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Draft Environmental Impact Statement (DEIS)

Proposed Chehalis River Basin Flood Damage Reduction Project

DEIS Comments by Jarred Figlar-Barnes

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To whom it may concern,

My comments focus on four topics affecting and impacting the proposal including; local geology and sediment transport, forest practices, hydrologic and local climate variability, and prior updated scoping comments regarding floodplain restoration.

Local Geology and Sediment Transport:

Using historic satellite imagery provided by Google Earth from September 2009, I mapped all visible landslides that occurred upstream of the proposed flood retention facility (referred to as a ***dam*** throughout the rest of these comments). These landslides appear to be from both the 2007 and early 2009 flood events in the upper Chehalis, and do not appear in earlier satellite imagery from 2006.

I am also submitting, with these comments, a .kmz file that can be opened in Google Earth which contains the map showing the landslides. Included with the map are a rough outline of the proposed temporary reservoir and all major tributaries upstream of the proposed dam, including a rough outline of the dam watershed. The reservoir boundary was drawn in 2015, based on an older proposal with a surface elevation of 680 ft. Evidently, the new elevation is 650 ft. for the FRE design which is slightly smaller in footprint than what I have drawn. However, the boundary I've drawn is still smaller than the proposed FRE-FC design.

From the Google Earth imagery and map, I counted 1,027 landslides and debris flows of varying sizes upstream of the proposed dam. Of these, around 60 occurred within the proposed temporary reservoir, including two large (~44,000 S.Y. and ~54,000 S.Y.) landslides. The significant number and size of the landslides within and above the proposed dam and temporary reservoir suggest the soils overlying bedrock are unstable and highly susceptible to over-saturation. This begs the following questions;

1. When the temporary reservoir is full, it will fully saturate soils overlying the bedrock along the reservoir side slopes. As stated in the DEIS, all trees and vegetation will be removed from this over 800 acre reservoir.
    a. How will soils along the sides of the reservoir be kept from sloughing / sliding into the reservoir bottom?
    b. How will soils upslope of the reservoir be kept in place if/when soils below them (within the reservoir) are eroded away?
    c. What are the likelihoods of large landslides entering the reservoir from the adjacent hillsides?
        i. Could waves generated by such landslides (inland tsunamis) impact the proposed dam facility?
        ii. What design elements ensure safe operation of the facility in the event of overtopping from such an incident?

2. During flood events (like 2007) which would close the dam, it is highly likely significant mass wasting events will occur upstream of the dam, both within and upstream of the temporary reservoir.
    a. Has total sediment load of the river been quantified from past events (such as 2007)?
    b. Using past events, has total sediment load of future events been estimated?
    c. Are significant alluvial sediment deltas likely to form in the inlets of the reservoir during major flood events?
        i. If so, how will this inlet sediment be removed afterwards to preserve reservoir capacity?
        ii. When would this removal be allowed to occur as to not interfere with fish passage, spawning, or juvenile salmonid stages?
        iii. What impacts (environmental or otherwise) would alluvial delta sediment removal have?
        iv. Where would this removed sediment go?
3. As seen by recent dam removals, such as the Elwha River dams, sediment stored in such alluvial deltas tend to be redeposited further into the reservoir by the river during reservoir drawdown. This process can create braided channels over large sediment deposits which result in artificially raised channels if the sediment deposits are not removed. This could lead to, during summertime low-flows, sections of the river within the reservoir bottom going subterranean through these thick deposits;
    a. Will reservoir drawdown be regulated so sediments within the alluvial deltas are not carried further into the reservoir?
    b. If not, how will sediment carried further into the reservoir by the river and tributaries be removed?
    c. If sediment is not removed from the reservoir bottom, how will fish passage during summertime low-flows be maintained if;
        i. Parts of the river become braided (decreasing water depth significantly) due to sedimentation and loss of channel definition (also due to loss of riparian buffers and vegetation)?
        ii. Parts of the river change to sub-surface flow due to sediment accumulation?
    d. If this sediment is removed, what are the costs of this removal?
        i. Are these costs included in the annual maintenance costs provided for the dam?
4. The sediments associated with the significant mass-wasting events of 2007 were both coarse and fine-grained in nature. In future events and as mentioned above, much of the courser grained material will likely be deposited in alluvial deltas at each of the temporary reservoir's inlets. Finer sediments however, will remain suspended in the reservoir for a few days before settling out of the water column in deposits spread across the entire reservoir bottom. As the reservoir is drawn down, wave action (or rain after drawdown) will likely carry deposits along the steep side slopes of the reservoir to the bottom of the slopes. After a few years to decades, these deposits could add up to a significant amount of lost storage capacity.
    a. Has fine sediment deposition quantities been quantified for future flood events based on past events (like 2007)?
    b. Again, how will this sediment be removed?
    c. What impacts (environmental or otherwise) would this sediment removal have?

