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FEASIBILITY ANALYSIS
SR 207 Realignment
Nason Creek Floodplain

Submitted to
Yakama Nation Fisheries

August 2021

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1.0 INTRODUCTION

1.1 Project Background and Need

The Yakama Nation Upper Columbia Habitat Restoration Project (UCHRP) has partnered with the Washington State Department of Transportation (WSDOT) for a project along Nason Creek between river mile 3.2 and 4.6, along State Route 207 in the vicinity of MP 0.15 to MP 1.00.

In 2018, the UCHRP and WSDOT Determined that Lower Nason Creek was a high priority area for restoration actions. Developing salmon and steelhead habitat restoration projects could benefit both endangered salmon species and the SR 207 roadway.

UCHRP worked with their engineer to develop restoration concepts in 2019 that showed a potential beneficial project for Nason Creek that could retain the existing alignment of SR 207. However, they recently developed a new concept idea that would reroute approximately one mile of SR 207 around the historical Nason Creek floodplain to both improve aquatic habitat conditions and protect roadway infrastructure.

The UCHRP hired Perteet Inc. to perform and preliminary design and feasibility analysis for rerouting the highway away from the Nason Creek as shown in the vicinity map below, staying within United States Forest Service (USFS) parcel boundaries.

This analysis presents three alignment alternatives, meeting WSDOT design standards that could be refined into a roadway construction project.

1.2 Project Goals

The main goals for this analysis were to develop three alternatives:

1. Minimize impacts to the Nason Creek floodplain and associated critical areas as identified by the Yakama Nation,
2. Identify the design requirements and constraints needed to advance the realignment of SR 207,
3. Optimize federal funding for the design and construction of a selected alternative by minimizing earthwork and impacts to US Forest Service land.

An additional goal of this analysis was to deliver the final feasibility memo by September 1, to allow Yakama Nation Fisheries staff to determine whether to proceed with the project using available grant funding.

This is a planning-level study that did not generate construction-ready documents for the corridor. Future design efforts will be necessary to produce those materials. However, this study has included planning level opinions of cost to include key project items that most

significantly affect the anticipated project cost. Where applicable, this report documents assumptions that should be considered when developing final design materials.

1.3 Study Area

Figure 1-1 shows the location of the project and adjacent land. SR 207 runs from southwest to northeast in the project area, but as WSDOT considers SR 207 roadway a north-south corridor, the roadway will be referred to in north-south terms in this analysis. Mileposts are increasing in the northbound direction. An existing culvert bounds the study under SR 207 to the north, private property boundaries to the south, Nason Creek to the west, and hillside topography to the east. The study length along the highway spans approximately 0.85 miles.

