



Planning and Zoning
Department of Transportation and Development
Development Services Building
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www.clackamas.us/planning

STAFF USE ONLY

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Jun 17 2026

Clackamas County
Planning & Zoning Division

Z0223-26

Staff Initials:

File Number:

Land use application for:

MASS MOVEMENT HAZARD AREA DEVELOPMENT

Application Fee: \$1,099

APPLICANT INFORMATION

Applicant name: Michael & Berenice Thomas	Applicant email:	Applicant phone: 503-810-0229	
Applicant mailing address: 12140 SE Greiner Lane	City: Happy Valley	State: Oregon	ZIP: 97086
Contact person name (if other than applicant):	Contact person email: alltechhdd@aol.com	Contact person phone: 503-810-0229	
Contact person mailing address: Same	City:	State:	ZIP:

PROPOSAL

Brief description of proposal:

We would like to build a 40x40 ft cabin at our property. Also install a septic system.

SITE INFORMATION

Site address: 21962 S Circle Diamond Lane Estacada Or 97023	Comprehensive Plan designation: R	Zoning district: FF-10
Map and tax lot #: Township: <u>3S</u> Range: <u>3E</u> Section: <u>15A</u> Tax Lot: <u>800</u> Township: _____ Range: _____ Section: _____ Tax Lot: _____ Township: _____ Range: _____ Section: _____ Tax Lot: _____	Land area: 15.29 Acres	
Adjacent properties under same ownership: Township: <u>3S</u> Range: <u>3E</u> Section: <u>15A</u> Tax Lot: <u>900</u> Township: _____ Range: _____ Section: _____ Tax Lot: _____		

Printed names of all property owners: Michael N Thomas Berenice Koller Thomas	Signatures of all property owners: 	Date(s): 6-15-2026 6-15-2026
I hereby certify that the statements contained herein, along with the evidence submitted, are in all respects true and correct to the best of my knowledge. Applicant signature:		Date: 6-15-2026

A. Review applicable land use rules:

This application is subject to the provisions of [Subsection 1003.02. Standards and Criteria for Mass Movement Hazard Area Development](#) of the [Clackamas County Zoning and Development Ordinance](#) (ZDO).

It is also subject to the ZDO's definitions, procedures, and other general provisions, as well as to the specific rules of the subject property's zoning district and applicable development standards, as outlined in the ZDO.

B. Turn in all of the following:

- ☒ **Complete application form:** Respond to all the questions and requests in this application, and make sure all owners of the subject property sign the first page of this application. Applications without the signatures of *all* property owners are incomplete.
- ☒ **Application fee:** The cost of this application is **\$1,099**. Payment can be made by cash, by check payable to "Clackamas County", or by credit/debit card with an additional card processing fee using the [Credit Card Authorization Form](#) available from the Planning and Zoning website. Payment is due when the application is submitted. Refer to the FAQs at the end of this form and to the adopted [Fee Schedule](#) for refund policies.
- ☒ **Site plan:** Provide a site plan (also called a plot plan). A [Site Plan Sample](#) is available from the Planning and Zoning website. The site plan must be accurate and drawn to-scale on paper measuring no larger than 11 inches x 17 inches. The site plan must illustrate all of the following (when applicable):
 - Lot lines, lot/parcel numbers, and acreage/square footage of lots;
 - Contiguous properties under the same ownership;
 - Areas of land movement, slump or earth flow, and mud or debris flow (*Note: The principal source of information for determining mass movement hazards is the State Department of Geology and Mineral Industries (DOGAMI) Bulletin 99 and accompanying maps. Approved site specific engineering geologic studies shall be used to identify the extent and severity of the hazardous conditions on the site, and to update the mass movement hazard area data base.*);
 - Elevation contour lines, with identification of their source of the information (e.g., an engineer, surveyor);
 - All existing and proposed structures, fences, retaining walls, roads, driveways, parking areas, other impervious surfaces, vegetation, and easements, each with identifying labels and dimensions;
 - Setbacks of all structures from lot lines and easements;
 - Areas of grading and vegetation stripping;
 - Significant natural features (rivers, streams, wetlands, geologic hazards, drainage areas, etc.); and
 - Location of utilities, wells, and all onsite wastewater treatment facilities (e.g., septic tanks, septic drainfield areas, replacement drainfield areas, drywells).
- ☒ **In certain cases, an engineering geologic study:** You must provide an engineering geologic study if development is proposed on slopes of 20 percent or greater in a mass movement hazard area (i.e., an area of land movement, slump or earth flow, and mud or debris flow). You must also provide an engineering geologic study for development in a mass movement hazard area, *regardless of the slope*, unless there is stabilization of the identified mass movement hazard condition based on established and proven engineering techniques which ensure protection of public and private property. When required, the engineering geologic study must establish that the site is stable for the proposed development, and must include the following:
 - An index map;
 - Project description, to include: location; topography; drainage; vegetation; discussion of previous work; and discussion of field exploration methods;

- Site geology, to include: site geologic map; description of bedrock and surficial materials including artificial fill; location of any faults, folds, etc.; and structural data including bedding, jointing, and shear zones;
- Discussion and analysis of any slope stability problems;
- Discussion of any offsite geologic conditions that may pose a potential hazard to the site or that may be affected by onsite development;
- Suitability of the site for proposed development from a geologic standpoint;
- Specific recommendations for cut slope stability, seepage, and drainage control, or other design criteria to mitigate geologic hazards;
- If deemed necessary by the engineering geologist to establish whether an area to be affected by the proposed development is stable, additional studies and supportive data shall include: cross sections showing subsurface structure; graphic logs of subsurface explorations; results of laboratory tests; and references;
- The signature and certification number of an engineer or engineering geologist registered in the State of Oregon; and
- Additional information analyses as necessary to evaluate the site.

C. Answer the following questions:

Accurately answer the following questions in the spaces provided. Attach additional pages, if necessary.

1. Is development or grading proposed on a slope of 20 percent or greater?

- ☐ YES, and an attached engineering geologic study establishes that the site is stable for the proposed use and development.
- ☒ NO, and even with the site's identified hazardous condition, an attached engineering geologic study establishes that the site is stable for the proposed use and development.
- ☐ NO, and the identified hazardous condition will be stabilized based on established and proven engineering techniques which ensure protection of public and private property, as explained in the box below:

2. Explain how vegetative cover will be maintained or established for stability and erosion control purposes:

Vegetation will be preserved to the maximum extent practicable. The clearing of any vegetation will only occur within the cabin footprint. This will minimize any raw soil exposure. Our goal is to have ~~0~~ exposure of soil or removal of any vegetation outside of the footprint of the cabin. Any soil exposed for more than 2 days will be addressed with straw or an erosion control blanket - upon completion all denuded areas will be permanently stabilized with native plants or native grasses, and cedar trees.

3. Per ZDO Subsection 1003.02(D), diversion of storm water into areas of land movement, slump or earth flow, and mud or debris flow is *prohibited*. Does your proposal include diversion of storm water into these areas?

☐ YES

☒ NO, as demonstrated in the attached site plan.

FAQs

When is a Mass Movement Hazard Area Development permit required?

Per Zoning and Development Ordinance (ZDO) [Subsection 1003.02, Standards for Land Use in Mass Movement Hazard Area Development](#), no development or grading is allowed in areas of land movement, slump or earth flow, or mud or debris flow without approval of an application for a Mass Movement Hazard Area Development permit. The principal source of information for determining mass movement hazards is the State Department of Geology and Mineral Industries (DOGAMI) Bulletin 99 and accompanying maps.

What is the permit application process?

Mass Movement Hazard Area Development permits are subject to a "Type II" land use application process, as provided for in [Section 1307](#) of the ZDO. Type II decisions include notice to owners of nearby land, the Community Planning Organization (if active), service providers (sewer, water, fire, etc.), and affected government agencies. If the application is approved, the applicant must comply with any conditions of approval identified in the decision. The Planning Director's decision can be appealed to the County Land Use Hearings Officer.

What is needed for the County to approve a land use permit?

Development in mass movement hazard areas on slopes 20 percent or greater *may* be permitted after an evaluation by the County of applicable standards of the ZDO. The applicant is responsible for providing evidence that their proposal does or can meet those standards. In order to address the standards, the information requested in this application should be as thorough and complete as possible. A permit will only be approved or denied after a complete application is received and reviewed. The County approves an application only if it finds that the proposal meets the standards or can meet the standards with conditions.

How long will it take the County to make a decision about an application?

The County makes every effort to issue a decision on a Type II land use application within 45 days of when we deem the application to be complete. State law generally requires a final County decision on a land use permit application in an urban area within 120 days of the application being deemed complete, and within 150 days for a land use permit in a rural area, although there are some exceptions.

If an application is submitted and then withdrawn, will a refund be given?

If a submitted Type II application is withdrawn before it is publicly noticed, 75% of the application fee paid, or the fee paid minus \$250, whichever is less, will be refunded. If a submitted application is withdrawn after it is publicly noticed, but before a decision is issued, 50% of the application fee paid, or the fee paid minus \$500, whichever is less, will be refunded. No refund will be given after a decision is issued. The \$5 Technology Fee is non-refundable.

Who can help answer additional questions?

For questions about the County's land use permit requirements and this application form, contact Planning and Zoning at [503-742-4500](tel:503-742-4500) or zoninfo@clackamas.us. You can also find information online at the Planning and Zoning website: www.clackamas.us/planning-and-zoning.

Clackamas County is committed to providing meaningful access and will make reasonable accommodations, modifications, or provide translation, interpretation or other services upon request. Please contact us at 503-742-4545 or drenhard@clackamas.us.

503-742-4545: ¿Traducción e interpretación? | Требуется ли вам устный или письменный перевод?

翻译或口译? | Cần Biên dịch hoặc Phiên dịch? | 번역 또는 통역?

