Engineering Geologic Risk Assessment

Suzie Q Timber Sale

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Prepared For:

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[11/06/2024]

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1.0 Introduction

The proposed Suzie Q timber sale includes one harvest unit within the Department of Natural Resources (DNR) Lower Chehalis block west of Oakville, Washington (Figure 1).

Washington's Forest Practices rules define potentially unstable landforms, commonly referred to as rule-identified landforms (RIL) (WAC 222-16-050(1)(d)(i), for purposes of classifying and reviewing forest practice applications and regulating in those areas. RILs are further defined in the Washington Forest Practices Board Manual, Section 16 (2016). Except as noted, forest management activities are not planned on any RILs in and around the Suzie Q sale.

Cable harvest will occur from proposed landings along the Q-1000 or short spur roads (Figure 2). This requires yarding trees over potentially unstable slopes (PUS) in proximity to two southeast flowing creeks. As presented in this Engineering Geologic Risk Assessment we conclude the likelihood of increasing the slope stability hazard from this yarding activity is low. This report is intended to satisfy the requirements of a Class IV-Special Forest Practices Application (FPA).

2.0 Scope of Services

The scope of our services included:

- Review of published 1:100,000-scale geologic map.
- Review of Forest Practices landslide inventory maps.
- Review of DNR Lidar digital elevation model and derivatives.
- Review of DNR digital ortho photographs from 1990, 2006, 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023.
- Field reconnaissance by State Lands Geologist John Jenkins on April 08, 2024, and May 09, 2024.
- Review of DNR yarding analysis results.
- Preparation of this report.

John Jenkins, a licensed engineering geologist (LEG #1818) prepared this report. He is a "qualified expert" for timberland slope stability evaluation (see Appendix A).

3.0 Site and Project Description

3.1 Suzie Q Sale Summary

The proposed sale is in Township 16 N, Range 05 W in Sections 05 and 08 W.M. (Willamette Meridian) in Grays Harbor (Figure 1). The variable retention harvest (VRH) area includes one unit of 73.1 acres (Figure 2).

Approximately 80% of the harvest area will be yarded by cable and felled by hand and/or tethered felling equipment where feasible. The other 20% will be harvested and yarded using ground-based systems. Restrictions are in place for all ground-based logging equipment.

Existing road will have pre-haul road maintenance. Approximately 940 feet of new road construction is planned. Proposed road construction and improvements are presented in the Suzie Q Timber Sale Road Plan document and the Forest Practices application with detailed road information.

3.2 Yarding Description

The location of cable corridors and potentially unstable slopes are shown on Figure 2. Landings will be established along the Q-1000 and short spur roads A through C. Unstable slopes primarily include inner gorge, bedrock hollows, and toes of bedrock deep-seated landslides in proximity to two type 4 unnamed streams that include type 5 segments.

To mitigate the slope stability hazard associated with yarding over potentially unstable slopes the timber harvest contract will require:

- Full suspension of logs above the ground within unstable slope areas
- No yarding corridors wider than 12 feet
- A minimum 90-foot-high tower with 40-foot length bucked logs.

Skyline analysis for all the yarding corridors that pass over unstable slopes indicate full suspension can be achieved based on the required minimum 90-foot tower and 40-foot length logs. Trees are commonly 140 ft or taller therefore the analysis shows some contact of suspended logs with trees will occur. We also anticipate some trees may need to be cut along yarding corridors to facilitate yarding. Cut trees will be left in place to provide surface roughness. A summary of the analysis and risk assessment is provided in Section 5.3.

4.0 Geologic Setting and Climate

The Suzie Q sale is located on moderate to steep sloped uplands near the western boundary of the Chehalis River valley and within the Gibson Creek WAU (Figure 1). This region of western Washington is part of the Willapa Hills Coast-Range geologic and physiographic province of Washington. The project region has a maritime climate with cool wet winters and warm, drier summers. Most precipitation generally occurs between November and April. The DNR Corporate GIS database indicates the mean annual precipitation (1991-2000) is approximately 70 inches.

Published geologic mapping (Logan, 1987) shows bedrock in the region as Lincoln Creek Formation marine sedimentary rocks of upper Eocene to Oligocene age. These rocks generally consist of tuffaceous siltstone and fine sandstone. Observations of bedrock during reconnaissance is consistent with Lincoln Creek Formation. The two main streams where yarding over potentially unstable slopes is planned combine and flow onto the gently sloped Chehalis River valley. At the outlet into the valley the stream flows onto an alluvial fan. Lidar review indicates the stream is disconnected with streams in the valley.

5.0 Unstable Slopes Review

5.1 Forest Practices Landslide Inventory Review

We consulted the Forest Practices Landslide Inventory (LSI) database during our office review. Numerous Forest Practices LSI polygons are present in and around the harvest unit. These were evaluated during reconnaissance with some areas being identified as potentially unstable.

