Forest Practices Application/Notification
Office Checklist Page 1
Northwest Region

FPA/N #: 28K1974
Received Date: 1-3-18
WDFW Concurrency Due Date: __________
WDFW Concurrency Review Completed: ______
Comments Due Date: 1-17-18
Decision Due Date: 2-2-18
FP Forester: 3K1048
Shutdown Zone: 658
RMAP #: 2800280L

<table>
<thead>
<tr>
<th>FPA/N CLASSIFICATION:</th>
<th>[ ] I [ ] II [ ] III [ ] IVG [ ] V</th>
<th>Biomass [ ]</th>
<th>FFP [ ]</th>
<th>20-acre exempt [ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowner Name:</td>
<td>Wagen</td>
<td>Project Name:</td>
<td>Lake Serene</td>
<td></td>
</tr>
<tr>
<td>WRIA:</td>
<td>Snohomish</td>
<td>WAU:</td>
<td>Skykomish River</td>
<td></td>
</tr>
<tr>
<td>WRIA:</td>
<td></td>
<td>WAU:</td>
<td>Sky River</td>
<td></td>
</tr>
<tr>
<td>WRIA:</td>
<td></td>
<td>WAU:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Description:</td>
<td>W12 30-27-10E</td>
<td>County:</td>
<td>Snohomish</td>
<td></td>
</tr>
</tbody>
</table>

Activity Type: Harvest 51 ac Spray 0 ac Stream Crossing(s): 8
Road Road Rock Pit ac
Construction 9250 ft Abandonment 9700 ft Spoils 500 cu

ALTERNATIVE PRESCRIPTIONS
[ ] Alternate Plan
[ ] Ten-Year Forest Management Plan
[ ] Columbia River Gorge National Scenic Area
[ ] Watershed Analysis: ________________

RESOURCE REVIEW
[ ] Unstable Slopes (Risk: Highway, Water: ________)
[ ] Soils Map (Highly Erodible & Very Unstable)
[ ] SLPSTAB
[ ] Landslide Hazard Zonation
[ ] Landslide Inventory Polygon
[ ] Rain-on-Snow and Outside Approved WA
[ ] Hydric Soils
  [ ] Wetland [ ] Forested, [ ] A, [ ] B
  [ ] In WMZ of [ ] A, or [ ] B Wetland
  [ ] In RMZ/ELZ of Type [ ] S, [ ] P, [ ] N water
  [ ] Water Verification

ASSOCIATED NON-SCANNED DOCUMENTS – On file with the FPA/N at the Region office.
[ ] SEPA Checklist/Documents

ASSOCIATED SCANNED DOCUMENTS
[ ] Conversion Option Harvest Plan
[ ] FPH Plans & Specifications
[ ] Planned Burn
[ ] Natural Regeneration Plan
[ ] Shoreline Permit
[ ] Marbled Murrelet Form
[ ] FP56 Appendix(s)
[ ] Small Landowner RMAP Checklist
[ ] CMZ Assessment Form

EARR Tax Credit: [ ] Yes [ ] No
ADDITIONAL COMMENTS:

Form completed by: __________ October, 2016 Version
Forest Practices Application/Notification
Western Washington

PLEASE USE THE INSTRUCTIONS TO COMPLETE THIS APPLICATION. TYPE OR PRINT IN INK.

1. Landowner, Timber Owner and Operator

<table>
<thead>
<tr>
<th>Legal Name of LANDOWNER</th>
<th>Legal Name of TIMBER OWNER (if different than Landowner)</th>
<th>Legal Name of OPERATOR (if different than Landowner)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weyerhaeuser Company</td>
<td>Weyerhaeuser NR</td>
<td>Weyerhaeuser NR</td>
</tr>
<tr>
<td>Mailing Address:</td>
<td>Mailing Address:</td>
<td>Mailing Address:</td>
</tr>
<tr>
<td>500 Metcalf Street, Building F-5E</td>
<td>500 Metcalf Street, Building F-5E</td>
<td>500 Metcalf Street, Building F-5E</td>
</tr>
<tr>
<td>City, State, Zip</td>
<td>City, State, Zip</td>
<td>City, State, Zip</td>
</tr>
<tr>
<td>Sedro-Woolley, WA 98284</td>
<td>Sedro-Woolley, WA 98284</td>
<td>Sedro-Woolley, WA 98284</td>
</tr>
<tr>
<td>Phone (360 )424-2014</td>
<td>Phone (360 )424-2014</td>
<td>Phone (360 )424-2014</td>
</tr>
<tr>
<td>Email: <a href="mailto:wes.worden@weyerhaeuser.co">wes.worden@weyerhaeuser.co</a></td>
<td>Email: <a href="mailto:wes.worden@weyerhaeuser.co">wes.worden@weyerhaeuser.co</a></td>
<td>Email: <a href="mailto:wes.worden@weyerhaeuser.co">wes.worden@weyerhaeuser.co</a></td>
</tr>
</tbody>
</table>

2. Contact Person

<table>
<thead>
<tr>
<th>Contact Person:</th>
<th>Phone (509 )387-0321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wes Worden</td>
<td>Email: <a href="mailto:wes.worden@weyerhaeuser.com">wes.worden@weyerhaeuser.com</a></td>
</tr>
</tbody>
</table>

3. Landownership information: See instructions

   a. ☒No ☐Yes Are you a small forest landowner per RCW 76.09.450?

      If yes, continue to b.

   b. ☐No ☒Yes Is your entire proposed harvest area on a single contiguous ownership consisting of one or more parcel?

4. If you are harvesting timber, enter the Forest Tax Reporting Account Number of the Timber Owner:

   800070834

   *For tax reporting information or to receive a tax number, call the Department of Revenue at 1-800-543-8829.*

5. Are you substituting prescriptions from an approved state or federal conservation agreement or watershed analysis?

   ☒No ☐Yes Write 'HCP' or 'Using Prescriptions' in tables that apply. Attach or reference prescriptions and/or crosswalks on file at the Region office.
6. What is the legal description of your forest practices?

<table>
<thead>
<tr>
<th>Section</th>
<th>Township</th>
<th>Range</th>
<th>E</th>
<th>Tax Parcel Number</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>27N</td>
<td>10</td>
<td>E</td>
<td></td>
<td>Snohomish</td>
</tr>
</tbody>
</table>

7. When are you planning to begin work on the proposed activity?  January 2018

8. Is the taxpayer eligible for the EARR Tax Credit?
   - ☐ No  ☒ Yes

9. Have you reviewed this forest practices activity area to determine whether it may involve historic sites and/or Native American cultural resources? Read the instructions before answering this question.
   - ☒ No  ☐ Yes

10. Do you have a DNR approved Road Maintenance and Abandonment Plan (RMAP)?
    - ☐ No  ☒ Yes  List the RMAP number: R28000009L
      If no, continue to b.
    - ☐ No  ☐ Yes  Is a Checklist RMAP required (see instructions)?

11. Are there potentially unstable slopes or landforms in the area of your forest practices activity?
    - ☐ No  ☒ Yes – attach Slope Stability Informational Form. If applicable, attach geotechnical report, the SEPA Environmental Checklist, HCP, or Watershed Analysis prescriptions.

12. Are there potentially unstable slopes or landforms around the area of your forest practices activity?
    - ☐ No  ☒ Yes – attach Slope Stability Informational Form. If applicable, attach geotechnical report, HCP, or Watershed Analysis prescriptions.

13. Is this forest practice application/notification (answer every question):
    - ☒ No  ☐ Yes  Within city limits or inside an urban growth area? If yes, see instructions for additional required documents.
    - ☒ No  ☐ Yes  For road work that is included in an approved Road Maintenance and Abandonment Plan (RMAP)?
    - ☒ No  ☐ Yes  Within a public park? If yes, include SEPA Environmental Checklist or SEPA Determination - except for harvest/salvage of less than 5,000 board feet within a developed public park.
    - ☒ No  ☐ Yes  Within 500 feet of a public park? Park name: ________________________________
    - ☒ No  ☐ Yes  In an approved Conversion Option Harvest Plan (COHP) from the local government? If yes, include a copy. This only applies to proposals within urban growth areas.
    - ☐ No  ☐ Yes  Within 200' of the Ordinary High Water Mark (OHWM) or floodway of Type S water? If yes, check with the county or city to determine whether a substantial development permit is required under the local shorelines master plan.
    - ☒ No  ☐ Yes  A request for a multi-year permit? If yes, length requested: ☐ 4 years or ☐ 5 years. Not everyone qualifies for a multi-year permit. See instructions for details.
h. ☒ No ☐ Yes An Alternate Plan? If yes, include a copy.

i. ☐ No ☒ Yes Within 50 miles of saltwater and do you own more than 500 acres of forest land in Washington State? If yes, include Marbled Murrelet Form or attach/reference HCP prescriptions.

j. ☒ No ☐ Yes In or directly adjacent to a potential Channel Migration Zone (CMZ)? If yes, include CMZ Assessment Form. Attach/reference applicable HCP and/or Watershed Analysis prescriptions.

***** If not working in or over typed waters, skip to Question 18 *****

You are required to verify Type Np and Ns water types within 200 feet of your proposed forest practices activities prior to submitting a Forest Practices Application / Notification. Use the Additional Information section, additional pages, the Water Type Classification Worksheet, and/or a Water Type Modification form to explain how you verified water types. See Water Typing Requirements in the instructions.

Prior to answering Questions 14-17 in this section please refer to the Forest Practices Application Instructions and Forest Practices Board Manual Section 5.

14. Are you proposing any of the following projects NOT permitted by current HPAs from WDFW?
   a. ☒ No ☐ Yes Installing, replacing, or repairing a culvert at or below the bankfull width of Type S or F water(s) that exceeds a five percent gradient?
   b. ☒ No ☐ Yes Constructing, replacing, or repairing a bridge at or below the bankfull width of unconfined streams in Type S or F water(s)?
   c. ☒ No ☐ Yes Placing fill material within the 100-year flood level of unconfined streams in Type S or F water(s)?

15. Have you consulted with DNR and/or WDFW about the proposed hydraulic project(s) in or over Type S or F water? ☒ No ☐ Yes

16. If installing, replacing, removing, or maintaining structures in or over any typed water, complete the table below. Type S and F waters require detailed plan information. Provide plan details in Question 31 or attach plan to the FPA/N. Provide crossing locations and identifiers on your Activity Map. A detailed plan with profiles may also be required for more complex hydraulic projects in Type N Waters per WAC 222-24-042(2).

<table>
<thead>
<tr>
<th>Crossing Identifier (letter and/or number)</th>
<th>Water Type (S, F, Ns)</th>
<th>*Existing HPA Number (if applicable)</th>
<th>HPA Expiration Date (if applicable)</th>
<th>Planned Activity (install, replace, remove, temporary maintenance)</th>
<th>Structure (culvert, bridge, flood**, pump, etc., other)</th>
<th>Proposed Size (dimensions of structure)</th>
<th>Culvert Design Method (No-slope, Stream-sim., Hydraulic, Other)</th>
<th>Channel Bed Width (ft)</th>
<th>Stream Gradient (%)</th>
<th>RMPP Project (Y or N)</th>
<th>FFP Project (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,B,C</td>
<td>Ns</td>
<td></td>
<td></td>
<td>temporarily</td>
<td>culvert</td>
<td>18&quot; x 30&quot;</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>D</td>
<td>Ns</td>
<td></td>
<td></td>
<td>temporary</td>
<td>culvert</td>
<td>18&quot; x 30&quot;</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>G,H</td>
<td>Np</td>
<td></td>
<td></td>
<td>temporary</td>
<td>culvert</td>
<td>24&quot; x 30&quot;</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
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<tr>
<td>Z</td>
<td>Ns</td>
<td></td>
<td></td>
<td>temporary</td>
<td>culvert</td>
<td>18&quot; x 30&quot;</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>E</td>
<td>Np</td>
<td></td>
<td></td>
<td>temporary</td>
<td>rock filter cell</td>
<td>12'w x 26'</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

*Existing HPAs issued by WDFW will be complied and enforced by WDFW until expiration. Plan details are not required for hydraulic projects permitted with an existing HPA (see instructions).

** Fords and equipment crossings on Type S and F Waters may result in an unauthorized incidental take of certain endangered or threatened fish species. For more information, see 'Background for the State's Incidental Take Permits for certain endangered and threatened fish species' following Question 24 of the FPA/N Instructions.
17. If conducting any of the following activities in or over typed water, complete the table below. Some activities will require identifiers on the Activity map and/or more information in Question 31. See instructions.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Type S Water</th>
<th>Type F Water</th>
<th>Type Np Water</th>
<th>Type Ns Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Crossing**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspending Cables</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Cable Yarding</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>LWD Placement/Removal</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Beaver Dam Removal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Felling and Bucking</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Other (describe in Question 31)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Existing HPAs issued by WDFW will be complied and enforced by WDFW until expiration. Plan details are not required for hydraulic projects permitted with an existing HPA (see instructions).

