E. STEVEN TOTH
Consulting Geomorphologist
Licensed Engineering Geologist

June 6, 2024

Mr. John Braun
1955 Salzer Valley Road
Centralia, WA 98531

Subject: Slope Stability Evaluation for the Proposed Construction of the Alpha Access Road in Parcel No. 021655001000, Lewis County

Dear Mr. Braun

The purpose of this letter is to describe and evaluate the slope stability of landforms for the proposed Alpha Access Road in the northeastern portion of your property (Parcel No. 021655001000) located southeast of Centralia, Washington in Lewis County (Figure 1). The access road will be about 3,700 feet in length and start from a road easement being provided at 274 Centralia-Alpha Road (Parcel No. 021677003000). The road easement extends across the north end of the parcel on relatively flat ground for about 465 feet before crossing into the northeast portion of your property in Section 21, Township 14 North, Range 2 West, W. M. (Figure 2).

The road is being constructed to access and manage timber in the parcel and crosses steep slopes as it enters and exits the valley for an unnamed fish-bearing tributary stream (Creek 1) to Salzer Creek. The access road will require full-bench construction on slopes of greater than 60 percent gradient, including crossing of rule-identified potentially unstable inner gorge terrain. This letter is written in accordance with the Washington Forest Practices Rules requirements for the evaluation of forest practices on potentially unstable slopes[1]. The Washington State Forest Practices Rules require a qualified expert to conduct a geotechnical review of proposed forest practices on potentially unstable slopes that could impact public resources or threaten public safety[2]. I am a licensed Engineering Geologist in the State of Washington with over 30 years of experience investigating unstable slopes in forest lands of the Pacific Northwest.

The scope of work consisted of a remote evaluation of the geological conditions in the project area and a field-based reconnaissance survey of the proposed road alignment to assess the potential for forest practices to cause or contribute to slope movement. Historical aerial

[1] WAC 222-10-030
[2] WAC 222-16-050 (1d)(d)

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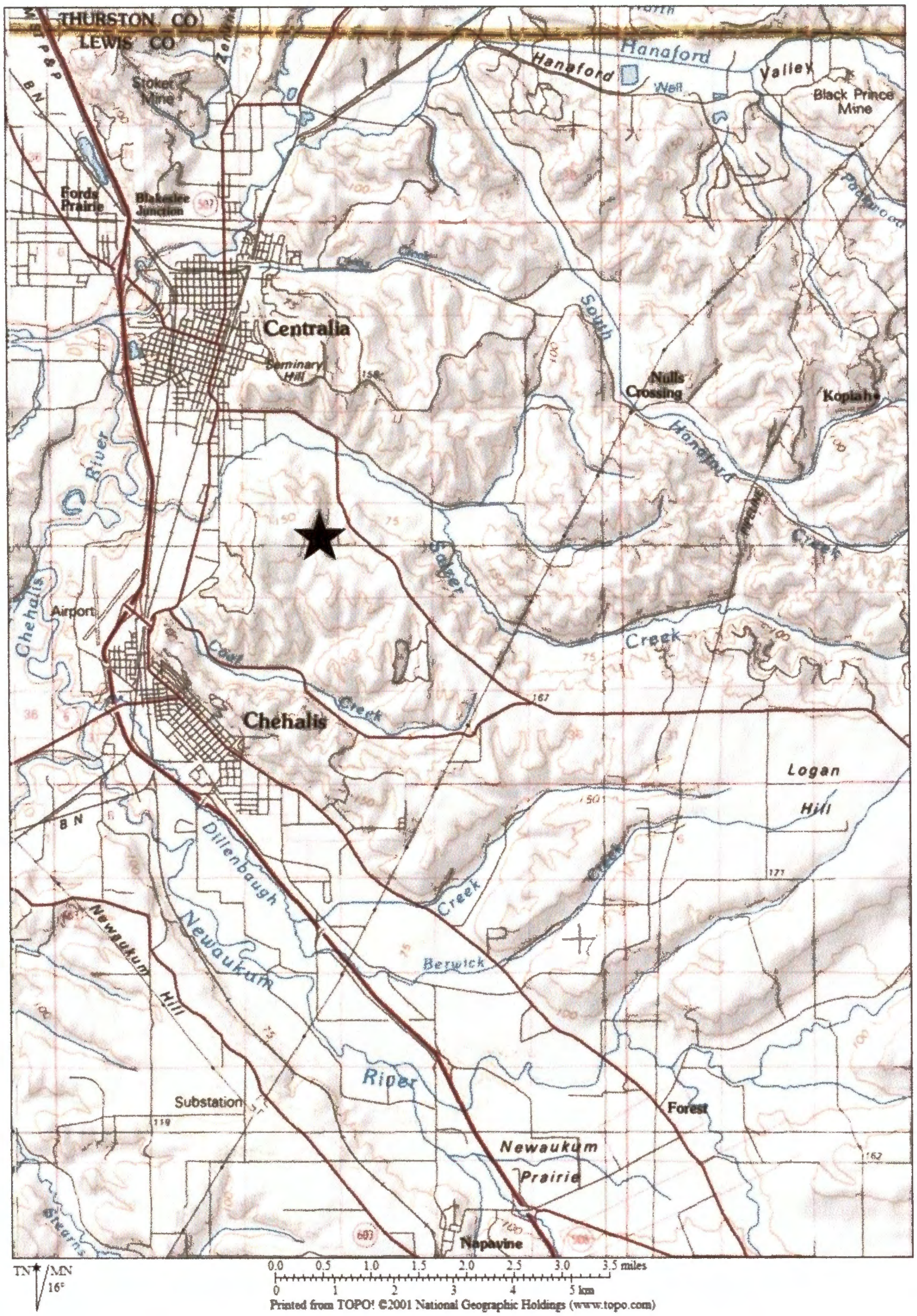

Figure 1. Location of the proposed Alpha Access Road southeast of the City of Centralia.

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Aerial photograph from USDA 2023 NAIP Digital Orthophoto Imagery

ALL BOUNDARIES ARE APPROXIMATE AND MAY NOT BE TO SCALE.

Figure 2. Aerial view of the proposed Alpha Access Road with parcel boundaries.

photographs, LiDAR-based digital elevation models, soil surveys, and regional geological maps were used to evaluate slope stability hazards. The proposed road location was reviewed with Mr. Dave Roberts, the engineer who developed the road design, on April 11th, 2024.

Site Description

The project area is located in forestlands at the foothills of the western Cascade Range approximately two miles southeast of the City of Centralia, Washington (Figure 1). The project area is located west of the Centralia Alpha Road and will be accessed through a road easement on a developed parcel (Parcel No. 021677003000). The proposed new road construction crosses a small perennial stream (Creek 1a) with steep terrain soon after it enters the property, and then crosses a broad wet valley bottom with the fish-bearing tributary stream (Creek 1) to Salzer Creek (Figure 2). Creek 1 would have historically supported coho salmon, steelhead trout, and sea-run cutthroat trout, but due to downstream passage barriers likely supports only resident cutthroat trout at this time (Washington Department of Fish and Wildlife 2024). The access road then climbs steeply out of the valley and crosses another small perennial stream (Creek 2a) as it switchbacks up the slope and out to the junction with an existing logging road. The forestlands along the road right-of-way range in elevation from approximately 310 feet above sea level at the Alpha Centralia Road, down to 240 feet at the Creek 1 crossing, and climbing to 530 feet at the logging road junction (Figure 3).

The average annual rainfall at the site is approximately 48 inches (MGS Engineering Consultants and Oregon Climate Service 2006). The project area is located in the lowland precipitation zone, which indicates a low likelihood of significant runoff during the late fall and winter involving both rainfall and snowmelt.

The land use in the area consists primarily of rural residential development, agriculture, and forestry operations by small private landowners, rather than large industrial forest landowners. The site currently supports a varied forest stand consisting primarily of Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*), with red alder (*Alnus rubra*) and big-leaf maple (*Acer macrophyllum*) in more open or disturbed areas.

Geology and Soils

The project area is situated at the junction of the Willapa Hills, Puget Lowland, and Southern Cascades geologic provinces. Most of the area is underlain by sedimentary rocks that were deposited between 25 to 45 million years ago. The sedimentary rocks have been overlain by glacial outwash and till as a result of several episodes of alpine glaciation from the Cascade Range during the Pleistocene about 750,00 years ago.

