



EARTH SCIENCE LLC

5319 University Drive, Suite 20
Irvine, California 92612
(949) 441-0433

December 16, 2025

AutoZone, Inc.

123 South Front Street
Memphis, Tennessee 38103

RE: Transmittal Letter – Geotechnical Report
AutoZone 10703 La Pine, Oregon
51429 Huntington Road
La Pine, Oregon 97739

Please find enclosed the Geotechnical Report (Report) prepared by GN Northern, Inc. for the above-mentioned address. If you have any questions, please contact our office at (949) 441-0433. Thank you.

Respectfully,

Sean Rakhshani

Enclosure:

-Geotechnical Report



GEOTECHNICAL SITE INVESTIGATION REPORT

**NEW AUTOZONE STORE #10703
NEAR 51429 HUNTINGTON ROAD
LA PINE, OREGON**



GNN PROJECT NO. 225-1862

DECEMBER 2025

Prepared for

**EARTH SCIENCE, LLC
5319 UNIVERSITY DRIVE, SUITE 20
IRVINE, CA 92612**



EARTH SCIENCE LLC

Prepared by

**GN NORTHERN, INC.
CONSULTING GEOTECHNICAL ENGINEERS
HERMISTON, OREGON
(541) 564-0991, (509) 248-9798**

*Common Sense Approach to Earth and Engineering
Since 1995*



At GN Northern our mission is to serve our clients in the most efficient, cost-effective way using the best resources and tools available while maintaining professionalism on every level. Our philosophy is to satisfy our clients through hard work, dedication, and extraordinary efforts from all of our valued employees working as an extension of the design and construction team.

December 16, 2025

Earth Science, LLC
5319 University Drive, Suite 20
Irvine, CA 92612

Attention: Sean Rakhshani, Principal

Subject: Geotechnical Site Investigation Report
New AutoZone Store #10703
Near 51429 Huntington Road
La Pine, Oregon

GNN Project No. 225-1862

Dear Mr. Rakhshani,

As requested, GN Northern (GNN) has completed a geotechnical site investigation for a proposed new AutoZone retail store to be constructed near 51429 Huntington Road in La Pine, Oregon.

Based on the findings of our subsurface study, we conclude that the site is suitable for the proposed construction provided that our geotechnical recommendations presented in this report are followed during the design and construction phases of the project. *The site is mapped with 'very high' liquefaction potential; GNN recommends performing a detailed site-specific liquefaction study to evaluate the risk of liquefaction-induced foundation settlement and geophysical Refraction Microtremor (ReMi) survey to determine seismic Site Classification.*

This report describes in detail the results of our investigation, summarizes our findings and presents our recommendations concerning earthwork and the design and construction of foundation, building pad and pavements for the proposed project. It is important that GN Northern provide consultation during the design phase as well as field compaction testing and geotechnical monitoring services during the earthwork phase to ensure implementation of the geotechnical recommendations.

If you have any questions regarding this report, please contact us at 509-248-9798.

Respectfully submitted,

GN Northern, Inc.


Aaron B. Cleveland, LG
Project Geologist
Karl A. Harmon, LEG, PE
Senior Geologist/Engineer

Enclosure

TABLE OF CONTENTS

	<i>Page No.</i>
1.0 EXECUTIVE GEOTECHNICAL SUMMARY.....	1
2.0 PURPOSE AND SCOPE OF SERVICES.....	2
3.0 PROPOSED CONSTRUCTION.....	3
4.0 FIELD EXPLORATION & LABORATORY TESTING.....	3
5.0 SITE CONDITIONS	4
6.0 GEOLOGIC CONDITIONS.....	5
6.1 REGIONAL GEOLOGY.....	5
6.2 FAULTING	5
7.0 SUBSURFACE CONDITIONS	7
7.1 NRCS SOIL SURVEY	7
7.2 GROUNDWATER	7
8.0 SEISMICITY & SEISMIC HAZARDS	8
8.1 SEISMICITY	8
8.2 SEISMIC SHAKING.....	9
8.3 RECORDED SEISMIC ACTIVITY.....	9
8.4 SURFACE-FAULT RUPTURE.....	9
8.5 LIQUEFACTION SUSCEPTIBILITY.....	10
8.6 SEISMIC DESIGN PARAMETERS.....	10
9.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS.....	12
9.1 CLEARING AND DEMOLITION	13
9.2 SITE GRADING	13
9.2.1 Erosion and Sediment Control.....	14
9.3 TEMPORARY EXCAVATIONS	14
9.4 WET WEATHER CONDITIONS.....	14
9.5 UTILITY EXCAVATION, PIPE BEDDING AND TRENCH BACKFILL	15
9.6 SUITABILITY FOR REUSE OF ONSITE SOILS AS ENGINEERED STRUCTURAL FILL	16
9.7 IMPORTED GRANULAR FILL SOILS.....	16
9.8 IMPORTED CRUSHED ROCK STRUCTURAL FILL	16
9.9 COMPACTION REQUIREMENTS FOR ENGINEERED STRUCTURAL FILL	17
9.10 FOUNDATION BEARING SUPPORT & ALLOWABLE BEARING CAPACITY	17
9.10.1 Minimum Dimensions, Embedment and Frost Protection	18
9.10.2 Foundation Bearing Capacity.....	18
9.10.3 Foundation Settlement.....	18
9.10.4 Lateral Resistance.....	19
9.11 CONCRETE SLAB-ON-GRADE FLOORS	19
9.12 LATERAL EARTH PRESSURE	20
9.13 PAVEMENT SUBGRADE PREPARATION & DESIGN SECTIONS	22
9.13.1 Flexible Pavement.....	23
9.13.2 Concrete (Rigid) Pavement.....	24
9.14 SUBGRADE INSPECTION AND COMPACTION VERIFICATION	24
9.15 SUBGRADE PROTECTION	25
9.16 SURFACE DRAINAGE	25
10.0 CONTINUING GEOTECHNICAL SERVICES.....	26
11.0 LIMITATIONS OF THE GEOTECHNICAL SITE INVESTIGATION REPORT.....	27

APPENDICES

APPENDIX I – VICINITY MAP (FIGURE 1) & SITE EXPLORATION MAP (FIGURE 2)

APPENDIX II – EXPLORATORY TEST-PIT LOGS & KEY CHART (FOR SOIL CLASSIFICATION)

APPENDIX III – SITE & EXPLORATION PHOTOGRAPHS

APPENDIX IV – LABORATORY TESTING RESULTS

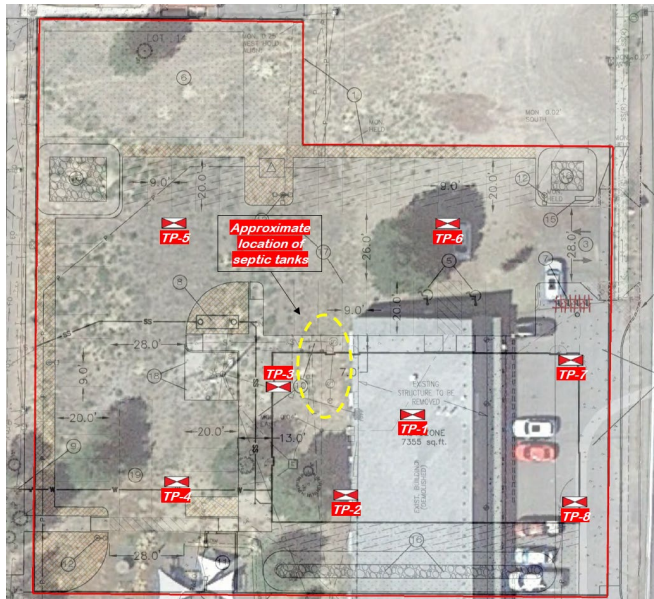
APPENDIX V – ASCE SEISMIC REPORTS & USGS DISAGGREGATION REPORT

APPENDIX VI – NRCS SOIL SURVEY

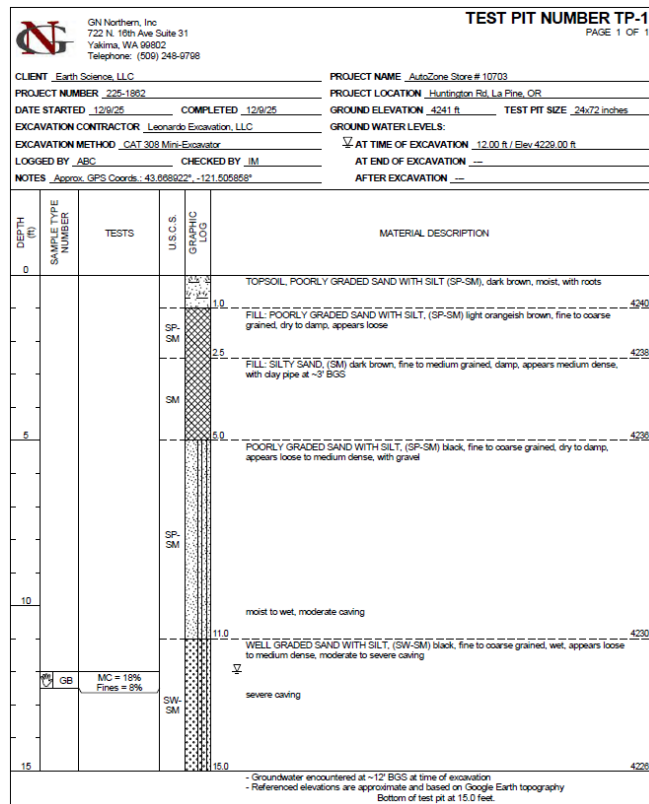
APPENDIX VII – OREGON WATER RESOURCES DEPARTMENT WELL LOGS

1.0 EXECUTIVE GEOTECHNICAL SUMMARY

Site Exploration Plan:



Typical Test-Pit Log (TP-1):



Subsurface Soils:

Undocumented man-made fill material to ~2 to ~6 feet BGS, generally consisting of Poorly Graded Sand w/Silt (SP-SM) with varying amounts of trash and misc. debris. Underlying native soil is fine to medium Silty Sand (SM), fine to coarse Poorly Graded Sand w/Silt (SP-SM) Well-Graded Sand (SW), and Well-Graded Sand w/Silt (SW-SM) with varying amounts of gravel, appears loose to medium dense.

Groundwater:

Encountered at ~12' BGS.

Site Preparation, Demolition & Clearing:

Strip any existing vegetation and roots; fully remove all remnant footings, slabs, pavements, or abandoned utilities; remove any disturbed soils.

Foundation Support:

Remove all existing undocumented man-made fill soils. Scarify and re-compact native sand to min. 95% of ASTM D155. Place suitable onsite soils or imported granular fill as compacted engineered fill to 12" below foundation bottom. Place a minimum 12" of 1½" minus imported crushed rock directly under all foundations. Compact crushed rock to 95% of ASTM D1557.

Slab Support:

Remove all existing undocumented man-made fill soils. Scarify and re-compact native sand to min. 95% of ASTM D155. Place suitable onsite soils or imported granular fill as compacted engineered fill to 6" below slab bottom. Place minimum 6" of ¾" minus imported crushed rock compacted to 95% of ASTM D1557.

Concrete Pavement:

Subgrade mitigation improvement required.
Heavy Duty: 6" concrete slab over 6" base course
Light Duty: 5" concrete slab over 6" base course

Asphalt Pavement:

Subgrade mitigation improvement required.
Heavy Duty: 4" AC over 8" base course
Light Duty: 3" AC over 6" base course

2.0 PURPOSE AND SCOPE OF SERVICES

This report has been prepared for the proposed new AutoZone Store to be constructed at the project site near 51429 Huntington Road in La Pine, Oregon; site location is shown on the *Vicinity Map* (Figure 1, Appendix I). Our investigation was conducted to collect information regarding subsurface soil/groundwater conditions and present recommendations for suitability of the subsurface materials to support the intended improvements and allowable bearing capacity for the proposed construction.

GN Northern, Inc. prepared this report for use by AutoZone, Inc. and Earth Science, LLC in the design and construction of the proposed improvements. Do not use or rely upon this report for other locations or purposes without the written consent of GN Northern, Inc.

Our study was conducted in general accordance with our *Proposal for Geotechnical Site Investigation* dated November 17, 2025, and our understanding of the proposed project based on the information provided by Earth Science, including a ‘Geotechnical Specifications’ document; notice to proceed was provided via a signed copy of the Proposal dated November 19, 2025 authorized by Mr. Rakhshani (PO# 25-2167).

A site plan document (10703 La Pine OR RFP Info.pdf) showing the proposed site layout was provided by Earth Science for our use via email on November 14, 2025. Field exploration, consisting of eight (8) test-pits, was completed on December 9, 2025. The exploratory test-pit locations are shown on the *Site Exploration Map* (Figure 2, Appendix I). Detailed test-pit logs are presented in Appendix II.

This report has been prepared to summarize the data obtained during this study and to present our recommendations based on the proposed construction and the subsurface conditions encountered at the site. Results of the field exploration were analyzed to develop recommendations for site development, earthwork, foundation bearing capacity, and floor slab design. Design parameters and a discussion of the geotechnical engineering considerations related to construction are included in this report.

3.0 PROPOSED CONSTRUCTION

Based on the information provided by the client, we understand that the proposed construction will include a 7,355-SF single-story AutoZone retail store with associated paved parking and drive-lanes. The following table summarizes information provided in the ‘Geotechnical Specifications’ document:

Table 1: Client-Provided Information

Category	Value
Building (7N2 Masonry)	Type: Masonry Area: 7,009 ft ² Length: 115.33 feet Width: 64 feet Height: 19 feet
Foundations	Type: Spread Footings Wall Footings: 24” wide x 12” deep Column Footings: [to be sized] Min. Bearing: 2,000 psf
Floor Slab	Thickness: 5-inch Concrete Strength: 3,000 psi
Loads	Walls: 3.0 kips per linear foot Interior Columns: 37-75 kips Exterior Columns: 20-50 kips Floor Slab: 100 psf
Settlement Tolerance	Total: 1-inch (max.) Differential: ½-inch (max.)
Pavement Design	Design Life: 20 years Heavy Duty: 30,567 18-kip EAL’s Light Duty: 11,279 18-kip EAL’s

4.0 FIELD EXPLORATION & LABORATORY TESTING

The field exploration was completed on December 9, 2025. A local public utility clearance was completed prior to the field exploration. Eight (8) exploratory test-pits were completed at locations selected in general accordance with AutoZone’s criteria outlined within their ‘Geotechnical Specifications’ document. Test-pits were excavated by Leonardo Excavation, LLC using a CAT 308 mini-excavator to depths ranging from approximately 10 to 15 feet below existing ground surface (BGS). The test-pits were logged by a GNN field geologist/engineer. Upon completion, the test-pits were loosely backfilled with excavated spoils. Test-pit locations are shown on *Site Exploration Map* (Figure 2, Appendix I).