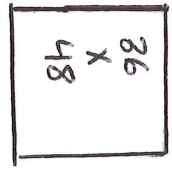
Clear Creek

High water mark

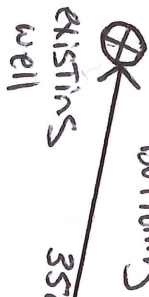


20' wide

- Circle Diamond LN -



Existing Ag Buildings



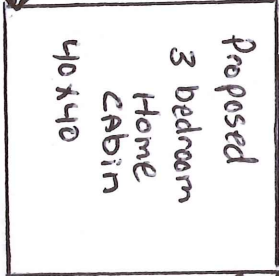
existing well 350'

APP 430' to property line

Neighbors well 300' from property line

Rain Drains To Circle Diamond Lane Ditch line 135' 4"

130'

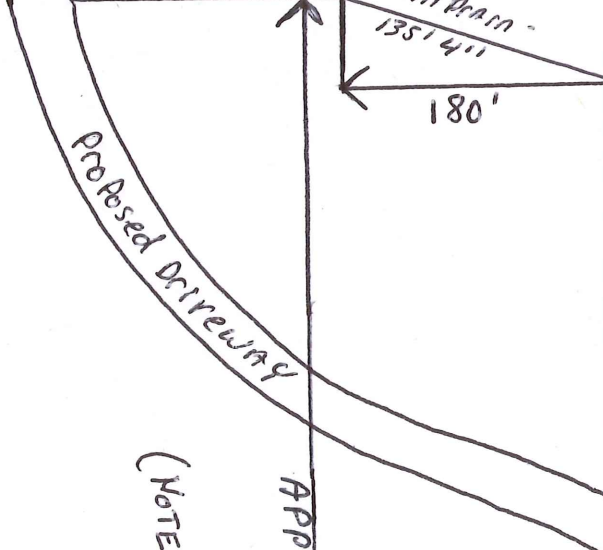


Proposed 3 bedroom Home cabin

40' x 40'

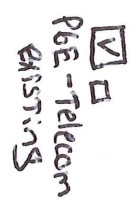
Rain Drain - 135' 4"

180'



Proposed Driveway

APP 250' to property line



Pole - Telecom existing

(NOTE) all utilities to be directional drilled in by my company

(No Trenching)

21962 Circle Diamond LN
Estacada OR, 97023
33E 15A 00800
Michael & Berenice Thomas

591.85'

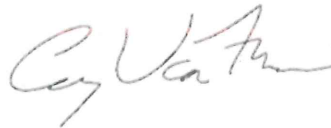
GEOTECHNICAL REPORT

Proposed Cabin Structure
21962 S. Circle Diamond Lane
Estacada, Oregon

June 5, 2026

Project # 26-1493

Prepared for:
Mike Thomas
E-mail: alltechhdd@aol.com



Cory Van Fosson
Senior Geotechnical Engineer



Exp. 6/30/2027

Randall S Goode, PE
Principal Geotechnical Engineer

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Appendix A: FIGURES

- Figure 1: Vicinity Map
- Figure 2: Site Plan with Topography and Exploration Locations
- Figure 3: Geophysical Map (Landslide Hazard Mapping)
- Figure 4: Steep Slope Areas (>20% Slope)

Appendix B: Soil Exploration

- Key to Soil Description
- Logs of Soil Test Pits

1.0 INTRODUCTION

At your request, Strata Design, LLC (STRATA) completed a geotechnical investigation for the proposed development located at 21962 S. Circle Diamond Lane in Estacada, Oregon, as shown on the Site Vicinity Map (Figure 1). The purpose of this report is to present the results of our investigation and provide geotechnical design and construction recommendations in general accordance with Clackamas County requirements for development in areas of potential geologic hazard.

The investigation included evaluation of site geology, slope conditions, and subsurface characteristics to assess the suitability of the site for the proposed cabin and to develop recommendations for site preparation, grading, drainage, and foundation design. The evaluation incorporated review of regional geologic mapping, LiDAR-derived topography, mapped landslide hazard data, and subsurface explorations performed at the site.

The scope of work was developed to address geotechnical and engineering geologic considerations associated with the proposed development and included the following:

- Identification and characterization of geologic hazard areas, where present.
- Evaluation of slope conditions, including areas exceeding 20 percent grade, and assessment of relative slope stability.
- Subsurface exploration consisting of three test pit excavations.
- Review of mapped landslide hazards and site geomorphology.
- Recommendations for building setbacks from slopes and hazard areas, as applicable.
- Recommendations for drainage and surface water management as they relate to slope stability.
- General foundation recommendations relative to identified geologic hazards.

2.0 SITE CONDITIONS

2.1 Regional Geology

The Site is located within the western foothills of the Cascade Range, a transitional physiographic zone between the Willamette Valley and the High Cascades. This region is primarily underlain by volcanic rocks of the Western Cascades, a deeply eroded volcanic arc composed of basaltic and andesitic flows, breccias, and tuffs deposited during the Eocene to Miocene (Walker & MacLeod, 1991¹). Overlying these units are Pleistocene basaltic andesite flows associated with the Boring Volcanic Field—a regional volcanic system

¹ Walker, G. W., & MacLeod, N. S. (1991). *Geologic map of Oregon*. U.S. Geological Survey.

characterized by numerous small shield volcanoes, cinder cones, and lava domes active during the late Quaternary (Evarts et al., 2009(2); Conrey et al., 1996(3)).

The regional geology reflects prolonged volcanic deposition followed by extensive weathering, erosion, and localized sedimentation associated with repeated late-Pleistocene Missoula Flood events. During these catastrophic floods, water levels within portions of the Willamette Valley and lower Columbia River corridor are interpreted to have reached elevations approaching approximately 800 feet. The subject property is located at elevations generally above the principal flood inundation zone and is underlain predominantly by residual volcanic soils and weathered basalt-derived materials rather than significant Missoula Flood deposits. Consequently, the engineering characteristics of the property are controlled primarily by weathered volcanic materials associated with the Western Cascade geologic terrain. These weathered volcanic units commonly form thick residual soil mantles that may be susceptible to landsliding where slopes are moderate to steep and where elevated soil moisture conditions are present. (4).

The site is located approximately 15 to 20 miles southeast of the Portland Hills Fault and approximately 10 to 15 miles southeast of both the Bolton Fault and Oatfield Fault. The Gales Creek Fault lies farther west at a distance of approximately 30 to 40 miles. Tectonically, the region is considered active, and these crustal faults are considered potentially active and capable of generating moderate to strong ground shaking; therefore, seismic design considerations are important for development in this area.

2.2 Site Geology

Regional geologic and mapped landslide hazard features in the vicinity of the site are shown on Figure 3. The project site is located within DOGAMI Statewide Landslide Information Database for Oregon (SLIDO) inventory feature Redland_186. The mapped feature consists of a broad, mature landslide landform exhibiting characteristics of a long-stabilized relict landslide deposit. The landform is characterized by subdued topography, extensive weathering, mature vegetation, and evidence of long-term geomorphic stability. Although DOGAMI classifies the feature as a mapped historic complex landslide inventory feature and assigns it a high confidence rating, field reconnaissance, LiDAR review, and subsurface explorations indicate that the mapped feature has undergone substantial weathering, erosion, and revegetation over an extended period of time.

Based on the observed geomorphic characteristics, degree of weathering, subdued topographic expression, mature vegetation, and regional geologic history, we surmise that the mapped landslide feature may have formed, or last experienced significant movement, during the late Pleistocene to early Holocene geologic timeframe. Accordingly, the feature is interpreted to be at least several thousand years old and potentially associated with landscape adjustments that occurred following repeated Missoula Flood events and other post-glacial geomorphic processes affecting the region. In addition, catastrophic

² Evarts, R. C., O'Connor, J. E., Wells, R. E., & Madin, I. P. (2009). *Geologic map of the Portland area, Oregon and Washington* (Scientific Investigations Map 2924). U.S. Geological Survey. <https://doi.org/10.3133/sim2924>

³ Conrey, R. M., Sherrod, D. R., Uto, K., & Uchiumi, S. (1996). Potassium-argon ages of volcanic rocks in the Portland Basin of Oregon and Washington: Implications for age of the Boring Volcanic Field. *Oregon Geology*, 58(1), 3–10.

⁴ Oregon Department of Geology and Mineral Industries. (2021). *Statewide landslide information database for Oregon (SLIDO)*. <https://www.oregongeology.org/sub/slido/>

flooding associated with the Missoula Floods likely contributed younger sediment deposits across portions of the surrounding landscape, locally mantling older volcanic and sedimentary materials. These observations further support the interpretation that the mapped landslide feature represents a mature, long-stabilized relict landform rather than an actively moving or recently reactivated landslide.

Review of available LiDAR imagery, topographic mapping, aerial imagery, and field observations indicates that the mapped landslide feature consists of a broad, mature landslide landform that has undergone substantial weathering, erosion, and revegetation. Distinct geomorphic indicators typically associated with active landsliding, such as fresh scarps, tension cracks, active seepage zones, hummocky ground, displaced vegetation, or evidence of recent slope deformation, were not observed within the proposed development area.

Subsurface conditions encountered during the investigation indicate that the mapped landslide deposit within the proposed cabin footprint is not readily distinguishable from the underlying native soils. The soil profile generally consists of shallow fine-grained soils overlying dense granular colluvial materials containing gravel, cobbles, and occasional boulders. The encountered materials exhibited significant excavation resistance and did not display characteristics commonly associated with active or recently reactivated landslide deposits.

Based on available geologic mapping, LiDAR review, field reconnaissance, and subsurface explorations, the proposed cabin area appears to be situated within a relatively stable portion of a broad mapped landslide landform. While DOGAMI classifies the feature as a historic complex landslide inventory feature, field observations indicate that the mapped feature exhibits characteristics consistent with a mature, well-vegetated, long-stabilized relict landslide deposit that has undergone substantial weathering, erosion, and geomorphic modification over an extended period of time. No evidence of recent or active landslide movement was observed within the proposed development area.

No fresh scarps, tension cracks, active seepage zones, hummocky ground, displaced vegetation, slope bulging, or other indicators commonly associated with active slope instability were observed during our investigation. The absence of these features, combined with the subsurface conditions encountered during exploration, suggests that the proposed building area currently exhibits favorable slope stability conditions.

