Carlson Geotechnical
A Division of Carlson Testing, Inc.
Phone: (503) 601-8250
www.carlsontesting.com

Bend Office	**(541) 330-9155**
Eugene Office	**(541) 345-0289**
Salem Office	**(503) 589-1252**
Tigard Office	**(503) 684-3460**

Geologic Assessment Report
Keubler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322

Prepared for

Andre Makarenko
Comfort Homes
3024 Brush College Road NW
Salem, Oregon 97304

March 5, 2025

Carlson Geotechnical
A Division of Carlson Testing, Inc.
Phone: (503) 601-8250
www.carlsontesting.com

Bend Office **(541) 330-9155**
Eugene Office **(541) 345-0289**
Salem Office **(503) 589-1252**
Tigard Office **(503) 684-3460**

March 5, 2025

Andre Makarenko
Comfort Homes
3024 Brush College Road NW
Salem, Oregon 97304

Geologic Assessment Report
Keubler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322

Dear Andre Makarenko:

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this Geologic Assessment Report (GAR) for the proposed Keubler Lot Partitions project. The site is located at 2592 Kuebler Road South in Salem, Oregon. We performed our work in general accordance with CGT Proposal GP24-440, dated December 20, 2024. Written authorization for our services was received on December 27, 2024.

We appreciate the opportunity to work with you on this project. Please contact us at (503) 601-8250 if you have any questions regarding this report.

Respectfully Submitted,
CARLSON GEOTECHNICAL

PARKER B RICHMOND
E2546
Expires 06/01/2025

Ariana Tenold, R.G.
Project Geologist
atenold@carlsontesting.com

Parker Richmond, R.G., C.E.G.
Senior Engineering Geologist
prichmond@carlsontesting.com

Doc ID: \\geosrv\public\GEOTECH\PROJECTS\2024 Projects\G2406322 - Keubler Lot Partitions Hazard Report\G2406322 - Geologic Asssessment\008 - Deliverables\Report\G2406322 Geologic Assessment Report.docx

Office: 18270 SW Boones Ferry Road, Suite 6, Durham, Oregon 97224
Mailing: P.O. Box 230997, Tigard, Oregon 97281

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this geologic assessment report (GAR) for the proposed Keubler Lot Partitions project. The site is located at 2592 Kuebler Road South in Salem, Oregon, as shown on the attached Site Location, Figure 1.

1.1 Project Information

CGT developed an understanding of the proposed project based on our correspondence with you and project documents provided to us on December 13, 2024. The documents provided included a partition site plan, prepared by MultiTech Engineering Services, Inc, dated November 5, 2024. We understand the project is in its preliminary stages of planning, but will consist of subdividing the 34.23-acre site into six residential lots. We anticipate future development will include construction of single-family residential structures and appurtenant features on each of the respective lots.

Based on review of a Land Use Application reviewed by the City of Salem, dated November 26, 2024, we understand the City of Salem has identified the property as an area of moderate landslide hazard risk, and therefore is requiring a GAR be completed for the project. As detailed in the City of Salem's Revised Code Section 810.030(a), sites classified as a "Category B – Moderate Landslide Risk," require a GAR. The GAR does not include specific geotechnical recommendations for use in design and construction of future site development.

CGT additionally completed a geotechnical investigation of the project site to provide geotechnical engineering recommendations for design and development of the proposed project. The geotechnical report is provided under CGT Project No. G2406322.B, dated February 26, 2025.

1.2 Scope of Services

The purpose of our work was to identify geologic hazards that may affect the property and prepare a GAR in accordance with the City of Salem requirements. Our specific scope of services included the following:

- Contact the Oregon Utilities Notification Center to mark the locations of public utilities at the site within a 20-foot radius of our planned explorations.
- Explore subsurface conditions at the site by observing the excavation of nine test pits to depths of up to about 8 feet below ground surface (bgs). A site plan showing the location of the test pits is attached as Figure 2.
- A surface reconnaissance was performed at the site by a qualified geologic staff member under the technical supervision of a CGT Certified Engineering Geologist (CEG).
- Review available literature for geologic hazards in the vicinity of the site. Specific hazards addressed by this study include:
    - Erosion potential
    - Landslide potential / Slope stability
    - Seismic potential
    - Flood potential
    - Volcanic hazards potential
- Review available topographic, geologic, and geologic hazard maps for the area.

- Detail geologic hazards that may affect the proposed land use.
- Provide an opinion regarding the geologic feasibility of the site for the proposed development, including a **qualitative** conclusion regarding the effects of the geologic conditions on the proposed land use, the effects of the proposed land use on future geologic processes, and the effects of the geologic conditions and proposed land use on surrounding properties.
- Provide recommendations for hazard mitigation.
- Provide this written report summarizing the results of our study.

2.0 GEOLOGY & GROUNDWATER

2.1 Regional Geology

The site is located in the central portion of the Willamette Valley physiographic province in Salem, Oregon. The Willamette Valley is a broad trough-like lowland defined by uplift and faulting of the Coast and Western Cascade Ranges to the west and east respectively. Approximately 35 million years ago, a large slab of oceanic crust and associated marine sediments accreted onto the margin of North America, which was located in a rough line from southwestern Oregon to the northeastern portion of the state. A portion of this accreted slab became the Willamette Valley, which was still covered by a shallow ocean. Additional accretion, faulting, and folding created the Coast Range to the west. This folding and faulting also raised the Willamette Valley out of the sea. Volcanic activity from the Cascade Range approximately 25 million years ago covered and filled in much of the southern and eastern portions of the early Willamette Valley[1].

Approximately 15 million years ago, Columbia River Basalts flowed down what is now the Columbia River Gorge as far west as the Oregon and Washington coast, and into the Willamette Valley as far south as Salem, Oregon. Uplift and faulting within the Willamette Basin formed the intra-valley highlands such as the Tualatin and Chehalem Mountains and the Amity, Eola, and Salem Hills. Infilling of the Willamette Valley continued from weathering of the adjacent hills and deposition of alluvium by the Willamette River and its tributaries throughout the valley. Catastrophic glacial floods later flowed into the Willamette Valley approximately 18,000 to 15,000 years ago[2] and deposited fine to coarse-grained sedimentary assemblages (Pleistocene flood deposits) mapped throughout the area[3,4,5].

2.2 Site Geology

Based on available geologic mapping[6] of the area, the site is located near a contact between Columbia River Basalt (Tcr), and Lower Terrace Bottomland deposits (Qltb). A portion of the geologic mapping is attached as Figure 3. The west half of the site is mapped as Columbia River basalt which consists of numerous fine-grained lava flows that primarily erupted from fissures in eastern Washington and Oregon and western Idaho

---

[1] Pacific Northwest Ecosystem Research Consortium, 2002. Willamette River Basin: trajectories of environmental and ecological change, Oregon State University Press.

[2] Allen, John Eliot, Burns, Marjorie, and Burns, Scott, 2009. Cataclysms on the Columbia, The Great Missoula Floods, Revised Second Edition: Ooligan Press, Portland State University.

[3] Bela, James L., 1981, Geology of the Rickreall, Salem West, Monmouth, and Sidney 7½' Quadrangles, Marion, Polk, and Linn Counties, Oregon: Oregon Department of Geology and Mineral Industries Map GMS-18, 2 plates.

[4] Orr, Elizabeth L., Orr, William N., and Baldwin, Ewart M., 1992, Geology of Oregon, Fourth Edition: Kendall/Hunt Publishing, pp. 203-222.

[5] O'Connor, Jim E., et al., 2001, Origin, extent, and thickness of quaternary geologic units in the Willamette Valley, Oregon: US Geological Survey, Professional Paper 1620,52p, 1plate.

[6] Bela, J.L., 1981, Geology of the Rickreall, Salem West, Monmouth, and Sidney 7.5-minute Quadrangles, Oregon Department of Geology and Mineral Industries, GMS 18.

during the Miocene (23.8 to 5.3 million years ago). Many individual flows are interbedded with thin paleosols that consist of clay-rich soils or sediments formed during periods of volcanic inactivity. The basalt, which has a flow thickness between 40 and 100 feet thick, features jointed patterns ranging from columnar to entablature/colonnade, and is described as having fresh exposures that are dark gray to black, while weathered exposures are gray-brown. Based on nearby well logs the basalt extends several hundred feet bgs in the vicinity of the site and is surfaced with approximately 20 to 30 feet of clay, a product of the basalt weathering in place.

The eastern half of the site is mapped as lower terrace alluvium which consists of variable amounts of slightly stratified silt, clay, and very fine-grained sand. This unit is deposited in relatively flat, low elevation areas along creek flood plains and interior drainages of bedrock units. It features poor drainage areas that are prone to ponding and contains both organic and low strength, compressible soils. Thickness is typically between 4 and 12 feet.

2.3 Groundwater

Groundwater seepage was encountered at depths ranging from 2½ to 5 feet bgs in TP-1 and TP-3 through TP-6. No groundwater was encountered within the remaining explorations excavated January 15, 2025. To determine approximate regional groundwater levels in the area, we researched well logs available on the Oregon Water Resources Department (OWRD)[7] website for wells located within Section 17, Township 8 South, Range 3 West, Willamette Meridian. Our review indicated that groundwater levels in the area generally ranged from about 94 to 100 feet bgs. More shallow water zones were reported at depths of about 54 feet bgs. Based on relatively deep depth of groundwater reported on the well logs in the vicinity of the site, and the medium to high plasticity clayey and silty soils encountered near the surface, we conclude the water observed was perched groundwater, likely related to the existing Croisan Creek and shallow ponds present at the site. We anticipate the perched groundwater levels will fluctuate due to seasonal and annual variations in precipitation, changes in site utilization, or other factors.

3.0 SEISMICITY

The site is located in a tectonically and seismically active area that may be affected by earthquakes generated by crustal and subduction zone sources.

3.1 Earthquake Sources

3.1.1 Crustal Sources

Crustal earthquakes typically occur at depths ranging from 15 to 40 kilometers bgs[8]. According to the United States Geological Survey Quaternary fault and fold database[9], nearby seismic sources capable of producing damaging earthquakes in this region include Salem-Eola Hills homocline, Waldo Hills fault, Mill Creek faults, and the Mount Angel fault. Quaternary faults in the vicinity of the site are shown on the attached Figure 4, and are summarized in the following table:

---

[7] Oregon Water Resources Department, 2025. Well Log Records, *accessed January 2025*, from OWRD web site: http://apps.wrd.state.or.us/apps/gw/well_log/.

[8] Geomatrix Consultants, 1995. Seismic Design Mapping, State of Oregon: unpublished report prepared for Oregon Department of Transportation, Personal Services Contract 11688, January 1995.

[9] U.S. Geological Survey, 2025. Quaternary fault and fold database for the United States, *accessed January 2025*, from USGS web site: http://earthquakes.usgs.gov/regional/qfaults/.