   d. What are the costs of this removal?
      i. Are they included in the annual maintenance costs provided for the dam?
5. Ultra-fine sediments will likely persist in the reservoir for weeks or months and be gradually carried downstream of the dam. With reduced coarse-grain sediment transport and reduced peak discharge, it's very likely ultra-fine-grained sediments will dominate the river substrate for miles downstream of the new facility. Release of turbid reservoir water long after a flood event has occurred can often be observed downstream of both the Wynoochee and Skookumchuck River Dams.
   a. How much ultra-fine sediment is likely to be allowed to continue downstream?
   b. What impacts will this have on salmonids and gravel spawning habitats?
   c. How many miles of river are likely to be impacted by increased sediment accumulation from reduced peak flows and increased ultra-fine sediment transport?
   d. How will these impacts be mitigated?
6. Reduced peak flows and increased fine sediments could result in significant downstream river channel evolution. Reduced peak flows and more fines can lead to increased fine sediment deposition, which in turn can elevate channel bottoms and decrease channel size as the river adjusts to the new flow regimes. This results in reduced channel capacity for flood waters downstream, potentially increasing localized flooding of farmland closer to the dam.
   a. Are long-term reductions in channel capacity (due to sedimentation) and resulting long-term increases in localized farmland flooding downstream a possibility?
   b. How will channel capacity be maintained downstream?
7. Conversely, loss of coarse-grained sediments can starve the river of replenishing gravels. In areas of steep gradient, this can lead to increased scour and erosion of banks while areas of shallow gradient fill-in with fine-grained sediments, as mentioned previously.
   a. Over the lifetime of the project, which includes the future FRE-FC expansion that results in a permanent reservoir, what are the expected losses in coarse-grained gravel downstream of the dam site?
   b. How will reduced or lost coarse-grain sediment load effect the river channel morphology downstream?
   c. What impacts will this have on salmonid spawning grounds downstream of the dam?
   d. What sections of the river may experience increased erosion due to loss of replenishing coarse-grained sediments?
   e. How will this erosion be mitigated?

Forest Practices:

8. A vast majority of the 1,027 landslides counted in Google Earth occurred within clear-cuts, very young timber stands, and/or along logging roads. It's abundantly clear the forest practices in the upper Chehalis Watershed contributed to significant mass wasting events in 2007 and 2009. The loss of forest canopy also deprived the river system of storage capacity, as significant amounts of water can be held and evaporated by trees, understory vegetation, and top soils anchored by vegetation.[1] A 2004 study by the University of Idaho found interception of rainfall in an old-growth Douglas-fir and western hemlock ecosystem was around 22% of gross precipitation, and

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[1] https://www.fs.fed.us/psw/publications/documents/psw_gtr018/psw_gtr018.pdf

could range in coniferous canopies from 9-48% of gross precipitation.[2] According to a 2009 study done in the coastal redwoods of Northwest California, between 10% and 40% of precipitation from a large rain event can be stored and evaporated by mature forest canopies and understory vegetation[3]. The same study found at least 22% of precipitation was intercepted and evaporated by the 120 year old redwood forest. The study estimates if the forest was clear-cut, **it would result in an increase in effective annual rainfall of 20-30%,** and that much of this increase would occur during large storms. It could therefore be inferred that if the watershed upstream of the proposed dam was completely forested as it had historically been, the peak flows from large rain events such as 2007 would have been reduced by a significant amount, likely at least 10% if not more.

As such, a sustainable, non-structural alternative to the dam could be to buy all forest lands above the proposed dam location, put to bed most of the logging roads, and restore the forest lands to prior-settlement conditions (i.e. a coastal range temperate rainforest). The new public land would be set aside for permanent land conservation. Importantly, such an alternative would preserve mainline logging roads for public recreation, fishing, and hunting access.

Based on the watershed I delineated in Google Earth, the area of land upstream of the dam is equal to approximately 43,972 acres, though round up to 44,000 acres to be safe. The average cost for timberland in Lewis County is $4,248 per acre[4]. Multiplying the two together gives you a total cost for land of $191,160,000 which rounds to $200 million. Add another $200 million for logging road abandonment and restoration, and probably another $100 million for forestland restoration (planting other native trees and vegetation besides commercial timber to better mimic the historic temperate rainforest) and you get a total project cost of around $500 million. This is a high clip estimate, and may be an overestimation as much of the reforestation could occur through natural succession.

a. Has the above alternative, which results in full secession of timber harvests in the upper watershed of the Chehalis, been considered as an alternative to the proposed dam?
b. Based on this alternative, of a fully restored mature forest in the watershed above the proposed dam, what would be the long-term reductions in peak stream flow associated with such a land use change?
c. What benefits would such alternative have on salmonid and other aquatic species?
d. What other benefits would such an alternative have?
    i. Specifically, would such an alternative reduce the long term impacts of climate change on the upper watershed?
    ii. What impacts would this have on stream temperatures?
    iii. What about water retention and flows during the summer months?

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[2] From ScienceDirect, *"The dynamics of rainfall interception by a seasonal temperate rainforest,"* 2004 University of Idaho Report, see: https://www.fs.fed.us/pnw/pubs/journals/pnw_2004_link001.pdf

[3] From Journal of Hydrology, *"Rates, timing, and mechanisms of rainfall interception loss in a coastal redwood forest,"* 2009 report, see: https://www.fs.fed.us/psw/publications/4351/Reid2009.pdf

[4] Value from *"Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species,"* Report, Page 114, Table H-1, *'Timberland Sold in 2011 in Lewis County'*; https://chehalisbasinstrategy.com/wp-content/uploads/2015/09/Comparison-of-Alternatives-Report_Final.pdf

   e. What would the net cost of such a land use change be (loss of timber revenue) when compared to the potential benefits and flood-related infrastructure and economic damages incurred by a do-nothing alternative?
   f. Would transitioning to selective harvesting of a largely intact forest canopy be a viable alternative to a complete secession of harvests?
      i. Alternatively, what about a longer rotation regime for timber harvesting?
      ii. Or a moratorium on harvesting timber on over-steep slopes?