The soils observed during our field exploration were classified according to the Unified Soil Classification System (USCS), utilizing the field classification procedures as outlined in ASTM D2488. A copy of the USCS Classification Chart is included in Appendix II. Photographs of the site and exploration are presented in Appendix III. Depths referred to in this report are relative to the existing ground surface elevation at the time of our investigation. The surface and subsurface conditions described in this report are as observed at the time of our field investigation.

Representative samples of the onsite soils obtained from the test-pits, were selected for testing to determine the index properties of the subsurface soils in general accordance with ASTM procedures. The following laboratory tests were performed:

Table 2: Laboratory Tests Performed

Test	To determine
Particle Size Distribution (ASTM D6913)	Soil classification based on proportion of sand, silt, and clay-sized particles
Natural Moisture Content (ASTM D2216)	Soil moisture content indicative of in-situ condition at the time samples were taken

Results of the laboratory tests are included on the test-pit logs and are also presented in graphic form in Appendix IV attached to the end of the report.

5.0 SITE CONDITIONS

The project site is located at/near 51429 Huntington Road in La Pine, Oregon. The ~0.94-acre site generally aligns with Tax Lot 600 of Tax Map 221015AD. The site is situated in the SE ¼ of the NE ¼ of Section 15, Township 22 South and Range 10 East, Willamette Meridian. The project site is bound to the west by Morson Street, to the east by Huntington Road, to the northeast and south by currently-vacant commercial properties, and to the northwest by a CenturyLink facility. The majority of the project site is relatively flat and generally level with the sidewalk grade along Huntington Road. Surface conditions generally consist of remnant asphalt and concrete cover in the southeastern portion and a moderate growth of brush/weeds across the remainder of the site with sparse trees on the western portion. Two exposed septic tanks are present near the center of the site, slightly outside the proposed building footprint. Other buried utilities at the project site include, but may not be limited to, power and telecommunications (fiber optics) lines.

6.0 GEOLOGIC CONDITIONS

6.1 Regional Geology

The project site, located in the High Lava Plains Geologic Province, is situated within the La Pine Basin in the Little Deschutes River Valley near the eastern foothills of the Cascade Mountains. This high desert area has been defined by extensive volcanic activity including significant ash deposits from Mt. Mazama and multiple lava flows from the Newberry Volcano. The Newberry Volcano, a large shield volcano located a few miles east of La Pine, is one of the largest Quaternary volcanos in the contiguous United States. This volcano is considered active and has erupted multiple times in the last 10,000 years, most recently, about 1,300 years ago. Other volcanic features in the area include hundreds of Cinder Cones and Buttes including Lava Butte, Finley Butte and Pringle Butte, as well as extensive lava fields of basaltic and rhyolitic lava flows.

The La Pine region is primarily characterized by substantial lacustrine and volcanic ash deposits, with the underlying bedrock largely consisting of basalt and rhyolite formations. Based on the map of the *Cooperative National Geologic Map*, (USGS), the project area is mapped as Quaternary-age lacustrine deposits (Ql). This unit is described as undifferentiated lacustrine sediments of well sorted/poorly graded gravel, sand, silt. and clay.

6.2 Faulting

There are eighteen (18) Quaternary-age Class A faults or fault systems identified within 100 kilometers of the project site as listed below in Table 3. The table below provides distances from the site as well as pertinent information about the fault. The nearest Quaternary fault to the site includes the various segments of the La Pine Graben faults (USGS Fault No. 838) with the most recent deformation notes as late quaternary (<130,000 years), located within about 5-km west of the project site.

Table 3: Faults Within 100 km of Site

Fault Name	USGS Fault No.	Fault Class	Distance From Site	Average Strike	Dip Direction	Most Recent Deformation	Slip Rate (mm/yr)
La Pine graben faults	838	A	~5 km	N40°E	W;E	<130 ka	<0.2
Chemult graben fault system	839a	A	~15 km	N7°E	E;W	<130 ka	<0.2
	839b	A	~19 km	N7°E	W	<1.6 ma	<0.2
unnamed fault near Lookout Butte	1808	A	~82 km	N19°E	W	<1.6 ma	<0.2
Unnamed faults near Antelope Mountain	836	A	~34 km	N36°W	SW	<1.6 ma	<0.2
Unnamed faults north of Diamond Lake	854	A	~47 km	N0°E	W	<130 ka	<0.2
Klamath fault graben system	843a	A	~73 km	N17°W	E;W	<130 ka	0.2 to 1.0
Paulina Marsh faults	834	A	~49 km	N25°W	SW	<15 ka	0.2 to 1.0
Faults north of Summer Lake	533	A	~75 km	N10°W	SW	<750 ka	<0.2
Unnamed faults near Millican Valley	841	A	~42 km	N54°W	SW	<750 ka	<0.2
Sisters fault zone	852	A	~41 km	N26°W	E	<130 ka	<0.2
Unnamed faults near Kiwa Butte	842	A	~28 km	N45°W	NE	<1.6 ma	<0.2
Metolius fault Zone	853a	A	~77 km	N11°W	W	<750 ka	<0.2
	853b	A	~38 km	N29°W	SW	<1.6 ma	<0.2
	853c	A	~24 km	N26°W	SW	<1.6 ma	<0.2
White Branch fault zone	1809	A	~57 km	N6°E	E	<750 ka	<0.2
Winter Rim fault system	831	A	~94 km	N4°W	SE	<15 ka	0.2 to 1.0
Southwest Newberry fault zone	837	A	~20 km	N41°E	SE	<750 ka	<0.2

*ka= kilo annum= 1,000 years

*ma= mega annum= 1,000,000 years

7.0 SUBSURFACE CONDITIONS

Based on the findings of our field exploration, subsurface soils at the project site consists of undocumented man-made fill soils in the upper approximately 2 to 6 feet. Test-pits TP- 2, TP-3, and TP-4 were all moved to avoid marked/existing underground utilities. The fill material was generally classified as Poorly Graded Sand with Silt (SP-SM) and Silty Sand (SM) with varying amounts of misc. trash and debris (pipe, cinder blocks, etc.). The native underlying soils were classified as fine- to medium-grained Silty Sand (SM), fine- to coarse-grained Poorly Graded Sand with Silt (SP-SM), Well-Graded Sand (SW) and Well-Graded Sand with Silt (SW-SM) with varying amounts of gravel. The native sandy soils typically appeared loose to medium dense. Test-pit logs in Appendix II show detailed descriptions and stratification of the soils encountered.

7.1 NRCS Soil Survey

The soil survey map of the site prepared by the Natural Resources Conservation Service (NRCS) identifies the near surface site soils as *Shanahan loamy coarse sand, low, 0 to 3 percent slopes* with parent material described as *volcanic ash over old alluvium*. The typical soil profile is described as *slightly decomposed plant material over loamy coarse sand atop gravelly loamy coarse sand above coarse sand over loamy coarse sand atop sandy loam overlying gravelly sandy loam over very gravelly coarse sand*. According to the soil survey map (Appendix VI), this unit generally consists of *somewhat excessively drained* materials. NRCS data indicates that the capacity of the most limiting layer in these soils to transmit water (Ksat) is *high* (1.98 to 5.95 in/hr).

7.2 Groundwater

Groundwater was encountered within the exploratory test-pits at a depth of about 12 feet BGS. To further assist in our evaluation, we reviewed the Oregon Water Resources Department database of nearby well logs to estimate groundwater levels in the vicinity of the site. Based on our review of available data, groundwater has been noted at depths ranging from 12 to 17 feet BGS in the area; well logs are included in Appendix VII. Groundwater levels will fluctuate with precipitation, irrigation, drainage, and regional pumping from wells. Groundwater should not be a factor in design and construction at this site.

8.0 SEISMICITY & SEISMIC HAZARDS

8.1 Seismicity

The seismicity of the site is controlled by the Cascadia Subduction Zone (CSZ), the Chemult graben fault system, Southeast Newberry fault zone, and the Metolius fault zone. Contributions from each of these sources to the total site seismic hazard were evaluated using the U.S. Geological Survey (USGS) Unified Hazard Tool.

Intraslab & Interface Sources: Subduction zones are characterized by the interaction of the oceanic Juan de Fuca Plate and continental North American Plate. As the oceanic plate subducts beneath the continental plate, the two plates lock together. As the plates move together, stresses that can be thought of as similar to a spring build in the overlying continental plate. When the magnitude of the stress becomes large enough to overcome the stresses locking the plates together, the plates will suddenly rupture causing an interface earthquake. Interface earthquakes are some of the largest magnitude earthquakes on record.

Intraslab earthquakes originate from a deeper zone of seismicity that is associated with bending and breaking of the subducting Juan de Fuca Plate. Intraslab earthquakes (such as the 2001 magnitude M7.0 Nisqually earthquake in west central Washington) occur at depths of 40 to 70 kilometers (km) and can produce earthquakes with magnitudes up to and greater than magnitude M7.0.

The 2019 Oregon Structural Specialty Code (OSSC, 2019) requires the consideration of an earthquake on the seismogenic part of the CSZ interface with a minimum magnitude of 8.5 (1803.3.2.1(3), Design Earthquake), which likely corresponds to a 10 percent chance of being exceeded in 50 years. A moment magnitude event of 9.0 likely corresponds to a 2 percent chance of being exceeded in 50 years. The 2019 OSSC requires the consideration of a deep earthquake on the seismogenic part of the subducting CSZ with a moment magnitude greater than 7 (1803.3.2.1(2), Design Earthquake).

Crustal Sources: Shallow crustal faults are caused by cracking of the continental crust resulting from the stress that builds as the subduction zone plates remain locked together. A number of small crustal faults are mapped within 100 km of the site. The nearest significant faults are La Pine

graben faults, Chemult Graben faults, Southeast Newberry fault zone, and the Metolius faults, located approximately 5 km, 15 km, 24 km, and 24 km from the site, respectively.

8.2 Seismic Shaking

We evaluated potential seismic shaking at the site using both the ASCE 7-16 and ASCE 7-22 site class along with data obtained from the USGS National Seismic Hazard Mapping Project website (USGS 2019a). Based on a “Site Class D”, the expected peak bedrock acceleration having a 2 percent probability of exceedance in 50 years (2,475-year return period) is 0.2697g.

We also evaluated a disaggregation of the data found at USGS (2019b) used in determining the anticipated peak bedrock acceleration at the site (Appendix V). The data indicates that the “mean source” for shaking at the site, based on a Site Class D, is a magnitude 7.19 earthquake with an epicenter approximately 74.36 kilometers (km) from the site. The “modal source” is a magnitude 7.11 earthquake with an epicenter approximately 26.3 km from the site. The mean value represents the “design level” earthquake, while the modal value represents the most likely actual scenario to be encountered by the structure. Seismic sources contributing to this potential ground shaking included intraplate (e.g., Cascadia Subduction Zone), interplate, and crustal faults.

8.3 Recorded Seismic Activity

The La Pine region is generally situated within an area of relatively low to moderate seismic activity. Within 100 km of the site there have been no historic earthquakes greater than magnitude 4.0 in the last 100 years. The nearest earthquake to the site was the 2.6 magnitude earthquake identified by the USGS as *M 2.6 - 17 km West of Three Rivers Oregon*, which was approximately 20 km northwest. The most recent recorded earthquake within 100 km of the site was the 2.7 magnitude earthquake identified by the USGS as *M 2.7 Explosion – 6 km SW of Prineville, Oregon*, located about 82 km northeast of the site occurred on January 29, 2025.

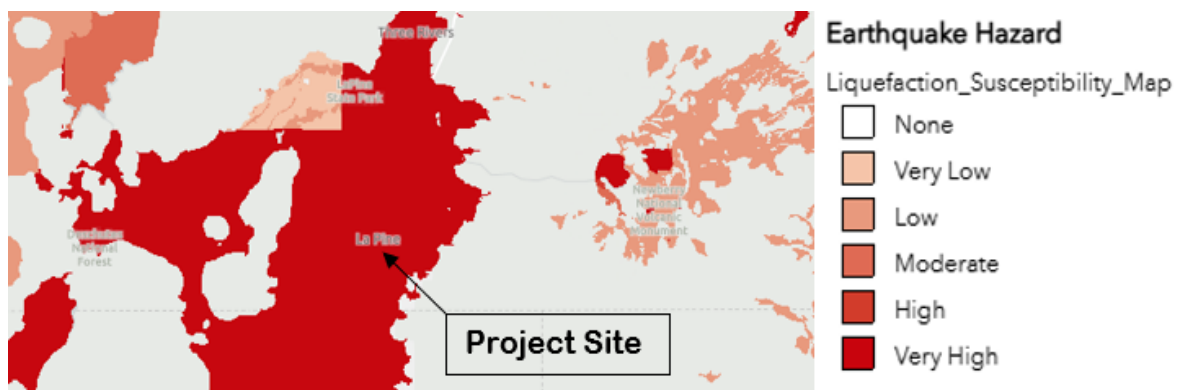
8.4 Surface-Fault Rupture

For the purposes of this report, an “active fault” is defined as a fault that has had displacement within the Holocene epoch or last 11,000 years. There are no known active faults that are mapped to cross the subject site. The closest Quaternary faulting includes the various segments of the of the La Pine graben faults (<130,000 years), located within about 5-km west of the project site. Hence,

based on review of the USGS Earthquake Hazards Program Quaternary Faults and Folds Database, the hazard of damage from fault rupture appears to be *low* at the project site.

8.5 Liquefaction Susceptibility

Liquefaction is the loss of soil strength from sudden shock or vibration (usually earthquake shaking), causing the soil to become a fluid mass. Liquefaction results in a loss of soil strength and can cause the structure/utility to settle if it occurs in the bearing zone. Soil liquefaction is a natural phenomenon that occurs when saturated granular soils (below the water table) are subjected to vibratory motions, causing an increase in the water pressure within soil pores, as the soil tends to reduce in volume. When the pore water pressure reaches the vertical effective stress, the soil particles become suspended in water causing a complete loss in soil strength.



Based on the Oregon Department of Geology and Mineral Industries (DOGAMI) Oregon HazVu: Statewide Geohazards Viewer (see image above), the site lies within mapped zone of ‘**very high**’ relative susceptibility for seismically induced liquefaction to occur. A detailed assessment of the liquefaction potential at the site, including liquefaction-induced settlement, is beyond the current scope of this study.