Table 1 Known Active or Potentially Active Crustal Faults in the Vicinity of the Site

USGS Fault No.	Fault Name	Distance and Direction from Site	USGS Fault Class[1]
719	Salem-Eola Hills homocline	2.75 km W	A
872	Waldo Hills fault	6.75 km SE	A
871	Mill Creek faults	8.75 km SE	A
873	Mount Angel fault	29.25 km NE	A

1 USGS Fault Classes from USGS Earthquake Hazards Program, 2008 National Seismic Hazard Maps

Class A: Fault with convincing evidence of Quaternary activity (ACTIVE)

Class B: Fault that requires further study in order to confidently define their potential as possible sources of earthquake-induced ground motion (POTENTIALLY ACTIVE)

Class C: Fault with insufficient evidence for Quaternary activity (LOW POTENTIAL FOR ACTIVITY)

3.1.1.1 Salem-Eola Hills homocline (USGS 719)

The Salem-Eola Hills homocline is a 31-kilometer-long homoclinal fold roughly coincident with the southwestern edge of the Salem and Eola Hills. The homocline deforms Miocene Columbia River Basalts (CRB), and marks the southwestern margin of the CRB in this area. The Salem-Eola Hills homocline is likely the result of very slow uplift of the Salem and Eola Hills. No direct evidence has been found for recent (Holocene) deformation, so the fold is typically considered to have a low probability of activity, and a long recurrence interval.

3.1.1.2 Waldo Hills fault (USGS 872)

The Waldo Hills fault is a 12-kilometer-long southeast-dipping reverse fault that is mapped on the northwestern front of the Waldo Hills. The fault is recognized in the subsurface by vertical separation of the top of the Columbia River Basalt[10]. No evidence for middle or late Quaternary displacement on the Waldo Hills fault has been identified; however, Oregon State University geologists suggest that the Waldo Hills fault may have a long recurrence interval and is considered active[11]. Recurrence interval estimates for earthquake activity on the Waldo Hills fault are considered to be on the order of 700,000 years or more. Extensive erosion and degradation of the identified fault scarps supports a long recurrence interval.

3.1.1.3 Mount Angel fault (USGS 873)

The Mount Angel fault is a northwest-trending, steeply northeast-dipping, oblique-slip reverse fault with a length of about 30 kilometers. The fault is mapped in the subsurface based on geophysical data, water well logs, and historical seismicity[12,13]. It displaces Columbia River Basalt at depth, as well as younger, overlying sediments[14]. Surface indications of the fault are minimal. The Mount Angel fault is considered to be the source for a series of small earthquakes (<M3.5) that occurred in 1990 near the town of Woodburn, and a M5.6 earthquake that occurred in 1993 near the town of Scotts Mills.

---

[10] Yeats, R.S., *et al*., 1996. Tectonics of the Willamette Valley Oregon: in Assessing earthquake hazards and reducing risk in the Pacific Northwest, v. 1: U.S. Geological Survey Professional Paper 1560, p. 183-222, 5 plates, scale 1:100,000.

[11] Geomatrix Consultants, 1995. Seismic Design Mapping, State of Oregon: Final Report to Oregon Department of Transportation, Project No. 2442.

[12] Yeats, R., *et al.*, 1991. Tectonics of the Willamette Valley, Oregon. U.S. Geological Survey Open File Report 91-441-P, 47 p.

[13] Werner, K.S., *et al.*, 1992. The Mount Angel Fault: Implications of Seismic-Refraction Data and the Woodburn, Oregon, Earthquake Sequence of August, 1990. Oregon Geology, v. 54, p. 112-117.

[14] Unruh, J.R., et al., 1994. Seismotectonic Evaluation: Scoggins Dam, Tualatin Project, Northwestern Oregon: Final Report, prepared by William Lettis and Associates and Woodward Clyde Federal Services, Oaklan, Californai for the U.S. Bureau of Reclamation, Denver, Colorado.

3.1.1.4 Mill Creek fault (USGS 871)

The Mill Creek fault consists of an 18-kilometer-long, steeply-dipping reverse fault bounding the southeast margin of the Waldo Hills. The Mill Creek fault is recognized in the subsurface by at least 160 feet of vertical separation of the top of the Columbia River Basalt. The Mill Creek fault does not appear to deform Pleistocene or Holocene deposits; however, this fault may have a long recurrence interval and is considered active.

3.1.2 Cascadia Subduction Zone Seismic Sources

The Cascadia Subduction Zone (CSZ) is a 1,100-kilometer-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continental plate at a rate of about 3 to 4 centimeters per year[15]. The fault trace is located off of the coast of southern British Columbia, Washington, Oregon, and northern California; approximately 193 kilometers west of the site (see attached Figure 5).

Two primary sources of seismicity are associated with the CSZ: relatively shallow earthquakes that occur on the interface between the two plates (Subduction Zone earthquakes), and deep earthquakes that occur along faults within the subducting Juan de Fuca plate (intraplate earthquakes).

3.1.2.1 Subduction Zone Earthquakes

Large subduction zone (megathrust) earthquakes occur within the upper approximate 30 kilometers of the contact between the two plates. As the Juan de Fuca Plate subducts beneath the North American Plate through this zone, the plates are locked together by friction[16]. Stress slowly builds as the plates converge until the frictional resistance is exceeded, and the plates rapidly slip past each other resulting in a "megathrust" earthquake. The United States Geologic Survey estimates megathrust earthquakes on the CSZ may have magnitudes up to M9.2.

Geologic evidence indicates a recurrence interval for major subduction zone earthquakes of 250 to 650 years, with the last major event occurring in 1700[17,18]. The eastern margin of the seismogenic portion of the Cascadia Subduction zone is located approximately 66½ kilometers west of the site, as shown on Figure 5.

3.1.2.2 Intraplate Earthquakes

Below about 30 kilometers, the plate interface does not appear to be locked by friction, and the plates slowly slide past each other. The curvature of the subducted plate increases as the advancing edge moves east, creating extensional forces within the plate. Normal faulting occurs in response to these extensional forces. This region of maximum curvature and faulting of the subducting plate is where large intraplate earthquakes

---

[15] DeMets, C., Gordon, R.G., Argus, D.F., Stein, S., 1990. Current plate motions: Geophysical Journal International, v. 101, p. 425-478.

[16] Pacific Northwest Seismic Network, 2025. Pacific Northwest Earthquake Sources Overview, *accessed January 2025,* from PNSN web site, http://pnsn.org/outreach/earthquakesources/.

[17] Atwater, B.F., 1992. Geologic evidence for earthquakes during the past 2,000 years along the Copalis River, southern coastal Washington: Journal of Geophysical Research, v. 97, p. 1901-1919.

[18] Peterson, C.D., Darienzo, M.E., Burns, S.F., and Burris, W.K., 1993. Field trip guide to Cascadia paleoseismic evidence along the northern California coast: evidence of subduction zone seismicity in the central Cascadia margin. Oregon Department of Geology and Mineral Industries, Oregon Geology, Vol. 55, p. 99-144.

are expected to occur, and is located at depths ranging from 30 to 60 kilometers[,19,20]. Intraplate earthquakes within the Juan de Fuca plate generally have magnitudes less than M7.5[21].

The 2001 M6.8 Nisqually earthquake near Olympia, Washington, occurred within this seismogenic zone at a depth of 52 kilometers. The site is located within the intraplate seismogenic zone, as shown on Figure 5.

3.2 Historic Seismicity

The Pacific Northwest is a seismically active area. Epicenters for historic earthquakes[22] in western Oregon from 1841 to 2024 are shown on Figure 6. The majority of these earthquakes are shallow (crustal) in nature, with a lesser amount of intraplate sources. No large-scale subduction-zone earthquakes occurred during this period.

4.0 LOCAL TOPOGRAPHY

In general, the site was located within a relatively level area along a drainage within the West Hills of Salem. The local topography gently descended to the east, levels out at the site, and then begins to gently ascend east of Croisan Creek. The site was bordered by Kuebler Boulevard to the north, Croisan Creek road to the east, Ballyntyne Road to the south, and residential properties to the west. Site topography observed during our reconnaissance is discussed in detail in Section 6.0 below.

5.0 HAZARDS

5.1 Flooding

The Federal Emergency Management Agency (FEMA) publishes the Flood Insurance Rate Maps (FIRM) for flood insurance purposes[23]. The FIRM map is attached as Figure 7, and shows Croisan Creek and its associated floodplain runs through the eastern portion of the property in a north-south direction. We understand that the final building locations for the eastern lots partially located within the mapped floodplain are not known at this time. For planning purposes, new residences associated with the new subdivision should be located outside of the mapped flood plain to avoid the risk of damage from flooding associated with Croisan Creek.

5.2 Landslides

Landsliding is a common hazard in the Pacific Northwest that can be initiated on marginally stable slopes by human disturbances such as grading and deforestation, and by natural processes including earthquake shaking, volcanism, heavy rainfalls, and rapid snow melt. Recent studies indicate that the most common causes for slope failures are intense rainfall and human alteration, including the placement of building loads

---

[19] Geomatrix Consultants, 1993. Seismic margin Earthquake For the Trojan Site: Final Unpublished Report For Portland General Electric Trojan Nuclear Plant, Rainier, Oregon, May 1993.

[20] Kirby, Stephen H., Wang, Kelin, Dunlop, Susan, 2002, The Cascadia Subduction Zone and Related Subduction Systems—Seismic Structure, Intraslab Earthquakes and Processes, and Earthquake Hazards: U.S. Geological Survey Open-File Report 02-328, 182 pp.

[21] Cascadia Region Earthquake Workshop, 2008. Cascadia Deep Earthquakes. Washington Division of Geology and Earth Resources, Open File Report 2008-1.

[22] U.S. Geological Survey, 2025. Earthquake Catalog, *accessed January 2025*, from USGS web site: https://earthquake.usgs.gov/earthquakes/.

[23] Federal Emergency Management Agency, 2025. FEMA Map Service Center, *accessed January 2025*, from FEMA web site: https://msc.fema.gov/portal.

on slopes, excavating or over-steepening slopes, and the infiltration or diversion of storm water runoff[24]. For example, excavation into the base of marginally stable slopes may reduce forces resisting failure on those slopes, thus causing movement. Adding fill and/or a structure to the top or mid portion of a slope increases the driving forces on a slope and may contribute to failure. Redirecting water onto or into slopes may exploit existing planes of weakness within those slopes, causing failure.

5.2.1 Regional Landslide Mapping

Review of the Statewide Landslide Information Database for Oregon (SLIDO)[25], indicates that no landslides are mapped within the vicinity of the site. A deep-seated landslide mass is located about 850 feet to the southwest of the site. This landslide mass is considered ancient and is not anticipated to impact the subject property.

Much of the SLIDO mapping is based on Light Detection and Ranging (lidar) data and imagery available from the Oregon Department of Geology and Mineral Industries (DOGAMI). We also reviewed the lidar imagery available on the DOGAMI lidar data viewer website[26]. DOGAMI provides contours and bare earth imagery, which has been filtered to remove foliage and buildings. The lidar data portray the topography at a much greater level of detail than traditional mapping methods, and can reveal features that are otherwise difficult to ascertain. In areas where human activity has modified the topography extensively, such as through road-building and general grading, the resulting “background noise” can mask features that might otherwise be apparent. Based on our review of the lidar data, we did not observe any obvious signs of previous landslides at or in the immediate vicinity of the site.

DOGAMI developed a statewide landslide susceptibility map[27] using the lidar data, USGS topography, SLIDO historical landslide information, and the state geologic map. The landslide susceptibility hazard mapping available via the DOGAMI Oregon Statewide Geohazards Viewer[28] (HAZVU) indicates a “moderate” (landsliding possible) for the northwestern portion of the site and surrounding properties based on their relative slope gradients.

Recognizing that the site is not located within an existing, mapped landslide, and the relatively gently slope gradients observed onsite, the risk of landslides occurring on the site is considered low.