Hydrologic and Local Climate Variability:

9. The proposed dam project's effectiveness assumes future rain events similar to those which caused the 2007 floods and in the same general location. This is a false dichotomy of sorts, in that future rain events are not limited to the same geographic location or intensity. In fact, there have been numerous significant flood events on the South Fork Chehalis River, Newaukum River, and Skookumchuck River that were caused by rain events focused on other parts of the Chehalis basin but still led to significant flood damages. The DEIS states the dam would only reduce flooding along I-5 (at Mellen Street) by 1 ft.[5]
   a. How will the proposed dam prevent flooding of these other rivers if/when a 2007 type rain event occurs **within their respective watersheds**?
   b. Could these other rivers still result in a 2007 size flood event (flooding I-5, Centralia & Chehalis) even with the proposed dam and levee in operation?
      i. If so, what are the probabilities of such events occurring compared to an exact repeat of the 2007 flood?
      ii. If so, how feasible and economically viable is the current proposal if the same level of flooding and flood damage can occur from adjacent rivers in the basin?
   c. How will this proposed flood reduction project prevent flooding on the other major rivers in the Chehalis Basin, specifically those in the lower basin when rain events comparable to 2007 occur in those watersheds?
10. It is common for storm systems to hit Western Washington in a series, with breaks of less than a day or up to a week, between large systems. Such storms individually do not necessarily cause significant flooding, but cumulatively they can. Should the proposed dam be closed and its reservoir filled up by the first of a series of storms, until the reservoir is drained, it's effectiveness to stop flooding of the Chehalis would be significantly reduced.
    a. What is the likelihood of the reservoir being full when another major rain event occurs?
    b. How effective would the proposed dam be at stopping the latter rain events of a storm series if its reservoir is already full?
    c. If a series of storms is forecasted, and the first one causes the proposed dam to close, would the reservoir be kept from filling up entirely so it would have additional storage capacity for the remaining forecasted storms?
       i. If not, would the dam actually have any impact on downstream flooding from the remaining storms if all its storage capacity is already used up?
       ii. If so, what would be the reduced effectiveness of the dam against the first storm, and of the future storms?

[5] From DEIS *Appendix 1: Project Description*, page 1-11.

11. Can the word “Upper” be put in front of the current project title of “Chehalis River Basin Flood Damage Reduction Project”? The proposed dam is situated entirely in the Upper Chehalis Basin, and has little to no significant flood damage reduction benefits in the lower basin, even if an exact repeat of the 2007 flood occurs.

Prior Updated Scoping Comments Regarding Floodplain Restoration:

Instead of a dam, could the same or more flood storage, in acre feet, be created in the Chehalis river valley by restoring the river floodplain back to wetlands and riparian forest? I.e., buying farmlands next to the river that were historically riparian zone and riverine wetlands and restore the land back to those conditions (excavating down the valley so it holds more water and creates wetlands and fish habitat). This is different than river dredging, as the storage you are creating is located in the floodplain, not the river itself. The Chehalis River and its tributaries are incised throughout the basin due to sluice logging and past dredging, so lowering the floodplain to the rivers level would significantly increase flood capacity while creating significant amounts of new habitat for salmonids and other fish and wildlife. It would also help reduce river velocity, allow river meandering, protect adjacent farmland, preserve a free-flowing mainstem Chehalis, and eliminate the need for expensive structures and long-term maintenance.

For example, assuming an equal amount of flood storage as the dam, 65,000 acre feet of storage is roughly equivalent to 6,500 acres of floodplain excavated down by an average of 10 ft. The average cost for farmland in the floodplain is around $3,829 per acre,[6] so 6,500 acres is roughly $24,888,500 million. However, rounding up to $50 million would be a more accurate assessment to account for unwilling sellers or bargaining.

For excavation and haul, assume a low unit cost of $5 or $10 per cubic yard for such a large quantity. 6,500 acres at 10 ft. excavation is 2,831,400,000 C.F. or 104,866,667 C.Y., and at $5 per cubic yard, you would be looking at around $524,333,333 for excavation. Assuming this quantity is broken into smaller projects / phases, and for each project you want to include mobilization, taxes, and other items not included, you’d be looking at around $1 billion total cost including cost of land. This is only slightly higher than the proposed dam cost, minus the cost for maintenance, operations, fish passage and future expansion. Further, this floodplain storage could be spread out over more of the floodplain, protecting against flood events not localized to the dam location.

It’s worth noting 6,500 acres of floodplain is approximately 4% of the total farmland in the river valley according to the flood authority, which states there is approximately 257 square miles of farmland in the river valley, or 164,480 acres of farmland[7] (6,500 acres divided by 164,480 acres is roughly 4%.). Excavating deeper in areas that allow it would reduce the overall farmland needed, or provide more storage than the current dam proposal would provide and over a larger area. Point is, for a similar cost to a dam, you can create the same amount of flood storage in the valley while also creating thousands of acres of riverine wetlands and riparian zone, which would be a massive boon for water quality and salmonids in the basin.