2.3 Site Conditions

The site is located within the western Cascade foothills and consists of a forested hillside containing a relatively broad bench that has been selected for the proposed cabin and drainfield. Ground surface slopes within the proposed building area are relatively gentle compared to the surrounding terrain. Site topography, mapped geologic hazards, and areas of steep slope are shown on Figures 3 and 4.

Areas with slopes greater than 20 percent occur throughout portions of the property and surrounding hillside, as shown on Figure 4. The proposed cabin is situated on a natural bench positioned between steeper upslope and downslope terrain. Although the site lies within a larger hillside setting that includes moderate to steep slopes, our review of LiDAR topography, geologic mapping, field observations, and subsurface explorations did not identify evidence of active slope instability within the proposed

development area. While the property is located within a mapped historic landslide deposit, the landform appears mature and well established. No tension cracks, fresh scarps, hummocky ground, active seepage zones, displaced vegetation, or other indicators of recent slope movement were observed during our investigation.

The area above the proposed cabin consists of a moderately inclined forested slope with mature coniferous trees, dense understory vegetation, and a well-developed organic surface layer. The slope is generally uniform and well vegetated, with no evidence of concentrated runoff, gullying, or erosion. Photo 1 shows typical conditions in the upslope area. Below the proposed cabin, the ground surface descends toward the existing gravel access road. This area is more open and consists of grass cover, scattered trees, and isolated areas of exposed soil. The slope geometry is generally uniform, and no evidence of active erosion or slope movement was observed during our site visit. Photo 2 shows typical downslope conditions.

Surface drainage currently occurs primarily as sheet flow directed downslope, and no well-defined drainage channels were observed within the proposed development area.

Overall, the proposed cabin and drainfield are located within a relatively gentle portion of the hillside surrounded by steeper terrain. The observed site conditions, geologic mapping, LiDAR review, and subsurface explorations indicate that the proposed building area is suitable for the proposed improvements.

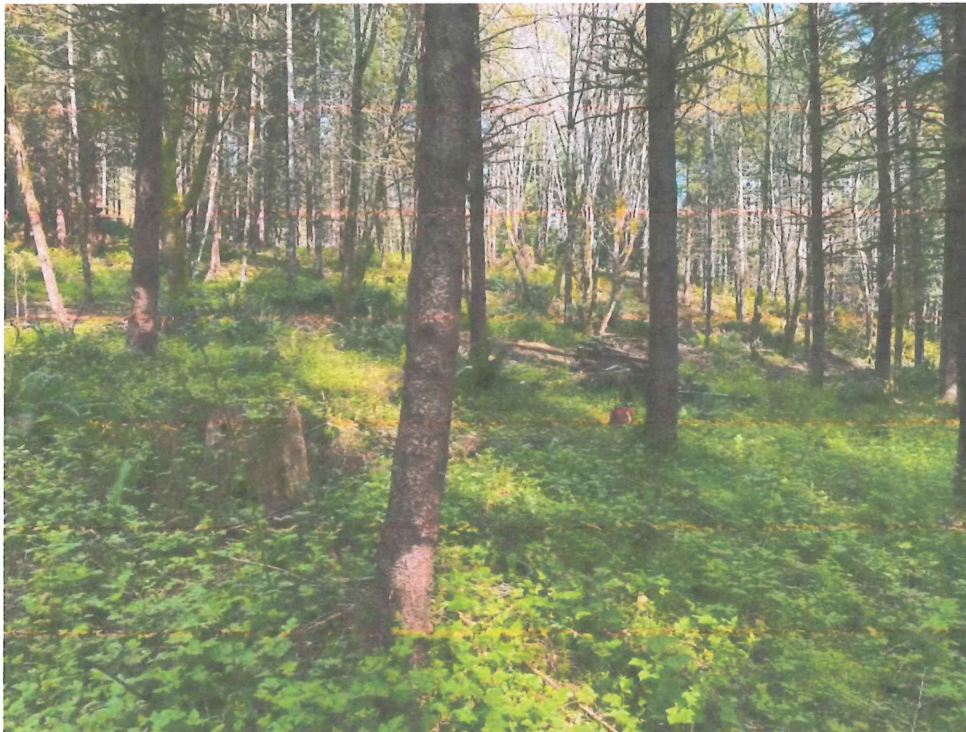


Photo 1 View looking upslope showing moderately inclined, forested terrain with mature coniferous trees, dense understory vegetation, and well-rooted surface soils. No visible signs of instability such as scarps, tension cracks, or erosion features.



Photo 2 View looking downslope toward access road showing gently to moderately sloping terrain with grass cover, scattered trees, and localized exposed soils. Slope appears uniform and stable with no evidence of active erosion or slope distress

2.4 Subsurface Explorations

On April 10, 2026, STRATA conducted a geotechnical investigation at the Site consisting of three test pits (TP-1 through TP-3) excavated to depths ranging from approximately 8 to 9.5 feet below ground surface (bgs). The test pits were excavated using an excavator, and the purpose of the investigation was to evaluate subsurface conditions in support of the proposed cabin, including foundation support, slope stability, and general constructability. Test pit locations were selected to evaluate the proposed building footprint and representative site conditions across the property. The approximate locations of the explorations are shown on Figure 2. Detailed logs of the soil explorations are provided in Appendix B.

Subsurface conditions encountered during the investigation generally consist of approximately 1 foot of topsoil overlying moist, medium stiff lean clay with sand extending to depths of approximately 2.5 to 3 feet. These fine-grained soils are underlain by granular colluvial materials consisting of silty sand, clayey sand, and gravel with increasing cobble content with depth. In deeper portions of the test pits, particularly in TP-3, very dense granular soils containing cobbles and occasional boulders were encountered, resulting in increased excavation resistance and localized refusal on larger fragments. These materials are interpreted as dense colluvium or highly weathered volcanic rock and are suitable for bearing support when properly exposed and evaluated.

Soils encountered during the investigation were classified in general accordance with ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Soil stratigraphy, moisture conditions, and consistency were recorded in the field, and the materials were grouped into the following generalized geotechnical units:

Topsoil (OL): The upper soil horizon across all test pits generally consisted of approximately 0.5 to 1.0 feet of topsoil. The material is dark brown, moist, loose, and organic-rich, containing abundant roots and forest debris. The soil is non-plastic, porous, and friable. This layer is unsuitable for structural support and should be removed during site preparation.

Lean Clay with Sand to Sandy Lean Clay (CL): Underlying the topsoil, the subsurface profile generally consists of lean clay with sand extending to depths of approximately 2.5 to 3.0 feet bgs. These soils are brown to yellowish brown, moist, and medium stiff to stiff, with moderate plasticity and a blocky structure. Trace to minor amounts of sand and fine gravel are present, increasing with depth. In TP-1, this unit transitions to sandy lean clay with approximately 10 to 15 percent sand and fine gravel content. These soils are interpreted as residual materials derived from in-place weathering of volcanic bedrock.

Colluvial Sand, Clayey Sand, and Gravel with Cobbles (SM, SC, SW-SM, GM): Below the fine-grained soils, the subsurface transitions into granular materials consisting of silty sand, clayey sand, and gravel with increasing cobble content with depth. These materials are typically yellowish brown to reddish brown, moist, and medium dense to very dense. Gravel content ranges from approximately 15 to 40 percent, with cobbles generally ranging from about 3 to 10 inches in diameter. In TP-2 and TP-3, these materials become clast-supported and exhibit increased excavation resistance with depth. The soils are non-plastic to low plasticity and are interpreted as basalt-derived colluvial deposits formed through downslope transport and reworking of weathered volcanic materials.

Very Dense Cobbly to Bouldery Volcanic Material (SW-GM): In deeper portions of the test pits—most notably below approximately 6.5 feet bgs in TP-3—very dense granular soils containing significant cobble and boulder content were encountered. These materials consist of very gravelly sand with approximately 30 to 50 percent gravel, cobbles ranging from approximately 6 to 12 inches, and occasional boulders ranging from approximately 1 to 3 feet in diameter. The material is angular to subangular, iron-stained, and partially weathered, and is interpreted as dense colluvium or highly weathered volcanic bedrock (saprolitic basalt). Excavation resistance increased significantly within this unit, and localized refusal was encountered on larger fragments.

Intermediate Fine-Grained Moisture Zone (CL-ML / ML): In TP-3, a distinct intermediate layer of silty clay to silty sand was encountered at depths of approximately 4.0 to 5.5 feet bgs. This material is grayish brown, moist to wet, medium stiff, and exhibits low plasticity with faint mottling and reduced oxidation. The soil was observed to be slightly slick when handled and is interpreted as a localized zone of reduced permeability. This layer likely contributes to the development of perched moisture conditions where overlying soils retain water above more permeable underlying materials.

2.5 Groundwater

Groundwater was not encountered within the depths explored (approximately 8 to 9.5 feet below ground surface) during the April 10, 2026 subsurface investigation. Soil conditions were generally moist, and localized zones of elevated moisture and mottling were observed within finer-grained soils. A localized fine-grained layer encountered in TP-3 indicates the potential for perched moisture conditions during periods of prolonged precipitation; however, no free groundwater, seepage, or standing water was observed.

A review of a nearby Oregon Water Resources Department (OWRD) well log indicates a static groundwater level of approximately 21 feet below ground surface and a primary water-bearing zone at approximately 74 feet below ground surface. Based on available information, regional groundwater is not expected to influence shallow excavations or foundation support for the proposed cabin.

Localized perched moisture conditions may occur seasonally due to the presence of lower-permeability soil layers. Surface and subsurface drainage should be designed to direct water away from the proposed structure and adjacent slope areas and to minimize infiltration into foundation soils.

3.0 GEOTECHNICAL RECOMMENDATIONS

3.1 General

The conclusions and recommendations presented in this report are based on the results of our subsurface exploration, site observations, available geologic data, and our professional judgment. Subsurface conditions may vary between and beyond the exploration locations due to the inherent variability of natural soils. STRATA should be consulted if the design, grading plan, or location of the proposed cabin changes, or if subsurface conditions encountered during construction differ from those described herein.