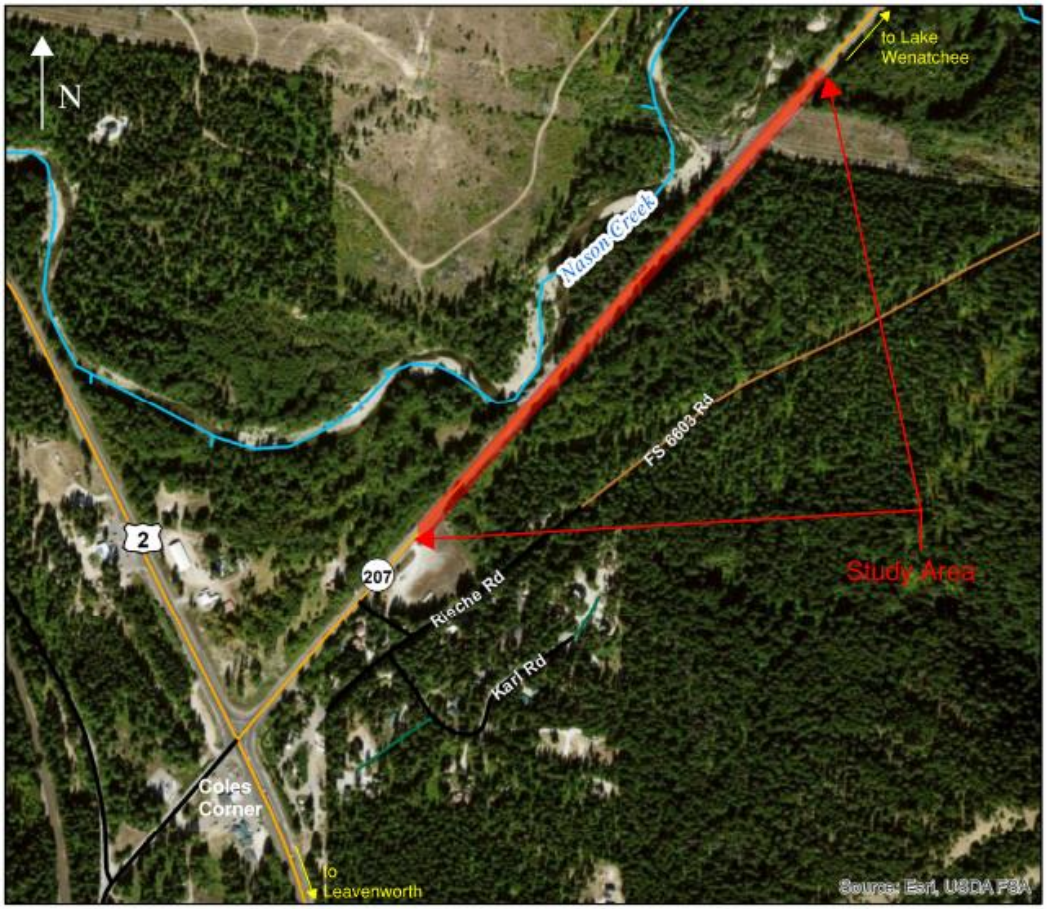

Figure 1-1. Study Area.

1.4 Existing Conditions

The posted speed limit on SR 207 is 55 miles per hour (mph) through the length of the study area. In the southbound direction, SR 207 approaches a stop condition at the intersection with US 2 at Coles Corner. In the northbound direction, SR 207 continues on a tangent alignment as it continues towards Lake Wenatchee. The highway realignment area is bounded by private

property to the south and an existing culvert under SR 207 to the north. SR 207 is not a National Highway System (NHS) Route in Washington State.

Nason Creek borders SR 207 to the west and abuts the roadway fill slope in two locations. The highway acts as a levee that restricts Nason Creek from flowing into its historic floodplain. United States Forest Service (USFS) land borders SR 207 to the south. The hillside slopes toward the roadway at 8% to 12% and is vegetated in timber and brush.

Other existing design data for SR 207 includes the following:

Table 1-1. Existing Design Data for SR 207.

Design Criteria	Existing
Functional Class	Rural Minor Arterial
Speed Limit	55 mph
Right-of-Way Width	70.0’
Lane Width	12.5’
Shoulder Width	6.0’
Guardrail	No
Ditch	Yes, unknown type
Cut Slope	None in study area
Fill Slope	4:1
Superelevation	N/A - tangent
Horizontal Curve Radius	N/A - tangent
Vertical Curve Radius	N/A - tangent

1.4.1 Typical Cross Section

The typical cross section for the existing roadway alignment includes 12.5’ lanes and 6.0’ shoulders with a typical centerline crown. The roadway is on a fill slope that varies from 4’-10’ in height.

1.4.2 Roadway Profile

SR 207 in the study area has no known vertical curves. The roadway alignment generally slopes downhill to the northeast at a grade of less than 1%, as measured from LiDAR data and verified in the field using a slope board.

1.4.3 Critical Areas and Geotechnical

The existing highway is adjacent to Nason Creek. There are several nearby wetlands, riparian and upland habitat, floodplain, and an aquifer recharge area. These areas are mapped in detail in Appendix A. There are no existing geotechnical hazards along the alignment mapped in the

DNR Geologic Information Portal, The Natural Resources Conservation Service (NRCS) Web Soil Survey map, or Chelan County's GIS mapping for geological hazards.