** Forays and equipment crossings on Type S and F Waters may result in an unauthorized incidental take of certain endangered or threatened fish species. For more information, see ‘Background for the State’s Incidental Take Permits for certain endangered and threatened fish species’ following Question 24 of the FPAN Instructions.

18. If constructing or abandoning forest roads, complete the table below. Show the road locations and identifiers on the Activity Map. Include abandonment plans for temporary roads and abandonment projects.

<table>
<thead>
<tr>
<th>Road Identifier (name, number)</th>
<th>Road Construction</th>
<th>Road Abandonment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length (feet)</td>
<td>Steepest Side-slope (%)</td>
</tr>
<tr>
<td>Spur 1,1A</td>
<td>5650</td>
<td>75</td>
</tr>
<tr>
<td>Spur 2,2A</td>
<td>1600</td>
<td>50</td>
</tr>
<tr>
<td>Spur 3,3A</td>
<td>2000</td>
<td>55</td>
</tr>
</tbody>
</table>

19. If depositing spoils and/or expanding or developing a rock pit for forestry use, complete the table below. Show locations and identifiers on the Activity Map.

<table>
<thead>
<tr>
<th>Spoil Area Identifier (letter, number)</th>
<th>Amount of Spoils Deposited (cubic yards)</th>
<th>Rock Pit Identifier (name, number or letter)</th>
<th>Acres of New Rock Pit Developed</th>
<th>Acres of Existing Rock Pit Expanded</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP1</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. If operating in or within 200 feet of a wetland, complete the table below. Show the boundaries of each wetland, along with its identifier, and WMZ on the Activity Map. See instructions for information.

<table>
<thead>
<tr>
<th>Wetland Identifier (number, letter)</th>
<th>Wetland Type (A, B, or Forested)</th>
<th>Planned Activities in Wetland</th>
<th>Planned Activities in Maximum Width WMZ</th>
<th>Total Wetland Area (acres)</th>
<th>How many acres will be drained?</th>
<th>How many acres will be filled?</th>
</tr>
</thead>
</table>

**** If not harvesting or salvaging timber, skip to Question 29
21. If harvesting or salvaging timber, complete the table below. Show all harvest areas and unit numbers on the Activity Map. For even-aged harvest units, also show surrounding stand information on the Activity Map.

<table>
<thead>
<tr>
<th>Unit Number</th>
<th>Harvest Type (Even-aged, Uneven-aged, Salvage, Right-of-Way)</th>
<th>Biomass Harvest (Y/N)</th>
<th>Harvest Method (Rubber Tired Skidder, Tracked Skidder, Dozer, Shovel, Full Suspension Cable, Lead-end Suspension Cable, Helicopter, Animal, Chipper-forwarder, Slash Bundler)</th>
<th>Acres to be Harvested</th>
<th>Volume to be Harvested (m³)</th>
<th>Volume to be Harvested (biomass tonnage)</th>
<th>Volume to be Harvested (%)</th>
<th>Steepest Slope in Harvest Unit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Even-aged, Salvage*</td>
<td>N</td>
<td>Shovel</td>
<td>4</td>
<td>120</td>
<td></td>
<td>99</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>Even-aged, Salvage*</td>
<td>N</td>
<td>Shovel, LE Cable, Tether</td>
<td>7</td>
<td>225</td>
<td></td>
<td>99</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Even-aged, Salvage*</td>
<td>N</td>
<td>Shovel, LE Cable, Tether</td>
<td>43</td>
<td>1850</td>
<td></td>
<td>99</td>
<td>85</td>
</tr>
<tr>
<td>4</td>
<td>Even-aged, Salvage*</td>
<td>N</td>
<td>Shovel, LE Cable, Tether</td>
<td>3</td>
<td>125</td>
<td></td>
<td>99</td>
<td>55</td>
</tr>
</tbody>
</table>

22. Reforestation. Check the appropriate box(es).

☒ Planting. Tree Species: Conifer

☐ Natural. Include a Natural Regeneration Plan

☐ Not required because of one or more of the following:

☐ I am converting some or all of this land to non-forest land in the next 3 years or lands are exempted under WAC 222-34-050.

☐ Individual dead, dying, down, or wind-thrown trees will be salvaged.

☐ Trees are removed under a thinning program reasonably expected to maximize the long-term productivity of commercial timber.

☐ I am leaving at least 100 vigorous, undamaged, and well-distributed saplings or merchantable trees per acre.

☐ An average of 190 tree seedlings per acre are established on the harvest area and my harvest will not damage it.

☐ Road right-of-way or rock pit development harvest only.

**** If you own MORE than 80 forested acres in Washington, skip to Question 27 ****

23. Are you using the exempt 20-acre parcel riparian management zone (RMZ) rule on type S, F, or Np waters?

☐ No If no, continue to Question 27.

☐ Yes If yes, continue to Question 24. See instructions for qualifications and information.

24. Choose the answer below that best fits your situation. Show all RMZs on the Activity Map.

☐ a. ALL of the following apply to me and my land: (If no, answer b.)

☐ Between June 5, 2006 and today's date I have always owned less than 80 acres of forestland in Washington.

☐ Between June 5, 2006 and today's date this parcel has always been 20 acres or less of contiguous ownership. See RCW 76.09.020 for definition of 'contiguous'.

☐ Between June 5, 2006 and today's date this parcel has always been owned by me or someone else that has owned less than 80 acres of forestland in Washington.

6/1/2016 Page 5 of 8 Western Washington
b. ONE OR MORE of the following apply to me and/or my land (check all that apply):

- I currently own more than 80 acres of forestland in Washington.
- Between June 5, 2006 and today’s date I have owned more than 80 acres of forestland in Washington.
- Between June 5, 2006 and today’s date this parcel has been a part of more than 20 acres of contiguous ownership. See RCW 76.09.020 for definition of ‘contiguous’.
- Between June 5, 2006 and today’s date this parcel has been owned by someone that has owned more than 80 forested acres in Washington.

If any of the statements in (b) above apply AND you use the 20-acre exempt RMZ rule, you are NOT authorized under the State’s Incidental Take Permits (see explanation in FPA instructions under Questions 24).

25. If harvesting within 115 feet of a Type S or F water on an exempt 20-acre parcel, complete the table below. Show RMZs and stream segment identifiers on the Activity Map. If you are harvesting within 75 feet or within the maximum RMZ (whichever is less), stream shade must be assessed and met following harvest. Describe how stream shade was determined to be met, using the ‘Stream Shade Assessment Worksheet’ if necessary.

<table>
<thead>
<tr>
<th>Stream Segment Identifier (letter)</th>
<th>Water Type (S, F)</th>
<th>Segment Length (feet)</th>
<th>Bankfull Width (feet)</th>
<th>Maximum RMZ Width (feet)</th>
<th>Are you harvesting within the maximum RMZ? (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

26. Are you harvesting within 29 feet of a Type Np water on a 20-acre exempt parcel?

- No Continue to Question 29.
- Yes See instructions and describe leave tree strategy in Question 31. Then continue to Question 29.

27. If harvesting within 200 feet of any of Type S or F water, complete the table below. Include DFC for all inner zone harvests unless you have an HCP prescription. Show RMZs, CMZs, and stream segment identifiers on the Activity Map. If you are harvesting within 75 feet or within the maximum RMZ (whichever is less), stream shade must be assessed and met following harvest. Describe how stream shade was determined to be met, using the ‘Stream Shade Assessment Worksheet’ if necessary.

<table>
<thead>
<tr>
<th>Stream Segment Identifier (letter)</th>
<th>Water Type (S or F)</th>
<th>Site Class (I - V)</th>
<th>Stream Width (feet)</th>
<th>Is there a CMZ? (Y/N)</th>
<th>RMZ Harvest Code(s) (see instructions)</th>
<th>DFC Run Number</th>
<th>Total width of RMZ (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>F</td>
<td>II</td>
<td>&gt;10'</td>
<td>N</td>
<td>B,M</td>
<td></td>
<td>170</td>
</tr>
<tr>
<td>F2</td>
<td>F</td>
<td>III</td>
<td>&gt;10'</td>
<td>N</td>
<td>B,M</td>
<td></td>
<td>140</td>
</tr>
<tr>
<td>F3</td>
<td>F</td>
<td>III</td>
<td>&lt;10'</td>
<td>N</td>
<td>B,M</td>
<td></td>
<td>140</td>
</tr>
</tbody>
</table>
28. If harvesting within 50 feet of Type Np water, complete the table(s) below. Show RMZs and stream segment identifiers on the Activity Map.

<table>
<thead>
<tr>
<th>Stream Segment Identifier (letter)</th>
<th>Total Stream Length in Harvest Unit (feet)</th>
<th>Length of No-Harvest, 50-foot Buffers in Harvest Unit (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Np1</td>
<td>475</td>
<td>400</td>
</tr>
<tr>
<td>Np2</td>
<td>775</td>
<td>500</td>
</tr>
<tr>
<td>Np22</td>
<td>565</td>
<td>340</td>
</tr>
<tr>
<td>Np23</td>
<td>600</td>
<td>500</td>
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<table>
<thead>
<tr>
<th>Stream Segment Identifier (letter)</th>
<th>Total Stream Length in Harvest Unit (feet)</th>
<th>Length of No-Harvest, 50-foot Buffers in Harvest Unit (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

29. How are the following marked on the ground? (Flagging, paint, road, fence, etc.)

- Harvest Boundaries: Pink timber harvest flagging
- Clumped Wildlife Reserve Trees/Green Recruitment Trees: within RMZs and potentially unstable areas
- Right-of-way limits/road centerlines: orange flagged centerline, see question 31 for additional information
- Stream Crossing Work: yellow tagged stations
- Riparian Management Zone Boundaries and Leave/Take Trees: Pink timber harvest flagging
- Channel Migration Zone: not applicable
- Wetland Management Zone Boundaries and Leave/Take Trees: not applicable

30. Are you converting the land to non-forestry use within 3 years of harvest?
- [ ] No  [ ] Yes  If yes, include your SEPA Determination and/or SEPA checklist.

31. Additional Information (attach additional pages if necessary): For hydraulic projects in or over Type S, F, or complex N water(s) see instructions for required plan information.

"Lake Serene", HUN 12481.

Question #21: * Salvage includes dead and down cedar shake and shingle material.
This proposal is class IV special due to harvest and road construction within groundwater recharge areas of glacial deep seated landslides and road construction through two small shallow slumps. Please see the included Geological Assessment dated December 15, 2017 written by John M. McKenzie, qualified expert geologist. All recommendations of this report will be followed including: 1) No fill will be imported onto the road alignment where spur 1 crosses Landslide #8 (between stations 14+50 and 15+50). 2) No fill shall be wasted on any landslide. 3) Abandonment of Spur 1 will include pulling back fill slopes and placing the material against the cut slope within Landslide #7 (between stations 10+10 and 10+70). 4) Road construction and abandonment will keep natural drainage patterns intact. Drainage will not concentrate water within groundwater recharge areas. 5) Where spur 1 crosses through the groundwater recharge areas of Landslide #10 and Landslide #13 the right-of-way harvest will be limited to the old running surface, shoulder, and cut slope (generally 30' -45'). All of the proposed road construction is temporary. Question #18: Road abandonment will include removing all culverts, restoring stream banks to natural angles, grass seeding and or mulching exposed soils immediately adjacent to types waters, installing water bars at all drainages and as appropriate to prevent runoff concentration and erosion. In addition road fills will be pulled back within Landslide #7 as described above. In addition the first 200 feet of spur 1 will have the fill pulled back so that vehicles cannot access these abandoned grades. Full-bench construction will be utilized where side slopes exceed a 60%. These areas on Spur 1 are shown on the road plan map and are also described within the road work list.

For road work within and adjacent to slides 7,8,9, and 10 many areas were slope staked. The top of the cut-slope and the lower edge of the fill-slope are slope staked with pink pin flags. Reference points are marked with yellow tags for the slope stakes. The right-of-way limits are flagged blue here as well. Please see additional road drawings and plans that provide additional information. The rock filters cell described at crossing E, and stations 15+07 and 16+09 will consist of clean 3" minus rock wrapped in geotextile fabric and covered with surface rock (pit run or 2" minus gravel). These will allow the water to pass while minimizing fill. See WTM NW-07-17-0021 for F/N stream breaks. Np vs Ns calis were made based on site visits in August and September 2017. Crossing Z culvert was sized based on a stream width of 1' x 3' depth. See road work comments for sizing on other culverts (also remember that they are temporary). During road construction the newly constructed subgrades will be promptly covered with rock surfacing to minimize sedimentation.

