



Report of Geotechnical Engineering Services:

2026 North Valley Road Improvement Project
From NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Central Project: YamhillCo-1-01



Prepared For:

Yamhill County
2060 NE Lafayette Avenue
McMinnville, OR 97128



Date: January 15, 2026

January 15, 2026

Yamhill County
2060 NE Lafayette Avenue
McMinnville, OR 97128

Attention: Greg Haffner haffnerg@yamhillcounty.gov

Subject: Report of Geotechnical Engineering Services
2026 North Valley Road Improvement Project
From NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon
Central Project No. YamhillCo-1-01

Central Engineering Services (Central) is pleased to submit this report of geotechnical engineering services for the 2026 North Valley Road Improvement project in Yamhill County, Oregon. This report was prepared in accordance with the professional services contract by and between Yamhill County and Central effective on September 25, 2025.

Thank you for the opportunity to work with you on this project. Please feel free to call our office with questions about this report.

Respectfully,

Central Engineering Services



Krey D. Younger, P.E., G.E.
Principal Engineer

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1.0 PROJECT DESCRIPTION

Central Engineering Services (Central) is pleased to submit this report of geotechnical engineering services for the 2026 North Valley Road Improvement project in Yamhill County, Oregon. The project limits extend from NE Ribbon Ridge Road to NE Albertson Road (approximately 3.8 miles). This report specifically addresses four areas of uneven pavement identified by Yamhill County (County). A summary of the uneven areas is presented in Table 1. Stationing is based on plan information provided by the County. Based on discussions between County and Central representatives, the uneven areas addressed in this report are likely a result of ground deformation related to historical landslides in the area and long-term creep.

Table 1. Summary of Uneven Areas

Area No.	Station (Approximate)	
	Begin	End
1	75+50	76+50
2	90+00	92+75
3	112+50	115+00
4	189+50	190+00

A vicinity map showing the extents of the four uneven areas relative to existing topographic and physical features is presented in Figure 1. An aerial image of the four uneven areas and the approximate locations of our explorations are shown on Figures 2A through 2D. A photographic log of the pavement distress existing at the four uneven areas is presented in Appendix A, Figures A-1 through A-8.

The uneven areas were previously identified and discussed in a 2021 Report of Pavement Engineering Services¹ prepared by NV5. The 2021 report concluded that typical pavement rehabilitation options would not improve long-term ride quality and pavements cracks in these uneven areas would likely redevelop within a year of rehabilitation.

2.0 PURPOSE AND SCOPE OF WORK

The purpose of our scope of services was to conduct a subsurface investigation and provide options for the uneven areas. . Our scope of services was written based on information discussed with County representatives, our experience in the area, and our understanding of the project. Our scope of services included the following:

1. Reviewed information regarding subsurface soil and groundwater conditions in the site vicinity, including reports in our files, available geologic maps, and other geotechnical engineering-related information.
2. Completed a geotechnical reconnaissance level evaluation of suspected slope hazards in the vicinity of the four uneven areas.
3. Coordinated and managed the field investigation, including public utility notification and scheduling of subcontractors and Central field staff. Public locates will be called in by our office as required by law.

¹ NV5. Report of Pavement Engineering Services; North Valley Road Improvements; NE North Valley Road; Yamhill County, Oregon, dated December 6, 2021 (NV5 Project: YamhillCo-6-01)

4. Obtained a right-of-way (ROW) work permit through the County, including a general work plan and traffic control plans.
5. Explored subsurface soil and groundwater conditions at the site by drilling a total of eight borings to depths ranging from 16.5 to 21.5 feet below ground surface (bgs) using a truck-mounted drilling rig.
6. Obtained samples at representative intervals from the explorations, observed groundwater conditions, and maintained detailed logs with soil classification in general accordance with ASTM International (ASTM) Standard Practices Test Method D2488. Qualified staff from our office observed and documented field activities.
7. Performed laboratory tests on selected soil samples obtained from the explorations to evaluate pertinent engineering characteristics. We performed the following laboratory tests:
 - Nineteen moisture content determination tests in general accordance with ASTM D2216.
 - Six dry density tests in general accordance with ASTM D7263.
 - Four Atterberg Limits determinations in general accordance with ASTM D4318.
8. Provided the results of our reconnaissance, subsurface and laboratory testing programs, and our conclusions and repair recommendations in this geotechnical engineering report.

3.0 SITE CONDITIONS

3.1 SITE GEOLOGY

North Valley Road is located near the base of the Chehalem Creek watershed in Yamhill County. Available geologic maps² published by Oregon Department of Geology and Mineral Industries (DOGAMI) indicate that the site is naturally underlain by young alluvium consisting of silt, sand, and clay. The alluvium deposits are noted as being 20 to 30 feet thick and contain poorly drained swampy areas having a permanently high water table.

In addition to the natural alluvial bedding, the surrounding area has experienced numerous landslides, which are discussed in the following section.

3.1.1 Landslide Mapping

The Oregon landslide inventory and hazard mapping compiled by DOGAMI in their Statewide Landslide Information Database for Oregon (SLIDO) 4.5 database classifies the site and vicinity as moderately to highly susceptible to landsliding. Moreover, based on a review of Light Detection and Ranging (LiDAR) bare earth digital elevation imagery from DOGAMI, we identified nine mapped landslide features within the project area. A brief discussion of the identified features is presented below, and the extent of the features is shown in Figure 3:

1. Holocene- and Pleistocene-age landslide deposits (Qls) generally comprise the east-facing slopes (west of Chehalem Creek). The Qls unit generally consists of poorly sorted, angular to subrounded bedrock blocks and fragments embedded in a weathered muddy matrix. These deposits commonly form lobed masses with hummocky ground surfaces and exhibit poor drainage conditions below arcuate head scarps.
2. A Pre-Holocene landslide deposit (Qlso) generally comprises the west-facing slopes adjacent to North Valley Road and are found at each of the four uneven areas. The Qlso unit consists of poorly sorted, angular to subrounded bedrock blocks and fragments set within a weathered muddy matrix. These

² Schlicker, H.G., and Deacon, R.J. 1967. Engineering geology of the Tualatin Valley Region. Oregon Department of Geology and Mineral Industries. Bulletin 60, 1967.

deposits typically form lobate masses with broad, hummocky topography; slide topography and head scarps are subdued by erosion and thick loess cover.

3. Alluvial fan deposits (Qaf) are shown underlying uneven areas 1 through 3 and these deposits appear to exist beneath North Valley Road south of area 3 throughout. The Qaf unit generally was formed by the downslope transport and accumulation of sediment at the base of steeper terrain. These deposits typically consist of poorly to moderately sorted mixtures of sand, silt, gravel, and angular to subrounded cobbles and boulders derived from nearby upland slopes or channelized runoff pathways.

3.2 SURFACE CONDITIONS

NE North Valley Road is functionally classified as a rural arterial with one travel lane in each direction. The roadway segment is approximately 3.8 miles long and is paved with asphalt concrete (AC). Roadway edges consist of narrow gravel shoulders with narrow drainage ditches existing on the east side of the roadway. Elevations vary along the alignment, ranging from approximately 180 to 240 feet above mean sea level.

Pavement distress existing at the four uneven areas mainly consists of longitudinal cracks resulting from irregular ground deformations associated with the settlement and creep movement of landslide debris and fan deposits. Crack separations within the uneven areas were generally 2 to 3 inches wide at the time of this study. In addition to the horizontal separations, irregular vertical deformations exist throughout the uneven areas, combining for poor ride quality. A photographic log showing the pavement distress at each of the four uneven areas is presented in Appendix A.

3.3 SUBSURFACE CONDITIONS

3.3.1 General

We explored subsurface conditions at the four uneven areas by drilling eight borings (B-1 through B-8) to depths ranging from 16.5 to 21.5 feet bgs at the approximate locations shown in Figures 2A through 2D. A detailed description of our subsurface exploration and laboratory testing programs, exploration logs, and laboratory testing results are presented in Appendix B. Existing pavement thickness along with lane and wheel track locations at each exploration is presented in Table 2.

Table 2. Existing Pavement Thickness

Area No.	Boring	Lane	Wheel Track ¹	AC Thickness (inches)	Aggregate Base Thickness (inches)
1	B-1	Southbound	BWT	11.0	12.0
	B-2	Southbound	BWT	11.0	12.0
2	B-3	Northbound	BWT	11.0	10.0
	B-4	Northbound	BWT	10.0	14.0
3	B-5	Southbound	BWT	10.0	14.0
	B-6	Southbound	BWT	10.0	14.0
	B-7	Southbound	BWT	10.0	14.0
4	B-8	Northbound	BWT	10.0	10.0

Notes:

¹ BWT = Between wheel track

3.3.2 Uneven Area 1

Soil conditions at uneven area 1 consist of black to brown and gray clay (CH). Based on Standard Penetration Test (SPT) blow counts, the consistency of the clay is primarily medium-stiff to stiff. Conversely, we observed soft to very-soft clay in boring B-2 at a depth of 15 feet bgs. Potential fill consisting of clay with trace angular gravel is below the aggregate base in boring B-2 extending to approximately 4 feet bgs. The potential fill is likely associated with construction of the road's embankment.