GNN recommends performing a detailed site-specific liquefaction evaluation that would include a 50-foot-deep exploratory soil boring with continuous SPT sampling beneath the groundwater table to assess the risk of liquefaction-induced foundation settlement.

8.6 Seismic Design Parameters

As per the 2021 International Building Code (IBC), the “Site Class” is a classification based on the properties of the upper 100 feet of the soil and bedrock materials at a site. Oregon Department of

Geology and Mineral Industries (DOGAMI) Oregon HazVu: Statewide Geohazards Viewer, the seismic site class is mapped as Site Class E/F (see image below). We recommend a site-specific Geophysical survey (Refraction Microtremor survey- ReMi) be conducted to determine the appropriate site class and seismic design parameters.



Based on the limited subsurface conditions observed during our site exploration, in our opinion a **Site Class D** may be used as a default value unless otherwise recommended by the structural engineer. Site Class D corresponds to ‘stiff soil’. Seismic parameters for a code-based response spectrum with a return period of 2,475 years based on ASCE/SEI 7-16 and 7-22 were obtained for the project site (Latitude: 43.668985°N / Longitude: 121.505959°W) using the online ASCE Hazard Tool (ascehazardtool.org). The following tables present recommended site-specific seismic design parameters:

Table 4a: ASCE 7-16 Code-Based Seismic Design Parameters (Site Class D)

Seismic Design Parameter	Value (unit)	Definition
S_S	0.425 (g)	MCE mapped spectral response acceleration at short periods
S_1	0.215 (g)	MCE mapped spectral response acceleration at 1-second period
F_a	1.46	Site coefficient for spectral response acceleration at short periods
F_v	N/A	Site coefficient for spectral response acceleration at 1-second period
S_{MS}	0.62 (g)	MCE spectral response acceleration at short periods as adjusted for site effects
S_{M1}	N/A	MCE spectral response acceleration at 1-second period as adjusted for site effects
S_{DS}	0.414 (g)	Design spectral response acceleration at short periods
S_{D1}	N/A	Design spectral response acceleration at 1-second period
PGA	0.194 (g)	Site modified peak ground acceleration
PGA_M	0.274 (g)	MCE geometric mean peak ground acceleration

Table 4b: ASCE 7-22 Code-Based Seismic Design Parameters (Site Class D)

Seismic Design Parameter	Value (unit)	Definition
S_S	0.47 (g)	MCE mapped spectral response acceleration at short periods
S_1	0.18 (g)	MCE mapped spectral response acceleration at 1-second period
S_{MS}	0.66 (g)	MCE spectral response acceleration at short periods as adjusted for site effects
S_{M1}	0.48 (g)	MCE spectral response acceleration at 1-second period as adjusted for site effects
S_{DS}	0.44 (g)	Design spectral response acceleration at short periods
S_{D1}	0.32 (g)	Design spectral response acceleration at 1-second period
PGA_M	0.27 (g)	MCE geometric mean peak ground acceleration

9.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following preliminary geotechnical recommendations are based on our current understanding of the proposed project depicted on the provided site plan and the ‘Geotechnical Specifications’ document provided by Earth Science LLC. Note that Soil Design Parameters and Recommendations presented in this report are predicated upon appropriate geotechnical monitoring and testing of the site preparation and foundation and building pad construction by a representative of GNN’s **Geotechnical-Engineer-of-Record (GER)**. Any deviation and nonconformity from this requirement may invalidate, partially or as a whole, the following recommendations.

We recommend that GNN should be engaged to review the geotechnical aspects of the approximately 95 percent plans and specifications (grading and foundation plans) for conformance with the intent of our recommendations and provide revised, augmented, and/or additional geotechnical recommendations as needed.

The recommendations provided in this report are considered preliminary, pending the results of site-specific liquefaction analysis. Depending on the magnitude of liquefaction-induced settlement, building pad and foundation recommendations may require revisions/modifications.

9.1 Clearing and Demolition

At the start of site grading, any existing vegetation or topsoil, existing pavements, undocumented man-made fill, buried building remnants, any underground utilities or other miscellaneous debris shall be fully removed from within and extending a minimum 2 feet beyond proposed development footprints. Deeper, and possibly shallower, stripping depths may be necessary as identified by GNN during earthwork grading. Depth of stripping can be minimized with real-time onsite observation of sufficient removals. The strippings are not suitable for use in engineered fill. Strippings may be used in landscaped areas or deposited off-site. Areas disturbed during clearing and grubbing shall be properly backfilled and compacted in accordance with the recommendations of this report.

9.2 Site Grading

Site grading shall incorporate the requirements of IBC 2021 Appendix J. The project GER or a representative of the GER should observe site clearing, grading, and the bottoms of excavations before placing fills. Local variations in soil conditions may warrant increasing the depth of over-excavation and recompaction. Seasonal weather conditions may adversely affect grading operations. To improve compaction efforts and prevent potential pumping and unstable ground conditions, we suggest performing site grading during dryer periods of the year.

Soil conditions shall be evaluated by in-place density testing, visual evaluation, probing, and proof-rolling of the imported fill and re-compacted on-site soil as it is prepared to check for compliance with recommendations of this report. A moisture-density curve shall be established in accordance with the ASTM D1557 method for all onsite soils and imported fill materials used as structural fill.

Each test-pit was loosely backfilled during our site investigation. During site development, the earthwork contractor is required to re-excavate the test-pits and backfill the excavations with suitable fill material and compact as appropriate for the location within the building/structure pads and hardscape areas.

9.2.1 Erosion and Sediment Control

Erosion and Sediment Control measures should be taken to minimize the transportation of sediment to drainage systems and adjacent properties and these measures should be in general accordance with local regulations and Best Management Practices (BMPs).

9.3 Temporary Excavations

It shall be the responsibility of the contractor to maintain safe temporary slope configurations since the contractor is at the job site, able to observe the nature and conditions of the slopes, and able to monitor the encountered subsurface conditions. Unsupported vertical cuts deeper than 4 feet are not recommended if worker access is necessary. The cuts shall be adequately sloped, shored, or supported to prevent injury to personnel from caving and sloughing. The contractor and subcontractors shall be aware of, and familiar with, applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards, and OSHA Health and Safety Standards for Excavations, 29 CFR Part 1929, or successor regulations.

It is our opinion that the soils encountered at the site are classified as **Type C soils**. Determination of soil type shall be performed by the onsite competent person as soil conditions are exposed. For excavation planning purposes, we recommend that temporary, unsupported, open cut slopes shall be no steeper than 1.5 feet horizontal to 1.0 feet vertical (1.5H:1V). No heavy equipment should be allowed near the top of temporary cut slopes unless the cut slopes are adequately braced. Final (permanent) fill slopes should be graded to an angle of 2H:1V or flatter. We recommend that permanent slopes be hydroseeded and/or planted with vegetation after construction. Where unstable soils are encountered, flatter slopes may be required. We recommend protecting slopes with waterproof covering during periods of wet weather to reduce sloughing and erosion.

The native sandy soils will be prone to caving in open excavations/trenches. Stability of open excavations, such as deeper utility trenches, shall be achieved by widening the excavation or other suitable means and methods. Trench box is a suitable option at this site.

9.4 Wet Weather Conditions

Contractor should employ best management construction practices as well as means and methods to protect subgrade during and after an extended wet weather period which may require importing and placement of granular materials and geosynthetic for subgrade stabilization. We recommend

that excavation and structural fill placement should be observed on a full-time basis by a representative of the GER to confirm that unsuitable materials are removed, and that suitable compaction and site drainage is achieved.

9.5 Utility Excavation, Pipe Bedding and Trench Backfill

To provide appropriate support and bedding for the pipe, we recommend the utilities be founded on suitable bedding material consisting of clean sand and/or sand & gravel mixture. Pipe bedding should provide a firm uniform cradle for support of the pipes. A minimum 4-inch thickness of bedding material beneath the pipe should be provided. Prior to installation of the pipe, the pipe bedding should be shaped to fit the lower part of the pipe exterior with reasonable closeness to provide uniform support along the pipe. Pipe bedding material should be used as pipe zone backfill and placed in layers and tamped around the pipes to obtain complete contact. To protect the pipe, bedding material should extend at least 6 inches above the top of the pipe, however initial lift thickness could be increased to levels recommended by the manufacturer to protect utilities from damage by compacting equipment.

Placement of bedding material is particularly critical where maintenance of precise grades is essential. Backfill placed within the first 12 inches above utility lines should be compacted to at least 90% of the maximum dry density (ASTM D1557), such that the utility lines are not damaged during backfill placement and compaction. In addition, rock fragments greater than 1 inch in maximum dimension should be excluded from this first lift. The remainder of the utility excavations should be backfilled and compacted to 95% of the maximum dry density as determined by ASTM D1557.

Gravel backfill for the bedding zone, pipe zone material, and trench backfill shall meet the *Oregon Department of Transportation Standard Specifications for Construction 2021* (ODOT-SS) 00405. Onsite soils may be considered suitable for utility trench backfill provided they are free of significant organic matter and oversized material and can be adequately compacted. All excavations should be wide enough to allow for compaction around the haunches of pipes. We recommend that utility trenching, installation, and backfilling conform to all applicable federal, state, and local regulations such as OSHA for open excavations.

Compaction of backfill material should be accomplished with soils within $\pm 2\%$ of their optimum moisture content in order to achieve the minimum specified compaction levels recommended in this report. Backfill operations shall be observed and tested to monitor compliance with these recommendations.

9.6 Suitability for Reuse of Onsite Soils as Engineered Structural Fill

The onsite sandy native and fill soils, free of deleterious materials including roots, organic matter, and oversize rocks (>4 inches), are generally suitable for reuse as engineered structural fill and utility trench backfill. The onsite sandy fill soils include trash/debris and will require screening/processing to be made suitable for re-use. The onsite soils shall be placed in maximum 8-inch lifts (loose) and compacted to at least 95% relative compaction (ASTM D1557) near its optimum moisture content. Compaction of onsite soils shall be performed within a range of $\pm 2\%$ of optimum moisture to achieve the proper degree of compaction.

9.7 Imported Granular Fill Soils

If needed, imported fill material should be pit or quarry run rock or crushed gravel and sand and should meet the specifications provided in ODOT SS 00330.14 – Selected Granular Backfill. The imported granular material should be well-graded between coarse and fine material and have less than 10% by weight passing the #200 sieve size.

9.8 Imported Crushed Rock Structural Fill

Imported crushed rock structural fill shall consist of well-graded, crushed aggregate material meeting the grading and quality requirements of ODOT SS 02630.10 (Dense-Graded Aggregate, 1½ inch minus) presented below:

Table 5: ODOT Standard Spec. Table 02630-1 (Dense-Graded Aggregate, 1½")

Sieve Size	Percent Passing (by Weight)
2 Inch Square	100
1½ Inch Square	95 – 100
¾ Inch Square	55 – 75
¼ Inch Square	35 – 50
U.S. No. 10	*

* Of the fraction passing the ¼ inch sieve, 40-60% shall pass the No. 10 sieve

A sample of each imported fill material shall be collected by GNN personnel prior to placement to ensure proper gradation and establish a moisture-density relationship (proctor curve).

9.9 Compaction Requirements for Engineered Structural Fill

All fill or backfill shall be approved by a representative of the GER, placed in uniform lifts, and compacted to a minimum 95% of the maximum dry density as determined by ASTM D1557. The compaction effort must be verified by a representative of the GER in the field using a calibrated nuclear density gauge in accordance with ASTM D6938. The thickness of the loose, non-compacted, lift of structural fill shall not exceed 8 inches for heavy-duty compactors or 4 inches for hand operated compactors.

9.10 Foundation Bearing Support & Allowable Bearing Capacity

Based on the findings of our site investigation, undocumented man-made fill material is present across the planned building footprint to depths of about 3 to 6 feet BGS. Foundation and building pad subgrade improvements will be required to minimize the risk of differential settlement.

In our opinion, the proposed building structure may be supported on conventional spread foundations bearing on a minimum of 12 inches of imported crushed rock structural fill placed atop suitable/screened onsite sourced soils or imported granular fill placed as engineered structural fill over recompacted native sandy soils. Prior to placement of engineered structural fill soils or crushed rock, foundation and building pad excavations shall be extended to expose the native sandy subgrade by complete removal of all existing undocumented fill material to a uniform depth of 6 feet BGS. Buried within the proposed building footprint, east of test-pit TP-3 near the northwestern corner of the currently planned building footprint, are 2 exposed septic tanks, and this portion will therefore require deeper over-excavation for full removal of the existing tanks and all undocumented fill soils.

Once confirmed by a representative of the GER, the native subgrade at the bottom of the foundation over-excavation shall be scarified minimum 12 inches, moisture-conditioned, and compacted to a minimum 95% of the maximum dry density as determined by ASTM D1557. Foundation excavations shall be backfilled with suitable onsite soils or imported granular fill soils placed as compacted engineered fill (see Section 8.6, 8.7 & 8.9) to 12 inches below the footing bottom elevations. Imported 1½-inch minus crushed rock structural fill shall be placed within the 12-inch zone directly below all footings (see Section 8.8 & 8.9).

9.10.1 Minimum Dimensions, Embedment and Frost Protection

Continuous wall and isolated spread footings should be at least 18 and 24 inches wide, respectively. The minimum footing depth shall be 24 inches below adjacent exterior finished grade for frost heave protection and bearing capacity considerations.

9.10.2 Foundation Bearing Capacity

Footings constructed in accordance with the above recommendations may be designed for an allowable bearing pressure of **2,000 pounds per square foot (psf)**. This value represents net bearing pressure; the weight of the foundation and overlying backfill can be ignored in calculating footing sizes. The recommended allowable bearing pressure applies to the total of dead plus long-term live loads and may be increased by one-third for short-term transient loading conditions such as wind or seismic forces. Footings adjacent to or along utility trenches shall be founded below an imaginary line projecting at a 1H:1V slope from the base of the utility trench.

The base of all foundation excavations should be free of water and loose soil. Excessively wet or any loose/disturbed material in the bottom of the footing excavations should be removed before foundation concrete is placed. If foundation subgrades become disturbed, or are otherwise deemed unsuitable by the GER, over-excavation of the unsuitable material and replacement (backfill) with compacted structural fill should be performed up to the footing base elevation per the recommendations of this report.

9.10.3 Foundation Settlement

Provided footing subgrades are prepared in accordance with the recommendations presented in this report, total post-construction static settlement for conventional foundation system should be less than 1-inch. We anticipate differential settlement will be about half of total settlements between adjacent columns and along approximately 40 feet of continuous footings. We assume there is no stress overlap from adjacent footings. Footings located less than two times the footing width (2B) from each other will increase stresses beneath the adjacent footing, resulting in increased settlement.