6/1/2016
32. We acknowledge the following:

- The information on this application/notification is true.
- We understand this proposed forest practice is subject to:
  - The Forest Practices Act and Rules AND
  - All other federal, state or local regulations.
- Compliance with the Forest Practices Act and Rules does not ensure compliance with the Endangered Species Act or other federal, state or local laws.
- If we said that we would not convert the land to non-forestry use, the county or city may deny development permits on this parcel for the next 8 years.
- The following may result in an unauthorized incidental take of certain endangered or threatened fish species:
  - Conversion of land to non-forestry use.
  - Harvesting within the maximum RMZ on a 20-acre exempt parcel that was acquired after June 5, 2006.
  - Equipment Crossings/Fords in or over Type S and F Waters.
- Inadvertent Discovery – Chapters 27.44, 27.53, 68.50 and 68.60 RCW
  - If you find or suspect you have found an archaeological object or Native American cairn, grave, or glyptic record, immediately cease disturbance activity, protect the area and promptly contact the Department of Archaeology and Historic Preservation at 360 586-3077.
  - If you find or suspect you have found human skeletal remains, immediately cease disturbance activity, protect the area, and contact the County Coroner or Medical Examiner and local law enforcement as soon as possible. Failure to report human remains is a misdemeanor.

The landowner understands that by signing and submitting this FPA, he/she is authorizing the Department of Natural Resources to enter the property in order to review the proposal, inspect harvest operations, and monitor compliance for up to three years after its expiration date RCW 76.09.150

<table>
<thead>
<tr>
<th>Signature of LANDOWNER</th>
<th>Signature of TIMBER OWNER*</th>
<th>Signature of OPERATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Name: Wes Worden</td>
<td>Print Name: Wes Worden</td>
<td>Print Name: Wes Worden</td>
</tr>
<tr>
<td>Date: 12/21/2017</td>
<td>Date: 12/21/2017</td>
<td>Date: 12/21/2017</td>
</tr>
</tbody>
</table>

* NOTE: If you are a “Perpetual Timber Rights Owner,” and are submitting this without the Landowner’s Signature, provide written evidence the landowner has been notified.

Please make a copy of this FPA/N for your records. If this FPA/N contains a hydraulic project requiring WDFW concurrence review, it will not be available online for public review until the WDFW concurrence review period.
Appendix D. Slope Stability Informational Form

Complete and attach this form to your FPA if you answered ‘Yes’ to FPA Question 11 or 12. Refer to WAC 222-16-050(1)(d) and Forest Practices Board Manual Section 16—Guidelines for Evaluating Potentially Unstable Slopes for definitions and descriptions of potentially unstable slopes or landforms.

1. What screening tools were used? ☒ Aerial Photo, ☒ LiDAR, ☒ Landslide Inventory, ☐ Landslide Hazard Zone Polygon, ☐ GIS/Other (describe):

2. Were there any features identified using the screening tools in #1 that did not exist in the field? If yes, describe:
   No

3. a. What potentially unstable slopes or landforms were identified in the area of your forest practices activity? Check all that apply:
   ☐ Inner Gorge ☒ Groundwater recharge areas for glacial deep-seated landslides
   ☐ Bedrock Hollow ☐ Convergent Headwall ☐ Toe of deep-seated landslide
   ☐ Outer edges of meander bends
   ☒ Other (Deep-seated landslides or other features of potentially unstable slopes). Describe:
   Road construction and associated right-of-way harvest is proposed across deep-seated landslides 7 and 8 and across the small shallow slumps 26 and 27. In addition road construction and harvest is proposed within the groundwater recharge areas of deep-seated landslides 7,8,10, and 13. See the geologic assessment dated 12/15/2017 for additional information on these slides (including Figure 2 which is a map of their locations).

   b. What activities may occur in potentially unstable slopes or landforms? Check all that apply:
      ☒ Timber harvest ☒ Road construction ☐ Suspending cables ☐ Yarding ☐ Tailholds

4. a. What potentially unstable slopes or landforms were identified around the area of your forest practices activity? Check all that apply:
   ☐ Inner Gorge ☒ Groundwater recharge areas for glacial deep-seated landslides
   ☐ Bedrock Hollow ☐ Convergent Headwall ☐ Toe of deep-seated landslide
   ☐ Outer edges of meander bends
   ☒ Other (Deep-seated landslides or other features of potentially unstable slopes). Describe:
   19 deep-seated landslides were identified around the proposed harvest and road construction including those described as: 1,2,3,4,5,6,9,11,12,14,15,16,17,18,19,20,21,22, and 24. In addition 3 shallow slides were identified around the proposed harvest and road construction including those described as: 23,25, and 28. See the geologic assessment dated 12/15/2017 for additional information on these slides (including Figure 2 which is a map of their locations).

   b. What activities may occur around potentially unstable slopes or landforms? Check all that apply:
      ☒ Timber harvest ☒ Road construction ☒ Suspending cables ☒ Yarding ☒ Tailholds

For use with FPA/N dated 6/1/2016 or later
5. If any features identified in #3.a. and /or #4.a. were bounded out, describe the manner in which the boundary was determined:

Deep-seated landslides and associated groundwater recharge areas were determined by following drainage divides and bound out accordingly. Some of these deep-seated landslides and groundwater recharge areas were inside of an area previously bound out. Shallow slumps 23 and 28 were bound out by following the observed soil failure. Shallow slump was within the previously bound out groundwater recharge area associated with slide 7. See the geologic assessment dated 12/15/2017 for additional information.

6. Were areas of public use (which may include, but are not limited to: public roads, utilities, designated recreation areas, occupied structures, etc.) identified in or around the area of your proposed forest practices activity? Show these locations on the map in #8.

Yes. Lake Serene Trail (USFS Road 6020-110) is located nearby.

7. Date of field review: **August 2017**

Person(s) that conducted field review:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/position</th>
</tr>
</thead>
<tbody>
<tr>
<td>John M. Mckenzie</td>
<td>Geologist</td>
</tr>
<tr>
<td>Wes Worden</td>
<td>Forest Engineer</td>
</tr>
</tbody>
</table>

8. Show all field reviewed areas for potentially unstable slopes or landforms on a map (may use a forest practices activity map, harvest map or GIS map – See example below). Show locations where areas of public use exist. **This map is intended to be developed by the field practitioner.**

For use with FPA/N dated 6/1/2016 or later
Area Screened for potentially unstable slopes

Please see Figure 2 of the included Geologic Assessment Dated 12/15/17 written by John McKenzie for field identified unstable slopes
<table>
<thead>
<tr>
<th>Station</th>
<th>Description</th>
<th>Pipe Sizes</th>
<th>Identify</th>
<th>Comments</th>
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<tr>
<td></td>
<td></td>
<td>Diam.</td>
<td>Length</td>
<td></td>
</tr>
<tr>
<td>0+00</td>
<td>Junction with USFS 6020-110</td>
<td>18</td>
<td>30</td>
<td>A 1' wide by 3' deep</td>
</tr>
<tr>
<td>0+80</td>
<td>Install Cross-drain Culvert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3+20</td>
<td>Ns Stream Crossing</td>
<td>18</td>
<td>30</td>
<td>B 1' wide by 3' deep</td>
</tr>
<tr>
<td>4+20</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>5+70</td>
<td>Ns Stream Crossing</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>6+50</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>7+50</td>
<td>Ns Stream Crossing</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>8+10</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>9+72</td>
<td>Ns Stream Crossing</td>
<td>18</td>
<td>30</td>
<td>D 1' wide by 3' deep</td>
</tr>
<tr>
<td>10+40</td>
<td>Install Cross-drain Culvert, Full Bench construction ahead to ridge (about 50 feet)</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>11+20</td>
<td>Np Stream Crossing, Install Rock Filter Cell (to minimize fill)</td>
<td>18</td>
<td>30</td>
<td>E 2' wide by 3' deep, RP 14' to TOC, 33.2' to Centerline</td>
</tr>
<tr>
<td>13-70</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>14-15</td>
<td>Install Rock Filter Cell</td>
<td>24</td>
<td>30</td>
<td>G 1'5' wide by 3' deep, RP 12' to TOC, 26.8' to Centerline</td>
</tr>
<tr>
<td>14-38</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>14-57</td>
<td>Install Cross-drain Culvert, Full Bench construction ahead to ridge (about 50 feet)</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>15-07</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>15-40</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
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<tr>
<td>16-09</td>
<td>Install Rock Filter Cell</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>16-34</td>
<td>Start cutting ahead</td>
<td>18</td>
<td>30</td>
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</tr>
<tr>
<td>16-58</td>
<td>Attempt to make cut slope 1/2:1 due to large cedar stumps on ridge (slope stakes are for 1:1 cut/slope)</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>18-10</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>18-74</td>
<td>Np Stream Crossing</td>
<td>24</td>
<td>30</td>
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<tr>
<td>19-55</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>20-40</td>
<td>Install Cross-drain Culvert</td>
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<td>30</td>
<td></td>
</tr>
<tr>
<td>20-75</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>22-24</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>22-67</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>25+50</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>28+00</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>30+00</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>33+30</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>36+75</td>
<td>Install Cross-drain Culvert</td>
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<td>30</td>
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<td>39+00</td>
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<tr>
<td>45+00</td>
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<td>30</td>
<td></td>
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<tr>
<td>52+00</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
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<tr>
<td>54+00</td>
<td>End of Road</td>
<td>18</td>
<td>30</td>
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</tr>
<tr>
<td>Spur1</td>
<td>Junction with Spur 1</td>
<td>18</td>
<td>30</td>
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<tr>
<td>3+30</td>
<td>Install Cross-drain Culvert</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>6+35</td>
<td>Junction with Spur 2a</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>9+30</td>
<td>Installing space for turn-around/outlet</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>12+50</td>
<td>Install Cross-drain Culvert to drain water onto the ridge</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>13+50</td>
<td>End</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

Spur 1a, 2, 2a, 3a
Install cross-drains as needed. Install landings at the ends of the roads

RECEIVED NW REGION
FE 0 2 2018
Marbled Murrelet Form  
Western Washington Forest Practices Application/Notification

*Complete this form only if you are harvesting timber (including salvage) or constructing roads. Do not complete this form if you have an HCP for marbled murrelets.*

**Answer every question.**

1. **X** No ☐ Yes  
   For this FPA/N, has a protocol survey(s) been completed that includes:
   - Harvest units (and within 300 ft on your ownership), or
   - Salvage units (and within 300 ft on your ownership), or
   - Any area of proposed road construction (and within 300 ft on your ownership)?
   
   *If 'Yes', fill out the table and check the appropriate findings below.*

<table>
<thead>
<tr>
<th>Survey ID (Name or Unit #)</th>
<th>Township, Range, &amp; Section</th>
<th>Survey was approved by WDFW (Attach approval letter from WDFW)</th>
<th>Survey was disapproved by WDFW and is being resubmitted with this FPA/N (Explain below)</th>
<th>Survey has been submitted to WDFW and survey approval is unknown (Explain below)</th>
<th>Survey is complete but has not yet been submitted to WDFW (Submit survey with FPA/N)</th>
</tr>
</thead>
<tbody>
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<td>☐ Presence</td>
<td>☐ Occupancy</td>
<td>☐ Occupancy</td>
<td>☐ Occupancy</td>
<td>☐ Occupancy</td>
</tr>
<tr>
<td>☐ No Detections</td>
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<td>☐ Presence</td>
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</tbody>
</table>

   **Explanation:**

2. **X** No ☐ Yes ☐ Unknown  
   Will you harvest, salvage, or construct roads within 0.25 miles of an occupied site?

3. **X** No ☐ Yes ☐ Unknown  
   Will you fly helicopter(s) over or within 0.25 miles of an occupied site?

4. **X** No ☐ Yes  
   Will you harvest *live* trees in a buffer of an occupied site?
   
   If Yes, describe the leaf trees and buffer widths you will leave. **NOTE:**  
   *If you leave less than required in WAC 222-16-080(1) (j) (v) this is a Class IV-Special and an Environmental Checklist is required*
5. □ No □ Yes  Are there nesting platforms within any harvest unit (including salvage and road construction) that are within 300 feet that:
   • Are not located within a surveyed area, and;
   • Have a minimum of 2 platforms per acre, and;
   • Are located within 7 or more acres of contiguous habitat, and;
   • Have a least 40% (number not volume) of the dominant and co-dominant trees made up of Douglas-fir, western hemlock, western red cedar, or Sitka spruce?

If "Yes", complete the table below for those areas.