3.3.3 Uneven Area 2

Soil conditions at uneven area 2 consist of black to brown clay (CH). The results of Atterberg Limit testing indicate that the clay is highly plastic based on a Plasticity Index (PI) of 71. SPT blow counts indicate the consistency of the clay is primarily medium-stiff to stiff with a very-soft to soft layer in B-4 at around 7 to 12 feet bgs.

3.3.4 Uneven Area 3

Soil conditions at uneven area 3 consist of gray to dark gray clay (CH) and silt (MH). The results of Atterberg Limit testing indicate that the clay is highly plastic based on Pls of 58 and 66. SPT blow counts indicate the consistency of the clay and silt is primarily medium-stiff to stiff with some SPT blow counts indicating soft to medium-stiff consistency at varying depths between 5 and 10 feet bgs.

3.3.5 Uneven Area 4

Soil conditions at uneven area 4 consist of gray clay (CH). Based on SPT blow counts, the consistency of the clay is soft directly below the aggregate base and grades to primarily medium-stiff to stiff. The results of Atterberg Limit testing indicate that the clay is highly plastic based on a PI of 81.

3.3.6 Groundwater Conditions

Groundwater was not observed at the time of exploration, except at boring B-6 where groundwater was observed at 21.5 feet bgs, near the base of the exploration. Depth to groundwater is expected to be highly variable and fluctuate with the levels of the nearby Chehalem Creek, during persistent wet weather, or during seasonal flood events. Additionally, groundwater likely follows the general elevation of the ground in the area as it infiltrates at the higher elevations existing east of the roadway and moves downward toward the creek. Likewise, the depth to groundwater will fluctuate in response to seasonal changes, prolonged rainfall, changes in surface topography, and other factors not observed in this study, but should be expected to be shallower than 10 feet bgs during extended periods of wet weather.

4.0 CONCLUSIONS AND REPAIR RECOMMENDATIONS

Based on our field observations, explorations, testing, and analysis, it is our opinion the uneven areas are a result of ground deformations associated with the road being founded on landslide debris and alluvial fan deposits. Due to the variable thickness and consistency of the landslide debris, it is difficult to predict the location and magnitude of future deformations. To eliminate the risk of future deformations, complete removal and replacement of the landslide debris material with new embankment fill or ground improvements such as soil-cement mixing will be required. However, we understand the associated cost of these options is not feasible and, based on discussions with the County, the return on investment is likely not worth the undertaking for the County. Therefore, we recommend a double-layer geogrid repair option that allows for future ground deformations but reduces the amount of differential movement and pavement cracking, thus reducing the effect of ground deformation on ride quality. The following sections provide our recommendations for repairing the four uneven areas.

4.1 PAVEMENT SECTION DESIGN

As part of our scope, we reevaluated the full-depth repair recommendation provided in the 2021 pavement design report to reflect newer traffic information. During the time of the 2021 report, COVID protocols resulted in relatively lower traffic volumes than typical for North Valley Road. The County provided traffic volume counts on North Valley Road between September 7 and September 11, 2023. Based on recommendations from the County, we used the traffic volume of 5,126 average daily traffic (ADT) from September 8, 2023. We recalculated the equivalent single axle loads (ESALs) using the new volume combined with the classification distribution from the 2021 pavement design report. Using this approach, we estimate a design 20-year ESAL value of approximately 2.57 million. We then used the 1993 AASHTO procedure to determine the minimum pavement thickness to satisfy the 20-year design ESAL value based on resilient modulus values, and the other design parameters listed in the 2021 pavement design report.

Pavement design calculation sheets are presented in Appendix C.

4.2 REPAIR RECOMMENDATION

With the intent of improving overall ride quality with the understanding that future deformations will occur in the uneven areas, we recommend reconstructing the pavement with double-layer geogrid reinforcement. Below is our recommended repair for the four uneven areas. Based on discussions with the County, rehabilitation and drainage improvements will be made throughout the project limits of North Valley Road. Therefore, the AC section below should be considered the long-term AC thickness after rehabilitation.

Recommended Repair Section (7 inches of AC over 16 inches of aggregate base over 12 inches of subbase):

- 3 inches of ½-inch, Level 3, dense ACP (surface course).
- 4 inches of ½-inch, Level 3, dense ACP (base course – 2 lifts).
- 16 inches of aggregate base with triaxial geogrid at mid-layer.
- 12 inches of subbase with triaxial geogrid at mid-layer.
- Subgrade geotextile.

NOTE: The limits of the repair should extend the width of the roadway and at least 30 feet past the longitudinal limits of the uneven area. Additionally, we recommend a taper approach with the double-layer geogrid where the subbase and bottom grid extends 15 feet past the limits of the uneven area and aggregate base and upper grid extends the entire 30 feet past the limits of the uneven area.

As noted above, the ultimate AC thickness should be 7 inches; variation in the intermediate AC base and surface course thickness as the overall rehabilitation efforts are performed for North Valley Road should be acceptable provided Central is offered the opportunity to review and comment on the rehabilitation procedure. Material specifications for the above repair recommendation are provided in the section below.

4.3 PAVEMENT REPAIR MATERIALS

We recommend that the contractor provide submittals of pavement construction materials as required by Oregon Standard Specifications for Construction (OSSC). The following sections list acceptable materials for use in the repair areas.

4.3.1 Asphalt Concrete

The AC should be Level 3, ½-inch, dense ACP with PG 62-22 binder according to the OSSC 00744 (Asphalt Concrete Pavement). Minimum and maximum lift thicknesses are 2.0 and 3.0 inches for ½-inch ACP,

respectively. An adjustment to lift thickness outside this range should be reviewed by Central and the County. Compaction of the AC should follow the recommendations in the specification.

4.3.2 Aggregate Base

Imported granular material used as aggregate base should be clean, crushed rock or crushed gravel and sand that are dense-graded. The aggregate base should meet the gradation defined in OSSC 00640 (Aggregate Base and Shoulders). The aggregate base should be compacted based on the requirements in the specification. Due to geogrid being required mid-layer, we recommend the aggregate base be placed in 8-inch lifts and compacted in accordance with OSSC 00330.43(c) (Earthwork Compaction Requirements).

4.3.3 Subbase

Subbase material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel and sand and should meet the requirements set forth in OSSC 00330.14 (Selected Granular Backfill) and OSSC 00330.15 (Selected Stone Backfill), with a maximum particle size of 2 inches, less than 10 percent by dry weight passing the U.S. Standard No. 200 sieve and having at least two mechanically fractured faces. The material should be free of organic material and other deleterious material.

Recycled material such as AC or existing aggregate base may be used as subbase provided they are processed to meet the requirements above and do not pose an environmental concern. Processing includes crushing and screening, grinding in place, or other methods. The processed material should be fairly well graded and not contain metal, organic material, or other deleterious material.

Due to geogrid being required mid-layer, we recommend the subbase be placed in 6-inch lifts and compacted in accordance with OSSC 00330.43(c).

4.3.4 Geogrid Reinforcement

Geogrid should be Tensar TX5 triaxial geogrid or equivalent. The geogrid should be manufactured from a punched polypropylene sheet, which is then oriented in three equilateral directions. A Tensar TX5 product specification sheet is included in Appendix D.

4.3.5 Subgrade Geotextile

Subgrade geotextile should be woven and conform to OSSC 02320 (Geosynthetics), Table-02320-4 and be installed in accordance with OSSC 00350 (Geosynthetic Installation).

4.4 DRAINAGE

Satisfactory performance of pavement is contingent on adequate surface and subsurface drainage. Poor drainage resulting in saturation of the pavement subgrade and aggregate base will reduce the performance and service life of the pavements. Site grading should eliminate isolated surface depressions that result in ponding adjacent to the road, which should be considered different from drainage ditches intended to ultimately convey water away from the road. Improving drainage ditches and adding pipe culverts to convey water should increase overall pavement performance for North Valley Road.

5.0 EARTHWORK RECOMMENDATIONS

5.1 SITE PREPARATION

In general, initial site preparation and primary earthwork operations in areas outside existing pavement areas will include stripping and grubbing of upper organics in landscaped areas, excavating and filling for new pavement sections/sidewalks, demolition of existing structures, and fine-grading to establish final grades, as well as relocating live utilities.