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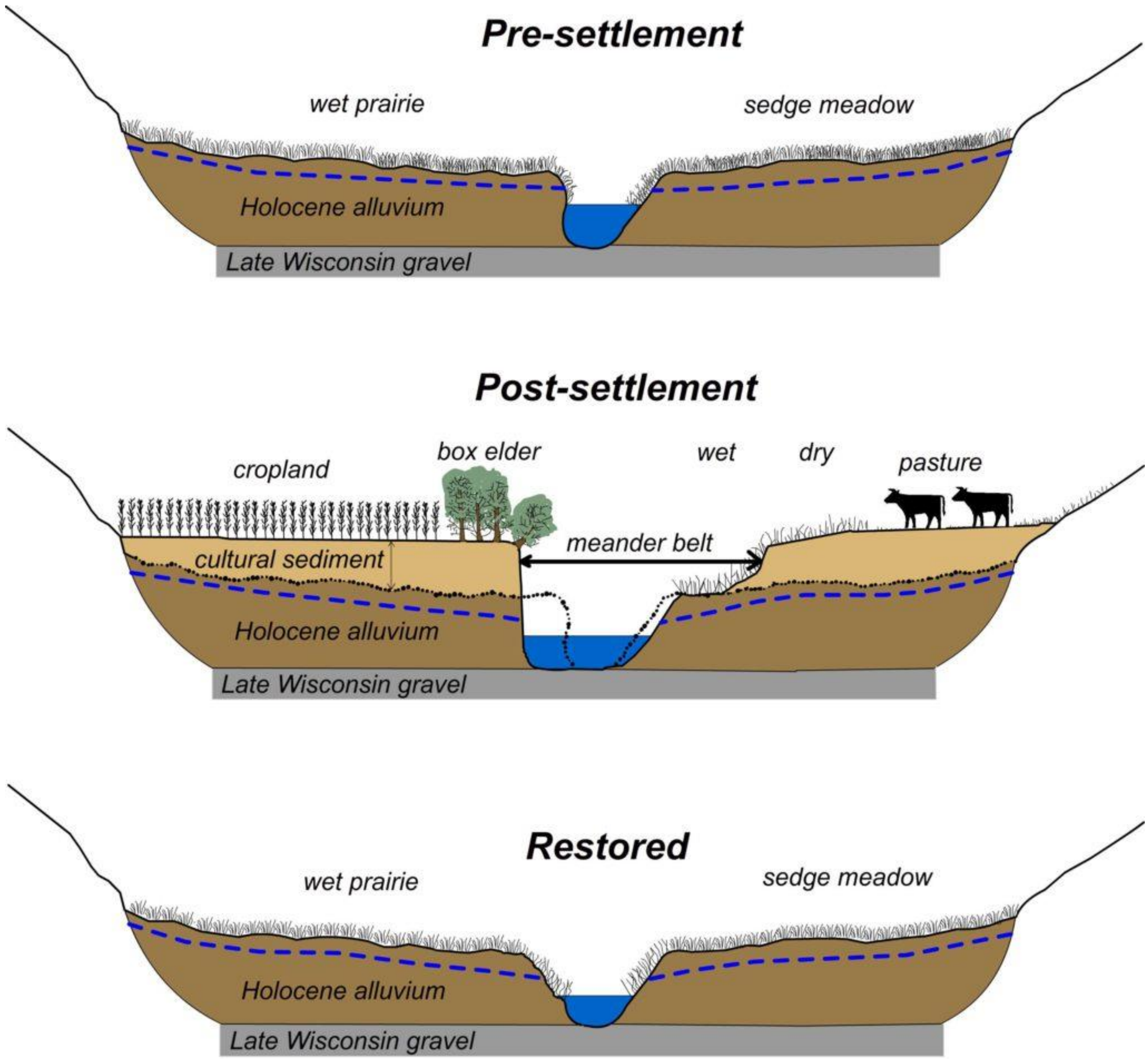
[6] Value from *“Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species,”* Report, Page 114, Table H-2, *‘Land For Sale in Lewis County’*; https://chehalisbasinstrategy.com/wp-content/uploads/2015/09/Comparison-of-Alternatives-Report_Final.pdf
[7] https://www.ezview.wa.gov/site/alias__1492/administration_background/27536/background.aspx

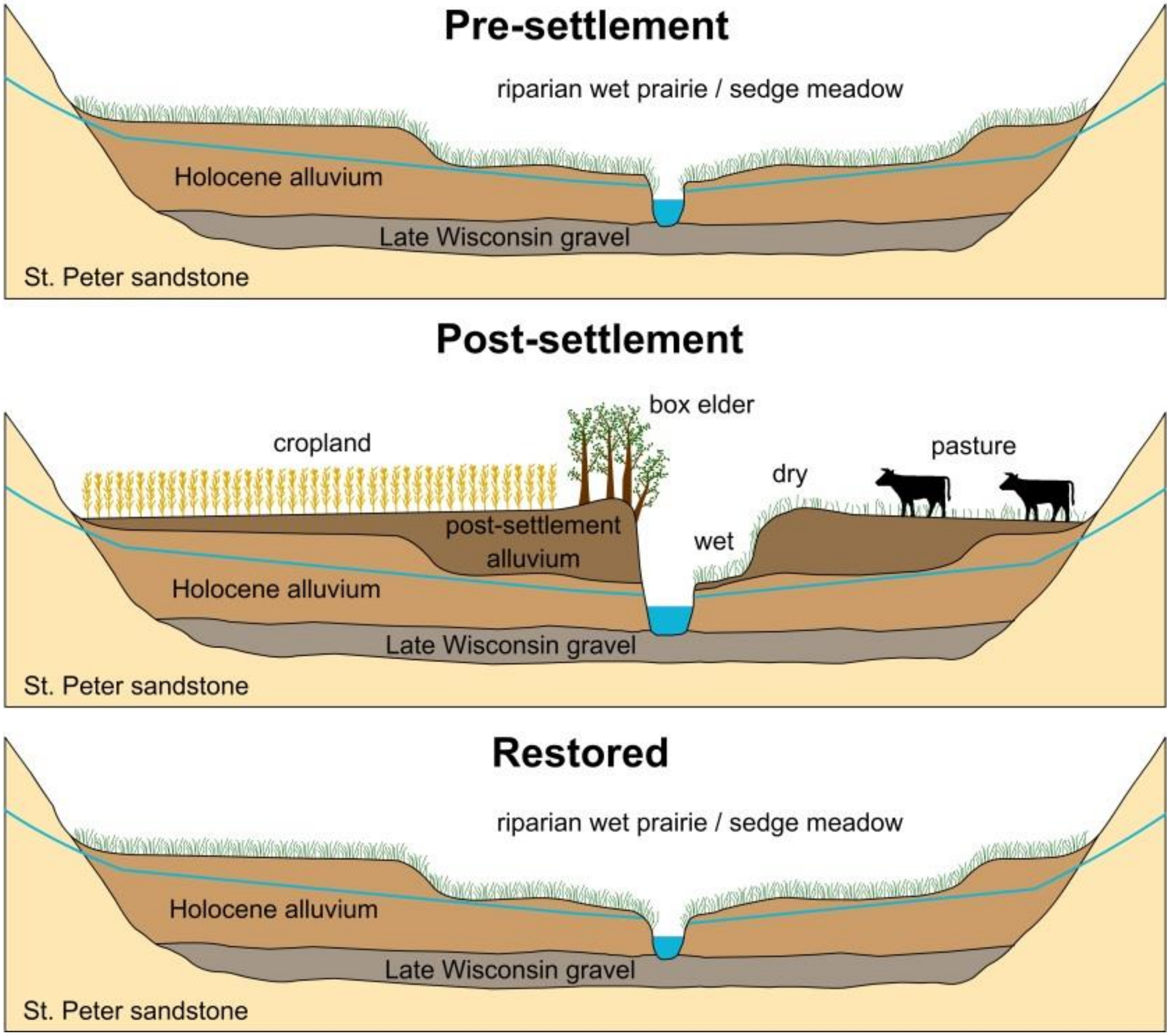
So, with all of that said, has this alternative been considered? If not, why? And can it be considered as an alternative to the dam?

