3.2.2.1.1.2	N65	Section 3.2.2.1.1.2 of the EIS provides a discussion of sediment transport modeling methods (general comment)	CE-QUALW2 is described as one of the sediment erosion modeling tools used to evaluate erosion from the temporary reservoir shoreline areas, and the reader is directed to the Earth Discipline section for details. However, there is no mention of CE-QUAL W2 in the Earth Discipline report as a modeling tool to analyze impacts. Further, CE-QUAL-W2 is only a one-dimensional water quality model that has no capability to simulate sediment transport. The District requests that a more complete description of the modeling methodology be included in the EIS. Specifically the EIS should state the modeled parameters. For example the EIS should describe how the inorganic suspended solids and sediment resuspension functions of the model were used, parameterized and calibrated, and include a description of the level of confidence in the model predictions. The District requests that the EIS provide sufficient explanation of how these tools were applied, their predictive abilities, conclusions drawn from the results and the potential range of impacts.
APPENDIX O – WETLANDS DISCIPLINE REPORT				
O-1	Summary	O-iii	Table O1 Summary of Probable Wetland and Regulatory Waterbody Impacts from Proposed Action	The District requests that the Ecology review and revise Table O-1 based on updated impact assumptions and quantifications per comments below.
O-2	2.3	O10	The EIS states: "The Lewis County Code and SMP require rivers and streams to be classified in accordance with a revised version of the Washington Department of	Neither WAC 222-16-030 nor Lewis County Code, which are the governing regulations for stream typing, distinguish between Type F-A and Type F-B Waters; both only use Type F waters. The District requests that the EIS clarify why this distinction is made or revise accordingly.

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			Natural Resources (DNR) water typing system (Washington Administrative Code [WAC] 222-16-030). This system categorizes rivers and streams into the following types: Type S Water (Shoreline of the State), Type F-A Water (fish-bearing greater than 10 feet wide), Type F-B Water (fish-bearing less than 10 feet wide), Type Np Water (non-fish habitat perennial flow), and Type Ns Water (non-fish habitat seasonal flow)."	
O-3	2.4.1.1	Figures O10 through O13	Maximum extent of temporary reservoir (general comment in reference to the following figures) Figure: O10 Wetlands and Waterbodies Near the FRE Facility Figure: O11 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir Figure: O12 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir Figure: O13 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir	The District requests that the EIS include water surface elevation or acreage used for max extent of reservoir in analysis. This will provide confirmation of the spatial extent of operational impacts provided later in the chapter.
O-4	2.4.1.1	Figures O11 through O13	Construction route mapping (general comment in reference to the following figures) Figure: O11 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir Figure: O12 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir Figure : O13 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir	Mapping provided in the DEIS of the construction route does not describe if the route is composed of existing roads or proposed roads. The District requests that the distinction be clarified in the FEIS. This will substantiate the basis for determining the area of newly disturbed areas due to road construction versus reuse of existing roads.
O-5	2.4.1.1	Figures O11 through O13	Stream mapping (general comment in reference to the following figures) Figure: O11 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir	Review of the mapping in this Chapter and in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* found indications of which streams were field-verified. The District requests that Ecology revise the maps to include this information and to

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			Figure: O12 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir Figure: O13 Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir	describe how stream buffer impacts were calculated and the significance of impacts assessed.
O-6	2.4.1.2	O30	On page O30, the EIS states: "Wetlands located within about 500 horizontal feet of the temporary reservoir maximum inundation area were also identified for this analysis. Overall, 27 wetlands, including one Category II wetland (0.01 acre) and 26 Category III wetlands (2.24 acres) are located adjacent to the temporary reservoir, but outside the potential inundation area, as shown in Figures O11 through O13." Table O7 Number of Existing Wetlands in Each Cowardin Class Within the Area of Airport Levee Changes On page O33, the EIS states: "A total of seven wetlands were visually identified within approximately 200 feet of the proposed airport levee study area boundary located on private property...These wetlands were identified due to their close proximity and the potential for buffers of these wetlands to extend into the airport levee footprint (Figure O14)."	The methodology for identifying wetlands 500 feet landward of the temporary reservoir in Section 2.3 is not explained in sufficient detail to assess the appropriateness of the methodology. If the Ecology 2011 data was utilized the District request that an explanation of the use of these data be included in the FEIS. If another source was used please identify the source and the methodology used. Figures O11 through O13 indicate only field-delineated wetlands are mapped. Please specify if wetlands 500 feet landward were also field delineated? The District requests the field verification status of all wetlands mapped be clearly specified and field verified or identified through desktop review. A total of eight wetlands are shown on Table O7. Text throughout this section indicates only six were delineated. Table O8 only has six wetlands. The District requests that these discrepancies be explained or corrected in the FEIS. Figure O14 indicates that all wetlands were field-delineated, which is inconsistent with the description of methods described in Section 2.4.1.2. Please revise either text or Figure to clarify what was delineated or estimated.
O-7	2.4.2.1, 3.2.1.1.2	O35, O44	On page O35, the EIS states: "The upper Chehalis River is the only stream located within the footprint of the FRE facility, excluding the quarry access roads On page O44, the EIS states: "Streams are the only type of regulatory waterbody located within the FRE facility and associated areas. The Chehalis River is the only stream identified within the proposed	Figure O10 shows that the right bank embankment of the FRE facility and Construction Areas intercept several unnamed tributaries. The District requests that Ecology clarify this statement as it contradicts what is shown on Figure O10 and please confirm whether the EIS assumes there would be temporary or permanent impacts to these water features as a result of FRE construction.

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			FRE facility and associated areas. Approximately 0.32 acre of the Chehalis River (as measured at the OHWM) would be permanently filled for construction of the FRE facility."	
O-8	2.4.2.2	O36	Table O11 Streams Crossed by the FRE Facility Quarry Access Roads	The District requests a table showing the number of streams by stream type and buffer width. The report does not show how many streams were identified as Type F vs Type Np/Ns, and stream buffer designations that were used to inform stream buffer impacts. The *Wetland, Water, and Ordinary High Water Mark Delineation Report* also does not specify stream types. Please list streams by type and buffer width in the temporary reservoir study area to cross-check to stream and stream buffer impacts and overall magnitude of impacts streams given later in chapter.
O-9	2.5	O39	The EIS states: "The analysis for impacts on wetlands and streams (regulatory waterbodies) considered the following: • Permanent loss of wetlands and wetland buffers • Temporary loss of wetlands and wetland buffers • Permanent loss of streams (regulatory waterbodies) and stream buffers • Temporary loss of streams (regulatory waterbodies) and stream buffers"	The District requests that the EIS be amended to provide criteria, and the basis for those criteria, to determine which proposed activities would constitute permanent versus temporary loss of wetlands and wetland buffers; and permanent versus temporary loss of streams and stream buffers. Subsequent sections do no distinguish between temporary or permanent impacts. A quantification of temporary versus permanent impacts is required to assessing compensatory mitigation for wetland impacts. The District also requests that EIS be amended to include the criteria, and basis for the criteria, used to determined level of significance (significant, moderate, or minor) of impacts to wetlands.
O-10	3.2.1.1.1	O40	The EIS states: "Potential permanent construction impacts on wetlands, wetland buffers, and associated functions and values could occur from land clearing, excavation, grading, and fill placement activities; these impacts are summarized in Table O12. Construction is estimated to last for 5 years, from 2025 to 2030."	The direct wetland and wetland buffer impacts described in this section make no distinction between permanent impacts, temporary construction impacts, or wetland vegetation conversion. Impacts appear to be treated the same across all actions. The District requests that the impacts be re-evaluated and classified as permanent, temporary construction or wetland vegetation conversion to inform the wetlands mitigation plan to be prepared and submitted by the District.
O-11	3.2.1.1.1	O40	Table O12: Summary of Probable Wetland Impacts from Construction Activities	The District requests that the impacts analysis presented in this section distinguish between two types of construction areas in order to accurately address temporary vs. permanent impacts. FRE facility impacts include both the permanent facility and

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				construction areas. The EIS should clarify as to how construction areas are treated in this impact analysis. Per the September 18, 2019 Chehalis Basin Strategy Construction Schedule Supplemental Information document that was submitted to Ecology, the construction areas are divided into staging and spoil areas, which will be treated differently during site restoration after construction of the project. The spoils areas will be left in perpetuity but other staging areas will be restored. The District requests that this information be considered in the impacts analysis and clarified in the EIS.
O-12	3.2.1.1.1, 3.2.1.1.2	O40, O44	Table O12: Summary of Probable Wetland Impacts from Construction Activities On page O44, the EIS states: "In addition, 10.79 acres of stream buffer would be permanently converted to non-forested conditions."	The removal of trees in the temporary reservoir area also appears to be treated as permanent disturbance similar to the FRE facility. It is inaccurate to treat tree clearing, which would not preclude a wetland to continue to function as a wetland, the in same manner as construction of the facility, which would permanently convert wetlands into non-wetlands. The District requests that the analysis address this distinction in order to accurately assess compensatory mitigation requirements for wetlands. Removal of trees is reported to affect a total of 6.5 acres among 62 wetlands. However, Section 2.4.1.2 and Table O5 indicates that only up to 39 wetlands are forested or a mix of forested and other wetland vegetation communities, totaling 5.49 acres across all wetlands that have a PFO component. Please describe how number of forested wetlands and acreage were determined for tree removal and verify that the values reported are correct.
O-13	3.2.1.1.1	O41	The EIS states: "Eight wetlands are located in the proposed construction footprint of the FRE facility and associated access, construction staging and spoils areas, and maintenance areas. All wetlands are Category III wetlands."	Figure O-10 only shows a total of five distinct wetlands within the FRE facility footprint and construction areas. The District requests that the EIS confirm if five or eight wetlands are located within the FRE facility and construction footprint and ensure acreage impacts are correct. FRE facility impacts include both the permanent facility and construction areas. The District requests that the EIS clarifies if these are temporary or permanent impacts in the construction areas and how these areas have been evaluated in the impact analysis.
O-14	3.2.1.1.1	O41	The EIS states: "These wetlands would be permanently filled or eliminated with FRE facility structures or spoils. Wetland regulatory buffer habitat for these wetlands would also be disturbed or eliminated."	The DEIS does not include a description that differentiates between filling and eliminating wetlands and wetland buffers. Typically, "disturb" implies a wetland buffer may be temporarily disturbed but can be restored, whereas elimination implies permanent conversion to non-vegetated buffer condition. The District requests that there be clear itemization of temporary vs. permanent buffer impacts. This will inform how impacts were determined to be minor, moderate, or significant, and the assessment of compensatory mitigation requirements.
O-15	3.2.1.1.1	O41	The EIS states: "These probable adverse impacts are considered moderate for	It is unclear whether 1.08 acres of wetlands would be permanently eliminated since impacts for the permanent facility and construction areas are lumped together. The

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			wetlands because eight wetlands with a total of 1.08 acres would be permanently eliminated. A total of 30.14 acres of wetland buffer habitat would also be disturbed or eliminated."	District requests that Ecology revise to distinguish temporary vs. permanent wetland impacts and re-evaluate the level of severity of these impacts.
O-16	3.2.1.1.1	O41	The EIS states: "Accessing these quarry areas would include widening, improving, and upgrading the existing roads. Potential wetland impacts associated with the quarry area access roads were identified based on the wetland delineations performed within the temporary reservoir and the Modeled Wetlands Inventory mapping dataset (Ecology 2011), assuming 25 feet on each side of the existing roads for construction activities."	These impacts appear to lump together both temporary and permanent impacts due to road construction. The District requests that EIS include a description that distinguishes between temporary construction and permanent road footprints.
O-17	3.2.1.1.1	O42	The EIS states: "As described earlier in the FRE facility and associated areas impact discussion, four wetlands located within the temporary reservoir would be filled or disturbed during FRE facility construction activities."	While the text indicates that four wetlands would be affected, Figure O10 shows only two wetlands in the temporary reservoir that would be impacted. The District requests that Ecology correct wetland quantities and confirm that acreage impacts are correctly quantified. Also see Comment O-14.
O-18	3.2.1.1.1, 3.2.1.1.2	O42, O43, O44	On page O42, the EIS states: "Over 2 to 5 years, all trees greater than 6 inches in diameter at breast height (dbh) would be removed from wetlands within the following lower two zones of the temporary reservoir: Zone 1 (10% or 10-year recurrence event) and Zone 2 (5% or 20-year recurrence event).....A total of 213.85 acres of wetland buffers are associated with the 62 wetlands located within the lower two zones of the temporary reservoir where all trees greater than 6 inches dbh would be removed during construction."	The basis for determining the areal extent of Zone 1 and Zone 2 within the inundation area is not described in this chapter. The District requests that these zones need to be depicted on maps and/or a WSEL needs to be provided to be able to confirm how tree removal within forested wetlands and forested wetland buffers was evaluated. The assumption that all trees will be removed in these inundation zones is not consistent with what is proposed in Chapter 2, which states that: "In the temporary reservoir area, the District stated that **all non-flood-tolerant tree species [emphasis added]** would be removed from the 405-acre zone where the inundation during FRE facility operation is expected to last 25 days or more. Common non-flood-tolerant species that would be removed include Douglas fir, big-leaf maple, red alder, and bitter cherry." Therefore, the tree removal assumption provided in this Appendix overestimates tree removal proposed in wetlands. The analysis in this section must be revised to appropriately assess the reasonable extent of tree removal in wetlands.

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			On page O43, the EIS states: "These probable impacts are considered significant for wetlands because the wetlands with forested habitat features would be changed into PSS and PEM wetland systems, with much reduced functions….Trees would also be removed from 213.85 acres of wetland buffers, causing further disturbance and loss of functions from the wetlands." On page O45, the EIS states: "Construction activities would include the removal (over 2 to 5 years) of all trees greater than 6 inches dbh within the following two inundation zones of the reservoir: Zone 1 (10% or 10-year recurrence event) and Zone 2 (5% or 20-year recurrence event)."	Similarly, the amount of tree removal appears to be over-estimated since it assumes all trees will be removed from inundation Zones 1 and 2, contrary to the project description. Although it is likely more non-flood tolerant tree species occur in wetland buffers, the extent to which 213.85 acres of wetland buffer is actually forested wetland buffer with non-flood tolerant species cannot be determined. These impacts should be reevaluated and clarified. Please see comments to Chapter 2 of the main DEIS document (see Comments 2-3, 2-4) and comments to Appendix 1 of the DEIS (see Comment APP1-3), which propose looking at inundation zones based on actual operation of the dam at three distinct events as opposed to the current Inundation Zone 1-4 designations. The District requests that the EIS consider the Inundation/Vegetation Analysis in its analysis of impacts and revise the impact conclusions accordingly.
O-19	3.2.1.1.1	O42	The EIS states: "Wetlands and wetland buffers with forested habitats would lose habitat functions associated with tree canopy cover such as shade, habitat features (snags and woody material), and habitat diversity. Most of these wetlands (52 wetlands, 6.07 acres) have higher habitat scores and functions because of the interspersion of habitats (i.e., interspersion between forested, shrub, and emergent areas within the wetland) and the presence of special habitat features including snags and downed wood."	The basis for calculating that 52 wetlands (6.07 acres) have forested wetland habitat that would be removed is not provided. Section 2.4.1.2 and Table O5 indicate that only 39 wetlands are forested or a mix of forested and other wetland vegetation communities, totaling 5.49 acres across all wetlands that have a PFO component. The District requests that this section be revised to substantiate the quantity of wetlands that would have forested habitat removed so that the wetland compensatory mitigation requirements can be accurately identified. Table O12 reports 6.5 acres and 62 wetlands that would be affected by tree removal. Please revise and ensure what is being reported is consistent throughout the EIS.
O-20	3.2.1.1.1, 3.2.1.1.2,	O43, O44	On page O50, the EIS states: "Mitigation is proposed for the Applicant to develop a Wetland and Wetland Buffer Mitigation Plan to mitigate impacts on wetlands and wetland buffers in the temporary reservoir area; however, there is uncertainty if the	There is no analysis in this section or Section 3.2.4 to substantiate the finding that wetland and wetland buffer mitigation; and stream and stream buffer mitigation is uncertain to be technically feasible and economically practicable. This statement is prejudicial since there is no underlying supporting analysis in the DEIS. The District is committed to mitigating all appropriate wetland impacts through technically and economically feasible means. The development of such mitigation plans has occurred

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			implementation of a plan is technically feasible and economically practicable." On page O56, the EIS states: "Mitigation is proposed for the Applicant to develop a Stream and Stream Buffer Mitigation Plan to mitigate impacts to streams and stream buffers in the FRE facility and associated areas; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable."	within the region for any number of projects including the creation of wetland mitigation banks. The development of these banks in and of themselves demonstrates the general feasibility of such mitigation. The District requests that this statement be removed from the EIS.
O-21	3.2.1.1.1	O43	The EIS states: "Eight wetlands are located within or partially within the airport levee construction study area. This larger boundary has been used as a conservative area of impact. These wetlands include five Category II wetlands and three Category III wetlands."	The number of wetlands (eight) called out in the impact analysis is not consistent with the number shown on Table O-8 (six). The District requests that Ecology confirm if the quantity and acreage of wetlands are correct, and re-assess based on proposed levee footprint.
O-22	3.2.1.1.1	O43	The EIS states: "These probable adverse impacts are considered significant for wetlands because eight wetlands with a total acreage of 6.63 acres would be filled or eliminated. A total of 44.2 acres of wetland buffer habitat would also be disturbed during construction. The wetland buffers that could be disturbed are associated with wetlands located both within the footprint of the proposed levee changes and wetlands within approximately 200 feet of the proposed footprint based on visual observations. The affected wetlands do not include Category I wetlands and are already highly disturbed. Four of the wetlands have moderate habitat function scores and four have low habitat function scores. Three of the eight wetlands also have high water	The description of the Airport levee disturbing 6.63 acres of wetlands 44 acres of wetland buffers is inaccurate. The Airport levee construction will be largely limited to the levee footprint, which is described in the project description submitted by the District to Ecology (please see letter to Ecology dated November 22, 2019, and March 12, 2019). Inclusion of all wetlands within 200 feet of the levee is an exaggeration which does not account for modern construction permitting and best management practices and misrepresents the impacts of the Airport levee. The District requests that the analysis in the EIS should be revised to reflect this information.

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			quality function scores. These types of wetlands are also common within the Chehalis Basin in general. ”	
O-23	3.2.1.1.2	O44	The EIS states: “Potential temporary construction impacts on streams include temporary disturbance below the OHWM and removal of vegetation within the stream buffers. Under the Proposed Action, some temporary construction impacts are anticipated, with subsequent restoration, in some areas, to preconstruction status and/or function. Permanent construction impacts would occur below the OHWM of the Chehalis River.”	The District requests that the EIS should provide clarification on what construction elements are temporary vs. permanent for stream and stream buffer impacts. Assumptions for permanent vs. temporary construction features associated with the FRE facility should be consistent.
O-24	3.2.1.1.2	O45	The EIS states: “A total of 88 streams (11.44 miles) are located within Zones 1 and 2, with 18.2 miles (counting length along each bank) and 312.8 acres of stream buffer.”	The District requests that Ecology confirm that stream buffer impacts and wetland buffer impacts are not double-counted in the impact acreages. The maps provided do not show stream buffers so it is not possible to confirm how impacts were quantified. The District requests that this analysis be reviewed to determine that double counting has not occurred or if it has to correct the analysis. The correct information is required to accurately quantify mitigation requirements.
O-25	3.2.1.1.2, 3.2.2.1.2	O45, O56	On page O45, the EIS states: “The majority of these streams are fish-bearing (8.79 miles); trees would be removed within 252.6 acres of stream buffers along fish-bearing streams.” On page O47, the EIS states: “These probable adverse impacts are considered significant for streams and stream buffers. The removal of trees would also reduce bank cohesion along the streams, likely resulting in increased channel width and channel migration. Water velocities and bed scour would likely be changed (affecting the morphology of the streams). Tree removal	The DEIS does not indicate which impacted streams are fish-bearing. The DEIS notes that a majority of streams are fish-bearing, but assumes that all streams are fish-bearing when assessing the impacts. This may have led to the finding of probable significant impact described on page O-47 to be overstated. The District requests that the analysis and impact findings be reviewed and revised as necessary.

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			would remove shading, cover, detrital and insect input, and large wood input." On page O56, the EIS states: "The probable adverse impacts are considered significant for streams because there would be erosion and/or sedimentation associated with the prolonged and deep inundation every time the reservoir is filled and then the subsequent drawdown of the reservoir, which could cause periodic changes to the stream channel morphology, and change OHWM dimensions (e.g., channel widening) and channel depths, and cause potentially rapid channel migration through deposited sediments. Additionally, stream buffer vegetation would die during an inundation event and would be permanently maintained in an early successional herbaceous or shrub/sapling condition, thus reducing shading, detrital input, large wood inputs, and cover functions for the streams."	
O-26	3.2.1.1.2	O47	The EIS states: "No probable indirect construction impacts on wetlands or wetland buffers under the Proposed Action have been identified."	This does not address common indirect impacts to wetlands during construction including but not limited to potential for increased sedimentation, temporary changes to drainage patterns from surrounding construction, or clearing of adjoining vegetation. The District requests that Ecology revise to address common indirect impacts due to construction.
O-27	3.2.1.2.2	O47	The EIS states: "As described in the Water Discipline Report, the removal of trees within the temporary reservoir inundation area during construction could have effects on the water quality of streams that have reduced canopy cover and likely increased solar radiation that would increase water temperatures. Removal of tree cover could also increase surface water runoff from the	See Comment O-25

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			stream buffer zones, cause bank erosion and turbidity, and reduce overall groundwater recharge that might cause reduced or subsurface flows during low-flow periods. This is considered a significant adverse impact on streams and stream buffer function within the temporary reservoir inundation area."	
O-28	3.2.2.1	O48, O54	On page O48, the EIS states: "The recurring flood scenario would generally have the same impacts as the catastrophic flood scenario and is not described separately." On page O54, the EIS states: "Under the Proposed Action, inundation could last up to 35 days. As described under wetland impacts, the temporary reservoir inundation area under a catastrophic flood scenario is calculated as an 847-acre area, slightly less than the 856-acre temporary reservoir maximum inundation area. Under a major flood scenario, inundation levels within temporary reservoir would be a 625-acre area, lower than the full reservoir capacity, submerging a large proportion of the streams."	The recurring flood scenario, which is defined as "a major flood or greater that occurs in each of 3 consecutive years" is not the same severity as a catastrophic flood in inundation extent and duration. A major flood is defined in Appendix 1 of the DEIS as a 7-year flood event, whereas a catastrophic flood is defined as a 100-year flood event. Further, Table 1-3 in Appendix 1 shows substantially different temporary inundation acreages between the major and catastrophic flood events. The District requests that the EIS either re-evaluate impacts under the two different scenarios more accurately, or better substantiate why the operational effects are considered similar enough in extent and duration to not warrant more clearly delineated impact analyses. This statement appears to conflate that the maximum pool under a catastrophic flood scenario or major flood scenario would last 35 days. This statement is inaccurate and needs to be revised based on Appendix 1 Project Description, of the DEIS (see Comment APP1-3) and refinements to inundation mapping provided in comments on Chapter 2 (see Comment 2-3, 2-4), and included as the Districts Inundation/Vegetation Analysis to this comment submittal.
O-29	3.2.2.1	O48	The EIS states: "A total of 85 wetlands located within the proposed temporary reservoir would be inundated and submerged under the full temporary reservoir capacity. Under the Proposed Action, inundation could last up to 35 days."	This statement reads as though the full temporary reservoir will be inundated for 35 days. This is contradictory to what is described In Section 2.3.3, Appendix 1 and needs to be refined. The District requests that the analysis needs to be revised to reflect consistency with the inundation zones described in Section 2.3.3 of Appendix 1. Please see comments to Chapter 2 of the main EIS document (Comments 2-3, 2-4) and comments to Appendix 1 (Comment APP1-3), and the District's Inundation/Vegetation Analysis included herein, which propose looking at inundation zones based on actual operation of the dam at three distinct events as opposed to the current Inundation Zone 1-4 designations.