Existing voids and new depressions created during site preparation, and resulting from removal of existing utilities, or other subsurface elements, should be cleaned of loose soil or debris down to firm soil and backfilled with compacted structural fill. Disturbance to a greater depth should be expected if site preparation and earthwork are conducted during period of wet weather.

5.2 DEMOLITION

All pavements to be demolished for the project should be completely removed from proposed improvement areas in accordance with OSSC 00748 (Asphalt Concrete Pavement Repair). Existing utilities, if any, that will be abandoned on-site should be identified prior to construction. Abandoned utility lines should be completely removed or filled with grout if abandoned and left in place to reduce potential settlement or caving in the future. Materials generated during demolition may be acceptable for use as subbase material provided it can be processed to meet the requirements in the "Subbase" section; otherwise, the material should be transported off-site and properly disposed of.

5.3 SITE SUBGRADE PREPARATION AND EVALUATION

Upon completion of site preparation activities, the exposed subgrade should be probed with a foundation rod to observe the general conditions of the subgrade. Probing should be conducted prior to placing fill or pavement materials and should be performed by a representative of Central who will evaluate the suitability of the subgrade and identify if any areas may require over-excavation and thicker subbase.

5.4 EXCAVATION

Excavations will be required for the project. Conventional earthmoving equipment in proper working conditions should generally be capable of making the necessary excavations. Boulders were not encountered in our explorations, but may exist in the landslide debris and if boulders are encountered, the contractor should be prepared for difficult excavation conditions that could require the use of specialized equipment and/or blasting. Likewise, if difficult excavations are encountered, trenches may also be wider than anticipated, increasing the amount of backfill material required.

Open excavation techniques may be used to excavate trenches to depths of 4 feet bgs, provided the walls of the excavation are cut at a slope of 1H:1V (horizontal to vertical), and groundwater seepage and boulders are not present. Sloughing and caving will likely occur in the excavation if seepage or boulders are encountered. Excavations should be flattened if excessive sloughing or raveling occurs. In lieu of large and open cuts, approved temporary shoring may be used for excavation support. A wide variety of shoring and dewatering systems is available. Consequently, we recommend the contractor be responsible for selecting the appropriate shoring and dewatering systems.

5.4.1 Safety

All excavations should be made in accordance with applicable OSHA and state regulations. While we have described certain approaches to utility trench excavations in the foregoing discussion, the contractor should be responsible for selecting the excavation and dewatering methods, monitoring the trench excavations for safety, and providing shoring as required to protect personnel and adjacent areas.

5.5 FILL BENCHING

We understand embankment fills are likely needed in areas of existing embankment slopes to widen shoulders. In locations where fills are to be placed on slopes steeper than 5H:1V (20 percent), level benches should be cut into the existing sloping surfaces as discussed in OSSC 00330.42(a)(7) (Foundation Benching). The benches should be a minimum of 10 feet wide or 1-½ times the width of the compaction equipment, whichever is wider. If groundwater seepage is identified in bench cuts during wet weather, the installation of subsurface drainage improvements (e.g., blanket or chimney drains) may be required.

5.6 EMBANKMENT FILL

Embankment fill material should have a maximum particle size of 4 inches and should be free of organic material or unsuitable material. If larger-than-standard equipment is used for compaction, maximum particle size may be increased to 6 inches if approved by the geotechnical engineer of record (GER) and provided adequate compaction can be applied where fill is proposed for use. Structural fill should only be placed over subgrade that has been prepared in conformance with the “Site Preparation” section. The fill should be placed on relatively flat surfaces in accordance with the “Fill Benching” section.

Embankment fill should be placed in lifts and compacted in accordance with OSSC 00330.43 (Earthwork Compaction Requirements). However, based on conversations with the County, we understand that the embankment fill will likely be placed in small, irregular areas; therefore, moisture-density testing may not be feasible and compaction should be performed in accordance with OSSC 00330.43(d) with the exception that “Deflection Testing” (proof rolling) in accordance with ODOT TM 158 be performed at final grade.

5.7 SUBGRADE PROTECTION AND WET-WEATHER CONSIDERATIONS

The soils at the site are highly susceptible to moisture. The contractor should be responsible for protecting the subgrade during construction. Earthwork planning should include considerations for minimizing subgrade disturbance. We have provided the following recommendations if wet-weather construction practices are needed for the improvement areas based on conditions observed at the time of construction. The contractor should be responsible for protecting the subgrade during construction.

- The ground surface in and around the work area should be sloped so that surface water is directed to a sump or discharge location. The ground surface should be graded such that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work areas.
- Earthwork activities should not take place during periods of heavy precipitation.
- The site soils should not be left in a disturbed or uncompacted state and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation may reduce the extent to which these soils become wet or unstable.
- Construction activities should be scheduled so that the length of time that soil is left exposed to moisture is reduced to the extent practicable.

6.0 OBSERVATION OF CONSTRUCTION

Satisfactory earthwork and pavement performance depend to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to determine whether subsurface conditions change significantly from those anticipated.

7.0 LIMITATIONS OF REPORT

We have prepared this report for the exclusive use of Yamhill County and their authorized parties for the project specifically identified in this report only. The report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between

explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, Central should be notified for review of the recommendations of this report, and revision of such if necessary.

This report is not intended for use by others, and the information contained herein is not applicable to other sites. No other party may rely on the product of our services unless we agree in advance and in writing to such reliance.

We recommend that Central be retained to review the plans and specifications and verify that our recommendations have been interpreted and implemented as intended. Sufficient geotechnical monitoring, testing, and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated.

Within the limitations of scope, schedule, and budget, the analysis, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology in this area at the time the report was prepared.

8.0 SIGNATURES

Thank you very much for the opportunity to work with you. If you feel obliged, we welcome referrals from our previous clients and would enjoy the opportunity to work with others in your professional and personal networks.

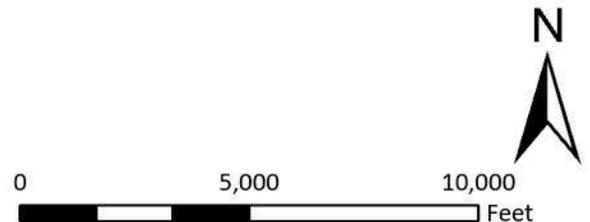
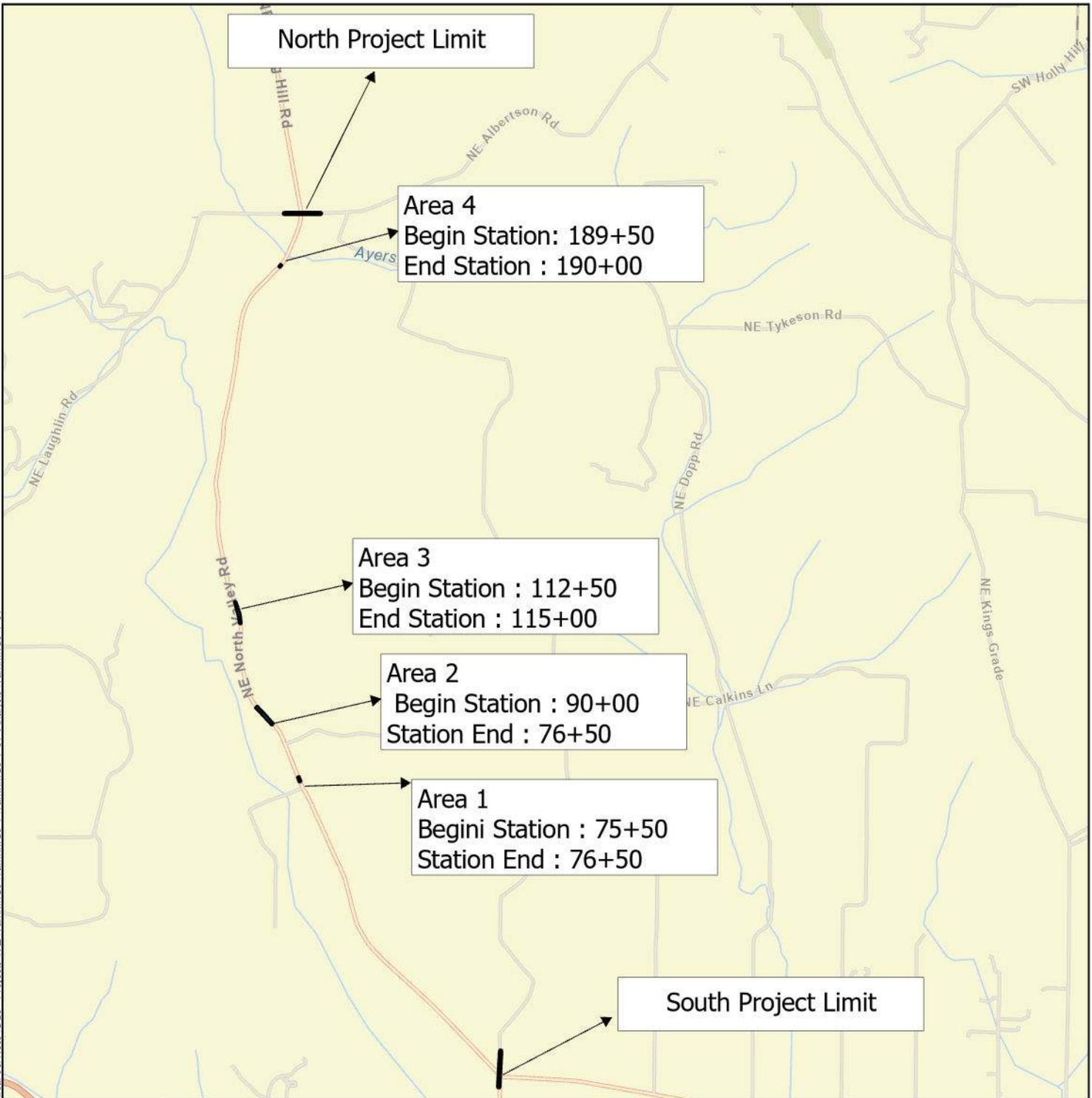
Central Engineering Services