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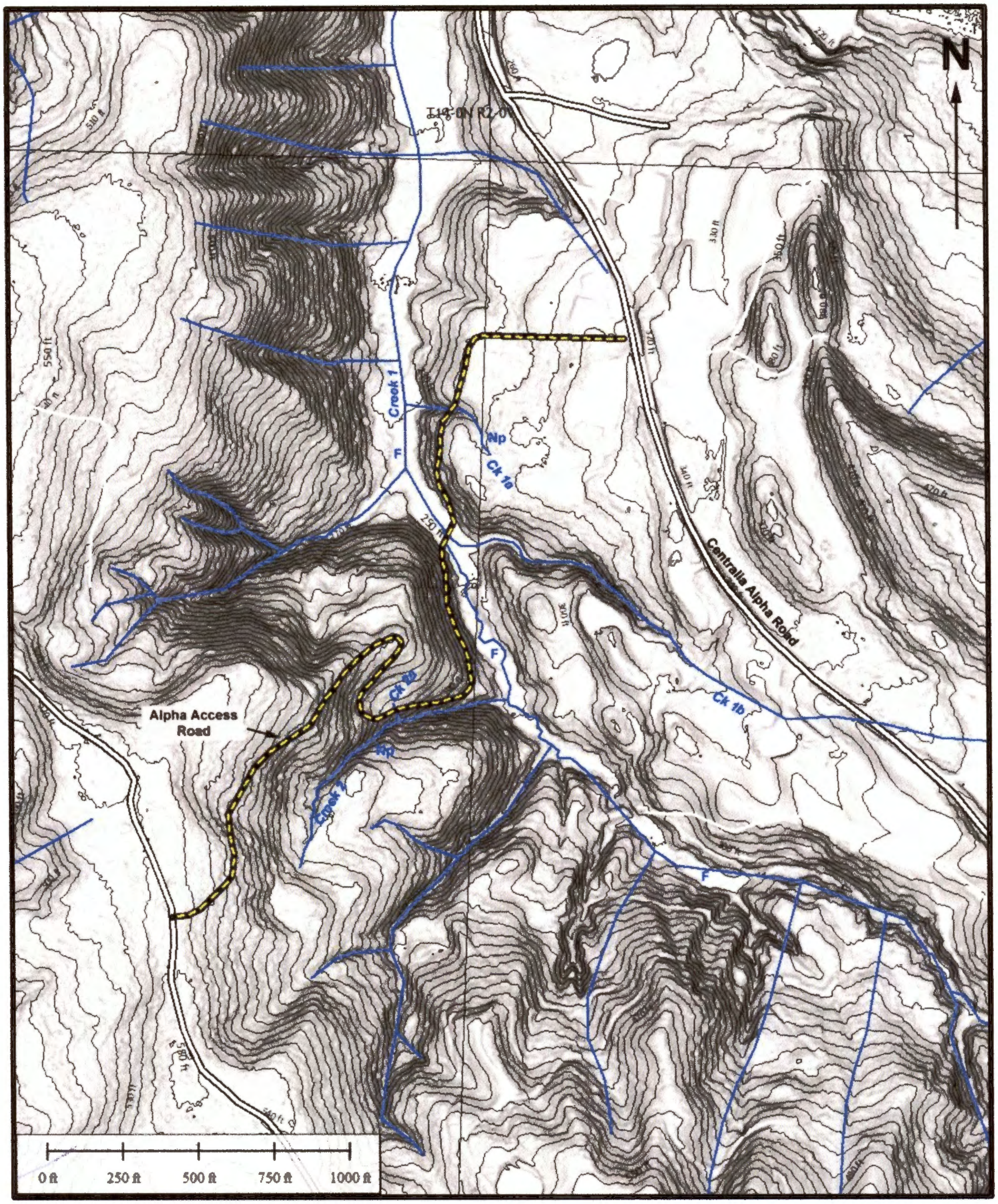

10-foot contours generated from 2017 Washington DNR LiDAR bare-earth DEMs

Figure 3. Topographic map of the proposed Alpha Access Road project area.

Figure 4 shows detailed geologic information for the project area based on 1:100,000 scale mapping of the Centralia quadrangle (Schasse 1987). The eastern two-thirds of the proposed access road is located within marine sedimentary rocks of the Lincoln Creek Formation [OEm(lc)]. The upper Eocene to lower Oligocene (25 to 38 million years before present) Lincoln Creek Formation consists of light gray, tuffaceous siltstone and fine-grained sandstone that is commonly concretionary and indistinctly to massively bedded. East of the Chehalis River, the formation grades into deltaic, nearshore, and continental deposits of basaltic sandstone with interbeds of pyroclastic rocks. A strike-dip measurement near the access road indicates that the sedimentary beds are dipping to the northwest at about 25 degrees (Figure 4). The western portion of the proposed road is mantled by Logan Hill Formation glacial outwash deposits [Qapo(lh)]. The Logan Hill Formation consists of early to middle Pleistocene (between 600,000 and 1.3 million years old) alpine outwash sand and gravel with minor interbeds of silt and clay. The reddish to yellowish-brown deposits are completely weathered to clay near the ground surface and moderately weathered at depth (Schasse 1987).

The Natural Resources Conservation Service (NRCS 2024) has mapped most of the proposed access road in Melbourne loam (131, 132) on slopes of 8 to 30 percent gradient and Buckpeak silt loam (72) on slopes of 30 to 65 percent. The well drained Melbourne loam soil type is derived from siltstone residuum and has a depth of greater than 80 inches. The NRCS has rated this soil type with moderate limitations in the construction of haul roads and landings, but no significant slope stability or erosional issues are anticipated. The Buckpeak soil formed in sandstone residuum and colluvium and typically has a depth of greater than 80 inches. The NRCS has rated the Buckpeak silt loam with severe limitations in the construction of haul roads and landings due to the steep slopes and low soil strength. While soils were physically examined in the field, detailed soil logs and laboratory testing of soil characteristics are beyond the scope of this assessment.

Slope Stability Hazard Evaluations

The Washington Department of Natural Resources has completed a landslide hazard assessment that consists of a generalized slope stability map. The slope stability risk is based upon calibrated slope stability models that use digital elevation models (DEMs) to generate slope and curvature information (Montgomery and Dietrich 1994; Shaw and Johnson 1995). The resulting SLPSTAB model is effective at identifying the area with the highest densities of landslides and discriminating between areas of higher slope stability risk (Whittaker and McShane 2012). The model divides slope stability into low, medium, and high risk categories. The model output provides a screening tool for shallow-rapid landslide potential and can be used to help focus field review efforts. The SLPSTB model output for the project area shows that the road crosses through steep inner gorge terrain with moderate to high risk for unstable slopes (Figure 6).