<table>
<thead>
<tr>
<th>Name or # (as shown on map) of delineated stands of contiguous habitat</th>
<th>Delineated stand acres</th>
<th>Nesting platforms per acre</th>
<th>Number of trees 32 inches dbh or greater with platforms</th>
<th>Platform Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Field Sampling Method, Sample Plot Method, 100% Cruise Method, Inventory Model Method, or Other</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

6. □ No □ Yes  Are there areas within this forest practice or within 300 feet that:
   • Are not surveyed, and;
   • Are not listed in question 5, and;
   • Have trees that are at least 32 inches dbh

If "Yes", list the forest practice unit numbers from your activity map. Provide brief description of current stand conditions. Such as tree species composition, stand age (if known), and maximum tree size (dbh).

Harvest Unit #(s) ______________  □ Within the Unit  □ Within 300 feet of the Unit

Description:

Harvest Unit #(s) ______________  □ Within the Unit  □ Within 300 feet of the Unit

Description:

Harvest Unit #(s) ______________  □ Within the Unit  □ Within 300 feet of the Unit

Description:

7. If you answered yes to question 1, 4, or 5, include a map (separate from your map that shows your harvest units and/or road construction) See the instructions for the information required on each map.
SUPPLEMENTAL ENGINEERING GEOLOGIC ASSESSMENT

SEVERAL DEEP-SEATED AND SHALLOW LANDSLIDES
LAKE SERENE FOREST PRACTICES APPLICATION

Prepared for:

Wes Worden, Harvest Manager
Weyerhaeuser Company
Sedro-Woolley, Washington

Prepared by:

John M. McKenzie, LEG
Roots Forestry Consulting, LLC
Arlington, Washington

December 15, 2017
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**SUPPLEMENTAL ENGINEERING GEOLOGIC ASSESSMENT**

**SEVERAL DEEP-SEATED AND SHALLOW LANDSLIDES**

**LAKE SERENE FOREST PRACTICES APPLICATION**

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<td>2.0 PURPOSE</td>
<td>1</td>
</tr>
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<td>3.0 SCOPE OF WORK</td>
<td>3</td>
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<td>4.0 ACCOMPANYING ILLUSTRATIONS</td>
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<td>5.0 RECAP OF THE SALIENT GEOLOGY AND GROUNDWATER POINTS</td>
<td>4</td>
</tr>
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<td>6.0 LANDSLIDES</td>
<td>4</td>
</tr>
<tr>
<td>7.0 METHODS/EVALUATION PROCESS</td>
<td>18</td>
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<td>8.0 COMPUTATIONAL RESULTS</td>
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</tr>
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<td>9.0 OTHER LANDSLIDE AND GWRA ISSUES</td>
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</tr>
<tr>
<td>9.1 Management Activities on Shallow Landslides #s 26 and 27</td>
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</tr>
<tr>
<td>9.2 Road Construction Landslides #s 7 and 8, GWRA landslides #s 10 and 13</td>
<td>12</td>
</tr>
<tr>
<td>9.3 Reconstruction of Existing Roads in the GWRA of Landslides #s 6, 7, 8, 9, 10, 11, 13, and 16</td>
<td>14</td>
</tr>
<tr>
<td>10.0 CONCLUSIONS</td>
<td>14</td>
</tr>
<tr>
<td>11.0 FOREST PRACTICES STATEMENTS</td>
<td>15</td>
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TO: Mr. Wes Worden, Harvest Manager
Weyerhaeuser Company
500 Metcalf Street
Sedro-Woolley, Washington 98284

SUBJECT: Supplemental Engineering Geologic Assessment
Several Deep-Seated Landslides
Lake Serena Forest Practices Application
Snohomish County, Washington

1.0 INTRODUCTION

The following supplemental engineering geologic assessment presents the results of our slope stability analysis for several deep-seated landslides (DSLS) associated with the proposed Lake Serena Forest Practices Application (FPA). The FPA in question was the subject of an earlier engineering geologic reconnaissance assessment prepared by our office dated August 22, 2017 (8/22/17). Basic information pertinent to the location (Figure 1), terrain, geologic setting, groundwater, harvest history, and aerial photographs reviewed in and about the FPA were discussed in that assessment. The reader is referred to that assessment regarding those topics. The landslide numbering system used in our 8/22/17 report is continued in this supplemental assessment.

2.0 PURPOSE

The purpose of this assessment was to provide additional information and analysis as requested in an Informal Conference Note (ICN) dated September 20, 2017. Additional geologic information was requested regarding:

- Two small landslides observed along Spur 1 Road at Stations 11+20 and 16+05 (Landslides #26 & #27 on Figure 2).

- A larger-scale FPA geologic map (Figure 2).
FIGURE 1 LOCATION MAP
Several Deep-Seated and Shallow Landslides
Lake Serene FPA
Scale: 1 inch = 1 mile

Roots Forestry Consulting, LLC
• Engineering Geologic Sections where timber harvest is proposed in the groundwater recharge area (GWRA) or where new road construction is proposed across a DSLS.

• Landslides in the FPA should be described with respect to activity, distribution, and failure type as per Section 16, Part 6.1 in the Forest Practices Board Manual (FPBM).

• An assessment of risks associated with forest practices in the GWRA of DSLS #s 3, 6, 7, 8, 9, 10, 11, 12, 13, and 16, and road building on DSLS #7 and #8, using pertinent sections of the FPBM at the discretion of applicants Qualified Expert, perform a water budget and assess the hydrologic contribution with respect to timber harvest in affected GWRAs, and if there would be significant increases in the groundwater to the pertinent DSLS, carry out a computational slope stability assessment as warranted.

3.0 SCOPE OF WORK

The scope of work preformed for this assessment is discussed in the pertinent sections below. Additional fieldwork was conducted in late September, early October, and early December 2017. Reconnaissance included a proposed new road alignment (subsequently abandoned) through the eastern area of the FPA, portions of the proposed Spur 1 Road alignment, and areas in the southern portion of the FPA. Supplemental research and stability analysis was also conducted.

4.0 ACCOMPANYING ILLUSTRATIONS

Accompanying illustrations are in the report or presented at the back of this assessment:

Figure 1  Location Map, Page 2
Figure 2  Simplified Geologic Map (Showing Deep-Seated Landslides and Associated Groundwater Recharge Areas), Page 5
Figure 3  Explanation for Figure 2 and Cross Sections, Page 6

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Figure 4  Engineering Geologic Cross Section A – A’
Figure 5  Engineering Geologic Cross Section B – B’
Figure 6  Engineering Geologic Cross Section C – C’
Figure 7  Engineering Geologic Cross Section D – D’
Figure 8  Field Developed Geologic Cross Section Landslide #26
Figure 9  Field Developed Geologic Cross Section Landslide #27
5.0 RECAP OF THE SAILENT GEOLOGY AND GROUNDWATER POINTS

The geology of the FPA (Figure 2) is characterized by essentially flat-lying glaciolacustrine deposits composed of blue-gray fine-grained sands with thin silty/clayey interbeds. These deposits are well exposed in the area of Landslide #1 and crop out locally on the slopes in the northeastern area of the FPA, in the areas of Landslides #6, #8, #13, #25, #27, #28, and on the north-facing slopes south of Stream NpA south of the FPA. The glaciolacustrine sediments are overlain by out-wash sediments characterized by generally thick-bedded, pale yellow-orange, fine- to coarse-grained sands and pebbles and cobbles. The glaciolacustrine sediments may grade upward into the out-wash deposits. Together this section was deposited unconformably on Tertiary age granitic rocks. Seeps and springs were noted at many locations throughout the areas underlain by the glaciolacustrine deposits.

6.0 LANDSLIDES

During initial field reconnaissance and subsequent field visits and an ID Team meeting 28 landslides were recognized. Their distribution is shown on Figure 2. Initially, 19 landslides were recognized and mapped. Subsequently, field reconnaissance of a since abandoned alternate road-alignment in the eastern area of the FPA revealed the presence of several here-to-fore unrecognized landslides. These landslides are numbered #20 to #24 on Figure 2. Landslide #23 is a shallow soil-slip-like failure involving an estimated 10 to 15 cubic yards. No streams are located down slope of this landslide. It is bounded out the FPA. During the ID Team meeting in mid-September a landslide was recognized in the GRWA of Landslide #7. This landslide is labeled #25 on Figure 2. It is essentially a very shallow (<5-feet thick) soil slip on a steep slope that traveled a short distance down slope. One very shallow soil slip (Landslide #28) about 20-feet wide and about 10-feet long was observed northwest of Station 3+20 on Spur 1 Road. It is not within the road alignment and is bound out the FPA. The two small landslides along the Right-of-Way of Spur 1 Road at Stations 11+20 and 16+05 are labeled #26 and #27, respectively (Figure 2).

Field reconnaissance and numerical analysis (discussed below in Sections 7.0 and 8.0) resulted in bounding out of the FPA Landslides #s 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 28 and their associated GWRAs, save for portions of the GWRA of Landslide #8, some minor construction of temporary road through a small portion the GWRAs of Landslides #s 10 and 13, and road construction on Landslides #7 and #8. Because Landslides #s 1, 2, 3, 4, 5, 6, 9, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 28 and their associated GWRAs are bounded out of the FPA they are not discussed any further in this assessment. In addition, because the GWRAs are defined by drainage divides (which are also FPA boundaries) or streams
FIGURE 2 SIMPLIFIED GEOLOGIC MAP
Several Deep-Seated and Shallow Landslides
Lake Serene FPA
See Figure 3 for Explanation
Base map modified from Weyerhaeuser Company
EARTH MATERIALS

Qo Glacial outwash deposits
Qgl Glaciolacustrine deposits
Tg Granitic rocks

MAP SYMBOLS

Contact, ? where uncertain, —— where concealed. Location of Qgl/Qo contact based on assumption glacial deposits are essentially flat lying, be gradational Tg/Qo contact very approximate.

Glacial deep-seated landslide

Shallow landslide

Area of road-fill/cut slope failures

Stream

Seep/spring, PIP

Property boundary

FPA boundary

Existing road

Proposed new road construction

Groundwater recharge area boundary
(shown only for Landslides #s 7, 8, 10, & 13)

A′ Engineering Geologic Cross Section

FIGURE 3 EXPLANATION FOR FIGURE 2 AND CROSS SECTIONS
Several Deep-Seated and Shallow Landslides
Lake Serene FPA
these landslides would not be judged to be “around” landslides.

Additional information for Landslides #s 7, 8, 10, 13, 27, and 28 is provided below. These landslides are discussed below in numerical order.

**Landslide #7** – Landslide #7 is about 220-feet long and up to about 100-feet wide (Figure 2 and Cross Section A – A’, Figure 4). It appears that it is about 10- to 15-feet thick. It could likely be best characterized as an earthflow-type landslide (Cruden and Varnes, 1996). The slide and the scarp are characterized by subdued topography. A Ns stream that flows along the length of the landslide is locally entrenched. The toe Landslide #7 appears to be about 30 feet from the main-stem F-stream. Based on LiDAR topography and field reconnaissance this landslide is best characterized as dormant-indistinct (Forest Practices Board Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landforms, 5/2016) or dormant-mature, as defined by Keaton and DeGraff (1996). The proposed Spur 1 Road will cross the head of this landslide.

**Landslide #8** – Landslide #8 is about 585-feet long and varies from 120-feet to about 300-feet wide (Figure 2 and Cross Section B – B’, Figure 5). It appears that it is likely about 20- (to perhaps slightly more) feet thick. It could likely be best characterized as an earthflow-type landslide (Cruden and Varnes, 1996). The slide and the scarp are characterized by subdued topography and streams Np1 and Np34 that flow over the length or along the left lateral margin (respectively) of the landslide are locally entrenched. The toe of Landslide #8 borders the main-stem F-stream. Based on LiDAR topography and field reconnaissance this landslide is best characterized as dormant-indistinct (Forest Practices Board Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landforms, 5/2016) or dormant-mature, as defined by Keaton and DeGraff (1996). Proposed Spur 1 Road crosses the central area of Landslide #8, and portions of this landslide and GWRA will be harvested.

**Landslide #10** – Landslide #10 is about 175-feet long and up to about 50-feet wide (Figure 2 and Cross Section C – C’, Figure 6). It appears that it is likely about 10- (to perhaps slightly more) feet thick. It could likely be best characterized as an earthflow-type landslide (Cruden and Varnes, 1996). The slide and the scarp are characterized by generally subdued topography. The toe Landslide #10 is bordered by Stream Np3. Based on LiDAR topography and field reconnaissance this landslide is best characterized as dormant-indistinct (Forest Practices Board Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landforms, 5/2016) or dormant-mature, as defined by Keaton and DeGraff (1996). Spur 1 Road will traverse a portion of the GWRA of this landslide.