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O-30	3.2.2.1	O48, O49	On page O48, the EIS states: "Of the 85 wetlands that would be inundated and submerged under the full temporary reservoir capacity, 62 wetlands, including 11 Category II wetlands (2.76 acres) and 51 Category III wetlands (3.74 acres), would be disturbed during tree removal construction activities. Wetlands and wetland buffers located within Zones 1 and 2 and Zones 3 and 4 are identified in Table O14." On page O49, the EIS states: "The probable adverse impacts are considered significant for wetlands because the wetland vegetation would not survive such prolonged and deep inundation every time the reservoir is filled, thus permanently changing existing wetland vegetation to emergent and short-term shrub/sapling vegetation that regrows after every event."	This statement and Table O14 contradict what is presented in Table 1-4 in Appendix 1, which states Zones 3 and 4 would have no tree harvest. It appears to presume that all wetlands in the maximum temporary inundation pool are forested and would require tree removal. This claim needs to be re-visited after re-assessment on indirect impacts based on comments above regarding extent and duration of inundation. In other words, The District requests that the impact analysis be revised or clarify the basis for the assumption for tree removal above Inundation Zones 1 and 2.
O-31	3.2.2.1	O49	The EIS states: "Thus, the permanent loss of trees and periodic inundation and death of all plants in the wetlands and their buffers would substantially reduce the habitat functions of these wetlands."	This statement seems to be based on the assumption of indiscriminate tree removal above inundation Zone 2. This is not consistent with what is proposed in the project description in Appendix 1. The District requests that Ecology re-evaluate this statement, and revise accordingly. Furthermore, please confirm which of these wetlands are actually forested. The EIS currently suggests all of the wetlands are forested wetlands. Please verify and/or revise.
O-32	3.2.2.1	O50	The EIS states: "The temporary reservoir inundation area under a major flood level scenario is calculated as a 625-acre area. Under the recurring flood scenarios, the inundation levels would vary but the submersion of wetland habitats would occur in consecutive years."	The EIS has not described how this acreage was determined. The EIS does not provide this information in the Project Description or other parts of the EIS. The District requests that Ecology clarify how this acreage was calculated for recurring flood scenario to confirm accuracy with Project Description acreage assumptions.
O-33	3.2.2.1.2	O54	The EIS states: "A total of 116 streams and their stream buffers are located within the proposed temporary reservoir that would	The District requests that Ecology reevaluate this statement based on comments about direct and indirect effects to vegetation in Inundation Zones 1 through 4. It is not

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			be inundated and submerged under the full temporary reservoir capacity and would be maintained in a permanent herbaceous or shrub state."	accurate to say that all vegetation in the full extent of the proposed temporary reservoir would be maintained in a permanent herbaceous or shrub state.
O-34	3.2.2.2.1	O61	The EIS states: "Overall, potential adverse indirect effects on groundwater and hyporheic exchange and bank recharge are likely to be minor because the FRE facility would only operate during major to catastrophic floods and 98% of flows will continue unaltered."	The District requests that Ecology clarify whether 98% refers to amount of water, frequency, or some other parameter.
O-35	3.2.4	O63	The EIS states: "WET1 (Wetland and Wetland Buffer Mitigation Plan): To mitigate the impacts to 10.8 acres of wetlands and 333 acres of wetland buffers from construction and operation of the Proposed Action within the FRE facility and temporary reservoir area…"	The District requests that Ecology reassess the total wetland and wetland buffer impact quantities based on previous comments (see Comments O-13, O-20, O-21) regarding the quantification of forested vegetation. The sum of wetland and wetland buffer impacts currently stated in this section do not comport with quantities reported in other sections of this Appendix as follows: • Wetland impacts: Table O12 indicates a total of 7.58 acres of wetland impacts due to construction. Table O14 indicates a total of 9.76 acres of impacts due to operations. Clarify what 10.8 acres of wetland impacts represent. • Wetland buffer impacts: Table O12 has a total of 243.99 acres of wetland buffer impacts, and Table O14 has 303.15 acres of wetland buffer impacts. Clarify what 333 acres of wetland buffer impacts represent.
O-36	3.2.4	O63	The EIS states: "…and to 6.6 acres of wetlands and 44 acres of wetland buffers within the airport levee area…"	The District requests that Ecology recalculate the impact quantities to wetlands and wetland buffers in the airport levee area with a footprint that more accurately represents what is proposed to be constructed. In a letter to Ecology, the District confirmed that the proposed action for the airport levee does not include relocating the northwest corner of the airport levee (please see letters to Ecology dated November 22, 2019, and March 12, 2019). It does not appear that the EIS has taken into consideration the revised project description provided to Ecology. Please revise the EIS accordingly.
O-37	3.2.4	O64	The EIS states: "Mitigation ratios prescribe the acreage needed to compensate for unavoidable impacts on wetlands, depending on the type of compensation, the	Mitigation also depends on the *type* of wetland and wetland buffer impact (permanent, temporary, or vegetation conversion). The District requests that this Appendix needs to more clearly delineate the types of wetland and wetland buffer impacts to inform technical and financial feasibility of adequate mitigation.

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			category of the affected wetland, and the proposed category of the compensatory mitigation wetland."	
O-38	3.2.4	O64	The EIS states: "To mitigate the impacts to 16.8 miles of streams (waterbodies) and 441 acres of stream buffers from construction and operation of the Proposed Action, mitigation is proposed for the Applicant to develop and implement a Stream and Stream Buffer Mitigation Plan."	The District requests that Ecology reassess the total stream and stream buffer impact quantities based on comments requesting that assumptions underlying calculation of impacts to forested vegetation need to be corrected. The analysis should also include a distinction between type of stream or stream buffer impacts. Similar to wetlands, the type of stream impact, such as the physical loss of linear feet of stream channel, requires different types of mitigation as opposed to loss of shade on a stream due to tree clearing. Stream buffer impact types (such as conversion from a vegetated buffer to non-vegetated buffer/developed land versus conversion from one type of vegetation community to another) were not itemized. The District requests that the EIS be revised to clearly delineate the types of stream and stream buffer impacts to inform the technical and financial feasibility of adequate mitigation.
O-39	3.4.1	O69	Section 3.4.1 (general comment)	The District requests that this section of the EIS be revised to provide a more quantitative analysis of impacts to wetlands and waterbodies. Section 4 of Appendix 1 identifies, known, permitted projects considered in the No Action Alternative. The EIS should be able to provide some estimate of impacts based on these known projects. This would allow for a comparison of construction impacts between the proposed project and No Action alternative.
O-40	3.4.2	O69	Section 3.4.2 (general comment)	The District requests that operational impacts be tied more closely to the known, permitted projects considered in the No Action Alternative identified in Section 4 of Appendix 1.
APPENDIX P – WILDLIFE SPECIES AND HABITATS DISCIPLINE REPORT				
P-1	SUMMARY	p-ii	Study area description as presented in the Summary section of Appendix P (general comment)	Quarry locations are not part of the study area described on the first page in the Summary. Quarry access roads are included in impacts table on the second page but the quarry sites themselves are not discussed. The District requests that the quarry locations be added to the study area description in this section and in more detail in section 2.1.
P-2	Table P1	p-vi	The EIS finds 'minor impacts' to disturbance of wildlife and habitat by airport levee operations.	The District requests that the table be revised to state that there would be no impacts from levee operations. The EIS has not appropriately characterized the impacts from the levee operation on wildlife. The levee is already currently located at the airport site and construction of the levee would be limited to adding additional flood protection.

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				It is not clear how presence of levee modifications would continue to have impacts after construction activities. Regular mowing already occurs at the site. The levee would prevent floodplain connectivity during flood events but levee repair as part of project would not have 'operational' impacts to wildlife.
P-3	2.4.1.3	P29	Table P5 Vegetation Community Cover Types Associated with the Temporary Reservoir Study Area	The open water acreage presented in table P5 does not appear to be accurate; the value given appears to be too low if it is supposed to also include streams and rivers. Section 2 states open water is not included in the vegetation cover analysis. The EIS should define what open water includes in the case of the 0.7 acres of impacts shown in Tables P5 and P13. The area of impact is listed in the table but what those impacts are in terms of FRE construction and vegetation removal is not clear. The District requests that Ecology verify the calculation of open water acreage and review that associated impact assessment, or remove the open water category from the tables.
P-4	2.4.1.4	P32	Figure P16 Vegetation and Land Cover Near the Airport Levee	Figure P16 should also include the levee construction footprint. Please see letters to Ecology dated November 22, 2019, and March 12, 2019 in which the District confirmed with Ecology that the bumpout would not be needed to accommodate FAA regulations and revised the project footprint. The District requests that Ecology revise this figure with the appropriate levee construction footprint.
P-5	2.4.1.7.1	P38	Table P9 Federally Listed Threatened and Endangered Plant Species that Potentially Occur in the Study Area indicates potential occurrence of Kincaid's lupine and Nelson's checkermallow at FRE and temporary reservoir.	Although listed as occurring in the county, the occurrence of these two prairie species (Kincaid's lupine and Nelson's checkermallow) is unlikely at the FRE facility due to lack of suitable habitat. The District requests that the Table P9 be revise to remove dots under FRE and Temporary reservoir columns for these two species.
P-6	2.4.3.1.2	P50	The EIS states: "While northern spotted owl, streaked horned lark, and yellow-billed cuckoo are identified by USFWS as having the potential to occur in the study area, habitat associated with these species (large areas of undisturbed old-growth forest or prairies) is not likely to occur within the study area."	Cottonwood-willow riparian habitat is potentially suitable for yellow-billed cuckoo and occurs in the Chehalis floodplain downstream of the FRE. The EIS should include this clarification. The statement refers to old growth forest and prairies as habitat for these species, which is only true for the owl and the lark. A brief discussion on this potential should be added as this species is still considered for potential impacts by USFWS in areas of potentially suitable habitat.
P-7	Table P10	P51	Table P10 Federally Listed Threatened and Endangered Bird Species that Potentially Occur in the Study Area indicates potential	The habitat description and mapping indicates no suitable habitat is present for streaked horned larks around the FRE facility. Herbaceous land cover polygons indicate these are recent cut blocks, and are not open grasslands used by this species. The

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			occurrence of streaked horned lark at the FRE facility and temporary reservoir.	District requests that Ecology revise Table P10 to remove the dot signifying streaked horned lark (SHL) under the FRE column and the statement on SHL occurrence should be revised to reflect known range and habitat use by the species as described by USFWS and Anderson and Pearson (2015).
P-8	2.4.3.1.3	P52, P63	The EIS finds that because of the lack of available data, evergreen, deciduous, mixed stand, and wetland habitat types in the FRE facility and temporary reservoir areas have been identified as suitable marbled murrelet habitat, and that evergreen, deciduous, mixed stand, and wetland habitat types in the FRE facility and temporary reservoir inundation area have been identified as suitable marbled murrelet habitat.	The District requests that the EIS be revised to exclude wetland habitats in areas identified as marbled murrelet habitat. Further explanation is required if wetlands contain mature conifers that would comprise suitable marbled murrelet habitat. Also, with a lack of data on what the forest habitat is comprised of, it is more appropriate to refer to these areas as "potentially suitable" habitat. Conservatively, evergreen and mixed stands could be considered potential marbled murrelet habitat, but deciduous and wetland areas should not be included in classification.
P-9	2.4.3.1.5	P53	The EIS states:"Of the federally listed mammal species identified as potentially occurring within the study area, only the four listed gopher species, Olympic, Roy Prairie, Tenino, and Yelm, also have designated critical habitat protected under the ESA within the counties associated with the study area."	The District requests that a brief discussion about wolverine and gray wolf and why they are not expected to occur in the study area be added to the EIS. These species are known to occur in forested areas in the region and are listed on USFWS species lists for the county. The document should add some discussion to support the conclusion that they would not be present since remote forested habitat is present in the project area around the FRE and temporary reservoir.
P-10	2.4.3.1.5 Table P12	P54	Table P12 Federally listed Threatened, Endangered, or Proposed Mammal Species that Potentially Occur in the Study Area states "Gray wolf – Federal status proposed endangered"	The Federal status of Gray Wolf in western Washington is endangered. The District requests that Table P-12 in the EIS be revised to reflect this status.
P-11	3.2		Section 3.2.1 (general comment)	Temporary and permanent impacts to habitat are not distinguished throughout the impacts analysis in the EIS. The District requests that discussion be added to the EIS providing introduction/overview of temporary and permanent impacts and explain how impact acreages were derived and distinguishing temporary vs permanent impacts instead of 'probable vegetation community impacts' (Table P13). The meaning of the second paragraph in section 3.2.1 is unclear and must be clarified.

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P-12	3.2		Section 3.2 Proposed Action (general comment)	The EIS discusses effects that would occur in zones 1 and 2, however the EIS simply refers to the temporary reservoir implying that the impacts would occur over the full 847 acres. This is not accurate; the analyses should address the different degree of impacts to zones 1 and 2, compared to the minor impacts to zones 3 and 4. This analysis may further be refined by consideration of the information found in the Inundation/Vegetation Analysis provided by the District with these comments.
P-13	3.2.1.1.1	P59	The EIS states: "The FRE structure site and associated areas include three proposed quarry areas (North Quarry, South Quarry, and Huckleberry Ridge Quarry). Accessing these quarry areas would include widening, improving, and upgrading the existing roads."	The District requests that the FEIS include a discussion of potential impacts from operation of the quarries in addition to the access road widening. Table P4 in section 2.4.1.2 describes 124 acres of habitat within the study area that surround the quarry site. The full 660 foot extent described in Table P4 is associated with noise impacts, but there also needs to be a description of the area needed to be cleared to construct the quarry. This section describes impacts from expansion of the quarry access roads but does not include a similar description for the quarry sites themselves, which is a key component of the FRE facility construction impacts.
P-14	3.2.1.1.1	P60	The EIS states: "Therefore, the analysis assumes construction activities would include the removal of all non-flood-tolerant trees within both Zones 1 and 2 of the temporary reservoir (approximately 420 acres) and all other trees greater than 6 inches dbh during the 5-year construction period as a conservative approach (Table P14)."	The District requests that Ecology consider the refinements to the inundation zones (see Inundation/Vegetation Analysis) and ensure the acreages presented in the EIS are consistent throughout. The EIS impact analysis is currently not consistent in the description of acreages affected. Page P63 says Zones 1 and 2 would be approximately 600 acres, whereas on Page P60 the EIS states "approximately 420 acres". Furthermore, this analysis may be refined using the Inundation/Vegetation Analysis and related vegetation management activities that would be intended to lessen the impact on vegetation and habitat should be considered in this analysis.
P-15	3.2.1.1.1	P63, P64	The EIS states: "Approximately 426 acres of forested and wetland habitat that could be suitable marbled murrelet habitat in Zones 1 and 2 would be eliminated. These probable adverse impacts are considered significant for wildlife habitat because approximately 90% of the trees within Zones 1 and 2 (approximately 426 forested acres of the total 600 acres of upland and riparian habitat) would be removed over the 5-year construction	The EIS appears be providing inconsistent acreages (see Comment P-14). The District requests that Ecology correct acreage inconsistencies as this factors into the final impact determinations and the calculations for future mitigation. Furthermore, the assumption of 90% of trees removed is likely overly conservative based on the inundation analysis provided in the Inundation/Vegetation analysis. The District requests that the EIS be revised accordingly.

No.	Section	Page #	Quote or Paraphrase from Original DEIS Text	Comments
			period, and replanting would only provide shrub cover."	
P-16	3.2.2.1.1	P73	The EIS states: "Under the catastrophic flood scenario, inundation in the maximum temporary reservoir inundation area would likely occur, submerging all wildlife habitats within it (847 acres) and killing all trees in Zones 3 and 4."	The District requests that the EIS differentiate effects in Zones 1 and 2 from lesser effects in Zones 3 and 4. This conclusion is not supported by the information provided in the EIS. The full 847 acres would not all experience significant impacts. Zone 4 would only be inundated for <1 day and would constitute only minor temporary impacts. Please refer to the Inundation/Vegetation Analysis and revise the EIS accordingly.
P-17	3.2.2.1.1	P76	The EIS states: "The temporary reservoir is predicted to have plant communities (Table P16) that would be in a permanent young stage (generally less than 10 years old), because most plants would die each time inundation occurs. The probable adverse impacts are considered significant for wildlife habitat within the temporary reservoir because the vast majority of the upland, wetland, and riparian vegetation would not survive such prolonged and deep inundation every time the reservoir is filled. Page 77 - Under the recurring flood scenario, where a major flood or larger occurs in 3 consecutive years, all existing vegetation in the temporary reservoir inundation area would die and only early colonizing annuals would likely colonize."	The District requests that this conclusion be reviewed as it is not supported by the information provided in the EIS. Vegetated areas would likely transition to more flood tolerant species such as willows/alders. All trees would not die each time the reservoir inundates. Please differentiate between different impacts in Zones 1 and 2 with those in Zones 3 and 4. Zone 4 for example would have rarely occurring minor temporary impacts and tree cover is not likely to significantly change with such short inundation (<1 day). On page 77, 4th paragraph needs further explanation of inundation periods between zones and should not treat the entire reservoir area as experiencing the same impacts.
P-18	3.2.2.1.1; 3.2.5	P84, P95	The EIS states: "All wildlife habitat within the 847-acre reservoir maximum inundation area would be inundated and submerged periodically during operations for any of the flood scenarios (see Section 3.2.2.1.1)." Also in 3.2.5 operations discussion on page P95, the EIS states: "During operation, all	This statement is incorrect. The District requests that the EIS needs to differentiate impacts to Zones 1 and 2 vs zones 3 and 4 which are less significant. See previous comments as well as Inundation/Vegetation Analysis as described and Comments 2-3 and 2-4.

No.	Section	Page #	Quote or Paraphrase from Original DEIS Text	Comments
			wildlife habitat within the proposed temporary reservoir inundation area (847 acres) would be inundated and would not survive."	
P-19	3.2.2.1.1	P85	The EIS states: "The loss of tree and shrub vegetation from the riparian zone in the temporary reservoir inundation area would directly remove nesting, denning, and feeding habitat used by wildlife including birds, mammals, amphibians, and other animals."	As described above, the District requests that the EIS needs to differentiate between different impacts in Zones 1 and 2 with those in Zones 3 and 4. The impacts described would occur only in zones 1 and 2 where trees are removed. Zones 3 and 4 where rare and very short duration inundation events would have negligible impact on tree cover as demonstrated in the Inundation/Vegetation Analysis provided by the District. The District requests that the EIS analysis be revised accordingly.
P-20	3.2.4	P93	The EIS states: "WILDLIFE3. The Applicant intends to remove non-flood-tolerant trees and trees over 6 inches dbh in the riparian zone within the temporary reservoir inundation area. To minimize impacts on riparian habitat and retain shade as long as possible, these trees will be removed in the last phase of the 5-year construction period."	As described above tree removal is only expected to occur in zones 1 and 2 according to the project description in Chapter 2. The District requests that the EIS be revises to be consistent with the refined vegetation community versus inundation zone analysis provided in the Inundation/Vegetation Analysis and Comments 2-3, 2-4 above.

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MEMORANDUM

Date: March 31, 2020
To: Chehalis Basin Board
From: Andrea McNamara Doyle, Office of Chehalis Basin Director
Cc: Gordon White and Diane Butorac, Department of Ecology; Michael Garrity and Celina Abercrombie, Department of Fish and Wildlife; Stephen Bernath, Department of Natural Resources; Bart Gerhart, Washington State Department of Transportation
Re: Response to Chehalis Basin Board Questions on the Chehalis River Basin Flood Damage Reduction Project

Introduction

The Department of Ecology (Ecology) released the Chehalis River Basin Flood Damage Reduction Project (Project) Draft State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) on February 27, 2020. Ecology briefed the Chehalis Basin Board (the Board) on the Draft SEPA EIS at the Board's March 5, 2020 board meeting. The purpose of the briefing was to provide the Board with information about the analysis and key findings contained in the Draft SEPA EIS. It was not a formal public hearing, and no comments on the Draft SEPA EIS were received.

At the briefing, Board Members asked questions and requested additional information about some of the analysis and findings in the Draft SEPA EIS. They also asked for clarification about how the Draft SEPA EIS analysis and findings compared or related to previous information that has been presented to the Board, such as from the Programmatic EIS and the Aquatic Species Restoration Plan Phase I document. Board Members have also expressed an interest in understanding more about the Draft SEPA EIS analysis and findings, and other Project effects, as part of their evaluation process for developing the long-term strategy.

The Office of Chehalis Basin has prepared this memorandum to provide responses to clarifying questions about the Project identified by Board members as important for their consideration of the Board's long-term strategy recommendation. The memorandum responds to clarifying questions about the Draft SEPA EIS analysis and findings raised at the March 5 meeting, as well as how that information compares or relates to other analyses and findings within the Programmatic EIS and other previous studies that have been presented to the Board (or its predecessor Governor's Work Group).

The information in this memorandum uses data directly from the Draft SEPA EIS, including the Draft EIS Chapters and related technical Discipline Reports in the Appendices.[1] Where necessary to answer the Board's questions, additional information from other referenced publicly available documents is also included. This memorandum is not a supplement or addendum to the Draft SEPA EIS. It is not a public comment on the Draft SEPA EIS.

[1] The Draft SEPA EIS states: "The EIS is organized to provide information in three ways. The Summary provides quick, high-level information on key findings and significant impacts. The Draft EIS chapters provide details on the EIS technical methods, impact analysis, and findings. Each EIS chapter for a resource has a related technical discipline report in the Appendices. The Discipline Reports include detailed and technical information. The Discipline Report is the official technical documentation for this EIS and if there is conflicting information between the Summary, EIS sections, or the Discipline Report, the Discipline Report is considered to be the controlling document" (p. 4).

Board Member's questions have been summarized and are listed below in bold, followed by responses from the Office of Chehalis Basin with input from Ecology and the Washington Department of Fish and Wildlife (WDFW). Every effort was made to ensure the information in this memorandum is consistent with the data in the Draft SEPA EIS. Any inconsistencies are the responsibility of the Office of Chehalis Basin, not Ecology or WDFW.

Responses to the Board Questions

1. Board Question: Clearly explain the flood events used to inform the analysis and the rationale for using the selected flood events.

Definition of major, catastrophic, and recurrent flood events

The Draft SEPA EIS analyzes probable significant adverse environmental impacts from the Proposed Action, the Local Actions Alternative, and the No Action Alternative under the following three flooding scenarios (flow rate is measured at the Grand Mound gage):

- Major flood: Water flow rate of 38,800 cubic feet per second (cfs) or greater
- Catastrophic flood: Water flow rate of 75,100 cfs
- Recurring flood: A major flood (38,800 cfs) or greater that occurs in each of 3 consecutive years

The EIS incorporates climate change projections for precipitation, temperature, flood peak flows, and streamflows throughout the analyses as part of the future conditions for all scenarios. There is no separate climate change chapter because projected climate changes have been included in the impact analyses for all resource areas (see Section 3.3 of the Draft SEPA EIS).

Definition of mid-century and late-century

If permitted, the Chehalis River Basin Flood Control Zone District (the Applicant) expects Flood Retention Expandable (FRE) facility construction would begin in 2025 with operations beginning in 2030, and the Airport Levee Changes construction would occur over a 1-year period between 2025 and 2030. The EIS analyzes probable adverse impacts from the Proposed Action and alternatives for construction during the years 2025 to 2030 and for operations from 2030 to 2080. For purposes of analysis, the term "mid-century" applies to the operational period from approximately 2030 to 2060. The term "late-century" applies to the operational period from approximately 2060 to 2080.

Effect of climate change on flood frequency and magnitude

As described in Appendix 1 of the Draft SEPA EIS, projected future climate conditions have been included in the impact analyses for resource areas to identify potential impacts. Data and models for predicted climate change conditions used in the EIS are from the University of Washington Climate Impacts Group, Watershed Science and Engineering, National Oceanic and Atmospheric Administration, Portland State University, and Anchor QEA, LLC.

The results of the most recent climate change precipitation modeling provide forecasted streamflow rates showing mid-century (2016 to 2060) peak flows would increase 12%, and late-century (2055 to 2099) peak flows would increase 26% (Anchor QEA and WSE 2019). To avoid bias in estimating streamflow under climate change for particular locations or gages, the adjustments to streamflow were applied to historical flows from active U.S. Geological Survey (USGS) gages basin-wide. This means the mid-century major and catastrophic floods were composed of the historical condition 10-year (major) and 100-year (catastrophic) floods with all flow values increased by 12%. Similarly, the late-century major and catastrophic floods were composed of the historical condition 10-year (major) and 100-year (catastrophic) floods with all flow values increased by 26%. The increased peak flows have been incorporated into the applicable EIS analyses. Both hourly and daily flows under future climate change conditions were developed for use in models, technical studies, and discipline reports.

With respect to frequency and magnitude of future flood events, there are several ways of describing the mid- and late-century flood events developed for the EIS (see Exhibit 3-1 of the Draft SEPA EIS, provided below). The historical 10-year flood will occur more frequently in the future and will be greater in magnitude. Note that the flow at various gages includes predicted climate change, which increases flow by 12% and 26% for mid- and late-century.

Exhibit 3-1 (Draft SEPA EIS)
Flood Level Terminology

QUALITATIVE TERM USED IN THE EIS	CHANCE OF OCCURRENCE IN 1 YEAR	ASSOCIATED FLOOD-YEAR TERM	FLOW AT (CFS)	OTHER NOTES
Major flood	Current: 14% Mid-century: 20% Late-century: 25%	Current: 7-year Mid-century: 5-year Late-century: 4-year	38,800 at Grand Mound gage	• **Similar Sized Chehalis Basin Floods for Reference** – 2009 flood
Catastrophic flood	Current: 1% Mid-century: 2% Late-century: 4%	Current: 100-year Mid-century: 44-year Late-century: 27-year	75,100 at Grand Mound gage	• **Similarity to Other Flood Plan Terminology (but the flow rates within plans are different)** – Comprehensive Flood Hazard Management Plans – Base flood level used by National Flood Insurance Program – High-risk FEMA flood zones – Special Flood Hazard Area on FEMA maps – Base flood level used by Lewis County floodplain development regulations • **Similar Sized Chehalis Basin Floods for Reference** – 1996 flood

Notes:
Mid- and late-century information is based on SEPA EIS analysis that incorporates climate change projections.

Was the 2007 flood used in the Draft SEPA EIS analysis?

The December 2007 flood was not used for any of the impact analyses completed for the Draft SEPA EIS. However, it was analyzed in the Programmatic EIS (Ecology 2017).

The catastrophic flood evaluated in the EIS is based on the Applicant's purpose for the Proposed Project, which is to reduce damage from a catastrophic flood. It is not intended to retain all the water from a larger event like the 2007 flood. In the case of a flood larger than the catastrophic flood, the temporary reservoir would hold about 65,000 acre-feet of water, and any additional water would flow over the emergency spillway of the FRE structure to the Chehalis River below (see Section 3.1 of the Draft SEPA EIS). Also see page 14 of this memorandum for additional detail.

2. Board Question: Summarize the potential benefits of the Proposed Action (e.g., flood retention facility) as compared to No Action Alternative for the following.

Transportation: I-5 and SR 6

Based on hydraulic modeling, the Proposed Action would reduce flooding at key transportation locations and would decrease the duration of roadway closures at most locations but most would remain inundated under the catastrophic flood, especially during late-century.

Interstate 5. Seven locations along Interstate 5 (I-5) or on its interchanges were reviewed in the Draft SEPA EIS. Modeling found that none of these locations would flood during a major flood under the No Action Alternative or Proposed Action. Modeling indicated that six of these locations would experience flooding under the No Action Alternative during a catastrophic flood. Under the Proposed Action, flooding would be eliminated in four of these six locations under the mid-century and one location under the late-century catastrophic flood. In other locations, flood depths would be reduced but may still result in road closures. Durations of flooding would be reduced by 8 to 39 hours in mid-century, and 5 to 20 hours in late-century. One location (I-5 interchange at NW Chamber of Commerce Way) would have reduced flood duration but would still have a flood duration of 48 hours during a late-century catastrophic flood (Appendix K of the Draft SEPA EIS).

The results for the interchange at NW Chamber of Commerce Way differ from the Programmatic EIS, which predicted that no flooding would occur at this location with the Proposed Action (flood retention facility and airport levee improvements). This is primarily due to the hydraulic modeling assumptions made in the Programmatic EIS versus the Draft SEPA EIS. The flood levels in the Draft SEPA EIS are different from the Programmatic EIS for three main reasons (see Section 5.1.2.2 of the Draft SEPA EIS):

1. Climate change predictions for more rain and bigger peak flows are included in the Draft SEPA EIS.
2. For the Programmatic EIS, a one-dimensional water model was used. For the Draft SEPA EIS, a two-dimensional model was used. It included topography (shape of the land) so this model is more detailed and precise.