1.4.4 Stormwater

Stormwater runoff flows from the existing pavement into roadside ditches on the south, and to the river and other wetland areas to the north. There are no water treatment facilities or infiltration basins present. The water is assumed to infiltrate into the ground or join existing water bodies.

1.4.5 Utilities

Chelan County PUD owns a 115kV line (Lake Wenatchee) that runs parallel to SR 207 which also hosts a distribution line underbuilt. A second 115kV line to Plain starts double-circuit with Lake Wenatchee at Coles Corner and then splits on its own pole lead and heads north on Richie Road.

Bonneville Power Association (BPA) owns a transmission line corridor with three extra high voltage transmission lines crossing the SR 207 right-of-way on two sets of lattice towers at the north end of the study area.

There are no known water, sewer, stormwater, or other underground utilities within the SR 207 corridor or the area of the potential roadway realignment. To the south and east, private property has several buried utilities, including a community well, septic systems, and underground power service connections.

2.0 CONCEPT DEVELOPMENT

This study included a multi-step design process to arrive at three "best fit" corridor concepts. The study team identified roadway design criteria per current WSDOT Design Manual requirements. Each alternative alignment corresponds to a potential speed limit, which controls roadway design including horizontal curve radius, superelevation, vertical curves, and sight distance. Per the request of Yakama Nation Fisheries, the development process did not include any public involvement or utility coordination.

2.1 Initial Concept Development

The planning-level concept development for this study included the design team evaluating preliminary roadway cross-section design elements and vertical design elements (e.g. grades, vertical curvature). All concept development work was based off existing GIS data, including LiDAR elevation data to provide contours for the study area, and two site visit evaluations to confirm approximate profile grades and surface feature locations. The GIS data used for design

was obtained in 2015 for the Oregon LiDAR Consortium (OLC) Chelan FEMA study area in Chelan County. The vertical accuracy for the data reported at 0.123 ft and relative accuracy is reported at 0.185 ft.

The roadway design process included multiple iterations to achieve "best fit" alignments that meet the objectives of Yakama Nation Fisheries while also meeting all WSDOT design standards.

The study team used the WSDOT Design Manual M 22-01.12 to determine appropriate design criteria for the roadway cross section as shown below.

Table 2-1. Existing and Proposed Design Criteria for SR 207.

Design Criteria	Proposed
Functional Class	Rural Minor Arterial
Speed Limit	35, 45, or 55 mph
Right-of-Way Width (widened as needed for roadway embankment maintenance or drainage features)	Min 65.0'
Lane Width	12.0', widened on corners per DM 1240.02(5)
Shoulder Width	6.0'
Guardrail	TBD
Ditch	Yes, trapezoidal per DM 1239-5
Cut Slope	2:1
Fill Slope	4:1
Superelevation	Max 6%
Horizontal Curve Radius	Varies, see DM 1250-4c
Vertical Curve Radius	Varies, see DM 1260-1
Roadway Grade	Max 5%

Key assumptions for designs include:

1. Future ROW width minimum of 65'. This is narrower than the existing 70'; however, it allows the roadway to maintain further distance from the historical floodplain by shifting curves south, closer to private property corners by a minimal amount. The amount of ROW needed may be increased or decreased to ensure WSDOT has enough space to maintain the roadway features.
2. Vertical curves were "best-fit" to existing contours of the hillside to minimize the overall earthwork (cut/fill) volumes, but volumes were not specifically balanced for each

alignment. Further iterations during final design can balance earthwork to meet WSDOT and Yakama Nation goals.

3. The slope of the new highway alignments stays under 5%.
4. The design team attempted to avoid the BPA power crossing on the north end due to size of facilities, but assumed that any Chelan County PUD transmission and distribution lines will be relocated away from the river and along the new alignments.

2.1.1 Roadway Cross-Section and Horizontal Design

The depths of pavement and crushed rock were assumed, as no geotechnical recommendations are yet available.

Using the cross-section shown, the study team laid out horizontal alignments and curves to avoid private property impacts and the historic Nason Creek floodplain while reducing the need for structures such as retaining walls. The team widened the lanes around curves as appropriate, and super-elevated the roadway of each alignment to a maximum of 6%. The horizontal designs were further refined to increase curve radii from the minimums in the 35mph and 45mph concepts. The 55mph curves are already at the maximum allowed to fit within site constraints. Several iterations of design changes resulted in smoother curves and increased stopping sight distance.