5.2.2 Marion County Landslide Hazard Maps

Table 810-1A and Table 810-1B in Section 810.025 in the City of Salem’s Revised Code references a series of geologic hazard maps published by DOGAMI for the area. The following maps are specified:

---

[24] Hofmeister, R., Madin, I., Wang, Y., and Hasenberg, C. 2003, Earthquake and Landslide Hazards Maps and Future Earthquake Damage Estimates, Clackamas County, Oregon: Oregon Department of Geology and Mineral Industries, Open File Report OFR 0-03-10.

[25] Oregon Department of Geology and Mineral Industries, 2025. Statewide Landslide Information Database for Oregon (SLIDO), *accessed January 2025*, from DOGAMI web site: http://www.oregongeology.org/sub/slido/index.htm.

[26] Oregon Department of Geology and Mineral Industries, 2025. Oregon Lidar Data Viewer, *accessed January 2025*, from DOGAMI web site: http://www.oregongeology.org/sub/LiDARdataviewer/index.htm.

[27] Burns, William J, Mickelson, Katherine A., and Madin, Ian P, 2025. Landslide susceptibility overview map of Oregon. Oregon Department of Geology and Mineral Industries, Open-File Report O-16-02. Available on Oregon Statewide Geohazards Viewer, *accessed January 2025*, from DOGAMI web site: http://www.oregongeology.org/sub/hazvu/index.htm.

[28] Oregon Department of Geology and Mineral Industries, 2025. Oregon Statewide Geohazards Viewer, *accessed January 2025*, from DOGAMI web site: http://www.oregongeology.org/sub/hazvu/index.htm.

- Interpretive Map Series (IMS) maps IMS-6[29] and IMS-17[30]
- Open File Report O-77-4;
- Excessive Slope Areas within Marion County (County Map).

The following paragraphs summarize the risk to the project site, as characterized by each of the above referenced documents. Additionally, snips of these maps (relative to the vicinity of the project site) are shown on the attached Figures 8 and 9.

The site is located within the study area for IMS-6: Water Induced Landslide Hazards, Western Portion of the Salem Hills as shown on Figure 8. The majority of the site is mapped as having a low potential (1) for water-induced slope instability, with two exceptions. The southwestern corner of the site is categorized as having a high (4) potential for slope instability, and the northeastern corner is mapped as having a moderate (2) potential for slope instability.

The site is located within the study area for IMS-17: Earthquake-Induced Slope Instability: Relative Hazard Map, a portion of which is attached as Figure 9. The site is mapped as having a low to moderate potential for earthquake-induced slope instability. The mapped level of hazard varies across the site with slope gradient.

The maps associated with DOGAMI Open File Report O-77-4 "Geologic Restraints to Development in Selected Areas of Marion County, Oregon," are no longer available from the State of Oregon (plates missing), and therefore were not reviewed as part of this study.

The Excessive Slope Areas within Marion County map indicates the site is not located within an excessive slope hazard area.

5.3 Seismic Hazards

5.3.1 <u>Liquefaction</u>

A wide variety of slope and ground failures can occur in response to intense seismic shaking during large magnitude earthquakes. These failures are often related to the phenomenon of liquefaction, the process by which water-saturated sediment changes from a solid to a liquid state. Since liquefied sediment may not support the overlying ground, or any structure built thereon, a variety of failures may occur, including lateral spreading, landslides, ground settlement and cracking, sand boils, oscillation lurching, etc. The conditions necessary for liquefaction to occur are: (1) the presence of poorly consolidated, generally cohesionless sediment; (2) saturation of the sediment by groundwater; and (3) an earthquake that produces intense seismic shaking (generally a moment magnitude greater than M5.0). In general, older, more consolidated sediment, and sediment above the water table will not liquefy[31]. Field performance data and laboratory tests indicate that liquefaction occurs <u>predominantly</u> in well-sorted, loose to medium dense sand or silty sand, but can also occur in lean clays and silts[32].

---

[29] Harvey, A.F., 1998. Water Induced Landslide Hazards, Western Portion of the Salem Hills, Marion County, Oregon. Oregon Department of Geology and Mineral Industries, IMS-6.

[30] Hofmeister, Jon R, *et al.*, 2000. Earthquake-Induced Slope Instability: Relative Hazard Map Western Portion of the Salem Hills, Marion County, Oregon. Oregon Department of Geology and Mineral Industries IMS-17.

[31] Youd, T.L. and Hoose, S.N. 1978. Historic ground failures in Northern California triggered by earthquakes: U.S. Geological Survey Professional Paper 993, p.117.

[32] Seed, R.B., et al. 2003. Recent Advances In Soil Liquefaction Engineering: A Unified And Consistent Framework. Earthquake Engineering Research Center College Of Engineering University Of California, Berkeley.

The liquefaction hazard mapping available via HAZVU indicates the soils in the mapped within the eastern half of the site are highly susceptible to liquefaction during a design level earthquake. Based on their medium to high plasticity, the native lean clay (CL) and elastic silt (MH) are considered non-liquefiable. Based on review of geologic mapping and our previous experience in the area, we do not anticipate liquefiable conditions are present at depths below those explored as part of this assignment.

5.3.2 Expected Ground Shaking

The HAZVU website includes a layer indicating the expected earthquake shaking felt at a site for a magnitude 9.0 Cascadia Subduction Zone earthquake (as discussed in Section 3.1.2). The mapping is based on six categories of ground shaking ranging from “light” (category 1) to “violent” (category 6). The map indicates a “very strong” (category 4) level of ground shaking anticipated at the site during a design level earthquake.

5.3.3 Surface Rupture

5.3.3.1 Faulting

As discussed above, the site is situated in a region of the country characterized by extensive faulting and known for seismic activity. However, no known faults are mapped on or immediately adjacent to the site, the risk of surface rupture impacting the proposed development at the site due to faulting is considered negligible.

5.3.3.2 Lateral Spread

Surface rupture due to lateral spread can occur on sites underlain by liquefiable soils that are located on or immediately adjacent to slopes steeper than about 3 degrees (20H:1V), and/or adjacent to a free face, such as a stream bank or the shore of an open body of water. During lateral spread, the materials overlying the liquefied soils are subject to lateral movement downslope or toward the free face. Recognizing the lack of liquefiable soils, we characterize the risk of lateral spread to be negligible.

6.0 SITE RECONNAISSANCE

CGT geologic staff member, Anna Juhr, GIT, overseen by Engineering Geologist Parker Richmond, RG, CEG, performed a reconnaissance for geologic hazards of the site on January 15, 2025.

6.1 Surface Conditions

6.1.1 On Site

The site conditions at the time of our field work are shown on the attached Site Photographs (Figure 10).

The 34.23-acre site was bordered by Kuebler Boulevard to the north, Channel Street to the east, Ballyntyne Road to the south, and residential properties to the west. Croisan Creek was observed to flow along the eastern boundary and four ponds were located on the property. The ponds were observed in the northeastern corner, east-central, and south-central areas, and based on review of online historical imagery the ponds remain full or partially full of water year round. At the time of our investigation, a couple motorhomes were present in the northwestern portion of the site and some miscellaneous storage structures were located in the center of the site. The eastern portion of the site was relatively level and gently ascended towards the west at a gradient of approximately 6 horizontal to 1 vertical (6H:1V). The remainder of the site was covered with short grasses and trees.

No indicators of recent or ongoing slope instability were observed on the site during the reconnaissance.

6.2 Site Subsurface Conditions

6.2.1 Subsurface Investigation

Our subsurface investigation consisted of nine test pits (TP-1 through TP-9) advanced at the site on January 15, 2025. The approximate exploration locations are shown on the Site Plan, attached as Figure 2. In summary, the test pits were excavated to depths ranging from about 3 to 8 feet bgs. Details regarding the subsurface investigation, and logs of the explorations are presented in Appendix A. Subsurface conditions encountered during our investigation are summarized below.

6.2.2 Subsurface Materials

Undocumented Poorly Graded Gravel Fill (GP Fill)
Undocumented poorly graded gravel fill was encountered at the surface of TP-9. Undocumented fill refers to materials placed without (available) records of subgrade conditions or evaluation of compaction. The soil was typically gray, moist, subangular to angular or subrounded, up to about ¾ inch in diameter, and contained a variable amount of clay. This soil extended to depths of about 4 feet bgs.

Lean Clay Fill CL (Fill)
A layer of lean clay fill was encountered between the layers of undocumented poorly graded gravel fill in TP-9. This soil was typically red, moist, exhibited medium plasticity, and contained some roots up to ¼ inch in diameter, and trace angular gravel up to ¾ inch in diameter. This soil extended to a depth of about 2½ feet bgs in that test pit.

Organic Soil (OL)
Organic soil was encountered at the surface of TP-1 through TP-9. The organic soil was typically brown, moist, exhibited medium plasticity, and contained abundant rootlets. This soil extended to depths of about ¼- to ¾-foot bgs in the explorations.

Lean Clay (CL)
Underlying the organic soil in TP-2 through TP-8 was native, lean clay. This soil was typically medium stiff to stiff, dark brown to borwn, moist to wet, exhibited medium plasticity, and contained variable amounts of fine-grained sand and trace roots up to 2-inches in diameter. This soil extended to the full depth explored in TP-6, about 3 feet bgs, and extended to depth ranging from 2 to 3½ feet bgs within the other explorations.

Elastic Silt (MH)
Encountered at the surface of TP-1, and underlying the lean clay soils in TP-2 through TP-8, was native elastic silt. This soil was typically medium stiff to hard, light brown to orange/red brown, moist to wet, exhibited high plasticity, and contained variable amounts of fine-grained sand. Trace subrounded gravels and cobbles up to 5 inches in diameter were encountered in TP-2 and TP-7, at depths of about 7 and 4 feet bgs, respectively. This soil extended to the full depths explored in those test pits, about 3½ to 8 feet bgs.

The soils encountered during our subsurface investigation were consistent with the mapped alluvium in the eastern portion of the site and the residual soils from the in-place weathering of basalt bedrock described in Section 2.2.

7.0 FINDINGS & RECOMMENDATIONS

The primary geologic hazards that may affect the site are potential for slope instability, erosion, and seismic shaking. We anticipate that with proper construction control, the geology and topography of the site and the surrounding area will not adversely affect the proposed project, and the project will have no geologic impact on adjacent properties or the risk of slope instability. It is our opinion that, with the use of generally accepted construction techniques and by strictly following the recommendations contained in this report and in the building code, the site is geologically suitable for the proposed residence.

7.1 Erosion & Slope Instability

Review of the Statewide Landslide Information Database for Oregon (SLIDO), available at the DOGAMI website[33], shows no prehistoric or historic landslides on the project site. HazVu shows a *low* hazard for landslides within the western half of the site, and a *high* hazard for landslides within the eastern half of the site; however, we anticipate those hazard levels were assigned based principally on slope gradients. DOGAMI developed a statewide landslide susceptibility map[34] using the LIDAR (Light Detection and Ranging) data, USGS topography, SLIDO historical landslide information, and the state geologic map. The landslide susceptibility hazard mapping indicates a *low to moderate* hazard for shallow landslides (less than 15 feet bgs) for the site and surrounding properties, based primarily on landslide topography identified by Schlicker (1972).