**Landslide #13** – Landslide #13 is about 360-feet long and about 160-feet wide (Figure 2 and Cross Section D – D’, Figure ). It appears that it is likely about 25-feet or so thick. It could likely be best characterized as an earthflow-type
landslide (Cruden and Varnes, 1996). The slide and the scarp are characterized by subdued topography, and part of stream Np18 flows on the landslide; Stream Np19 flows along the eastern lateral margin of the landslide. Based on LiDAR topography and field reconnaissance this landslide is best characterized as dormant-indistinct (Forest Practices Board Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landforms, 5/2016) or dormant-mature, as defined by Keaton and DeGraff (1996). Proposed Spur 1a Road traverses the southern portion of the GWRA of Landslide #13.

Landslide #26 – Landslide #26 is a small shallow slump that will be crossed by Spur 1 Road at about Station 11+20 (Figure 2). It is estimated to be about 40-feet long and about 20-feet wide. Based on the field developed cross section (Figure 8) it does not appear to be deep seated. No streams are located immediately down slope from this landslide. The main-stem F-stream is about 130 feet from the toe of this landslide. Evidence suggesting the landslide is active was not observed. Spur 1 Road will cross the head of this landslide within a couple of feet of grade.

Landslide #27 – Landslide #27 is a relatively small shallow slump that will be crossed by Spur 1 Road at about Station 16+05 (Figure 2). It is estimated to be about 20-feet wide and up to about 45-feet long. Based on the field developed cross section (Figure 9) it does not appear to be deep seated. Stream Np1 is near the toe of Landslide #27. There is a seep at the head of the landslide. Evidence suggesting the landslide is active was not observed. The road plan shows Spur 1 Road will cross this landslide a couple of feet below grade on a thin rock fill.

7.0 METHODS/EVALUATION PROCESS

As noted above, timber harvest and/or new road construction is proposed on only a few deep-seated landslide or in GWRAs recognized during fieldwork for the Lake Serene FPA. Those deep-seated landslides are #s 7, 8, 10, and 13. (Landslides #26, and #27 are not judged to be deep-seated landslides, based on field-derived topographic profiles (Figures 8 and 9). Subsurface investigation of landslides #s 7, 8, 10, and 13, to discern the geometry and thickness of the landslides-in-question, was judged to be impractical do to site logistics and the invasive damage to the slopes that would be required of such methods, and the potential ambiguity of the results using less invasive methods. However, geologic cross sections are required for a stability analysis and were prepared. The locations of each of these cross sections are shown on Figure 2. Using my discretion, these geologic cross sections were prepared using the LiDAR topography of the base map of Figure 2. The approximate location of the failure plane was determined based on field reconnaissance, the type of the landslide, and my past experience with landslide investigations where subsurface investigations did yield the information required to delineate a failure plane/slide plane. For each DSLS, what was judged to be a reasonable slide
plane, based on the longitudinal (and simple transverse profiles), past experience, and professional judgment, was added to the cross sections, along with the geology and, where appropriate, the location of the proposed Spur 1 Road and other details.

It was decided to forgo preparation of a water budget and determination of the hydrologic contribution of the GWRAs of the several landslides-in-question. It was judged that though a water-budget analysis would yield a result as to how much additional water could be contributed to a given landslides, without a solid understanding of the existing groundwater conditions in the landslides-in-question, knowledge of the additional water that would be delivered to the landslide would not be very useful. However, the influence of the groundwater setting on the stability of the landslides-in-question was not ignored. How the GWRA and groundwater influence on the stability analysis was incorporated into the stability analysis is discussed below.

To assess the stability of the several landslides in question a computational slope stability assessment was utilized. Based on the geometry of the landslides shown on the cross sections it was decided that an infinite-slope model would best represent the deep-seated landslides-in-question. The infinite slope equation (presented below) from Prellwitz (1994a) was used in the computations.

\[
FOS = \frac{C_r + C_s + [q_o + \gamma d + (\gamma_{sat} - \gamma_w - \gamma) d_w] \cos^2 \alpha \tan \phi}{[q_o + \gamma d + (\gamma_{sat} - \gamma) d_w] \sin \alpha \cos \alpha}
\]

The following assumptions and typical values from published sources were used regarding material properties and strength parameters used in the equation:

- The slope angle \( \alpha \) was measured directly from the cross sections.
- The depth of the failure (thickness of the soil column) "\( d \)" was measured from the cross section.
- The depth of the water in the soil column "\( d_w \)" was assumed to be one-half foot below the ground surface, essentially saturating the soil column.
- The angle of internal friction of 30 degrees for the earth materials of the slide planes of Landslides #s 7, 8, 10, 12, and 13 was utilized.
- A dry density of 100 lb/cubic foot used.
- The density of 62.5 lb/cubic foot for water was used.
- A saturated density of 130 lb/cubic foot was used.
Soil cohesion \( C_s \), root cohesion \( C_r \), and tree surcharge \( q_t \) were assumed to be zero.

The assumptions for the slope angle, friction angle, dry density, saturated density, and tree surcharge are discussed below as follows:

The slope of the landslide was averaged as a "best fit" straight line along the ground surface of the majority of the length of the landslide. Then the angle was measured off the cross section.

The friction angle was reduced to 30 degrees from residual values of 35 to 36 degrees published in Hammond and others (1992) for medium-dense sands with some fine fraction (a description that it is judged closely mirrors the bluish gray sands and interbedded silt/clay of the glaciolacustrine sediments in which Landslides #s 7, 8, 10, and, in part, 13 occur. Thirty degrees is a little above the slope of the steepest measured ground surface (26 degrees) of the landslides that occurred in the glaciolacustrine sediments that are bounded out of the FPA. (If cohesion is 0, the friction angle cannot be less that the slope or the slope will not stay up.) For Landslide #13, the friction angle used was also 30 degrees though part of Landslide #13 occurred in the somewhat stronger sands of the out-wash deposits.

The range of dry densities for earth materials similar those at the FPA range from lows of about 100-lb/cubic foot (Hammond and others, 1992) to up to 116 lb/cubic foot (Peck and others, 1974). The 100 lb/cubic foot value was chosen because it closely reflected the earth materials that corresponded to the published friction angles listed by Hammond and others (1992).

Saturated density values of 130-lb/cubic foot were reported by Peck and others (1974) and used in many examples of calculated stability analysis (Perllwitz, 1994a).

Tree surcharge was assumed to be 0 because Denning (1994) reports that the infinite-slope equation is fairly insensitive to tree surcharge where landslide thickness are greater than 5 feet.

All of these assumptions taken together, plus setting the water depth at one-half foot below the ground surface combine to create, in my opinion, a fairly conservative approach to the stability analysis for the landslides-in-question.

An essentially saturated landslide was the subject of the analysis to simulate what might be the case if the GWRA were clear-cut. If the analysis showed that a saturated landslide had a FOS greater than 1.2; it was decided that harvest in the GWRA would not result in destabilizing and reactivate the landslide-in-question.
8.0 COMPUTATIONAL RESULTS

The results of the computational stability analysis using the parameters presented above for Landslides #s 7, 8, 10, and 13 are presented below. Hammond and others (1992) note that Factors of Safety (FOS) of 1.2 to 1.5 are considered acceptable to provide a conservative margin against the variability of the site conditions. It must be kept in mind that in the cases of Landslides #s 7, 8, 10, and 13 the landslides are essentially saturated for the analysis.

The FOS for Landslide #7 was calculated to be 1.2

The FOS for landslide #8 was calculated to be 1.4

The FOS for Landslide #10 was calculated to be 0.8

The FOS for Landslide #13 was calculated to be 1.0

The FOS for Landslides #s 7 and 8 was explored under a variety of different scenarios including varying the friction angle to as low as 27 degrees in an essentially saturated state with results that were still greater than a FOS equal to 1.0 (1.1 and 1.2, respectively). Thickness and dry density was also varied, with little deviation from the FOS listed above, as expected (Hammond and others, 1992).

The GWRAs of Landslides #s 10 and 13 are bounded out of the FPA, save for proposed road alignments, and will likely not reach the saturated state used in the analysis. This is discussed in more detail below in section 9.2.

Based on these results, portions of the GWRA of Landslide #8 has been included in the FPA. It is proposed to harvest approximately 76 percent of the GWRA of Landslide #8. The recharge area of Landslide #7 has been bounded out of the FPA for reasons related to Landslide #6 and other operational reasons. The recharge areas of Landslides #s 10 and 13 are bounded out of the FPA, save for some minor new-road construction (Spur 1 and 1a Roads).

9.0 OTHER LANDSLIDE AND GWRA ISSUES

Other issues related to impacts of management activities on slope stability include the shallow Landslides #s 26 and 27, road construction on Landslides #7 and #8 and through the GWRAs of Landslide #10 and #13, and reconstruction of the existing road through the GWRAs of Landslide #s 6, 8, 9, 10, 11, 12, 13, and 16. These issues are discussed in turn below.

9.1 Management Activities on Shallow Landslides #26, and #27 – Road construction is proposed on shallow Landslides #26 and #27 (Figures 2, 8, and 9).
Both of these landslides can be characterized as rotational-type landslide (Cruden and Varnes, 1996). The slides and the scarps are characterized by somewhat subdued topography. Based on field reconnaissance, these landslide are likely best characterized as dormant-distinct (Forest Practices Board Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landforms, 5/2016) or dormant-young, as defined by Keaton and DeGraff (1996). At the time of failure the landslides did not travel very far, suggesting that the driving forces dissipated fairly quickly. Past performance of these landslides provides in-sight into how they would likely perform in the future if they were reactivated. Based on their past performance it is unlikely these landslides would travel very far if they were reactivated.

**Landslide #26** – Landslide #26 is not adjacent to or near a stream, the nearest stream is about 130 feet to the southeast of Landslide #26 over relatively gentle ground, there are no streams mapped immediately down slope of this landslide. As noted above, this landslide did not travel very far down slope at the time of failure, arguing the potential for delivery is remote. The proposed Spur 1 Road will cross the head of the slide, it is a temporary road, and the amount cut or fill to be placed is uncertain, but should not be much to maintain grade. If the road construction were to reactivate the slide it could become a maintenance problem as long as the road is open but it is not anticipated that delivery of sediment to a stream would occur. During road abandonment any fill placed on the landslide should be removed.

**Landslide #27** – Landslide #27 is near stream Np1 and Np34. If this landslide were to move in response to the proposed road construction there is a potential for sediment delivery to stream Np1 or Np34. To mitigate this potential the grade of Spur 1 Road will be lowered several feet and a rock blanket (Figure 10) will be placed to carry the road over the water from the seep at the head of the landslide. Based on the road sections at 16+09, the excavation for the road and the placement of the rock fill will essentially equal each other, thus the mass balance of the landslide will not be altered. This will reduce the potential that road construction across the landslide will reactivate Landslide #27.

### 9.2 Road Construction Landslides #7 and 8, GWRAs Landslides #10 and #13

It is proposed to construct a new road across the head area of Landslide #7, across the central area of Landslide #8, and through the GWRA of Landslides #s 10 and 13. These proposed management activities are discussed below; road construction across the landslides is discussed first, then road construction through the GWRAs.

**Road Construction on Landslides #s 7 and 8** – Careful consideration has been given to the road design where the proposed temporary road will
cross Landslides #7 and 8. Where the road will cross these two landslides the slopes are relatively gentle.

**Landslide #7** straddles Station 10+17. The GWRA of Landslide #7 is bounded out of the FPA. It is proposed to temporarily place about two to three feet of fill to accommodate a culvert. It is not anticipated that the temporary fill will have an adverse impact on Landslide #7. The landslide has a calculated FOS of 1.2 under saturated conditions, currently it enjoys a higher FOS, and retention of the timber in the GWRA will reduce the likelihood that saturated conditions will be realized. Thus it is not judged that the temporary placement of fill and the subsequent removal of the fill would have an adverse impact on the stability of Landslide #7.

On **Landslide #8** very localized cuts up to about 3- to 4-feet high will be excavated to keep the centerline of Spur 1 Road essentially on grade. Rock-filter blankets will be used for a stream crossing and a ditch-relief culvert. To accommodate both, the rock-filter blankets will be about 25-feet long by about 8-feet wide; up to about 3-feet thick and extend to the base of the adjacent cut slopes. Road cuts for the rock filter blankets will also be up to about 3- to 4-feet high. It is anticipated that the excavation of the cut and placement of the rock-drainage blankets should not alter the over all mass balance of Landslide #8 to any significant extent.

**Road Construction across GWRAs of Landslides #10 and #13** – The temporary road will cross parts of the GWRA of Landslides #s 10 and 13.

**Landslide #10** has a calculated FOS of .8 under saturated conditions. At this time the landslide is not saturated. The entire GWRA of Landslide #10 has been bounded out of the FPA so it is not likely that saturated conditions will be realized for Landslide #10. The proposed temporary road will require Right-of-Way harvest of about 11 percent (an area on average about 45-feet wide by about 200-feet long) of the GWRA of Landslide #10. In my professional judgment the impacts should be small, for 89 percent of the vegetation will be retained, thus reducing the potential for a significant increase in groundwater flow and an adverse impact to Landslide #10.