Based on the results of our investigation, the proposed cabin footprint is underlain by firm to very dense native soils and dense colluvial materials suitable for support of conventional shallow spread foundations when properly prepared. The observed soil conditions are considered adequate to support the proposed structure when constructed in accordance with the recommendations contained in this report.

Localized perched moisture conditions may occur seasonally due to the presence of lower-permeability soil layers. Therefore, proper site drainage, moisture control, and construction practices should be implemented to maintain subgrade performance and long-term foundation support.

3.2 Site Development

3.2.1 Slope Setback and Mass Movement Hazard Considerations

As shown on Figure 4, slopes exceeding 20 percent occur throughout portions of the property and surrounding hillside. The proposed cabin and drainfield are located within a relatively gentle bench area that was specifically evaluated as part of this geotechnical and landslide hazard investigation.

The property is located within DOGAMI Statewide Landslide Information Database for Oregon (SLIDO) inventory feature Redland_186, which is mapped as a complex landslide feature with a high confidence rating. Review of available geologic mapping, LiDAR-derived topography, aerial imagery, field reconnaissance, and subsurface explorations indicates that the proposed development area is situated within a relatively stable portion of this mapped landslide landform. Although the mapped landslide encompasses a broad area of the surrounding hillside, distinct geomorphic indicators commonly associated with active landslide movement were not observed within the proposed development area.

Field observations conducted during the investigation did not identify fresh scarps, tension cracks, hummocky ground, displaced vegetation, active seepage zones, slope bulging, localized slope failures, or other indicators of recent or ongoing instability. In addition, subsurface explorations encountered medium stiff to stiff fine-grained soils overlying dense granular colluvial materials containing gravel, cobbles, and occasional boulders. The encountered materials exhibited significant excavation resistance and did not display characteristics commonly associated with active or recently reactivated landslide deposits.

STRATA recommends maintaining a minimum horizontal setback of 20 feet from the crest of the primary downslope area for all structural elements. Where practical, additional separation from slope breaks is beneficial. Surface water should be directed away from slope areas, and concentrated runoff should not be discharged over slope faces, toward slope crests, or into areas where infiltration could adversely affect slope stability.

Based on available geologic mapping, LiDAR review, field reconnaissance, and subsurface explorations, the proposed development area does not exhibit evidence of active mass movement or conditions indicative of ongoing slope instability. The proposed cabin location is situated on a relatively gentle bench between steeper slope segments and is set back from significant topographic breaks. Provided drainage is properly managed and the recommendations contained within this report are implemented, construction of the proposed cabin and associated improvements is not anticipated to adversely affect slope stability or increase landslide risk within the surrounding hillside.

3.2.2 Site Preparation and Grading

We anticipate that only minor stripping and clearing will be required within the proposed cabin footprint and immediate development area. Vegetated areas should be stripped of organic-rich topsoil, forest duff, and root mat to a depth of approximately 0.5 to 1.0 feet, or deeper as necessary to expose firm, non-organic native soils. Based on subsurface exploration, near-surface soils consist of topsoil overlying lean clay with sand, which may exhibit reduced strength when wet. In areas where soft, loose, or moisture-sensitive soils are encountered, additional over-excavation may be required to achieve a competent bearing subgrade.

Undocumented fill, root zones, or localized areas of saturated or unsuitable soils—including zones influenced by perched moisture—should be removed and replaced with properly compacted engineered structural fill. If buried obstructions, organic materials, or soft pockets are encountered during grading, those areas should be excavated and backfilled in accordance with the recommendations provided herein.

Due to the presence of fine-grained soils and the potential for localized perched moisture conditions, site grading should be performed during favorable weather conditions where practical. Exposed subgrade soils may become unstable if worked during wet conditions and may require drying, stabilization, or over-excavation prior to placement of structural elements.

Final site grades should be established to promote positive drainage away from the proposed cabin and adjacent slope areas. A minimum slope of 2 percent away from building perimeters is recommended. Surface runoff, including roof drainage, should be directed away from the structure and should not be allowed to discharge onto or concentrate near slope crests or faces.

Permanent cut and fill slopes should generally not exceed 2H:1V unless additional geotechnical evaluation is performed. Cut slopes within the colluvial and residual soils encountered at the site should be constructed in a controlled manner to minimize disturbance and reduce the potential for raveling or localized instability.

Following rough grading, the exposed subgrade within foundation areas should be observed and, where appropriate, tested by geotechnical personnel to verify that competent native soils or properly compacted structural fill have been achieved prior to placement of footings, slabs, or other structural elements.

Where excavations are performed near slope areas or future foundation elements, care should be taken to avoid over-steepening or undermining adjacent soils. Excavations should be sloped or shored in accordance with applicable OSHA requirements. Any excavation that approaches a foundation influence zone or slope crest should be evaluated in the field, and temporary support measures should be implemented as necessary to maintain stability during construction.

Grading and site development should be performed in a manner that minimizes disturbance to steeper slope areas. Concentrated grading, excavation, or drainage discharge should be avoided near slope breaks and steeper downslope areas to reduce the potential for localized instability or erosion.

3.3 Structural Fill

Structural fill should consist of approved granular material and should be placed in controlled lifts not exceeding approximately 8 to 12 inches in loose thickness and compacted to at least 95 percent of the maximum dry density as determined by ASTM D698 (Standard Proctor). Particular attention should be given to compaction in foundation areas, utility trenches, and transitions between cut and fill to minimize the potential for differential settlement.

Import materials typically used for structural fill include 1.5-inch-minus or 4-inch-minus crushed rock, depending on the application. Materials greater than 4 inches in diameter are not suitable for use as structural fill. Imported granular structural fill should consist of crushed rock that is fairly well graded between coarse and fine particle sizes, and should contain no organic matter, debris, or particles larger than 4 inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. For the footing base pads, the percentage of fines can be increased (to 12 percent) if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary, for proper compaction. For fine grading purposes, the maximum particle size should be limited to no more than 3/4 inches for granular fill placed under structural elements (footings, concrete slabs, etc.). Separation geotextiles and geogrid reinforcement of subgrade soils may be utilized to stabilize soft, yielding areas.

3.4 Shallow Spread Foundations

Conventional shallow spread concrete footings are suitable for support of the proposed cabin, provided that foundations are established on undisturbed, competent native soils or properly placed and compacted structural fill.

All topsoil, organics, and unsuitable near-surface materials should be removed from foundation areas. Footings should be embedded at least 12 inches below the lowest adjacent grade; however, a minimum embedment depth of 18 inches is recommended to reduce the effects of seasonal moisture variations. An allowable bearing capacity of 2,000 psf may be used for design, provided that footings bear on firm native soils or properly compacted structural fill. This recommendation is based on observed subsurface conditions, including medium stiff to stiff fine-grained soils underlain by dense to very dense granular materials exhibiting high excavation resistance.

This value represents a net allowable bearing pressure and may be increased by one-third for short-term loading conditions such as wind or seismic events. If unsuitable soils are encountered at footing subgrade, those materials should be over-excavated and replaced with compacted structural fill.

Due to the potential for perched moisture conditions, foundation drainage is recommended to reduce the potential for moisture-related impacts to foundation performance.

3.4.1 Settlement

Total and differential settlements for the proposed cabin founded on properly prepared subgrade are expected to be small. Based on the subsurface conditions encountered and the recommended foundation support, we estimate that total settlement should not exceed approximately 1 inch, with differential settlement on the order of ½ inch or less, provided that foundations are supported on uniform, competent native soils or properly compacted structural fill.

Settlement performance is dependent on proper site preparation, including removal of unsuitable materials, adequate compaction of structural fill, and uniform support conditions beneath the foundation. Variability in subgrade conditions, particularly at transitions between native soils and fill, should be minimized to reduce the potential for differential settlement.

3.4.2 Lateral Resistance

Lateral loads imposed on footings may be resisted by a combination of passive earth pressure acting on the sides of footings and frictional resistance at the base. For footings embedded in competent native soils or properly compacted structural fill, an allowable passive earth pressure of 250 pounds per cubic foot (pcf) may be used. This value incorporates a reduction factor to account for the deformation required to mobilize passive resistance.

The upper 12 inches of soil adjacent to footings, as well as any unconfined or disturbed soils, should not be considered when evaluating passive resistance. A coefficient of friction of 0.35 may be used to estimate sliding resistance at the base of footings bearing on native soils or structural fill. These values do not include a factor of safety and should be used in accordance with applicable structural design criteria.

3.5 Wet Weather Considerations

We recommend stabilizing the areas of the site experiencing heavily loaded construction traffic with a support layer of crushed rock with 3-inch or greater particle size. Silt fences, inlet protection, soil stockpile covers, etc., are required to reduce sediment transport during construction to acceptable

levels. Measures to reduce erosion should be implemented in general accordance with project civil site plan and state, county, and city regulations.

3.6 Seismic Design Parameters

Based on our review of the 2021 International Building Code (IBC)⁵, ASCE 7-22⁶, and the subsurface conditions observed during our April 2026 field exploration, we recommend classifying the site as Site Class C in accordance with Chapter 20 of ASCE 7-22.

This classification is based on subsurface conditions consisting of medium stiff to stiff fine-grained soils underlain by dense to very dense granular colluvial materials with increasing cobble content at depth, as observed in the test pits. These materials exhibited relatively high excavation resistance and are interpreted to provide competent support conditions for the proposed cabin.

Although subsurface explorations did not extend to a depth of 100 feet and shear wave velocity measurements were not performed, the observed soil conditions and regional geologic setting are considered consistent with Site Class C for design purposes. In accordance with ASCE 7-22, where sufficient data are not available to define a more precise classification, assignment of Site Class C is considered appropriate based on available information and engineering judgment.

Seismic design parameters were obtained from the U.S. Seismic Design Maps tool (ASCE 7-22) using the project site location. The results correspond to Risk Category II structures and are summarized below.