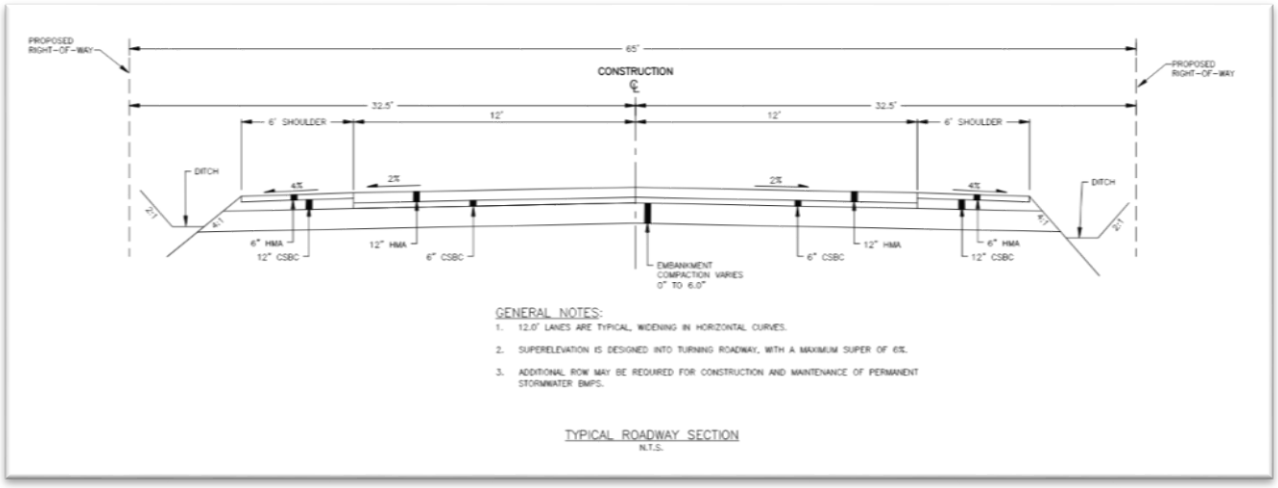

Figure 2-1. Proposed SR 207 Alignment Cross-Section.

2.1.2 Roadway Vertical Design

Once preliminary horizontal alignments were laid out, the design team created corresponding vertical alignments, attempting to follow the existing hillside profile to the extent feasible to minimize earthwork. As noted in the design criteria table, the design team did not exceed 5% roadway grade. The vertical curves were designed to meet or exceed stopping sight distance requirements and coordinate with the horizontal curves per recommendations in WSDOT DM Chapter 1220 for Geometric Profile Elements.

Along the entire length of each alignment, the preliminary concepts show that by using 2:1 cut slopes and 4:1 fill slopes, no retaining walls are needed. This will be confirmed with a full geotechnical analysis in further phases of this project.

Appendix A includes the three alternative alignment drawings.

2.2 Alternative Comparisons

The study team determined that all three alternative alignments and concepts are feasible geometric alignments for re-routing SR 207 away from Nason Creek. The study team does not identify a preferred alternative alignment; however, concept comparisons are provided below.

Table 2-2. Concept Comparisons.

Design Criteria	35 mph	45 mph	55 mph
Roadway Alignment Length	3,514 LF	3,744 LF	4,111 LF
Overall Cut Volume	20,190 CY	32,760 CY	48,710 CY
Overall Fill Volume	21,851 CY	27,954 CY	62,448 CY
Clearing and Grubbing Area (includes timber removal)	6.0 Acres	7.0 Acres	9.0 Acres
Utilities to be Relocated	Chelan County PUD transmission lines	Chelan County PUD transmission lines	Chelan County PUD transmission lines
Design Analysis (deviations) Anticipated	None	None	None
Private Property Right-of-Way Impacts	None	None	None

Alignment alternatives and proposed cross section are shown in Appendix A.