3. Projects that were completed after the Programmatic EIS are included in the Draft SEPA EIS, including new airport pumps and culverts.

For the Programmatic EIS, it was assumed that the area around the Chehalis-Centralia airport would be fully protected by the airport levee improvements and additional walls and levees to the east side of I-5. For the Draft SEPA EIS, the Applicant did not propose additional protection east of I-5; therefore, the levee improvements would partially protect the airport area and I-5 at Chamber Way.

State Route 6. Six locations along State Route 6 (SR 6) were reviewed within the Draft SEPA EIS. Modeling indicated that two of these locations would experience flooding under the No Action Alternative during a major flood and five of these locations would experience flooding during a catastrophic flood. Under the Proposed Action, flooding would be eliminated in most locations during a major flood. Flooding would not be eliminated during a catastrophic flood, but it would be reduced at all locations. Modeled depths of flooding indicate some of these locations that would experience reduced flooding during a catastrophic flood would still experience road closures. Durations of flooding during a catastrophic flood would be reduced by 4 to 10 hours in mid-century, and 7 to 11 hours in late-century. Two locations (SR 6 near Twin Oaks Road and SR 6 and Heden Road) would have reduced flood duration but would still have a flood duration of up to 25 and 29 hours. See Figure K-7 and Tables K-8 and K-9 excerpts from the *Transportation Discipline Report* (Appendix K of the Draft SEPA EIS) that show SR 6 locations and their modeled flood depths and durations.

Excerpt from Table K-8 (Appendix K of Draft SEPA EIS)
Maximum Simulated Flood Depth for Transportation Facilities with Proposed Action and No Action Alternative (Feet) – I-5 and SR 6 Locations

	CATASTROPHIC FLOOD					
	MID-CENTURY			LATE-CENTURY		
LOCATION	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
INTERSTATE 5						
I-5 at Labree Road Interchange	0.0	0.0	0.0	0.0	0.0	0.0
I-5 at 13th Street Interchange	0.2	**0.0**	-0.2	0.5	**0.0**	-0.5
I-5 north of SW 13th Street Interchange (Exit 76)	1.8	0.7	-1.1	2.3	1.4	-0.9
I-5 at SR 6 Interchange	0.8	**0.0**	-0.8	1.2	0.5	-0.8
I-5 Interchange at NW Chamber of Commerce Way [6]	7.0	0.4	-6.6	8.4	4.7	-3.8
I-5 at Salzer Creek	1.1	**0.0**	-1.1	2.6	0.1	-2.4
I-5 at Mile Post 81	1.9	**0.0**	-1.9	3.2	0.3	-2.9
STATE ROUTE 6						
SR 6 and River Road	0.9	**0.0**	-0.9	2.2	**0.0**	-2.2
SR 6 and Boistfort Road	5.7	0.8	-4.8	7.5	1.8	-5.7
SR 6 and Spooner Road	0.0	0.0	0.0	0.0	0.0	0.0
SR 6 near Twin Oaks Road (600 feet west of intersection)	5.5	3.8	-1.6	6.0	4.5	-1.4
SR 6 and Heden Road	2.1	1.1	-1.0	2.6	1.5	-1.0
SR 6 and Donahoe Road	0.3	**0.0**	-0.3	0.5	0.1	-0.4

Notes:

6. Maximum simulated flood depths at I-5 near NW Chamber of Commerce Way are not thought to be affected by the fact that the culverts and pump station that drain this area are not included in the main stem RiverFlow2D model.

Bold and shading indicates locations where the flood depth is reduced to zero under the Proposed Action.

Excerpt from Table K-9 (Appendix K of Draft SEPA EIS)
Estimated Flood Duration at Transportation Facilities with Proposed Action and No Action Alternative (Hours) – I-5 and SR 6 Locations

LOCATION	CATASTROPHIC FLOOD					
	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
INTERSTATE 5						
I-5 at Labree Road Interchange	0	0	0	0	0	0
I-5 at 13th Street Interchange	0	0	0	10	**0**	-10
I-5 north of SW 13th Street Interchange (Exit 76)	20	12	-8	25	20	-5
I-5 at SR 6 Interchange	9	**0**	-9	15	6	-9
I-5 Interchange at NW Chamber of Commerce Way[6,7]	52	13	-39	59	48	-11
I-5 at Salzer Creek	10	**0**	-10	18	**0**	-18
I-5 at Mile Post 81	14	**0**	-14	22	2	-20
STATE ROUTE 6						
SR 6 and River Road	4	**0**	-4	7	**0**	-7
SR 6 and Boistfort Road	15	6	-9	17	9	-8
SR 6 and Spooner Road	0	0	0	0	0	0
SR 6 near Twin Oaks Road (600 feet west of intersection)	31	22	-9	35	25	-10
SR 6 and Heden Road	34	24	-10	40	29	-11
SR 6 and Donahoe Road	5	**0**	-5	11	0	-11

Notes:

6. Flood durations at I-5 near NW Chamber of Commerce Way are affected by ponding within the airport levee. Flood duration results for this area were estimated using a modified version of the RiverFlow2D model that includes the pumps and culverts. The analysis does not, however, include small-scale drainage features such as storm drains and ditches.
7. The flood duration for the late-century catastrophic flood with the Proposed Action at I-5 near NW Chamber of Commerce Way was simulated using a test version of the model that attempts to simulate the drawdown after the peak of the flood. The level of accuracy of this duration analysis is uncertain.

Bold and shading indicates locations where the flood depth is reduced to zero under the Proposed Action. Note that a duration of zero means water never reaches a depth of 0.25 feet (or 3 inches).

Figure K-6 (Appendix K of Draft SEPA EIS)
Locations Evaluated for Flooding at I-5 and Interchanges

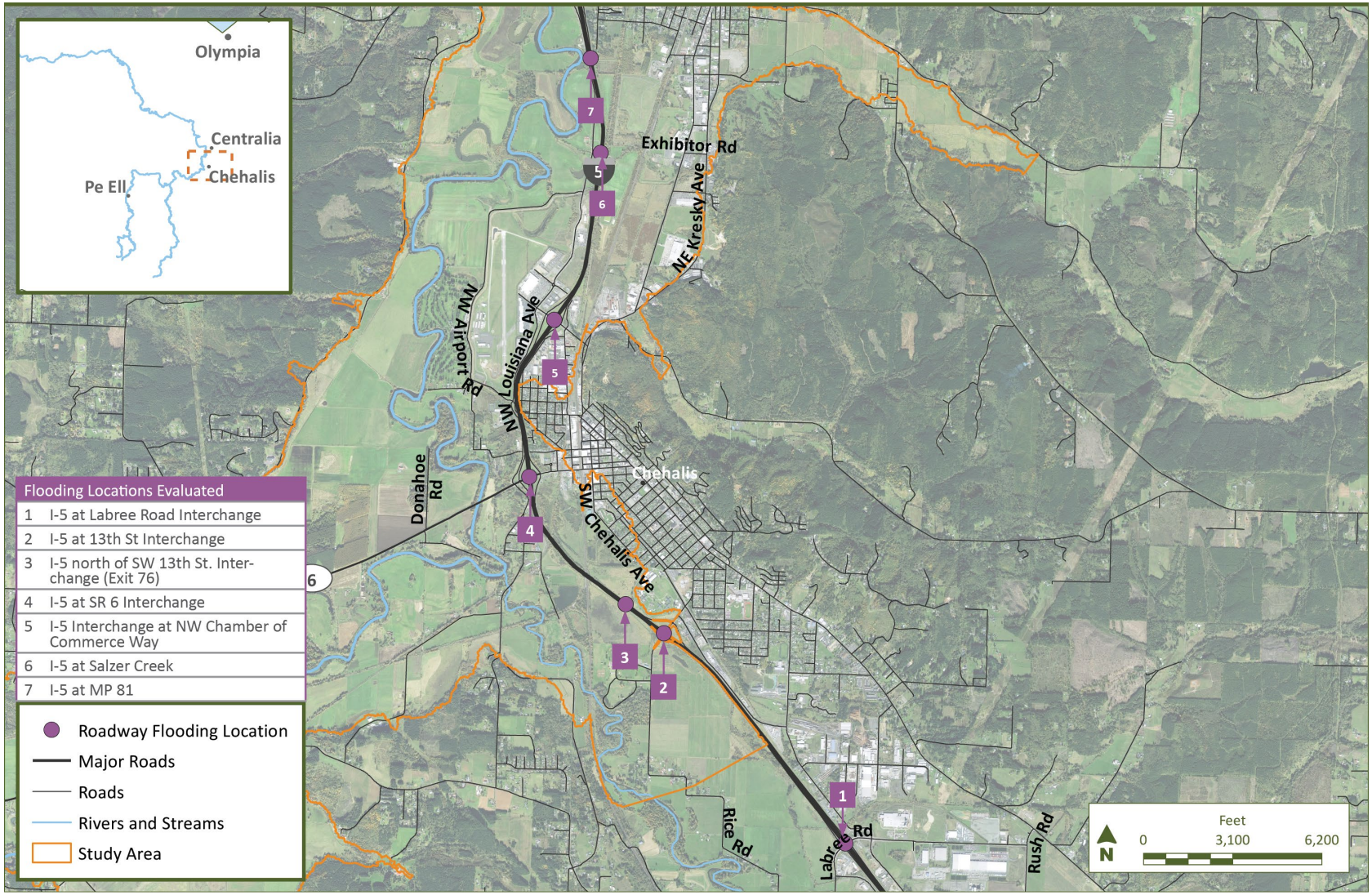
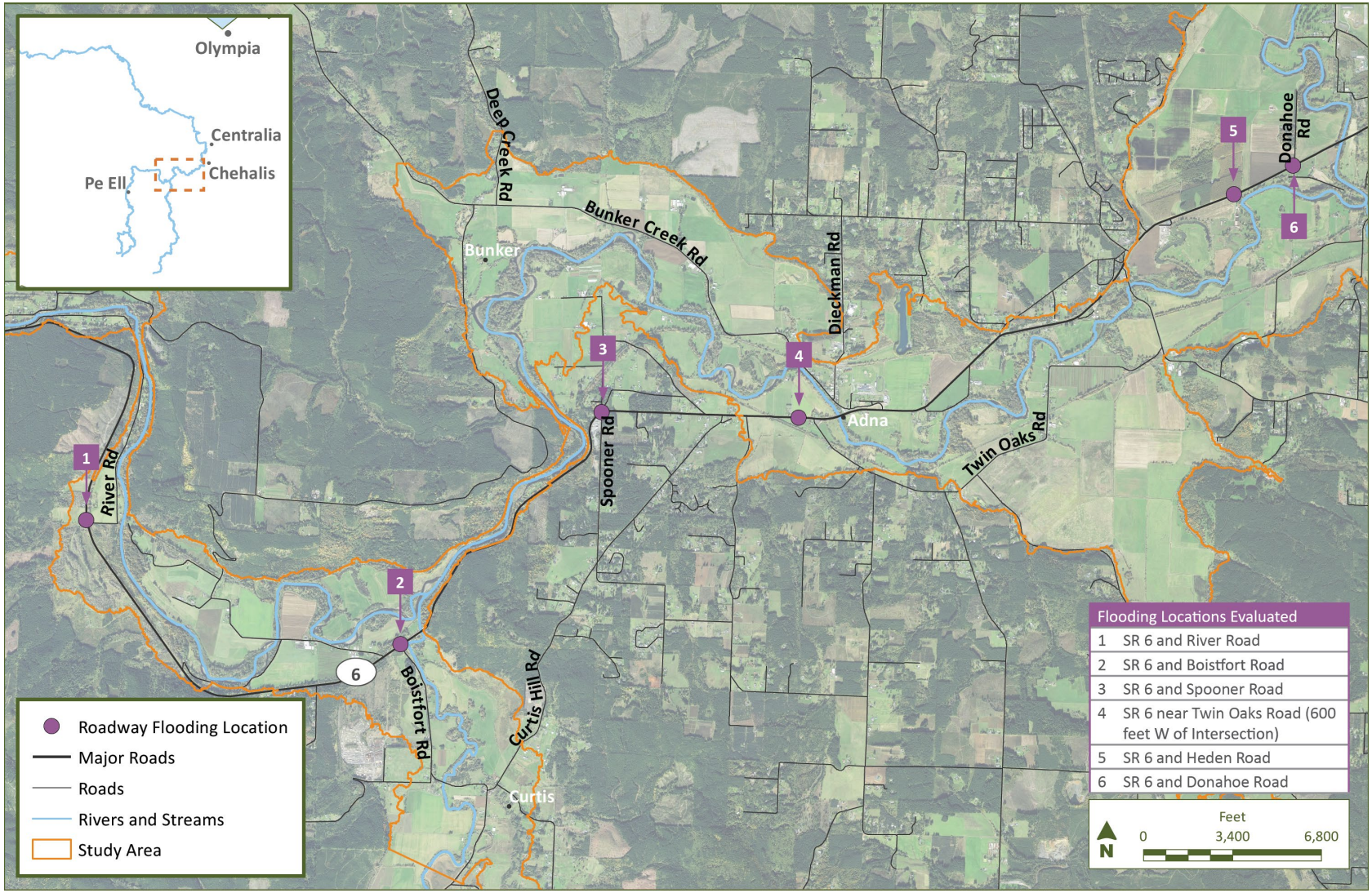


Figure K-7 (Appendix K of Draft SEPA EIS)
Locations Evaluated for Flooding at State Route 6



Land use – structures no longer flooded

The Draft SEPA EIS found that, with the Proposed Action, 1,280 existing structures of value and approximately 3,795 acres would be protected from flooding risk during a catastrophic flood in the late-century. Approximately 13% of the acres predicted to be no longer inundated are within incorporated city limits (approximately 500 to 600 acres) and many residential areas within the City of Centralia (Appendix G of the Draft SEPA EIS). The Draft SEPA EIS also found that the Proposed Action would reduce the number of valuable structures currently exposed to flooding inundation during catastrophic floods by 50% in the mid-century and by 43% in the late-century. For information on areas that would still experience flooding with the Proposed Action, please refer to Appendix G of the Draft SEPA EIS.

Within the Draft SEPA EIS study area, changes in downstream inundation were analyzed to evaluate the effects on existing land uses with the Proposed Action. The degree of reduction in inundation would vary by flood scenario and location for both major and catastrophic flood scenarios. Under a late-century major flood, areas no longer inundated are largely near the confluence of the South Fork Chehalis River (between Bunker and Littell), in Centralia (west of Fort Borst Park), and in smaller areas downstream to Oakville (Section 5.7.2.3 of the Draft SEPA EIS). Under a late-century catastrophic flood, much of the study area from Pe Ell to just upstream of the South Fork Chehalis River would no longer be inundated. Many residential areas within the City of Centralia are predicted to be protected from flooding and many residential areas within the City of Chehalis would experience a reduction in inundation levels. The Chehalis-Centralia Airport would be protected from flooding under a mid-century catastrophic flood scenario but would not be protected from flooding under a late-century catastrophic flood scenario (Section 5.7.2.3 of the Draft SEPA EIS).

Under the No Action Alternative, 366 buildings would likely be inundated to some level in mid-century and 517 buildings would likely be inundated in late-century for major floods. For catastrophic floods, 2,245 buildings would likely be inundated to some level in mid-century and 2,955 buildings in late-century. The Programmatic EIS found that, for a catastrophic flood, 1,379 structures could be inundated.

Table 1 compares the number of structures that would no longer be inundated under the major and catastrophic flood scenarios compared to the No Action Alternatives using data from Tables G-9a, G-9b, G-10a, and G-10b in the *Land Use Discipline Report* (Appendix G of the Draft SEPA EIS). Results from the Programmatic EIS structure evaluation are also included for comparison (Ecology 2017).

Table 1

Number of Structures No Longer Inundated Under Various Flood Scenarios

STRUCTURE	MAJOR FLOOD		CATASTROPHIC FLOOD		PEIS[1] (100-YEAR FLOOD WITHOUT CLIMATE CHANGE)
	MID-CENTURY	LATE-CENTURY	MID-CENTURY	LATE-CENTURY	
Structures with Identified Finished Floor Elevations that are No Longer Inundated	35	44	836	1,036	559[2]
Structures without Identified Finished Floor Elevations that are No Longer Inundated	91	104	299	244	N/A
Total Structures that are No Longer Inundated	**126**	**148**	**1,135**	**1,280**	**559**

Notes:
1. PEIS: Programmatic Environmental Impact Statement
2. For the PEIS analysis, if structures had an identified finished floor elevation, it was used to identify inundation depths. If a finished floor elevation was not identified, the ground elevation was used to identify inundation depths.

For purposes of the Draft SEPA EIS evaluation, finished floor elevation is the elevation of the lowest finished floor of valuable structures calculated by the estimated height of the finished floor above ground level. The finished floor elevation is used to identify inundation depth under different flood scenarios. For those structures where finished floor elevation estimations were not available, inundation depth was calculated based on modeled inundation depth at ground elevation for a structure's location. If a structure with an identified finished floor elevation is no longer flooded, that means that flood levels will not rise to the level of the finished floor. It is possible that a structure could still experience flooding in this scenario, but flooding would be below the finished floor elevation. If a structure without an identified finished floor is no longer flooded, that means that flood levels will not reach the ground elevation of the structure.

Based on the information in the Draft SEPA EIS, some of the structures where finished floor elevations were not identified may benefit from the FRE facility if their finished floors are higher than the ground elevation.

What are the locations where lower income housing and/or rental structures are affected?

Based on information in the Draft SEPA EIS, the Proposed Action, in comparison to the No Action Alternative, would have a reduction in flood risk to environmental justice populations of interest in the study area from a major or catastrophic flood. The environmental justice analysis relies on data from the U.S. Census Bureau's 2013 to 2017 American Community Survey 5-year estimates to identify the locations of low-income populations. Additional information on economics characteristics from the Washington Department of Health was also considered. These sources do not indicate specific locations

of lower income housing or rental structures, but those types of housing are likely also found in the block groups where these populations are indicated. Figures D-4 and D-5 from the *Environmental Justice Discipline Report* (Appendix D of the Draft SEPA EIS) show the locations of low-income populations in Census block groups that intersect the Study Area, which are also locations where lower income housing and rental structures can be assumed.

As noted in the previous sections of this memorandum, the degree of reduction in inundation would vary by flood scenario and location for both major and catastrophic flood scenarios. Areas that include environmental justice populations of interest and that would no longer be inundated under a late-century major flood are largely in Centralia (west of Fort Borst Park) and in smaller areas downstream to Oakville (see Section 5.7.2.3 of the Draft SEPA EIS). Under both late-century major and catastrophic floods, many residential areas within the City of Centralia that include environmental justice populations of interest are predicted to be protected from flooding and many residential areas within the City of Chehalis that include environmental justice populations of interest would experience a reduction in inundations. However, many structures (including residences) would continue to experience substantial flood risk, including in areas that have environmental justice populations of interest. As noted in the previous sections of this memorandum, for purposes of the Draft SEPA EIS evaluation, predictions of structures that would be protected from flooding are based on the finished floor elevation where available (i.e., if a structure with an identified finished floor elevation is no longer inundated, that means that flood levels will not rise to the level of the finished floor). Where finished floor elevations were not available, predictions of structures that would be protected from flooding indicate flood levels would not rise to the ground elevation at that structure's location.

Figure D-4 (Appendix D of Draft SEPA EIS)
Low-Income Populations in Study Area Block Groups

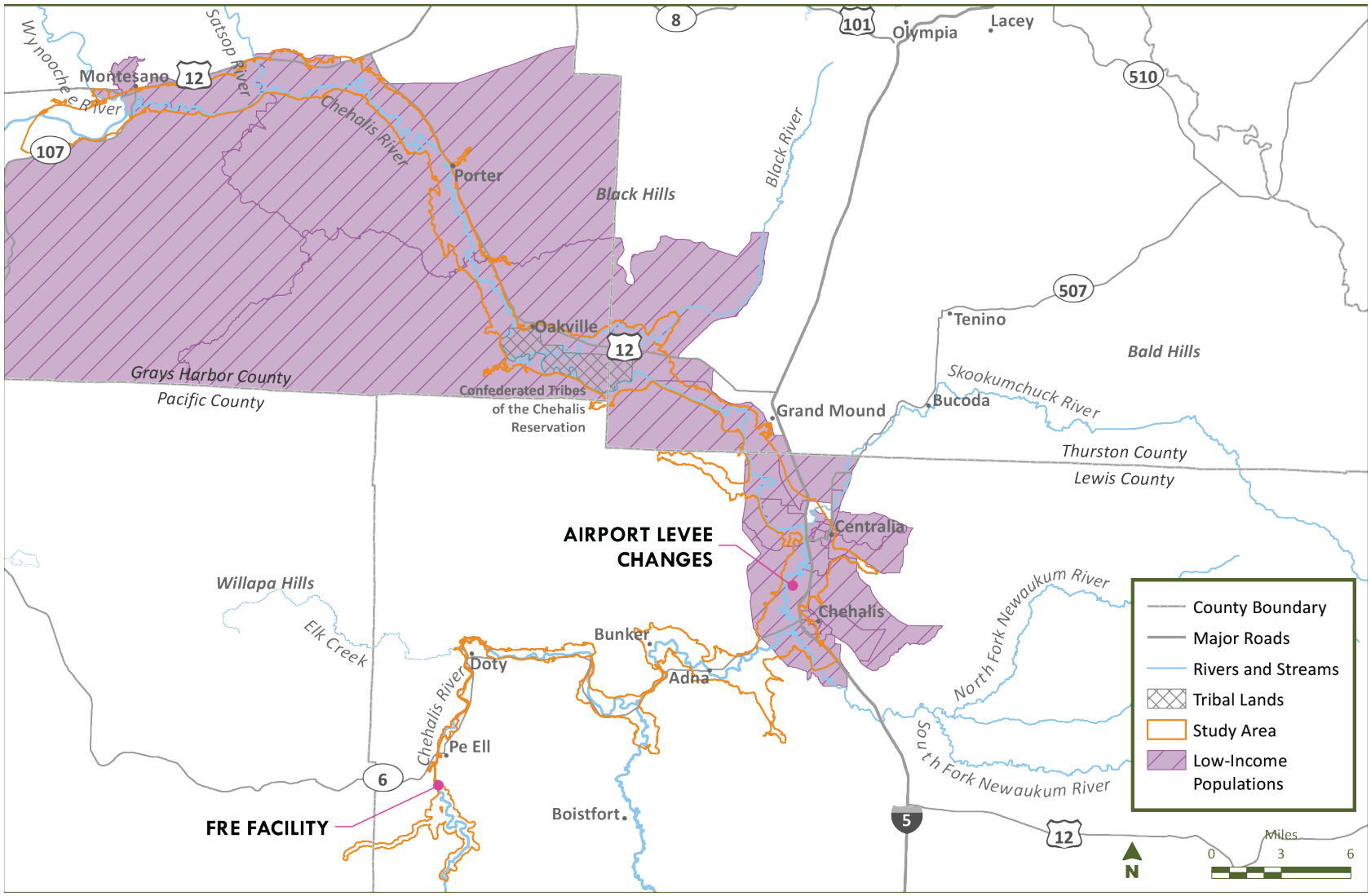
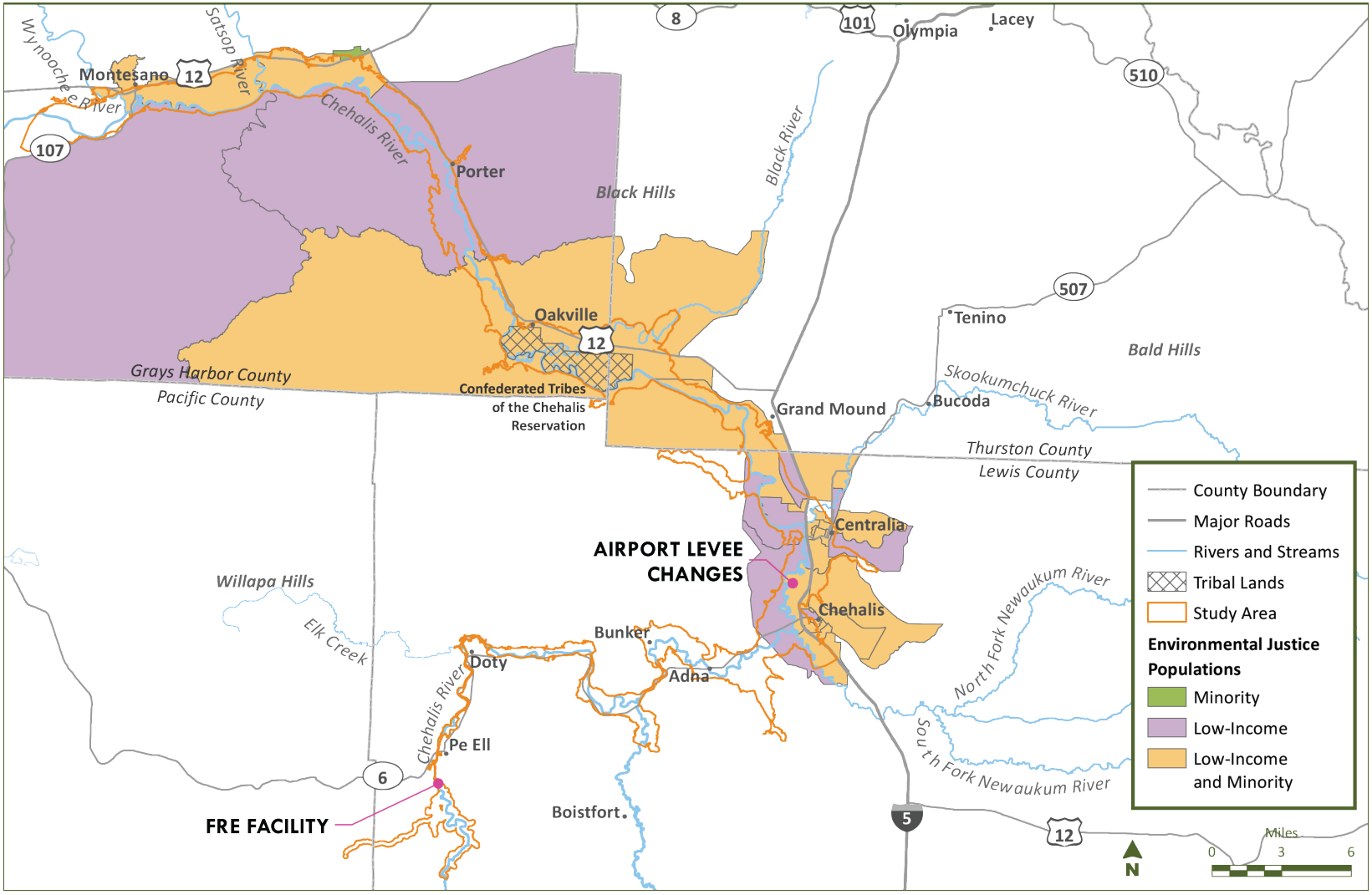


Figure D-5 (Appendix D of Draft SEPA EIS)
Environmental Justice Populations in the Study Area



Note: Although Census Tract 950400 Block Group 2 also includes minority populations, it is not shown on this figure because the small portion of the Block Group overlapping the Study Area is managed forest where people do not live.