Table 1 - Seismic Ground Motion Values

Parameter	Value	Description
S_s	0.75	MCER spectral acceleration at 0.2 sec (Site Class C)
S_1	0.29	MCER spectral acceleration at 1.0 sec (Site Class C)
S_{MS}	0.85	MCER spectral acceleration at 0.2 sec (adjusted for Site Class C)
S_{M1}	0.40	MCER spectral acceleration at 1.0 sec (adjusted for Site Class C)
S_{DS}	0.56	Design spectral acceleration at 0.2 sec ($2/3 \times S_{MS}$)
S_{D1}	0.27	Design spectral acceleration at 1.0 sec ($2/3 \times S_{M1}$)
Site Class	C	Based on subsurface conditions (per ASCE 7-22 Ch. 20)
Seismic Design Category	C	Based on Risk Category II and $S_{DS} = 0.56$ g
P_{GAM}	0.37	MCEG peak ground acceleration (for Site Class C)
T_L	16	Long-period transition period
T_s	0.47	Transition period (S_{D1}/S_{DS})
T_0	0.09	Short-period slope start ($0.2 \times T_s$)

⁵ Evarts, R. C., O'Connor, J. E., Wells, R. E., & Madin, I. P. (2009). *Geologic map of the Portland area, Oregon and Washington* (Scientific Investigations Map 2924). U.S. Geological Survey. <https://doi.org/10.3133/sim2924>

⁶ American Society of Civil Engineers. (2022). *Minimum design loads and associated criteria for buildings and other structures (ASCE/SEI 7-22)*. American Society of Civil Engineers.

3.7 Liquefaction Hazards

Review of the DOGAMI Statewide Geohazards (online viewer) indicates that the project site is located within an area mapped as having high to very high liquefaction susceptibility. This mapping is regional in nature and is intended as a screening-level tool based on generalized geologic, geomorphic, and groundwater conditions. As such, it does not account for site-specific subsurface conditions encountered within the proposed building footprint.

Subsurface exploration performed at the site indicates that the near-surface soils within the proposed cabin area consist primarily of medium stiff to stiff fine-grained soils overlying dense to very dense granular colluvial materials with cobbles and localized boulders. These materials exhibited relatively high density and significant excavation resistance during test pit exploration. In addition, free groundwater was not encountered within the explored depths of approximately 8 to 9.5 feet below ground surface, although localized perched moisture may occur seasonally.

Based on the soil conditions encountered within the depth of the proposed shallow foundation system, the liquefaction susceptibility of the explored bearing soils is interpreted to be very low to low. The dense nature of the granular materials, the presence of significant cobble content, the fine-grained character of the upper soils, and the absence of shallow groundwater at the time of investigation all reduce the likelihood of liquefaction affecting the proposed cabin foundation soils under typical conditions.

It should be noted that this interpretation is based on the scope of the subsurface exploration completed for this project and applies to the shallow subsurface conditions relevant to support of the proposed cabin. Regional liquefaction mapping may reflect deeper or more generalized subsurface conditions that were not specifically evaluated as part of this investigation.

For the proposed cabin, which is expected to be supported on shallow foundations bearing on properly prepared native soils or structural fill, liquefaction is not considered a controlling design hazard for the shallow foundation system.

4.0 ADDITIONAL SERVICES AND CONSTRUCTION OBSERVATION

Because the future performance and integrity of the structural elements will depend largely on proper site preparation, drainage, fill placement, and construction procedures, monitoring and testing (geotechnical special inspection) by experienced geotechnical personnel should be considered an integral part of the design and construction process. Consequently, we recommend that STRATA be retained to provide the following post-investigation services, where applicable:

- Review construction plans and specifications to verify that our design criteria presented in this report have been properly integrated into the design.
- Observe placement of fill and conduct density testing of structural fill and utility backfill.
- Observe structure and retaining wall footing subgrades before footings are constructed to verify the soil conditions.
- Prepare a post-construction letter-of-compliance summarizing our field observations, inspections, and test results.

- Observe site stripping, grading, and foundation excavation activities within the proposed building area to verify that subsurface conditions are generally consistent with those described in this report and that no previously unidentified geologic hazards, unsuitable soils, seepage conditions, or slope stability concerns are encountered.

5.0 LIMITATIONS

This report has been prepared for the exclusive use of the client and their design and construction team for aiding in the design and development of the proposed improvements at 21962 S Circle Diamond Lane, Estacada, Oregon. It is not intended to be used or relied upon by third parties without the express written consent of the client and STRATA. Reproduction of this report, in whole or in part, by any means—including electronic transmission—without written permission is prohibited.

The observations, interpretations, and recommendations provided in this report are based on information obtained from our April 2026 field exploration (test pits), site reconnaissance, review of available geologic data, and our professional judgment. Subsurface conditions may vary between and beyond the exploration locations due to the inherent variability of natural soils and geologic materials. If subsurface conditions encountered during construction differ from those described herein, STRATA should be notified to evaluate whether modifications to the recommendations are warranted.

Seasonal fluctuations in soil moisture, perched groundwater conditions, and localized slope-related processes may influence site conditions beyond those observed at the time of our investigation. While groundwater was not encountered within the depths explored, available well log data indicate that regional groundwater occurs at greater depths. Localized perched moisture or seepage conditions may develop, particularly during periods of extended precipitation.

This report does not include an environmental assessment or investigation for the presence of hazardous materials, soil contamination, or jurisdictional wetlands. Separate evaluations should be conducted to address such environmental considerations, if required.

If a significant period of time elapses between issuance of this report and construction, or if there are changes to the project scope, grading plan, or site conditions, STRATA should be consulted to review the applicability of the recommendations provided herein. Changes in site conditions, land use, or regulatory requirements may affect the conclusions of this report. STRATA recommends that this report not be relied upon beyond a period of three years without reevaluation.

We recommend that STRATA be retained to review final construction documents prior to construction and to provide construction observation services to verify that geotechnical recommendations are properly implemented.