Footings, foundations, and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential movement. The use of joints at opening or other discontinuities in masonry walls is recommended.

9.10.4 Lateral Resistance

Lateral forces on foundations from short term wind and seismic loading would be resisted by friction at the base of foundations and passive earth pressure against the buried portions. An allowable passive pressure of **250 pcf** (equivalent fluid unit weight) can be used for the onsite soils placed directly against the vertical footing face. Adjacent floor slabs, pavements, or the upper 24-inch depth of adjacent unpaved areas should not be considered when calculating passive resistance.

We recommend an ultimate coefficient of sliding friction of **0.45** be used between cast-in-place concrete and the imported crushed rock surface. The passive earth pressure and friction components may be combined, provided the passive component does not exceed two-thirds of the total. An appropriate factor of safety should be used to calculate sliding resistance at the base of footings.

9.11 Concrete Slab-on-Grade Floors

We recommend placing a minimum 6-inch layer of $\frac{3}{4}$ " minus crushed aggregate fill beneath the slabs. Material shall meet ODOT-SS 02630-1, provided it contains less than 5% passing the No. 200 sieve (fines). The crushed rock material shall be compacted to at least 95% of the maximum dry density as determined by the ASTM D1557 method. Prior to placing crushed rock, all existing undocumented man-made fill soils shall be completely removed from within the building slab areas to expose the underlying native sandy soils. This will require a uniform over-excavation to a depth of 6 feet BGS across the building pad, extending 2 feet beyond all sides. The exposed native subgrade shall be scarified, moisture conditioned and proof-rolled with a minimum 25-ton smooth drum roller to a dense and non-yielding surface and to at least 95% of the maximum dry density as determined by ASTM D1557 method. Any areas pumping during proof-compaction shall be over-excavated an additional 12-inches and replaced with suitable onsite soils or imported granular fill placed as compacted structural fill. Slab subgrade over-excavations shall be backfilled with suitable onsite soils or imported granular fill soils placed as compacted engineered fill (see Section 8.6, 8.7 & 8.9) to 6 inches below the slab bottom elevation. We recommend a modulus of subgrade reaction

equal to **120 pounds per cubic inch (pci)** based on a value for gravel presented in the Portland Cement Association Publication No. EB075.01D. Slab thickness, reinforcement and joint spacing shall be determined by a licensed engineer based on the intended use and loading.

The architect and design team should evaluate whether a vapor barrier is needed under the new slab areas receiving moisture sensitive resilient flooring/VCT. A vapor barrier will reduce the potential for moisture transmission through and efflorescence growth on the floor slabs. Additionally, flooring manufacturers require vapor barriers to protect flooring and flooring adhesives and will warrant their product only if a vapor barrier is installed according to their recommendations. Actual selection and design of an appropriate vapor barrier should be based on discussions between the architect and members of the design team. The slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder. The architect shall determine the need and use of a vapor barrier.

9.12 Lateral Earth Pressure

Recommended lateral earth pressures, in terms of equivalent fluid pressure, for design of retaining walls or below-grade structures are presented in Table 5. These values are for retained soils and engineered structural backfill consisting of imported granular fill and are valid for static loading cases only and assume that the structural wall backfill is adequately drained to avoid saturation and introduction of hydrostatic pressures. The recommended design lateral earth pressures do not include a factor of safety.

In order to develop an active condition, the wall must rotate about base, with top lateral movements of 0.002 H to 0.004 H. For at-rest pressure, no movement is assumed; use at-rest pressures for restrained or braced walls. For passive earth pressure, walls must move horizontally to mobilize resistance. The horizontal resultant force (pressure $\times$ H/2, where H = height of buried wall) should be applied at an H/3 distance from the base of the wall.

Table 6: Lateral Earth Pressure Design Parameters

Retained Soil	Equivalent Fluid Unit Weight for Level Backfill, (pcf)		Moist Unit Weight, (pcf)	Internal Friction Angle (Drained)
	At-rest	Active		
Onsite Sandy Soils	58	38	120	31°
Granular Structural Backfill / Drain Rock Material	56	35	135	36°

1. No safety factor is included in these values
2. Retained material may include engineered structural backfill or undisturbed native soil. Structural wall backfill should consist of imported free draining granular material. Backfill should be prepared and compacted to at least 95 percent of maximum dry density as determined by the modified Proctor test (ASTM D1557).
3. The granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.
4. The upper 6 inches of soil should be neglected in passive pressure calculations. If exterior grade from top or toe of retaining wall is sloped, GNN should be contacted to provide location-specific lateral earth pressures
5. For sloped backfill conditions, GNN should be contacted for additional analysis and recommendations.

If any surface, surcharge loads are closer than one-half of the wall height (horizontal distance) to the edge of the below-grade and/or retaining wall, increase the design wall pressure by $q/2$ over the whole area of the retaining wall. In this expression, q is the surface surcharge load in psf. GNN should review anticipated surcharge loading to confirm that the appropriate design values are considered. The horizontal surcharge resultant force (pressure x H, where H is height of buried wall) should be applied at an H/2 distance from the base of the wall.

Wall Drainage: Retaining structures should include adequate back drainage to avoid build-up of hydrostatic pressures. Positive drainage for retaining walls should consist of a vertical layer of permeable material (chimney drain), such as a pea gravel or crushed rock (typically 1/4- to 3/4-inch crushed), at least 18 inches thick, positioned between the back of wall and the backfill and extend up to within 12 inches of finished grade where it should be capped with compacted low permeability fill to reduce infiltration of surface water into the drain system.

We recommend the select granular wall backfill be separated from general fill and/or native soil using an appropriate drainage geotextile filter fabric. A non-woven filter fabric such as Mirafi 140N is typically used for this application.

A 4-inch perforated rigid PVC drainpipe shall be embedded at the base of the drain rock. The drainpipe should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less

than 3 percent passing the No. 200 sieve. The free-draining aggregate should be encapsulated in a filter fabric.

Backfill and Subgrade Compaction: Compaction on the retained side of the wall within a horizontal distance equal to 5 feet should be performed by hand-operated or other lightweight compaction equipment. This is intended to reduce potential locked-in lateral pressures caused by compaction with heavy grading equipment. Retaining wall foundation subgrade improvements and design shall be constructed in accordance with the recommendations of this report.

9.13 Pavement Subgrade Preparation & Design Sections

Due to the presence of undocumented man-made fills throughout the project site, remedial grading will be required to minimize the risk of pavement distress. We recommend that the new pavement section be constructed on an improved subgrade. Due to the presence of undocumented fills soils that include some miscellaneous debris, the pavement subgrade over-excavation shall be completed in accordance with one of the following two options:

- (1) Pavement areas shall be fully over-excavated to remove the historic fill soils. Based on our site exploration, we anticipate that the maximum depth of excavation could be as great as approximately 6 feet.
- (2) Excavate the proposed pavement areas to a minimum depth of 18 inches BGS. We recommend installing a Tensar TX160 geogrid at the bottom of the over-ex. It must be understood that if this option is selected, the owner must accept some risks related to future distresses to the pavements including the potential for settlement and cracking.

After appropriate over-excavation is complete and confirmed by a representative of the GER, the exposed native subgrade shall be moisture-conditioned and compacted to a dense and non-yielding surface. After a suitable subgrade is confirmed by a representative of the GER, the over-excavation shall be backfilled with engineered structural fill soil consisting of suitable onsite soil or imported granular fill material. Engineered structural fill soils shall be placed in max. 8-inch thick loose lifts and each lift compacted to 95% of ASTM D1557.

9.13.1 Flexible Pavement

Pavement analyses are based on *1993 AASHTO Guide for Design of Pavement Structures*. Table 7 presents recommended pavement sections for this project:

Table 7: Recommended Asphalt Concrete Paving Sections

Traffic Application	Asphalt Thickness (inches)	Crushed Aggregate Base Course (inches)	Subgrade Preparation
Heavy Duty [†]	4	8*	upper min. 12 inches scarified, moisture conditioned and re-compacted to at least 95% of the maximum dry density as determined by ASTM D1557
Light Duty ^{††}	3	6*	

[†]Heavy duty applies to pavements section for entrance drives, and trash enclosure drive lanes

^{††}Standard duty applies to general parking areas

*The upper 2" of crushed rock should be top course rock placed over the base course layer

Pavement design recommendations assume proper and positive drainage and construction monitoring and are based on AASHTO Design parameters for a 20-year design period. Asphalt pavements tend to develop thermal and fatigue cracking over time from environmental factors and traffic loads. Asphalt, being a viscoelastic material, weakens from temperature influx. Timely preventative measures for continual flexible maintenance such as crack filling and seal coating at 8-10 year intervals to control the progression of surface cracking and distress to prevent water from infiltrating into the base course and subgrade shall be considered. Performing this intermediate level of maintenance will net at least a 20-year service life/performance life.

The base course rock shall be placed in 6-inch lifts and each lift shall be compacted to at least 95% of the maximum dry density as determined by ASTM D1557 method. The asphalt cement binder should be PG 64-22 Performance Grade Asphalt Cement according to ODOT-SS 00744.11 - Asphalt Cement and Additives. The AC should consist of dense graded Level 3, ½-inch hot mix asphalt. The minimum lift thickness should be 2-inches. The AC should conform to ODOT-SS 00744.13 and be compacted to 91% of Rice Density of the mix, as determined in accordance with ASTM D2041.

9.13.2 Concrete (Rigid) Pavement

PCC pavement design recommendations are based on an assumed modulus of rupture of 550 psi and a minimum compressive strength of 4,000 psi and nominal maximum aggregate size of 1.5 inches. The PCC should be constructed with a maximum joint spacing of 15 feet. The slabs shall be interlocked at contraction joints (e.g., continuous slab with no dowels). However, dowels should be used at construction and expansion joints. The following table presents thicknesses for plain (unreinforced) PCC with dowelled joints.

Table 8: Recommended Concrete Pavement Sections

Traffic	Crushed Aggregate Base Course Thickness (inches)	Concrete Paving Thickness (inches)
Standard Duty	6	5
Heavy Duty	6	6

The recommendation pavement sections require dowel reinforcement in longitudinal and transverse contraction joints as shown in ACI 330.2R-17. If PCC is selected for use in general pavement areas, proper design and detailing of longitudinal and transverse control joints, tie bars and joint dowels will be required. GNN should be contacted to provide more detailed recommendations and to review jointing plans and details for the project.

9.14 Subgrade Inspection and Compaction Verification

GNN's geotechnical inspector shall be onsite during earthwork to inspect and test subgrade and each fill layer. Proceed with subsequent earthmoving only after inspections confirm previously completed work complies with requirements of this report. Inspections and tests include:

1. Determine prior to placement of fill that subgrade has been prepared in compliance with requirements of the Geotechnical Report.
2. Determine that fill material and maximum lift thickness and moisture comply with requirements of the Geotechnical Report.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements of the Geotechnical Report.

When the geotechnical inspector indicates that subgrades, and fills have not achieved subgrade acceptance criteria or degree of compaction specified, scarify, and moisten or aerate, or remove

and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

9.15 Subgrade Protection

The degree to which construction grading problems develop is expected to be dependent, in part, on the time of year that construction proceeds and the precautions which are taken by the contractor to protect the subgrade. The existing near surface soils currently present on the site may be moisture and disturbance sensitive due to their fines content and may become unstable (pumping) if allowed to increase in moisture content and are disturbed (rutted) by construction traffic if wet. If necessary, the construction access road should be covered with a layer of gravel or quarry spalls course. The soils are also susceptible to erosion in the presence of moving water. The soils shall be stabilized to minimize the potential of erosion into the foundation excavation. The site shall be graded to prevent water from ponding within construction areas and/or flowing into excavations. Accumulated water must be removed immediately along with any unstable soil. Foundation concrete shall be placed, and excavations backfilled as soon as possible to protect the bearing grade.

9.16 Surface Drainage

With respect to surface water drainage, we recommend that the ground surface be sloped to drain away from the structure. Final exterior site grades shall promote free and positive drainage from the building areas. Water shall not be allowed to pond or to collect adjacent to foundations or within the immediate building area. We recommend that a gradient of at least 5% for a minimum distance of 10 feet from the building perimeter be provided, except in paved locations. In paved areas, a minimum gradient of 1% should be provided unless provisions are included for collection/disposal of surface water adjacent to the structure. Catch basins, drainage swales, or other drainage facilities should be aptly located. All surface water such as that coming from roof downspouts and catch basins be collected in tight drain lines and carried to a suitable discharge point, such as a storm drain system. Surface water and downspout water should not discharge into a perforated or slotted subdrain, nor should such water discharge onto the ground surface adjacent to the building. Cleanouts should be provided at convenient locations along all drain lines.

10.0 CONTINUING GEOTECHNICAL SERVICES

GNN recommends that the Client should maintain an adequate program of geotechnical consultation, construction monitoring, and soils testing during the final design and construction phases to monitor compliance with GNN's geotechnical recommendations. **Maintaining GNN as the geotechnical consultant from beginning to end of the project will provide continuity of services.** If GN Northern, Inc. is not retained by the owner/developer and/or the contractor to provide the recommended geotechnical inspections/observations and testing services, the geotechnical engineering firm or testing/inspection firm providing tests and observations shall assume the role and responsibilities of Geotechnical Engineer-of-Record.

GNN can provide construction monitoring and testing as additional services. The costs of these services are not included in our present fee arrangement but can be obtained from our office. The recommended construction monitoring and testing includes, but is not necessarily limited to, the following:

- Consultation during the design stages of the project.
- Review of the grading and drainage plans to monitor compliance and proper implementation of the recommendations in GNN's Report.
- Observation and quality control testing during site preparation, grading, and placement of engineered fill as required by the local building ordinances.
- Geotechnical engineering consultation as needed during construction.

11.0 LIMITATIONS OF THE GEOTECHNICAL SITE INVESTIGATION REPORT

This GEOTECHNICAL SITE INVESTIGATION REPORT (“Report”) was prepared for the exclusive use of the Client. GN Northern, Inc.’s (GNN) findings, conclusions and recommendations in this Report are based on selected points of field exploration, and GNN’s understanding of the proposed project at the time the Report is prepared. Furthermore, GNN’s findings and recommendations are based on the assumption that soil, rock and/or groundwater conditions do not vary significantly from those found at specific exploratory locations at the project site. Variations in soil, bedrock and/or groundwater conditions could exist between and beyond the exploration points. The nature and extent of these variations may not become evident until during or after construction. Variations in soil, bedrock and groundwater may require additional studies, consultation, and revisions to GNN’s recommendations in the Report.