For the dam operation, what is the dam's ability to contain floods larger than the 2007 flood, per the Operations Plan, and catastrophic flood into the future (mid-century and late-century)?

The Draft SEPA EIS does not provide specific details on the FRE function with a scenario that replicated 2007 conditions. While the flood retention facility has the capacity to retain the 2007 flood event without spilling water per the *Operations Plan for Flood Retention Facilities* (Anchor QEA 2017a), this plan did not include updated climate change predictions. As described in Section 5.1.2.2 of the Draft SEPA EIS, the temporary reservoir would be able to hold the 65,810 acre-feet of water expected for a catastrophic flood. Flows above the temporary reservoir's design capacity of 66,360 acre-feet would spill over the top of the structure using an emergency spillway.

As described in Section 3.1 of the Draft SEPA EIS, the 2007 flood event was an atmospheric river (pineapple express) event with extremely high rainfall concentrated in the Willapa Hills. This event affected the Chehalis River mainstem and South Fork, with far less rainfall to the east in the Skookumchuck River Basin. The USGS gage for Grand Mound read 79,100 cfs for the 2007 flood; however, peak flows at the Doty gage were estimated at 52,600 cfs, almost double the next highest flood in the 74-year record. This flood is approximately a 500-year flood with a 0.2% chance of occurring in a year (at the Doty gage).

For the late-century catastrophic flood scenario in the Draft SEPA EIS, rainfall and runoff projections are modeled statistically throughout the Chehalis River Basin, with peak flows distributed in all areas in the basin, and not focused on a particular area. Because rain for the 2007 flood event was focused in one area, the estimated peak flows in 2007 are higher at Doty than peak flows under the late-century catastrophic flood scenario, but lower at Grand Mound. So, while the numbers at the Grand Mound gage are similar, the 2007 flood was much larger than the catastrophic flood modeled for the EIS.

3. Board Question: Describe discrete impacts from the flood retention facility on salmonid populations separate from the No Action Alternative.

What is the incremental impact on salmonid abundance that would result from the flood retention facility (construction and operation) at mid and late century as compared to the predicted condition of salmonid abundance under the No Action Alternative (which includes the effects of climate change)? What contributes to the differences? Why is the percentage impact of the flood retention facility at mid-century greater than at late century? Are there differences between the integrated model results and EDT results? Are there differences between the integrated model results for ASRP versus SEPA EDT results on both a basin-wide and sub-basin level? If so, what is important to understand about the differences?

The analysis of impacts to salmonids for the Draft SEPA EIS did not include the effects from implementing the Aquatic Species Restoration Plan (ASRP) or from actions to mitigate the impacts

identified in the Draft SEPA EIS. The relationship between the impacts of the Proposed Action, compensatory mitigation for the Proposed Action, and the ASRP will be assessed as part of the Chehalis Basin Strategy by the Chehalis Basin Board in the summer and fall of 2020. Decisions by the Board regarding the Chehalis Basin Strategy could have significantly different outcomes for salmonids depending on what actions are taken and when they are taken.

The Draft SEPA EIS evaluated the effects of the No Action Alternative and Proposed Action Alternative on salmonids by assessing the effects on spring-run and fall-run Chinook salmon, coho salmon, and steelhead within two spatial units directly related to the proposed FRE facility: Rainbow Falls to Crim Creek (below the proposed FRE facility) and Above Crim Creek (above the proposed FRE facility). Two analytical models were used. The first was the Ecosystem Diagnostics and Treatment (EDT) model, which was also used in the Programmatic EIS and is being used to estimate effects of ASRP scenarios. EDT estimates the productivity of habitat for salmonids under a specific set of modeled conditions.

A second approach was developed for the Draft SEPA EIS that incorporates salmon population dynamics and the probability of FRE flood retention events on salmonids over time. This integrated the EDT model with a salmonid life cycle model developed by the National Oceanic and Atmospheric Administration (NOAA) and simulated changes in salmonid population abundance from the current time period through late-century. This second model was termed the EDT-NOAA integrated model, or simply the integrated model. Results from both modeling approaches are reported in the Draft SEPA EIS because both models provide different types of information that were used to inform the effects of the Proposed Action. The characterization of trends in salmonid abundance through time in the Draft SEPA EIS relied primarily on integrated model results. This is because the integrated model provided both estimates of abundance and variability around the estimates by conducting multiple model runs that incorporate the probability of flood retention events occurring, and the integrated model could be used to simulate the effects of a worse-case scenario on salmonids if a major flood occurred 3 years in a row.

Four parameters were developed by NOAA Fisheries scientists to evaluate salmonid population viability: abundance, spatial structure, productivity, and diversity (McElhaney et al. 2000). Abundance is often the key parameter of interest and is discussed here in response to the Board's question. The other three parameters are discussed in the following question.

Figures 1 and 2 show estimated impacts on salmon and steelhead under the No Action Alternative and Proposed Action in mid-century and late-century, both of which included predicted climate change. These figures present the changes in abundance based on integrated model results for the two spatial units assessed and provide a visual depiction of the changes through time. These figures report the results of Exhibits 5.3-3, 5.3-4, 5.3-6, and 5.3-7 of the Draft SEPA EIS, but in a different format for comparison of the No Action Alternative to the Proposed Action. The relative changes in salmonid abundance are also presented in the Draft SEPA EIS as tables and are included after the figures.

Figure 1
Estimated Abundance Impacts Above Crim Creek from the Proposed Action and No Action Alternative

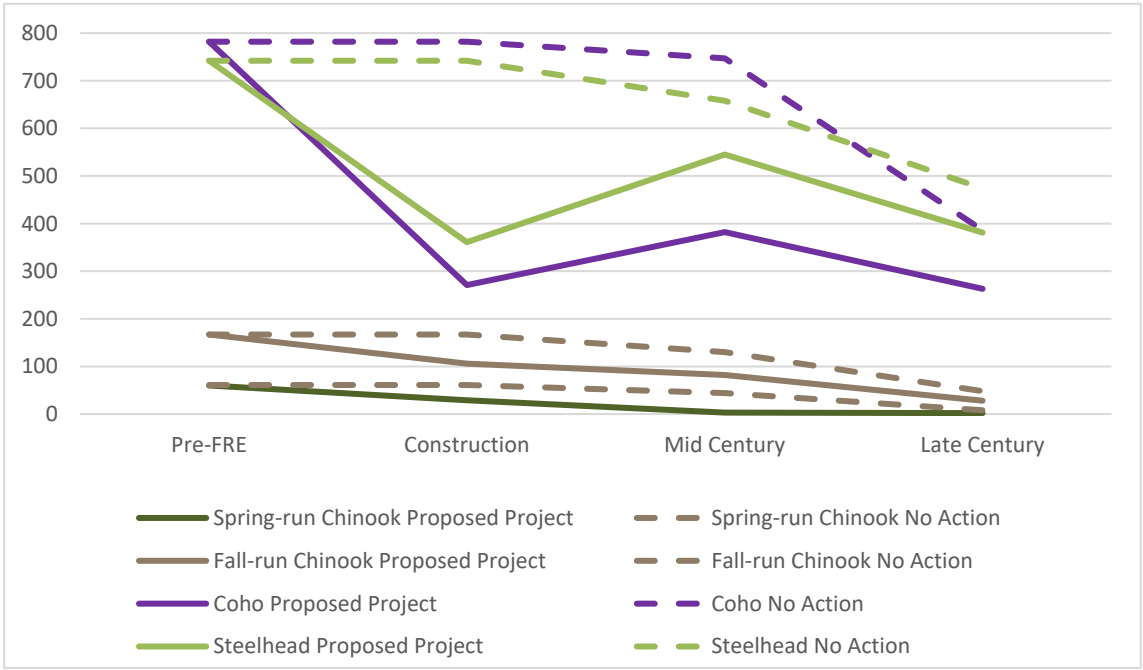
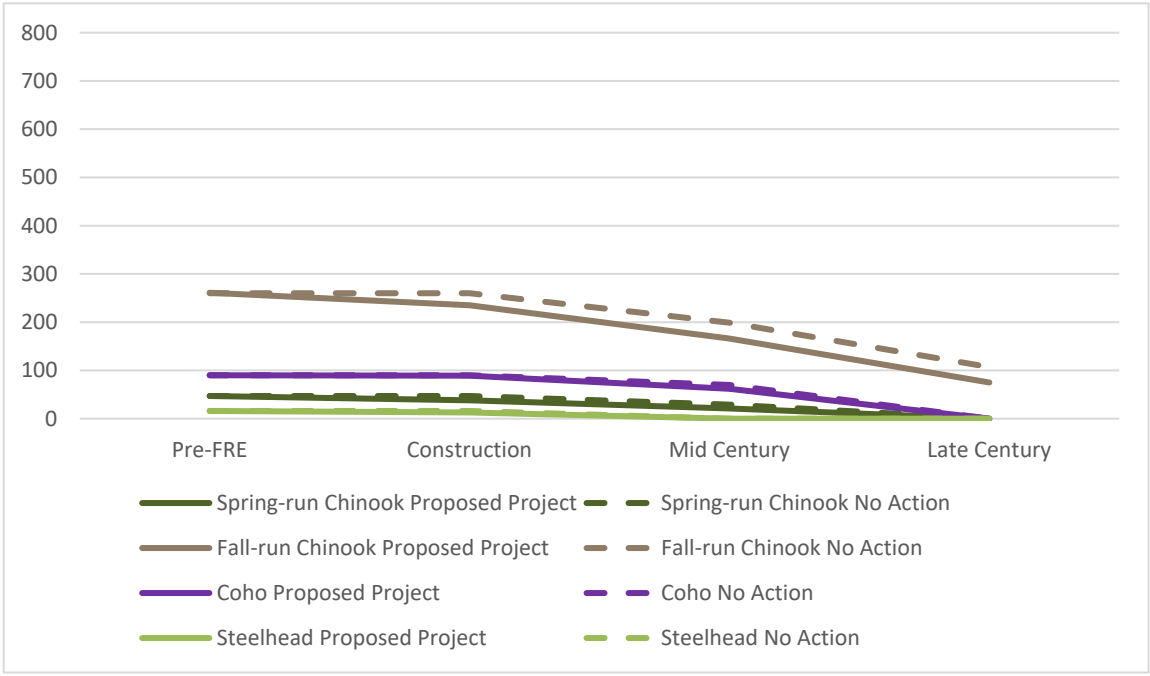


Figure 2
Estimated Abundance Impacts Crim Creek to Rainbow Falls from the Proposed Action and No Action Alternative



The effects of the Proposed Action and FRE facility alone presented in the figures above include the effects of constructing and operating the FRE facility under the typical (2-year), major (10-year), and catastrophic (100-year) flood conditions modeled. The Draft SEPA EIS discusses the effects of construction alone on salmonids because of the large effect the action had on estimated abundance. Results of the construction period from both the EDT model and integrated model were provided in Table E-10 (Appendix E of the Draft SEPA EIS). Results differ for construction between the EDT model and the integrated model because the EDT model reported abundance under the construction condition at equilibrium (which would occur at some time in the future), while the integrated model confined the effect to the 5-year construction period. Also, the integrated model allows fish born prior to construction to return as adults during construction. Both of these factors resulted in the changes in estimated abundance based on the integrated model being less than those based on the EDT model, so both sets of data were provided in Table E-10 (Appendix E of the Draft SEPA EIS).

Table E-10 (Appendix E of Draft SEPA EIS)
Change in Estimated Abundance of Salmon and Steelhead During Construction of the Proposed FRE Facility

SPECIES	ABOVE CRIM CREEK		RAINBOW FALLS TO CRIM CREEK	
	INTEGRATED MODEL	EDT	INTEGRATED MODEL	EDT
Spring-run Chinook salmon	-52%	-84%	-19%	-29%
Fall-run Chinook salmon	-37%	-45%	-10%	-13%
Coho salmon	-65%	-81%	-1%	-3%
Steelhead	-51%	-54%	-19%	-42%

The Draft SEPA EIS analysis incorporated many factors into the Proposed Action and No Action Alternatives included the effects of the FRE facility with future conditions to identify the impact analysis of the Proposed Action. To answer the Board's question, and using information presented in Tables E-11 and E-23 (Appendix E of the Draft SEPA EIS), the effect of the FRE facility alone can be approximated by subtracting the changes in abundance under the No Action Alternative from those estimated for the Proposed Action. This allows the effect of the FRE facility to be computed from model results and provides information on the effects of the FRE facility alone on salmonids in mid-century and late-century. The differences between Tables E-11 and E-23 are presented in Table 2.

Table 2
Overall Change in Estimated Abundance of Salmon and Steelhead Between the Proposed Action and the No Action Alternatives in Mid-Century and Late-Century

SPECIES	ABOVE CRIM CREEK		RAINBOW FALLS TO CRIM CREEK	
	MID-CENTURY	LATE-CENTURY	MID-CENTURY	LATE-CENTURY
Spring-run Chinook salmon	-67%	-10%	-17%	0%
Fall-run Chinook salmon	-29%	-12%	-12%	-12%
Coho salmon	-47%	-15%	-9%	0%
Steelhead	-16%	-13%	0%	0%

The information represents the computed change in salmonid abundance that occurred from the FRE facility alone when the results from the No Action Alternative are subtracted from the Proposed Action (Proposed Action - No Action). For example, for spring-run Chinook salmon in the Above Crim Creek spatial unit in late-century, there was a 97% decrease in estimated abundance under the Proposed Action (Table E-11) and a 87% decrease under the No Action Alternative (Table E-23). Thus, the effect of the FRE facility alone was an additional 10% decrease in the abundance of this species in this spatial unit in this timeframe when compared to the No Action Alternative.

Table 2 provides information on the change in projected fish abundance and how the effects vary among species and between the two time periods modeled. In the Rainbow Falls to Crim Creek spatial unit, values of 0 indicate no additional change in abundance is estimated from the FRE facility alone. This occurred when the change in estimated abundance was 100% under both alternatives, meaning the fish were eliminated from the unit under the No Action Alternative and the Proposed Action had no additional effect. The data in Table 2 indicate a general pattern where the effects of the FRE facility alone are greatest in mid-century but decrease in late-century due to the increased impacts of climate change on salmonids in late-century.

Regarding differences between the integrated model results for the ASRP versus the Draft SEPA EIS EDT model, the ASRP did not use the integrated model developed for the Draft SEPA EIS. Instead, the EDT model was used to assess the ASRP scenarios. The baseline assumptions in the ASRP and the EIS also differed. In addition, the ASRP assumed substantial restoration throughout the basin by late-century, including within the Project Area, which was not included in the EIS, while the EIS included the Proposed Project, which was not included in the ASRP.

Regarding changes in abundance at broader spatial scales such as the Chehalis Basin, these were not analyzed as part of the Draft SEPA EIS. Changes were analyzed at broader scales under the Programmatic EIS. Results of EDT modeling conducted to evaluate Alternative 1 are presented in Table 5.3-4 of the Programmatic EIS. Decreases in estimated abundance among Chinook salmon, coho salmon, and steelhead for the flood retention only alternatives evaluated (i.e., without habitat restoration) ranged from less than 1% to 4% at the Chehalis Basin scale. It is important to note that the assumptions and modeling approaches were different between the Programmatic EIS and Draft SEPA EIS.

What is the effect of the flood retention facility on VSP parameters for salmon populations both in the project impact area and basin-wide? How is this differentiated between species? For example, please clarify the following from the EIS "The modeling predicts that the Proposed Project would reduce the genetic diversity within and among salmon populations of each species across the Chehalis Basin."

In the Draft SEPA EIS, the effects of the Proposed Action and No Action Alternative were evaluated using the following Viable Salmonid Population (VSP) metrics originally developed by NOAA Fisheries (McElhany et al. 2000). These are defined as follows:

- Abundance: the number of adult fish returning to the basin in the absence of harvest
- Productivity: the density-independent survival rate from spawner to progeny (returns per spawner)
- Diversity: the breadth of potential fish performance across the modeled life-history variation
- Spatial structure: the pattern of estimated fish abundance across the Chehalis Basin

Taken together, the four parameters provide information on the number of fish returning to a basin, the ability of the habitat they depend on to support the population, and the complexity of the population. Increased complexity helps buffer the population from environmental variability and human-caused stressors. Changes in abundance for the Project Area were discussed above. Effects on spatial structure, productivity, and diversity are also addressed in detail in Appendix E, Section 3.2.3.2.2.5, of the Draft SEPA EIS. Information on these three parameters is summarized for the Board in the following sections.

The information on all four parameters was used in assessing the effects of the Proposed Action and No Action Alternatives on salmonids in the Draft SEPA EIS because they each provide important, but different, information on aspects of a population's response. The Draft SEPA EIS went into more detail on these parameters than was done in the Programmatic EIS, which focused only on changes in salmonid abundance.

Spatial Structure

The Project Area in the Above Crim Creek Subbasin represents a significant proportion of the salmon and steelhead spawning in the upper Chehalis Basin. In addition, a large fraction of salmon and steelhead spawn in the proposed FRE facility inundation area. Specifically, between 2013 and 2017, 93%, 86%, 39%, and 33% of all spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead redds, respectively, surveyed in the Chehalis River above Crim Creek were located in the reservoir inundation area (Ashcraft et al. 2017). Therefore, impacts associated with the inundation area represent significant impacts to the spatial structure of salmon and steelhead in the upper Chehalis Basin. The No Action Alternative and Proposed Action, which include climate change, would decrease the spatial structure of populations in the basin.

The decline in spatial structure for spring Chinook salmon is important because: 1) spring Chinook salmon are the least abundant anadromous salmonid in the Chehalis Basin due to habitat constraints (based on EDT model results); 2) their spatial distribution in the basin is limited; and 3) there are possible genetic issues related to fall-run Chinook salmon breeding with spring-run Chinook salmon. There are six spring-run Chinook salmon populations delineated in EDT, two of which are in the Project Area. Both populations within the Project Area were almost entirely eliminated by late-century within the EDT analysis, due to predicted climate change and the Proposed Action. The research that informed

the ASRP indicated that the Willapa Hills area of the Upper Chehalis River (south of Pe Ell, including the East Fork and West Fork Chehalis rivers and other major tributaries), is no longer a stronghold for spring-run Chinook salmon. Recent observed returns of spring-run Chinook salmon to the Project Area have been very low (Ronne 2019). However, the area has supported greater abundance of spring-run Chinook salmon in the recent past under habitat conditions that are not markedly different from current conditions. Given the restricted current distribution of the species in the Chehalis Basin, habitat within the Project Area is important to the spatial structure and viability of this species (Appendix E, Section 3.2.2.1, of the Draft SEPA EIS).

Productivity

Another VSP parameter is productivity. In the EDT model, life history trajectories with a productivity that is less than 1 are considered non-sustainable. Productivity values estimated by the EDT model for the Current Condition, Proposed Action Alternative, and No Action Alternative are shown below (note that the table numbering is identical to Appendix E of the Draft SEPA EIS). The information has been reorganized to present side-by-side comparisons of changes in productivity associated with the Proposed Action compared to the No Action Alternative in late-century. The tables show reductions in the productivity of all four species in both Rainbow Falls to Crim Creek and Above Crim Creek spatial units when the Proposed Action is compared to current conditions and to the No Action Alternative in late-century.

Excerpt from Tables E-24 and E-16 (Appendix E of Draft SEPA EIS)
Estimated Spring-Run Salmon Productivity (Returns per Spawner) by Subbasin under the No Action Alternative and Proposed Action in Late-Century

	NO ACTION ALTERNATIVE (LATE-CENTURY)		PROPOSED ACTION (LATE-CENTURY)	
FLOW SCENARIO	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK
Typical seasonal flood	0.10	2.01	0.00	0.02
Major flood	0.10	2.01	0.00	0.00
Catastrophic flood	0.10	2.01	0.00	0.00

Excerpt from Tables E-24 and E-16 (Appendix E of Draft SEPA EIS)
Estimated Fall-Run Salmon Productivity (Returns per Spawner) by Subbasin under the No Action Alternative and Proposed Action in Late-Century

	NO ACTION ALTERNATIVE (LATE-CENTURY)		PROPOSED ACTION (LATE-CENTURY)	
FLOW SCENARIO	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK
Typical seasonal flood	3.39	3.18	0.09	0.04
Major flood	3.40	2.90	0.07	0.02
Catastrophic flood	3.40	2.68	0.07	0.02

Excerpt from Tables E-25 and E-17 (Appendix E of Draft SEPA EIS)
Estimated Coho Salmon Productivity (Returns per Spawner) by Subbasin under the No Action Alternative and Proposed Action in Late-Century

FLOW SCENARIO	NO ACTION ALTERNATIVE (LATE-CENTURY)		PROPOSED ACTION (LATE-CENTURY)	
	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK
Typical seasonal flood	0.12	2.67	0.00	0.08
Major flood	0.12	2.67	0.00	0.09
Catastrophic flood	0.12	2.67	0.00	0.07

Excerpt from Tables E-25 and E-17 (Appendix E of Draft SEPA EIS)
Estimated Winter Steelhead Productivity (Returns per Spawner) by Subbasin under the No Action Alternative and Proposed Action in Late-Century

FLOW SCENARIO	NO ACTION ALTERNATIVE (LATE-CENTURY)		PROPOSED ACTION (LATE-CENTURY)	
	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK	RAINBOW FALLS TO CRIM CREEK	ABOVE CRIM CREEK
Typical seasonal flood	0.03	8.00	0.00	0.28
Major flood	0.03	7.98	0.00	0.28
Catastrophic flood	0.03	7.96	0.00	0.28

The Draft SEPA EIS (Appendix E, Section 3.2.3.2.2.5) characterizes the productivity of the four species as follows:

Spring-run Chinook salmon: The low abundance of spring-run Chinook salmon basin-wide reflects low productivity compared to other species. These fish face a number of challenges that reduce survival (productivity) including the need to survive as adults during summer prior to spawning. In a warm system like the Chehalis River, this requires cool water refugia, which can be limiting. The low abundance and productivity of spring-run Chinook salmon, the need for summer holding habitat, and other issues related to genetics and interbreeding with fall-run Chinook salmon make spring-run Chinook salmon the most threatened of the four species modeled.

Fall-run Chinook salmon: Productivity of fall-run Chinook salmon is appreciably greater than that of spring-run Chinook salmon because fall-run Chinook salmon do not experience the impact on survival that occurs for spring-run Chinook salmon during the summer adult holding period. Fall-run Chinook salmon are most abundant and have the highest productivity of the four species in the Rainbow Falls to Crim Creek Subbasin below the site of the proposed FRE facility (Tables E-12 and E-13). The higher survival of fall-run Chinook salmon in this area compared to other species is because they do not have

the adult summer holding stage while juveniles emigrate in their first spring and so do not experience the high summer water temperature that characterizes this section of the river.

Coho salmon: Productivity of coho salmon in the Rainbow Falls to Crim Creek Subbasin, as estimated by the EDT model, is approximately 1.6 adult returns per spawner. The low productivity of coho salmon in this subbasin means that sustained production of coho salmon may not occur in this area during years of poor ocean survival when productivity could drop below 1.0. In addition, this species is estimated to be extirpated from this subbasin by late-century due to the limited quantity and quality of habitat for coho salmon in the reach.

Steelhead: Based on EDT model results, approximately 6% of the basin-wide steelhead habitat potential was estimated to be above Rainbow Falls, and 97% of the current potential above Rainbow Falls was in the Above Crim Creek spatial unit. Steelhead potential in the Rainbow Falls to Crim Creek Subbasin is low compared to the other species as a result of steelhead life history. Winter steelhead spawn in late winter and juveniles emerge in spring and summer. The Rainbow Falls to Crim Creek Subbasin has high summer water temperature that reduced the survival of fry produced in this area in the EDT model. Based on WDFW observations of steelhead escapement across the Chehalis Basin, 15% of the steelhead produced in the basin comes from the upper Chehalis River, which represents only 4% of the total habitat. Thus, the upper Chehalis River is an important area for steelhead production.

Diversity

The Draft SEPA EIS concludes that the upper Chehalis Basin is warmer and is geographically and hydrologically distinct from other regions of the Chehalis Basin. The reduction of spring-run and fall-run Chinook salmon, coho salmon, and steelhead from the upper Chehalis Basin due to the Proposed Action represents a significant impact to the genetic, physiological, morphological, and behavioral diversity of these salmon and steelhead in the Chehalis Basin.

Diversity is calculated within the EDT model. It is defined as the proportion of sustainable life history trajectories (those with a productivity greater than 1) for a species that is used to calculate equilibrium abundance. In EDT, diversity relates to the breadth of suitable habitat within the spatial unit and variation in modeled life histories within the population being analyzed. As habitat is degraded, the proportion of trajectories with productivity greater than 1 declines, indicating that the calculated abundance relies on an increasingly narrow range of suitable habitat and life histories within the population. Populations with higher EDT diversity values are assumed to have greater resiliency to environmental perturbations compared to those with lower diversity values.

As habitat is projected to degrade in the future due to the Proposed Action, the diversity of salmonids would also decline because all of the life-history trajectories that start within the temporary reservoir area would be eliminated when the FRE outlets are closed during a flood retention event. This means

the projected abundance and productivity of salmonids would be supported by a smaller array of life-history strategies.

Regarding the statement "The modeling predicts that the Proposed Project would reduce the genetic diversity within and among salmon populations of each species across the Chehalis Basin," the statement is supported by the following text in the Draft SEPA EIS (Appendix E, page E-145):

"…coho salmon and steelhead found at and upstream of the proposed FRE facility are genetically distinct from coho salmon and steelhead in lower river areas. Additionally, Chinook salmon genetic structure (both spring-run and fall-run) within the Chehalis Basin indicates that there is population structure consisting of an upstream group (South Fork and upper Chehalis River, Newaukum River, and Skookumchuck River) and a downstream group (Wynoochee, Wishkah, Satsop, Black, and Chehalis mainstem rivers; Brown et al. 2017). Any decline of Chinook salmon, coho salmon, or steelhead in the upper basin due to the Proposed Action would be a significant loss of genetic diversity from Chehalis Basin populations."