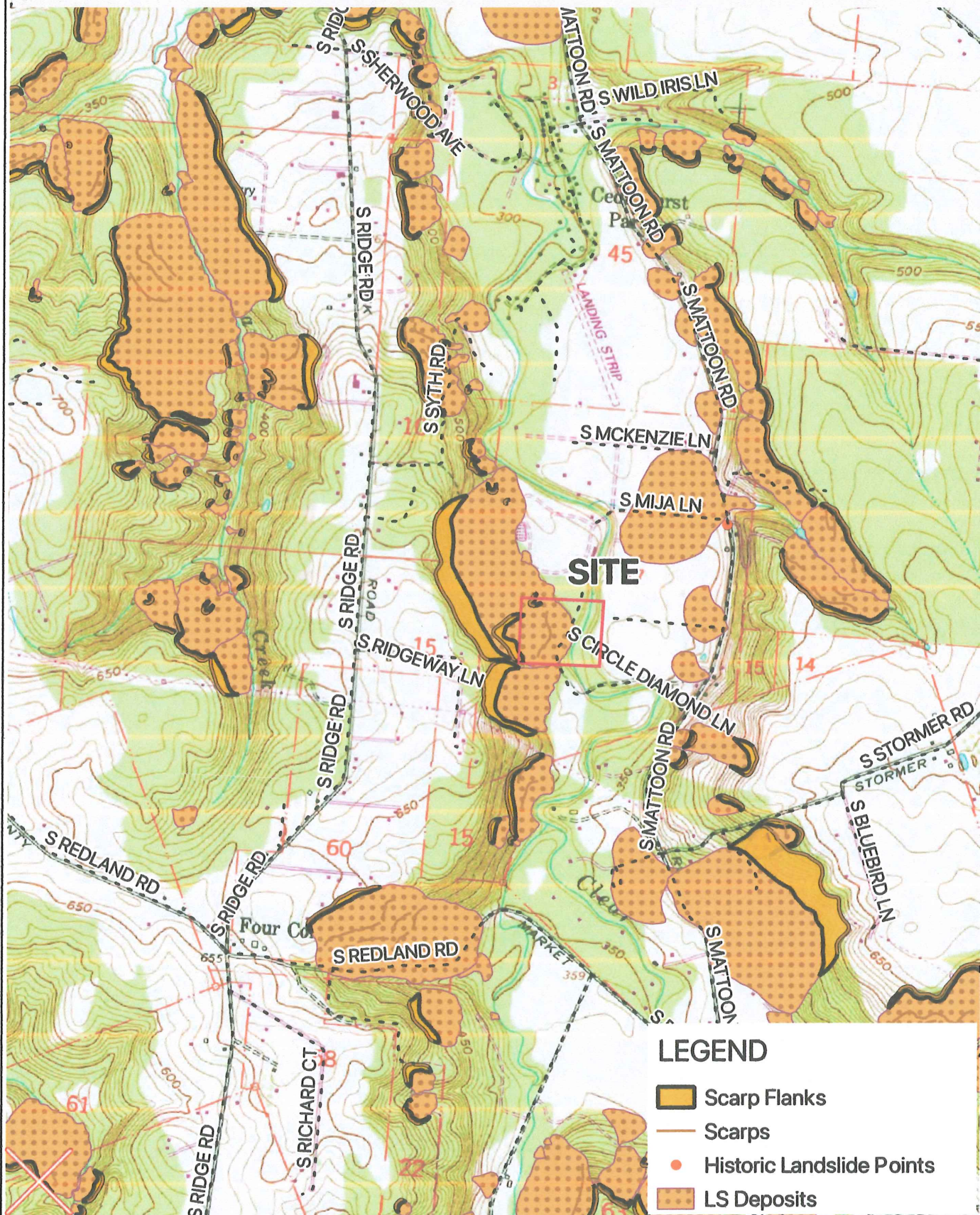


APPENDIX A: FIGURES

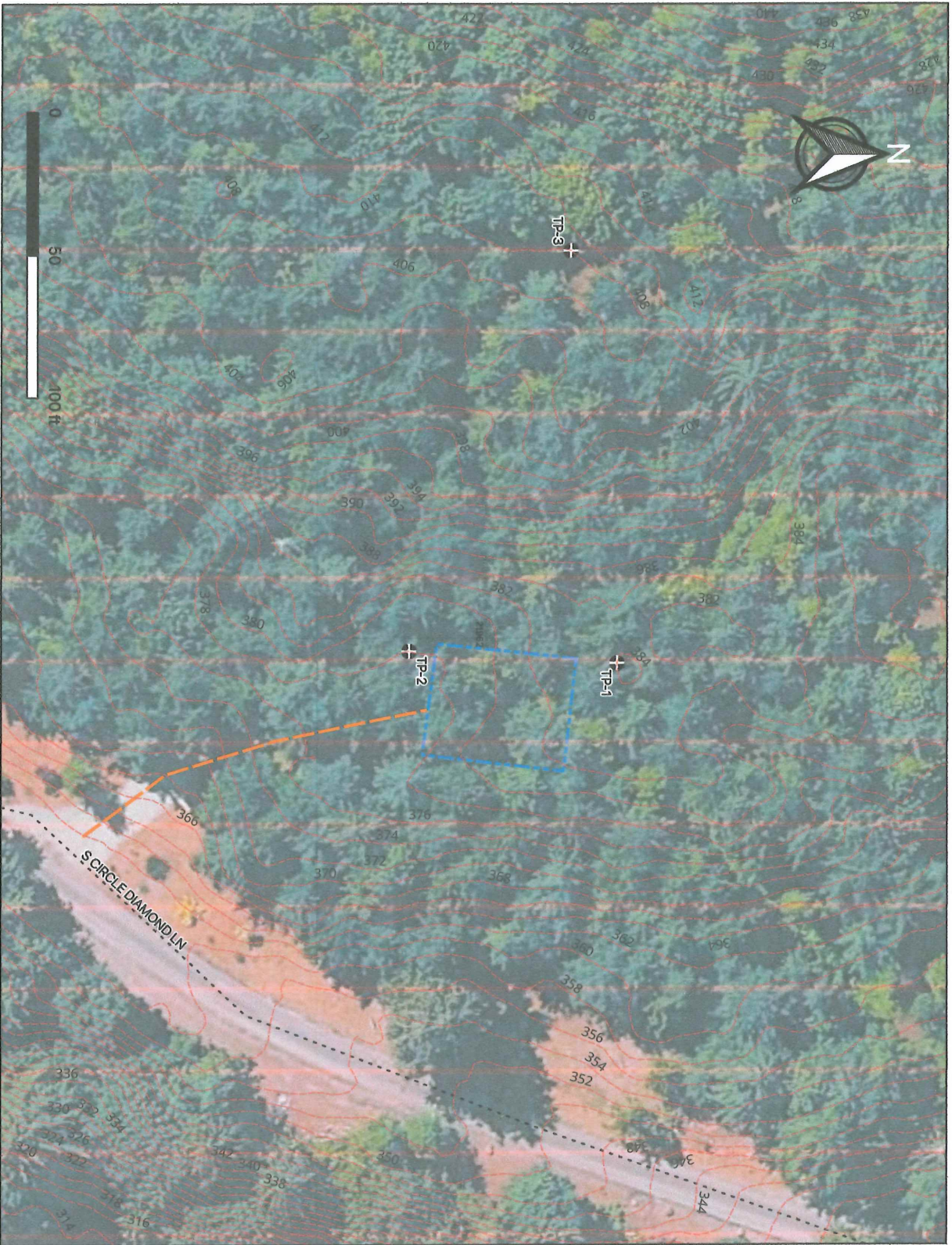
- Figure 1 – Vicinity Map
- Figure 2 – Existing Conditions & Subsurface Exploration

FIGURE 1 - VICINITY MAP

21962 S Cir Diamond Lane, Estacada, Oregon 97023



Source: Statewide Landslide Information for Oregon (SLIDO), Version 4.4, maintained by the Oregon Department of Geology and Mineral Industries: <http://www.gis.dogami.oregon.gov/maps/slido>



**Site Plan and
Exploration Locations**
Proposed New Cabin
21962 S Cir Diamond Ln
Estacada, OR 97023

2-Foot Contours (2009 LIDAR)

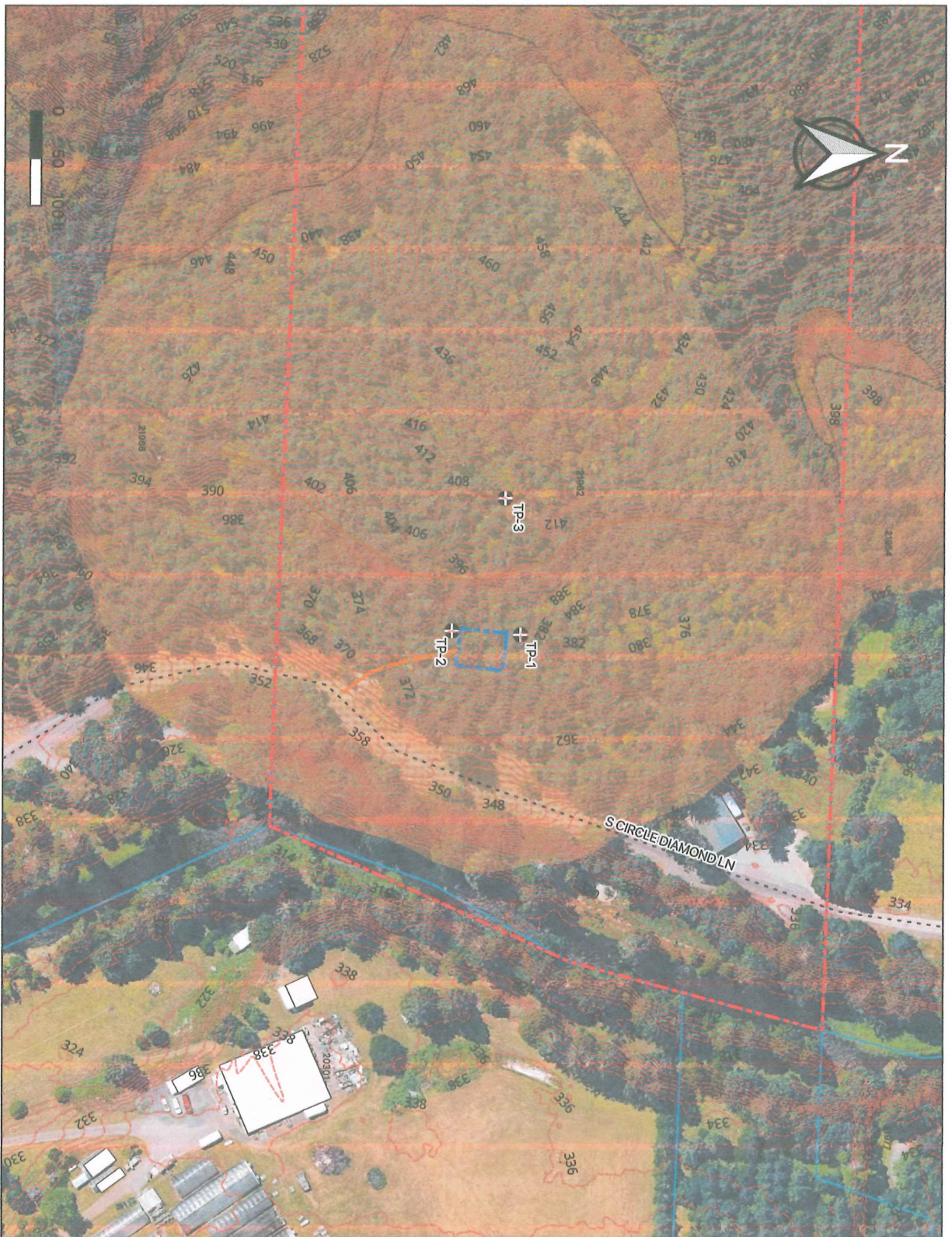
Job #26-1493
APRIL 2026

Lot lines shown are from GIS and
should be considered approximated

- LEGEND**
- 2 Foot Contours
 - Access Road
 - Project Sites
 - Proposed Cabin
 - Test Pits

Boundary Line shown is approximate
based from GIS

Figure 2



Site Topography and Geologic Hazards

Proposed New Cabin
21962 S Cir Diamond Ln
Eliacada, OR 97023

2-Foot Contours (2009 LIDAR)

Job #26-1493

APRIL 2026

Lot lines shown are from GIS and
should be considered approximated

LEGEND

- 2 Foot Contours
- Access Road
- Parcel
- Proposed Cabin
- Test Pits
- Historic Landslide Points
- Scarps
- Index LS Studies
- Scarp Flanks
- LS Deposits

Boundary Line shown is approximate,
based from GIS

Figure 3



Steep Slope Areas ($\geq 20\%$ Slope)