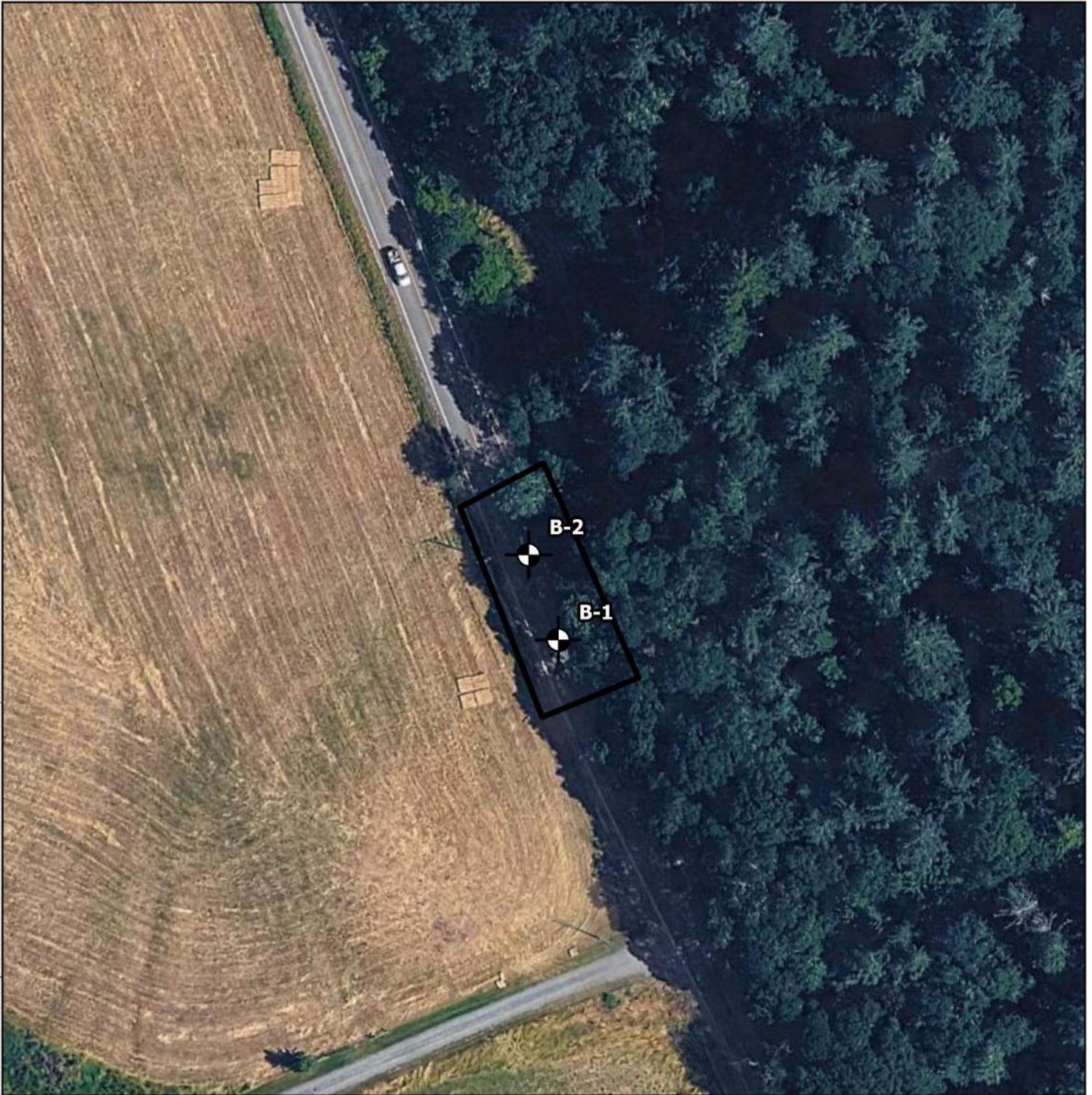
Reed S. Kistler, PE
Senior Project Manager

Krey D. Younger, PE, GE
Principal Engineer

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YamhillCo-1-01	
Project Vicinity	
	Figure-1



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Legend

 Area-1

Approximate Boring Location and Exploration Designation

 Boring



0 200
 Feet

YamhillCo-1-01

Site Plan

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Figure-2A



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Legend

 Area-2

Approximate Boring Location and Exploration Designation

 Boring



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YamhillCo-1-01	
Site Plan	
 CENTRAL GEOTECHNICAL SERVICES, LLC	Figure-2B

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Legend

 Area-3

Approximate Boring Location and Exploration Designation

 Boring



0 200 400 600 Feet

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YamhillCo-1-01	
Site Plan	
 CENTRAL GEOTECHNICAL SERVICES, LLC	Figure-2C