What are the major causes of the impacts to salmonids?

The major causes of impacts of the Proposed Action (specifically, the FRE facility) on all four species as estimated by the modeling approach were as follows:

1. Inundation of mainstem and lower tributary reaches above Crim Creek in years when the FRE facility was closed
2. Habitat degradation in the mainstem and lower tributaries above Crim Creek in years when the FRE facility was open caused by the removal of vegetation in the reservoir footprint and from previous flood retention events
3. Decreased adult fish passage survival during construction due to assumptions about the effectiveness of temporary trap-and-transport facilities, especially for coho salmon and steelhead

Habitat degradation within the reservoir footprint was assumed to include the loss of riparian cover due to land clearing, increased water temperature due to loss of riparian shade, increased sedimentation during reservoir filling and landslides, decreased large wood supplied to the river channel, and increased bed scour.

Additional factors that could affect salmonids, resident fish, shellfish, and aquatic macroinvertebrates during construction and operations were considered separately and were not incorporated in the model. For example, for construction this included effects of noise and vibration from blasting and equipment operation, the inability of temporary trap-and-transport facilities to pass all fish species and life stages, and potential impacts to adult steelhead (kelts) that move downstream after spawning.

What are key uncertainties in the impacts, what factors affect those uncertainties, and how are these uncertainties affected over time?

Many potential uncertainties were identified within the Draft SEPA EIS. They pertain to the state of knowledge regarding the species being modeled, how habitat will change in the future with predicted climate changes, and FRE construction and operations (including fish passage). Despite many uncertainties identified in the Draft SEPA EIS, the analysis used data and models for evaluating impacts to salmonids that was the best information available. Also, generally speaking, uncertainty increases with time and there is always greater certainty associated with what could occur in the near term compared to the long term.

The Draft SEPA EIS, Appendix E, states the following on pages E2-33 to E2-35:

"For the salmonid impacts modeling conducted for the SEPA EIS, the following limitations of the modeling approach and areas of uncertainty are acknowledged:

- The biological status of spring-run Chinook salmon in the Chehalis Basin, including current and historic distribution and pre-spawning behavior
- Uncertainties about spring-run Chinook salmon in the Chehalis Basin: Spring-run Chinook salmon are difficult to distinguish from fall-run Chinook salmon in the field during abundance surveys. There is considerable uncertainty in recent abundance estimates for the species. Recent genetics studies suggest that spring-run Chinook salmon abundance in spawner surveys has likely been overestimated, making it difficult to gauge how well the integrated model is performing relative to empirical spawner counts.
- How habitat conditions above and below the FRE facility during construction and operation will change, including:
  - How fast will habitat recover from an FRE facility closure event?
  - What will habitat above the FRE facility look like through time?
  - How will downstream conditions change?
  - Will fish recolonize habitat after an FRE facility event, and if so, how quickly?
  - Will fish self-distribute downstream from the FRE facility during a closure and spawn successfully?
- Uncertainty associated with 10- or 100-year floods occurring during FRE facility construction (rather than 2-year floods, which is what is currently modeled). A 10- or 100-year flood during this period could have impacts on fish species and habitat.
- Uncertainty associated with fish passage estimates as noted in Attachment E-3.
- The effect of climate change on conditions in Grays Harbor and the ocean. Inclusion of these factors would affect the numeric estimates of fish performance under both alternatives. Annual variation in ocean conditions and ocean survival is a significant contributor to annual variation in spawner abundance for salmon and steelhead. It is not clear how climate change will affect

salmon and steelhead survival in Grays Harbor and the ocean, although climate models suggest that ocean temperatures will likely increase in the future and increasing ocean temperatures may lead to reduced adult returns (Logerwell et al. 2003). For small or declining populations, this annual variation may result in populations going to very low numbers (or zero in some years), possibly resulting in earlier functional extirpation.

- In this analysis, effects of peak flow outside the project area were not modeled so that effects of the Proposed Action were easier to detect. This results in an underestimation of the functional extirpation of weak species, especially spring-run Chinook salmon. Inclusion of flood effects outside the project area may result in earlier functional extirpation of small populations (e.g., spring-run Chinook salmon) if that was to be modeled.
- Uncertainty in mid- and late-century conditions for peak flows, low flows, and stream temperature. There is considerable uncertainty in climate projections resulting from uncertainty in projected greenhouse gas emissions, as well as differences among climate models. While effect of this uncertainty can be evaluated in models (e.g., by using high and low estimates), this uncertainty cannot be reduced.
- Basic model uncertainties (life-stage representation, capacity estimates, survival estimates, changes in parameters due to habitat change, etc.), which are common modeling uncertainties.
- Uncertainty associated with conditions above the proposed FRE facility or in any tributary of the Chehalis River because the HEC-RAS model could not be used to evaluate these areas.
- Uncertainty in flooding impacts to flow and channel width because the EDT model is structured based on monthly (not daily) increments of time. The impacts of the flood events are diminished when daily flows are incorporated into a monthly time step in the analysis.
- Uncertainties associated with lack of variation in timing and duration of the flood events in 2-, 10-, and 100-year flood years; no variation in flow conditions at other, non-flood event, times of the year; and no variation in the life stage of the salmon and steelhead being affected by the flood event. Additionally, uncertainties due to actual differences in 2-, 10-, and 100-year flood conditions in the future have not been captured since specific water years were chosen as representative in the models.
- Uncertainty associated with the impacts of bed scour on salmon and steelhead survival in tributaries of the two modeled reaches as this was not include in the models (only impacts to the mainstem were included).
- Uncertainty associated with the fact that changes in hydrology associated with the 3 water years modeled were not modeled in the reach above the proposed FRE facility.
- Impacts due to changes in mainstem river water temperature associated with 2-, 10-, 100-year flow recurrence intervals are uncertain as these data were not available.
- Uncertainty associated with aspects of the project that were not considered in the modeling approach for areas downstream of the FRE facility:
  - Broad, long-term effects of a lack of channel-forming flows during floods

- How a lack of flooding would impact channel width, fine sediment levels, floodplain maintenance and formation, and riparian structure and function"

What is the relationship between the model predictions for current abundance and the recent redd counts? Is there other field data that are relevant to this question?

EDT estimates of salmon abundance do not line up directly with WDFW escapement estimates for two reasons. First, WDFW monitoring units do not directly align with EDT model units (geospatial unit designations). Second, WDFW reports escapement (the number of adults on the spawning grounds after harvest) while EDT reports total potential return of adults to spawning grounds in the absence of harvest (it estimates the potential of the habitat to produce salmon and steelhead). Therefore, EDT abundance should generally be appreciably higher than WDFW numbers, which represent escapement only. EDT model results are compared to WDFW escapement estimates to ensure the model is producing results that reflect trends in abundance among species across basins.

Does the No Action Alternative assume impacts to salmon populations from floods? In the past it appears large floods have had an impact that can last over several salmon life cycles. Please describe.

Floods are a natural part of the salmon landscape, and salmon evolved with floods. Floods can both impact salmon (e.g., block access, disrupt spawning, redistribute adults or juveniles, and scour redds) and benefit salmon (e.g., bank avulsions are a major source of gravel recruitment, floods move bedload and redistribute silt and cleanse spawning gravels in the process, floods water up side channels and floodplain habitats, floods displace or disrupt predators, and floods can import terrestrial nutrients into the aquatic system). Effects will vary with the timing, location and magnitude of the flood, and by species. It is difficult to relate the effect of a flood to adult returns several years later because salmon evolved to express diverse life history traits and spread their risk of not reproducing across years, and because of the variability among environments they encounter across time.

Floods were incorporated into the assessment of the Proposed Action to evaluate the effects flood retention may have on salmonids, and because data on changes in flows associated with the Proposed Action were developed specifically for this purpose and was available. The No Action Alternative was modeled in exactly the same manner as the Proposed Action (except without the proposed FRE facility). This included the effect of floods (typical flows, major floods, and catastrophic floods) under future conditions with climate change. The Draft SEPA EIS identified the continuing substantial flood risk to fish and habitat but did not make a determination of significance associated with the No Action Alternative.

4. Board Question: If the EDT model is estimating the habitat potential of the upper Chehalis Basin for spring chinook as approximately 100 adults under the No Action Alternative, what factors were used to determine that their loss under the proposed action would have a moderate adverse impact on Southern Resident killer whales? During what timeframe (current, mid, or late century)?

Provide more context for the number of Spring Chinook and other salmon species that could be impacted by the proposed action, the importance of this number of fish and orca's dependency on these populations (NOAA ranking of priority populations).

It is assumed that Southern Resident killer whales eat some Chehalis Basin salmon when residing outside Grays Harbor in fall, winter, and spring. However, they are also preying on a much more abundant and mixed group of Chinook salmon stocks from the Columbia/Snake Rivers and Central Valley California (Hanson et al. 2013, 2017).

Marine predators that prey on Chehalis Basin salmon, such as Southern Resident killer whales and fish-eating birds, would be affected by a change in salmon population sizes. The degree to which the decline of salmon and steelhead from the upper Chehalis Basin resulting from construction of the FRE facility would affect Southern Resident killer whales is uncertain. The number of fish that would likely be impacted by the Proposed Action represents a small proportion of the overall diet of the Southern Resident killer whale. However, the loss of salmon and steelhead, in particular spring-run Chinook salmon, from the Chehalis River, would present a moderate adverse impact on Southern Resident killer whales.

Justification for moderate impact on Southern Resident killer whales by loss of spring-run Chinook salmon from the upper Chehalis Basin (Appendix E, Section 3.2.3.2.5) is as follows:

The Southern Resident Distinct Population Segment killer whale population was federally listed as endangered in 2005 and updated in 2014 (70 Federal Register 69903; 79 Federal Register 20802). Grays Harbor and the coast of Washington lie outside the designated critical habitat for Southern Resident killer whales (71 Federal Register 69054); they spend the majority of spring, summer, and fall in the inland waters of Puget Sound and Strait of Juan de Fuca. In summer, salmonids make up the majority of the Southern Resident killer whale diet (more than 98%), with Chinook salmon from the Fraser River and Puget Sound composing most of their summer diet (Hanson et al. 2010; Ford et al. 2016).

The winter range and feeding habits of the Southern Resident killer whale are not as well studied; however, they have been observed frequently outside of Grays Harbor near Westport between January and June, presumably following and preying upon large runs of returning Columbia River Chinook salmon (Hanson et al. 2013). In March 2018, Governor Inslee issued an executive order directing state

agencies to take immediate actions to help the struggling killer whale population and establishing the Southern Resident Orca Task Force to develop a long-term plan for recovering killer whales (Office of the Governor 2018). The task force's recommendations support overarching goals to benefit killer whales, including increasing the abundance of Chinook salmon, decreasing disturbance and other risks posed by vessel traffic and noise, reducing exposure to toxic pollutants for killer whales and their prey, and ensuring adequate funding, information, and accountability measures are in place to support effective recovery efforts moving forward.

The priority list developed by NOAA Fisheries and WDFW (NOAA Fisheries and WDFW 2018) is used as a relative and dynamic picture of which West Coast Chinook salmon populations are currently supporting the Southern Resident killer whales. The Southern Resident killer whales prefer Chinook salmon as prey, although they also feed on chum salmon, coho salmon, steelhead, and other species such as halibut and lingcod. The stocks from the Puget Sound, Columbia River, Strait of Georgia, Fraser River, and Snake River were found to be highest priority. The Washington Coast stocks include spring-run and fall-run Chinook salmon from the Chehalis River and were rated in the next category for priority.

Chinook salmon that originate from the upper Chehalis River are several subpopulations of Chinook salmon from the Chehalis River and Grays Harbor tributaries, all of which contribute to the Grays Harbor population. The Southern Resident killer whales depend on spring-run Chinook salmon as a food source. The number of these fish has been decreasing throughout the region, and several Chinook populations (outside of the Chehalis Basin) that are preyed upon by Southern Resident killer whales are designated as threatened or endangered (70 Federal Register 37160, 79 Federal Register 20802).

5. Board Question: What assumptions does the EIS use for flood-related turbidity under the No Action Alternative, and how do those turbidity conditions compare to the effects on turbidity under the proposed action (construction and operation)?

Stream turbidity levels are naturally highly variable, depending on conditions. They are typically highest in winter months during periods of heavy precipitation and low flows, and lowest in summer months when precipitation and flows are low. For example, turbidity measured on the Chehalis River at the proposed FRE facility site was 610 nephelometric turbidity units (NTUs) on February 9, 2017, during high flows, and 12.2 NTUs on March 29, 2017, during moderate flows, based on data collected by Anchor QEA in the *Summary of Upper Chehalis River and Select Tributary Water Quality Data* Technical Memorandum (Anchor QEA 2017c). Data from Ecology's long-term monitoring sites at Dryad and Porter show that summer turbidity is often in the range of 2 NTUs or less.

The Draft SEPA EIS evaluates flood-related turbidity in the context of state water quality standards to determine the significance of impacts. It is important to note that naturally elevated turbidity levels that occur during floods (e.g., the No Action Alternative) do not necessarily violate state water quality

standards for turbidity. Rather, Washington's turbidity criteria are based on an activity's potential to cause stream turbidity to increase over background levels. The aquatic life turbidity criteria for Chehalis Basin streams state that an activity shall not cause turbidity to exceed 5 NTUs over background when the background is 50 NTUs or less, or a 10% increase in turbidity when the background is more than 50 NTUs. Because there is no FRE facility or temporary reservoir under the No Action Alternative, the EIS compares predicted turbidity in proposed reservoir inflows ('background') to predicted turbidity in reservoir outflows ('compliance point') to evaluate impacts relative to water quality criteria.

General Effects on Turbidity

FRE facility operations would potentially increase turbidity in the Chehalis River during certain periods and reduce turbidity during others. Turbidity impacts would be influenced by several factors relating to both surface runoff and in-water processes, as described in the *Water Discipline Report* (Appendix N of the Draft SEPA EIS) and the *Earth Discipline Report* (Appendix F of the Draft SEPA EIS) and summarized below.

Flood flows typically carry relatively high levels of suspended sediments as a result of high water velocities and associated mobilization of bed and bank material (scour). When high-velocity, high-turbidity flows enter the temporary reservoir (when the FRE facility is impounding water), velocities would slow and some suspended sediments would settle out. When the FRE facility gates are closed and the temporary reservoir is impounding water, some water would still flow through the FRE facility at a minimum of 300 cfs. However, the inflows would exceed outflows, and peak turbidity in water leaving the temporary reservoir would be lower than peak turbidity in water entering the temporary reservoir. In such conditions, FRE facility operations would not increase downstream turbidity levels.

Resuspension of deposited sediments while the temporary reservoir is draining, or during subsequent storms or high flows when the temporary reservoir is not storing water, could lead to temporary increases in turbidity. Resuspension of sediments may be caused by several factors, such as erosion in the active river channel during and after impoundment, erosion on the valley walls along the shoreline due to wave action as the temporary reservoir drains, and hillslope erosion due to rainfall events after the temporary reservoir is drained. Those factors are discussed in more detail in the *Earth Discipline Report* and the *Reservoir Water Quality Report* (Anchor QEA 2017b).

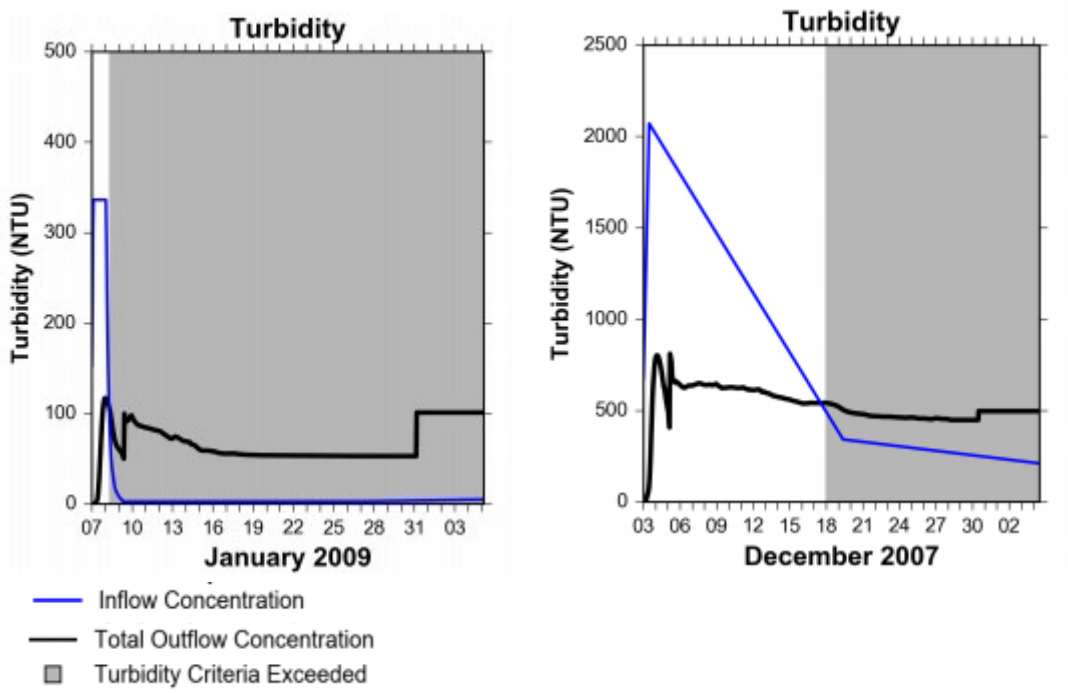
Model Results Summary

The modeling described in the above-noted *Reservoir Water Quality Report* (Anchor QEA 2017b) used data from two historic floods, with the December 2007 flood for a catastrophic flood and January 2009 for a major flood.

The modeling for impoundment conditions predicted that the FRE facility would reduce *peak* outflow turbidity concentrations by more than 50% relative to reservoir inflows for both major and catastrophic floods when the FRE facility gates are closed. The modeling also showed that during major flood or larger

events, the FRE facility may cause an exceedance of turbidity water quality criteria when the temporary reservoir is draining and turbidity in temporary reservoir outflows exceeds turbidity in temporary reservoir inflows. Using conservative "worst-case" assumptions during modeling based on data from past flood events, water quality criteria exceedances were predicted to occur for 18 days for a modeled catastrophic flood and 28 days for a modeled major flood. Because turbidity water quality criteria are based on increases relative to background levels, exceedances of turbidity criteria are highly dependent on the turbidity of Chehalis River flows entering the temporary reservoir following the flood. The modeling predicted more days of exceedances for the major flood than the catastrophic flood because inflowing turbidity remained elevated longer for the catastrophic flood and returned to lower levels more quickly for the major flood, so outflow turbidity remained at least 10% higher than inflow turbidity for a longer time for the major flood.

The graphs below from the *Reservoir Water Quality Report* (Anchor QEA 2017b) illustrate predicted inflow and outflow turbidity levels for the modeled January 2009 and December 2007 floods.



Modeling for non-impounding conditions showed that deposited sediments from previous inundations could later be eroded during a storm, leading to an exceedance of turbidity criteria, particularly when the background turbidity is relatively low. Increases in turbidity from rainfall-induced erosion would generally be limited to the period of the rain event. Vegetation conditions would change when water is held in the temporary reservoir because plants that are inundated for a long period would not survive. Loss of vegetation and temporary loss of root strength would reduce soil cover and is expected to increase the potential for erosion. As flood-tolerant species regrow and annual vegetation grows

between periods of temporary reservoir inundation, root strength and soil cover would increase, reducing the potential for both shallow landslides and erosion. However, the frequency of major floods increases in the future so the potential for regrowth would be reduced (see Section 5.2.2.1 in the Draft SEPA EIS).

6. Board Question: What assumptions does the EIS use for water temperature under the No Action Alternative compared to the proposed action? What are the main causes of the incremental temperature impacts of the flood retention facility as compared to the No Action Alternative?

The Draft SEPA EIS evaluates water temperatures in the context of state water quality standards to determine the significance of impacts, as presented in the *Water Discipline Report* (Appendix N of the Draft SEPA EIS). The water temperature evaluation in the EIS is based largely on analyses and modeling described in the following primary studies and reports by Anchor QEA and Portland State University (PSU):

- *Reservoir Water Quality Model* (Anchor QEA 2017b)
- *Chehalis Water Quality and Hydrodynamic Modeling: Model Setup, Calibration, and Scenario Analysis* (PSU 2017)

Anchor QEA modeling analyzed water temperatures for the proposed temporary reservoir under flood storage conditions for the proposed FRE facility. PSU and Anchor QEA modeling also evaluated temperature impacts to the Chehalis River and its tributaries within the reservoir footprint under non-storage conditions, and temperature impacts to the Chehalis River downstream of the proposed FRE facility under storage and non-storage conditions.

Temperature Impacts and Main Cause

The *Water Discipline Report* (Appendix N of the Draft SEPA EIS) discusses temperature impacts of the proposed FRE facility compared to the No Action Alternative. When the FRE facility is not storing water and the Chehalis River passes through the facility outlets, daily maximum temperatures of the Chehalis River could increase by up to 2°C to 3°C in mid- to late-summer in the temporary reservoir footprint relative to the No Action Alternative, exceeding temperature water quality criteria (PSU 2017). Additionally, with the FRE facility, summer temperatures immediately downstream could be up to 2°C to 3°C warmer than with no FRE facility, exceeding temperature water quality criteria. The modeling showed the Chehalis River temperature impacts decrease moving downstream, becoming negligible below about the confluence with the South Fork Chehalis River at RM 88 (PSU 2017).

The main cause of the predicted increase in summer water temperatures as a result of the FRE facility is the associated alteration of riparian vegetation and reduced stream shading in the reservoir footprint. The construction of the FRE facility would involve removal of mature, coniferous, non-flood tolerant trees and large trees over 6 inches diameter breast height within the reservoir footprint. The Applicant's

currently proposed revegetation plan would involve replanting flood-tolerant vegetation (e.g., shrubs and deciduous trees such as willow and cottonwood), but there would be a net reduction in stream shading. The water temperature modeling and predicted increase in summer temperatures for the proposed FRE facility reflect this 'partial shading' scenario.

During operations, for a catastrophic flood, the reservoir would temporarily hold water and 847 acres would be inundated. A total of 85 wetlands (9.8 acres) and wetland buffers (303 acres), and 116 streams (16.8 miles) and stream buffers (25.5 miles and 441.3 acres) would be submerged underwater for up to 35 days. Plants would not survive being submerged for this amount of time and the wetland vegetation would permanently change to smaller plants that must regrow after every flood. In addition, sediment could fill the wetlands and erosion could reduce its ability to retain water and promote the spread of non-native plants.

7. Board Question: What assumptions does the EIS use for flood-related erosion under the No Action Alternative, and how does this compare to the effects on erosion from the proposed action?

The Draft SEPA EIS evaluates three different erosion mechanisms during flood events:

- Erosion from mass wasting within the FRE footprint as a result of FRE inundation and drawdown
- Erosion from sediment that is deposited within the reservoir during flood events that is subsequently eroded during and after the reservoir is emptied
- Bank erosion downstream from the FRE facility

For each of these erosion mechanisms, the No Action Alternative assumes that existing land use, precipitation, and flood flows that contribute to erosion from these sources during flood events continues. For the Proposed Action, operation of the FRE facility during flood events that results in reservoir inundation and changes in flows downstream from the FRE facility are evaluated as described in detail in the *Earth Discipline Report* (Appendix F of the Draft SEPA EIS) and summarized below.

Mass Wasting

During flood events under the No Action Alternative, existing mass wasting (large deep-seated landslides and smaller shallow-rapid landslides) within the FRE facility is assumed to continue at similar rates as with existing timber harvest and road conditions. Although it is likely that increased mass wasting would result from climate change-induced precipitation increases, it is assumed that changes to mass wasting on forested/roaded areas resulting from differences in rainfall from climate change would be the same for the No Action Alternative and Proposed Action.

Changes to mass wasting under the Proposed Action are assumed to be the result of inundation and resulting saturation of soils within the FRE footprint that could destabilize vulnerable slopes and lead to mass wasting. Slope stability calculations were used to determine which portions of the reservoir

footprint could become unstable and result in shallow-rapid landslides based on slope gradient. It was assumed that there would be no root strength within the FRE footprint as a result of harvest of timber within the FRE footprint (a maximizing assumption because there would be some tree growth in parts of the reservoir). Slope stability modeling was used to evaluate identified and confirmed large, deep-seated landslides during drawdown conditions following reservoir inundation events.

Approximately 10% of the reservoir area contains soil on slopes steep enough that they may be unstable if saturated and all root strength was removed, potentially resulting in shallow-rapid landslides. The result of the mass wasting assessment indicated that two of the potential deep-seated landslides in the proximity of the FRE could become unstable during drawdown conditions. The Applicant's project design states slope stabilization methods would be used during construction to stabilize these slides.

The soil moved during any mass wasting events that occur while the reservoir is operating (impounding water or being drawn down) would primarily be deposited within the reservoir footprint including the Chehalis River and streams.

Sediment Deposited In Reservoir and Subsequently Eroded

During times when the temporary reservoir impounds water (flood conditions), some portion of the sediment that flows into the reservoir from the Chehalis River and tributaries would be deposited in the reservoir. As the reservoir drains, this sediment could be re-eroded and suspended in outflowing water (post-flood conditions).

For the No Action Alternative, there is no deposition and re-erosion of sediment within the reservoir because the reservoir does not exist. For the Proposed Action, deposition and re-suspension was estimated based on two historic flood conditions. Estimates were based on sediment loads in the inflowing river water, deposition of this sediment within the reservoir, and subsequent re-suspension and erosion of a portion of this sediment from wave erosion and surface erosion processes.

The net effect of these erosion mechanisms during FRE facility operation would be to decrease sediment input to the mainstem Chehalis River downstream of the FRE facility during impoundment events and increase fine sediment input in the mainstem Chehalis River as the temporary reservoir drains and during one or two intense rainstorms after the temporary reservoir is drained. The turbidity effects of these erosion processes are described in the *Water Discipline Report* (Appendix N of the Draft SEPA EIS).