**Landslide #13** has a calculated FOS of 1.0. under saturated conditions. At this time the landslide is not saturated. The entire GWRA of Landslide #13 has been bounded out of the FPA so it is not likely that saturated conditions will be realized for Landslide #13. The proposed temporary road will require Right-of-Way harvest of about 7 percent (an area on average about 45-feet wide by about 150-feet long) of the GWRA of Landslide #13. The impacts should be small, for 93 percent of the vegetation will be retained, thus reducing the potential for a significant increase in groundwater flow and an adverse impact to Landslide #13.
The GWRAs new road drainage should be carefully thought out to avoid excess levels of concentration of runoff in order to reduce the potential for localized erosion and slope instability. In addition, the road drainage system should not redirect runoff from one small watershed to an adjacent watershed. This will help to keep the runoff input to each small watershed in pre-road conditions.

9.3 Reconstruction of Existing Roads in the GWRAs of Landslides #s 6, 8, 9, 10, 11, 13, and 16.

The existing roads in the GWRAs of Landslides #s 6, 8, 9, 10, 11, 12, 13, and 16 will be reconstructed on the existing road grades. These road grades date back to before 1958, and maybe a decade or two more. They are now a well established part of the GWRAs of Landslides 6, 8, 9, 10, 11, 13 and 16, and are not a new “landform” or a new “management activity” being imposed on the unaltered hillsides of the GWRA. To date, it does not appear that these old existing roads in the GWRAs-in-question have had an adverse impact on the associated landslides-in-question. It is proposed to reconstruct the roads, staying within the existing foot-print of the current road, cutting only the trees on the running surface (and danger or clearance trees). The GWRAs of the afore-listed landslides have had at least 60, to maybe 70, years or more to adjust to the presence of the roads in the GWRAs. The potential for reconstruction of the roads to now adversely impact the stability of the landslides associated with each GWRA is judged to be low. That being said, the road drainage should be carefully thought out to avoid excess levels of concentration of runoff in order to reduce the potential for localized erosion and slope instability at culvert outlets. In addition, the road drainage system should not redirect runoff from one small watershed to an adjacent watershed. This will help to keep the runoff input to each small watershed in pre-road conditions.

10.0 CONCLUSIONS

Based on the results of our office analysis and field reconnaissance Landslides #s 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 24, and their associated GWRAs, save for some minor construction of temporary roads through a small portion the GWRAs of Landslides #s 10 and 13, have been bounded out of the FPA. Numerical stability analysis of Landslides #s 7, 8, 10, and 13 using conservative strength values and essentially saturated conditions showed that Landslides #s 7, and 8 had FOS equal to or greater than 1.2 (1.2 and 1.4 respectively). Based on these results approximately 76 percent of the GWRA of Landslide #8 will be harvested. In my opinion, based on the results of the numerical analysis this percent of harvest should not have an adverse impact on the stability of Landslide #8. For a verity of reasons essentially all of the GWRA of Landslide #7 has been bounded out of the FPA. Landslide #10, under saturated conditions had a FOS of .8 and Landslide #13 a FOS of 1.0. The
GWRAs of these two landslides were also bounded out of the FPA, save for some minor new road construction, which would impact about 11 percent of the GWRA of Landslide #10 and about 7 percent of the GWRA of Landslide #13. Due to the high FOS under saturated conditions for Landslide #8 part of the GWRA of that landslide is included in the FPA. Road construction across Landslides #s 7 and 8 is judged to not likely to adversely impact the stability of those landslides. In addition, road construction through the GWRAs of Landslides #s 10 and 13 is also judged to not likely have an adverse impact on the stability of those landslides because only a small portion of the GWRA will be cut and it is judged that such harvest will not significantly increase the flow of groundwater to Landslides #s 10 and 13. Where Spur 1 Road crosses Landslide #26 the potential for sediment delivery is judged to be low if the landslide were to be reactivated during the short-term use of the road. Where Spur 1 Road crosses Landslide #27 the excavation of the road grade on that landslide and replacement of the landslide debris with a rock-drainage blanket will reduce the potential for reactivation of Landslide #27, for the cut and fill will balance each other and should not noticeably alter the mass balance of the landslide.

11.9 FOREST PRACTICES STATEMENTS

The required Forest Practices Statements addressing WAC 222-10-030 (1) (a,b,c) follow. These responses are based on the discussions presented above in sections 6.0, 7.0, 8.0, 9.0, and 10.0, and the background information presented in sections 3.0 and 5.0. To keep these responses simple and clear and to avoid redundancy, please read, if you have not already, those sections just noted above for detailed information supporting the following statements.

a) The likelihood that the currently proposed forest practices will cause movement on the potentially unstable slopes or landforms, or contribute to further movement of a potentially unstable slope or landform is in my opinion low.

b) The likelihood of delivery of sediment or debris to any public resources, or in a manner that would threaten public safety, is in my opinion low.

c) Mitigation measures shall include careful design of the temporary-road drainage where it crosses Landslides #s 7, and 8 and the GWRA of Landslides #s 10 and 13. These mitigation measures shall include the recommendations in section 12.0 below.

12.0 RECOMMENDATIONS

The following recommendations shall be incorporated into the FPA:
1. On Landslide #8 no additional fill ("imported fill") shall be placed on the road alignment save for the rock necessary for an adequate running surface and to balance the excavations on Landslide #8.

2. No earth materials excavated during road construction shall be wasted on any landslide, in particular Landslides #s 7 and 8.

3. Upon abandonment of the road the road fill shall be "pulled" on Landslide #7.

4. In the GWRAs, road drainage shall, as much as feasible, avoid redirecting runoff to an inappropriate location, such as a different GWRA.

5. Tree harvest on the existing road grades in the GWRAs of Landslides #s 10 and 13 shall be limited to that necessary to provide clearance for log trucks and yarding equipment, and danger trees.

13.0 ASSESSMENT LIMITATIONS

This engineering geologic assessment of several deep-seated and shallow landslides, results, and conclusions are based on the scope of work outlined above and in our 3/22/17 assessment, the Lake Serene FPA as it is currently proposed, and our professional experience with similar field situations. No warrantee is expressed or implied. Site conditions or the FPA proposal can change with time. In addition, road construction or other forest practices could reveal geologic information not available or obvious at the time of our reconnaissance. The conclusions and recommendations presented in this assessment are predicated on the FPA and associated road construction discussed in this assessment going forward as proposed at the time of preparation of this assessment. If changes in the proposal, execution of the FPA, or changes in site conditions were to be exposed, or changes in the locations of the roads were to occur, our geologic interpretations and opinions would be invalidated and thus our conclusions and recommendations could require modification.
Weyerhaeuser Company
Several Deep-Seated and Shallow Landslides
Lake Serene FPA

If you have any questions, please call.

ROOTS FORESTRY CONSULTING, LLC.

John M. McKenzie
Chief Engineering Geologist
LEG #861

John M. McKenzie
12/19/17
REFERENCES CITED


FIGURE 8

FIELD DEVELOPED ENGINEERING GEOLoGIC CROSS SECTION LANDSLIDE #26
LAKE SERENE FPA

Approximate location Spur 1 Road
Crossing about on grade
LANDSLIDE #26

Assumed elevations

VIEW LOOKING NNE
Approx Sta. 11+20

1" = 10' (H = V)
TOPOGRAPHY APPROXIMATE

ROTS FORESTRY CONSULTING, LLC
FIGURE 9

Field Developed Engineering Geologic Cross Section Landslide #27
Lake Serene FPA

Conceptual View Looking NNE
Approx Sta. '16+05

1" = 10' (H=V)
Topography Approximate

Roots Forestry Consulting, LLC
<table>
<thead>
<tr>
<th>DATE</th>
<th>DOCUMENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/2/2018</td>
<td>Numerous</td>
<td>Replaced pgs. 4 &amp; 7 and road work list; added drawings of Spur Road 1, rock filter cell detail, &amp; additional geo-tech information.</td>
</tr>
</tbody>
</table>
Hi Linda,

Regarding FPA 2816174, “Lake Serene” please see the attachment for detail on construction of the rock filter cells that are proposed on the road construction. Also replace page 4 of the original application (changed abandonment date to the end of June 2018) and page 7 (added a sentence in question 31 about adding energy dissipaters to the outlets of cross-drain culverts). In addition please replace the road work list to reflect the moving of a cross-drain culvert on Spur 1 from station 14+15 to 14+38.

In the morning I will also provide updated drawings of the plan view and cross-section views of the Spur 1 Road Construction within the areas of the slides (the updates will show additional cross-drain culverts as described on the road work list) and a quantification of how the rock filter cell at crossing E will perform as well as a culvert.

Thanks.

Wes Worden
Forest Engineering Specialist
Weyerhaeuser Company
509-387-0321
Hi Linda,

I would like to rescind my withdrawal of FPA 2816174 since the geologist was able to prepare the additional requested information sooner than I had thought. Please see the attachments. Thanks.

From: Worden, Wes  
Sent: Wednesday, January 31, 2018 1:39 PM  
To: U TGARD, LINDA (DNR); Neil Shea; McMichael, Aaron (DNR)  
Cc: Carter, Connie; HUANG, STEVEN (DNR)  
Subject: RE: FPA 2816174 ("Lake Serene")  

Hi Linda,

I request to withdraw Forest Practice Application# 2816174 based on the additional information requested by Aaron McMichael. This information will be provided at the time of resubmitting (our contracted geologist doesn't have enough time to prepare the report before the due date). Thanks.

Get Outlook for Android
Steps

1. Excavate the Bed

2. Lay Fabric

3. Fill Excavated Bed With Rock

4. Wrap Fabric Across the Top

5. Install Surfacing
LAKE SERENE ROAD

ROCK FILTER CELL

Water Flow Conveyance Calculation
Based on Representative Cross Section

4"-8" Quarry Spalls

This cross section diagram is a representation only. Actual construction may vary.

Rock Filter Outside Dimension = 20 SQFT
Representative Quarry Spall = 15 SQFT
Remaining Opening = 5 SQFT
24" Culvert End Area @ 0.905 = 2.8 SQFT
30" Culvert End Area @ 0.905 = 4.4 SQFT

RECEIVED NW REGION
FEB 02 2018
Question 31.

ROOTS FORESTRY

January 31, 2018
Project No. P2017-005

TO: Mr. Wes Worden, Harvest Manager
Weyerhaeuser Company
500 Metcalf Street
Sedro-Woolley, Washington  98284

SUBJECT: Additional Engineering Geologic Assessment
Several Deep-Seated Landslides
Lake Serene Forest Practices Application
Snohomish County, Washington

1.0 INTRODUCTION

The following additional engineering geologic assessment presents the results of our slope stability analysis for several deep-seated landslides (DSLS) associated with the proposed Lake Serene Forest Practices Application (FPA). These landslides are #s 7, 8, 10, and 13 (See attached figures). A numerical analysis of the stability of these deep-seated landslides in the Lake Serene FPA was presented in our supplemental engineering geologic assessment dated December 15, 2017. Prior to that the FPA in question was the subject of an earlier engineering geologic reconnaissance assessment prepared by our office dated August 22, 2017 (8/22/17). Basic information pertinent to the location (Figure 1), terrain, geologic setting, groundwater, harvest history, and aerial photographs reviewed in and about the FPA were discussed in that assessment. The reader is referred to that assessment regarding those topics. The landslide numbering system used in our 8/22/17 report is continued in this supplemental assessment.

2.0 PURPOSE

The purpose of this assessment was to provide additional information and analysis as requested following an ID Team meeting on January 26, 2018. During that field meeting it was recognized that the lower portions of the glacial-lake deposits (where the landslides-in-question occur) in the FPA were likely not as sandy as earlier understood, and that it would be more appropriate to conduct the numerical stability analysis using criteria more characteristic of silty/clayey
glacial-lake sediments. In addition, it was requested to provide some discussion regarding the disposition of the additional precipitation that will fall on Landslide #8 following timber harvest.

3.0 METHODS/EVALUATION PROCESS

As noted above, timber harvest and/or new road construction is proposed on only a few deep-seated landslide or in GWRAs recognized during fieldwork for the Lake Serene FPA. Those deep-seated landslides are #s 7, 8, 10, and 13. Geologic cross sections required for a stability analysis and were prepared for the December 13, 2017 assessment. The locations of each of these cross sections are shown on Figure 2. These geologic cross sections were prepared using the LiDAR topography of the base map of Figure 2. The approximate location of the failure plane for the landslides-in-question was determined based on field reconnaissance, the type of the landslide, and my past experience with landslide investigations where subsurface investigations did yield the information required to delineate a failure plane/slide plane. For each DSLS, what was judged to be a reasonable slide plane, based on the longitudinal (and simple transverse profiles), past experience, and professional judgment, was added to the cross sections, along with the geology and, where appropriate, the location of the proposed Spur 1 Road and other details.