No obvious signs of recent or on-going instability were observed at the site during our field investigation in January 2025. Due to the relatively gently sloped topography at and surrounding the site, the risk of slope instability at the site is considered low. Provided the recommendations presented in the corresponding geotechnical report (CGT Project No. G2406322.B) are incorporated into design and construction, the proposed development is not anticipated to increase the hazard associated with seismically-induced slope instability. Notwithstanding the above, any construction within hillside areas inherently bears greater risk of slope instability. This risk increases in seismically active areas, such as the Pacific Northwest. The owner must recognize and accept the risk of potential slope instability from causes beyond their control or as yet unrecognized.

7.2 Seismic Shaking

To minimize the risk that this hazard will adversely impact the existing development, the slope should be constructed in accordance with current building codes. The existing development will have no impact on this hazard.

7.3 Other Hazards

Other geologic hazards identified in the State of Oregon Engineering Geology Report guidelines include:

---

[33] Oregon Department of Geology and Mineral Industries, 2025. Statewide Landslide Information Database for Oregon (SLIDO), *accessed February 2025*, from DOGAMI web site: https://gis.dogami.oregon.gov/maps/slido/.

[34] Burns, William J, Mickelson, Katherine A., and Madin, Ian P, 2016. Landslide susceptibility overview map of Oregon. Oregon Department of Geology and Mineral Industries, Open-File Report O-16-02.

- Subsidence
- Shallow Groundwater
- Fault Rupture
- Expansive Soils
- Volcanic Hazards

Based on our research, field reconnaissance, and previous experience in the area, none of these hazards are present at the site.

8.0 LIMITATIONS

The scope of this assignment did not include services related to geotechnical engineering for the proposed development such as bearing capacity evaluation, settlement estimates, recommendations regarding stripping and filling, or the use of footing/floor slab drains, etc. Additionally, quantitative soil or rock slope stability analyses was not performed. Our recommendations are not intended to indicate that all geologic hazards can be mitigated by proper engineering. They are provided in order to assist the project engineer in evaluating site conditions based on geologic research and preliminary, site specific, surface and shallow subsurface exploration. If you would like CGT to provide geotechnical recommendations or geotechnical construction observations during site construction, we can prepare a geotechnical report for the site for an additional fee.

We have prepared this report for use by the owner/developer and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed as, a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

This site evaluation consisted of visual examinations of exposed soil conditions within shallow excavations and a review of readily available geologic resources judged pertinent to the evaluation. Accordingly, the limitations of the site evaluation must be recognized. An exploration of subsurface conditions at depth was not conducted for this evaluation. An investigation to explore subsurface conditions at depth using deeper soil borings or excavations could be conducted at additional cost to the owner to further define the risk of unforeseen, adverse geological issues on this site. However, based on our observations and the information available, the risk of unforeseen adverse geological issues on this site appear to be small and could, in our opinion, be assumed by the owner.

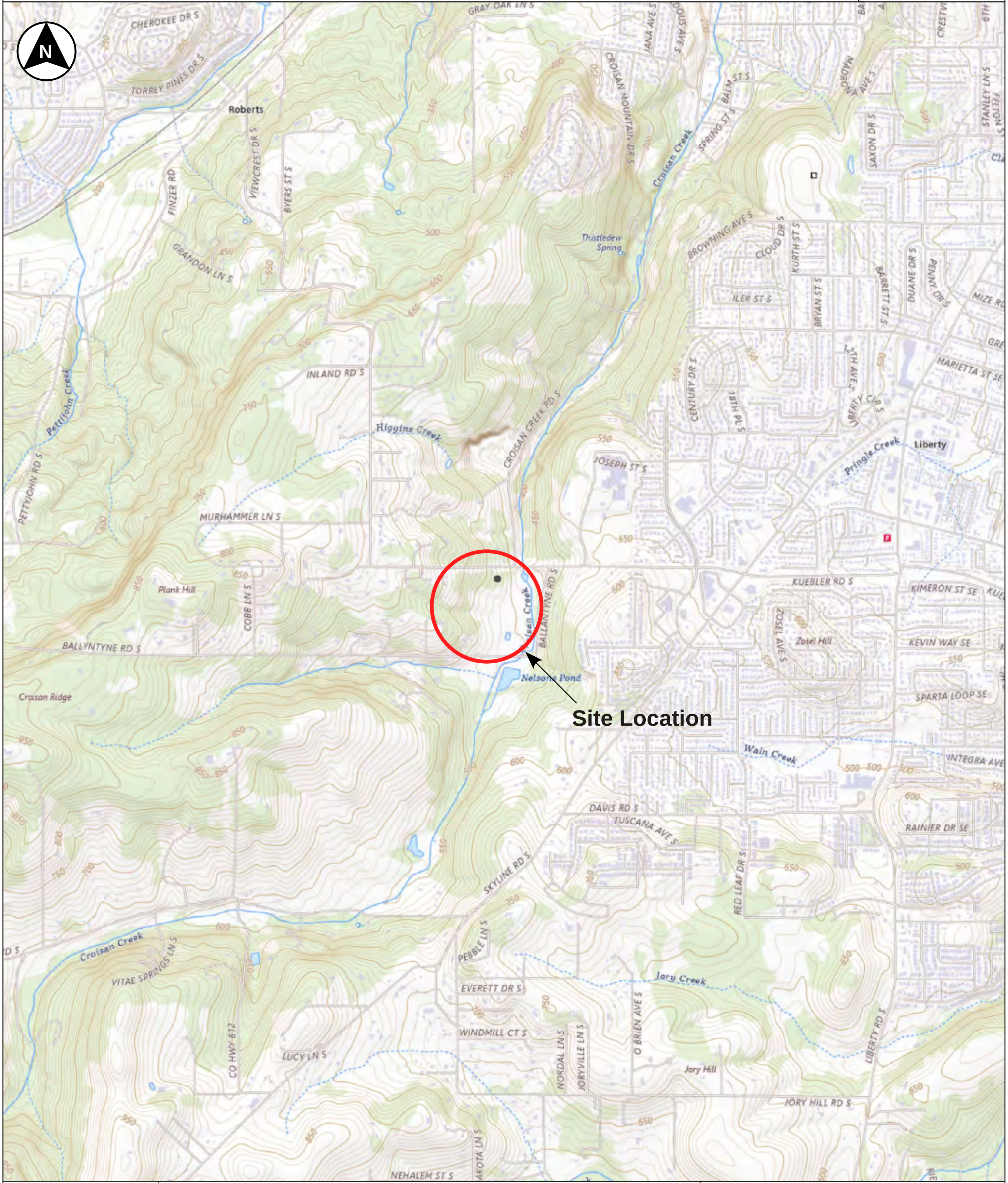
We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between or away from the explorations. If subsurface conditions vary from those encountered in our site exploration, CGT should be alerted to the change in conditions so that we may provide additional recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process. The owner/developer is responsible for insuring that the project designers and contractors implement our recommendations.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood. This report is subject to review and should not be relied upon after a period of three years.

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 1

Site Location



Site Location

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by:AET

USGS Topographic base map created with The National Map, 2025, at https://apps.nationalmap.gov/viewer/

Township 8 South, Range 3 West, Section 17, Willamette Meridian

Latitude: 44.881444° North
Longitude: 123.084281º West

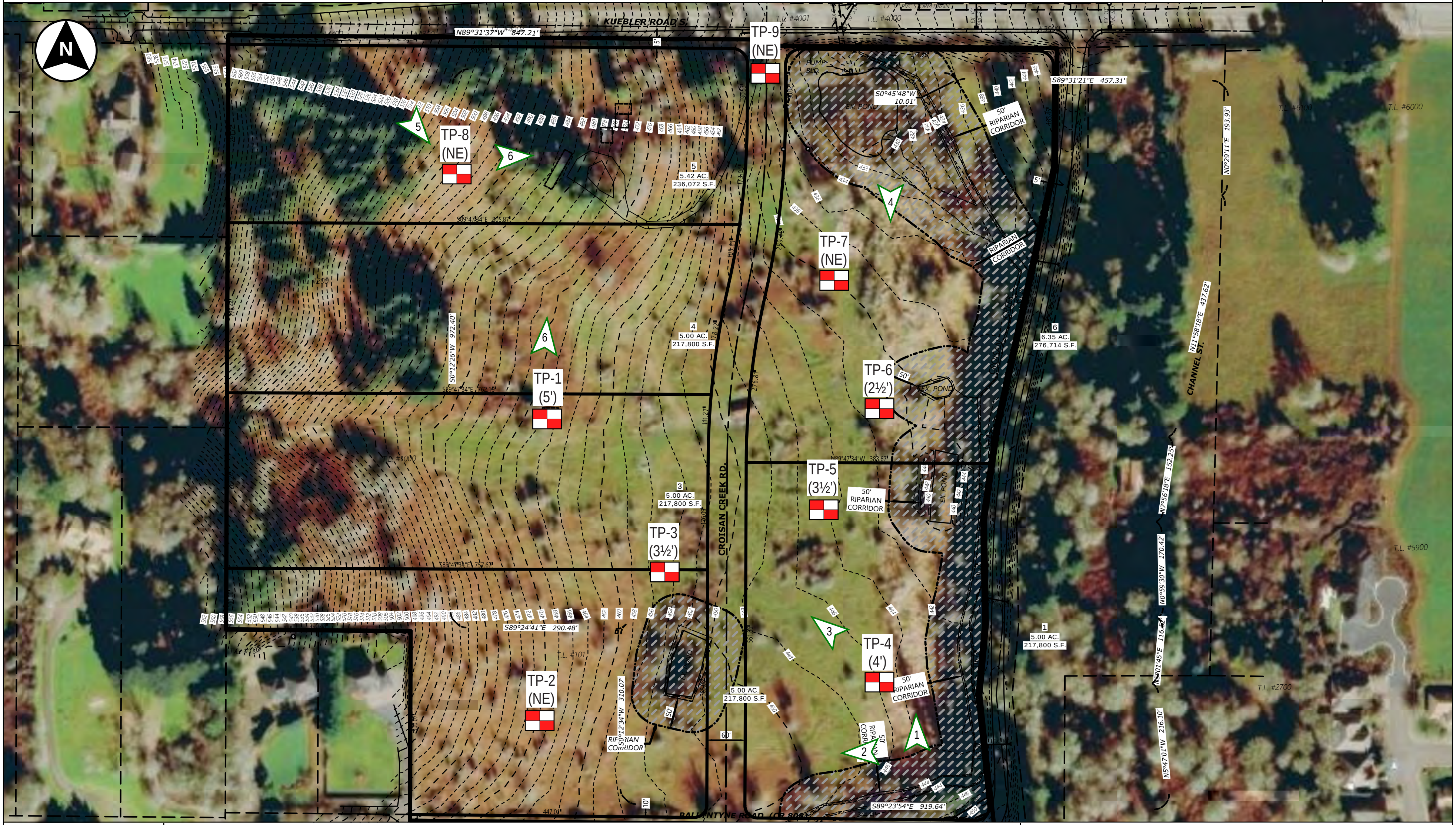
1 Inch = 2,000 feet

0 2000 4000

KEUBLER LOT PARTITONS - SALEM, OREGON
Project Number G2406322

FIGURE 2

Site Plan



CARLSON
CGT
GEOTECHNICAL
503-601-8250

Drafted by: AET

LEGEND

TP-1 (5') 🟥	Test pit exploration. Depth of water indicated in (). (NE) = not encountered.
◁1	Orientation of site photographs shown on Figure 10..