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Legend

 Area-4

Approximate Boring Location and Exploration Designation

 Boring

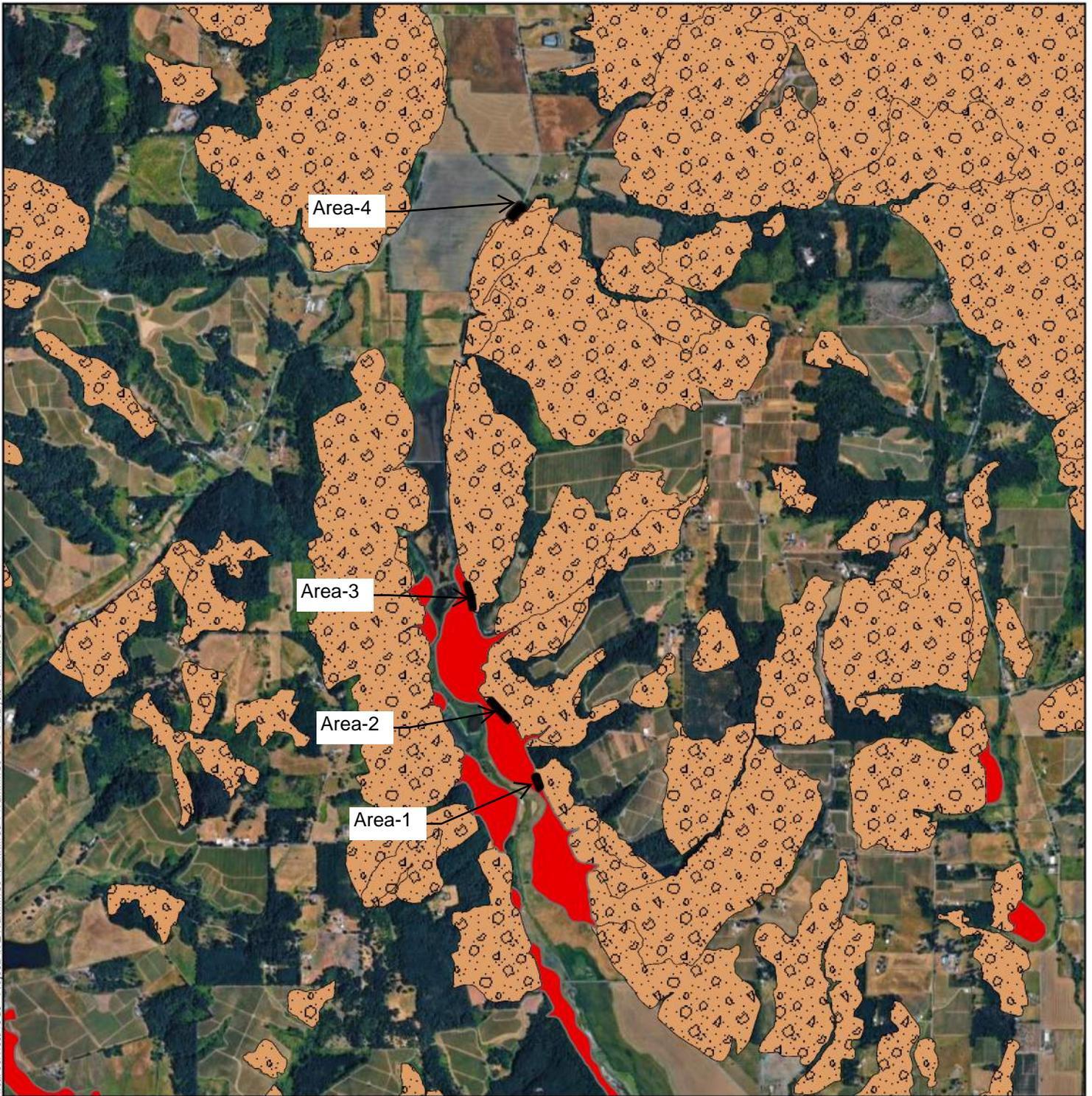


0 100 200 300 400 500 600 Feet

YamhillCo-1-01	
Site Plan	
 CENTRAL <small>GEOTECHNICAL SERVICES, LLC</small>	Figure-2D

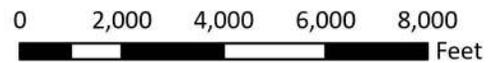
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Legend