PROPOSED CABIN
21962 S Cir Diamond Lane
Estacada, Oregon

Job #26-1493

JUNE 2026

Lot lines shown are from GIS and should be considered approximated

LEGEND

Slope Areas $\geq 20\%$ Slope

Drainfield

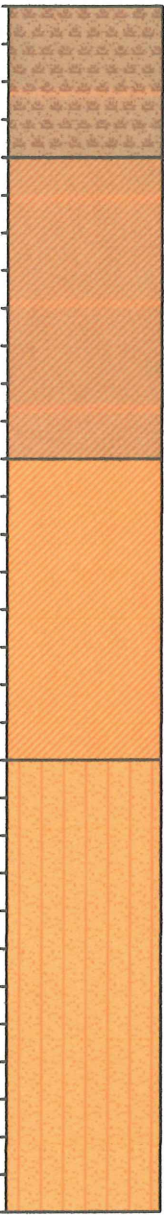
Cabin

Boundary Line shown is approximate, based from GIS

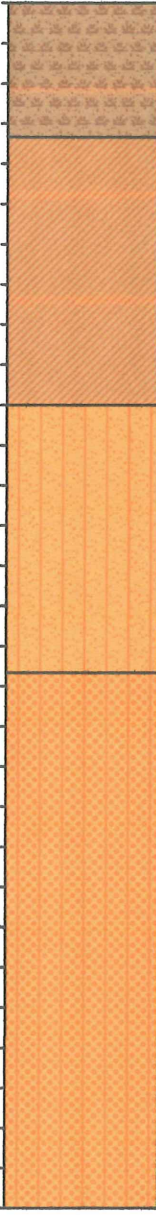


Figure 4

APPENDIX B: SUBSURFACE EXPLORATION

 2117 NE Oregon Street, Suite 102 • Portland, OR 97232 503 • 451-7574 • STRATADESIGN.COM		PROJECT NAME: <u>Proposed New Cabin</u>		START DATE: <u>4/10/2026</u>		TP-1	
		LOCATION: <u>21962 S Cir Diamond Ln, Estacada, OR 97023</u>		END DATE: <u>4/10/2026</u>		Page 1 of 1	
		CUSTOMER: <u>Mike Thomas</u>		LATITUDE: _____		LOGGED BY: <u>CVF</u>	
		PROJECT ID: <u>26-1493</u>		LONGITUDE: _____		CHECKED BY: <u>RG</u>	
		ELEVATION: _____					
DEPTH [ft]	GRAPHIC LOG (BORING)	POCKET PEN (TSF)	MATERIAL DESCRIPTION (BORING)			USCS CLASSIFICATION	
<i>Note: Lines representing the interface between soil/rock units of differing descriptions are approximate only, inferred where between samples, and may indicate a gradual transition</i>							
0.00			TOPSOIL (OL) TOPSOIL (OL), dark brown (10YR 3/2), moist, loose, organic-rich, with abundant roots and forest debris, non-plastic, porous, friable (abrupt @ 1.0 ft).			TOPSOIL (OL)	
0.25			Lean Clay with Sand (CL) Lean Clay with Sand (CL), brown (10YR 4/3), moist, medium stiff, trace sand and trace fine gravel (~5%), moderate plasticity, blocky structure, residual (gradual @ 3.0 ft).			Lean Clay with Sand (CL)	
0.50							
0.75							
1.00			Sandy Lean Clay (CL) Sandy Lean Clay (CL), brown to yellowish brown (10YR 5/4), moist, stiff, some sand and fine to medium gravel (~10–15%), moderate plasticity, blocky to granular structure, transitioning with depth, residual to colluvial (diffuse @ 5.0 ft).			Sandy Lean Clay (CL)	
1.25							
1.50							
1.75							
2.00							
2.25							
2.50							
2.75							
3.00			Silty Sand with Gravel (SM) Silty Sand with Gravel (SM), yellowish brown (10YR 5/6), moist, dense, some gravel (~20%) and occasional cobbles (approximately 3 to 6 inches, <10%, subangular), non-plastic, granular, poorly graded, basalt-derived colluvium, minor raveling.			Silty Sand with Gravel (SM)	
3.25							
3.50							
3.75							
4.00							
4.25							
4.50							
4.75							
5.00							
5.25							
5.50							
5.75							
6.00							
6.25							
6.50							
6.75							
7.00							
7.25							
7.50							
7.75							
8.00							
Key:			DRILLING COMPANY: <u>All Tech</u> METHOD OF DRILLING: <u>Excavator</u>				

 2117 NE Oregon Street, Suite 102 • Portland, OR 97232 503 • 455-7574 • STRATADESIGN.COM		PROJECT NAME: <u>Proposed New Cabin</u>		START DATE: <u>4/10/2026</u>		TP-2 Page 1 of 1	
		LOCATION: <u>21962 S Cir Diamond Ln, Estacada, OR 97023</u>		END DATE: <u>4/10/2026</u>			
		CUSTOMER: <u>Mike Thomas</u>		LATITUDE: _____		LOGGED BY: <u>cvf</u>	
		PROJECT ID: <u>26-1493</u>		LONGITUDE: _____			
		ELEVATION: _____		CHECKED BY: <u>rg</u>			

DEPTH [ft]	GRAPHIC LOG (BORING)	POCKET PEN (TSF)	MATERIAL DESCRIPTION (BORING)	USCS CLASSIFICATION
<i>Note: Lines representing the interface between soil/rock units of differing descriptions are approximate only, inferred where between samples, and may indicate a gradual transition</i>				
0.00			TOPSOIL (OL) TOPSOIL (OL), dark brown (10YR 3/2), moist, loose, organic-rich, with roots, porous, friable (abrupt @ 1.0 ft).	TOPSOIL (OL)
0.30			Lean Clay with Sand (CL) Lean Clay with Sand (CL), brown (10YR 4/3), moist, medium stiff, trace sand and trace gravel (~5%), moderate plasticity, blocky structure, residual (gradual @ 3.0 ft).	Lean Clay with Sand (CL)
0.60				
0.90				
1.20			Silty Sand with Gravel (SM) Silty Sand with Gravel (SM), yellowish brown (10YR 5/4), moist, medium dense, some gravel (~15–25%) and occasional cobbles (approximately 3 to 6 inches, ~5–10%, subangular), non-plastic, granular, poorly graded, colluvial, slight raveling (abrupt @ 5.0 ft).	Silty Sand with Gravel (SM)
1.50			Gravelly Sand with Cobbles (SW-SM) Gravelly Sand with Cobbles (SW-SM), yellowish brown to light olive brown (2.5Y 5/4), moist, dense to very dense, some to significant gravel (~20–40%) and cobbles (approximately 3 to 8 inches, ~15–30%, subangular to angular), non-plastic, granular, clast-supported, basalt-derived colluvium, difficult excavation.	Gravelly Sand with Cobbles (SW-SM)
1.80				
2.10				
2.40				
2.70				
3.00				
3.30				
3.60				
3.90				
4.20				
4.50				
4.80				
5.10				
5.40				
5.70				
6.00				
6.30				
6.60				
6.90				
7.20				
7.50				
7.80				
8.10				
8.40				
8.70				
9.00				

Key:	DRILLING COMPANY: <u>All Tech</u> METHOD OF DRILLING: <u>Excavator</u>
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 2117 NE Oregon Street, Suite 102 • Portland, OR 97232 503 • 451-7574 • 1700000000000000		PROJECT NAME: Proposed New Cabin		START DATE: 4/10/2026		TP-3 Page 1 of 1	
		LOCATION: 21962 S Cir Diamond Ln, Estacada, OR 97023		END DATE: 4/10/2026			
		CUSTOMER: Mike Thomas		LATITUDE:		LOGGED BY: CVF	
		PROJECT ID: 26-1493		LONGITUDE:			
		ELEVATION:		CHECKED BY: RG			

DEPTH [ft]	GRAPHIC LOG (BORING)	POCKET PEN (TSF)	MATERIAL DESCRIPTION (BORING)	USCS CLASSIFICATION
0.00			TOPSOIL (OL) TOPSOIL (OL), dark brown (10YR 3/2), moist, loose, organic-rich, with roots, porous, friable (abrupt @ 1.0 ft).	TOPSOIL (OL)
0.30			Lean Clay with Sand (CL) Lean Clay with Sand (CL), brown (10YR 4/3), moist, medium stiff, trace sand and trace gravel (~5%), moderate plasticity, blocky structure, residual (gradual @ 2.5 ft).	Lean Clay with Sand (CL)
0.60				
0.90				
1.20			Clayey Sand with Gravel and Cobbles (SC) Clayey Sand with Gravel and Cobbles (SC), brown (10YR 4/4), moist, medium dense, some sand with gravel (~15–25%) and cobbles (approximately 3 to 6 inches, ~10%, subangular), low to moderate plasticity, heterogeneous, granular to weakly blocky structure, colluvial (diffuse @ 4.0 ft).	Clayey Sand with Gravel and Cobbles (SC)
1.50				
1.80				
2.10				
2.40			Silty Clay to Silty Sand (CL-ML / ML) Silty Clay to Silty Sand (CL-ML / ML), grayish brown (2.5Y 5/2), moist to wet, medium stiff, trace gravel (<5%), low plasticity, blocky structure with faint mottling, reduced oxidation, possible perched moisture zone, slightly slick when handled (sharp @ 5.5 ft).	Silty Clay to Silty Sand (CL-ML / ML)
2.70				
3.00				
3.30				
3.60				
3.90			Sandy Gravel with Cobbles (GM) Sandy Gravel with Cobbles (GM), yellowish brown to strong brown (7.5YR 5/6), moist, dense, some to significant gravel (~20–40%) and cobbles (approximately 4 to 10 inches, ~20–30%, angular to subangular), non-plastic, granular, clast-supported, weathered basalt fragments, increasing excavation resistance (abrupt @ 6.5 ft).	Sandy Gravel with Cobbles (GM)
4.20				
4.50				
4.80		Very Gravelly Sand with Cobbles and Boulders (SW-GM) Very Gravelly Sand with Cobbles and Boulders (SW-GM), reddish yellow to strong brown (7.5YR 6/6 to 5YR 5/6), moist, very dense, significant gravel (~30–50%), cobbles (approximately 6 to 12 inches, ~20–40%), and boulders (approximately 1 to 3 feet, occasional larger), angular, iron-stained, partially weathered basalt (saprolitic), granular, rock-dominated, very hard digging, frequent refusal on large fragments.	Very Gravelly Sand with Cobbles and Boulders (SW-GM)	
5.10				
5.40				
5.70				
6.00				
6.30				
6.60				
6.90				
7.20				
7.50				
7.80				
8.10				
8.40				
8.70				
9.00				
9.50				

Key:	DRILLING COMPANY: All tech
	METHOD OF DRILLING: Excavator

BORING AND TEST PIT LOGS

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for exploration by our field representative. The log contains information concerning soil and groundwater encountered, sampling depths, sampler types used and identification of samples selected for laboratory analysis. The final logs presented in this report represent our interpretation of subsurface conditions based on the contents of the field logs, observations made during explorations, and the results of laboratory testing. Our recommendations are based on the contents of the final logs and the information contained therein, and not on the field logs.

SOIL CLASSIFICATION SYSTEM

Soil samples are classified in the field in general accordance with the United Soil Classification System (USCS) presented in ASTM D2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." Final logs reflect field soil classifications and laboratory testing results. A summary of the USCS is provided on page 3. Classifications and sampling intervals are shown in the logs.