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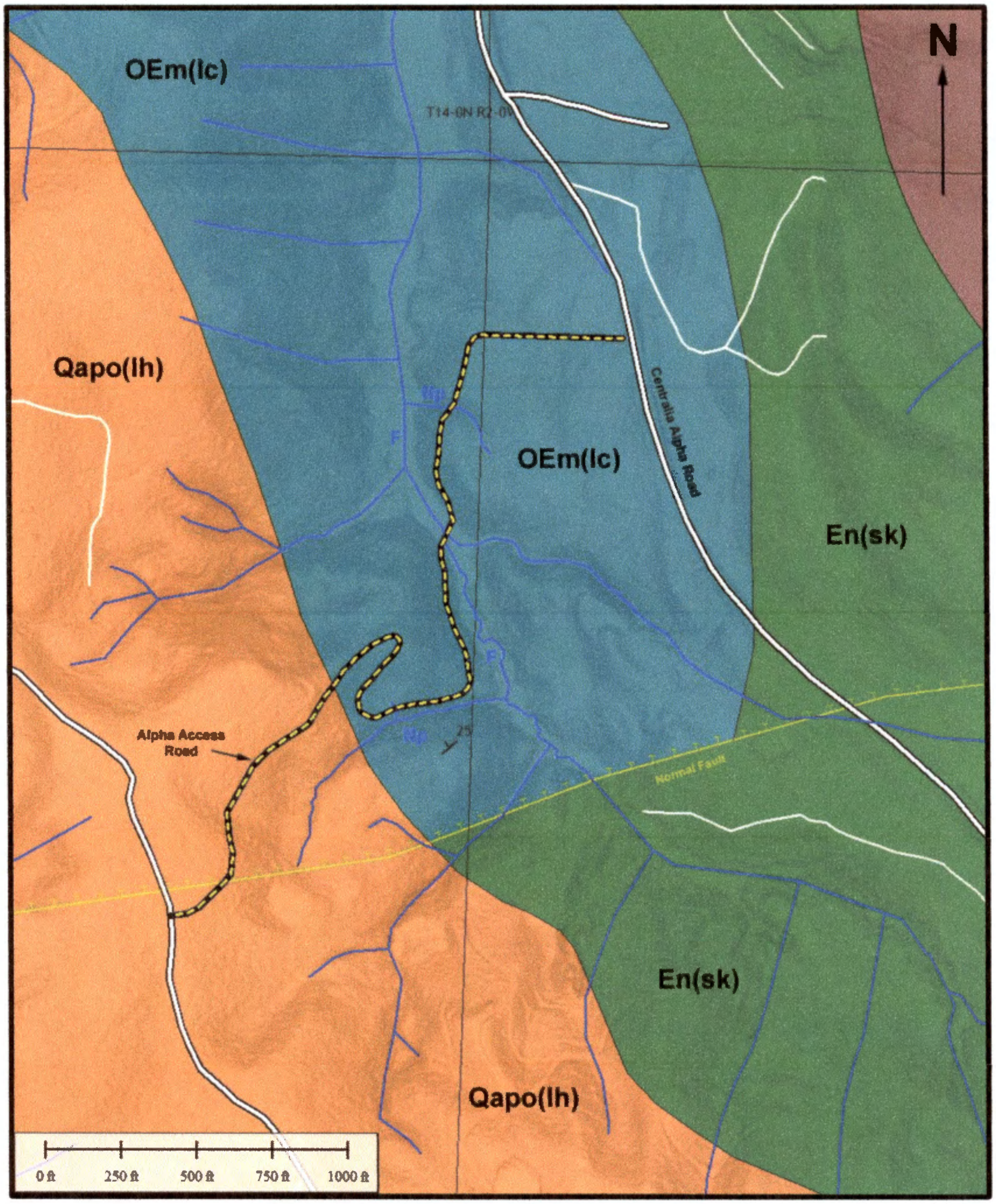
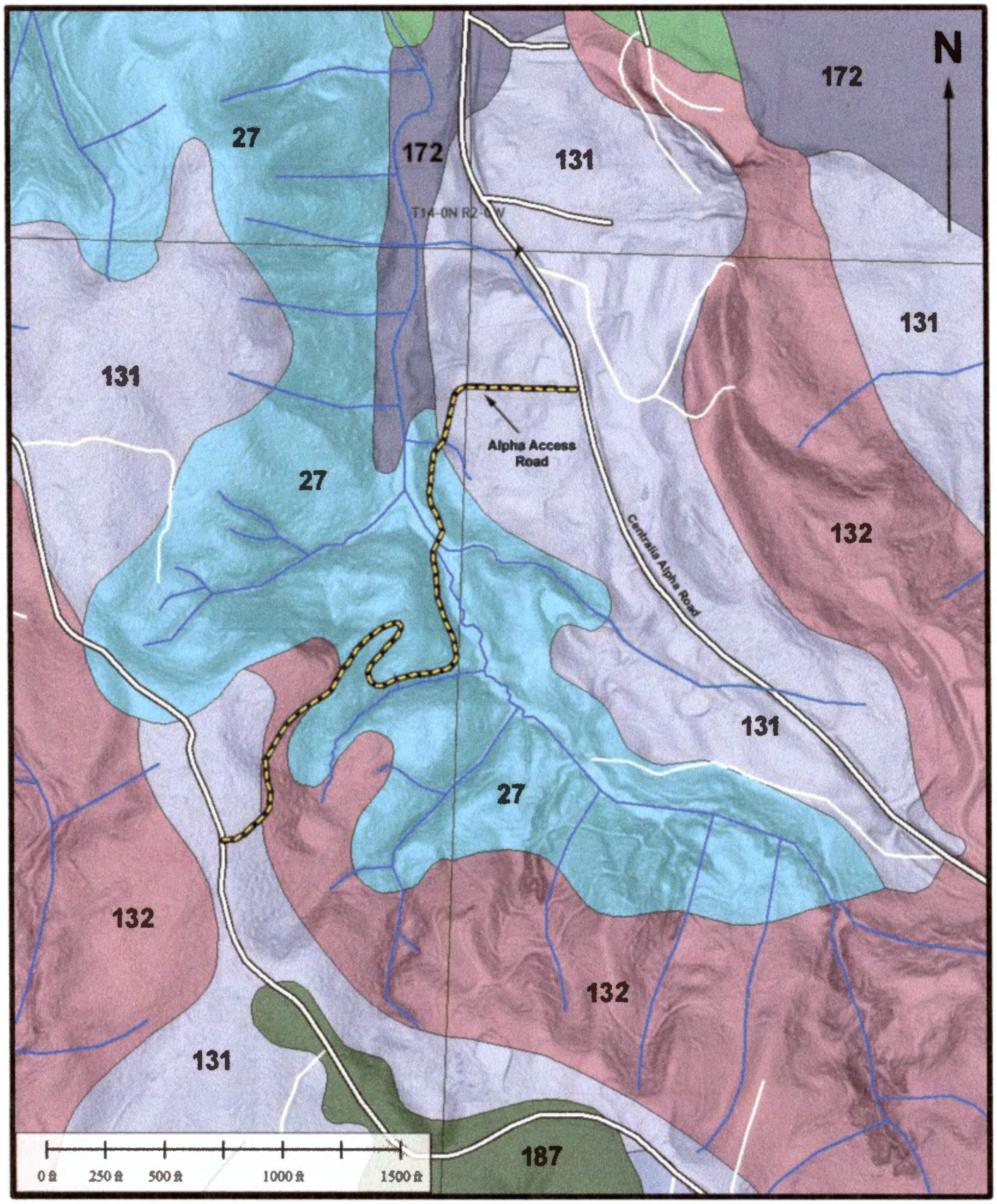


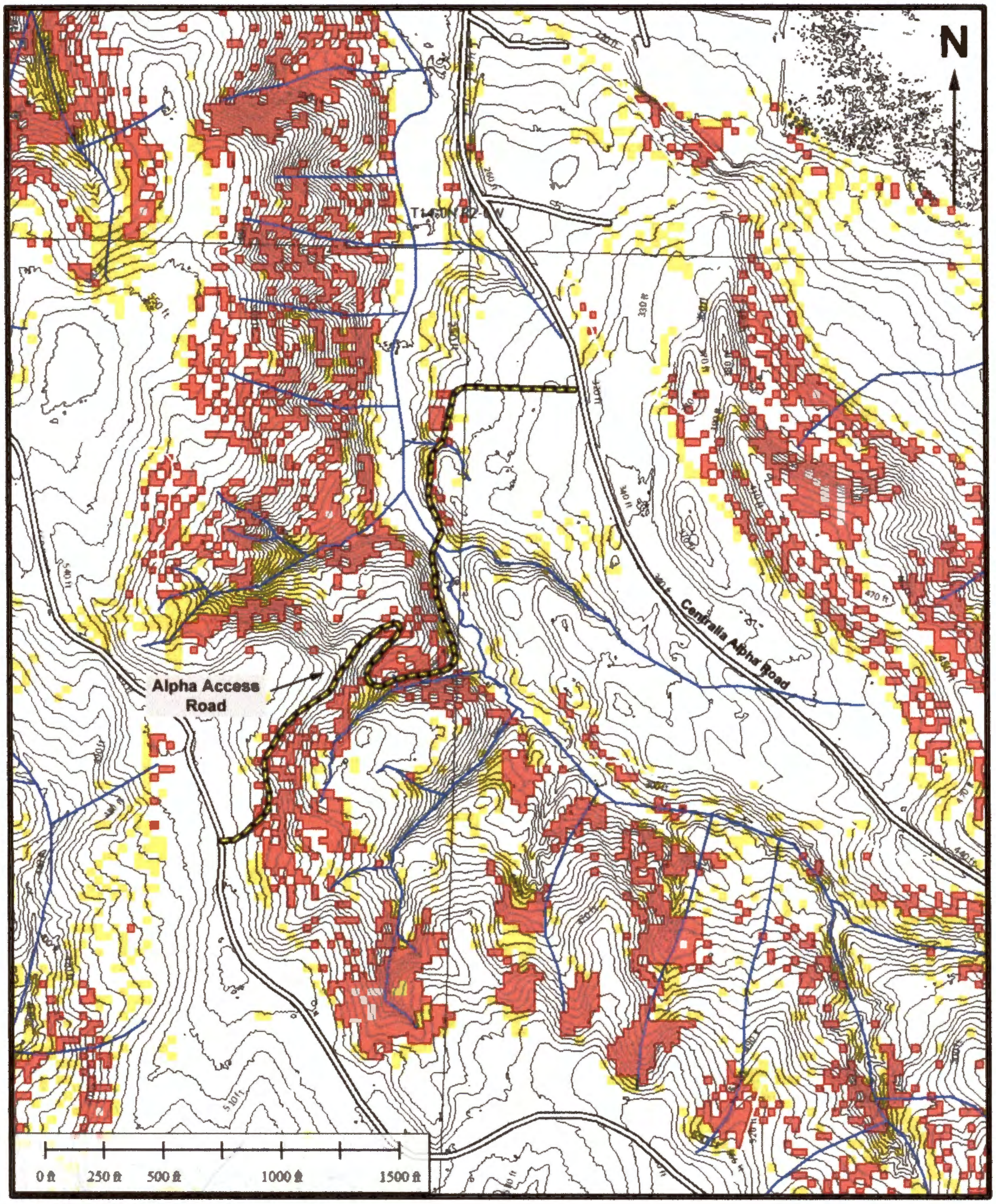
Key: **Qapo(lh)** – Logan Hill Formation alpine glacial outwash deposits;
OEm(lc) – Lincoln Creek Formation sedimentary rocks;
En(sk) – Skookumchuck Formation sedimentary rocks

Figure 4. Geological map for the Alpha Access Road project area (Schasse 1987).



Key: **27**– Buckpeak silt loam 30 to 65 percent slopes
131, 132 – Melbourne loam 8 to 30 percent slopes;
172– Reed silty clay loam, 0 to 3 percent slopes;
187 – Salkum silty clay loam, 0 to 5 percent slopes

Figure 5. Soil type map for the Alpha Access Road project area (NRCS 2024).



10-foot contours generated from 2017 Washington DNR LiDAR bare-earth DEMs

Figure 6. Slope stability model output for the Alpha Access Road project area. *The red and yellow pixels correspond to high and moderate risk for unstable slopes, respectively.*

Historical Aerial Photographs

Historical aerial photographs from 1952 through 2023 were reviewed for evidence of slope movement (Table 1; Appendix A). The earliest photographs from 1952 show that most of the project area is forested with a mixed alder and conifer forest stand. Both the Centralia Alpha Road and the logging road at the end of the proposed access road have already been constructed by that time. Recent small patches of clear-cut forest stands are present at the western end of the proposed access road (Appendix A). No significant changes are apparent in the 1968 through 1990 aerial photographs. New residential development and forest clearing along the Centralia Alpha Road is first visible in the 2006 aerial photographs. Recent timber harvest has also occurred around the southern half of the proposed access road. The 2009 through 2023 aerial photographs show a regenerating forest stand in the parcel, but no signs of slope movement were observed in these or any of the other historical aerial photographs.