This Report’s findings are valid as of the issued date of this Report. However, changes in conditions of the subject property or adjoining properties can occur due to passage of time, natural processes, or works of man. In addition, applicable building standards/codes may change over time. Accordingly, the findings, conclusions, and recommendations of this Report may be invalidated, wholly or partially, by changes outside of GNN’s control. Provided that the site conditions are not disturbed or altered after the planned grading is completed, the report will be valid for a period of **3 years** from the issued date of the Report.

In the event that any changes in the nature, design, or location of structures are planned, the findings, conclusions and recommendations contained in this Report shall not be considered valid unless the changes are reviewed by GNN and the findings, conclusions, and recommendations of this Report are modified or verified in writing.

This Report is issued with the understanding that the owner or the owner’s representative has the responsibility to bring the findings, conclusions, and recommendations contained herein to the attention of the architect and design professional(s) for the project so that they are incorporated into the plans and construction specifications, and any follow-up addendum for the project. The owner or the owner’s representative also has the responsibility to verify that the general contractor and all subcontractors follow such recommendations during construction. It is further understood

that the owner or the owner's representative is responsible for submittal of this Report to the appropriate governing agencies. The foregoing notwithstanding, no party other than AutoZone Inc. and the Client shall have any right to rely on this Report and GNN shall have no liability to any third party who claims injury due to reliance upon this Report, which is prepared exclusively for AutoZone Inc. and Client's use and reliance.

GNN has provided geotechnical services in accordance with generally accepted geotechnical engineering practices in this locality at this time. GNN expressly disclaims all warranties and guarantees, express or implied.

Client shall provide GNN an opportunity to review the final design and specifications so that earthwork, drainage and foundation recommendations may be properly interpreted and implemented in the design and specifications. If GNN is not accorded the review opportunity, GNN shall have no responsibility for misinterpretation of GNN's recommendations.

APPENDICES

Appendix I

Vicinity Map (Figure 1)

Site Exploration Map (Figure 2)

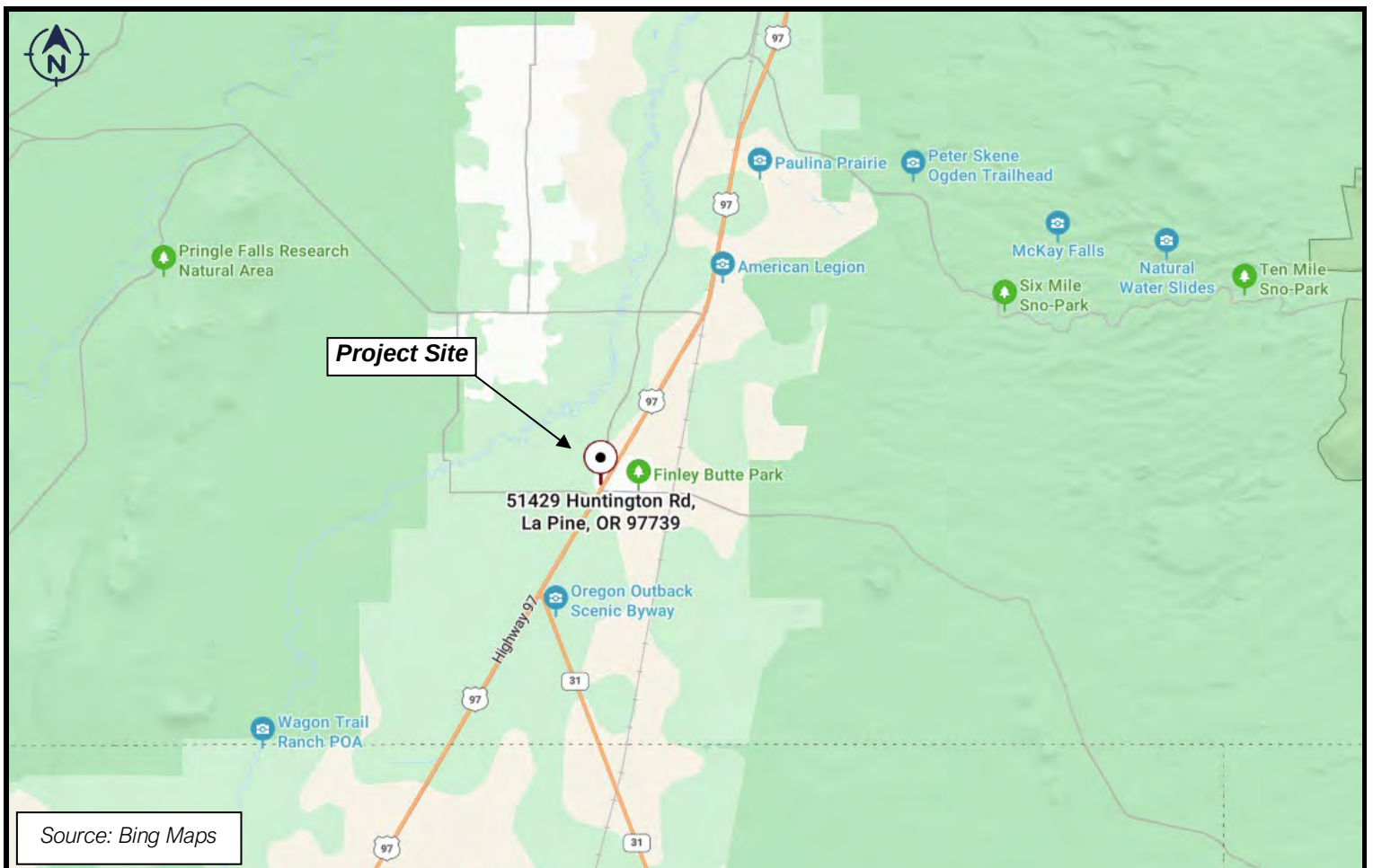


FIGURE 1: VICINITY MAP



Appendix II

Exploratory Test-Pit Logs *Key Chart (for Soil Classification)*



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-1

PAGE 1 OF 1

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25

COMPLETED 12/9/25

GROUND ELEVATION 4241 ft

TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

▽ AT TIME OF EXCAVATION 12.00 ft / Elev 4229.00 ft

LOGGED BY ABC

CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.668922°, -121.505858°

AFTER EXCAVATION ---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\K\HARMON\DRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S. GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				TOPSOIL, POORLY GRADED SAND WITH SILT (SP-SM), dark brown, moist, with roots
			1.0	4240.0
			SP-SM	FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, dry to damp, appears loose
			2.5	4238.5
			SM	FILL: SILTY SAND, (SM) dark brown, fine to medium grained, damp, appears medium dense, with clay pipe at ~3' BGS
5			5.0	4236.0
			SP-SM	POORLY GRADED SAND WITH SILT, (SP-SM) black, fine to coarse grained, dry to damp, appears loose to medium dense, with gravel
10				moist to wet, moderate caving
			11.0	4230.0
			SW-SM	WELL GRADED SAND WITH SILT, (SW-SM) black, fine to coarse grained, wet, appears loose to medium dense, moderate to severe caving
	GB	MC = 18% Fines = 8%		▽ severe caving
15			15.0	4226.0

- Groundwater encountered at ~12' BGS at time of excavation
- Referenced elevations are approximate and based on Google Earth topography
Bottom of test pit at 15.0 feet.



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-2

PAGE 1 OF 1

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25

COMPLETED 12/9/25

GROUND ELEVATION 4241 ft

TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

▽ AT TIME OF EXCAVATION 12.00 ft / Elev 4229.00 ft

LOGGED BY ABC

CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.668838°, -121.505953°

AFTER EXCAVATION ---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\KHARMIONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S. GRAPHIC LOG	MATERIAL DESCRIPTION
0				TOPSOIL, POORLY GRADED SAND WITH SILT (SP-SM), dark brown, moist, with roots
			1.5	4239.5
			SP-SM	FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, medium to coarse grained, dry, appears loose, with buried wire at ~1' BGS
			3.0	4238.0
			SM	SILTY SAND, (SM) dark brown, fine to medium grained, damp, appears loose to medium dense, APPARENT NATIVE
5	GB	MC = 7% Fines = 17%	5.5	4235.5
			SP-SM	POORLY GRADED SAND WITH GRAVEL, (SP-SM) dark brown to black, fine to coarse grained, damp, appears loose to medium dense
10				moist to wet, caving
			11.0	4230.0
			SW-SM	WELL GRADED SAND WITH SILT, (SW-SM) black, fine to coarse grained, wet, appears loose to medium dense, with gravel, moderate to severe caving
			▽	severe caving
			14.5	4226.5

- Test-pit terminated at ~14.5' BGS due to severe caving
 - Groundwater encountered at ~12' BGS at time of excavation
 - Referenced elevations are approximate and based on Google Earth topography
- Bottom of test pit at 14.5 feet.



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-3

PAGE 1 OF 1

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25

COMPLETED 12/9/25

GROUND ELEVATION 4241 ft

TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

▽ AT TIME OF EXCAVATION 12.00 ft / Elev 4229.00 ft

LOGGED BY ABC

CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.668950°, -121.506049°

AFTER EXCAVATION ---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\KHARMIONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S. GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				TOPSOIL, POORLY GRADED SAND WITH SILT (SP-SM), dark brown, moist, with roots, with landscaping fabric at ~1' BGS
			1.5	4239.5
			SP-SM	FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, medium to coarse grained, damp, appears loose to medium dense, with wire art ~1.5' BGS
			4.0	4237.0
5	GB	MC = 12% Fines = 19%	SM	SILTY SAND, (SM) brown, fine to medium grained, moist, appears medium dense, APPARENT NATIVE
			7.5	4233.5
			SP-SM	POORLY GRADED SAND WITH SILT, (SP-SM) dark brown to black, fine to coarse grained, damp to moist, appears medium dense, with gravel
10			11.0	4230.0
			SW-SM	WELL GRADED SAND WITH SILT, (SW-SM) black, fine to coarse grained, wet, appears loose to medium dense, caving ▽ severe caving
			14.5	4226.5

- Test-pit terminated at ~14.5' BGS due to severe caving
- Groundwater encountered at ~12' BGS at time of excavation
- Referenced elevations are approximate and based on Google Earth topography
Bottom of test pit at 14.5 feet.



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-4

PAGE 1 OF 1

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25 COMPLETED 12/9/25

GROUND ELEVATION 4241 ft TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

AT TIME OF EXCAVATION ---

LOGGED BY ABC CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.668852°, -121.506193°

AFTER EXCAVATION ---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\KHARMIONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					
				TOPSOIL, POORLY GRADED SAND WITH SILT (SP-SM), dark brown, moist, with roots	4240.5
				FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, damp, appears loose to medium dense, with buried wire at ~1.5' BGS	
		SP-SM		white PVC pipe encountered at ~3' BGS	
					4237.0
5				DRAIN ROCK	
					4235.5
				POORLY GRADED SAND WITH SILT, (SP-SM) dark brown to black, fine to coarse grained, damp, appears medium dense, with gravel	
		SP-SM			
10					4230.5

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography
Bottom of test pit at 10.5 feet.

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25

COMPLETED 12/9/25

GROUND ELEVATION 4241 ft

TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

AT TIME OF EXCAVATION ---

LOGGED BY ABC

CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.669120°, -121.506198°

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					TOPSOIL, POORLY GRADED SAND WITH SILT (SP-SM), dark brown, moist, with roots
				1.0	4240.0
			SP-SM		FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, dry to damp, appears loose
				2.0	4239.0
					POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, dry, appears loose, trace gravel, APPARENT NATIVE
5					brown, damp, trace gravel
			SP-SM		
					dark brown to black, coarse grained, appears loose to medium dense
10	GB	MC = 10% Fines = 10%			
				10.5	4230.5

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography
Bottom of test pit at 10.5 feet.

Bottom of test pit at 10.5 feet.



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-6

PAGE 1 OF 1

CLIENT	Earth Science, LLC	PROJECT NAME	AutoZone Store # 10703
PROJECT NUMBER	225-1862	PROJECT LOCATION	Huntington Rd, La Pine, OR
DATE STARTED	12/9/25	COMPLETED	12/9/25
EXCAVATION CONTRACTOR	Leonardo Excavation, LLC	GROUND ELEVATION	4239 ft
EXCAVATION METHOD	CAT 308 Mini-Excavator	TEST PIT SIZE	24x72 inches
LOGGED BY	ABC	CHECKED BY	IM
NOTES	Approx. GPS Coords.: 43.669119°, -121.505808°		
GROUND WATER LEVELS:		AT TIME OF EXCAVATION ---	
		AT END OF EXCAVATION ---	
		AFTER EXCAVATION ---	

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\K\HARMON\DRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				TOPSOIL, POORLY GRADED SAND WITH SILT (SP-SM), dark brown, moist, with roots
				1.5
				POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, dry to damp, appears loose to medium dense, trace grave, trace cobbles, with roots to ~6.56' BGS
5				
				damp, with gravel
10				
				10.0
				4229.0

- Groundwater not encountered at time of excavation
 - Referenced elevations are approximate and based on Google Earth topography
- Bottom of test pit at 10.0 feet.



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-7

PAGE 1 OF 1

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25

COMPLETED 12/9/25

GROUND ELEVATION 4240 ft

TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

▽ AT TIME OF EXCAVATION 12.00 ft / Elev 4228.00 ft

LOGGED BY ABC

CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.668978°, -121.505634°

AFTER EXCAVATION ---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\KHARMIONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
					0.3 ~4" ASPHALTIC CONCRETE	4239.7
					0.6 ~4" GRAVEL BASE COURSE	4239.4
					FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, damp, appears medium dense, trace gravel	
			SP-SM			
5						
					6.0 WELL GRADED SAND, (SW) dark brown to black, fine to coarse grained, damp, appears medium dense, with gravel	4234.0
			SW			
	GB	MC = 5% Fines = 3%				
10						
					11.0 WELL GRADED SAND WITH SILT, (SW-SM) black, fine to coarse grained, wet, appears loose to medium dense, caving	4229.0
			SW-SM		severe caving	
					14.5	4225.5

- Test-pit terminated at ~14.5' BGS due to severe caving
 - Groundwater encountered at ~12' BGS at time of excavation
 - Referenced elevations are approximate and based on Google Earth topography
- Bottom of test pit at 14.5 feet.