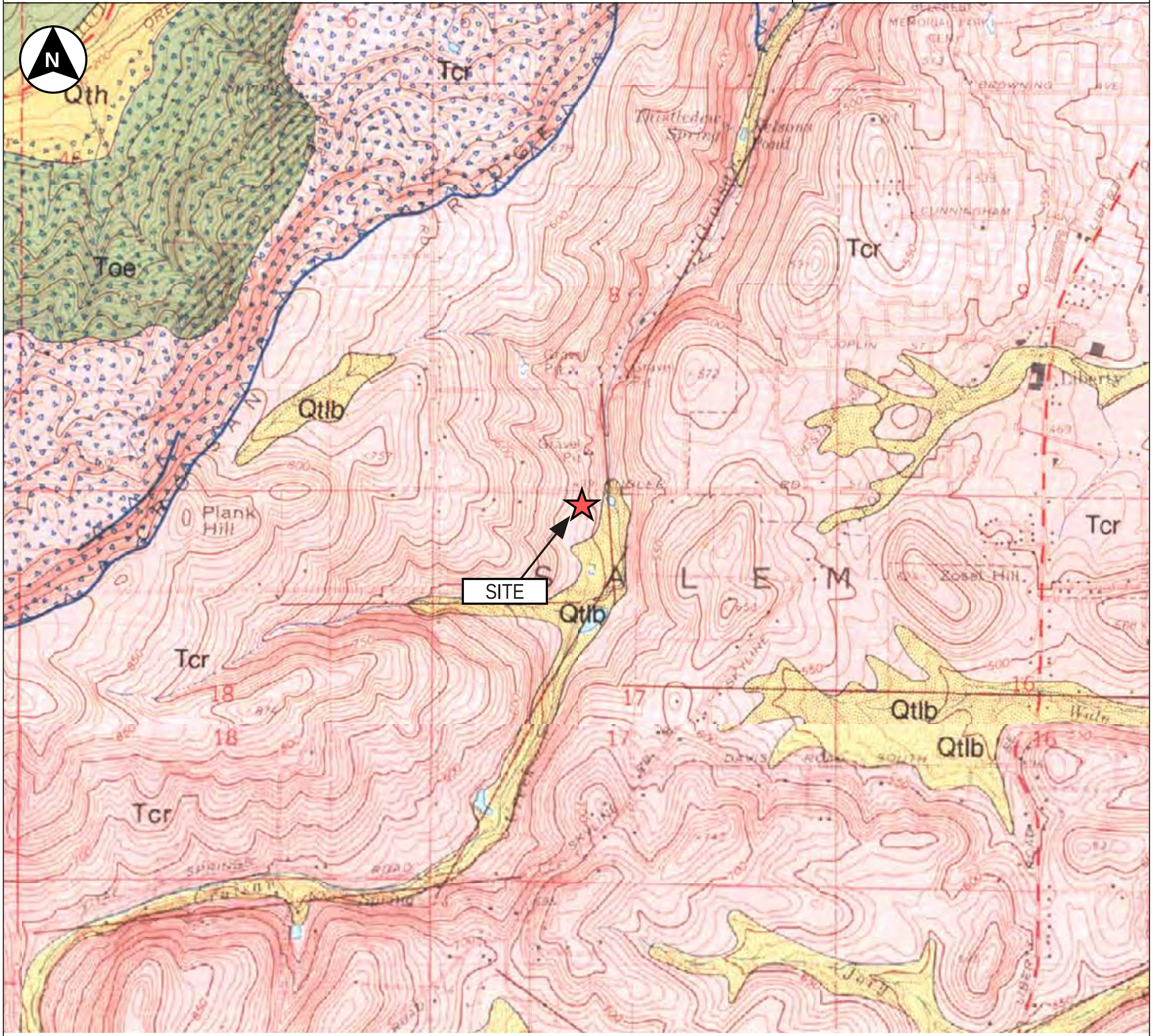
1 Inch = 250 Feet

0 250 500

NOTES: Drawing based on observations made while on site and Sheet P2, "Shadow Plan," dated June 30, 2025, produced by MultiTech. All locations are approximate. 2020 aerial image from City of Salem GIS Maps.

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 3
Geologic Map



Legend

Surficial Deposits

Qtlb Lower terrace deposits of alluvial bottomlands

Qth Higher terrace deposits

Bedrock Units

Tcr Columbia River Basalt Group

Toe Eocene-Oligocene sedimentary rock

Map Symbols

∴ Landslide deposits

CARLSON
CGT
GEOTECHNICAL
503-601-8250
Drafted by: AET

Map adapted from Bela, 1981, Geology of the Rickreal, Salem West, Monmouth, and Sidney NE 7.5 Minute Quadrangles, Oregon Department of Geology and Mineral Industries, GMS-18.

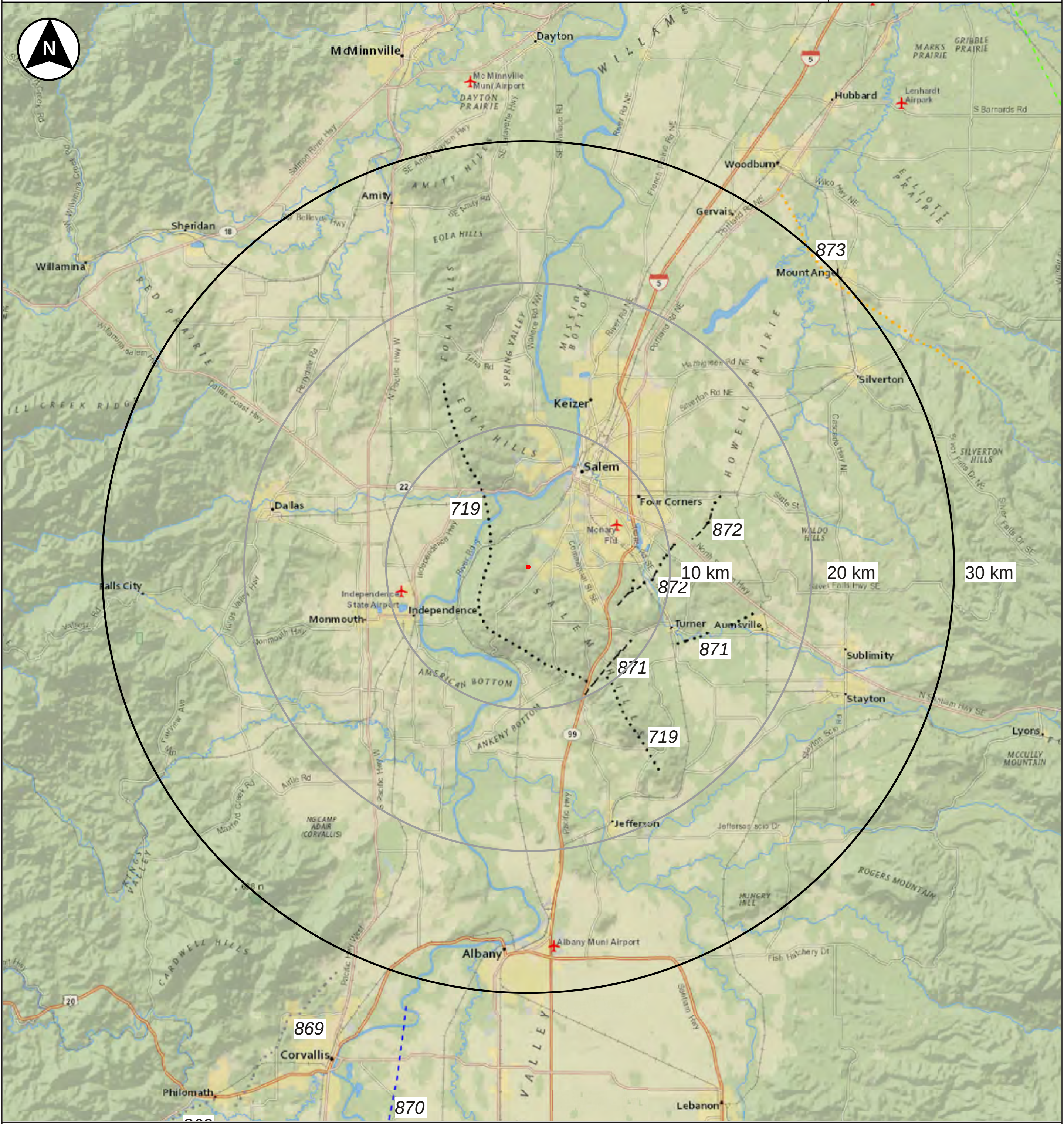
Township 8 South, Range 3 West, Section 17 Willamette Meridian

Latitude: 44.881444° North
Longitude: 123.084281° West

1 Inch = 2,000 feet
0 2000 4000

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 4
USGS Quaternary Faults



LEGEND

🟥	Historic (< 150 years)
🟧	Latest Quaternary (< 15,000 years)
🟩	Late Quaternary (< 130,000 years)
🟦	Middle and late Quaternary (< 750,000 years)
⬛	Undifferentiated Quaternary (< 1.6 million years)
🟨	Unspecified Age
⬜	Class B (age varies)

━━	Well constrained location (solid line)
━ ━	Moderately constrained location (dashed line)
▪ ▪ ▪	Inferred location (dotted line)
716	USGS Fault Number

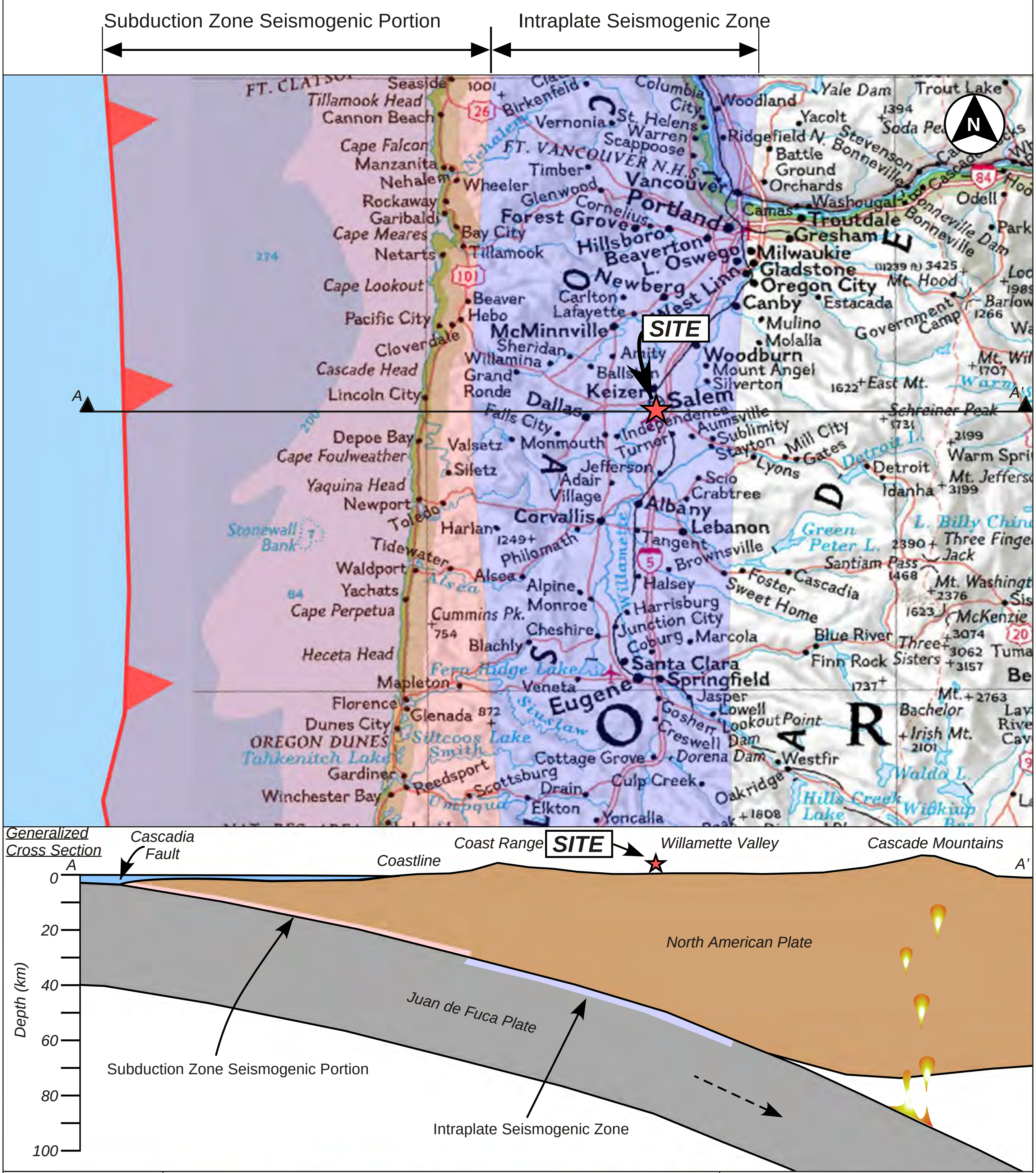
CARLSON CGT GEOTECHNICAL
503-601-8250
Drafted by: AET