Bank Erosion

During flood events, bank erosion can occur along the Chehalis River as the river migrates across the floodplain in unconfined areas. Operation of the FRE facility would reduce the magnitude of some flood events and would likely change bank erosion rates. Based on the analysis of migration rates in the Chehalis River between the FRE facility (RM 108) and the Mellon Street Bridge (RM 83) from 1945 to

2013, it appears that channel migration takes place during even small peak floods in unconfined areas in response to flow against banks on the outside of meanders (Appendix F of the Draft SEPA EIS).

Bank erosion rates for the No Action Alternative were assumed to be similar to historical bank erosion rates. Bank erosion rates under the Proposed Action were assumed to be lower than under the No Action Alternative as a result of reduced large peak flows events, less large woody material, and less accumulation of coarse sediment (Appendix F of the Draft SEPA EIS).

8. Board Question: Does the air quality impact resulting from the flood retention facility assume that trucks and other heavy vehicles are idle if not used in the construction of the facility?

The commenter expressed concern that idling and operational emissions from construction equipment would occur somewhere else if the Proposed Project would not be approved.

Where and when construction equipment is deployed and operated is the responsibility of the contractor. If the contractor works on another project that is subject to SEPA, then emissions from construction-related activities would be required to be analyzed for that project. Air quality and greenhouse gas assessments relative to both SEPA and the National Environmental Policy Act have long considered construction-related exhaust emissions as part of their analysis and determinations of significant effects on the environment.

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Technical Memorandum

Date	May 18, 2020
Project:	Chehalis River Basin Flood Damage Reduction Project
To:	Chehalis Basin Flood Control Zone District
From:	Lisa Danielski, PWS (HDR) Ed Zapel, PE (HDR)
Subject:	SEPA DEIS Review: FRE Facility Temporary Reservoir Inundation and Vegetation Analysis Clarification

1.0 Introduction and Purpose

The purpose of this technical memorandum (TM) is to provide refined spatial analysis of existing hydrologic data for operation of the Flood Retention Expandable (FRE) facility temporary reservoir and land cover within the temporary reservoir for the Proposed Chehalis River Basin Flood Damage Reduction project (project). This TM summarizes the results of detailed mapping of the duration and extent of inundation that would occur in the temporary reservoir when the FRE facility is activated during specific major flood events, as well as vegetation communities and land uses that occur within the temporary reservoir.

The primary purpose of this mapping is to assess the extent, duration, and severity of potential inundation and provide more granularity to land cover classifications in the temporary reservoir area in order to inform the detailed Vegetation Management Plan that is being prepared by the Chehalis Basin Flood Control Zone District (District) for the permitting phase of the project. This TM also serves to provide more targeted documentation of the effects of project operations over a range of flood flows as described in the *Proposed Chehalis River Basin Flood Damage Reduction Project Draft EIS* (Washington State Department of Ecology 2020), and anticipated effects to land cover within the temporary reservoir.

2.0 Hydrologic Events of Interest

For the purpose of this TM, existing hydrologic data were reviewed and available information for the following events were analyzed. No hydrographs for forecasted climate change conditions were available, so climate change events could not be analyzed. However, climate change events are expected to be similar in severity to the events considered here, but may occur more frequently and at different times of the year. Regardless, the FRE facility would be operated the same and therefore, the conclusions drawn here would likely be applicable to future events as well. The specific events considered included:

- 10-year recurrence interval event
- 100-year recurrence interval event
- 1996 flood event

- 2007 flood event (event of record to date)
- 2009 flood event

Anchor QEA confirmed with HDR Engineering, Inc. (HDR) that these flood events match what was evaluated in the draft Environmental Impact Statement (EIS) (Adam Hill, Anchor QEA personal communication, April 1, 2020) and the *Chehalis Basin Strategy Operations Plan for Flood Retention Facilities* (Anchor QEA 2017).

3.0 Assumptions and Given Information

The period of record used by Anchor QEA to generate the reservoir routing analyses was assumed to cover the United States Geological Survey (USGS) gage data available for the several gages included in the study. The hydrologic analysis conducted by Anchor QEA was concluded in September 2018. The period of record used in the study therefore terminated at study conclusion, though these gages continue in operation to collect continuous data since that date. The individual periods of record for these USGS gages vary, as follows:

- **Gage 12020000:** Chehalis River near Doty, Washington, 1939 to September 2018
- **Gage 12027500:** Chehalis River near Grand Mound, Washington, 1928 to September 2018
- **Gage 12031000:** Chehalis River at Porter, Washington, 1952 to September 2018

Topography data were obtained from public light detection and ranging (LiDAR) databases. A series of digital terrain models (DTMs) provided by the Washington State Department of Natural Resource's LiDAR program were used to generate contour lines (datum: North American Vertical Datum of 1988 [NAVD88]). The LiDAR data acquired were collected from 2012 to 2018 and have an average relative vertical accuracy of 0.167 foot (0.051 meter).

Flow hydrographs for the Hydrologic Engineering Center River Analysis System (HEC-RAS) river modeling conducted by Watershed Science and Engineering (WSE) to support the project characterization work were obtained from WSE via email attachment from Larry Karpack of WSE's staff, dated February 5, 2020, at 4:46 p.m. In addition to the HEC-RAS flow files, the reservoir routing analysis (i.e., inflows, outflows, reservoir elevation) data characterizing the proposed FRE operations were obtained from Anchor QEA via email attachment from Adam Hill of Anchor QEA's staff dated February 17, 2020, at 12:10 p.m. HDR did not conduct additional analyses using these data or any other topographic or hydrologic data to develop the maps and hydrograph representations illustrated in this TM.

4.0 Methods

4.1 Inundation Mapping

The project area considered encompasses the temporary reservoir pool from water surface elevation (WSEL) 425 up to WSEL 620 feet, the maximum WSEL for the 2007 event of record. The following methods were used to generate the temporary reservoir inundation limits anticipated for the regulation of flood events by the proposed FRE dam.

HDR used ArcGIS's "Mosaic to New Raster" tool to merge multiple DTM's into a single DTM that covers the entire project area. Once created, the new DTM was used to derive contours using ArcGIS's Contour tool. This tool was used to define the base contour, contour interval, and maximum vertices per contour. No unit conversion factor (Z factor) was used to generate the project contours. For the purpose of modeling we created contours at a 5-foot contour interval with a base contour of zero.

The contour files were imported to AutoCAD 2018 and used to generate the inundation contour lines and show the aerial extent of these inundation limits. We selected the following key WSEL contours to illustrate the aerial (i.e., planform) extent of inundation during each of the three stages of temporary reservoir drawdown that will be implemented to evacuate the reservoir after a major flood event when the FRE facility is activated:

1. **Initial Reservoir Evacuation (Max. Pool to WSEL 528 feet):** To evacuate the temporary reservoir after a major flood event, the partially closed reservoir outlet gates will open and increase outflow by 1,000 cfs per hour, from 300 cfs (minimum outflow during flood operations) to a maximum outflow of 5,000 to 6,500 cfs. This will cause drawdown of the temporary reservoir from its peak WSEL at the maximum pool, which will be limited to 10 feet per day (5 inches per hour) to reduce risk of landslides. The maximum WSEL for each major flood event will vary depending on the intensity of the flood event. During all major flood events, the 10 feet per day drawdown rate will continue until the storage pool elevation reaches 528 feet. Once the storage pool elevation reaches 528 feet, debris management operations will begin.

2. **Debris Management Evacuation (WSEL 528-500 feet):** During major flood events, debris from surrounding tributaries and hillsides will likely be swept into the reservoir. Debris management procedures will be used to ensure that large woody debris will not impact dam operations or cause damage to the FRE facility.

   During all major flood events, debris management will begin once the pool elevation reaches 528 feet. At this time, drawdown rates will be slowed to 2 feet per day (1 inch per hour) for a 14-day period. During this period, crews will use a boat to move large debris from the reservoir to an existing log sorting yard previously operated by Weyerhaeuser. The slowed drawdown rate will continue until the storage pool elevation reaches 500 feet. Once the storage pool elevation reaches 500 feet, debris management operations will conclude.

3. **Final Reservoir Evacuation (WSEL 500-425 feet):** During all major flood events, once the temporary reservoir reaches WSEL of 500 feet, drawdown rates will increase to 10 feet per day (5 inches per hour) once debris management operations are complete. Drawdown will continue at this rate until the storage pool has emptied and the pool elevation returns to 425 feet. At this time, the reservoir will no longer be impounding water and the Chehalis River will return to a free-flowing state.

To determine the maximum reservoir WSELs occurring with each of the flood events noted in the EIS (See Section 2.0 above), we obtained the regulated and unregulated flood hydrographs from the EIS, and added notations to the hydrograph plots to clarify key drawdown stages. Then we applied similar information to the inundation limit map created in AutoCAD 2018.

Additionally, we determined the total inundation time above each of the three key reservoir drawdown elevations - maximum WSEL, 528, and 500 - from the time steps obtained from the flood hydrographs provided in the EIS.

4.2 Land Cover Mapping

We have refined mapping of land cover in the study area using GIS data and aerial photography developed as part of the DEIS studies and available from public sources. A map exchange document (mxd) was set up in GIS with an empty feature class with defined domains for each of the land cover communities that would be digitized. The mxd was populated with the following GIS reference files from previous studies and publicly available information: digital surface models showing the height of tree canopy (Washington Department of Natural Resources [WDNR] 2020a), digital terrain models representing the ground elevation (WDNR 2020b), streams, wetlands and ditches mapped by Anchor QEA (2018), as well as logging road data (WDNR 2020c).

Using the reference data above as well as Google Earth aerial imagery from 1990 through 2018 (Google Inc. 2019), we characterized vegetation in the study area and digitized polygons into distinct land cover types using the vegetation communities identified in the *Proposed Flood Retention Facility Pre-construction Vegetation Management Plan* (Anchor QEA 2016), as amended with additional land use classifications such as open water, bare ground/roads and logged lands to accurately capture current conditions in the study area. Table 1 summarizes land cover classifications, typical vegetation composition, and distinct characteristics used to map land cover in the study area.

Table 1. Summary of Land Cover Classifications

Land Cover Classification	Typical Vegetation	Distinct Characteristics
Wetland	See Anchor QEA (2018)	Wetlands Delineated by Anchor 2018.
Open Water/Sand Bar	N/A	Mapped aquatic features (Anchor QEA 2018) and associated sand bars, rock features, etc.
Terrestrial Bare Ground/Roads	Unvegetated	Lack of vegetation over multiple growing seasons; often associated with logging roads and equipment staging areas.
Herbaceous/Grass	Reed canarygrass (*Phalaris arundinacea*), colonial bentgrass (*Agrostis capillaris*), sword fern (*Polystichum munitum*), western lady fern (*Athyrium angustum*), piggyback plant (*Tolmiea menziesii*), creeping buttercup (*Ranunculus repens*)	Grasses and forbs present during growing season; often found adjacent to wetlands, riparian corridors, and recently disturbed areas.
Deciduous Riparian Shrubland	Various willows (*Salix* spp.), young red alder (*Alnus rubra*), red-osier dogwood (*Cornus alba*), vine maple (*Acer circinatum*), Indian plum (*Oemleria cerasiformis*), thimbleberry (*Rubus parviflorus*), salmonberry (*Rubus spectabilis*)	Dominated by deciduous shrub/sapling species less than 6 meters (20 feet) tall (>75% cover)
Deciduous Riparian Forest with Some Conifers	Red alder, Western red cedar (*Thuja plicata*), Western hemlock (*Tsuga heterophylla*), black cottonwood (*Populus balsamifera*), cascara (*Frangula purshiana*), willows, big leaf maple (*Acer macrophyllum*), red elderberry (*Sambucus racemosa*), snowberry (*Symphoricarpos albus*)	Dominated by deciduous tree species 6 meters (20 feet) tall or taller (>75% cover).
Mixed Coniferous/Deciduous Transitional Forest	Douglas fir (*Pseudotsuga menziesii*), red alder, big leaf maple	Approximately even distribution of deciduous and coniferous species (not clearly dominated by one or the other).
Coniferous Forest	Douglas fir	Dominated by coniferous species (>75% cover).
Logged, replanted 0-5 years	Sun-tolerant grasses and forbs, Douglas fir seedlings	Evidence of logging (i.e. clearcutting) on historic aerial imagery; replanting visible within last 5 years (2015-2020) or not replanted.
Logged, replanted 5-15+ years	Douglas fir saplings	Evidence of logging on historic aerial imagery; replanting visible 5 or more years ago (prior to 2015).

4.2.1 Wetland and Open Water/Sand Bar

Wetlands and streams mapped in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018) were imported into GIS to create the Wetland and Open Water/Sand Bar land cover classifications, respectively.

The OHWM for Crim Creek, Roger Creek, and the Chehalis River were not delineated in their entirety during field visits conducted by Anchor QEA due to access limitations and the length of reaches within the project area. Instead, Anchor QEA conducted a desktop-based GIS analysis using LiDAR-generated topography to interpret the OHWM elevation between each point that

was gathered in the field. We made minor adjustments to GIS-based stream mapping to more accurately reflect the spatial extent of streams visible on aerial photography.

4.2.2 Terrestrial Bare Ground/Roads

This land cover class mainly includes wide logging roads and equipment staging areas. Historic aerial imagery was used to identify areas lacking vegetation for multiple growing seasons that were not associated with aquatic areas. To account for the surface area of logging roads obscured by dense vegetation and not visible on aerial imagery, a 7.5-foot buffer was applied to the centerline of mapped road features.

4.2.3 Herbaceous/Grass

The Herbaceous/Grass category accounts for upland areas dominated by grasses and forbs that are not wetlands. Herbaceous vegetation was distinguished from bare ground by comparing multiple years of aerial imagery to confirm the presence of vegetation during the growing season. Herbaceous vegetation was also commonly associated with areas recently disturbed by logging operations, and was found adjacent to areas categorized as Terrestrial Bare Ground. Species typically found in these areas include reed canarygrass (*Phalaris arundinacea*), colonial bentgrass (*Agrostis capillaris*), sword fern (*Polystichum munitum*), western lady fern (*Athyrium angustum*), piggyback plant (*Tolmiea menziesii*), and creeping buttercup (*Ranunculus repens*).

4.2.4 Deciduous Riparian Shrubland

The Deciduous Riparian Shrubland community was modeled after the Cowardin “Scrub-Shrub” class, which includes areas dominated by woody vegetation less than 6 meters (20 feet) tall, including true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions (Cowardin et al. 1979). This community was identified and mapped based on the prevalence of deciduous shrub species and proximity (generally within 200 feet) to mapped streams and aquatic areas. Species typically found in these areas include various willows (*Salix* spp.), red-osier dogwood (*Cornus alba*), vine maple (*Acer circinatum*), Indian plum (*Oemleria cerasiformis*), thimbleberry (*Rubus parviflorus*), salmonberry (*Rubus spectabilis*), and red alder (*Alnus rubra*).

4.2.5 Deciduous Riparian Forest with Some Conifers

The Deciduous Riparian Forest community was established based on the Cowardin “Forested” class, which includes forested areas characterized by woody vegetation that is 6 meters (20 feet) or taller (Cowardin et al. 1979). Deciduous forest stands were differentiated from scrub-shrub communities using the DHM (digital height model) GIS layer to determine approximate tree height. Although the community is dominated by deciduous tree species (approximately >75% deciduous cover), scattered conifer trees were also commonly observed in these areas. Deciduous species were distinguished from conifers using multiple years of aerial imagery to identify seasonal differences in canopy cover. Species typically found in the Deciduous Riparian Forest community includes red alder, Western red cedar (*Thuja plicata*), Western hemlock (*Tsuga heterophylla*), black cottonwood (*Populus balsamifera*), cascara (*Frangula purshiana*), willows, big leaf maple (*Acer macrophyllum*), red elderberry (*Sambucus racemosa*), and snowberry (*Symphoricarpos albus*).

4.2.6 Mixed Coniferous/Deciduous Transitional Forest

Mixed Coniferous/Deciduous Transitional Forest represents areas with an approximately equal distribution of coniferous and deciduous tree species. Tree heights were estimated using the DHM layer, and the distribution of coniferous and deciduous species was determined using seasonal differences in canopy cover from historic aerial imagery. Species typically found in these areas include Douglas fir (*Pseudotsuga menziesii*), red alder, and big leaf maple.

4.2.7 Coniferous Forest

Areas dominated by coniferous tree species (approximately >75% cover) were characterized as Coniferous Forest. The Coniferous Forest community is typically dominated by Douglas fir and often includes stands of various age classes produced for logging.

4.2.8 Recently Logged Areas

Areas with evidence of recent logging activity (i.e. clearcutting) were identified by comparing multiple years of aerial imagery. Recently logged areas with evidence of replanting within the last 5 years (2015 to present) or no evidence of replanting were characterized as “Logged, replanted 0-5 years.” Areas with evidence of replanting older than 5 years ago (prior to 2015) were characterized as “Logged, replanted 5-15+ years.” The five-year threshold represents an approximation of time required for logged lands in the Pacific Northwest to transition from an early seral stage where grasses and forbs are predominant to a shrub-sapling stage where Douglas-fir seedlings accelerate in growth (USDA Forest Service 2012, Lam and Maguire 2011, Burns and Honkala 1990).

5.0 Results and Conclusions

5.1 Inundation Mapping

Table 2 shows the acreage and duration of inundation expected during the three stages of temporary reservoir drawdown for each major flood event evaluated in the EIS. Inundation maps for historical and modeled flood events are presented in Attachment 1. The figures show the Initial Reservoir Evacuation, Debris Management, and Final Reservoir Evacuation areas in blue, yellow, and orange, respectively. Hydrographs for each major flood event are provided in Attachment 2.

The terms used in Table 2 are defined as follows:

- **Area of inundation** refers to the area (in acres) of reservoir inundated during each stage of temporary reservoir drawdown. As described above, the Debris Management and Final Reservoir Evacuation stages will have uniform operation during all major flood events; therefore, the acreage will be consistent during these operational milestones. The area inundated at the start of the Initial Reservoir Evacuation stage differs based on the severity of the flood event.
- **Duration of inundation** represents the maximum number of days of inundation during each stage of reservoir drawdown. The duration differs depending on the severity of the historical or modeled flood event. For the Debris Management Evacuation stage, this number includes 14 days for debris clearing activities.

Table 2. Acreage and Duration of Inundation for Historical/Modeled Flood Events during Temporary Reservoir Drawdown Stages

Historical/ Modeled Event	Initial Reservoir Evacuation (WSEL >528 feet)				Debris Management Evacuation (WSEL 528-500 feet)			Final Reservoir Evacuation (WSEL 500-425 feet)		
	Area of Inundation above WSEL 528 feet	Duration of Inundation above WSEL 528 feet	Total Reservoir Area[a]	Maximum WSEL[b]	Area of Inundation at WSEL 500–528 feet	Duration of Inundation at WSEL 528-500 feet[c]	Total Reservoir Area	Area of Inundation at WSEL 425–500 feet	Duration of Inundation at WSEL 500-425 feet[d]	Total Reservoir Area
10-year event	238 acres	Up to 5.9 days	519 acres	568 feet	122 acres	Up to 20.2 days	281 acres	159 acres	Up to 26.9 days	159 acres
100-year event	426 acres	Up to 10.7 days	707 acres	604 feet	122 acres	Up to 25.0 days	281 acres	159 acres	Up to 31.8 days	159 acres
1996 flood event	410 acres	Up to 9.8 days	691 acres	601 feet	122 acres	Up to 24.5 days	281 acres	159 acres	Up to 31.0 days	159 acres
2007 flood event	527 acres	Up to 11.1 days	808 acres	620 feet	122 acres	Up to 25.2 days	281 acres	159 acres	Up to 32.3 days	159 acres
2009 flood event	324 acres	Up to 7.8 days	605 acres	585 feet	122 acres	Up to 22.0 days	281 acres	159 acres	Up to 28.8 days	159 acres

[a] This value also represents the maximum area of inundation for the modelled flood event
[b] This value also represents the maximum WSEL for the modelled flood event
[c] Includes 14 days for debris clearing activities starting when drawdown following flood peak falls to elevation 528 feet.
[d] This value also represents the maximum number of days of flooding for the modelled flood event

- **Maximum WSEL** gives the peak temporary reservoir pool WSEL for each flood event prior to the start of the Initial Reservoir Evacuation stage.

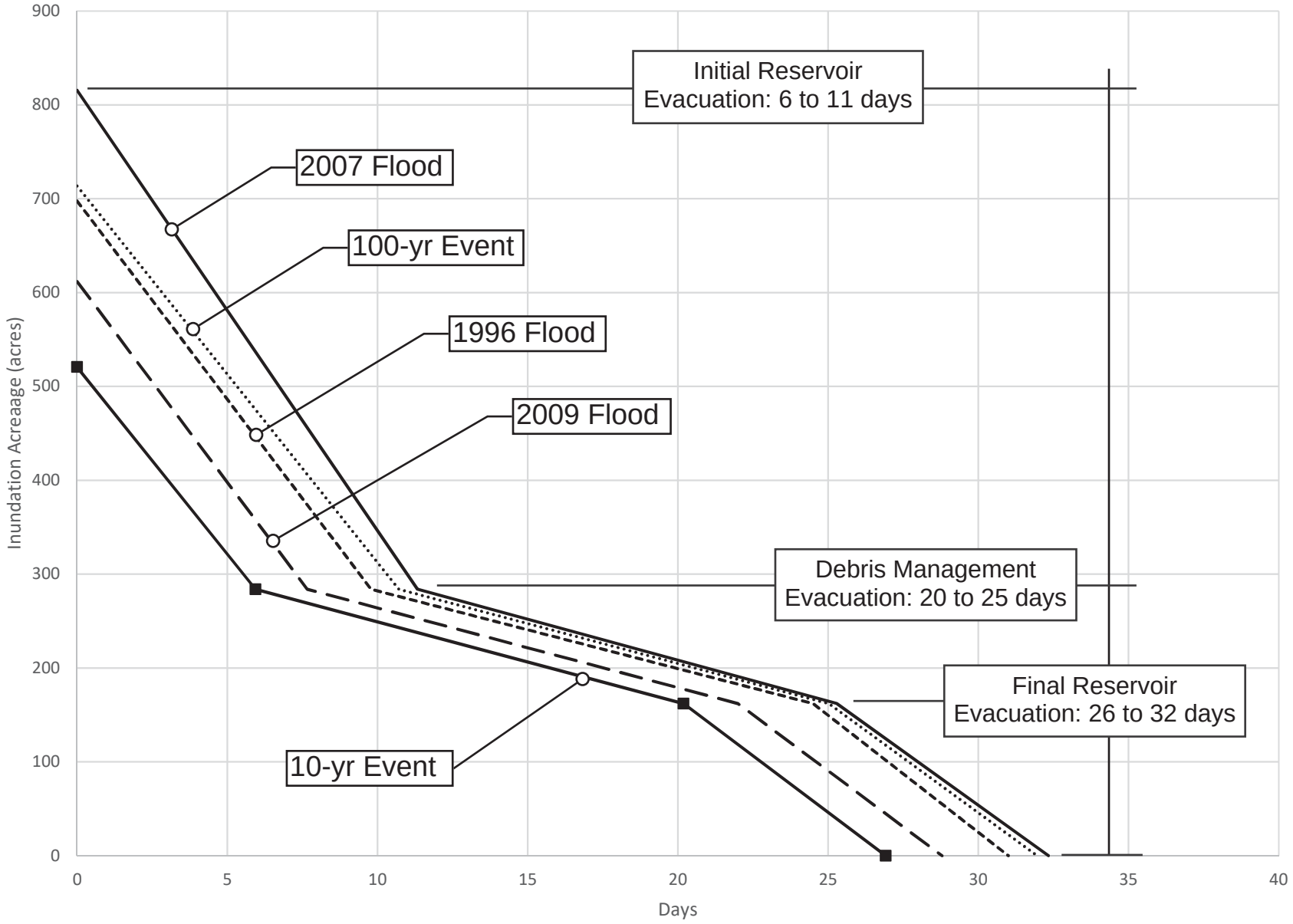
The results of the inundation mapping show that the Initial Reservoir Evacuation area at maximum WSEL will range between 568 and 620 feet. The acreage of inundation above 528 feet will range between 238 and 527 acres, and the duration of inundation will range between 5.9 and 11.1 days. The Debris Management Evacuation area will have 122 acres of inundation between WSEL 500 and 528 feet, and will be inundated between 20.2 and 25.2 days. The Final Reservoir Evacuation area will have 159 acres of inundation between WSEL 425 and 500 feet. This area will be inundated at least 26 days under each flood event, and up to 32 days under the event of record.

Table 3 summarizes the range of acreage, inundation extent and duration at each drawdown stage from the more frequent (10% chance) major flood event to the least frequent (<1% chance) major flood event. Figure 1 graphically depicts each drawdown stage for each flood event plotted as acreage of inundation over time. The standardized three-stage drawdown operations that will be implemented when the dam is activated during all major flood events provides a more accurate depiction of the duration and extent of inundation to evaluate impacts during operation of the dam. During any major flood event, nearly half of the reservoir or greater will only be inundated for 6 to 11 days. Longer periods of inundation that will have more potential effects on vegetation will commence at the Debris Management Evacuation stage.