-  Areas
-  Scarp
-  Head Scarp
-  Talus-Colluvium
-  Fan
-  Landslide



YamhillCo-1-01

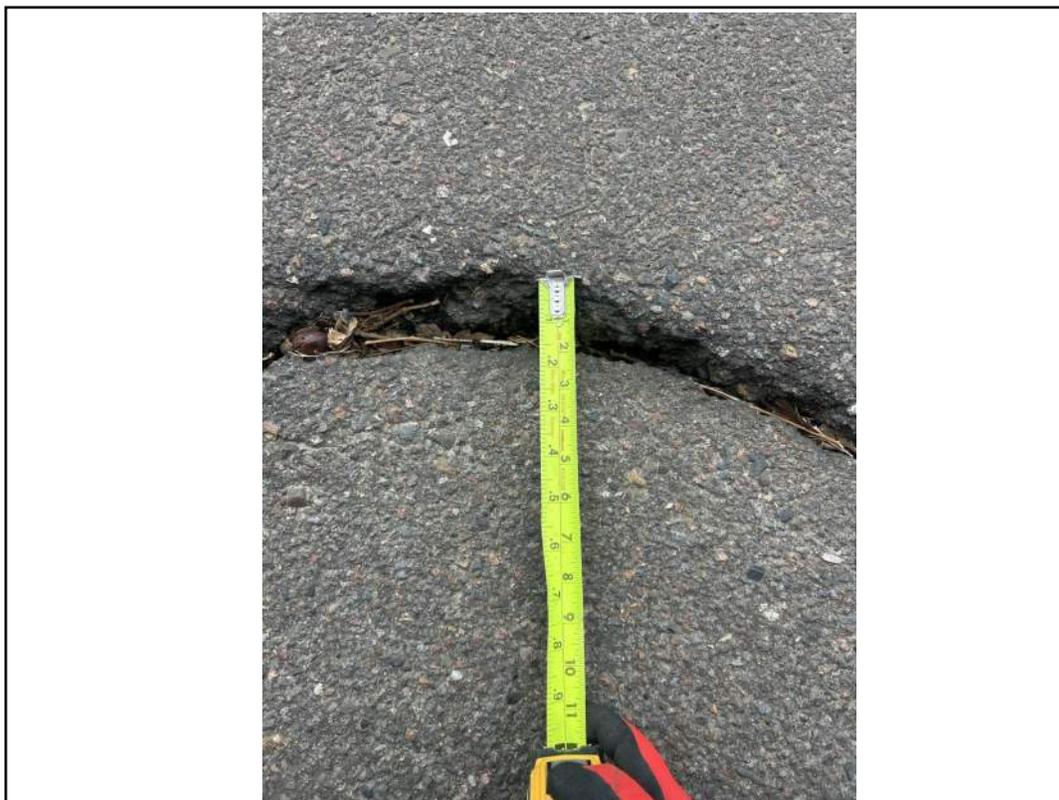
Landslide Inventory Map



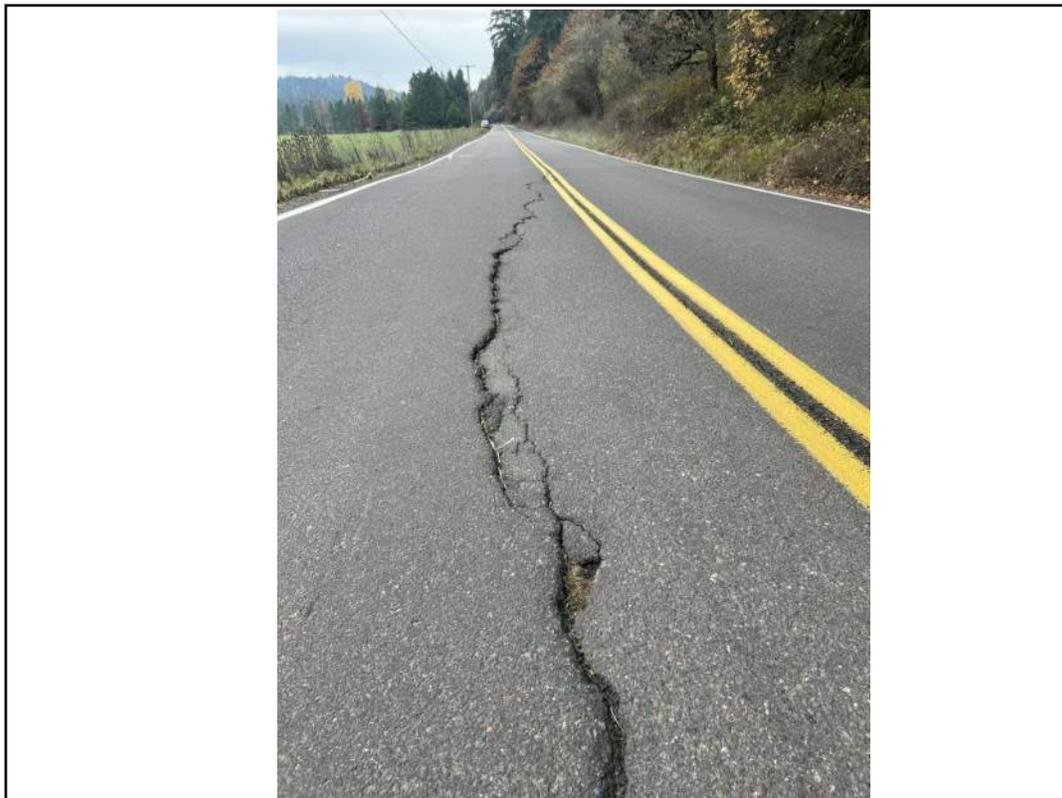
Figure-3



APPENDIX A: Pavement Distress Photographic Log



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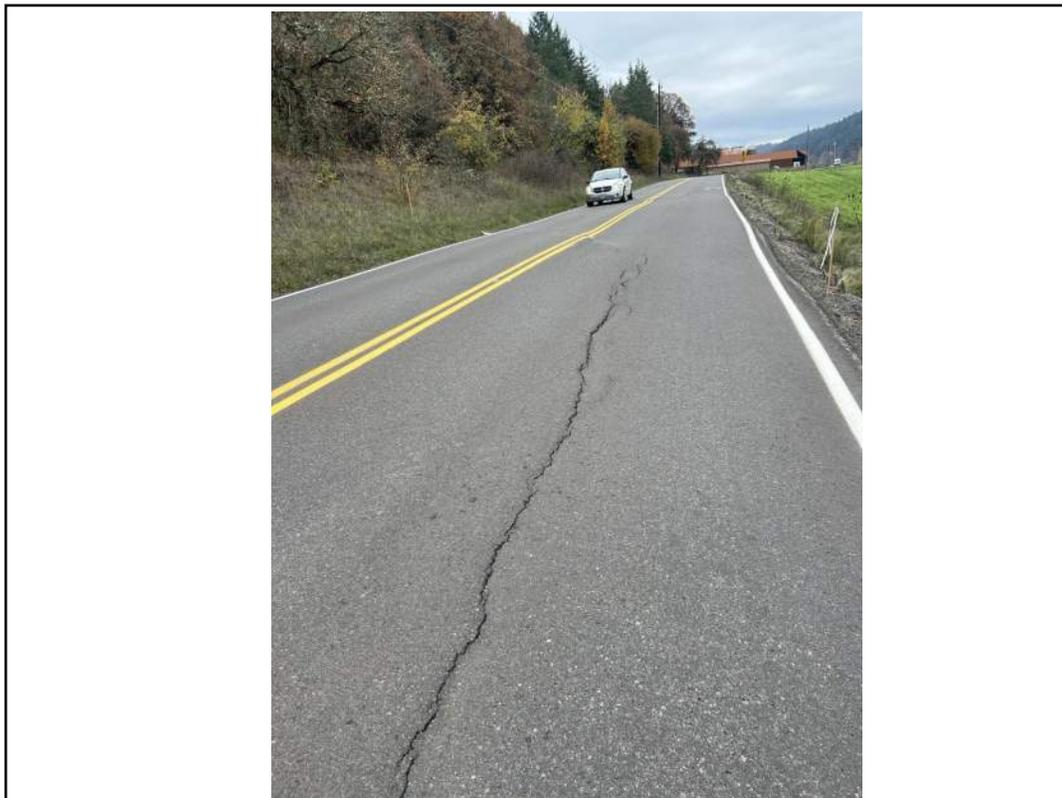
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APPENDIX B: Field Explorations and Laboratory Testing

APPENDIX B: Field Explorations and Laboratory Testing

FIELD EXPLORATIONS

Subsurface and groundwater conditions in the uneven areas were explored on November 18 and 19, 2025 by drilling a total of eight boring explorations (B-1 through B-8) at the approximate locations shown on Figures 2A through 2D. The explorations were drilled to depths ranging from 16.5 to 21.5 feet bgs with a truck-mounted drilling rig using a hollow-stem auger. The explorations were completed by Western States Soil Conservation of Hubbard, Oregon (WSSC).

Exploration locations were determined in the field by pacing from existing site features. This information should be considered accurate to the degree implied by the method used. Explorations were continuously monitored by qualified staff from our office who maintained detailed logs of subsurface explorations, visually classified the soil encountered, and obtained representative samples from the borings. Representative soil samples were obtained from each exploration at the depths indicated on the exploration logs.

Representative soil samples were primarily obtained from each boring at selected depth intervals using a 1-inch-inside-diameter, standard split-spoon sampler. The samplers were driven into the soil using a 140-pound hammer, free-falling 30 inches on each blow. The number of blows required to drive the sampler, each of three, 6-inch increments of penetration, were recorded in the field. The sum of the blow counts for the last two, 6-inch increments of penetration is reported on the boring logs as the ASTM International (ASTM) Test Method D 1556 Standard Penetration Test (SPT) N-value. The average efficiency of the automatic SPT hammer used by WSSC was 85 percent (Rig 15). The calibration testing results are presented at the end of this appendix.

Several relatively undisturbed soil samples were obtained using a 3-inch-outer-diameter thin-walled tube (Shelby tube), which was pushed into the soil in general accordance with ASTM D 1587 - Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.

LABORATORY TESTING

MOISTURE CONTENT

The natural moisture content of select soil samples was determined in general accordance with ASTM D2216. The natural moisture content is a ratio of the weight of the water to dry soil in a test sample and is expressed as a percentage. The test results are presented in this appendix.

ATTERBERG LIMITS

The plastic limit and liquid limit (Atterberg limits) of selected soil samples were determined in accordance with ASTM D 4318. The Atterberg limits and the plasticity index were completed to aid in the classification of the soil. The test results are presented in this appendix.

DRY DENSITY

The dry density and moisture content of selected soil samples was determined in general accordance with ASTM D7263. The sample is collected in a 2.41-inch-diameter, 1-inch-tall brass ring. The sample is extracted from the ring in the laboratory, and the sample dry density is determined by weighing the oven-dried sample and dividing by the volume of the sample extracted from the sampling ring. The natural moisture content is a ratio of the weight of the water to dry soil in a test sample and is expressed as a percentage. The test results are presented in the respective boring logs in this appendix.

CLASSIFICATION

Recovered samples from exploratory borings were visually classified in the field in general accordance with ASTM D 2488 and the classification chart listed in Key to Exploration Logs. The visual classifications were updated based on laboratory testing results in accordance with ASTM D 2487. The boring logs are presented in this appendix. The logs are based on interpretation of the field and laboratory data and indicate the depth at which subsurface materials or their characteristics change, although these changes might actually be gradual.



Relative Density - Coarse-Grained Soil						GEOTECHNICAL TESTING EXPLANATIONS		
Term	SPT (140-lb Hammer)*	D&M Sampler (140-lb Hammer)*		D&M Sampler (300-lb Hammer)*	ATT	Atterberg Limits		
Very-loose	0-4	0-11		0-4	CBR	California Bearing Ratio		
Loose	4-10	11-26		4-10	CON	Consolidation		
Medium-dense	10-30	26-74		10-30	DD	Dry Density		
Dense	30-50	74-120		30-47	DS	Direct Shear		
Very-dense	>50	>120		>47	HYD	Hydrometer Gradation		
Consistency - Fine-Grained Soil						LL	Liquid Limit	
Term	SPT (140-lb Hammer)*	Sampler (140-lb Hammer)*	Sampler (300-lb Hammer)*	Pocket Pen (tsf)	Torvane (tsf)	PL	Plastic Limit	
						PI	Plasticity Index	
Very-soft	0-2	0-3	0-2	<0.25	<0.13	MC	Moisture Content	
Soft	2-4	3-6	2-5	0.25-0.5	0.13-0.25	MD	Moisture-Density	
Medium-stiff	4-8	6-12	5-9	0.5-1	0.25-0.5	NP	Non-Plastic	
Stiff	8-15	12-25	9-19	1.0-2.0	0.5-1.0	OC	Organic Content	
Very-stiff	15-30	25-65	19-31	2.0-4.0	1.0-2.0	P	Pushed Sample	
Hard	>30	>65	>31	>4.0	>2.0	PP	Pocket Penetrometer	
SPT N-value correlation based off ASTM D1586						RES	Resilient Modulus	
Unified Soil Classification System (USCS)						SIEV	Sieve Gradation	
USCS Symbols	Graph	Typical Descriptions				TOR	Torvane	
GP		Poorly graded GRAVEL, <5% fines				UC	Unconfined Compressive Strength	
GP-GM/GP-GC		Poorly graded GRAVEL w/ silt/clay, 5 to 12% fines				VS	Vane Shear	
GM		silty GRAVEL, over 12% fines				CONTACT LINES		
GC		clayey GRAVEL, over 12% fines				Distinct contact between soil strata (approximate location)		
GW		well graded GRAVEL, <5% fines				Approximate contact between soil strata		
SP		poorly graded SAND, <5% fines						
SP-SM/SP-SC		poorly graded SAND w/ silt/clay, 5 to 12% fines						
SM		silty SAND, over 12% fines				WATER LEVELS		
SC		clayey SAND, over 12% fines					Water Level at Time of Drilling, or as labeled	
SW		well graded SAND, <5% fines					Water Level at End of Drilling, or as labeled	
ML		SILT, low plasticity					Static Water Level, or as labeled	
MH		SILT, high plasticity						
CL		CLAY, low plasticity						
CH		CLAY, high plasticity						
OL		ORGANIC SILT, low plasticity				Moisture (ASTM D2488)		
OH		ORGANIC CLAY, medium to high plasticity				Dry	Very low moisture, dry to touch	
PT		PEAT				Moist	Damp, without visible moisture	
						Wet	Visible free water, usually saturated	
ADDITIONAL CONSTITUENTS						ADDITIONAL MATERIALS		
Silt/Clay in:			Sand/Gravel in:					
Percent*	Fine-Grained	Coarse-Grained	Percent*	Fine-Grained	Coarse-Grained	AC		ASPHALT CONCRETE
<5	trace	trace	<5	trace	trace	CC		CEMENT CONCRETE
5-12	minor	with	5-15	minor	minor	CR		CRUSHED ROCK
>12	some	silty/clayey	15-30	with	with	SOD		SOD/FOREST DUFF
			>30	sandy/gravelly	with	FILL		FILL
SYMBOL	SAMPLER DESCRIPTIONS				SYMBOL	SAMPLER DESCRIPTIONS		
	Location of grab sample (GS)					Location of sample collected using Standard Penetration Test with recovery (SS)		
	No Recovery					Location of sample collected using Shelby tube/Geoprobe sample with recovery (ST)		
	Location of rock coring interval (RC)					Location of sample collected using Dames & Moore sampler or pushed with recovery (D&M)		

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Central Engineering Services
7662 SW Mohawk St
Tualatin, OR 97062
Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-1

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/19/25
Date Completed: 11/19/25

Approximate Ground Elevation:
 Groundwater at time of drilling: --
 Groundwater at end of drilling: --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
1		ASPHALT CONCRETE (11- inches)					
2		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
3		Stiff, gray with orange mottles, CLAY (CH), trace sand, moist, sand is fine	SPT S-1	6	38	9	
6			ST S-2	24			
8		Grades to brown at 8 feet bgs.	SPT S-3	12	35	11	
10		Grades to gray at 10 feet bgs.					
11			SPT S-4	12		9	
15		Grades to medium-stiff at 15 feet bgs.					
16			SPT S-5	18		6	

Boring completed at 16.5 feet bgs
Groundwater was not observed at the time of exploration.