3.0 IMPACTS AND PERMITTING

Overall, there are few environmental constraints for this project, and the mitigation opportunities from removing and restoring the current road bed area are likely more than enough to mitigate any impacts from constructing the new road.

3.1 Right-of-Way

The currently alignment SR 207 is assumed to be built upon Federal lands under a State Highway Easement. This will also be true for proposed alternative alignments, and all will require WSDOT coordination with USFS to determine final right-of-way requirements for roadway maintenance. Re-aligning the roadway is a significant change in right-of-way area, and will required an amendment to the recorded Easement Deed between WSDOT and the US Forest Service.

The USFS will need to provide early guidance and advice to WSDOT regarding project consistency with the applicable forest plan. Additionally, WSDOT and USFS will coordination on needed environmental documents and approvals. See Section V, Planning, in the existing memorandum of understanding between USFS and WSDOT as shown in Appendix D.

The study team advises that Yakama Nation Fisheries should request that WSDOT add this realignment project to their Statewide Transportation Improvement Program as soon as possible.

3.2 Environmental Review

3.2.1 Regulatory Context and Permitting

Overall, there are few environmental constraints for this project, and the mitigation opportunities from removing and restoring the current road bed area are likely more than sufficient to mitigate any impacts from constructing the new road. The most important actions are to investigate the presence of additional wetlands and a stream and determine actual locations and buffers. See Appendix C for a full discussion of permitting related to critical areas.

3.2.2 Geotechnical

Existing hillside slopes in the vicinity of the alternative alignments range from 8% to 12%. Perteet did not perform a geotechnical analysis as a part of this study; however, the study team reviewed Chelan County's records to confirm any areas of historical instability in the study area. There are no known geo-hazard areas indicated in the study area, nor are there any landslide areas identified. There is one area of erosion hazard within all three alignments, as well as 800' uphill. The Natural Resources Conservation Service (NRCS) Web Soil Survey map confirms that the erosion hazard is slight. Additionally, the DNR Geologic Information Portal indicates that no faults are on or near the study site and the liquefaction is identified as moderate to high liquefaction risk.

Geotechnical assumptions used for alignment alternatives include:

- New culverts will be round, closed arch, and/or closed box culverts and will be hydraulically designed in the future phases of work.

- Common borrow excavated from the site will be used for backfill or embedment material zones during dry-weather months (June to September), which is a typical construction timeframe in WSDOT's North Central Region. For the study opinion of cost, 75% of the common borrow will be useable as fill material. The rest of the fill material is assumed to be gravel borrow.
- Stormwater infiltration may be feasible in certain locations within the study area but has not been assumed in the study opinion of cost. Further study is required to determine if infiltration is possible and the design infiltration rates that be used to confirm the feasibility and sizing of infiltration systems.

3.2.3 Storm Drainage

This study did not include a stormwater technical information report; however, our team reviewed the site for potential requirements. The largest stormwater cost to the roadway project is likely flow control and water quality treatments. If WSDOT obtains enough right-of-way space, the dispersion method may be a viable option for both, which is a low-cost treatment with large space requirements. Other opportunities could include media filter drains, bio swales, or bioretention facilities. These are more expensive alternatives but require a smaller footprint. For this study, the planning level opinions of cost include conservative values for the more complicated bioretention facilities.

3.3 Opinion of Cost

Perteet prepared planning-level opinions of cost for the three alternative alignments:

1. Alignment 1 – 35 mph
2. Alignment 2 – 45 mph
3. Alignment 3 – 55 mph

The opinions of cost include roadway construction, right-of-way acquisition, environmental, engineering, and construction management costs. The following notes and assumptions apply to these cost estimates:

- No costs were included for removal of the existing alignment of SR 207 between the new connection points. Those costs are assumed to be included in future work related to re-establishing Nason Creek in the historical floodplain.
- No costs are included for relocation of power utilities.
- Development files, aerial imagery, GIS right-of-way, and critical areas were used for the basemap.
- Earthwork quantities were generated using AutoCAD Civil 3D 2018 corridor tools. These relied on LiDAR data and therefore accuracy is limited to the accuracy of the LiDAR.