5.2 Potentially Unstable Slopes Around the Sale

High density Lidar flown in 2012 covers the site area; geomorphology is depicted using the default sun angle hill shade digital elevation model from Lidar (Figure 2).

Potentially unstable slopes around the sale are primarily inner gorge and bedrock hollow rule identified landforms. Several ancient bedrock deep seated landslides occur in and around the sale unit. Toe slopes generally exceed 65% and thus are classified as RILs. These toe slopes occur in riparian management zones (RMZ) or non-tradable leave tree areas. All the RILS are within the "potentially unstable slopes" polygons shown on Figure 2 and the Slope Stability Map included with Appendix D of the Suzie Q FPA.

Reconnaissance by the geologist occurred on these landforms where yarding over the landforms is proposed (see geologist track; Figure 2).

5.3 Yarding Hazard and Risk Assessment

Results of the SkyLine excel analysis for proposed yarding corridors show full suspension over the potentially unstable slopes can be achieved. Thus, ground disturbance from yarded logs will not occur. As noted previously the analysis is based on a 90-foot tower height and cut trees bucked to 40-foot lengths prior to yarding and accounting for the tag line length.

The amount of ground clearance is variable. Most trees exceed 140 feet in height thus some contact between yard logs and standing trees is anticipated. This could result in some standing tree damage however normally this type of impact (limb breakage) does not lead to tree mortality.

A maximum 12-foot yarding corridor width is required. Because full suspension above the tree canopy is not possible selected trees along the yarding corridors will need to be cut. Soil cohesion from tree roots will thus be reduced around the cut trees. The cut trees will remain on the ground to provide surface roughness and reduce erosion potential.

Provided the above plans are followed, it is my opinion that yarding over the potentially unstable slopes will not substantially increase the slope stability hazard and will have a low likelihood of causing slope movement that will deliver sediment to streams. Because the stream flows onto a broad alluvial fan on the Chehalis River valley without an apparent

connection to existing streams in the valley the risk to public safety and infrastructure is very low or nonexistent.

6.0 Forest Practice Rule Statements

The following are the required Forest Practice Rule statements addressing WAC 222-10-030 (1) (a, b, c). These responses are based on the data and discussion presented above.

(a) *The likelihood that the 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 low.*

Rule-identified potentially unstable slopes around the sale primarily include inner gorges, bedrock hollows, and toes of ancient bedrock deep-seated landslides. These landforms are protected within no-harvest riparian management zones/leave tree areas.

Analysis of yarding logs across potentially unstable shows full suspension above the ground surface. Some contact between trees and yarded logs is anticipated but sufficient tree damage to cause tree mortality is unlikely. We also anticipate some trees may need to be cut to facilitate yarding however cut trees will remain on the ground to provide surface roughness.

(b) *The likelihood of delivery of sediment or debris to a public resource, or in a manner that would threaten public safety is low.*

This conclusion is based on our opinion that there is a low likelihood the proposed forest practices will cause movement on the potentially unstable slopes or landforms. However, if there are any shallow failures along the rule identified landforms, there may be a high likelihood that sediment and debris will be delivered to a public resource. Existing conditions indicate that stream is disconnected from streams on the adjacent Chehalis River valley and no downstream infrastructure is at risk.

There is low likelihood for public safety to be threatened.

(c) *Any possible mitigation for the identified hazards and risks:*

The primary mitigation measure for the identified hazards and risks is avoidance. Mitigation measures for the yarding corridors that cross potentially unstable slopes is described. The measures include full suspension of yarded logs above the ground and minimizing tree damage and tree cutting along the yarding corridors.

7.0 Assessment Limitations

This report is intended to be submitted with the forest practices application (FPA) for the Suzie Q timber sale to meet the requirements of a Class IV-special classification. The conclusions presented in this report are based on observed site conditions, as they existed at the time of the field visits. It is not possible to fully define the geologic conditions of the site based on this limited investigation; however, the work was performed using practices consistent with geologic and geotechnical industry standards in the region for forest slope stability. It is not possible to predict slope movement with certainty with the available scientific knowledge.

If any changes in the proposed FPA are formulated or carried out differently in the field than currently proposed, our conclusions and recommendations shall not be considered valid unless those changes are reviewed in writing by the author.

8.0 References

Logan, R.L., 1987, Geologic map of the Chehalis River and Westport Quadrangles, Washington. Washington Division of Geology and Earth Resources Open File Report 87-8. 1:100,000 scale.

Washington Administrative Code 222-16-050 (1)(d)(i)

Washington Forest Practices Board Manual, 2016, Section 16, Guidelines for evaluating potentially unstable slopes and landforms, Washington Department of Natural Resources, Olympia, Washington.