To assess the stability of the several landslides in question a computational slope stability assessment was utilized. Based on the geometry of the landslides shown on the cross sections it was decided that an infinite-slope model would best represent the deep-seated landslides-in-question. The infinite slope equation (presented below) from Prellwitz (1994) was used in the computations. [F = Factor of Safety (FOS)].

\[
F = \frac{C_r + C_s + (\gamma_d + (\gamma_{sat} - \gamma_w - \gamma)d_w)\cos^2\alpha\tan\phi \sin\alpha \cos\alpha}{(\gamma_d + (\gamma_{sat} - \gamma)d_w)\sin\alpha \cos\alpha}
\]

The following assumptions and typical values from published sources were used regarding material properties and strength parameters used in the equation:

- The slope angle $\alpha$ was measured directly from the cross sections.

- The depth of the failure (thickness of the soil column) "d" was measured from the cross section.

- The depth of the water in the soil column "dw" was assumed to be one-half foot below the ground surface, essentially saturating the soil column.

- The angle of internal friction of 27 degrees for the earth materials of the slide
planes of Landslides #s 7, 8, 10, and 13 was utilized.

- A dry density of 100-lb/cubic foot used.
- The density of 62.5-lb/cubic foot for water was used.
- A saturated density of 125-lb/cubic foot was used.
- Soil cohesion “Cₕ” of 250-pounds/square foot was used
- Root cohesion “Cᵣ” and tree surcharge “qₑ” were assumed to be zero.

The assumptions for the slope angle, friction angle, dry density, saturated density, cohesion, and tree surcharge are discussed below as follows:

The slope of the landslide was averaged as a “best fit” straight line along the ground surface of the majority of the length of the landslide. Then the angle was measured off the cross section.

The internal-friction angle of 27 degrees was chosen from the values determined for the Upper Lacustrine sediments exposed in the scarp of the 530 Landslide of 22 March 2014. This value was derived from geotechnical testing of these earth materials by Stark and others (2016) and is a residual strength value. Descriptions of the Upper Lacustrine sediments closely resemble the glacial-lake sediments in the FPA. The 27-degree value represents the upper value of a range of values from 20 degrees to 27 degrees. The upper value was chosen because it was decided that, based on the slopes of the ground surface of several landslides bound out of the FPA and locally the steep inclination of the natural undisturbed slopes, a residual strength of 27 degrees appeared to be a reasonable assumed value.

Based on the liquid limit values and the plastic limit values reported by Stark and others (2016) for the Upper Lacustrine deposits at the 530 Landslide and the subsequently derived plasticity index, the glacial-lake deposits at the FPA could be best classified as a CL-like soil, but plotting close to the A-Line. The range of dry densities for earth materials similar to the glacial-lake deposits at the FPA range from lows of about 78- to 94-pounds/cubic foot [Savage and others (2000) in the Lawton Clay [a generally glaciolacustrine deposit whose physical description is somewhat similar to the lake deposits at the FPA (the Lawton Clay is overconsolidated)] to 100- to 125-pounds/cubic foot for clays and silty clays [Engineering Tool Box (www. Engineering Tool Box.com and Geotechnical Information.com)]. Koloski and others (1989) report dry densities for glaciolacustrine deposits varying from 100- to 120-pounds/cubic foot. Most of the dry-density values from the sources just cited clustered around 100-pounds/cubic foot so that value was used for the dry density.
A saturated density of 125 pounds/cubic foot for clays was reported by Geotechnical Information.com and saturated density values of 110 to 129 pounds/cubic foot were reported by Peck and others (1974) for soft glacial clay and stiff glacial clay, respectively. Based on this research a value of 125-pounds/cubic foot was used for the saturated density.

Koloski and others (1989) report cohesion values as high as 3,000-pounds/square foot for glaciolacustrine sediments (likely a peak value, residual values would be less; perhaps much less). Savage and others (2000) cite reported residual cohesion strength values from 0 to 500-pounds/square foot based on laboratory testing of samples of the Lawton Clay. A value of half that, 250-pounds/square foot was chosen for this analysis. This is also based on the slopes of the ground surface of several landslides bound out of the FPA and locally observations of the steep inclination of the natural undisturbed slopes, suggesting some inherit strength. Calculations showed that lower cohesion values down to 208- to 222-pounds/square foot would be sufficient to produce a FOS of 1.2 for Landslides #s 10 and 13, and even lower for a FOS of 1.1 (see below in section 4.0).

Tree surcharge was assumed to be zero (0) because Denning (1994) reports that the infinite-slope equation is fairly insensitive to tree surcharge where landslide thickness are greater than 5 feet.

An essentially saturated landslide was the subject of the analysis to simulate what might be the case if the GWRA were clear-cut, which will not be the case for Landslides #s 10 and 13. If the analysis showed that a saturated landslide had a FOS greater than 1.2, it was decided that timber harvest in the GWRA would not result in destabilizing and reactivate the landslide-in-question.

4.0 COMPUTATIONAL RESULTS

The results of the computational stability analysis using the parameters presented above for Landslides #s 7, 8, 10, and 13 are presented below. Hammond and others (1992) note that Factors of Safety of 1.2 to 1.5 are considered acceptable to provide a conservative margin against the variability of the site conditions. It must be kept in mind that in the cases of Landslides #s 7, 8, 10, and 13 the landslides are essentially saturated for the analysis.

The FOS for Landslide #7 was calculated to be 1.8
The FOS for landslide #8 was calculated to be 1.8
The FOS for Landslide #10 was calculated to be 1.2
The FOS for Landslide #13 was calculated to be 1.2
In the case of Landslide #7, cohesion could be reduced to 63-pounds/square foot and the FOS would be 1.2, for Landslide #8 cohesion of 63-pounds/square foot would result in a FOS of 1.4. The cohesion for Landslide #10 and 13 could be reduced to 222- and 208-pounds/square foot (respectively) and still retain a FOS of 1.2. Further reduction in the cohesion to 180- and 124-pounds/square foot for Landslide #s 10 and 13, respectively, would result in FOS for Landslide #10 of 1.1 and Landslide #13 of 1.1 also.

As just noted, cohesion values significantly lower that 250-pounds/square foot were found to result in FOS of 1.1 for Landslide #s 10 and 13. This is slightly lower than the 1.2 minimum noted above. In these two cases only a small part of the GWRAs of these landslides will be disturbed. These landslides are dormant suggesting the FOS for these landslides must be at least in the range of 1.1 [or even up to 1.2 considering that at least some portion of the GWRAs of these landslides has been harvested at least once (harvest history in the 8/22/17 assessment)] and they appear to not have been measurably disturbed, if at all, by that earlier harvest. The GWRAs of Landslides #s 10 and 13 are bounded out of the FPA, save for the proposed road alignments, no managerial change in the GWRAs of these landslides will occur. Thus, the proposed FPA will impact only a small portion of the GWRAs of Landslide #s 10 and 13 and result in a relatively very small increase in the flow of groundwater towards Landslide #s 10 and 13 and not likely result in saturating these landslides. In my judgment such a small increase presents a low risk to destabilizing Landslide #s 10 and 13.

Based on these results, portions of the GWRA of Landslide #8 has been included in the FPA. It is proposed to harvest approximately 76% of the GWRA of Landslide #8. The recharge area of Landslide #7 has been bounded out of the FPA for reasons related to Landslide #6 and other operational reasons. The recharge areas of Landslides #s 10 and 13 are bounded out of the FPA, save for some minor new-road construction (Spur 1 and 1a Roads).

5.0 OTHER LANDSLIDE AND GWRA ISSUES

Other issues related to impacts of management activities on slope stability include road construction on Landslides #7 and #8 and through the GWRAs of Landslide #10 and #13. These issues are discussed in-turn below.
Reconstruction of the existing road through the GWRAs of Landslide #s 6, 8, 9, 10, 11, 12, 13, and 16 is discussed in the December 15, 2017 assessment.

**Road Construction on Landslides #s 7 and 8** – Careful consideration has been given to the road design where the proposed temporary road will cross Landslides #s 7 and 8. Where the road will cross these two landslides the slopes are relatively gentle.
Landslide #7 straddles Station 10+17. The GWRA of Landslide #7 is bounded out of the FPA. It is proposed to temporarily place about two to three feet of fill to accommodate a culvert. It is not anticipated that the temporary fill will have an adverse impact on Landslide #7. The landslide has a calculated FOS of 1.8 under saturated conditions, currently it enjoys a higher FOS, and retention of the timber in the GWRA will reduce the likelihood that saturated conditions will be realized. Thus it is not judged that the temporary placement of minor amounts of fill and the subsequent removal of the fill would have an adverse impact on the stability of Landslide #7.

On Landslide #8 very localized cuts up to about 3- to 4-feet high will be excavated to keep the centerline of Spur 1 Road essentially on grade. Rock-filter blankets will be used for a stream crossing and a ditch-relief culvert. To accommodate both, the rock-filter blankets will be about 25-feet long by about 8-feet wide; up to about 3-feet thick and extend to the base of the adjacent cut slopes. Road cuts for the rock filter blankets will also be up to about 3- to 4-feet high. It is anticipated that the excavation of the cut and placement of the rock-drainage blankets should not alter the over all mass balance of Landslide #8 to any significant extent.

Road Construction across GWRA of Landslides #10 and #13 – The temporary road will cross parts of the GWRA of Landslides #s 10 and 13.

Landslide #10 has a calculated FOS of 1.2 under saturated conditions. At this time the landslide is judged to not be saturated. The entire GWRA of Landslide #10 has been bounded out of the FPA so it is not likely that saturated conditions will be realized for Landslide #10. The proposed temporary road will require Right-of-Way harvest of about 11 percent (an area on average about 45-feet wide by about 200-feet long) of the GWRA of Landslide #10. In my professional judgment the impacts should be small, for 89 percent of the vegetation will be retained, thus reducing the potential for a significant increase in groundwater flow and an adverse impact to Landslide #10.

Landslide #13 has a calculated FOS of 1.2 under saturated conditions. At this time the landslide is judged to not be saturated. The entire GWRA of Landslide #13 has been bounded out of the FPA so it is not likely that saturated conditions will be realized for Landslide #13. The proposed temporary road will require Right-of-Way harvest of about 7 percent (an area on average about 45-feet wide by about 150-feet long) of the GWRA of Landslide #13. The impacts should be small, for 93 percent of the vegetation will be retained, thus reducing the potential for a significant increase in groundwater flow and an adverse impact to Landslide #13. The GWRA’s new road drainage should be carefully thought out to avoid excess levels of concentration of runoff in order to reduce the potential for localized erosion and slope instability. In addition, the road drainage
system should not redirect runoff from one small watershed to an adjacent watershed. This will help to keep the runoff input to each small watershed in pre-road conditions.

6.0 DISPERSEMENT OF PRECIPITATION REGARDING LANDSLIDE #8

As part of this FPA approximately 76% of the recharge area of Landslide #8 will be harvested. This will reduce the canopy cover and the amount of interception of precipitation and also a corresponding increase in the amount of precipitation that reach the ground. This water will be dispersed through some infiltration into the landslide, runoff carried away by the drainage system that drains the landslide, and some overland flow. The parsing-out of the quantitative dispersement of the additional rainfall reaching the ground surface of Landslide #8 is difficult to estimate; however, an unpublished study in northern California suggests that about 25% of rainfall is intercepted and then evaporated back into the atmosphere, 25% is accounted for through evapotranspiration, and the other 50% goes into runoff and infiltration. Moore and Wondzell (2005) also report about 50% going in to runoff and infiltration. Since about 75% of the interception and 75% of evapotranspiration will be lost there will be a corresponding increase in infiltration, stream-drainage runoff, and overland flow. The numerical stability analysis has taken into account infiltration into the landslide, the analysis being a saturated state. The other processes are not seen as landslide destabilizing influences.