See the below for cross section examples of floodplain restoration taken from another part of the country, however the principles are the same:



[8]

[8] https://hydroecology.cee.wisc.edu/research/east-branch-pecatonica-river-restoration-observatory/restoration/



[9]

[9] https://serc.carleton.edu/details/images/36342.html

DRAFT COMMENT LETTER (UPDATED FOR 2025 REVISED DRAFT EIS)

To:
Washington State Department of Ecology
Attn: Meg Bommarito, EIS Project Manager

Re: Comments on Revised Draft EIS for the Proposed Chehalis River Basin Flood Damage Reduction Project (Publication No. 25-06-008)

Dear Ms. Bommarito and Ecology Staff,

My name is **Jarred Figlar-Barnes**, and I am a **Transportation Engineer III at WSDOT commenting as a private Chehalis Basin resident** who has followed the Chehalis River flood and dam discussions closely since before the 2007 and 2009 floods. I previously submitted detailed technical comments on the **2020 SEPA Draft EIS** for the earlier iteration of this project. These comments update and refine my 2020 submittal in light of the **2025 Revised Draft EIS** and related technical documents.

Ecology's own summary of the Revised Draft EIS states that construction and operation of the proposed flow-through dam and temporary reservoir would **significantly and negatively impact** fish, aquatic and terrestrial habitats, recreation, earth, water, transportation, wetlands, land use, tribal and cultural resources, environmental health and safety, environmental justice, and utilities, and that even with mitigation, many impacts remain **significant and unavoidable with substantial uncertainty about mitigation feasibility**. ([Washington State Department of Ecology]())

Given that, my comments focus on five areas where I believe the Revised Draft EIS remains incomplete or unclear:

1. **Expandable dam design and potential future reservoir expansion**
2. **Landslides, slope stability, and inland-tsunami risk in the temporary reservoir**
3. **Sediment transport, geomorphic change, and long-term fish habitat**
4. **Hydrologic limits, climate change, and residual flood risk (including induced development)**
5. **Alternatives: Local Actions / LAND and basin-wide floodplain + forest management**

In each section below, I provide a short rationale and then **specific questions** I request Ecology and the project proponents to answer in the Final EIS.

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1. "Flood Retention Expandable" Design and Future Expansion (Segmentation Concern)

The project is still formally described as a **Flood Retention Expandable (FRE)** facility with a temporary reservoir and associated airport levee improvements. (Washington State Department of Ecology)

The **Revised Project Description Report** prepared for the Flood Control Zone District describes two alternatives: a Flood Retention Expandable structure (FRE) and a smaller "flood retention only" structure (FRO). That report states that the FRO would use a **smaller foundation and would not include a design allowance for future expansion**, whereas the FRE is sized to **retain the option of a larger "future condition" storage capacity (FRE-FC)**.

Earlier NEPA and SEPA documents, and now Appendix 1 of the 2025 Revised Draft EIS itself, explicitly acknowledge that the FRE facility is "expandable." The structure would be built with foundations and hydraulic structures sized so as not to preclude expanding storage from its current design capacity of up to 62,000 acre-feet to roughly 130,000 acre-feet in the future, with any expansion to be evaluated in a separate environmental review. (Chehalis Basin Strategy)

While Appendix 1 acknowledges this potential future expansion and states it would undergo a separate environmental review, the Revised Draft EIS does not meaningfully analyze the cumulative and reasonably foreseeable impacts of that larger "future condition" reservoir, despite building the FRE to preserve that option.. (Washington State Department of Ecology)

Given Washington's SEPA requirements to avoid piecemeal or segmented review of foreseeable project phases, this is a critical issue.

Questions:

1. **Does the revised FRE design still intentionally include foundation sizing, structural provisions, or "design allotments" that would enable a future expansion of flood storage capacity (FRE-FC) or conversion to a more conventional permanent reservoir?**
    - If yes, **where in the Revised Draft EIS and appendices** are the environmental consequences of this "future condition" evaluated, including effects on fish, geomorphology, reservoir sedimentation, water quality, slope stability, and tribal resources?
2. If the FRE design does **not** in fact preserve an expansion option any longer, **why is the facility still named and described as "Flood Retention Expandable" in the project documentation**, and where is that design change clearly documented for the public record?
3. Under SEPA, agencies must analyze the **entire proposal**, including clearly foreseeable future phases. **How has Ecology determined that any potential FRE-FC expansion is not a "reasonably foreseeable" future action**, given that:
    - The current facility is labeled "Expandable" and
    - Prior EIS documents describe a specific "future condition" with approximately double the storage volume? (Chehalis Basin Strategy)
4. In the absence of a full FRE-FC analysis, **would Ecology require a completely new SEPA/NEPA EIS if the Flood Control Zone District or another sponsor later**

proposed to increase the reservoir size or convert it to a long-term storage facility? If so, **how is that commitment documented**?