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-8

PAGE 1 OF 1

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR

DATE STARTED 12/9/25

COMPLETED 12/9/25

GROUND ELEVATION 4241 ft

TEST PIT SIZE 24x72 inches

EXCAVATION CONTRACTOR Leonardo Excavation, LLC

GROUND WATER LEVELS:

EXCAVATION METHOD CAT 308 Mini-Excavator

▽ AT TIME OF EXCAVATION 12.00 ft / Elev 4229.00 ft

LOGGED BY ABC

CHECKED BY IM

AT END OF EXCAVATION ---

NOTES Approx. GPS Coords.: 43.668828°, -121.505641°

AFTER EXCAVATION ---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 12/15/25 11:59 - C:\USERS\KHARMIONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\225-1862 AUTOZONE, LAPINE OR\225-1862 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					
				~4" ASPHALTIC CONCRETE	4240.7
				~4" GRAVEL BASE COURSE	4240.4
				FILL: POORLY GRADED SAND WITH SILT, (SP-SM) light orangeish brown, fine to coarse grained, damp, appears medium dense, with misc. debris (dimensional lumber, cinder blocks, pipe)	
		SP-SM		brown	
5					
					6.0
		SW		WELL GRADED SAND, (SW) dark brown to black, fine to coarse grained, damp, appears medium dense, with gravel	4235.0
10				moist to wet, moderate caving	
					11.0
		SW-SM		WELL GRADED SAND WITH SILT, (SW-SM) black, fine to coarse grained, wet, appears loose to medium dense, caving	4230.0
				severe caving	
15					4226.0

- Groundwater encountered at ~12' BGS at time of excavation
 - Referenced elevations are approximate and based on Google Earth topography
- Bottom of test pit at 15.0 feet.

KEY CHART

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE					
COARSE-GRAINED SOILS			FINE-GRAINED SOILS		
DENSITY	N (BLOWS/FT)	FIELD TEST	CONSISTENCY	N (BLOWS/FT)	FIELD TEST
Very Loose	0 – 4	Easily penetrated with ½-inch reinforcing rod pushed by hand	Very Soft	0 – 2	Easily penetrated several inches by thumb
Loose	4 – 10	Difficult to penetrate with ½-inch reinforcing rod pushed by hand	Soft	2 – 4	Easily penetrated one inch by thumb
Medium -Dense	10 – 30	Easily penetrated with ½-inch rod driven with a 5-lb hammer	Medium-Stiff	4 – 8	Penetrated over ½-inch by thumb with moderate effort
Dense	30 – 50	Difficult to penetrate with ½-inch rod driven with a 5-lb hammer	Stiff	8 – 15	Indented about ½-inch by thumb but penetrated with great effort
Very Dense	> 50	penetrated only a few inches with ½-inch rod driven with a 5-lb hammer	Very Stiff	15 – 30	Readily indented by thumb
			Hard	> 30	Indented with difficulty by thumbnail

USCS SOIL CLASSIFICATION						
MAJOR DIVISIONS			GROUP DESCRIPTION			
Coarse-Grained Soils	Gravel and Gravelly Soils <50% coarse fraction passes #4 sieve	Gravel (with little or no fines)		GW	Well-graded Gravel	
				GP	Poorly Graded Gravel	
		Gravel (with >12% fines)		GM	Silty Gravel	
				GC	Clayey Gravel	
	Sand and Sandy Soils >50% coarse fraction passes #4 sieve	Sand (with little or no fines)		SW	Well-graded Sand	
				SP	Poorly graded Sand	
		Sand (with >12% fines)		SM	Silty Sand	
				SC	Clayey Sand	
Fine-Grained Soils	Silt and Clay Liquid Limit < 50			ML	Silt	
				CL	Lean Clay	
				OL	Organic Silt and Clay (low plasticity)	
	Silt and Clay Liquid Limit > 50			MH	Inorganic Silt	
				CH	Inorganic Clay	
				OH	Organic Clay and Silt (med. to high plasticity)	
	Highly Organic Soils			PT	Peat	 Top Soil

LOG SYMBOLS		
	2S	2" OD Split Spoon (SPT)
	3S	3" OD Split Spoon
	NS	Non-Standard Split Spoon
	ST	Shelby Tube
	CR	Core Run
	BG	Bag Sample
	TV	Torvane Reading
	PP	Penetrometer Reading
	NR	No Recovery
	GW	Groundwater Table
		

MODIFIERS	
DESCRIPTION	RANGE
Trace	<5%
Little	5% – 12%
Some	>12%

MOISTURE CONTENT	
DESCRIPTION	FIELD OBSERVATION
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but not visible water
Wet	Visible free water

SOIL CLASSIFICATION INCLUDES

- Group Name
- Group Symbol
- Color
- Moisture content
- Density / consistency
- Cementation
- Particle size (if applicable)
- Odor (if present)
- Comments

MAJOR DIVISIONS WITH GRAIN SIZE							
SIEVE SIZE							
12"	3"	3/4"	4	10	40	200	
GRAIN SIZE (INCHES)							
12	3	0.75	0.19	0.079	0.0171	0.0029	
Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

Conditions shown on boring and testpit logs represent our observations at the time and location of the fieldwork, modifications based on lab test, analysis, and geological and engineering judgment. These conditions may not exist at other times and locations, even in close proximity thereof. This information was gathered as part of our investigation, and we are not responsible for any use or interpretation of the information by others.

Appendix III

Laboratory Testing Results



GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

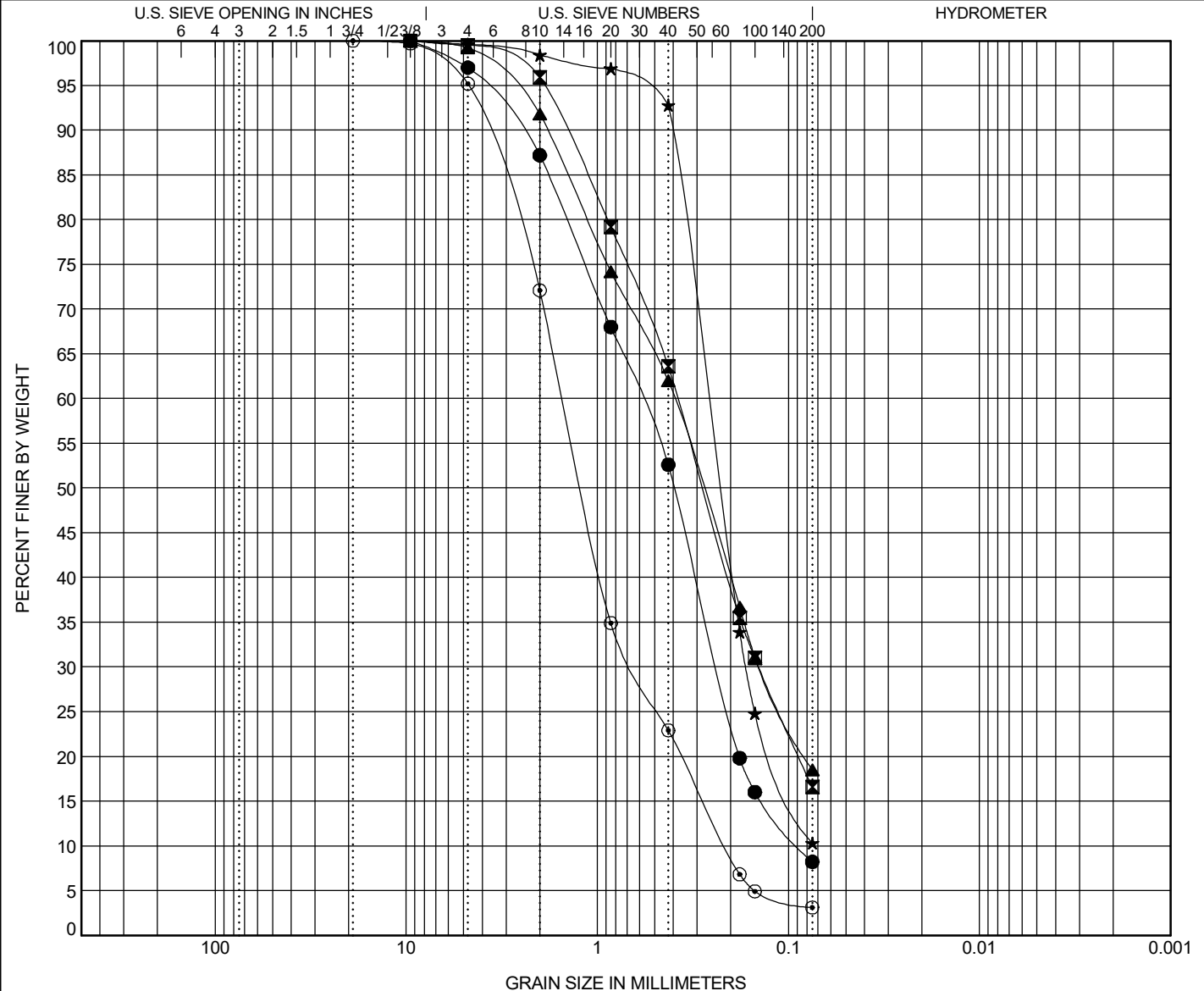
GRAIN SIZE DISTRIBUTION

CLIENT Earth Science, LLC

PROJECT NAME AutoZone Store # 10703

PROJECT NUMBER 225-1862

PROJECT LOCATION Huntington Rd, La Pine, OR



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LOCATION	DEPTH	Classification					LL	PL	PI	Cc	Cu
● TP-1	12.0	WELL-GRADED SAND with SILT (SW-SM)								1.06	6.74
▣ TP-2	4.5	SILTY SAND (SM)									
▲ TP-3	5.0	SILTY SAND (SM)									
★ TP-5	9.0	POORLY GRADED SAND with SILT (SP-SM)								1.42	3.56
⊙ TP-7	8.5	WELL-GRADED SAND (SW)								1.27	7.09
LOCATION	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● TP-1	12.0	9.5	0.593	0.235	0.088	3.0	88.8	8.2			
▣ TP-2	4.5	9.5	0.381	0.143		0.5	82.9	16.6			
▲ TP-3	5.0	9.5	0.397	0.141		0.8	80.7	18.5			
★ TP-5	9.0	9.5	0.263	0.166		0.4	89.3	10.3			
⊙ TP-7	8.5	19	1.514	0.64	0.214	4.8	92.1	3.1			

Appendix IV

Site & Exploration Photographs



View of site conditions near test-pit TP-1 looking south



View of site conditions near test-pit TP-1 looking north



Exposed subsurface soil profile within test-pit TP-1



View of site conditions near test-pit TP-2 looking south



Exposed subsurface soil profile within test-pit TP-2



View of site conditions near test-pit TP-3 looking east



View of site conditions near test-pit TP-3 looking south/southwest



Exposed subsurface soil profile within test-pit TP-3



View of site conditions near test-pit TP-4 looking southwest



Exposed subsurface soil profile within test-pit TP-4



View of site conditions near test-pit TP-5 looking northwest



View of site conditions near test-pit TP-5 looking south



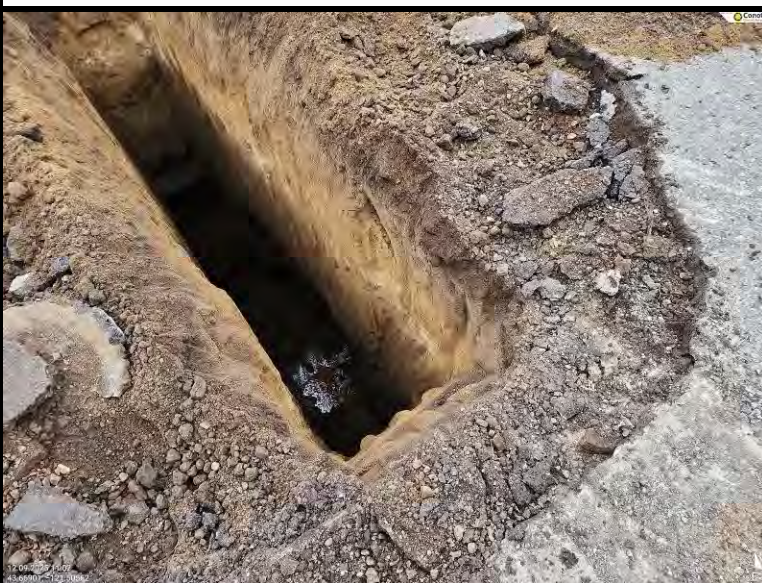
Exposed subsurface soil profile within test-pit TP-5



View of site conditions near test-pit TP-6 looking west



Exposed subsurface soil profile within test-pit TP-6



Exposed subsurface soil profile within test-pit TP-7



View of site conditions near test-pit TP-8 looking northwest



Exposed subsurface soil profile within test-pit TP-8

Appendix V

ASCE 7-22 Seismic Report

ASCE 7-16 Seismic Report

USGS Disaggregation Report



ASCE Hazards Report

Address:

No Address at This Location

Standard:

ASCE/SEI 7-22

Risk Category: III**Soil Class:**

D - Stiff Soil

Latitude:

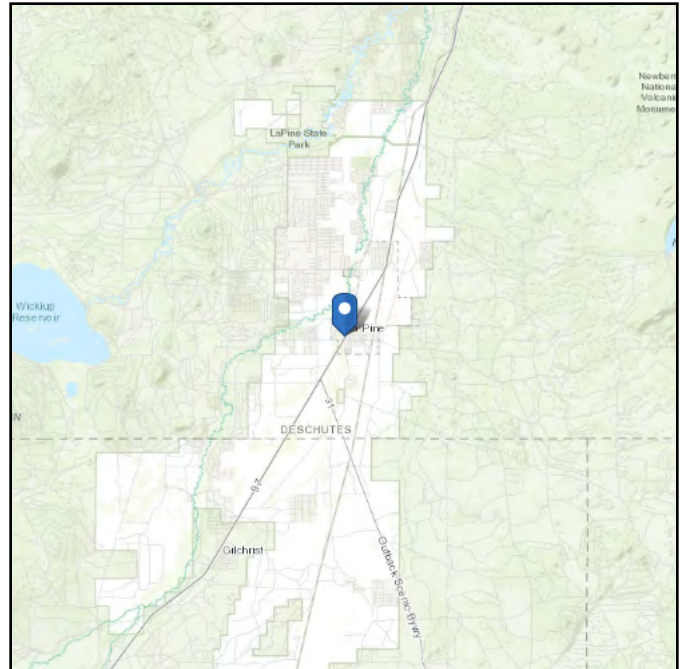
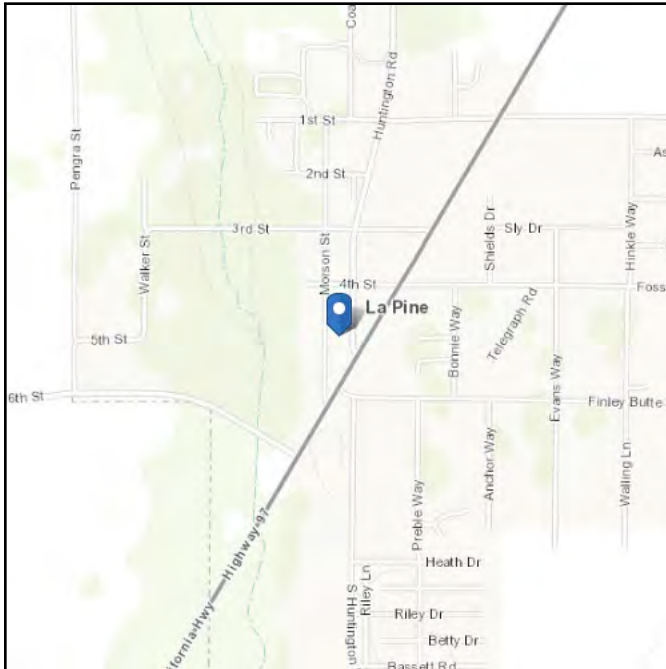
43.668985