7.0 CONCLUSIONS

Based on the results of our office analysis and field reconnaissance Landslides #s 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 24, and their associated GWRAs, save for some minor construction of temporary roads through a small portion the GWRAs of Landslides #s 10 and 13, have been bounded out of the FPA. Numerical stability analysis of Landslides #s 7, 8, 10, and 13 using conservative strength values and essentially saturated conditions showed that Landslides #s 7 and 8 had FOS of 1.8. Based on these results approximately 76 percent of the GWRA of Landslide #8 will be harvested. In my opinion, based on the results of the numerical analysis this percent of harvest should not have an adverse impact on the stability of Landslide #8. For a verity of reasons essentially all of the GWRA of Landslide #7 has been bounded out of the FPA. Landslide #10, under saturated conditions had a FOS of 1.2 and Landslide #13 a FOS of 1.2. The GWRAs of these two landslides were bounded out of the FPA, save for some minor new-road construction, which would impact about 11 percent of the GWRA of Landslide #10 and about 7 percent of the GWRA of Landslide #13. Road construction across Landslides #s 7 and 8 is judged to not likely adversely impact the stability of those landslides. In addition, road construction through the GWRAs of Landslides #s 10 and 13 is
also judged to not likely have an adverse impact on the stability of those
landsides because only a small portion of the GWRA will be cut and it is judged
that such harvest will not significantly increase the flow of groundwater to
Landslides #s 10 and 13.

8.0 FOREST PRACTICES STATEMENTS

The required Forest Practices Statements addressing WAC 222-10-030 (1) (a,b,c)
follow. These responses are based on the discussions presented above in sections
3.0, 4.0, 5.0, 6.0, and the background information and other discussions presented
in the earlier assessments cited in section 1.0. To keep these responses simple
and clear and to avoid redundancy; please read, if you have not already; those
sections of this assessment just noted above, or the earlier assessments, for
detailed information supporting the following statements.

a) The likelihood that the currently proposed forest practices will cause
movement on the potentially unstable slopes or landforms, or contribute to
further movement of a potentially unstable slope or landform is in my
opinion low.

b) The likelihood of delivery of sediment or debris to any public resources, or in
a manner that would threaten public safety, is in my opinion low.

c) Mitigation measures shall include careful design of the temporary-road
drainage where it crosses Landslides #s 7, and 8 and the GWRA of Landslides
#s 10 and 13. These mitigation measures shall include the recommendations in
section 9.0 below.

9.0 RECOMMENDATIONS

The following recommendations shall be incorporated into the FPA:

1. On Landslide #8 no additional fill ("imported fill") shall be placed on
   the road alignment save for the rock necessary for an adequate running
   surface and to balance the excavations on Landslide #8.

2. No earth materials excavated during road construction shall be wasted
   on any landslide, in particular Landslides #s 7 and 8.

3. Upon abandonment of the road the road fill shall be "pulled" on
   Landslide #7.

4. In the GWRAs, road drainage shall, as much as feasible, avoid
   redirecting runoff to an inappropriate location, such as a different
GWRA.

5. Tree harvest on the existing road grades in the GWRAs of Landslides #s 10 and 13 shall be limited to that necessary to provide clearance for log trucks and yarding equipment, and removal of danger trees.

10.0 ASSESSMENT LIMITATIONS

This supplemental engineering geologic assessment of several deep-seated landslides, and the accompanying results and conclusions are based on the scope of work outlined above and pertinent information in our 8/22/17 and 12/15/17 assessments for this FPA, the Lake Serene FPA as it is currently proposed, and our professional experience with similar field situations. No warrantee is expressed or implied. Site conditions or the FPA proposal can change with time. In addition, road construction or other forest practices could reveal geologic information not available or obvious at the time of our reconnaissance. The conclusions and recommendations presented in this assessment are predicated on the FPA and associated road construction discussed in this assessment going forward as proposed at the time of preparation of this assessment. If changes in the proposal, execution of the FPA, or changes in site conditions were to be exposed, or changes in the locations of the roads were to occur, our geologic interpretations and opinions would be invalidated and thus our conclusions and recommendations could require modification.

If you have any questions, please call.

ROOTS FORESTRY CONSULTING, LLC.

John M. McKenzie
Chief Engineering Geologist
LEG #861

Attachments (They are as is taken from the 12/15/18 assessment):

Figure 1  Location Map
Figure 2  Simplified Geologic Map (Showing Deep-Seated Landslides and Associated Groundwater Recharge Areas)
Figure 3  Explanation for Figure 2 and Cross Sections
Figure 4  Engineering Geologic Cross Section A – A'
Figure 5  Engineering Geologic Cross Section B – B'
Figure 6  Engineering Geologic Cross Section C – C'
Figure 7  Engineering Geologic Cross Section D – D'
REFERENCES CITED


FIGURE 1 LOCATION MAP
Several Deep-Seated and Shallow Landslides
Lake Serene FPA
Scale: 1 inch = 1 mile

Roots Forestry Consulting, LLC
FIGURE 2 SIMPLIFIED GEOLOGIC MAP
Several Deep-Seated and Shallow Landslides
Lake Serene FPA
See Figure 3 for Explanation
Base map modified from Weyerhaeuser Company

Roots Forestry Consulting, LLC
EARTH MATERIALS

Qo  Glacial outwash deposits
Qgl Glaciolacustrine deposits
Tg  Granitic rocks

MAP SYMBOLS

Contact, ? where uncertain, ..., where concealed. Location of Qgl/Qo contact based on assumption glacial deposits are essentially flat lying, be gradational Tg/Qo contact very approximate.

- Glacial deep-seated landslide
- Shallow landslide
- Area of road-fill/cut slope failures
- Stream
- Seep/spring, PIP
- Property boundary
- FPA boundary
- Existing road
- Proposed new road construction
- Groundwater recharge area boundary (shown only for Landslides #s 7, 8, 10, & 13)

A-----A'  Engineering Geologic Cross Section

FIGURE 3 EXPLANATION FOR FIGURE 2 AND CROSS SECTIONS
Several Deep-Seated and Shallow Landslides
Lake Serene FPA

Roots Forestry Consulting, LLC
Hi Linda,

As promised here are the updated drawings for Spur 1 of FPA 2816174.

Get [Outlook for Android](#)

Thanks!

David Garvida Jr
Weyerhaeuser RMAP Coordinator
david.garvida@weyerhaeuser.com

Genesis Forestry Inc.
360-584-4890
genesisforestry@comcast.net
1:1
Use RipRap
Armor as needed

28.8'

16+34

4.0'

4.8'

TOP OF RIDGE

LAKE SERENE ROAD
LAKE SERENE ROAD

18+74
Np 24x30

17.6' 17.7'

1.8' 0.6'
Use RipRap as needed
Decision

[ ] Notification  Operations shall not begin before the effective date.

[X] Approved  This Forest Practices Application is subject to the conditions listed below.

[ ] Disapproved  This Forest Practices Application is disapproved for the reasons listed below.

[ ] Closed  Applicant has withdrawn FPA/N.

FPA/N Classification

[ ] Class II  [ ] Class III  [ ] Class IVG  [X] Class IVS

Number of Years Granted on Multi-Year Request

[ ] 4 years  [ ] 5 years

Conditions on Approval / Reasons for Disapproval

A meeting with road construction operator and landowner will be required prior to start of road construction activities.

Notify DNR Northwest Region Office (360-856-3500) 48 business hours before commencing road construction operations. Please provide the application number and legal description for your operation.

Issued By: Steven Huang

Region: Northwest

Date: 2/2/2018

Copies to: [X] Landowner, Timber Owner and Operator.

Issued in person: [ ] Landowner [ ] Timber Owner [ ] Operator By: __________________________
**Appeal Information**

You have thirty (30) days to appeal this Decision and any related State Environmental Policy Act determinations to the Pollution Control Hearings Board in writing at the following addresses:
- **Physical address:** 1111 Israel Rd. SW, Ste 301, Tumwater, WA 98501
- **Mailing address:** P.O. BOX 40903, OLYMPIA, WA 98504-0903

Information regarding the Pollution Control Hearings Board can be found at: [http://www.eluho.wa.gov/](http://www.eluho.wa.gov/)

At the same time you file an appeal with the Pollution Control Hearings Board, also send a copy of the appeal to the Department of Natural Resources’ region office and the Office of the Attorney General at the following addresses:

Office of the Attorney General  
Natural Resources Division  
1125 Washington Street SE  
PO Box 40100  
Olympia, WA 98504-0100

And  

Department Of Natural Resources  
Northwest Region  
919 N Township St  
Sedro-Woolley WA 98284

**Other Applicable Laws**

Operating as described in this application/notification does not ensure compliance with the Endangered Species Act, or other federal, state, or local laws.

**Transfer of Forest Practices Application/Notification (WAC 222-20-010)**

Use the "Notice of Transfer of Approved Forest Practices Application/Notification" form. This form is available at region offices and on the Forest Practices website: [http://www.dnr.wa.gov/businesspermits/forestpractices](http://www.dnr.wa.gov/businesspermits/forestpractices).

Notify DNR of new Operators within 48 hours.

**Continuing Forest Land Obligations (RCW 76.09.060, RCW 76.09.070, RCW 76.09.390, and WAC 222-20-055)**

Obligations include reforestation, road maintenance and abandonment plans, conversions of forest land to non-forestry use and/or harvest strategies on perennial non-fish habitat (Type Np) waters in Eastern Washington.

Before the sale or transfer of land or perpetual timber rights subject to continuing forest land obligations, the seller must notify the buyer of such an obligation on a form titled "Notice of Continuing Forest Land Obligation". The seller and buyer must both sign the "Notice of Continuing Forest Land Obligation" form and send it to the DNR Region Office for retention. This form is available at DNR region offices.

If the seller fails to notify the buyer about the continuing forest land obligation, the seller must pay the buyer’s costs related to continuing forest land obligations, including all legal costs and reasonable attorneys’ fees incurred by the buyer in enforcing the continuing forest land obligation against the seller.

Failure by the seller to send the required notice to the DNR at the time of sale will be prima facie evidence in an action by the buyer against the seller for costs related to the continuing forest land obligation prior to sale.

**DNR affidavit of mailing:**

On this day 2/2/2018, I placed in the United States mail at Sedro-Woolley, WA, postage paid, a true and accurate copy of this document, Notice of Decision FPA # 2816174  

L Utgard  
(Linked)  
(Printed name)  
(Signature)

Washington State Department of Natural Resources • Notice of Decision • August 5, 2013  
Page 2
<table>
<thead>
<tr>
<th>DATE</th>
<th>DOCUMENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/2/2018</td>
<td>Numerous</td>
<td>Replaced pgs. 4 &amp; 7 and road work list; added drawings of Spur Road 1, rock filter cell detail, &amp; additional gec-tech information.</td>
</tr>
</tbody>
</table>

| 2-17-18    | TransferForm | Change of Operator |
# Forest Practices Application/Notification

## NOTICE OF TRANSFER

I/we transfer my/our rights, privileges, and obligations under this approved Forest Practices Application or Notification. I/we affirm that the information contained below is true and agree to comply with the rules authorized by the Forest Practices Act and be bound by all conditions on the approved application or notification.

<table>
<thead>
<tr>
<th>FPA/N Number: 2810174</th>
<th>Section(s): 30</th>
<th>Township: 27</th>
<th>Range: 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Landowner (Signature):</td>
<td></td>
<td>Connie Carter</td>
<td></td>
</tr>
<tr>
<td>Original Landowner (Printed):</td>
<td>Deyeschauer Co.</td>
<td>Date: 2/9/18</td>
<td></td>
</tr>
</tbody>
</table>

### New Operator – Complete this section **only** if you are:

- [X] Changing an operator for:
- [ ] Adding an operator for:

<table>
<thead>
<tr>
<th>Legal Name of New Operator: (Print)</th>
<th>Marcon Timber Co., Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone: (509) 670-6656</td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:mark@marcontimber.com">mark@marcontimber.com</a></td>
<td></td>
</tr>
<tr>
<td>Mailing Address:</td>
<td>PO Box 318</td>
</tr>
<tr>
<td></td>
<td>Peshastin, WA 98847-0318</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New Operator Signature:</th>
<th>W. B.</th>
<th>Date: 2/9/18</th>
</tr>
</thead>
</table>

### New Landowner – Complete this section **only** if you are transferring your FPA to a new landowner:

- [ ] No
- [X] Yes

- Are you a small forest landowner per RCW 76.09.450 *(if yes, continue to question below)*
- [ ] No
- [X] Yes

<table>
<thead>
<tr>
<th>Legal Name of New Landowner: (Print)</th>
<th>Mailing Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone:</td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
</tbody>
</table>

| New Landowner Signature: | | Date: |
|--------------------------|-------------|

### New Timber Owner – Complete this section **only** if you are transferring your timber rights:

<table>
<thead>
<tr>
<th>Legal Name of Timber Owner: (Print)</th>
<th>Mailing Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone:</td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
</tbody>
</table>

**Forest Tax Reporting Account Number:** (Contact Dept. of Revenue at: 1-800-548-8829)

| New Timber Owner Signature: | | Date: |
|----------------------------|-------------|

**Received by:** B. Vagese

**(DNR Forest Practices Staff Signature):** 11/01/2017

**Date:** 2/12/18