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2. Landslides, Slope Stability, and Inland-Tsunami Risk in the Temporary Reservoir

In my 2020 comments, I documented—based on my own mapping of the 2007 storm using LiDAR and Google Earth—that **hundreds to over a thousand landslides** occurred in the upper Chehalis Basin during that single event, including multiple large slides within the footprint of the proposed reservoir. This qualitative observation is now broadly confirmed by Ecology's Earth Discipline Report, which notes that **extreme rainfall in the 2007 storm produced more than 1,000 landslides in the Chehalis Basin** and that there are **existing shallow landslides within the temporary reservoir area**. (Office of Chehalis Basin)

The **Revised Draft EIS's Cumulative Impacts Appendix** explicitly states that changing water levels in the temporary reservoir during FRE operations could trigger landslides, and that a landslide while water is impounded **could generate a wave that impacts or even overtops the dam.** (Ecology Apps)

A 2021 **Reservoir Evacuation Operations Plan** indicates that once the temporary reservoir's water surface elevation reaches about **500 feet**, the drawdown rate would increase to **10 feet per day** until the pool returns to the approximate normal river condition. (Chehalis FCZD)

Mitigation planning documents from 2024 also acknowledge that the **post-first-inundation condition of reservoir slopes is "uncertain" due to potential sloughing, landslides, and sedimentation**, to the point where even revegetation strategies for the inundation zone are being questioned. (Chehalis FCZD)

Despite these acknowledgements, I still see major unanswered questions about **slope stability**, **"inland tsunami" waves**, and **long-term loss of storage** from slope failures and rapid drawdown effects.

2.a Saturation of Steep Slopes and Loss of Soil Cohesion

The temporary reservoir would periodically saturate thin soils on very steep hillslopes that overlie bedrock, including fully forested slopes. When full, reservoir water would extend partway up many of these slopes, increasing pore pressures and reducing effective stress in soils near the waterline.

Questions:

5. **What factors of safety were calculated for slopes within the temporary reservoir footprint under:**
    - (a) saturated, full-reservoir conditions, and

- (b) during and after rapid drawdown?

Please identify the range of slope angles, soil depths, rooting depths, and geologic units analyzed.

6. **How many mapped landslides (existing features) within the reservoir area were included in detailed stability analyses, and what criteria were used to select them?** The 2020 NEPA Geology Discipline Report identified 27 slides as large enough to affect storage capacity, but more than 1,000 landslides occurred in the 2007 event basin-wide. (Office of Chehalis Basin) How many such features are now recognized as relevant for the revised reservoir area?
7. **Has Ecology required an updated, basin-wide landslide susceptibility or hazard map for the reservoir area** that:
    - Includes both the slopes directly inundated and the hillslopes above the maximum pool elevation, and
    - Incorporates projected future storm intensities under climate-change scenarios, rather than assuming historical rainfall only?

2.b Rapid Drawdown and Slope Failure Risk

The operations plan calls for drawdown rates up to **10 feet per day** once the reservoir reaches certain elevations. (Chehalis FCZD) As you know, rapid drawdown is a classic trigger of slope failure because external water pressure is removed faster than pore pressures dissipate within saturated soils.

Questions:

8. **Which methods were used to evaluate slope stability under rapid drawdown conditions, and what specific drawdown rates (ft/day) were modeled in the Revised Draft EIS?**
9. **Has Ecology evaluated whether the proposed maximum 10-ft/day drawdown rate is compatible with slope stability for the full range of soil types and slope geometries present in the reservoir area?** If so, **what is the documented margin of safety**, and under which storm sequences (single major event, back-to-back floods, etc.)?
10. **Was a slower drawdown alternative (e.g., 2–5 ft/day) modeled to compare landslide risk vs. flood-risk reduction, and where are those results presented?** If such analyses were not performed, **why not**, given that the Cumulative Impacts Appendix explicitly acknowledges drawdown-related landslide and wave/overtopping hazards? (Ecology Apps)

2.c Landslide-Generated Waves and Dam Overtopping

The Cumulative Impacts Appendix recognizes that **a landslide into the temporary reservoir could generate a wave that impacts or overtops the dam**. (Ecology Apps) Globally, it is well-documented that landslide-generated waves in reservoirs can be catastrophic even when the slide volume seems modest.

Questions:

11. **What specific landslide volumes, runout distances, and impact configurations were modeled to estimate landslide-generated wave heights in the reservoir?**
12. **What is the design-basis landslide scenario used for dam freeboard and structural safety (e.g., a slide of X cubic yards at Y location on the pool margin)?**
13. **How many distinct wave scenarios (different slide locations and volumes) were modeled, and what were the resulting maximum wave runup heights at the dam face?**
14. **Do the Revised EIS and associated design documents evaluate the compound risk of:**

- A near-full reservoir under a major or catastrophic flood scenario *combined with*
- A landslide-generated wave,

and if so, **what is the residual probability of overtopping under that combined scenario over the project's 50-year operating life?**

15. **How much storage capacity is projected to be lost over the 50-year operations period due to:**

- (a) landslide deposits, and
- (b) progressive bank retreat and sloughing,

and how does this loss affect the dam's long-term ability to actually achieve its stated flood-reduction objectives?