Date	Scale	Flight Line and Negative Number
1952	1:37,400	GS-QK 1-95
1968	1:80,000	GS-VCBB 1-49
1980	1:30,000	GS-VEYV 1-253
1990	1:12,000	USDA USFS Digital Orthophoto Centralia Quadrangle
2006	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2009	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2011	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2013	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2015	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2017	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2019	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2021	1:12,000	USDA NAIP Digital Orthophoto Quadrangle
2023	1:12,000	USDA NAIP Digital Orthophoto Quadrangle

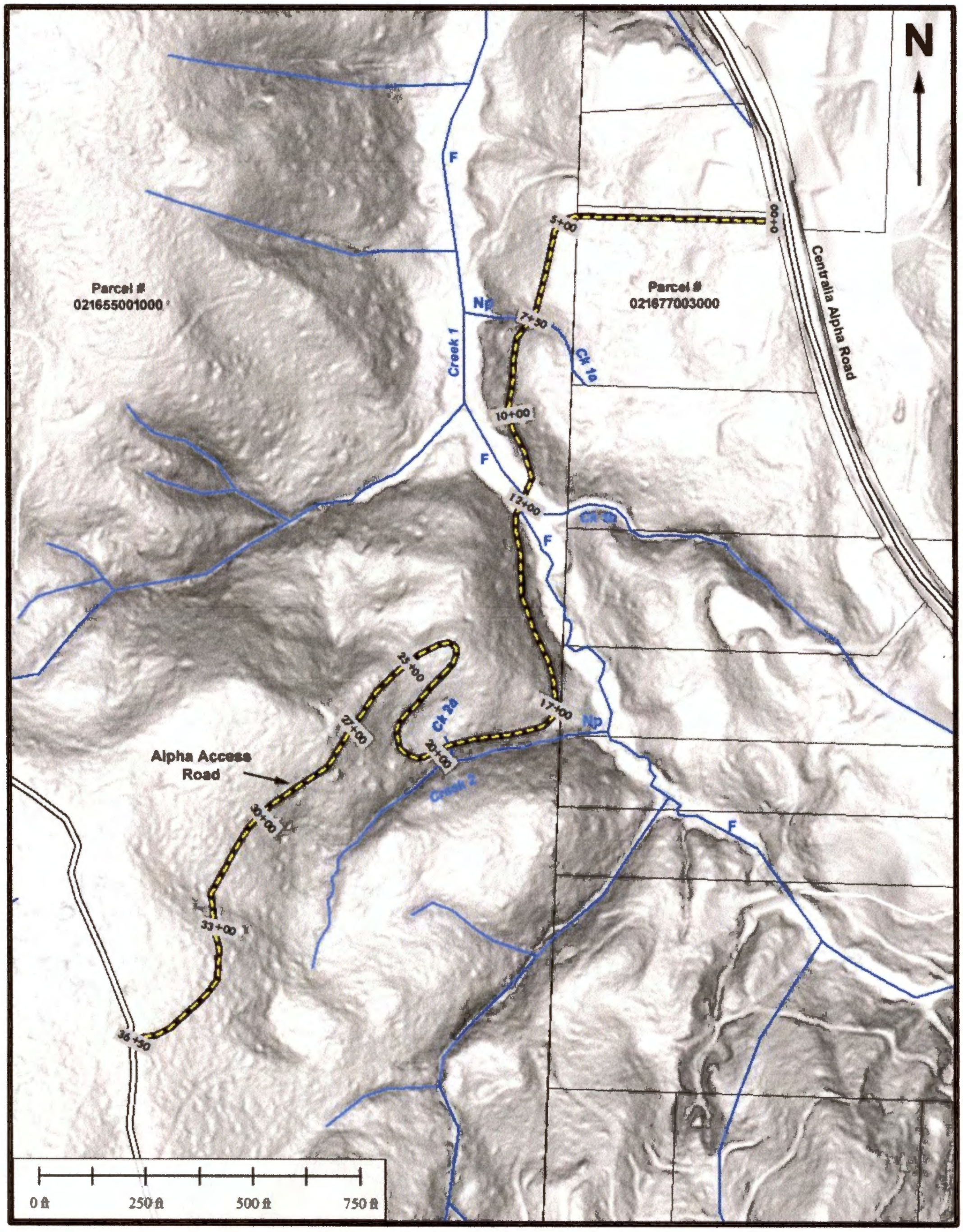
Table 1. Summary of aerial photographs used to evaluate historical changes within the Alpha Access Road project area.

Assessment of Potential Slope Stability Issues

The proposed access road is being constructed according to the standards and guidelines in the current forest practices rules and regulations. The details of the design are provided in cross-sectional profiles of the proposed road grade in Appendix B. The proposed road location was reviewed with Mr. Dave Roberts, the engineer who designed the road, on April 11th, 2024.

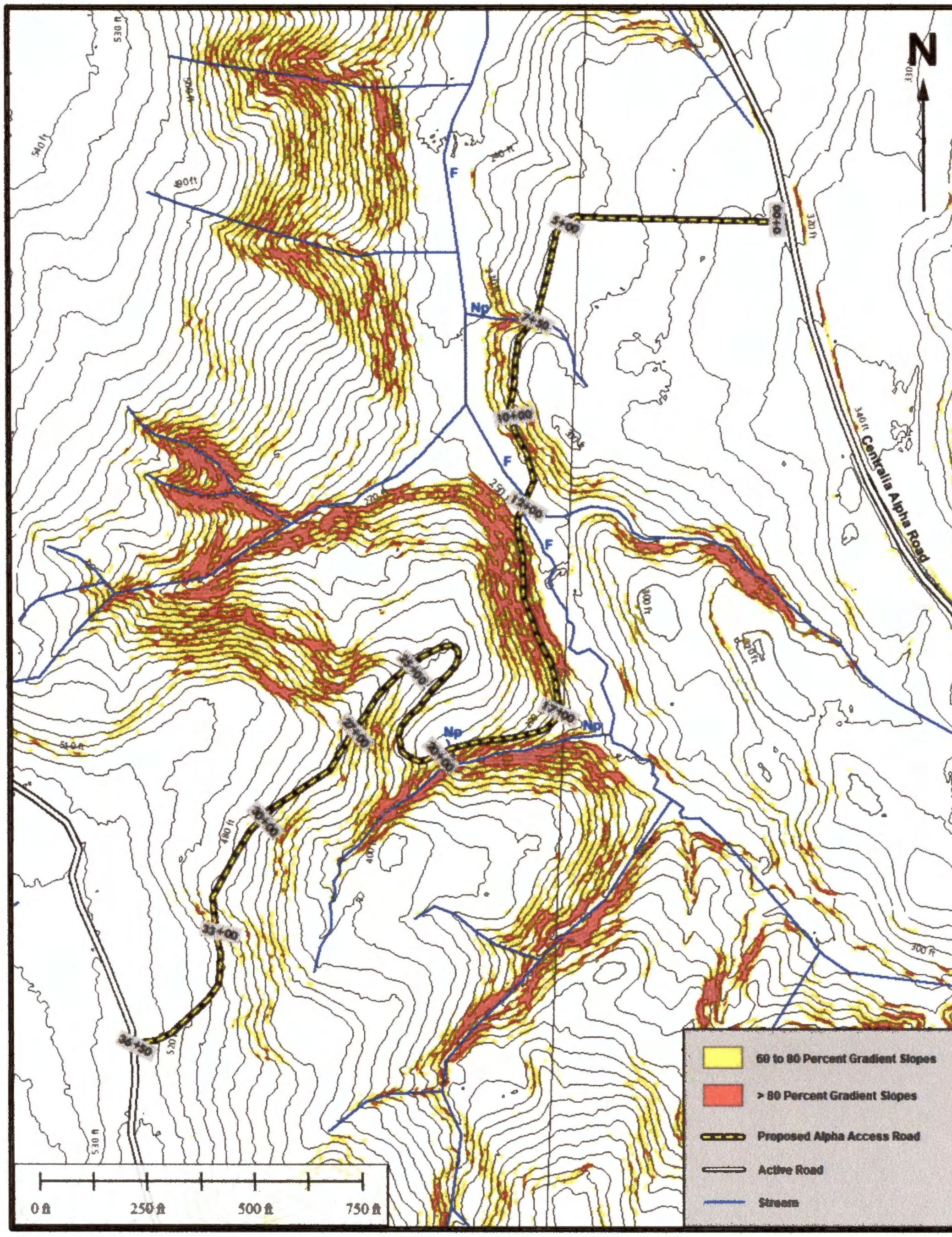
The first 450 feet of the new access road as it heads west off of the Centralia Alpha Road is situated on relatively flat, graded terrain on Parcel No. 021677003000 that dips towards the west (Figure 7). The road easement is located at the northern end of the parcel and is currently forested with approximately 20-year-old trees. The road enters Parcel No. 021655001000 at about Station 4+65 and turns south as it follows the contour of the hillside. The road crosses a 2-foot-wide perennial stream (Creek 1a) at Station 7+50. Creek 1a is incised about 10 feet and has gradients of 60 to 80 percent (Figure 8). The colluvium consists of a silty loam with weathered angular siltstone rock fragments and would be classified as fine-grained inorganic silts and fine sands (ML). The inner gorge terrain includes recent blow down and signs of significant soil creep and past sloughing of colluvium into the stream. The stream crossing will include a 76-foot-long, 24-inch diameter culvert and have a 12-foot-deep fill. The culvert inlet should be countersunk to capture all streamflow and be bedded in at least 8 inches of compacted 3" minus quarry rock. Quarry spalls should also be placed at the culvert outlet to dissipate the energy of the streamflow and prevent channel incision and bank erosion. Straw mulch and grass seed should also be added to the fill slope area following completion of soil disturbing activities to limit the potential for surface erosion.