- Proposed 12-inch hot mix asphalt (HMA) pavement over six inches of crushed surfacing base course (CSBC) for new pavement zones. Shoulders will receive six-inch HMA depth over 12 inches of CSBC.
- Environmental costs include permitting in final design, construction compliance, wetland (buffer) mitigation, and temporary water pollution and erosion control.
- 30% of construction costs for construction contingency to cover additional project costs to be identified during final design.
- 10% of construction subtotal for mobilization.
- 15% of construction subtotal, including mobilization, for construction engineering.
- 5% of construction subtotal, including mobilization, for Yakama Nation Fisheries coordination and construction administration.
- 20% of construction total for final design.
- 5% of construction total for Yakama Nation coordination and design administration.
- No right-of-way acquisition costs from USFS are included; however, $80K is included for WSDOT agency coordination and administration of road easement or ROW needs per the Memorandum of Understanding between WSDOT and USFS (WSDOT Agreement No. GCB 1336).
- All costs presented in 2021 dollars, to be escalated by the Yakama Nation during budgeting.

The full opinions of cost are included in Appendix B for all three Alternatives. Table 3-1 summarizes the total costs. One other item that can reduce future costs is accelerating one or more stages of the project (ROW, design, and/or construction), as the design team anticipates that inflation will cause time, labor, and materials costs to increase year over year.

Table 3-1. Alternative Alignments Ranges of Cost (2021 $).

Roadway(s)	Eng. and Admin.	New Roadway Construction	Remove Existing Roadway	Total
Alignment – 35 mph	$1.1M to $1.2M	$5.8M to $6.3M	TBD	**$6.9M to $7.5M**
Alignment – 45 mph	$1.1M to 1.2M	$6.5M to $6.9M	TBD	**$6.6M to $8.1M**
Alignment – 55 mph	$1.1M to 1.2M	$8.6M to $9.3M	TBD	**$9.7M to $10.5M**

3.4 Considerations for Final Design

There are several project elements that should be explored further in final design. The current opinion of cost is conservative because of the limited basemaps on which study work was conducted.

Horizontal and Vertical Alignments

The chosen roadway alignment alternative can be further evaluated to better balance cut and fill quantities and reduced offsite haul needs required. Additionally, with WSDOT concurrence, roadway grade could be increased up to 9% for a design speed of 35mph. This may further reduce earthwork quantities.

During the final design phase, the roadway design team should coordinate with USFS to determine an appropriate connection location to existing Forest Service Road 6603.

Environmental Impacts and Permitting

All three alignment alternatives are likely to have impacts on one or more wetland or stream in the study area. After a final alternative is chosen, the impacts will be confirmed so that mitigation can be designed into the project. The environmental review memo from this planning study should be updated during final design as the project footprint changes and, potentially, the governing requirements adjust over time.

A list of potential federal, State, and local determination and permit requirements are listed in the Appendix C Environmental Review Memo prepared as part of this study. Permitting timelines are a risk to project delivery depending on each agency's review and processing timeline.

Utility Coordination

As part of the design and permitting process, a relocation of SR 207 will require coordination and potential relocation of significant utilities owned by Chelan County PUD, Bonneville Power Administration (BPA), and others, if more are made apparent through full project survey. A vacation of current right-of-way and reclamation of native habitat will drive relocation of utilities located in or parallel to the highway. Main tasks for coordination are:

1. Identify utility conflicts – vertical and horizontal clearances, control zone, construction, and maintenance access. Identify any customers served in this segment and develop conceptual plan to keep in service.
2. Conduct property rights review.
3. Notify impacted utilities. Host coordination meetings (from concept through final design and construction).
4. Develop concept for replacement easement and right-of-way in relation to new SR 207 alignment.
5. Acquire cost estimates from utilities for their relocations – establish funding and agreements.
6. Work with utility on their relocation design. Perform design reviews. Identify conflicts with proposed construction or other utilities.
7. Develop construction sequencing and schedule.