Longitude:

-121.505959

Elevation:

4235.602086356192 ft
(NAVD 88)

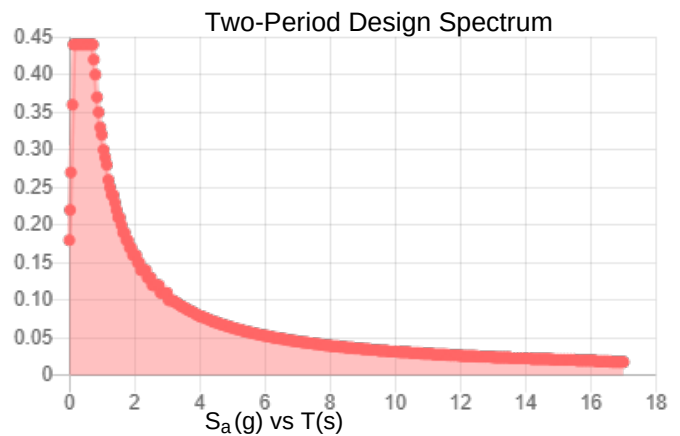
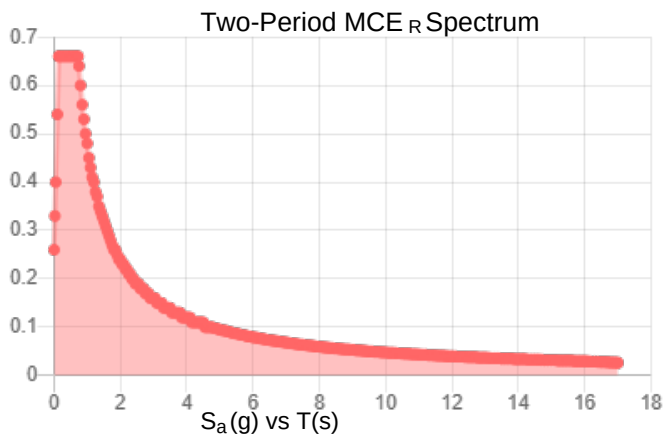
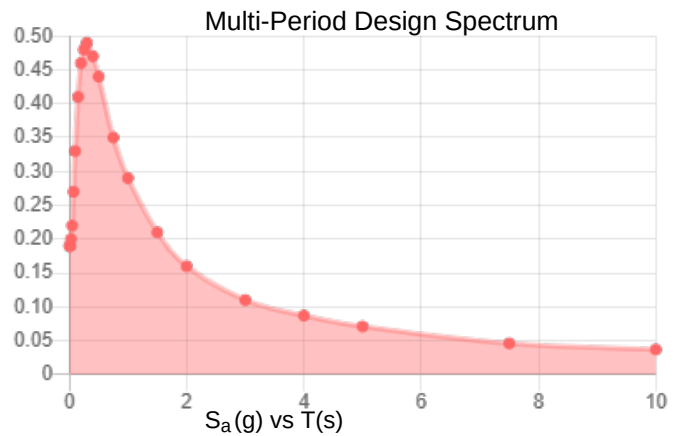
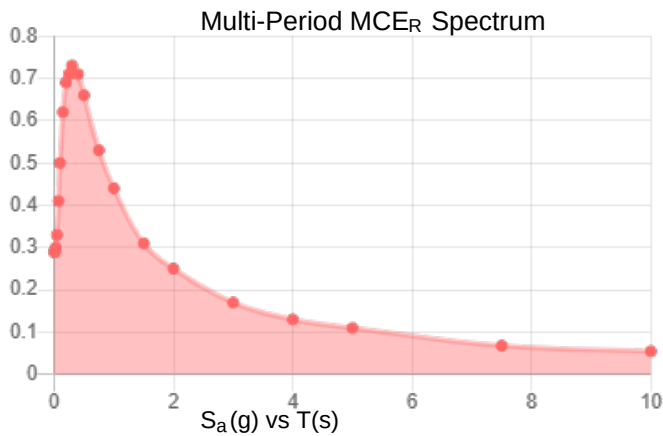


Site Soil Class: D - Stiff Soil

Results:

PGA _M :	0.27	T _L :	16
S _{MS} :	0.66	S _S :	0.47
S _{M1} :	0.48	S ₁ :	0.18
S _{DS} :	0.44	V _{S30} :	260
S _{D1} :	0.32		

Seismic Design Category: D



MCE_R Vertical Response Spectrum
Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum
Vertical ground motion data has not yet been made available by USGS.

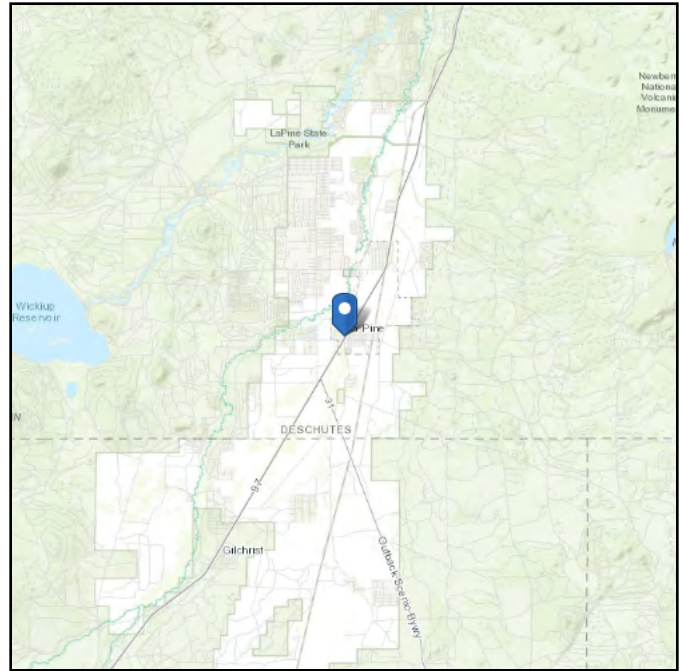
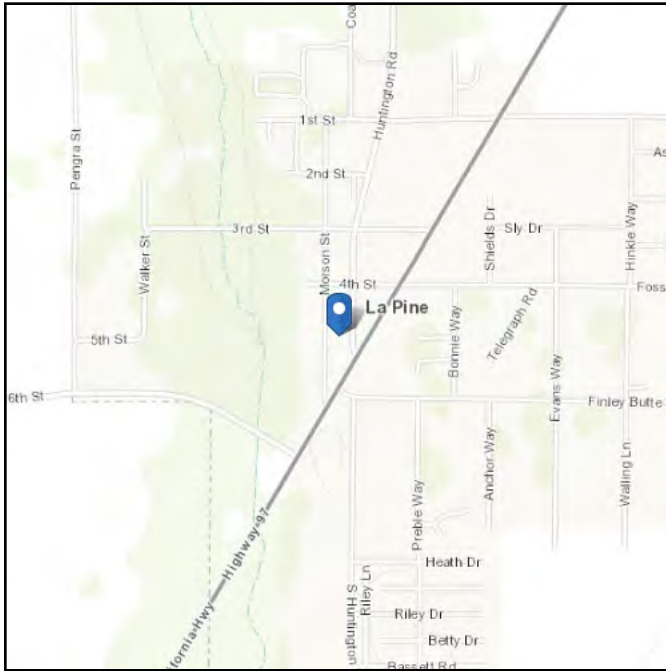


ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: III
Soil Class: D - Stiff Soil

Latitude: 43.668985
Longitude: -121.505959
Elevation: 4235.602086356192 ft
(NAVD 88)



Site Soil Class: D - Stiff Soil

Results:

S_S :	0.425	S_{D1} :	N/A
S_1 :	0.215	T_L :	16
F_a :	1.46	PGA :	0.194
F_v :	N/A	PGA_M :	0.274
S_{MS} :	0.62	F_{PGA} :	1.413
S_{M1} :	N/A	I_e :	1.25
S_{DS} :	0.414	C_v :	0.983

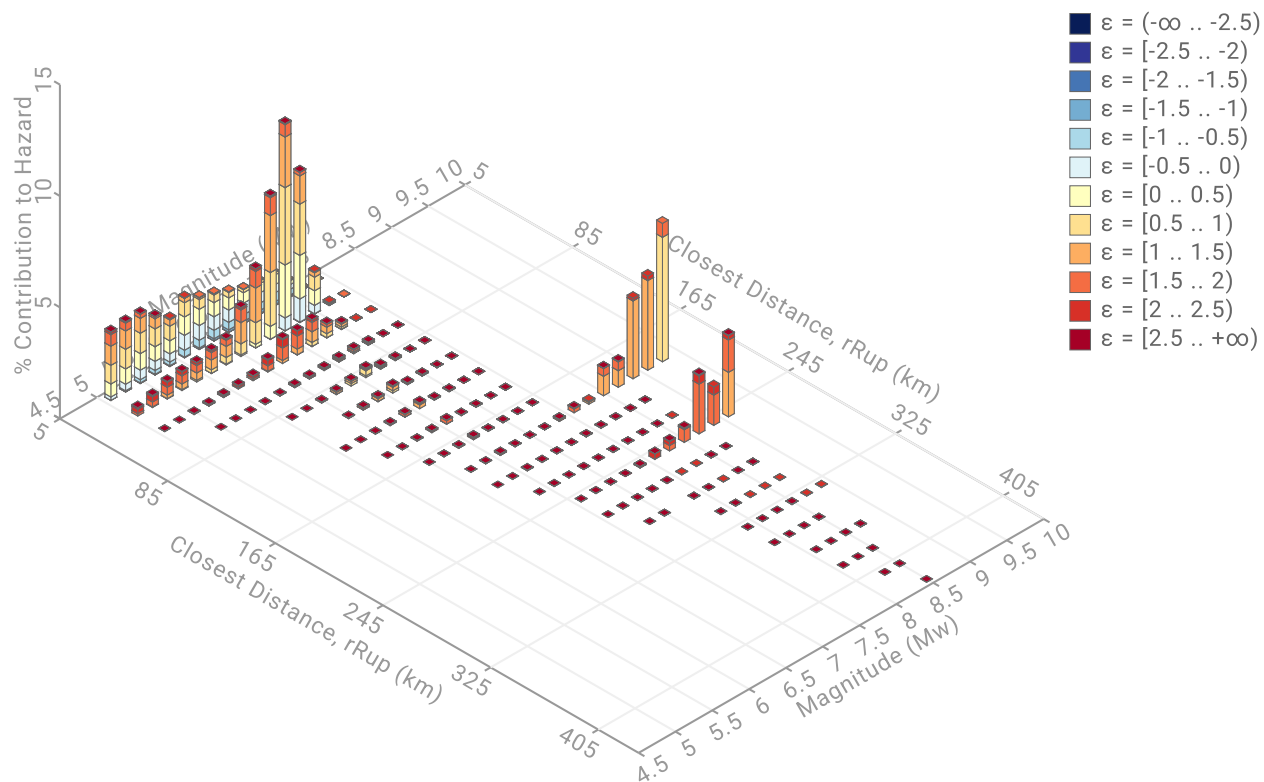
Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed Dec 10 2025

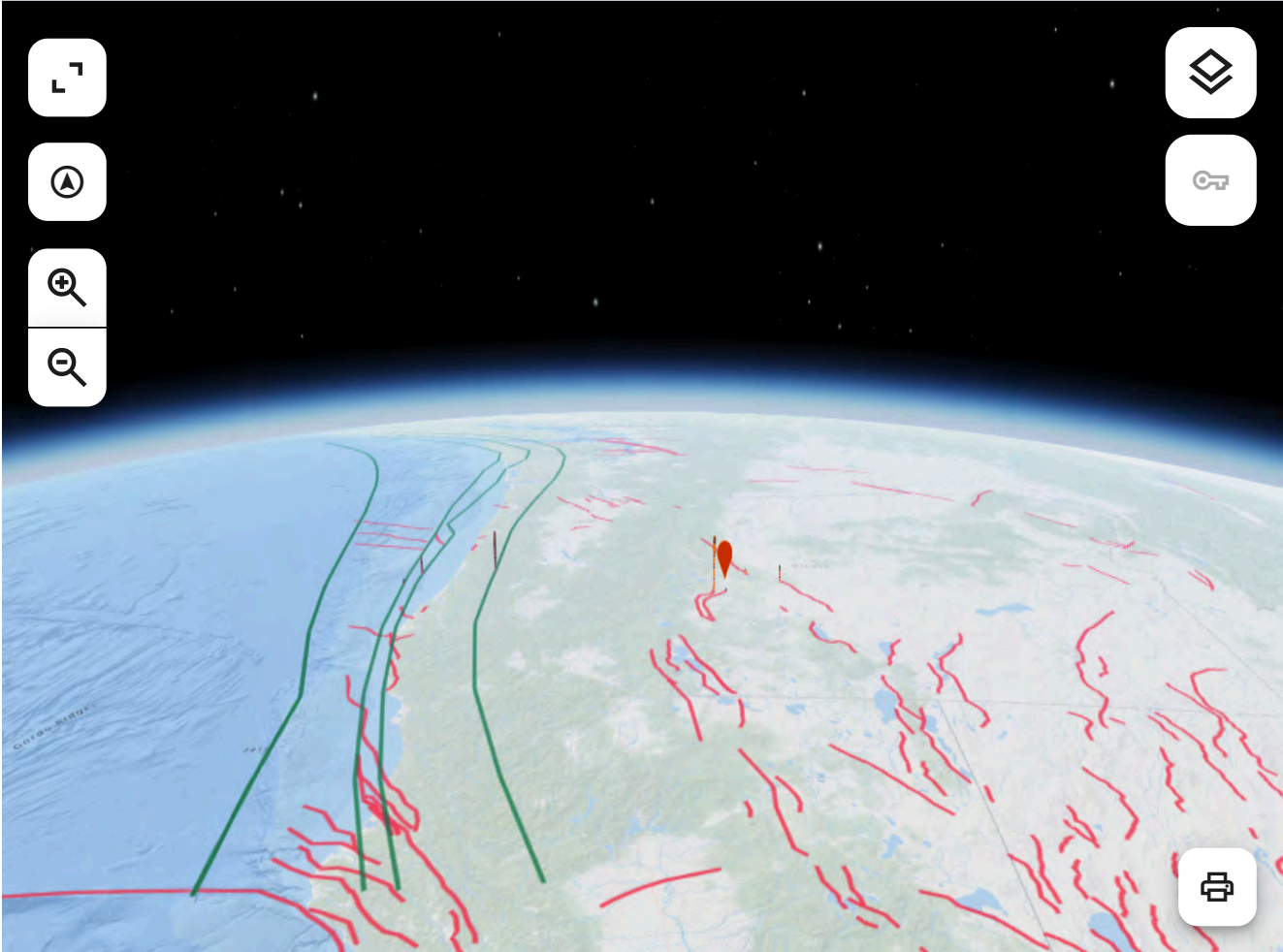
Date Source: [USGS Seismic Design Maps](#)