The road continues at an adverse grade of 11 percent for 200 feet down the hillside on slopes of 60 to 80 percent gradient between Stations 7+50 and 9+50 (Figure 7). Full bench road construction will be required as the road cuts through these steep slopes. The road then crosses over an old deep-seated landslide slump at around Station 10+00. The deep-seated landslide is about 1/6 of an acre in size, with a 30-foot-wide bench on the landslide body and a 15-foot-high scarp of 60 to 70 percent gradient. The landslide is situated in silty loam colluvium likely derived from weathered siltstone. The feature is considered a relict landslide based on the presence of a mature forest with old-growth stumps, the vague lateral margins without any drainage, and topography that has been smoothed by erosion over time and is unbroken by recent slope displacement (Keaton and DeGraff 1996). Despite past clear-cut timber harvest, the landslide does not show evidence of reactivation in modern times. The road crosses on the relatively flat body of the landslide for about 75 feet before again entering inner gorge slopes of 70 to 80 percent gradient for about 150 feet between Stations 10+30 and 11+80. Full bench road construction will also be required for this section of road as it enters the wet valley bottom of Creek 1. Large, angular, 2- to 3-man quarry rocks may need to be keyed into the cutslope to help stabilize the colluvium along this stretch of road.



Shaded relief generated from 2017 Washington DNR bare-earth LiDAR DEMs

Figure 7. Road stations for the proposed Alpha access road.



10-foot contours generated from 2017 Washington DNR bare-earth LiDAR DEMs

Figure 8. Slope gradient map highlighting the steepest slopes in the project area.

The road enters a roughly 100-foot-wide wet meadow at the confluence of Creek 1 and Creek 1b (Figure 7). The valley bottom is dominated by reed canary grass (*Phalaris arundinacea*), with a few young alder and cedar trees scattered across the wetland area (Figure 9). The saturated mineral soils are generally characterized as a clayey silt (ML) but can be variable across the valley bottom, with lenses of sand and small gravel (SM or GM) within the finer sediments. The proposed road crossing of the wet valley bottom is being designed with 40-foot logs buried in the saturated soils to serve as a foundation for the road. The anaerobic conditions in the saturated soils of the wet meadow are expected to preserve the buried logs for the life span of the road. Geotextile fabric will cover the soil and log foundation before it is buried with pit-run rock and clean fill for the base course material and then finer aggregated compacted to cover the road grade. The road is expected to be elevated about 10 feet above the valley bottom. Two pipes are being proposed through the road grade, including a 78-inch diameter corrugated steel pipe towards the right bank (eastern edge) of the valley along Creek 1b and a 96-inch diameter corrugated steel pipe towards the left bank (western edge) of the valley for Creek 1. The culverts should follow stream simulation design guidelines and be bedded in at least 8 inches of compacted 3" minus rock. The road fill and culvert inlets will be protected by larger quarry spalls at the base of the road grade.

As the road leaves the wet meadow, it climbs at a favorable grade of 10 percent across steep inner gorge slopes on the west side of Creek 1 from Station 12+00 to 17+00. The inner gorge terrain consists of planar slopes of 70 to 100 percent gradient (Figure 10). The trees on the lower slopes consist primarily of mature alder, but patches of western red cedar are also present. While a few old-growth stumps are scattered on the steep hillside, the slopes generally show signs of significant soil creep and small colluvial slumps. Many of the trees on the steeper slopes are pistol-butted and have buttressed roots. While no bedrock outcrops were found within the road centerline, the rock fragments in the colluvium (GM or SM) indicate the presence of siltstone and fine-grained sandstone. The sedimentary rock is likely to be highly weathered and fractured, so that mechanical excavation will likely be feasible for road construction, with minimal, if any, need for drilling and shooting explosives. Full bench road construction will be required through the rule-identified landform, and waste material will need to be pushed or end-hauled to a safe location. Depending on the depth of the colluvium, large, angular 2- to 3-man quarry rocks may need to be to be stacked between 3 to 6 feet high and keyed into the hillside to prevent cut-slope failures, particularly if groundwater seepage is intercepted. The cut-slope will be constructed at a ¾:1 slope and be roughly 10 to 15 feet high. Additional 2- to 3-man quarry rock may also be used along the outside edge of the road to help stabilize the road grade and minimize the potential for colluvial slumps. Road drainage will have to be carefully managed to avoid placing additional water onto steep, potentially unstable slopes. Colluvial slumps from the steep cutslope may also periodically fill the ditchline and cause water to flow onto the road prism. Strategic placement of water-bars

Figure 9. Looking upstream and downstream at the wet meadow area around Station 12+00 of the proposed Alpha Access Road.

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Figure 10. Inner gorge terrain on the west side of the Creek 1 valley.

is recommended to minimize road surface runoff and to provide a back-up drainage system for the road runoff in case a portion of the ditch becomes plugged.

The proposed access road cuts through the ridgeline at Station 17+00 and then climbs parallel to Creek 2 for about 400 feet to Station 21+00 (Figure 7). Full bench road construction will be required as the road follows along the edge of 60 to 90 percent gradient rule-identified inner gorge terrain (Figure 11). A recent translational landslide that deposited into Creek 2 was observed from the inner gorge slopes on the opposite side of the draw. The road also crosses a small 2-foot-wide perennial tributary stream (Creek 2a) at about Station 19+50. A 24-inch diameter pipe will be added for this stream crossing.

The road then switchbacks up the hill twice between Station 20+00 and Station 27+00 (Figure 7). The road will maintain a consistent grade of about 12 percent as it climbs away from the larger non-fish-bearing stream between Station 20+00 and Station 23+00. At the first switchback at about Station 21+50, the road will be cut from 5 to 7 feet below the ground surface (Figure 12). An 18-inch diameter cross-drain structure will be placed at this location because of the high likelihood for groundwater interception from the steep convergent terrain upslope from the road. The road grade flattens at the second switchback at about Station 23+00 and will serve as a waste area for excess material. The road crosses through one additional steep section of 60 to 80 percent gradient slopes between Station 26+50 and 27+50 that will require full bench construction and end-haul of waste material (Figure 8). These steep planar slopes feed into the first switchback area and could potentially impact the small tributary stream at Station 19+50 (Figure 12).

The remainder of the road between Station 27+50 and 36+50 will be a standard balanced cut-and-fill road design since it crosses moderate gradient terrain of 20 to 60 percent (Figure 8). The road crosses through a ridge of sedimentary rock between Station 27+50 and Station 29+00 and then hits glacial outwash sediments of the Logan Hill Formation. The glacial outwash mantles the terrain across the remainder of the access road to Station 36+50. The glacial outwash consists of weathered, orange-red, poorly consolidated, rounded gravel and cobble in a matrix of sand, silt, and clay. No signs of slope instability were noted in the glacial sediments. The depth to bedrock is unknown, but a well log from the middle of Section 21 indicates that the highly weathered sandy clay deposits and water-bearing sand and gravel deposits extend at least 130 feet below the ground surface. A well log to the southeast of the road project, however, had only 10 feet of weathered clay before encountering light brown sandstone between 10 and 78 feet below the ground surface.

Figure 11. Typical slope along the Creek 2 road location at about Station 18+00 and a recent shallow-rapid landslide from the inner gorge along Creek 2.

Figure 12. First switchback at Station 21+50 with 5 to 7 feet of road-cut and the steep upslope area above the switchback and below Stations 26+00 and 27+50.

Conclusions

As required by the Washington State Department of Natural Resources Forest Practices Division, the following conclusions are provided to address WAC 222-10-030 (1) (a,b,c).

(1) In order to determine whether such forest practices are likely to have a probable significant adverse impact, and therefore require an environmental impact statement, the applicant must submit the following additional information, prepared by a qualified expert. The expert must describe the potentially unstable landforms in and around the application site and analyze:

(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;

The proposed Alpha Access Road in Parcel No. 021655001000 is unlikely to cause or contribute to further movement on potentially unstable inner gorge terrain of greater than 70 percent gradient because the road will utilize a full-bench design. All excavated material for areas with a full bench design will be pushed or end-hauled to a safe location, and no waste material will be side-cast onto slopes greater than 60 percent gradient. The design also includes the use of stacked quarry rock that will be keyed into the steep cutslope areas and along the outside edge of the road as necessary. The removal of trees along the road right-of-way will not increase the likelihood of slope movement because most of the colluvium that would be at risk of failure is being removed and wasted in a stable location.