Operator: Western States Soil Conservation Inc.
Equipment: CME 75 HT Truck **Rig Number:** 15
Drilling Method: 6" HSA

Logged By: Nabin B.
Checked By: Reed K.
Approximate Location Coordinates:
Lat: Long:

Remarks:

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Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-2

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/19/25
Date Completed: 11/19/25

Approximate Ground Elevation:
 Groundwater at time of drilling: --
 Groundwater at end of drilling: --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
1		ASPHALT CONCRETE (11- inches)					
1.9		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
1.9		Medium-stiff to stiff, black to brown, CLAY (CH), trace sand and gravel, moist, sand is fine, gravel is angular (FILL)	SPT S-1	6	40	8	
4.0		Medium-stiff to stiff, black to brown, CLAY (CH), trace sand, moist, sand is fine					
6			ST S-2	24	25		Dry Density : 85.1 pcf
8		Grades to gray to black with brown mottles at 7.5 feet bgs.	SPT S-3	12		8	
11		Grades to stiff, brown to gray at 10 feet bgs.	SPT S-4	15		9	
16		Grades to very-soft to soft at 15 feet bgs.	SPT S-5	18		2	
20.0		Medium-stiff, gray with orange mottles, SILT (MH), trace sand, moist, sand is fine	SPT S-6	18		6	
21.5							

Boring completed at 21.5 feet bgs
Groundwater was not observed at the time of exploration.

Operator: Western States Soil Conservation Inc.
Equipment: CME 75 HT Truck **Rig Number:** 15
Drilling Method: 6" HSA

Logged By: Nabin B.
Checked By: Reed K.
Approximate Location Coordinates:
Lat: Long:

Remarks:

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Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-3

PAGE 1 OF 1

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/19/25
Date Completed: 11/19/25

Approximate Ground Elevation:
▽ **Groundwater at time of drilling:** --
▼ **Groundwater at end of drilling:** --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
0.9		ASPHALT CONCRETE (11- inches)					
1.7		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
1.7		Stiff, black, CLAY (CH), trace sand, moist, sand is fine	ST S-1	24	24		Dry Density : 82.4 pcf
5.0			SPT S-2	16	48	9	LL = 114 PL = 43
7.5		Grades to medium-stiff at 7.5 feet bgs.	SPT S-3	18		6	
10.0		Grades to soft at 10 feet bgs.	SPT S-4	18		3	
15.0		Grades to medium-stiff, gray with brown mottles at 15 feet bgs.	SPT S-5	18		5	
16.5							

Boring completed at 16.5 feet bgs.
Groundwater was not observed at time of exploration.

Operator: Western States Soil Conservation Inc.
Equipment: CME 75 HT Truck **Rig Number:** 15
Drilling Method: 6" HSA

Logged By: Nabin B.
Checked By: Reed K.
Approximate Location Coordinates:
Lat: Long:

Remarks:

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Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-4

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/19/25
Date Completed: 11/19/25

Approximate Ground Elevation:
 Groundwater at time of drilling: --
 Groundwater at end of drilling: --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
0.8		ASPHALT CONCRETE (10- inches)					
1		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
2.0		Medium-stiff, dark-brown, CLAY (CH), moist to wet	SPT S-1	8	49	6	
3							
4							
5							
6		Grades to soft to medium-stiff, light-brown, with sand, sand is fine to medium at 5 feet bgs.	SPT S-2	18		4	
7							
8		Grades to very-soft, with brown mottles at 7.5 feet bgs.	SPT S-3	16		1	
9							
10							
11			ST S-4	24	36		Dry Density : 78.9 pcf
12							
13		Grades to medium-stiff, trace sand, sand is fine at 12 feet bgs.	SPT S-5	16		6	
14							
15							
16			SPT S-6	18		5	
16.5							

Boring completed at 16.5 feet bgs.
Groundwater was not observed at time of exploration.

Operator: Western States Soil Conservation Inc.	Logged By: Nabin B.	Remarks:
Equipment: CME 75 HT Truck Rig Number: 15	Checked By: Reed K.	
Drilling Method: 6" HSA	Approximate Location Coordinates: Lat: Long:	

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Tualatin, OR 97062
Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-5

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/18/25
Date Completed: 11/18/25

Approximate Ground Elevation:
▽ **Groundwater at time of drilling:** --
▼ **Groundwater at end of drilling:** --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
0.8		ASPHALT CONCRETE (10-inches)					
2.0		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
3.0		Medium-stiff, gray with orange mottles, SILT (MH), trace gravel, moist, gravel is sub angular	SPT S-1	6	23	6	
6.0			ST S-2	24	56		Dry Density : 88.9 pcf LL = 117 PL = 51
8.0		Grades to soft to medium-stiff, gray to dark-gray, no gravel at 7.5 feet bgs.	SPT S-3	10		4	
11.0		Grades to medium-stiff at 10 feet bgs. Grades to brown at 10.5 feet bgs.	SPT S-4	18		7	
16.5		Grades to medium-stiff to stiff, gray at 15 feet bgs. Grades to dark-gray at 16 feet bgs.	SPT S-5	18		8	

Boring completed at 16.5 feet bgs.
Groundwater was not observed at time of exploration.

Operator: Western States Soil Conservation Inc.
Equipment: CME 75 HT Truck **Rig Number:** 15
Drilling Method: 6" HSA

Logged By: Nabin B.
Checked By: Reed K.
Approximate Location Coordinates:
Lat: Long:

Remarks:

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Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-6

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/18/25
Date Completed: 11/18/25

Approximate Ground Elevation:
 Groundwater at time of drilling: --
 Groundwater at end of drilling: --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
1		0.8 ASPHALT CONCRETE (10-inches)					
2		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
3		Stiff, gray, CLAY (CH), trace gravel and sand, moist, sand is fine, gravel is sub-angular	SPT S-1	8	41	10	
4							
5							
6		Grades to soft to medium-stiff, black at 5 feet bgs.	SPT S-2	10		4	
7							
8		Grades to stiff at 7.5 feet bgs.	SPT S-3	8		9	
9		Grades to light-brown at 8.5 feet bgs.					
10							
11		Grades to medium-stiff, gray at 10 feet bgs.	SPT S-4	8		6	
12		Grades to brown to dark-brown at 11 feet bgs.					
13							
14							
15							
16			ST S-5	24			
17							
18		Grades to stiff, light-gray, sandy, sand is fine to medium, wet at 17 feet bgs.	SPT S-6	18		9	
19							
20							
21		Grades to sand is fine to coarse at 20 feet bgs.	SPT S-7	18		9	

Boring completed at 21.5 feet bgs.
Ground water observed at 21.5 feet bgs after drilling.