NOTES: Data from USGS Quaternary Fault and Fold Database, *accessed January 2025*, at website: https://earthquake.usgs.gov/cfusion/qfault/.

1 Inch = 10 Kilometers
0 10 20

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 5
Cascadia Subduction Zone



CARLSON GEOTECHNICAL 503-601-8250

Drafted by: AET

McCrory, Blair, Oppenheimer, and Walter, 2004. Depth to the Juan de Fuca slab beneath the Cascadia subduction margin - A 3-D model for storing earthquakes: U.S. Geological Survey Data Series 91.

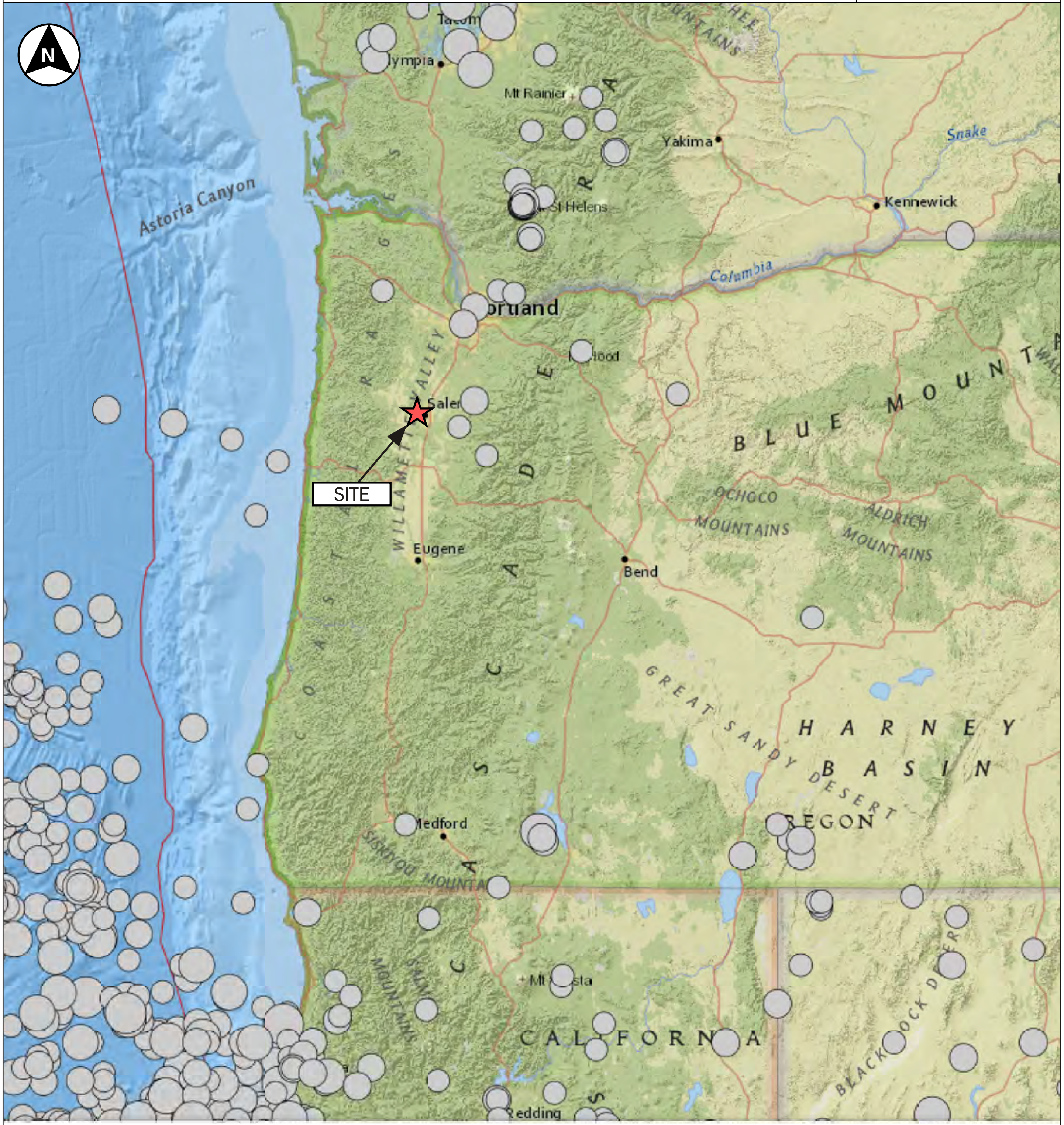
Scale 1 Inch = 50 kilometers

0 50 100

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 6

Vicinity Earthquakes



1901 - 2024 Earthquakes with Magnitude above M4.5

CARLSON
CGT
GEOTECHNICAL
503-601-8250
Drafted by: AET

Map created from USGS Earthquake Catalog at https://earthquake.usgs.gov/earthquakes/, accessed January 2025.

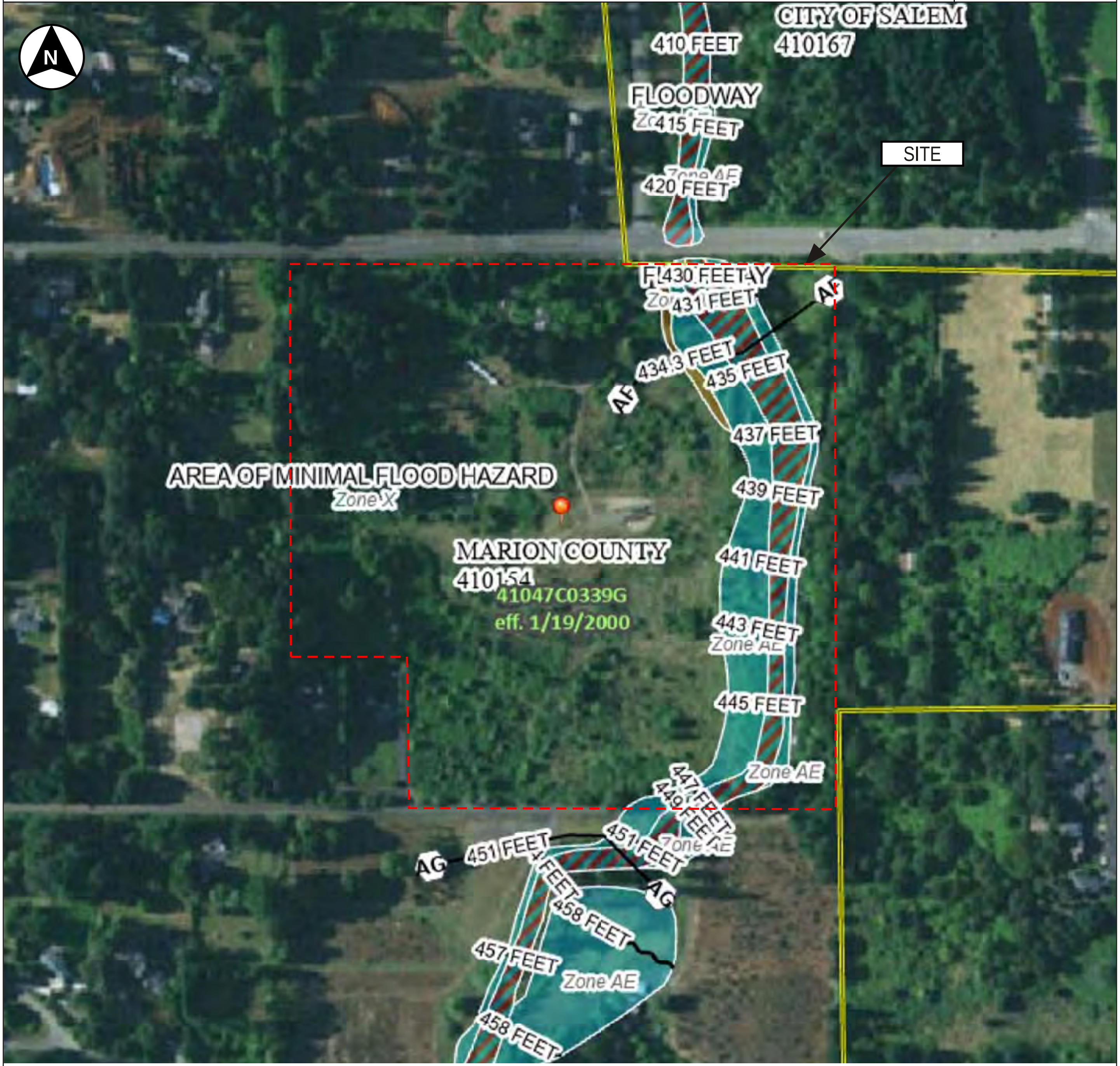
Latitude: 44.881444° North
Longitude: 123.084281° West

1 Inch = 100 kilometers
0 100 200

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 7

FEMA



LEGEND

SPECIAL FLOOD HAZARD AREAS	▨	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	▨	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	▨	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	▨	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	▨	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	▨	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	▨	Area with Flood Risk due to Levee *Zone D*