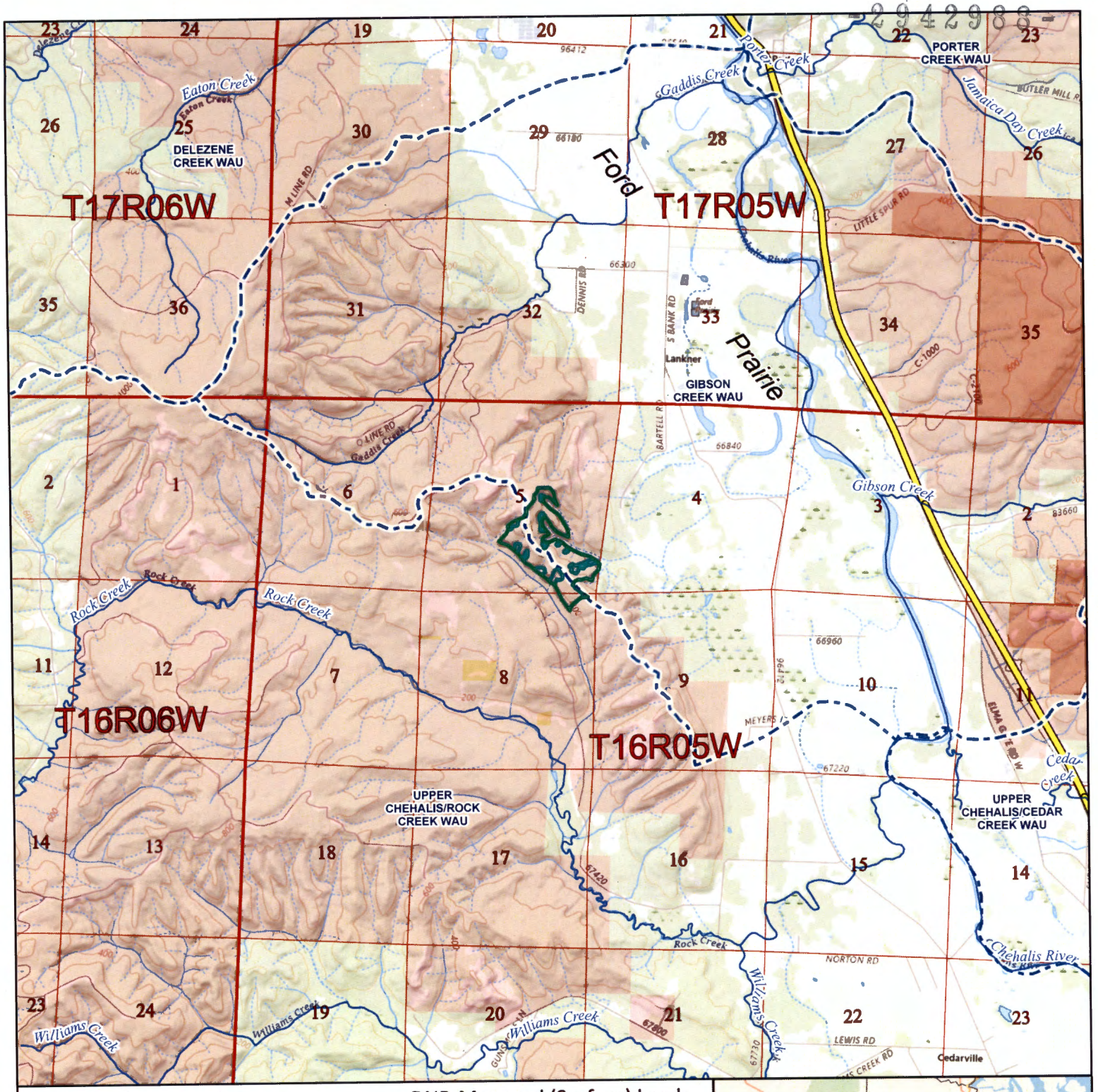

Fig. 1

VICINITY MAP

Suzie Q

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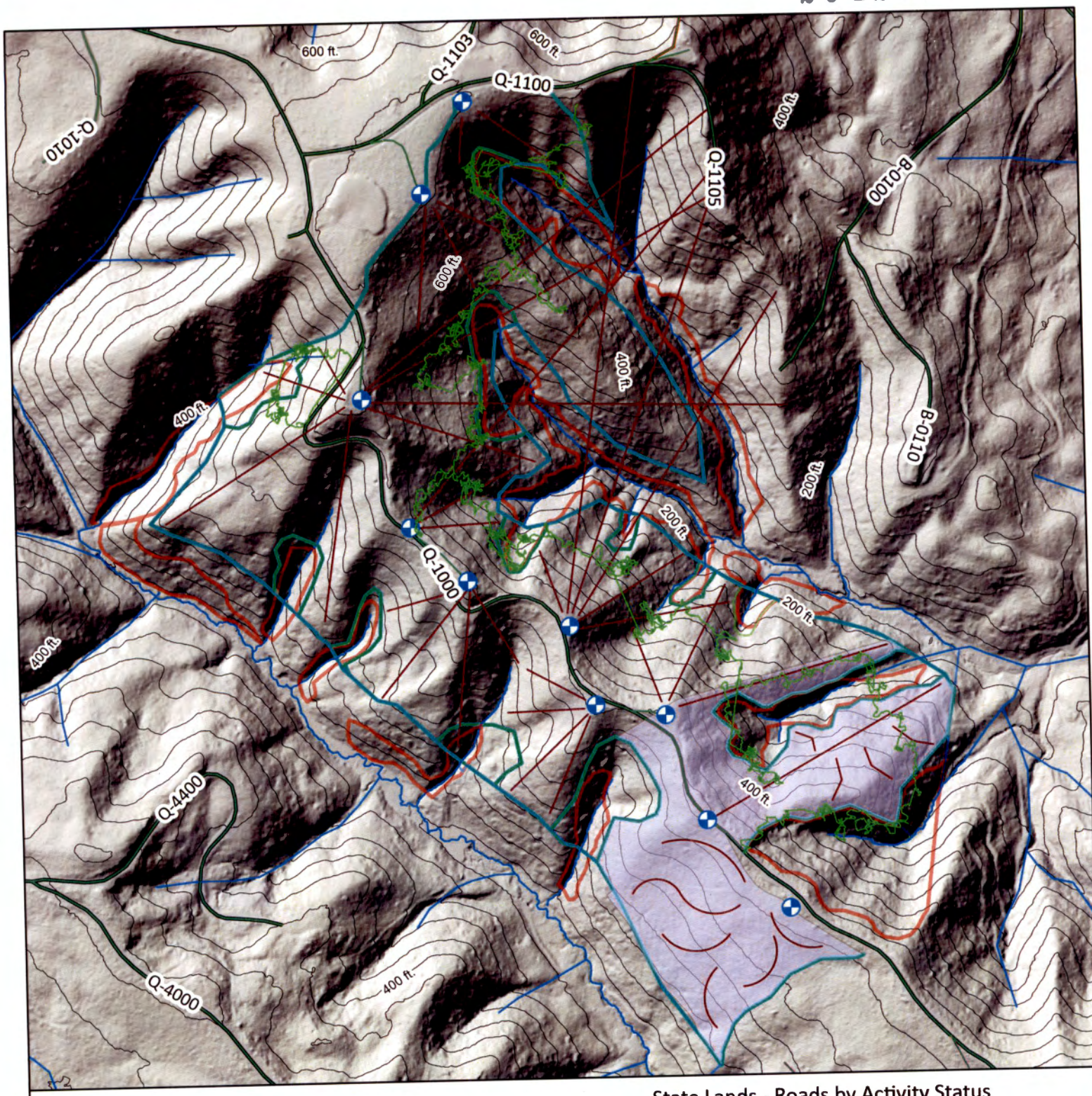

Unit Tags
Cable Yarding Road
Landing - Proposed
Spur Road
Streams
Geologist track

Special Mgt Areas
Potentially Unstable Slopes
Leave Tree Area
Non-Tradeable Leave Clump
Riparian Mgt Zone
Timing Restriction

State Lands - Roads by Activity Status
1: Active
3 Decommisioned
5: Approved Abandoned
9: Unknown

Fig. 2

GEOMORPHOLOGY AND YARDING MAP
Susie Q Timber Sale

0 250 500 Feet
Scale: 1:6,000

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Export Date:

Appendix A
Geologist Qualifications

Washington's forest practices rules (Title 222 WAC) define a "qualified expert" as a person licensed under chapter 18.220 RCW as an engineering geologist with three years of experience in the evaluation of relevant problems on forested lands (WAC 222-10-030(5)).

John Jenkins has a Bachelor of Science degree and a Master of Science degree, both in geology, from University of Illinois, Champaign-Urbana, and the New Mexico Institute of Mining and Technology, Socorro, NM. He has been employed by the Washington Department of Natural Resources (DNR) since April 2012. His duties include providing technical and scientific support to the agency's Forest Resources Division. Most of his work with DNR has focused on landslide risk assessment related to forest practices activities. Mr. Jenkins has over 30 years of experience in slope stability risk assessment ranging from site-scale to regional-scale projects for public agencies and private parties. Additional professional experience was gained during employment with the Oregon Department of Transportation, the U.S. Bureau of Reclamation and geologic mapping for the U.S. Geological Survey. Mr. Jenkins is a Licensed Engineering Geologist (LEG #1818) and Licensed Hydrogeologist (LH #1818) in Washington. He has been recognized as a qualified expert pursuant to Washington's forest practice rules.