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3. Sediment Transport, Reservoir Deposition, and Downstream Habitat

The FRE facility would temporarily store up to roughly **60–65,000 acre-feet** of water during major events, based on both prior NEPA analysis and figures in Appendix 1 of the Revised Draft EIS. (Ecology Apps) As a result, it will intercept and trap substantial volumes of **coarse bedload and suspended sediment** during the very events that currently drive channel migration, floodplain reconnection, and spawning-gravel recruitment in the upper Chehalis.

Earlier NEPA and technical reviews (including those by the Quinault Indian Nation) concluded that the original sediment and geomorphic analysis **underestimated sediment inputs from both chronic erosion and landslides**, and therefore likely **understated long-term geomorphic impacts** and potential loss of salmonid habitat downstream. (Chehalis Dam DEIS Quinault Comments)

The Revised Draft EIS summary confirms that there would be **significant and unavoidable adverse impacts on fish, aquatic habitats, wetlands, and related resources**, even with mitigation proposals. (Washington State Department of Ecology)

Questions:

16. **What proportion of coarse bedload and sand-sized sediment (by volume or mass) does the Revised Draft EIS project will be trapped in the temporary reservoir under:**

- Major flood operations
- Catastrophic flood operations
- Recurring annual floods (if any water is stored)?

Please provide separate estimates for **bedload**, **sand**, and **finer silts/clays**, and identify where in the EIS these numbers appear.

17. **How are landslide contributions to sediment (both catastrophic slides and more frequent smaller failures) represented in the sediment budget and reservoir deposition modeling in the Revised Draft EIS?**

- Are the more than **1,000 landslides** from the 2007 storm explicitly used to calibrate localized sediment yield and slope behavior, or are generic basin-scale assumptions used instead? (Office of Chehalis Basin)

18. **Has Ecology required updated sediment and geomorphic modeling that explicitly responds to the deficiencies identified in the 2020 NEPA Geology and Ecosystems technical reviews**, and if so, **where are those responses and updated model results documented in the Revised Draft EIS?** (Chehalis Dam DEIS Quinault Comments)
19. **What is the projected long-term effect of the FRE facility on:**

- (a) downstream spawning-gravel recruitment,
- (b) channel migration and floodplain reconnection, and
- (c) large woody debris transport,

particularly under climate-change scenarios where higher peak flows are expected?

20. **Does the Revised Draft EIS quantitatively compare geomorphic and habitat outcomes between the FRE project and the Local Actions Alternative (LAND) and No-Action Alternative**, and if so, **where can the public see a clear side-by-side comparison of those outcomes for salmonid habitat?**

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4. Hydrologic Limits, Climate Change, and Residual Flood Risk

Ecology's public summary states that under the proposal, the river would flow freely through the dam except during **major or catastrophic floods** triggered by heavy rainfall in the Willapa Hills, when the gates would close to temporarily store water and reduce flood peaks **from Pe Ell to Centralia**. (Washington State Department of Ecology) It also explicitly notes that:

- The project **“is not intended to address flooding in all parts of the Chehalis River basin”** and
- It **“would not stop regular annual flooding.”** (Washington State Department of Ecology)

The Revised Draft EIS integrates climate change into its analysis and recognizes that **floods will become more frequent and more dangerous** and that climate change will put **native fish runs at higher risk**. (Washington State Department of Ecology)

Given this, it is crucial that the EIS clearly describe what **residual flood risk** remains after the dam and levee are built, particularly for:

- Lower-basin communities (Chehalis downstream through Grays Harbor)
- The **I-5 corridor** near the Skookumchuck and Newaukum confluences
- Areas affected by **backwater flooding**, tide, and sea-level rise

Questions:

21. **Does the Revised Draft EIS provide clear maps or tables showing which communities and infrastructure segments would *not* see meaningful flood-risk reduction from the FRE + airport levee project under the Major, Catastrophic, and Recurring flood scenarios?** If so, **where**?
22. **How does the project perform under sequences of multiple large storms within a single wet season**, where:

- The reservoir may already be partially or fully filled from a prior event, and
- Additional inflows arrive before the reservoir has fully evacuated?

Specifically, **what is the modeled probability that the FRE will have insufficient operational storage to meaningfully reduce a second or third major flood within the same year under future climate conditions?**

23. For the **I-5 corridor**, which is repeatedly cited as a key justification for large-scale flood investments in the basin, **what flood depths and closure durations are projected with and without the FRE facility under the three scenarios**, and **how do those projections compare to non-structural + Local Actions / LAND scenarios at similar or lower cost?**
24. **Does the Revised Draft EIS include any analysis of induced development or “moral hazard”**—that is, new or intensified development in the Centralia/Chehalis floodplain that may be encouraged by a perceived reduction in flood risk once the dam is built?

- The **LAND study** notes that much of the damage from recent major floods occurred precisely where **central cities have developed more heavily within the floodplain**. (Office of Chehalis Basin)
- If induced development is not explicitly analyzed, **why not**, given that flood-control structures often historically lead to increased exposure and long-term societal risk?

25. **How has sea-level rise, changing tidal dynamics at Grays Harbor, and potential backwater effects been incorporated into the hydrologic modeling**, especially for communities downstream of Centralia/Chehalis who would see **no direct benefit** from the FRE storage but could be affected by changed flood timing and magnitude?

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5. Fish, Aquatic Life, Tribal Resources, and Environmental Justice

Ecology's Revised Draft EIS summary concludes that the FRE project would have **significant and unavoidable adverse impacts** on:

- Fish and aquatic habitats
- Terrestrial habitats and wetlands
- Land use
- **Tribal and cultural resources**
- **Environmental health and safety and environmental justice**, among others. (Washington State Department of Ecology)

The summary also notes that **mitigation measures have been proposed but their effectiveness and feasibility are uncertain**, and that the EIS did **not** evaluate whether these measures would actually offset impacts. (Washington State Department of Ecology)

The Chehalis Basin's salmon runs are already in severe decline, and climate change is expected to further increase water temperatures, alter flows, and stress cold-water species. (Washington State Department of Ecology) Tribal nations, including the Quinault Indian Nation, have previously submitted extensive technical comments documenting that upstream storage and associated thermal/flow changes would substantially increase extinction risk for certain fish populations. (Chehalis Dam DEIS Quinault Comments)

Questions:

26. **Where in the Revised Draft EIS can the public find a quantitative, species-by-species assessment of changes in extinction risk or population viability for key salmonid species (e.g., spring Chinook, steelhead, coho) under:**

- No Action
- FRE + airport levee
- Local Actions / LAND?