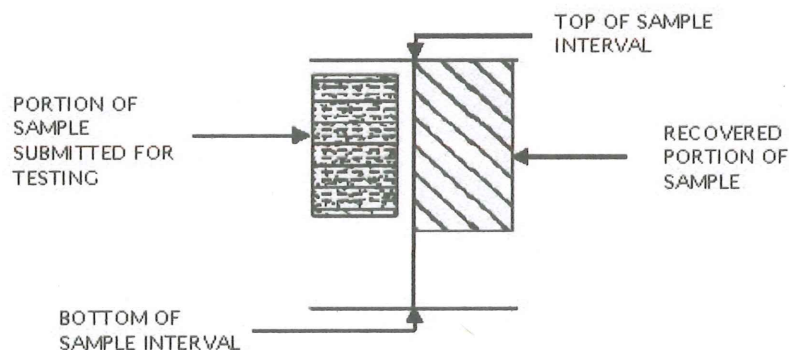
VARIATION OF SOIL BETWEEN EXPLORATIONS

The final logs and related information depict subsurface conditions only at the specific location and on the date(s) indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ.

TRANSITION BETWEEN SOIL AND ROCK CLASSIFICATIONS

The lines designating the interface between soil, fill, or rock on the final logs and on the subsurface profiles presented in the report are determined by interpolation and are, therefore, approximate. The transition between the materials may be abrupt or gradual. Only at specific exploration locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes.

BORING LOG SAMPLES



EXPLORATION LOG SYMBOLS



Sample Location with
No Sample Recovery



Sample Location Using Direct Push
Sampler (ASTM D 6282)



Sample Location Using Ring-Lined
Barrel Sampler (ASTM D 3550)



Sample Location Using Split-Barrel
Sampler (ASTM D 1586)



Sample Location Using Thin-Walled
Tube Sampler (ASTM D 1587)



Rock Core Interval



Grab Sample Location



Soil Sample Submitted for
Chemical Testing



Soil Sample Submitted for
Physical Property Testing



Water Sample
Screened Interval



Water Sample Submitted
for Chemical Testing



Water Sample Tested
in the Field



Groundwater Level
Encountered While Drilling



Static Groundwater
Level



Perched
Groundwater



Groundwater Level
at Time of Sampling

SOIL CHARACTER

Granular Soil		Cohesive Soil		
Density	Standard Penetration Test *	Consistency	Standard Penetration Test*	Unconfined Compressive Strength (tsf)
Very Loose	0 - 4	Very Soft	Less Than 2	Less Than 0.25
Loose	4 - 10	Soft	2 - 4	0.25 - 0.5
Medium Dense	10 - 30	Medium Stiff	4 - 8	0.50 - 1.0
Dense	30 - 50	Stiff	8 - 16	1.0 - 2.0
Very Dense	Greater Than 50	Very Stiff	16 - 32	2.0 - 4.0
Blows Required to Drive a Split-Barrel Sampler 12 inches		Hard	Greater Than 32	Greater Than 4.0

DEFINITIONS AND ABBREVIATIONS

AT	ATTERBERG LIMITS TEST	ND	NON DETECT	PPB	PARTS PER BILLION
BGS	BELOW GROUND SURFACE	NEG	NEGATIVE RESULT	PPM	PARTS PER MILLION
CO	CONSOLIDATION TEST	NS	NO VISIBLE SHEEN	PSF	POUNDS PER SQUARE FOOT
DS	DIRECT SHEAR TEST	OC	ORGANIC CONTENT	RS	SOIL RESISTIVITY TEST
DW	DRY UNIT WEIGHT	P	PUSHED SAMPLE	S4	SUDAN IV SOIL TEST
GS	MECHANICAL GRAIN SIZE TEST	P200	P200 FINES CONTENT TEST	SG	SPECIFIC GRAVITY TEST
HS	HEAVY SHEEN	PCF	POUNDS PER CUBIC FOOT	SPT	STD. PENETRATION TEST
HYD	HYDROMETER TEST	PH	SOIL pH	SS	SLIGHT SHEEN
MC	MOISTURE CONTENT	PID	PHOTOIONIZATION DETECTOR	TO	TORVANE
MG/KG	MILLIGRAMS PER KILOGRAM	POS	POSITIVE RESULT	TSF	TONS PER SQUARE FOOT
MS	MODERATE SHEEN	PP	POCKET PENETROMETER	UV	ULTRAVIOLET LIGHT TEST

GRAIN SIZE DEFINITIONS			MINOR FRACTIONS IN FINE GRAINED SOIL		GROUNDWATER SEEPAGE	
SAND	FINE	No. 200 to No. 40	No Mention (CLAY, SILT)	< 15 percent	Slow	< 1 gpm
	MEDIUM	No. 40 to No. 10	With Sand, With Gravel	15 to 30 percent	Moderate	1-3 gpm
	COARSE	No. 10 to No. 4	Sandy, Gravelly	30 to 49 percent	Rapid	> 3 gpm
GRAVEL	FINE	No. 4 to 3/4-inch	FIELD MOISTURE OBSERVATION		CAVING	
	COARSE	3/4- to 3-inches	Dry	Absence of moisture, dusty, dry to touch	Minor	
COBBLE		3-inches to 12-inches	Moist	Damp but no visible water.	Moderate	
BOULDER		> 12-inches	Wet	Saturated, below groundwater	Severe	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

ROCK CLASSIFICATION GUIDELINES

HARDNESS		DESCRIPTION
Very soft	(RH-0)	For plastic material only
Soft	(RH-1)	Carved or gouged with a knife
Moderate	(RH-2)	Scratched with a knife
Hard	(RH-3)	Difficult to scratch with a knife
Very hard	(RH-4)	Rock scratches metal; rock cannot be scratched with a knife
STRENGTH		DESCRIPTION
Plastic		Easily deformable with finger pressure
Friable		Crumbles by rubbing with fingers
Weak		Crumbles only under light hammer blows
Moderately Strong		Few heavy hammer blows before breaking
Strong		Withstands few heavy hammer blows and yields large fragments
Very Strong		Withstands many heavy hammer blows, yields dust and small fragments
WEATHERING		DESCRIPTION
Severe		Rock decomposed; thorough discoloration; all fractures extensively coated with clay, oxides, or carbonates.
Moderate		Intense localized discoloration of rock; fracture surfaces coated with weathering minerals.
Little		Slight and intermittent discoloration of rock; few stains on fracture surfaces.
Fresh		Rock unaffected by weathering
FRACTURING		FRACTURE SPACING
Crushed		Less than 5/8 inch to contains clay
Highly Fractured		5/8 inch to 2 inches
Closely Fractured		2 inches to 6 inches
Moderately fractured		6 inches to 1 foot
Little Fractured		1 foot to 4 feet
Massive		Greater than 4 feet
JOINT SPACING		DESCRIPTION
Papery		Less than 1/8 inch
Shaley or Platey		1/8 inch to 5/8 inch
Very Close		5/8 inch to 3 inches
Close		3 inches to 2 feet
Blocky		2 to 4 feet
Massive		Greater than 4 feet

GLOSSARY

- Alluvial** – Made up of or found in the materials that are left by the water of rivers, streams, floods, etc.
- Bearing pressure** – The total stress transferred from the structure to the foundation, then to the soil below the foundation.
- Bulk density (Soil density)** – The total mass of water and soil particles contained in a unit volume of soil: lb/ft³.
- Coefficient of active earth pressure** – The ratio of the minimum horizontal effective stress of a soil to the vertical effective stress at a single point in a soil mass retained by a retaining wall as the wall moves away from the soil.
- Cohesive soil** – Clay type soil with angles of internal friction close to zero. Cohesion is the force that holds together molecules or like-particles within a substance.
- Colluvium** – A loose accumulation of soil and rock fragments deposited through the action of gravity, such as erosion and soil creep.
- Differential settlement** – The vertical displacement due to settlement of one point in a foundation with respect to another point of the foundation.
- Engineered fill** – Soil used as fill, such as retaining wall backfill, foundation support, dams, slopes, etc., that are to be placed in accordance with engineered specifications. These specifications may delineate soil grain-size, plasticity, moisture, compaction, angularity, and many other index properties depending on the application.
- Excess pore pressure** – That increment of pore water pressures greater than hydro-static values, produced by consolidation stresses in compressible materials or by shear strain; excess pore pressure is dissipated during consolidation.
- Factor of safety** – The ratio of a limiting value of a quantity to the design value of that quantity.
- Fines** – Material by weight passing the U.S. Standard No. 200 Sieve by washed analysis.
- Fluvial** – Produced by the action of rivers or streams.
- Homogenous soil** – A mass of soil where the soil is of one characteristic having the same engineering and index properties.
- In situ** – Undisturbed, existing field conditions.
- Lacustrine** – Of a lake, e.g., the depositional environment of a lake.
- Liquefaction** – The sudden, large decrease of shear strength of cohesionless soil caused by collapse of the soil structure, produced by small shear strains associated with sudden but temporary increase of pore water pressure. Usually a problem in submerged, poorly graded sands within the upper 50 feet of subgrade in earthquake-prone environments.
- Maximum dry density** – A soil property obtained in the laboratory from a Proctor test. Density of soil at 100% compaction.
- Overbank deposit** – Sediment that has been deposited on the floodplain of a river or stream by flood waters that have broken through or overtopped the banks.
- Permeability** – A measure of continuous voids in a soil. The property which allows the flow of water through a soil. See also coefficient of permeability.
- Porosity (Pore space)** – The ratio of the volume of voids to the total volume: unitless or expressed as a percentage.
- Residual soil** – Soil that has been formed in place by rock decay.
- Shear strength** – The maximum shear stress which a soil can sustain under a given set of conditions. For clay, shear strength = cohesion. For sand, shear strength = the product of effective stress and the tangent of the angle of internal friction.
- Surcharge** – An additional force applied at the exposed upper surface of a restrained soil.
- Tuff** – An igneous rock (from molten material) that forms from the debris ejected by an explosive volcanic eruption.
- Unit weight** – The ratio of the total weight of soil to the total volume of a unit of soil: lb/ft³.