The proposed access road also crosses through the body and upper toe of a small, relict deep-seated landslide in weathered sedimentary rock. The deep-seated landslide does not show evidence of reactivation in modern times, despite historical clear-cut harvest of the landslide area. Most of the road cut will be into the body of the landslide and will actually remove weight from the toe of the landslide. Little disturbance is expected along the toe of the feature. Given the lack of impact along the landslide toe, the road has a low likelihood of causing or contributing to further deep-seated slope movement.

(b) The likelihood of delivery of sediment or debris to any public resources or in a manner that would threaten public safety; and

The proposed Alpha Access Road in Parcel No. 021655001000 has a low likelihood of increasing the delivery of sediment or debris to public resources because the road is being constructed using a full-bench road design through inner gorge terrain. Waste material generated from excavation along steep slopes will not be side-cast onto fill-slopes of greater than 60 percent gradient, and instead will be pushed or end-hauled to a stable location. The proposed road construction will not threaten public safety since the road will be gated on private property and lacks public access.

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

Road construction across steep slopes must employ best management practices to minimize the potential for soil erosion or mass wasting. A detailed pre-work plan should be provided to the forest practices forester prior to construction. Excavation work should only be done during periods of generally dry weather to avoid erosion and potential slope movement. During construction, project activities should be supervised by a forest engineer or construction supervisor with experience doing full-bench road construction across steep slopes. In general, soil should not be placed on slopes in excess of 60 percent gradient. Fill and waste material should not be perched on logs or other organic debris at the edge of the road. Areas of soil disturbance should have generous placement of straw mulch or slash debris to minimize erosion of the soil surface. Finally, road drainage should be carefully managed to prevent runoff directly onto steep slopes.

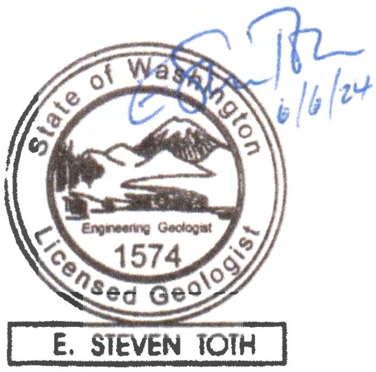
Limitations

The conclusions presented in this report are based on a limited investigation of site conditions, as they existed at the time of our field visit. Subsurface explorations could not be performed, and vegetation and topography limited our observations. It is not possible to fully define the geological conditions of the site based on this limited investigation; however, the work was done in accordance with generally accepted geological practices. Currently available science is insufficient to make specific predictions about future slope movement. Landowners must recognize that timber harvest and road construction on steep slopes carries an inherent risk of causing or contributing to instability. These risks may be increased by actions or events, such as poor construction practices, not implementing best management practices, insufficient or improper maintenance activities, and extreme storms. The evaluation of slope stability does not include any assessment of seismically-induced hazards.

This report is for the sole use of the client on this project and may not be relied upon by other parties. If there is a substantial lapse of time between the submission of this report and the start of work or if conditions have changed due to natural causes or work at or adjacent to the site, please contact me so that the geotechnical report can be reviewed to determine the applicability of the conclusions and recommendations. No other warranty, expressed or implied, is made.

If you have any questions about the contents or conclusions of this letter, please let me know.

Sincerely,



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Attachments: References
Appendix A: Historical Aerial Photographs
Appendix B: Road Profiles for the Proposed Alpha Access Road

References

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APPENDIX A

Historical Aerial Photographs

Figure A-1. Rectified 1952 aerial photograph of the Alpha Access Road project area.

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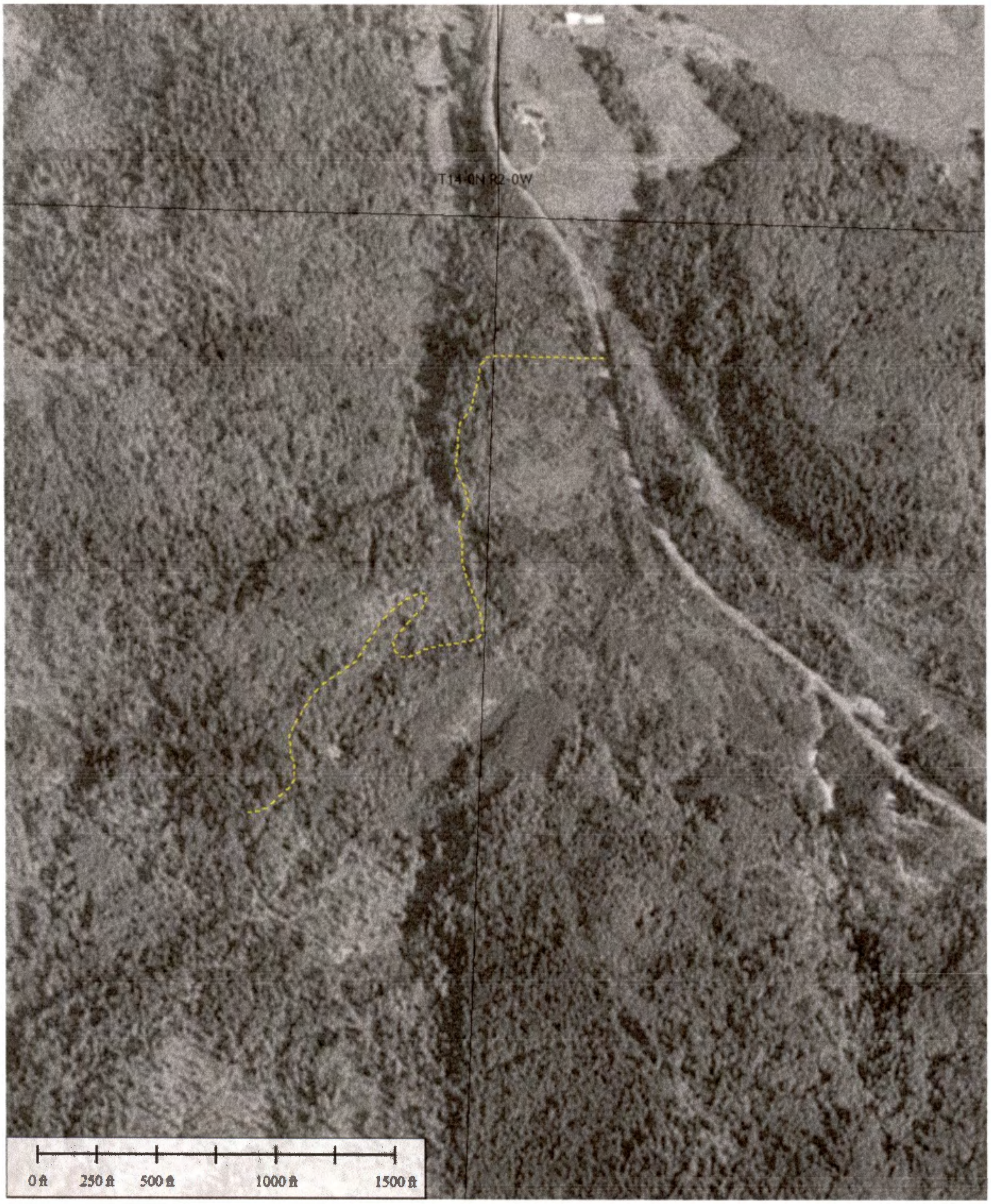

Figure A-2. Rectified 1968 aerial photograph of the Alpha Access Road project area.