Operator: Western States Soil Conservation Inc.	Logged By: Nabin B.	Remarks:
Equipment: CME 75 HT Truck Rig Number: 15	Checked By: Reed K.	
Drilling Method: 6" HSA	Approximate Location Coordinates: Lat: Long:	

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Tualatin, OR 97062
Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-7

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/18/25
Date Completed: 11/18/25

Approximate Ground Elevation:
 Groundwater at time of drilling: --
 Groundwater at end of drilling: --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
0.8		ASPHALT CONCRETE (10-inches)					
1		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
2.0							
3		Medium-stiff, dark-gray, CLAY (CH), trace gravel	SPT S-1	8	38	6	
4							
5		Grades to medium-stiff, dark-gray at 5 feet bgs.	SPT S-2	12		6	
6							
7							
8		Grades to medium-stiff at 7.5 feet bgs. Grades to gray to light-gray at 8 feet bgs.	SPT S-3	16	44	7	LL = 97 PL = 39
9							
10							
11			ST S-4	19	27		Dry Density : 81.4 pcf
12							
13			SPT S-5	18		7	
14							
15							
16		Grades to light-gray, with sand, sand is fine to medium at 15 feet bgs	SPT S-6	18		5	
16.5							

Boring completed at 16.5 feet bgs.
Groundwater was not observed at the time of drilling

Operator: Western States Soil Conservation Inc.
Equipment: CME 75 HT Truck **Rig Number:** 15
Drilling Method: 6" HSA

Logged By: Nabin B.
Checked By: Reed K.
Approximate Location Coordinates:
Lat: Long:

Remarks:

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Telephone: 503.616.9419

Project No:
YamhillCo-1-01

BORING LOG B-8

Client: Yamhill County
Project: North Valley Road Subsurface Investigation
Location: NE Ribbon Ridge Road to NE Albertson Road
Yamhill County, Oregon

Date Started: 11/18/25
Date Completed: 11/18/25

Approximate Ground Elevation:
▽ **Groundwater at time of drilling:** --
▼ **Groundwater at end of drilling:** --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	MOISTURE (%)	N-Value	LAB RESULTS/REMARKS
0							
1		ASPHALT CONCRETE (11- inches)					
2		Dense, gray, GRAVEL with silt and sand (GP-GM), moist, sand is fine to coarse, gravel is angular (AGGREGATE BASE)					
3		Soft, gray with orange mottles, CLAY (CH), trace sand, moist, sand is fine	SPT S-1	10	35	3	
4							
5		Grades to stiff at 5 feet bgs.					
6			SPT S-2	8	36	10	LL = 116 PL = 35
7							
8			ST S-3	24			Dry Density : 87.4 pcf
9							
10			SPT S-4	12	26	10	
11		Grades to medium-stiff to stiff, gray at 11 feet bgs.					
12			SPT S-5	12		8	
13							
14							
15		Grades to hard at 15 feet bgs.					
16			SPT S-6	16		50 for 5"	

Boring completed at 16.5 feet bgs
Groundwater was not observed at the time of exploration.

Operator: Western States Soil Conservation Inc.
Equipment: CME 75 HT Truck **Rig Number:** 15
Drilling Method: 6" HSA

Logged By: Nabin B.
Checked By: Reed K.
Approximate Location Coordinates:
Lat: Long:

Remarks:

Summary of SPT Test Results

Project: rig 15, Test Date: 12/30/2024

FMX: Maximum Force		N		Average		Average		EFV: Maximum Energy	
VMX: Maximum Velocity		Value	N60	FMX	VMX	BPM	EFV	ETR: Energy Transfer Ratio - Rated	
BPM: Blows/Minute			Value	kips	ft/s	bpm	ft-lb	ETR	
Instr. Length ft	Blows Applied /6"							%	
34.00	9-11-15	26	36	47	16.1	52.7	300	85.9	
37.50	9-14-18	32	45	46	14.8	52.1	303	86.6	
38.50	10-13-24	37	52	47	13.6	52.2	276	78.7	
42.50	11-19-20	39	55	45	14.5	52.4	308	88.1	
43.50	8-13-21	34	48	45	14.5	52.2	301	86.1	
Overall Average Values:				46	14.6	52.3	297	85.0	
Standard Deviation:				1	0.9	0.3	13	3.7	
Overall Maximum Value:				49	17.1	53.1	317	90.4	
Overall Minimum Value:				43	12.9	51.4	267	76.2	



APPENDIX C: Pavement Design Calculations

Yamhill County Daily Vehicle Volume Report

Study Date: Friday, 09/08/2023

Unit ID:

Location: North Valley Road

	Northbound Volume	Southbound Volume	Total Volume
00:00 - 00:59	5	8	13
01:00 - 01:59	6	7	13
02:00 - 02:59	2	3	5
03:00 - 03:59	4	12	16
04:00 - 04:59	40	11	51
05:00 - 05:59	77	61	138
06:00 - 06:59	186	139	325
07:00 - 07:59	179	144	323
08:00 - 08:59	134	142	276
09:00 - 09:59	126	96	222
10:00 - 10:59	116	126	242
11:00 - 11:59	127	110	237
12:00 - 12:59	125	143	268
13:00 - 13:59	126	160	286
14:00 - 14:59	163	205	368
15:00 - 15:59	173	296	469
16:00 - 16:59	205	306	511
17:00 - 17:59	229	245	474
18:00 - 18:59	204	133	337
19:00 - 19:59	103	78	181
20:00 - 20:59	60	71	131
21:00 - 21:59	57	52	109
22:00 - 22:59	40	54	94
23:00 - 23:59	20	17	37
Totals	2507	2619	5126
AM Peak Time	06:23 - 07:22	07:20 - 08:19	06:23 - 07:22
AM Peak Volume	204	152	349
PM Peak Time	16:59 - 17:58	15:28 - 16:27	15:55 - 16:54
PM Peak Volume	233	323	518

Table C-1
ESAL Calculation - North Valley Road (9/8/2023)

Project ID YamhillCo-1-01
 Project Name North Valley Road Improvements
 Date of Traffic Count 9/8/2023
 Calculation Methodology ODOT Pavement Design Guide
 Traffic Count Data Source Provided by Yamhill County

Year of Traffic Count	2023	
Assumed Construction Year	2026	
Duration of Traffic Count (hours)	24	
Average Daily Traffic	5,126	
One way or Two Way Traffic Data	Two-way	
Growth Rate (percent)	2.00	(compound growth)
Pavement Type	Flexible	
Lane Distribution Factor (percent)	100	
Percentage Trucks	26.3	

*Directional Factor = 55 percent

FHWA Classification	Average Daily Traffic by Classification in 2023	Conversion Factor*	ESALs from Year of Traffic Count
4	28.7	123.0	3,876
5	1193.8	52.0	68,283
6	26.7	142.0	4,177
7	3.8	378.5	1,590
8	59.2	126.5	8,239
9	17.2	233.0	4,406
10	9.6	280.5	2,947
11	0.0	301.5	0
12	1.9	273.0	574
13	9.6	518.5	5,447
Total ESALs in traffic count year			99,538

Calculated ESAL Values	
2-Year	213,000
15-Year	1,827,000
20-Year	2,567,000
30-Year	4,285,000
40-Year	6,380,000
50-Year	8,934,000

Design Value

Project ID YamhillCo-1-01
 Project Name North Valley Road Improvements
 Date 12/11/2025
 Calculation Methodology 1993 AASHTO Pavement Design Guide - Flexible

	North Valley Road (2023 counts)			
ESAL	2,567,000			
Design Life (years)	20			
Resilient Modulus (psi)	5,240			
Reliability	85			
Standard Deviation	0.49			
Aggregate Base Modulus (psi)	20,000			
Required SN	4.49			
Minimum AC Thickness	6.75			
Drainage Coefficient (base)	1.0			
Drainage Coefficient (subbase)	1.0			
Layer Coefficient (AC)	0.42			
Layer Coefficient (base)	0.10			
Layer Coefficient (subbase)	0.08			
Design AC Thickness (inches)	7.0			
Design Base Thickness (inches)	16.0			
Design Subbase Thickness (inches)	12.0			
Calculated SN	5.50			
Calculated SN > Required SN	Yes			



APPENDIX D: Geogrid Product Specification Sheet

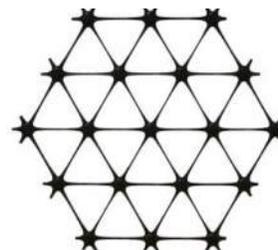
Product Specification - TriAx® TX5 Geogrid

Tensar International Corporation reserves the right to change its product specifications at any time. It is the responsibility of the person specifying the use of this product and of the purchaser to ensure that product specifications relied upon for design or procurement purposes are current and that the product is suitable for its intended use in each instance.

General

1. The geogrid is manufactured from a punched polypropylene sheet, which is then oriented in three substantially equilateral directions so that the resulting ribs shall have a high degree of molecular orientation, which continues at least in part through the mass of the integral node.
2. The properties contributing to the performance of a mechanically stabilized layer include the following:

Tensar TriAx® Geogrid



Index Properties¹

Longitudinal/ Transverse

Diagonal

General

- Rib pitch⁽²⁾, mm (in)
- Mid-rib depth⁽²⁾, mm (in)
- Mid-rib width⁽²⁾, mm (in)
- Rib shape
- Aperture shape

40 (1.60)
1.2 (0.05)
1.2 (0.05)

40 (1.60)
1.3 (0.05)
0.9 (0.04)

Rectangular
Triangular

Dimensions and Delivery

The TX geogrid shall be delivered to the jobsite in roll form with each roll individually identified. Rolls are shipped with nominal measurements: Equal to 4.0 meters (13.1feet) in width by 75 meters (246 feet) in length or 4.87 meters (16 feet) in width by 100 meters (328 feet) in length.

Notes

1. Unless indicated otherwise, values shown are minimum average roll values determined in accordance with ASTM D4759-02. Brief descriptions of test procedures are given in the following notes.
2. Nominal dimensions.