CARLSON CGT GEOTECHNICAL
503-601-8250
Drafted by: AET

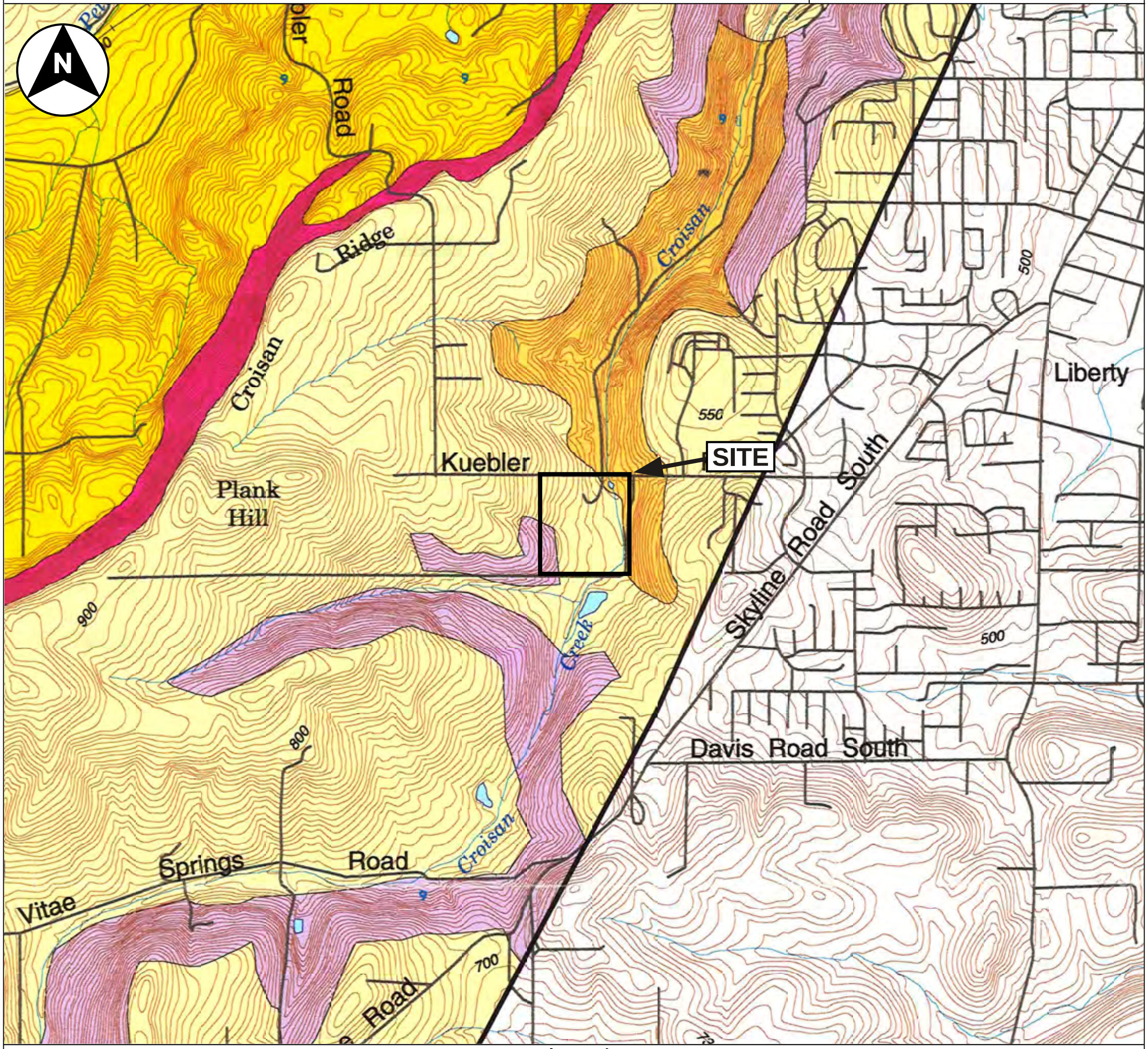
FEMA, 2025 Floodplain information obtained from the Federal Emergency Management Agency web site http://www.msc.fema.gov, accessed January 2025

1 Inch = 500 feet
0 500 1,000

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

Figure 8

Water-Induced Landslide Hazard



Explanation

Category	Susceptibility Rating
6	High, along steep escarpments
5b	High, located within a massive landslide that exhibits local activity.
5a	High, located within area of localized instability and poor drainage.
4	High, on slopes of 15% and greater where clay soils overlie basalt bedrock.
3	Moderate, along steep drainage slopes.
2	Low, located within a dormant mature landslide mass.
1	Low, on slopes less than 15%.

CARLSON CGT GEOTECHNICAL 503-601-8250
Drafted by: AET

Map adapted from Harvey, and Peterson, 1998, Water-Induced Landslide Hazards, Western Portion of the Salem Hills, Marion County, Oregon. DOGAMI, Map IMS-6.

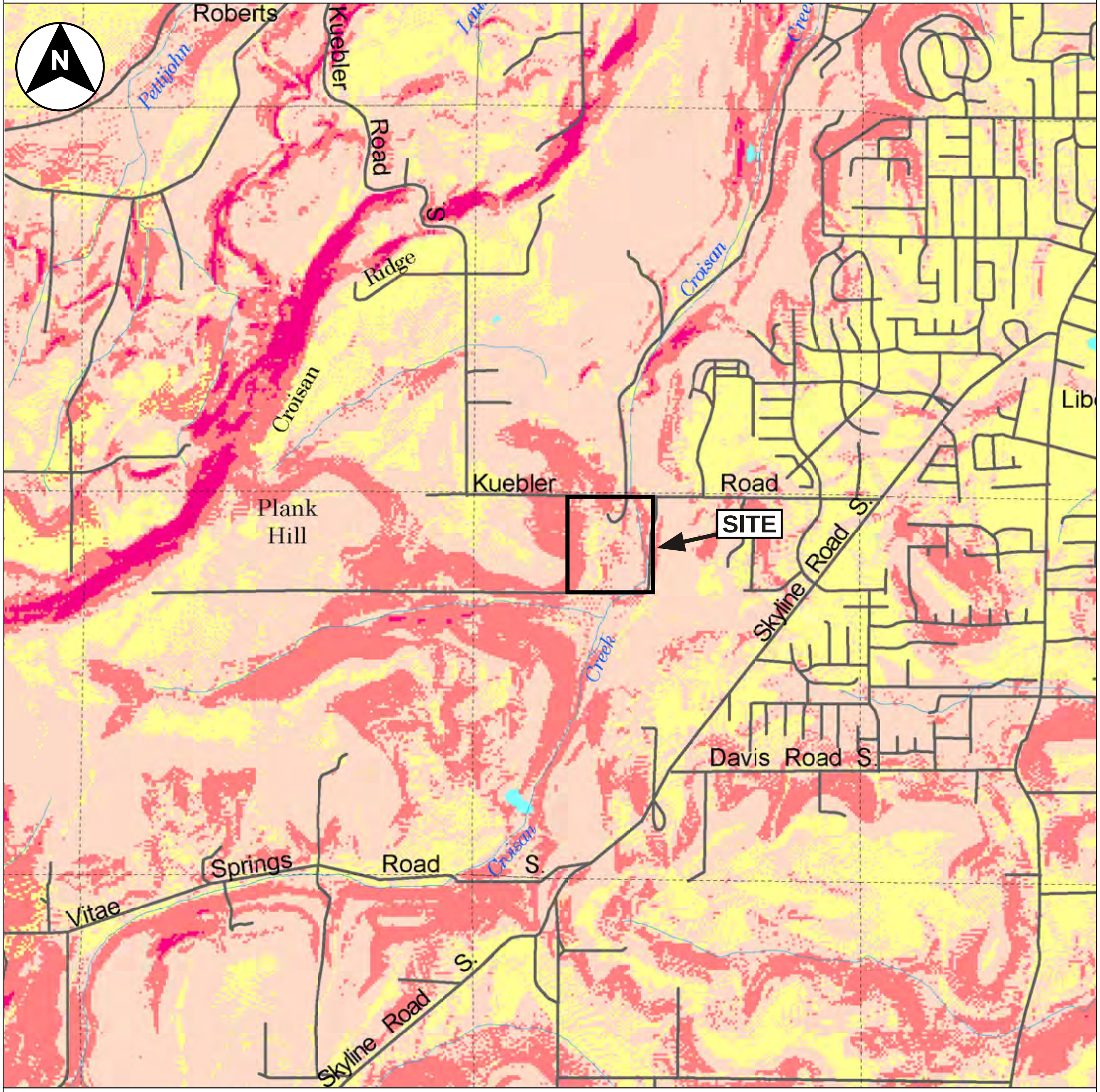
Township 8 South, Range 3 West, Section 17
Willamette Meridian

1 Inch = 2,000 feet
0 2000 4000

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

Figure 9

Earthquake-Induced Slope Instability



Explanation

Hazard Rating

🟪 High

🟥 Moderate

🟧 Low

🟨 Very Low

This relative hazard map shows areas that are susceptible to slope failures triggered by earthquake shaking. The classes *High* to *Very Low* indicate a range of slope hazard from more prone to less prone to failure from an earthquake event. A relative hazard rating of *High* does not necessarily mean that a slope will fail in any earthquake, and a rating of *Very Low* does not mean there is no potential for movement.

CARLSON
CGT
GEOTECHNICAL
503-601-8250
Drafted by: AET

Map adapted from Hofmeister, R.J., and others, 2000, Earthquake-Induced Slope Instability: Relative Hazard Map Western Portion of the Salem Hills. Oregon Department of Geology and Mineral Industries, Map IMS-17.
All locations are approximate.

Township 8 South, Range 3 West, Section 17
Willamette Meridian

1 Inch = 2,000 feet

0 2000 4000

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE 10

Site Photographs

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

CARLSON CGT GEOTECHNICAL
503-601-8250
Drafted by: AET

See Figure 2 for approximate photograph locations and directions. Photographs were taken at the time of our fieldwork.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
Phone: (503) 601-8250
www.carlsontesting.com

Bend Office	**(541) 330-9155**
Eugene Office	**(541) 345-0289**
Salem Office	**(503) 589-1252**
Tigard Office	**(503) 684-3460**

Appendix A: Subsurface Investigation

Kuebler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322

March 5, 2025

Prepared For:

Andre Makarenko
Comfort Homes LLC
3024 Brush College Road NW
Salem, Oregon 97304

Prepared by
Carlson Geotechnical

Office: 18270 SW Boones Ferry Road, Suite 6, Durham, Oregon 97224
Mailing: P.O. Box 230997, Tigard, Oregon 97281

A.1.0 SUBSURFACE INVESTIGATION

Our field investigation consisted of nine test pits completed on January 15, 2025. The exploration locations are shown on the Site Plan, attached to the report as Figure 2. The exploration locations shown therein were determined based on measurements from existing site features (trees, pavements, etc.) and are approximate. Surface elevations indicated on the logs were estimated based on the topographic contours (by others) shown on the referenced Site Plan and are approximate. The attached figures detail the exploration methods (Figure A1), soil classification criteria (Figure A2), and present detailed logs of the explorations (Figures A3 through A11), as discussed below.

A.1.1 Test Pits

CGT observed the excavation of nine test pits (TP-1 through TP-9) at the site to depths of about 3 to 8 feet bgs. Test pits TP-1, TP-2, TP-4, TP-7, and TP-8 were terminated due to practical refusal, which occurs when a mini-excavator cannot be advanced further, often due to hard soils or coarse particles (cobbles/boulders) in the soil. Test pits TP-3, TP-5, and TP-6 were terminated due to the presence of shallow groundwater. The test pits were excavated using a Kubota KX057-5 mini-excavator provided and operated by the client’s subcontractor.