Table 3. Inundation Zones Based on Temporary Reservoir Drawdown Stages

Temporary Reservoir Drawdown Stage	% Chance of being flooded in a year	Duration	WSEL Range	Total Reservoir Area
Initial Reservoir Evacuation	10%	Up to 5.9 days	568-528	238 acres
	<1%	Up to 11.1 days	620-528	527 acres
Debris Management Evacuation	10%	Up to 20.2 days	528-500	122 acres
	<1%	Up to 25.2 days	528-500	122 acres
Final Reservoir Evacuation	10%	Up to 26.9 days	500-425	159 acres
	<1%	Up to 32.3 days	500-425	159 acres

Figure 1. Inundation Acreage vs Inundation Time



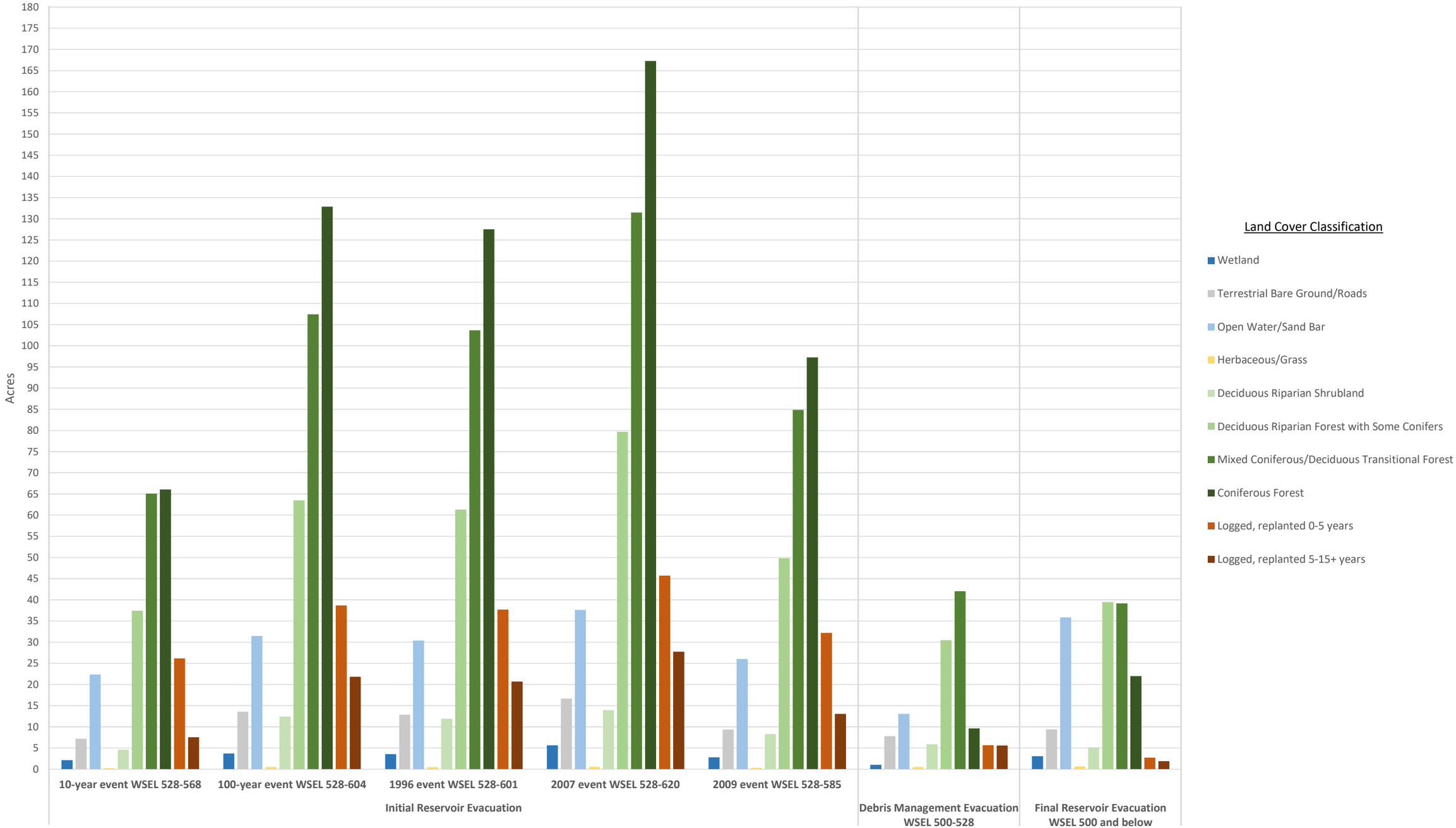
5.2 Land Cover Mapping and Inundation Effects

Figure 2 shows acreage of land cover communities mapped within the project area at each drawdown stage. Land cover acreages are also expressed as a percentage of total land cover for each major flood event and drawdown stage. An existing land cover map of the study area is presented in Attachment 3.

The Initial Reservoir Evacuation Area consists mainly of Coniferous Forest, followed by Mixed Coniferous/Deciduous Transitional Forest and Deciduous Riparian Forest with Some Conifers. Tree species in the Coniferous Forest community, particularly Douglas-Fir, are least tolerant of inundation, whereas the other forested communities consist of tree and shrub species that have higher tolerance for flooding (Anchor QEA 2016). Appendix 1 of the DEIS (Ecology 2020) states that "all non-flood-tolerant tree species would be removed from the zone where the inundation duration is expected to last 25 days or more when the reservoir is storing water." Lands in the Initial Reservoir Evacuation Area would only be inundated 6 to 11 days. Therefore, selective tree harvest of non-flood tolerant tree species is not expected be required throughout the Initial Reservoir Evacuation Area, although some individual trees that are exposed to longer inundation may die.

The Debris Management Evacuation and Final Reservoir Evacuation Areas mainly consist of Deciduous Riparian Forest with Some Conifers and Mixed Coniferous/Deciduous Transitional Forest; Coniferous Forest is the fourth most predominant land cover after Open Water. Although the Debris Management Evacuation Area would be inundated between 20 and 25.2 days, we are currently conservatively assuming that the duration of inundation throughout this area will likely require selective tree harvest of non-flood tolerant species as described in the project description of the DEIS. Selective tree harvest would be required throughout the Final Reservoir Evacuation Area. In total, up to 187 acres of forested vegetation communities would be subject to selective tree harvest in these two drawdown areas.

Figure 2. Land Cover Acreage by Drawdown Stage



6.0 Literature Cited

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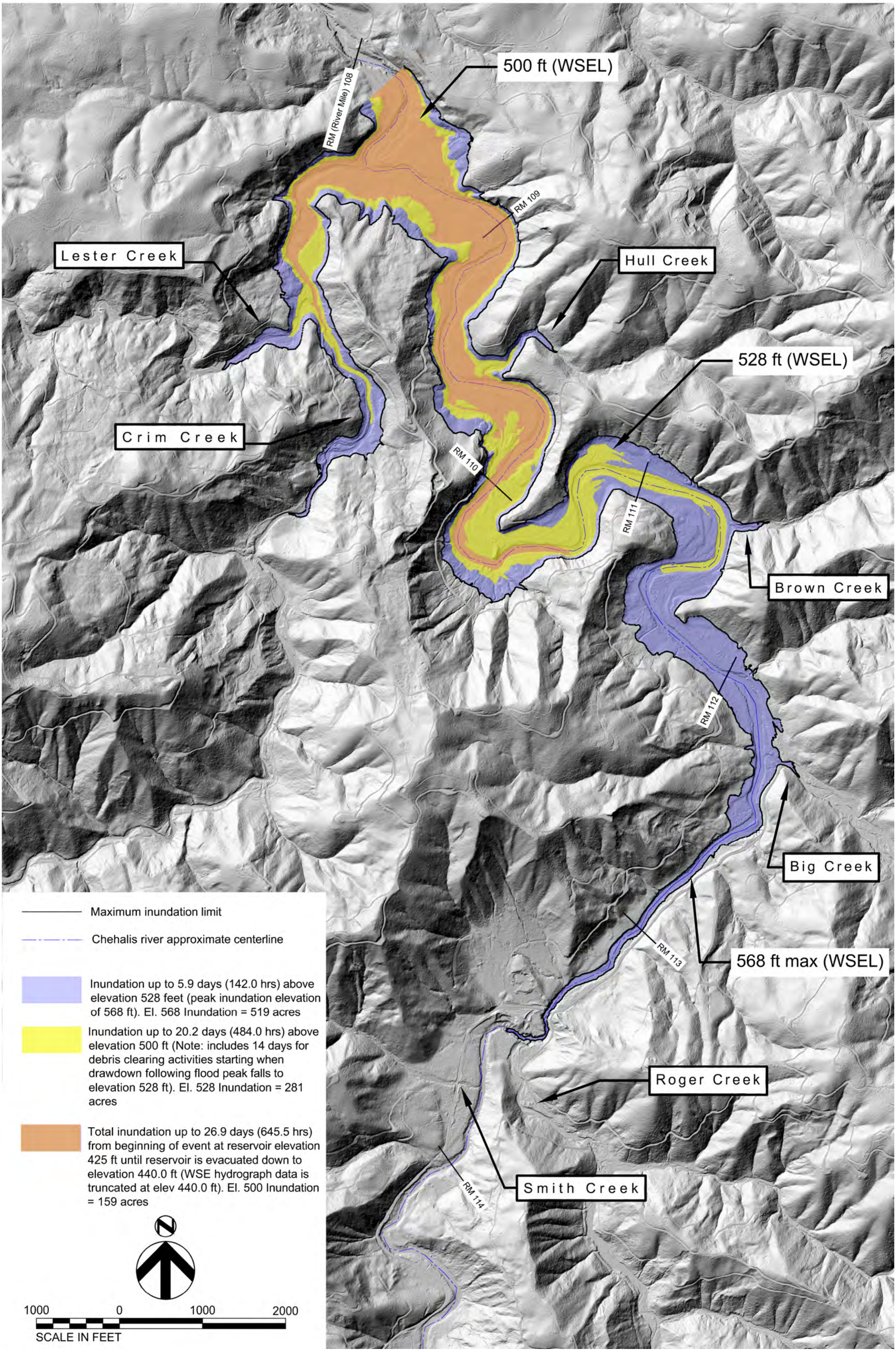
Attachment 1. Inundation Maps

10 Year Event Inundation Map for Proposed Dam (FRE)



Maximum inundation limit

Chehalis river approximate centerline

Inundation up to 5.9 days (142.0 hrs) above elevation 528 feet (peak inundation elevation of 568 ft). El. 568 Inundation = 519 acres

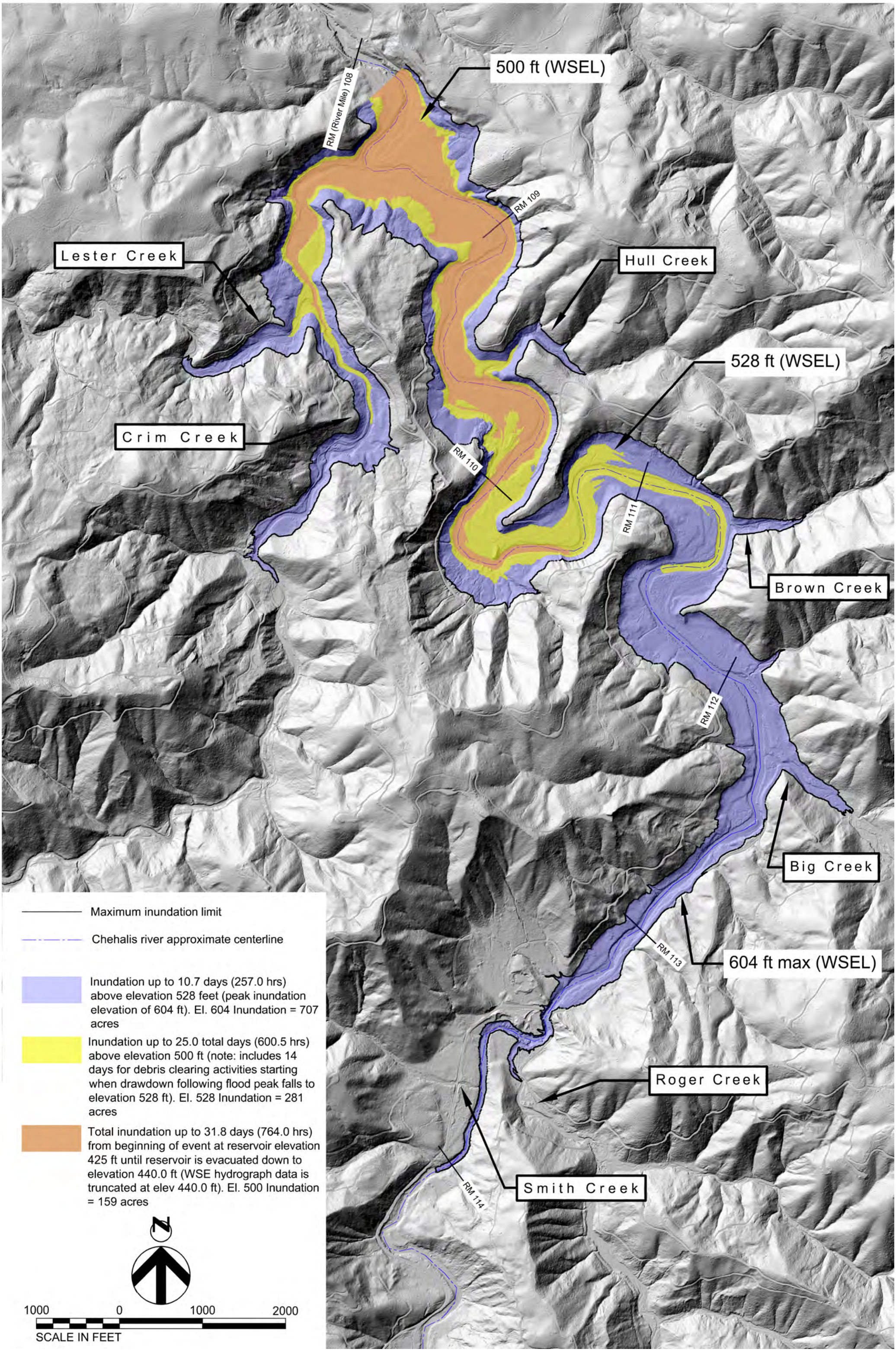
Inundation up to 20.2 days (484.0 hrs) above elevation 500 ft (Note: includes 14 days for debris clearing activities starting when drawdown following flood peak falls to elevation 528 ft). El. 528 Inundation = 281 acres

Total inundation up to 26.9 days (645.5 hrs) from beginning of event at reservoir elevation 425 ft until reservoir is evacuated down to elevation 440.0 ft (WSE hydrograph data is truncated at elev 440.0 ft). El. 500 Inundation = 159 acres

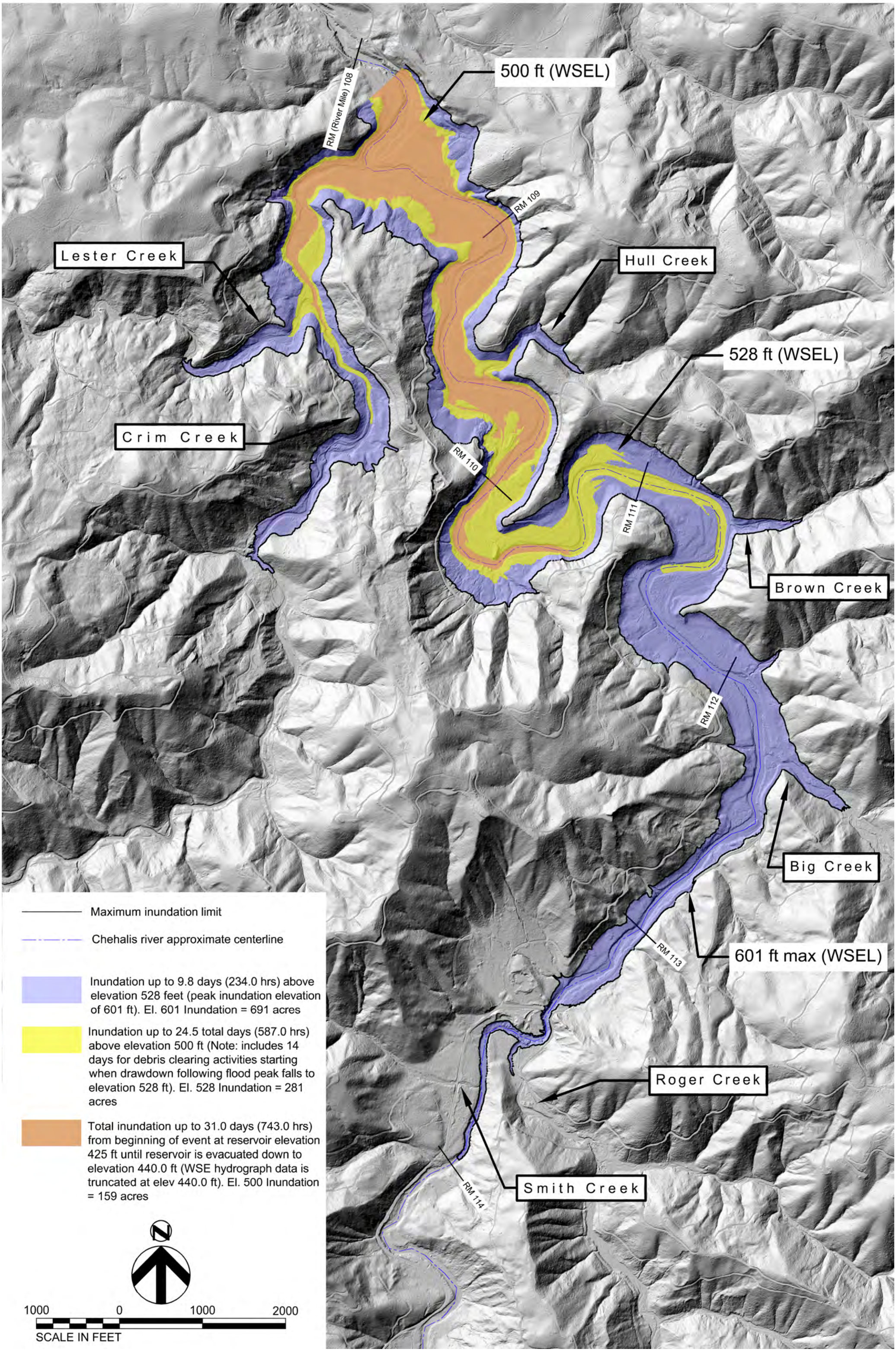
1000 0 1000 2000

SCALE IN FEET

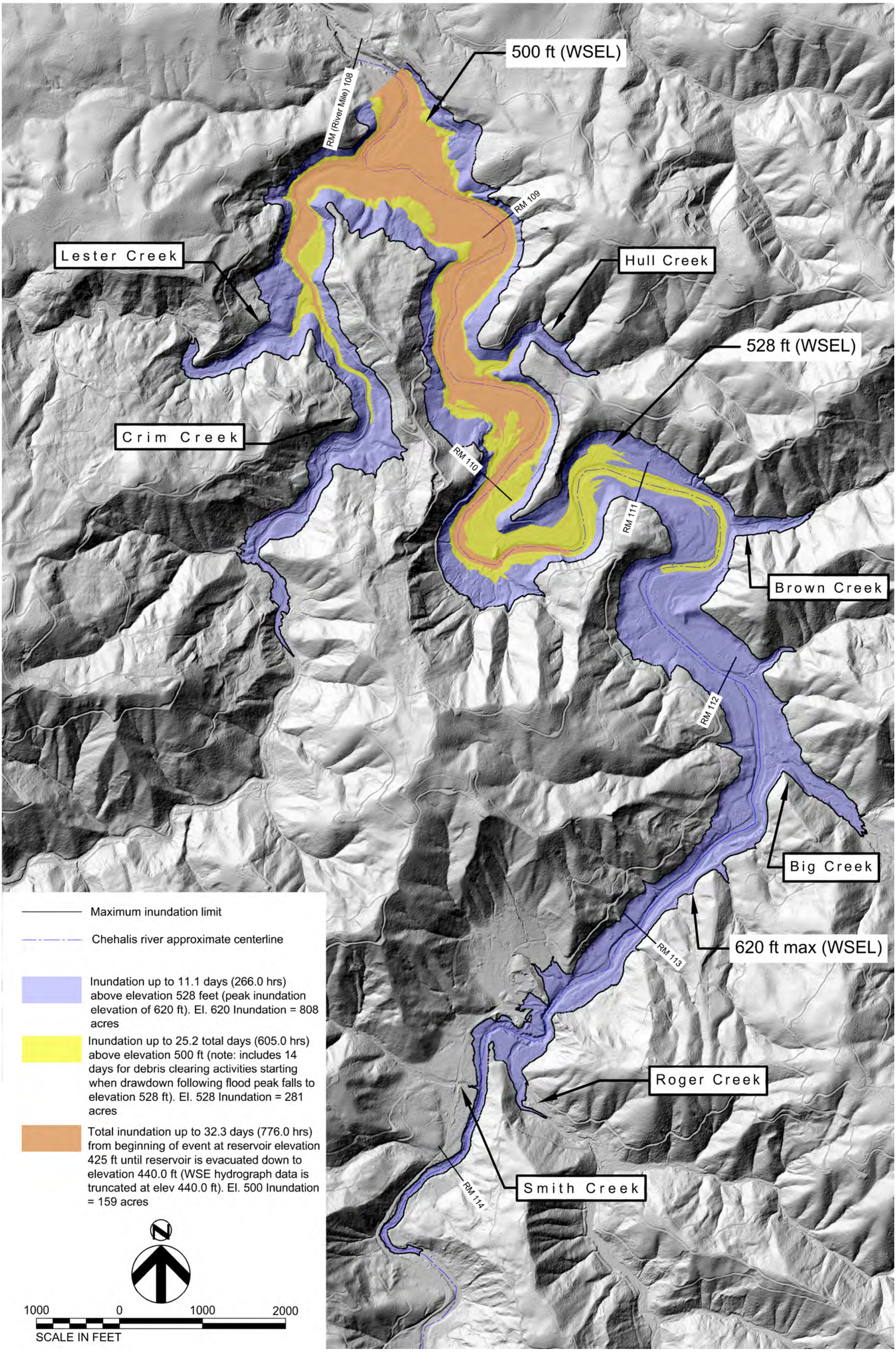
100 Year Event Inundation Map for Proposed Dam (FRE)



1996 Event Inundation Map for Proposed Dam (FRE)



2007 Event Inundation Map for Proposed Dam (FRE)



Maximum inundation limit

Chehalis river approximate centerline

Inundation up to 11.1 days (266.0 hrs) above elevation 528 feet (peak inundation elevation of 620 ft). El. 620 Inundation = 808 acres

Inundation up to 25.2 total days (605.0 hrs) above elevation 500 ft (note: includes 14 days for debris clearing activities starting when drawdown following flood peak falls to elevation 528 ft). El. 528 Inundation = 281 acres

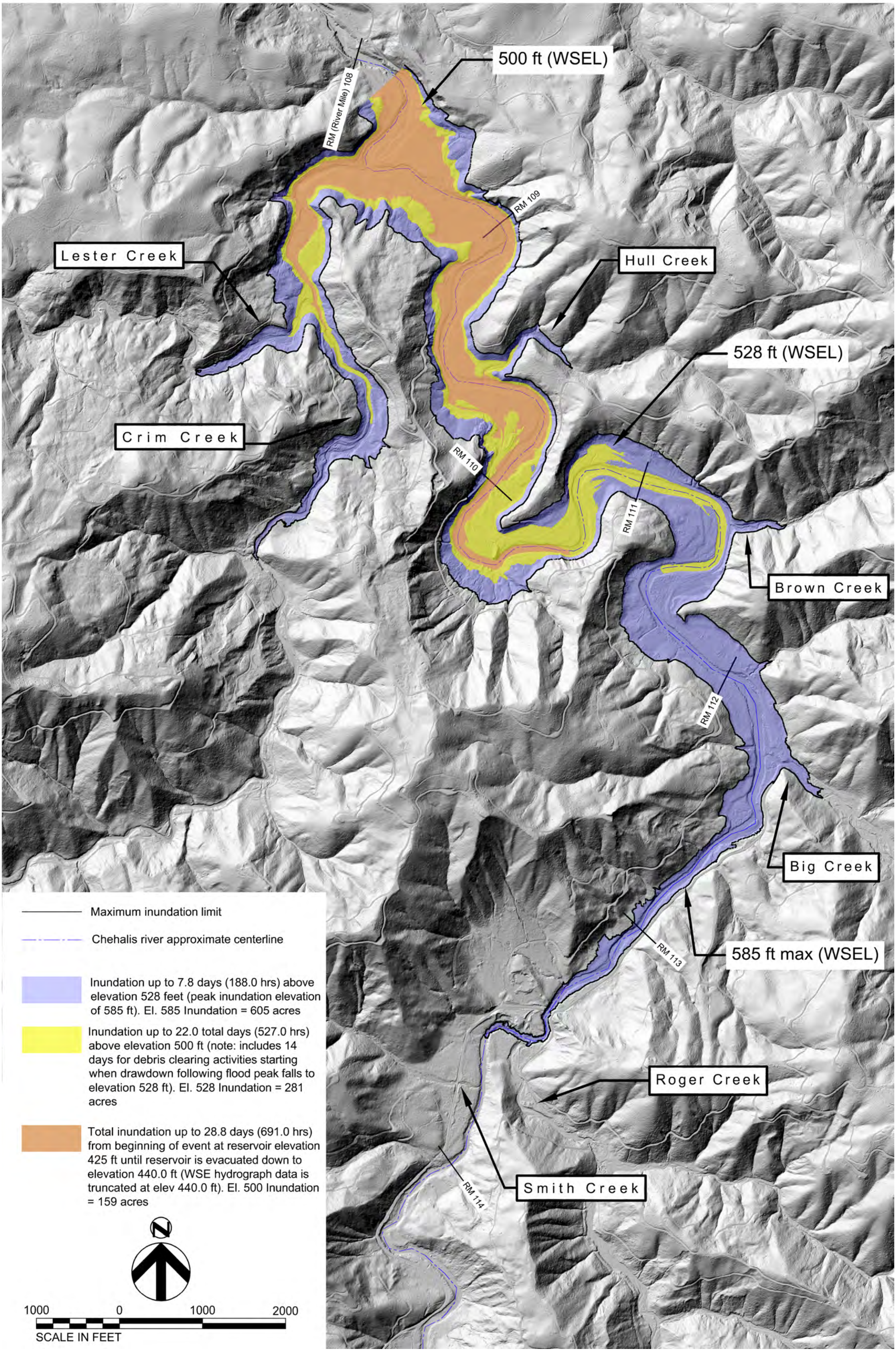
Total inundation up to 32.3 days (776.0 hrs) from beginning of event at reservoir elevation 425 ft until reservoir is evacuated down to elevation 440.0 ft (WSE hydrograph data is truncated at elev 440.0 ft). El. 500 Inundation = 159 acres