Disaggregation Report

Disaggregation



Geographical Disaggregation



CHS, Esri, GEBCO, Garmin, NaturalVue | County of Clark, WA, Oregon State Parks, WA State Parks GIS, Esri, T... Powered by [Esri](#)

Parameter Summary

Model: NSHM Conterminous U.S. 2018

Latitude: 43.668988 °

Longitude: -121.506026 °

Site Class: D (Vs30 260)

Intensity Measure Type: PGA

Return Period: 2475 (2% in 50)

Component: Total

Disaggregation Summary: Total

Disaggregation targets

Return period : 2475 yrs
Exceedance rate : 4.040e-4 yr⁻¹
PGA ground motion : 2.697e-1 g

Totals

Binned : 100 %
Residual : 0 %
Trace : 0.75 %

Mode (largest m-r bin)

m : 7.11
r : 26.3 km
ε₀ : 0.74 σ
Contribution : 9.3 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km
m : min = 4.4, max = 9.4, Δ = 0.2
ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Recovered targets

Return period : 2424.6953 yrs
Exceedance rate : 4.124e-4 yr⁻¹

Mean (over all sources)

m : 7.19
r : 74.36 km
ε₀ : 0.95 σ

Mode (largest m-r-ε₀ bin)

m : 9.34
r : 185.3 km
ε₀ : 0.9 σ
Contribution : 5.59 %

Epsilon keys

ε0 : [-∞ .. -2.5)
ε1 : [-2.5 .. -2.0)
ε2 : [-2.0 .. -1.5)
ε3 : [-1.5 .. -1.0)
ε4 : [-1.0 .. -0.5)
ε5 : [-0.5 .. 0.0)
ε6 : [0.0 .. 0.5)
ε7 : [0.5 .. 1.0)
ε8 : [1.0 .. 1.5)
ε9 : [1.5 .. 2.0)
ε10 : [2.0 .. 2.5)
ε11 : [2.5 .. +∞]

Disaggregation Contributions: Total

Source Set	Source	Type	r	m	ϵ_0	lon	lat	az	%
Cascadia (full, bottom)		Interface							13.36
	Cascadia (full, bottom)		185.30	9.13	1.12	123.764°W	43.882°N	278.21	13.36
Extensional (fixed) (opt)		Grid							11.57
Chemult Graben (west) [50°]		Fault							10.84
	Chemult Graben (west) [50°]		25.30	7.04	0.81	121.625°W	43.490°N	205.73	10.84
Extensional (adaptive) (opt)		Grid							8.43
Cascadia (full, middle)		Interface							5.96
	Cascadia (full, middle)		241.39	8.93	1.65	124.492°W	43.863°N	276.17	5.96
Compressional - WA,OR (fixed) (opt)		Grid							5.06
Compressional - No Puget (fixed) (opt)		Grid							5.06
Compressional - No Puget (adaptive) (opt)		Grid							5.06
Compressional - WA,OR (adaptive) (opt)		Grid							5.06
Southeast Newberry [50°]		Fault							3.89
	Southeast Newberry [50°]		39.29	7.06	1.38	120.967°W	43.673°N	89.16	3.89
Chemult Graben (west) [35°]		Fault							3.74
	Chemult Graben (west) [35°]		24.89	7.04	0.80	121.625°W	43.490°N	205.73	3.74
Chemult Graben (west) [65°]		Fault							3.42
	Chemult Graben (west) [65°]		25.62	7.04	0.84	121.625°W	43.490°N	205.73	3.42
OR Intraslab		Slab							2.38
Southeast Newberry [35°]		Fault							2.07
	Southeast Newberry [35°]		33.85	7.06	1.12	120.967°W	43.673°N	89.16	2.07
Metolius [50°]		Fault							1.82
	Metolius [50°]		21.61	7.11	0.38	121.283°W	43.810°N	48.81	1.82
Cascadia (full, top)		Interface							1.65
	Cascadia (full, top)		251.79	8.83	1.77	124.631°W	43.700°N	271.87	1.65
Chemult Graben (east) [50°]		Fault							1.38
	Chemult Graben (east) [50°]		24.61	7.00	0.83	121.511°W	43.474°N	180.96	1.38

Application Metadata

Application: Disaggregation

URL: <https://earthquake.usgs.gov/nshmp/hazard/disagg>

Repository: nshmp-apps

Version: 21.1.2

URL: <https://code.usgs.gov/ghsc/nshmp/nshmp-apps>

Repository : nshmp-haz

Version: 2.7.2

URL: <https://code.usgs.gov/ghsc/nshmp/nshmp-haz>

Repository : nshmp-lib

Version: 1.7.15

URL: <https://code.usgs.gov/ghsc/nshmp/nshmp-lib>

Repository : nshm-conus

Version: 5.2.4

URL: <https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus.git>

December 16, 2025, 08:14 AM

Appendix VI

NRCS Soil Survey



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties



Custom Soil Resource Report
Soil Map



Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties

115A—Shanahan loamy coarse sand, low, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 23zd

Elevation: 4,000 to 4,500 feet

Mean annual precipitation: 18 to 25 inches

Mean annual air temperature: 40 to 44 degrees F

Frost-free period: 10 to 30 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Shanahan, low, and similar soils: 90 percent

Minor components: 1 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shanahan, Low

Setting

Landform: Lava plains

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Interfluve

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Volcanic ash over old alluvium

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

H1 - 1 to 9 inches: loamy coarse sand

H2 - 9 to 14 inches: gravelly loamy coarse sand

H3 - 14 to 21 inches: coarse sand

H4 - 21 to 27 inches: loamy coarse sand

H5 - 27 to 38 inches: sandy loam

H6 - 38 to 45 inches: gravelly sandy loam

H7 - 45 to 62 inches: very gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F006XY718OR - Pumice Plateau, Flats and Frost Pockets
(Lodgepole Pine / Antelope bitterbrush) 18-25 PZ

Custom Soil Resource Report

Other vegetative classification: Pinus contorta/Pushia tridentata/Festuca
idahoensis (CLS214)

Hydric soil rating: No

Minor Components

Cryaquolls

Percent of map unit: 1 percent

Landform: Terraces

Ecological site: R006XB102OR - Cold Wet Meadow

Hydric soil rating: Yes

Appendix VII

Oregon Water Resources Department Well Logs

WATER WELL REPORT
STATE OF OREGON

State Well No.

225/10E-15da

State Permit No.

(1) OWNER:

Name U.S. National Bank (LaPine)

Address 51469 Main St.

City LaPine

State Oregon

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Air ☐ Driven ☐
Rotary Mud ☐ Dug ☐
Bored ☒

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

(5) CASING INSTALLED:

Steel ☒ Plastic ☒
Threaded ☐ Welded ☒

6" Diam. from 0 ft. to 32 ft. Gauge .250

" Diam. from ft. to ft. Gauge

LINER INSTALLED:

" Diam. from ft. to ft. Gauge

(6) PERFORATIONS:

Perforated? ☒ Yes ☐ No

Type of perforator used saw

Size of perforations .020 in. by 2 1/2 in.

1250 perforations from 32 ft. to 42 ft.

perforations from ft. to ft.

perforations from ft. to ft.

(7) SCREENS:

Well screen installed? ☒ Yes ☐ No

Manufacturer's Name Simpson

Type Plastic Model No. 160PSI.

Diam. 6 Slot Size .020 Set from 32 ft. to 42 ft.

Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? driller

25 gal./min. with 20 ft. drawdown after 12 hrs.

" " " "

Air test gal./min. with drill stem at ft. hrs.

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Special standards: Yes ☐ No ☐

Well seal—Material used cement

Well sealed from land surface to 25 ft.

Diameter of well bore to bottom of seal 16 in.

Diameter of well bore below seal 6 in.

Number of sacks of cement used in well seal 9 sacks

How was cement grout placed? pressure grout

Was pump installed? Type HP Depth ft.

Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of Water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☒ No Size of gravel: ft.

Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County Deschutes

Driller's well number

NE 1/4 SE 1/4 Section 15 T. 22 S. R. 10 E W.M.

Tax Lot # Lot Blk Subdivision

Address at well location: 51468 Main St.

(11) WATER LEVEL: Completed well.

Depth at which water was first found 31 ft.

Static level 12 ft. below land surface. Date 6-11-81

Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing

Depth drilled 42 ft. Depth of completed well 2 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Top Soil	0	4	
Plumice	4	7	
Clay loam	7	12	
Sand	12	16	
Clay	16	24	
Sand/brown	24	25	
Clay	25	31	12
Gravel/fine-coarse sand	31	42	

RECEIVED

JUN 16 1981

WATER RESOURCES DEPT
SALEM, OREGON

Work started 6-9 1981 Completed 6-11 19 81
Date well drilling machine moved off of well 6-11 19 81

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Mike Brubaker Date 6-15, 1981
(Drilling Machine Operator)

Drilling Machine Operator's License No. 917

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name Mike's Well Drilling

Address 84851 Prodan Lane Pleasant Hill, Ore.

[Signed] Mike Brubaker 97401
(Water Well Contractor)

Contractor's License No. 620 Date 6-15, 1981

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP*12658-690

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

RECEIVED

APR 14 1994

(START CARD) # W-65180

Instructions for completing this report are on the last page of this form.

(1) OWNER:

Well Number 97466
Name POPPY WARRICK - GORDON BUREN
Address P.O. BOX 141
City POWERS State OR. Zip 97739

(2) TYPE OF WORK

☐ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:

☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☐ No Depth of Completed Well 35 ft.
Explosives used ☐ Yes ☐ No Type _____ Amount _____

HOLE			SEAL			Sacks or pounds
Diameter	From	To	Material	From	To	
10	0	18	CEMENT	0	18	6 SACKS
6	18	35				

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other

Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	41	20	250	☒	☐	☒	☐
Liner:	5	35	5		☐	☒	☒	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☒ Perforations		Method <u>SAW CUT</u>					
☐ Screens		Type <u>160</u>		Material <u>ON PIPE</u>			
From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
<u>20</u>	<u>35</u>	<u>020</u>	<u>800</u>	<u>5"</u>		☐	☒
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☒ Pump	☐ Bailer	☐ Air	☐ Flowing Artesian
Yield gal/min	Drawdown	Drill stem at	Time
18	1		1 hr. <u>AR.</u>

Temperature of water 46 Depth Artesian Flow Found _____
Was a water analysis done? ☐ Yes By whom _____
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other NO
Depth of strata: _____

(9) LOCATION OF WELL by legal description:

County DESCHUTES Latitude _____ Longitude _____
Township 22-S N or S Range 10-E E or W, WM.
Section 14CB S-W 1/4 N.W. 1/4
Tax Lot 00100 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) 16469 Fuller
Butte, OR. LA PINE CO. 97739

(10) STATIC WATER LEVEL:

14 ft. below land surface. Date 4-8-94
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:

Depth at which water was first found 18

From	To	Estimated Flow Rate	SWL
18	35	25	14

(12) WELL LOG:

Ground Elevation _____

Material	From	To	SWL
Pyritic	0	3	
CLAY SAND.	3	18	
FINE SAND CINDERS	18	35	14

Date started 4-7-94 Completed 4-7-94

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

Signed DAVE PINKLEY WWC Number _____ Date _____

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

Signed James B. Blum WWC Number 1525 Date 4-8-94

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

RECEIVED

MAR - 2 1993

(START CARD) #

W-49863

(1) OWNER:

Name DENNIS & NANCY CARTER
Address P.O. Box 184
City LAKE State OR. Zip 97239

(2) TYPE OF WORK:

☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD:

☐ Rotary Air ☐ Rotary Mud ☒ Cable
☐ Other

(4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☐ No Depth of Completed Well 35 ft.
Explosives used ☐ Yes ☐ No Type _____ Amount _____

HOLE		SEAL		Amount	
Diameter	From To	Material	From To	sacks or pounds	
10	0 18	CEMENT	0 18	5 sacks	
6	18 35				

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other

Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	11	23	250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	5	11	36		☐	☒	☒	☐
					☐	☐	☐	☐

Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:

☒ Perforations Method S&W-cut
☐ Screens Type 160 Material DUPPIPE

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
18	32	020	600	5"		☐	☒
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☒ Pump	☐ Bailer	☐ Air	☐ Flowing
☐ Artesian			
Yield gal/min	Drawdown	Drill stem at	Time
15	3'		1 hr. 4 Hr.

Temperature of Water 42 Depth Artesian Flow Found _____

Was a water analysis done? ☐ Yes By whom _____

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other NO

Depth of strata: _____

LOCATION OF WELL by legal description:

County Deschutes Latitude _____ Longitude _____
Township 22-S N or S. Range 10 E E or W. WM. _____
Section 15 AD 3 E 1/4 NW 1/4
Tax Lot 1800 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) 51447 MORROW
ST LAURENCE OR. 97239

(10) STATIC WATER LEVEL:

17 ft. below land surface. Date 17-FEB-93

Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:

Depth at which water was first found 18'

From	To	Estimated Flow Rate	SWL
18	32	20	17

(12) WELL LOG:

Ground elevation _____

Material	From	To	SWL
PUMICE	0	3	
PUMICE - GRAVEL	3	17	
CLAY	17	18	17
BROWN SAND CINDER	18	32	
SAND PLUG	32	36	

Date started 15 FEB-93 Completed 16 FEB 93

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed _____ WWC Number _____
Date _____

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed Kenneth R. Plow WWC Number 1525
Date 17 FEB-93