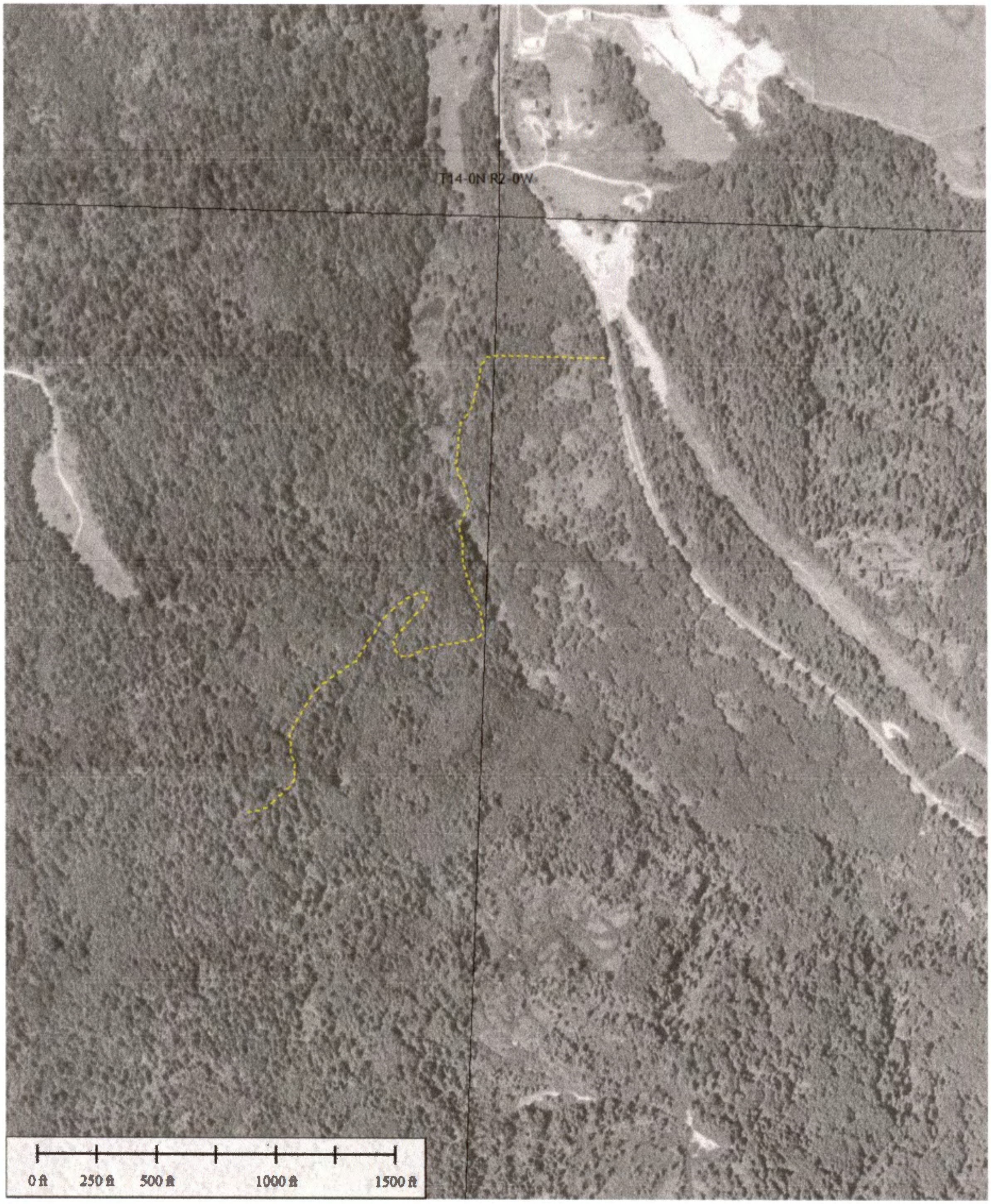

Figure A-3. Rectified 1980 aerial photograph of the Alpha Access Road project area.

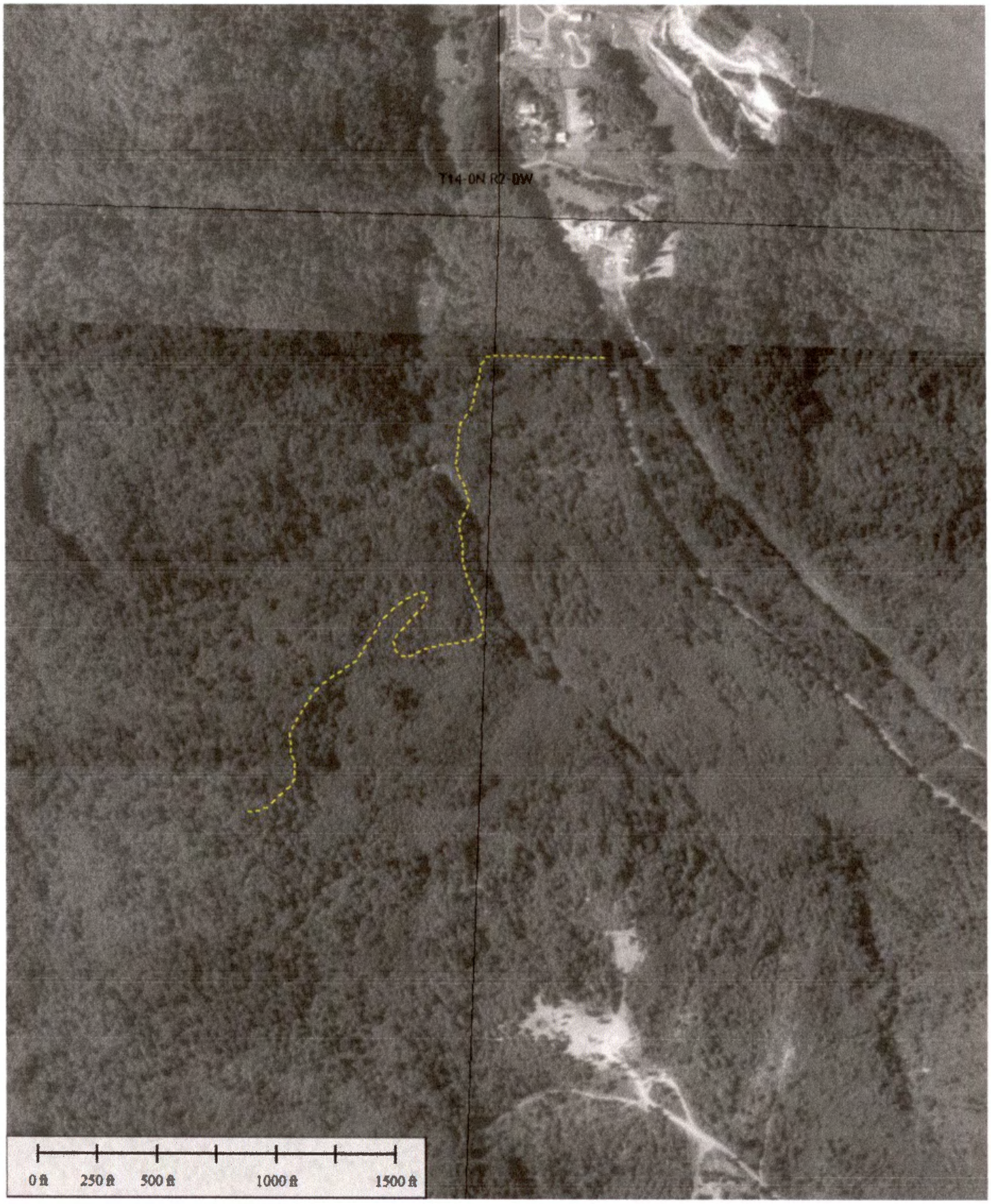

Figure A-4. 1990 aerial orthophotograph of the Alpha Access Road project area.

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Figure A-5. 2006 aerial orthophotograph of the Alpha Access Road project area.

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Figure A-6. 2009 aerial orthophotograph of the Alpha Access Road project area.

Figure A-7. 2011 aerial orthophotograph of the Alpha Access Road project area.

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Figure A-8. 2013 aerial orthophotograph of the Alpha Access Road project area.

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Figure A-9 2015 aerial orthophotograph of the Alpha Access Road project area.

Figure A-10. 2017 aerial orthophotograph of the Alpha Access Road project area.

Figure A-11. 2019 aerial orthophotograph of the Alpha Access Road project area.

Figure A-12. 2021 aerial orthophotograph of the Alpha Access Road project area.

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Figure A-13. 2023 aerial orthophotograph of the Alpha Access Road project area.

APPENDIX B

Road Profiles for the Proposed Alpha Access Road

Produced By Mr. Dave Roberts, Road Engineer

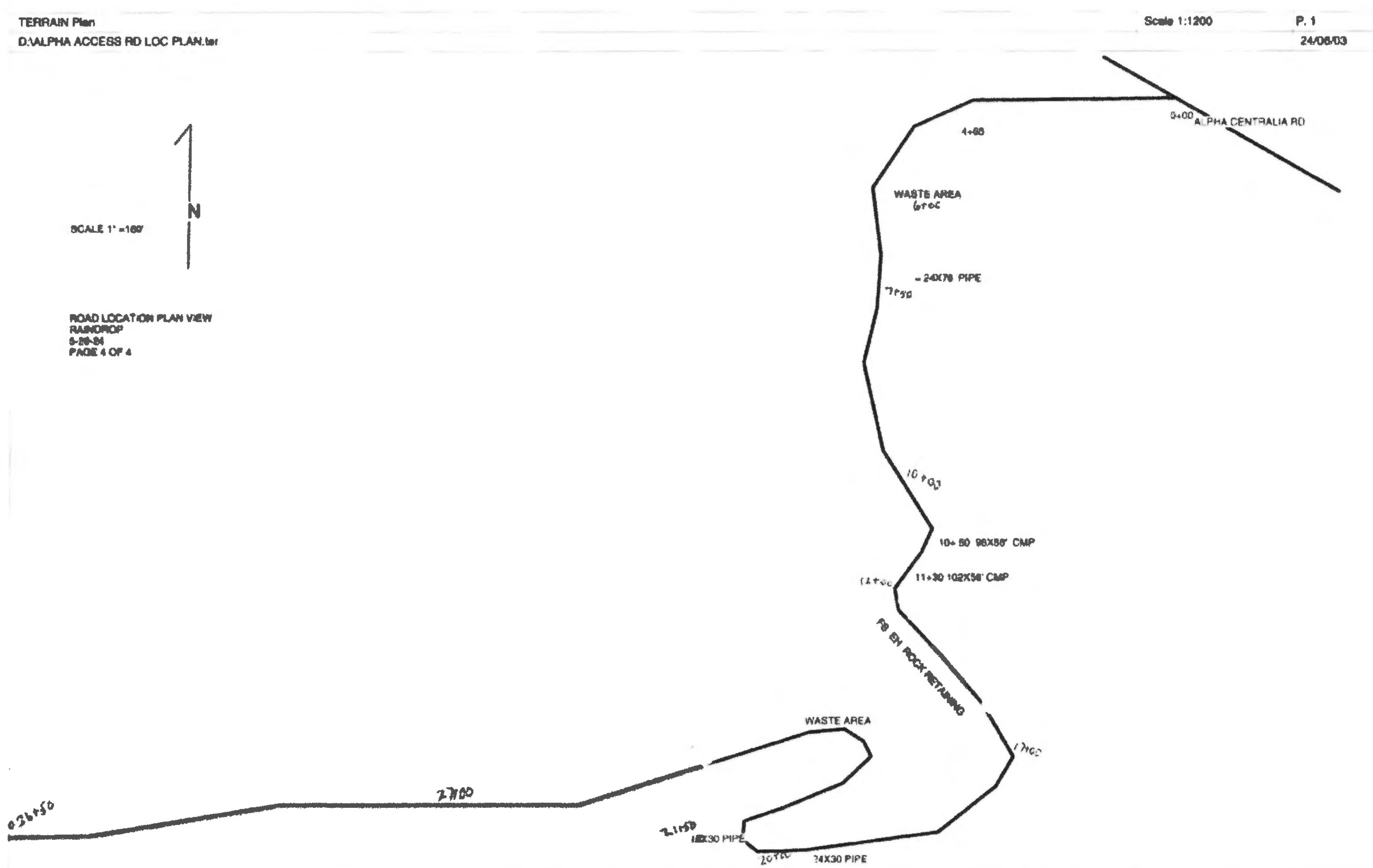

Figure B-1. Plan view of the proposed Alpha Access Road with road stationing.