N

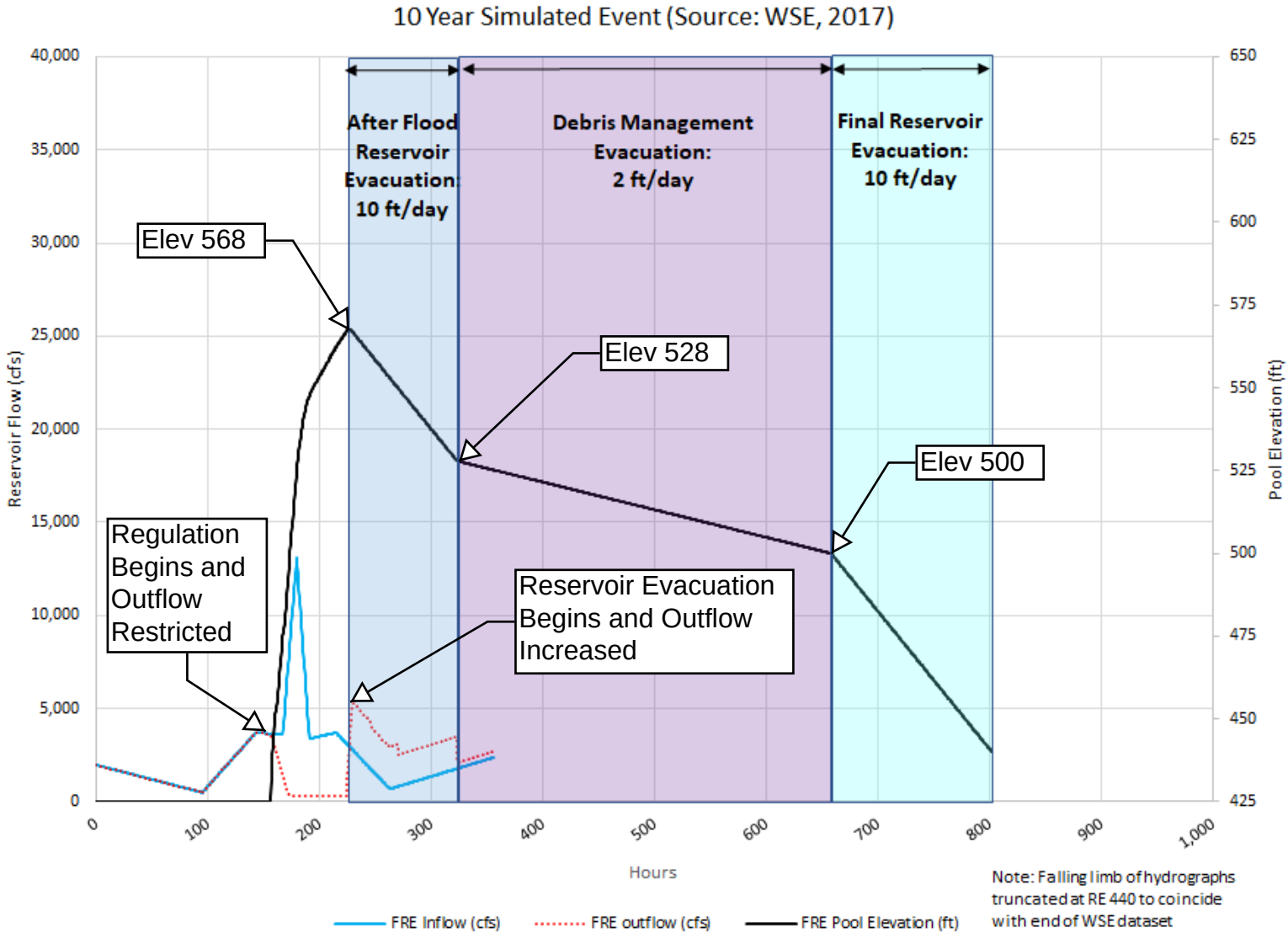
1000 0 1000 2000

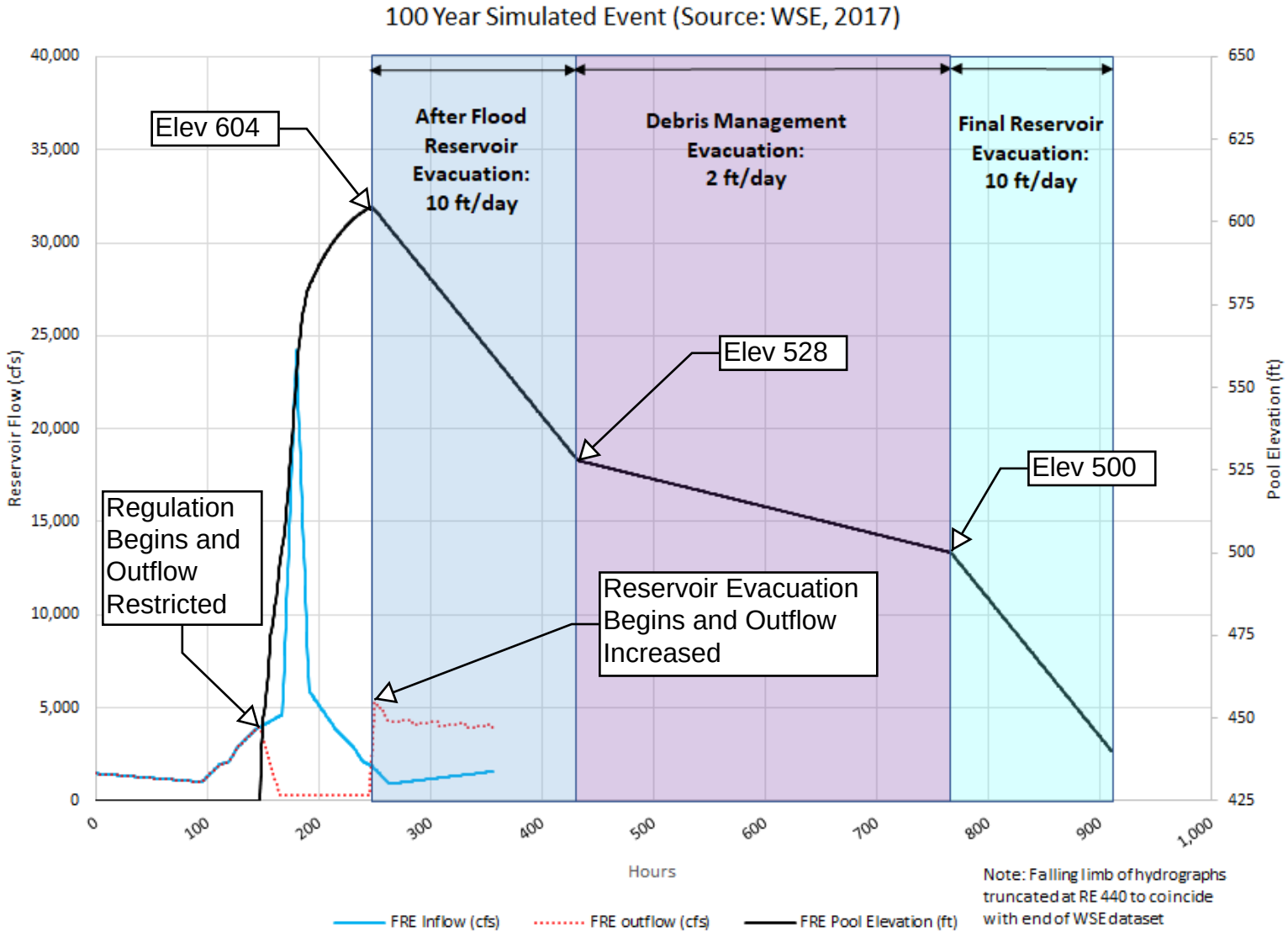
SCALE IN FEET

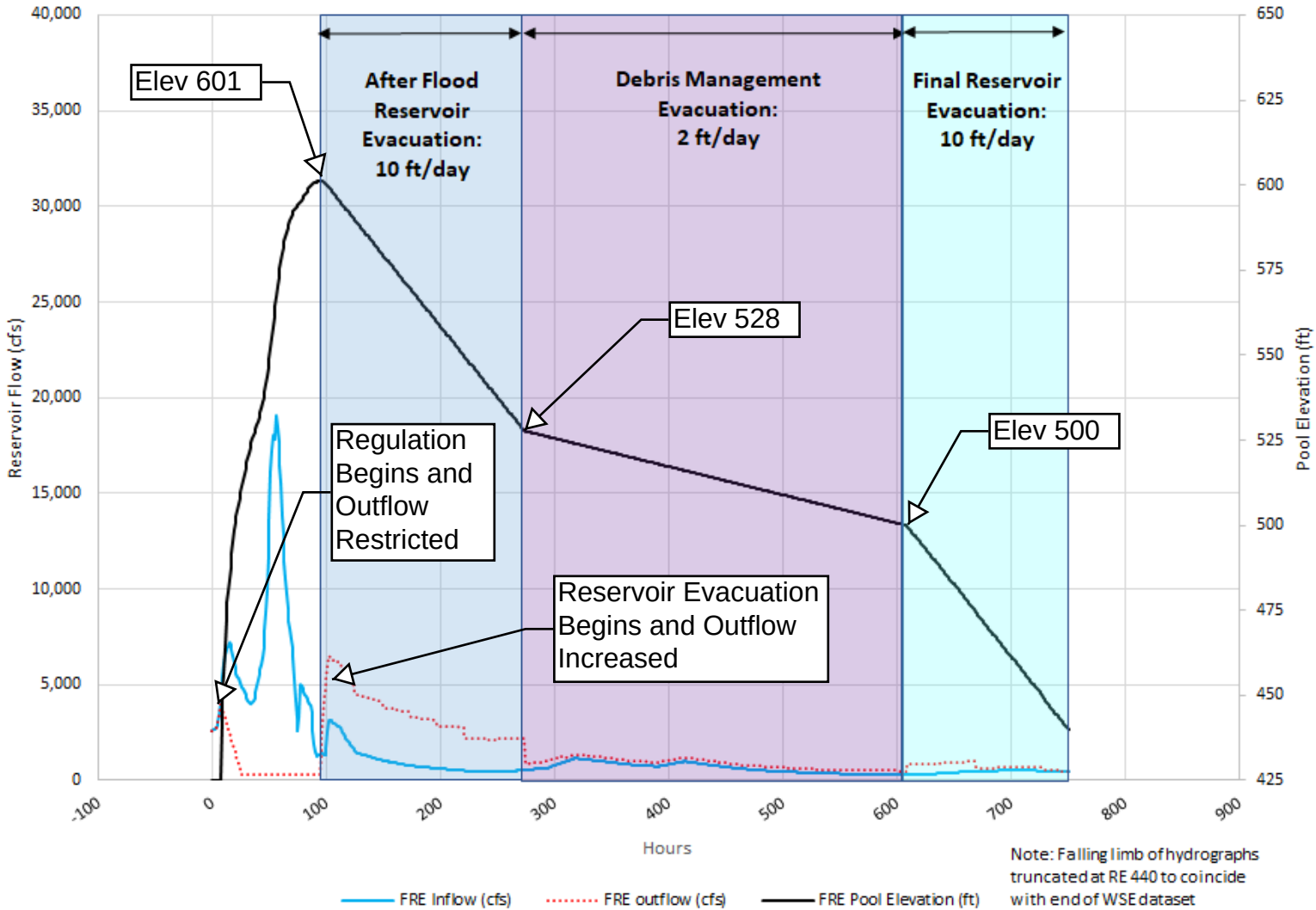
2009 Event Inundation Map for Proposed Dam (FRE)

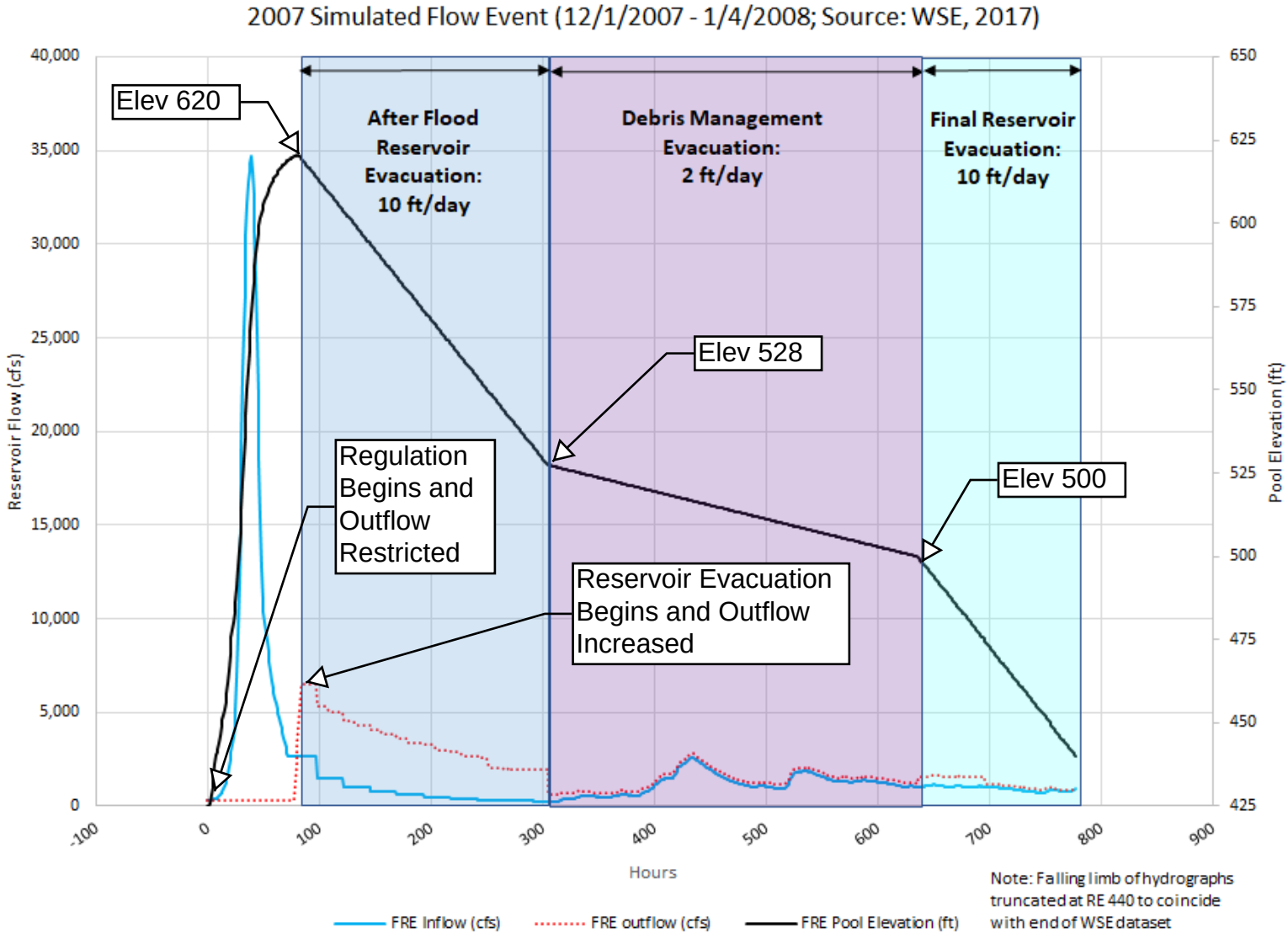


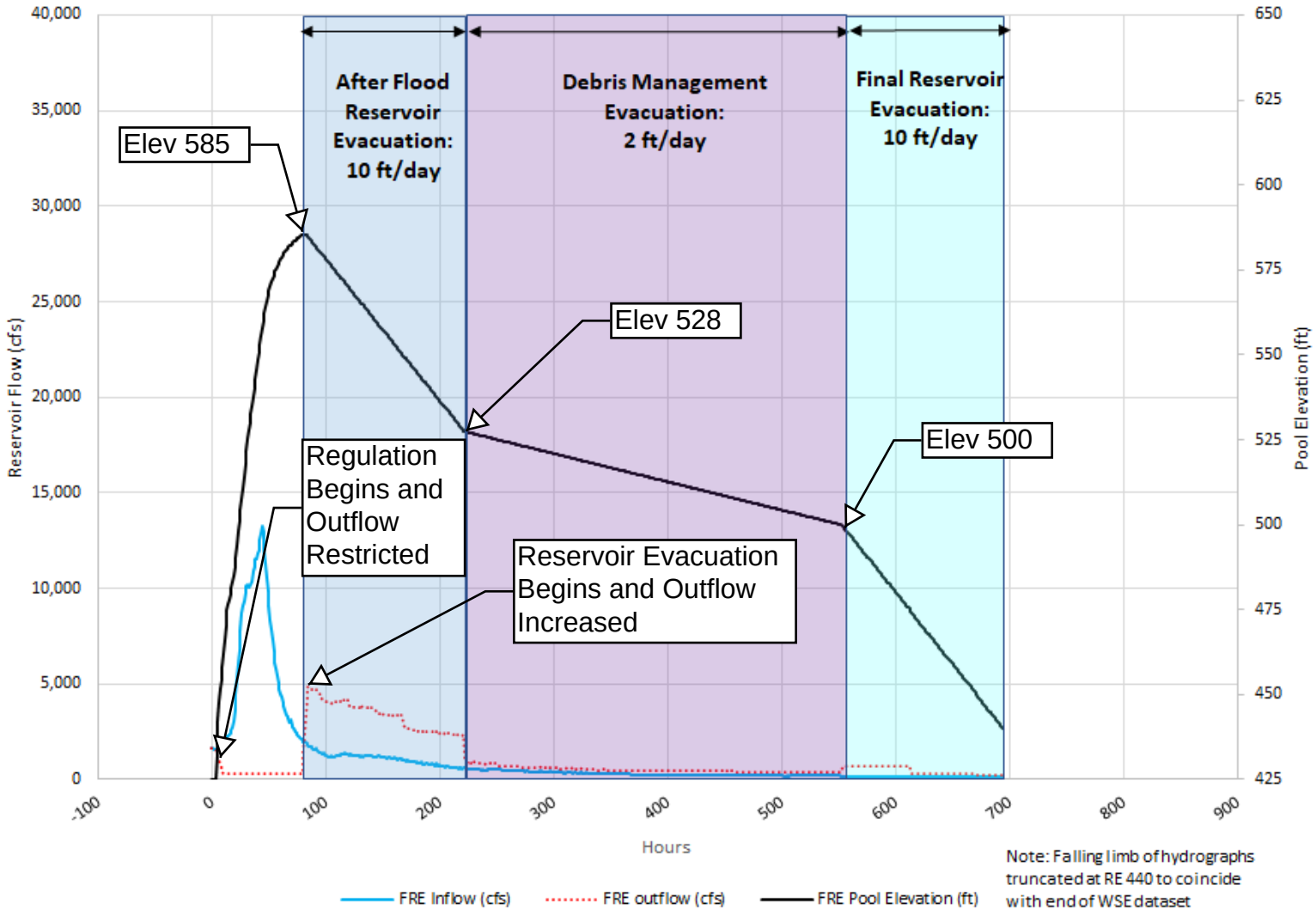
Attachment 2. Hydrographs


10 Year Simulated Event (Source: WSE, 2017)
After Flood Reservoir Evacuation: 10 ft/day
Debris Management Evacuation: 2 ft/day
Final Reservoir Evacuation: 10 ft/day
Elev 568
Elev 528
Elev 500
Regulation Begins and Outflow Restricted
Reservoir Evacuation Begins and Outflow Increased
Reservoir Flow (cfs)
Pool Elevation (ft)
Hours
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
650
625
600
575
550
525
500
475
450
425
0
100
200
300
400
500
600
700
800
900
1,000
FRE Inflow (cfs)
FRE outflow (cfs)
FRE Pool Elevation (ft)
Note: Falling limb of hydrographs truncated at RE 440 to coincide with end of WSE dataset

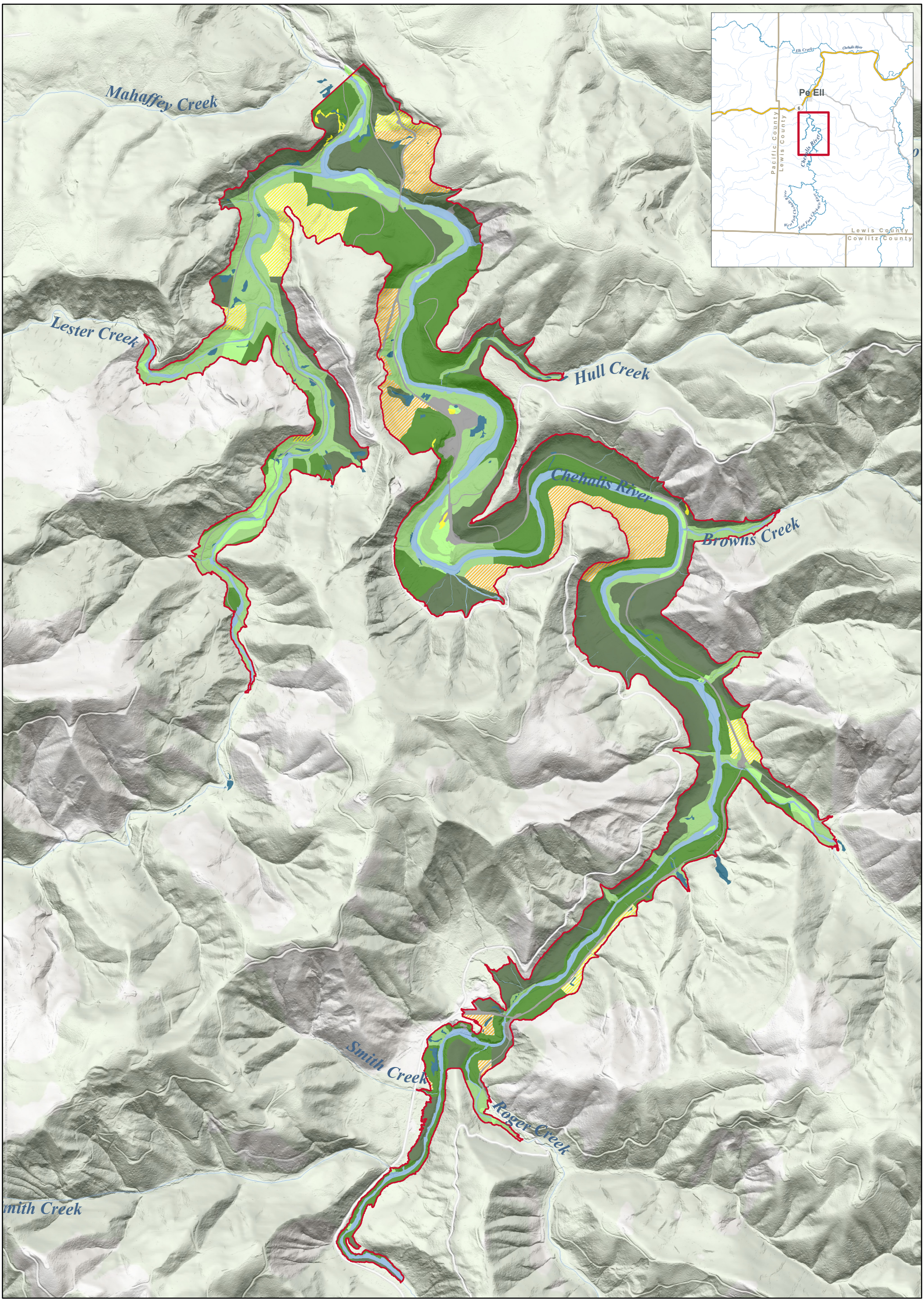

100 Year Simulated Event (Source: WSE, 2017)
Elev 604
After Flood Reservoir Evacuation: 10 ft/day
Debris Management Evacuation: 2 ft/day
Final Reservoir Evacuation: 10 ft/day
Elev 528
Elev 500
Regulation Begins and Outflow Restricted
Reservoir Evacuation Begins and Outflow Increased
Reservoir Flow (cfs)
Pool Elevation (ft)
Hours
FRE Inflow (cfs)
FRE outflow (cfs)
FRE Pool Elevation (ft)
Note: Falling limb of hydrographs truncated at RE 440 to coincide with end of WSE dataset


1996 Simulated Flow Event (2/6/1996 - 3/11/1996; Source: WSE, 2017)
Elev 601
After Flood Reservoir Evacuation: 10 ft/day
Debris Management Evacuation: 2 ft/day
Final Reservoir Evacuation: 10 ft/day
Elev 528
Elev 500
Regulation Begins and Outflow Restricted
Reservoir Evacuation Begins and Outflow Increased
Reservoir Flow (cfs)
Pool Elevation (ft)
Hours
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
650
625
600
575
550
525
500
475
450
425
-100
0
100
200
300
400
500
600
700
800
900
FRE Inflow (cfs)
FRE outflow (cfs)
FRE Pool Elevation (ft)
Note: Falling limb of hydrographs truncated at RE 440 to coincide with end of WSE dataset


2007 Simulated Flow Event (12/1/2007 - 1/4/2008; Source: WSE, 2017)
Elev 620
After Flood Reservoir Evacuation: 10 ft/day
Debris Management Evacuation: 2 ft/day
Final Reservoir Evacuation: 10 ft/day
Elev 528
Elev 500
Regulation Begins and Outflow Restricted
Reservoir Evacuation Begins and Outflow Increased
Reservoir Flow (cfs)
Pool Elevation (ft)
Hours
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
650
625
600
575
550
525
500
475
450
425
-100
0
100
200
300
400
500
600
700
800
900
FRE Inflow (cfs)
FRE outflow (cfs)
FRE Pool Elevation (ft)
Note: Falling limb of hydrographs truncated at RE 440 to coincide with end of WSE dataset


2009 Simulated Flow Event (1/6/2009 - 2/6/2009; Source; WSE, 2017)
After Flood Reservoir Evacuation: 10 ft/day
Debris Management Evacuation: 2 ft/day
Final Reservoir Evacuation: 10 ft/day
Elev 585
Elev 528
Elev 500
Regulation Begins and Outflow Restricted
Reservoir Evacuation Begins and Outflow Increased
Reservoir Flow (cfs)
Pool Elevation (ft)
Hours
FRE Inflow (cfs)
FRE outflow (cfs)
FRE Pool Elevation (ft)
Note: Falling limb of hydrographs truncated at RE 440 to coincide with end of WSE dataset

Attachment 3. Land Cover Map for Study Area



Source: Landcover, FRE Facility - HDR; Streams - DNR; Basemap - ESRI Online; Hillshade - DNR LiDAR Portal

Landcover

- Coniferous Forest
- Mixed Coniferous/Deciduous Transitional Forest
- Deciduous Riparian Forest w/some Conifers
- Deciduous Riparian Shrubland
- Herbaceous/Grass
- Wetland
- Logged, replanted 5-15+ years
- Logged, replanted 0-5 years
- Open Water/Sand Bar
- Terrestrial Bare Ground/Roads
- Streams
- Study Area (WSEL: 628ft)

0 1,000 2,000 Feet

LAND COVER CLASSIFICATION

Chehalis River Basin Flood Damage Reduction Project

Date: 5/6/2020