8. Permitting – easement and crossing permits. Acquisition of easement will require survey, legal descriptions, appraisals, landowner negotiations, etc. Develop exhibits for crossings (highway and BPA).
9. Environmental permitting – depending on who is leading the effort, utilities may request assistance to acquire or want their activities permitted under the highway construction. The project will require public outreach and solicitations. SEPA/NEPA, EIS, etc.
10. Construction agreements. Utilities will want to create firm scopes to bid to contractors and might question who is doing what or who is liable for what. This could get complicated if there are multiple contractors running through the site at the same time under different permitting requirements and contracts, particularly with sensitive environmental and cultural resources.

Electric Transmission Lines

BPA owns a corridor with three extra high voltage transmission lines crossing the SR 207 right-of-way on two sets of lattice towers. BPA will need to evaluate clearances to the proposed relocated highway, including proximity to grading and construction activities, equipment operating under the lines, and access roads to maintain the lines during normal or abnormal operating conditions. It is hopeful that these lines can remain without modification to the lines or lattice towers. A relocation of these facilities would likely require $1-2M and two to three years to accomplish this agency. At this time, all three alternative alignments were designed to maintain minimum horizontal and vertical clearances from the towers and lines; however, this should be confirmed with survey and coordination with BPA as soon as possible.

Chelan County PUD owns a 115kV line (Lake Wenatchee) that runs parallel to SR 207 that also hosts a distribution line underbuilt. A second 115kV line to Plain starts double-circuit with Lake Wenatchee at Coles Corner and then splits on its own pole lead and heads down Richie Road.

Since the highway corridor will no longer be accessible, these lines will need to be relocated. A property rights review is needed, but the utility may have private easement or franchise agreement that would need to be replaced with like-kind in another area suitable for relocated lines. The costs for the easement and relocation would likely be billed to the organization requiring the relocation. Due to fire danger, the utility may have need to replace wood structures with metal (steel or ductile iron). These materials are more costly and perhaps can be negotiated to some degree. If electrical customers are served along this line segment, then those services will need to be maintained by rerouting where needed. It does not appear there are many customers served in this area. This relocation could be a significant project in its own right requiring easement, environmental permits, roads, tree clearing, etc. This might take $600k to $1M and one to two years to accomplish with overhead wood pole construction. For steel construction, add $500k and six months. This is a significant project risk that should be investigated with Chelan County PUD as soon as possible.

Geotechnical

The final design should include a geotechnical analysis to provide detailed recommendations for elements such as fill embankment and pavement section subgrade preparation, wet weather considerations, re-use of on-site materials as structural fill, potential retaining walls, and temporary excavations/shoring. Additionally, it should provide recommendations as needed for potential "erosion" areas, including a summary of seismic hazards (if present) and design parameters.

Stormwater

Future phases of work should include hydraulic design and engineering documented in a WSDOT Type A Hydraulic Report, including:

- Threshold Discharge Area (TDA) confirmation using available basemap, as-built, GIS, and contour information in accordance with the WSDOT Highway Runoff Manual.
- Necessary mapping to include in the Hydraulic Report, including basin maps, TDA maps, existing condition maps, existing and proposed impervious area maps.
- Coordination with the project geotechnical engineer to evaluate infiltration feasibility.
- Perform threshold analysis and confirm existing, new, and replaced impervious (both PGIS and NPGIS) surfaces for the project and confirm the minimum requirements that will apply to each TDA.
- Establish equivalent area capture for each flow control and water quality facility.
- Perform runoff treatment and flow control facility sizing calculations based on the project footprint.

Schedule Risks

The roadway design and construction drawings are straightforward and can likely be completed within 12-months. However, there are several schedule risks that should be considered during the design phase of work, as listed below:

- Coordination with Chelan County PUD for line relocation of two sets of power lines,
- Coordination with Bonneville Power Association to confirm clearances to towers and coordinate permits, if required,
- ROW coordination between USFS and WSDOT, and,
- Environmental processes and permits as described in the Environmental Review Memo in Appendix C.

Coordination with all parties should begin as soon as the Yakama Nation decides whether to proceed with this roadway realignment project to minimize risk of project delays.