27. **Has Ecology or the project proponent defined any explicit "fish viability" or "no-net-loss" thresholds beyond which the project would be considered incompatible with basin recovery goals?** If yes, **what are those thresholds**, and **how does the FRE project perform relative to them?**

28. **Given that Ecology's own summary states the project would significantly and negatively affect tribal and cultural resources and environmental justice**, has Ecology evaluated a **tribal-centered alternative** focused on:

- Large-scale floodplain reconnection,
- Headwaters forest and road management, and
- Voluntary buyouts + safe-structure programs,

without constructing a major dam? If not, **why is such an alternative absent from the alternatives analysis**, given SEPA's emphasis on reasonable alternatives?

29. **What specific measures, if any, would automatically trigger changes in dam operations or even decommissioning if fish populations continue to decline despite mitigation?**

- For example, is there any **binding operational requirement** tied to observed salmon survival metrics, or is fish protection left primarily to non-binding adaptive-management language?

30. **How does Ecology reconcile endorsing further evaluation of an FRE dam whose own EIS finds significant and unavoidable adverse impacts to fish, tribal resources, and environmental justice, with the Chehalis Basin Strategy's stated dual goals of flood-damage reduction *and* aquatic ecosystem restoration?** (Washington State Department of Ecology)

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6. Alternatives: Local Actions / LAND, Forest Management, and Floodplain Restoration

The Revised Draft EIS includes a **Local Actions Alternative**, which Ecology's summary describes as "localized and nonstructural actions that could help retain floodwaters and reduce flood-related damage." (Washington State Department of Ecology) The **Local Actions Non-Dam Alternative (LAND)** planning effort has since produced a multi-project conceptual portfolio, with a planning-level cost range reported on the order of **$850 million to $1.5 billion (inclusive of contingencies)**—broadly comparable to publicly reported cost ranges for the FRE facility when realistic contingencies and escalation are considered. (Ecology Apps)

The LAND report also notes that substantial flood-damage reduction could be achieved by **increasing floodplain storage, roughness, and connectivity** and by better **managing development in high-risk areas**—approaches that could be more easily scaled and adapted under climate change. (Ecology Apps)

In my 2020 comments, I outlined a conceptual **floodplain-excavation and reconnection strategy** combined with buyouts and relocation of critical farmland and structures to higher ground, as a potential non-dam alternative. Much of that conceptual logic (distributed storage, floodplain reconnection, avoiding induced development) remains valid and appears broadly consistent with what LAND is now exploring.

Questions:

31. **Where in the Revised Draft EIS are the Local Actions and No-Action Alternatives compared to the FRE proposal in terms of:**

- Expected **flood-damage reduction** (for homes, businesses, farms, and I-5),
- **Fish and aquatic habitat outcomes**, and
- **Tribal and environmental-justice impacts**,

on a **side-by-side, basin-wide basis**?

32. **Has Ecology directed the project proponents or the Chehalis Basin Board to develop a fully engineered, shovel-ready non-dam alternative (building on LAND) to a comparable level of design and cost certainty as the FRE dam, so that the Legislature can make a truly informed choice between structural and non-structural approaches?** If not, **why not?**
33. **How do the risk profiles of FRE vs. Local Actions / LAND compare under aggressive climate-change scenarios**, in terms of:

- Residual flood risk,
- Flexibility to adapt or scale measures, and
- Irreversibility of environmental harm (e.g., dam footprint vs. reversible land-use and floodplain measures)?

34. **Have headwaters forest management, road decommissioning, and reforestation been quantitatively evaluated as part of any alternative**, given the documented role of commercial timberlands in generating thousands of landslides during the 2007 event and contributing to both flood and sediment hazards? (Cascade PBS)
35. **Would Ecology consider requiring a more detailed, basin-wide "Restoration + Local Actions" alternative—combining LAND, headwaters forest hydrology measures, aggressive floodplain buyouts, and safe-structure programs—as a condition for any further advancement of the FRE proposal?** If not, please explain how the current alternatives analysis fully satisfies SEPA's requirement to consider a reasonable range of alternatives that could meet project objectives with less environmental harm.

Closing

Ecology's own Revised Draft EIS summary makes it clear that the proposed FRE dam and airport levee project would cause **significant, unavoidable, and in many cases uncertain impacts** to a wide range of environmental and cultural resources, even while climate change continues to increase flood and fish risks. (Washington State Department of Ecology)

Given the magnitude, cost, irreversibility, and cross-generational implications of this decision, I respectfully request that Ecology:

- Provide clear, detailed answers to the questions above in the **Final EIS**;
- Ensure that any **future expansion potential (FRE-FC)** is transparently addressed in a manner consistent with SEPA's prohibition on segmented review; and
- Seriously consider whether a **non-dam, basin-wide restoration and local-actions alternative**—developed to a comparable level of engineering and cost detail—could better meet the basin's long-term flood-resilience and salmon-recovery goals with less irreversible harm.

Thank you for the opportunity to comment on the Revised Draft EIS and for your work on behalf of the Chehalis Basin's communities and ecosystems.

Sincerely,
Jarred Figlar-Barnes