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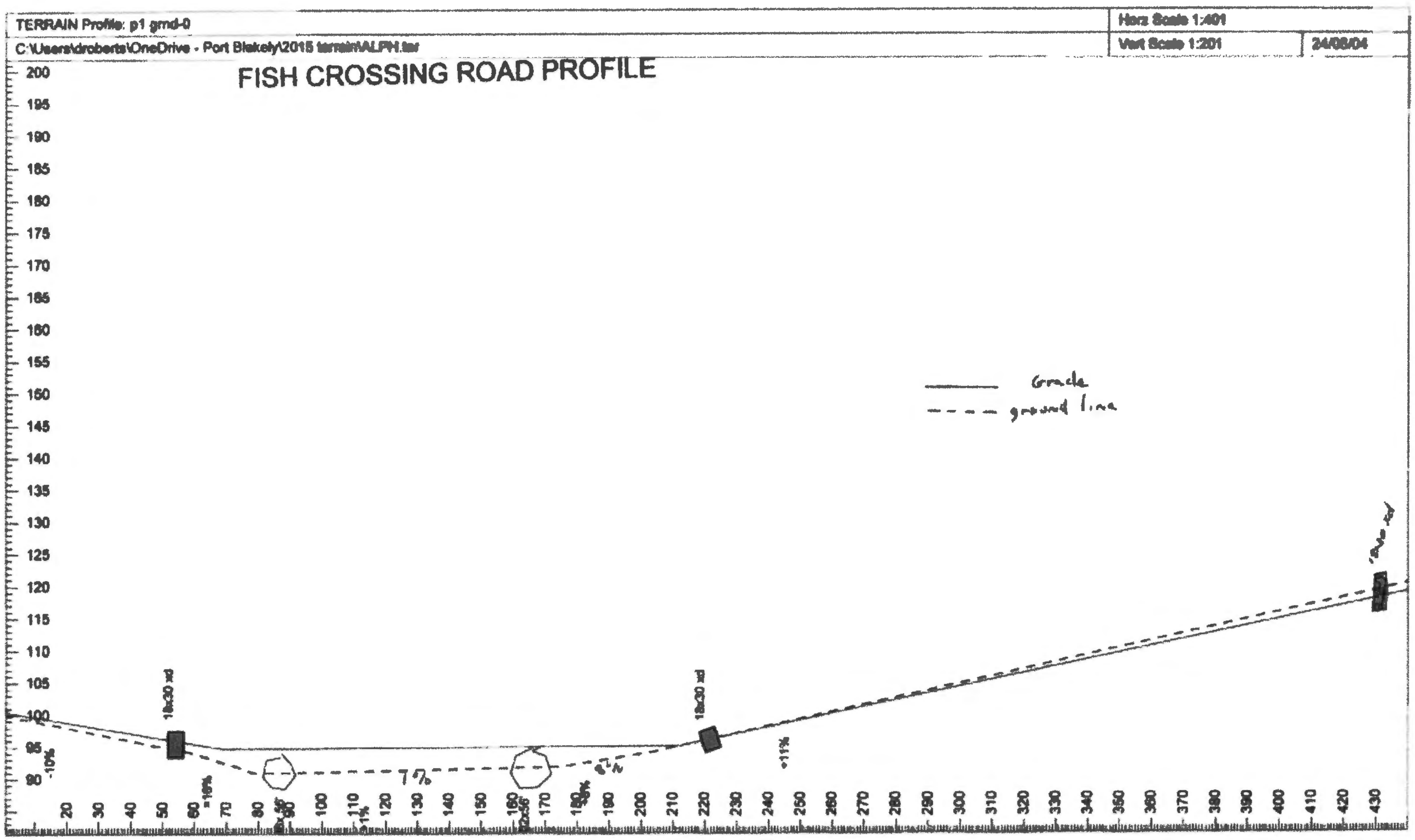

Figure B-2. Cross-sectional profile of the fish-bearing stream crossings between Stations 8+00 and 12+50.

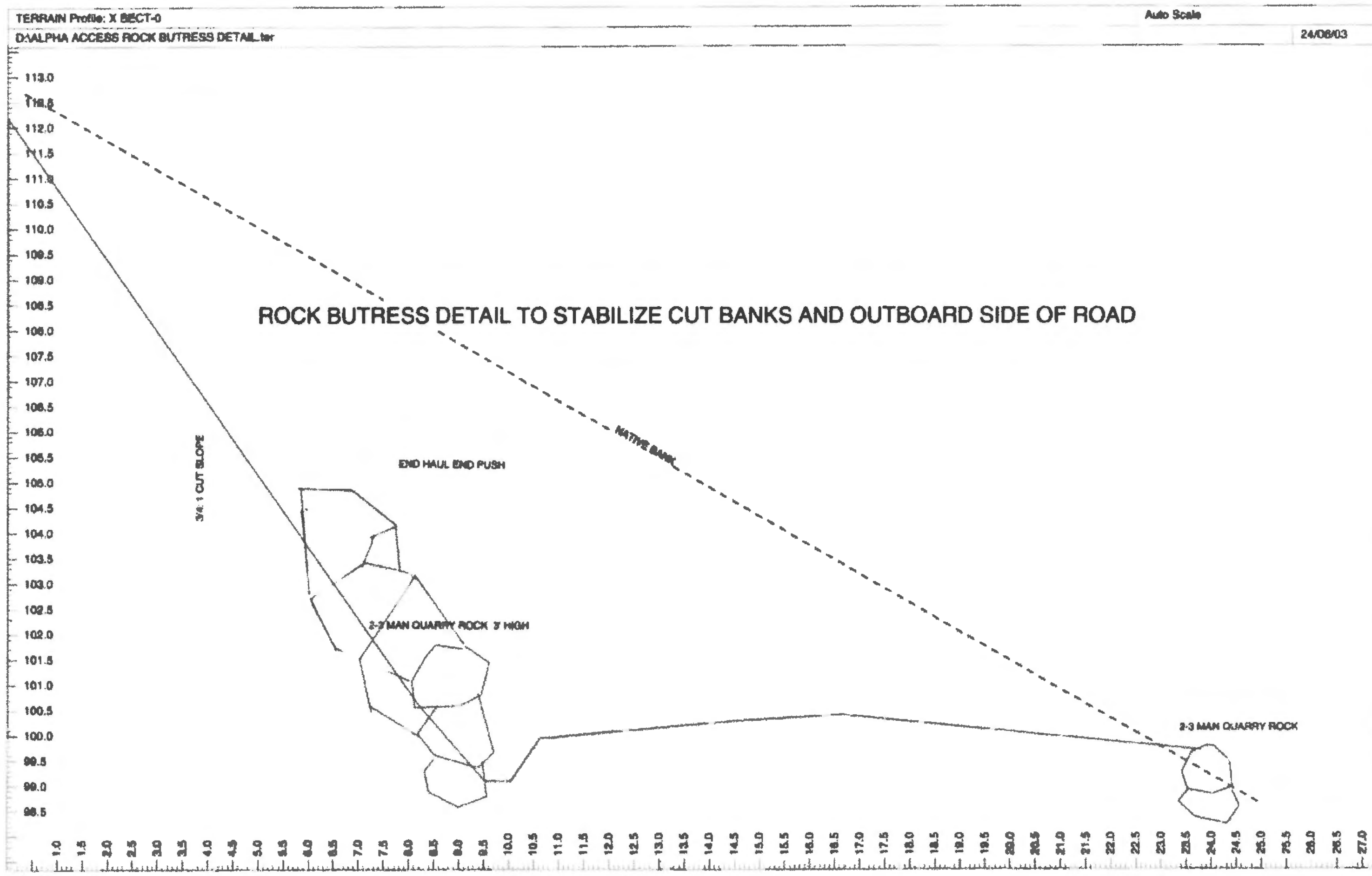

Figure B-3. Cross-sectional profile and rock buttress detail for the full bench road design along inner gorge terrain between Stations 12+00 and 17+00.