A.1.2 In-Situ Testing: Pocket Penetrometer Tests

Pocket penetrometer readings were generally taken at approximate ½-foot intervals in the upper four feet of test pits TP-1 through TP-5, TP7, and TP-8. The pocket penetrometer is a hand-held instrument that provides an approximation of the unconfined compressive strength of cohesive, fine-grained soils. The correlation between pocket penetrometer readings and the consistency of cohesive, fine-grained soils is provided on the attached Figure A2.

A.1.3 Material Classification & Sampling

Representative disturbed (grab) samples of the soils encountered were obtained at select intervals within the test pits. Qualified members of CGT’s geological staff collected the samples and logged the soils in general accordance with the Visual-Manual Procedure (ASTM D2488). An explanation of this classification system is attached as Figure A2. The grab samples were stored in sealable plastic bags and transported to our office for further examination. Our geotechnical staff visually examined all samples in order to refine the initial field classifications.

A.1.4 Subsurface Conditions

Subsurface conditions are summarized in Section 6.2 of the report. Detailed logs of the explorations are presented on the attached exploration logs, Figures A3 through A11.

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE A1

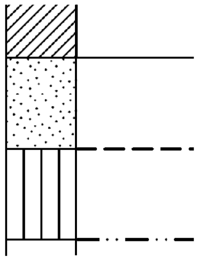
Exploration Key

PL ├──●──┤ LL MC	Atterberg limits (plasticity) test results (ASTM D4318): PL = Plastic Limit, LL = Liquid Limit, and MC= Moisture Content (ASTM D2216)
☐ FINES CONTENT (%)	Percentage passing the U.S. Standard No. 200 Sieve (ASTM D1140)

SAMPLING

✋ GRAB	Grab sample
BULK	Bulk sample
☒ SPT	**Standard Penetration Test** (SPT) consists of driving a 2-inch, outside-diameter, split-spoon sampler into the undisturbed formation with repeated blows of a 140-pound, hammer falling a vertical distance of 30 inches (ASTM D1586). The number of blows (N-value) required to drive the sampler the last 12 inches of an 18-inch sample interval is used to characterize the soil consistency or relative density. The drill rig was equipped with an cat-head or automatic hammer to conduct the SPTs. The observed N-values, hammer efficiency, and N_{60} are noted on the boring logs.
⧗ MC	**Modified California** sampling consists of 3-inch, outside-diameter, split-spoon sampler (ASTM D3550) driven similarly to the SPT sampling method described above. A sampler diameter correction factor of 0.44 is applied to calculate the equivalent SPT N_{60} value per Lacroix and Horn, 1973.
▯ CORE	**Rock Coring** interval
▮ SH	**Shelby Tube** is a 3-inch, inner-diameter, thin-walled, steel tube push sampler (ASTM D1587) used to collect relatively undisturbed samples of fine-grained soils.
WDCP	**Wildcat Dynamic Cone Penetrometer** (WDCP) test consists of driving 1.1-inch diameter, steel rods with a 1.4-inch diameter, cone tip into the ground using a 35-pound drop hammer with a 15-inch free-fall height. The number of blows required to drive the steel rods is recorded for each 10 centimeters (3.94 inches) of penetration. The blow count for each interval is then converted to the corresponding SPT N_{60} values.
DCP	**Dynamic Cone Penetrometer** (DCP) test consists of driving a 20-millimeter diameter, hardened steel cone on 16-millimeter diameter steel rods into the ground using a 10-kilogram drop hammer with a 460-millimeter free-fall height. The depth of penetration in millimeters is recorded for each drop of the hammer.
POCKET PEN. (tsf)	**Pocket Penetrometer** test is a hand-held instrument that provides an approximation of the unconfined compressive strength in tons per square foot (tsf) of cohesive, fine-grained soils.

CONTACTS



Observed (measured) contact between soil or rock units.

Inferred (approximate) contact between soil or rock units.

Transitional (gradational) contact between soil or rock units.

ADDITIONAL NOTATIONS

Italics	Notes drilling action or digging effort
{ Braces }	Interpretation of material origin/geologic formation (e.g. { Base Rock } or { Columbia River Basalt })

CARLSON CGT GEOTECHNICAL 503-601-8250

All measurements are approximate.

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322

FIGURE A2

Soil Classification

Classification of Terms and Content

NAME: Group Name and Symbol
Relative Density or Consistency
Color
Moisture Content
Plasticity
Other Constituents
Other: Grain Shape, Approximate Gradation
Organics, Cement, Structure, Odor, etc.
Geologic Name or Formation

Grain Size

		U.S. Standard Sieve
Fines		<#200 (0.075 mm)
Sand	Fine	#200 - #40 (0.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75 mm)
Gravel	Fine	#4 - 0.75 inch
	Coarse	0.75 inch - 3 inches
Cobbles		3 to 12 inches
Boulders		> 12 inches

Coarse-Grained (Granular) Soils

Relative Density

SPT N_{60}-Value	Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
>50	Very Dense

Minor Constituents

Percent by Volume	Descriptor	Example
0 - 5%	"Trace" as part of soil description	"trace silt"
5 - 15%	"With" as part of group name	"**POORLY GRADED SAND WITH SILT**"
15 - 49%	Modifier to group name	"**SILTY SAND**"

Fine-Grained (Cohesive) Soils

SPT N_{60}-Value	Torvane tsf Shear Strength	Pocket Pen tsf Unconfined	Consistency	Manual Penetration Test
<2	<0.13	<0.25	Very Soft	Thumb penetrates more than 1 inch
2 - 4	0.13 - 0.25	0.25 - 0.50	Soft	Thumb penetrates about 1 inch
4 - 8	0.25 - 0.50	0.50 - 1.00	Medium Stiff	Thumb penetrates about ¼ inch
8 - 15	0.50 - 1.00	1.00 - 2.00	Stiff	Thumb penetrates less than ¼ inch
15 - 30	1.00 - 2.00	2.00 - 4.00	Very Stiff	Readily indented by thumbnail
>30	>2.00	>4.00	Hard	Difficult to indent by thumbnail

Minor Constituents

Percent by Volume	Descriptor	Example
0 - 5%	"Trace" as part of soil description	"trace fine-grained sand"
5 - 15%	"Some" as part of soil description	"some fine-grained sand"
15 - 30%	"With" as part of group name	"**SILT WITH SAND**"
30 - 49%	Modifier to group name	"**SANDY SILT**"

Moisture Content

Dry: Absence of moisture, dusty, dry to the touch

Moist: Leaves moisture on hand

Wet: Visible free water, likely from below water table

	Plasticity	Dry Strength	Dilatancy	Toughness
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Medium	Medium to High	None to Slow	Medium
MH	Medium to High	Low to Medium	None to Slow	Low to Medium
CH	Medium to High	High to Very High	None	High

Structure

Stratified: Alternating layers of material or color >6 mm thick

Laminated: Alternating layers < 6 mm thick

Fissured: Breaks along definite fracture planes

Slickensided: Striated, polished, or glossy fracture planes

Blocky: Cohesive soil that can be broken down into small angular lumps which resist further breakdown

Lenses: Has small pockets of different soils, note thickness

Homogeneous: Same color and appearance throughout

Visual-Manual Classification

Major Divisions			Group Symbols	Typical Names
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: 50% or more *retained* on the No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel/sand mixtures, little or no fines
			GP	Poorly-graded gravels and gravel/sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel/sand/silt mixtures
			GC	Clayey gravels, gravel/sand/clay mixtures
	Sands: More than 50% *passing* the No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand/silt mixtures
			SC	Clayey sands, sand/clay mixtures
Fine-Grained Soils: 50% or more Passes No. 200 Sieve	Silt and Clays Low Plasticity Fines		ML	Inorganic silts, rock flour, clayey silts
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			OL	Organic soil of low plasticity
	Silt and Clays High Plasticity Fines		MH	Inorganic silts, clayey silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic soil of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

CARLSON CGT GEOTECHNICAL
503-601-8250

References:

ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

Terzaghi, K., and Peck, R.B., 1948, Soil Mechanics in Engineering Practice, John Wiley & Sons.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A3

Test Pit TP-01

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 475 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
▽ **GROUNDWATER DURING DRILLING** 5.0 ft / El. 470.0 ft
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL ●MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
			ELASTIC SILT: Medium stiff to stiff, red/brown, moist, high plasticity, trace fine-grained sand. {Residual soil}						1.00		
474									1.50		
									3.50		
					2				3.50		
						GRAB 1	100				
			Hard below about 2½ feet bgs.						4.50		
472									4.50		
									4.00		
					4				4.00		
		MH									
470			Wet below 5 feet bgs.	▽		GRAB 2	100				
			Black mottling below 5½ feet bgs.								
					6						
468						GRAB 3	100				
					8						
466											

· Test pit terminated at about 8 feet bgs due to practical refusal on hard soils.
· No caving encountered.
· Groundwater encountered at about 5 feet bgs.
· Test pit left open upon clients request.

CGT EXPLORATION WITH WDCP G2406322B.GPJ 3/5/25 DRAFTED BY: MDI

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A4

Test Pit TP-02

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 471 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
GROUNDWATER DURING DRILLING ---
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
		CL	**LEAN CLAY:** Medium stiff, dark brown, moist, medium plasticity, trace fine-grained sand, trace roots up to ¼ inch in diameter. {Alluvium}						2.00		
470						GRAB 1	100		0.50		
									0.50		
			No roots below 2 feet bgs.		2				0.75		
									2.50		
468									2.00		
		MH	**ELASTIC SILT:** Very stiff, red/brown, moist, high plasticity. {Residual soil}						1.75		
					4				1.50		
						GRAB 2	100				
466											
					6						
						GRAB 3	100				
464			Some weathered, subrounded gravel and cobbles up to 5 inches in diameter below 7 feet bgs.								
462											

· Test pit terminated at about 7 feet bgs due to practical refusal on hard soils.
· No groundwater or caving encountered.
· Test pit left open upon clients request.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A5

Test Pit TP-03

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 455 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
▽ **GROUNDWATER DURING DRILLING** 3.5 ft / El. 451.5 ft
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL ● MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
454	▨	CL	**LEAN CLAY:** Stiff, dark brown, moist, medium plasticity, trace fine-grained sand, trace roots up to ½ inch in diameter. {Alluvium}		2				0.50 0.50 1.50 1.75		
452	▥	MH	**ELASTIC SILT:** Medium stiff, light brown, moist, high plasticity. {Residual soil}	▽		GRAB 1	100		1.50 0.75 0.75		

450

448

446

- Test pit terminated at about 3½ feet bgs due to shallow groundwater.
- No caving encountered.
- Groundwater encountered at about 3½ feet bgs.
- Test pit left open upon clients request.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A6

Test Pit TP-04

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 445 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
▽ **GROUNDWATER DURING DRILLING** 5.0 ft / El. 440.0 ft
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL ● MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
444		CL	**LEAN CLAY:** Medium stiff, brown, moist, medium plasticity, trace fine-grained sand. {Alluvium}						0.50 0.75		
			Stiff to very stiff below 2 feet bgs.		2	GRAB 1	100		1.50 2.00		
442		MH	**ELASTIC SILT:** Stiff, red/brown, moist, high plasticity. {Residual soil}		4	GRAB 2	100		3.00 1.75 1.50 2.00		
440			Wet below 5 feet bgs.	▽	6	GRAB 3	100				
438											
436											

· Test pit terminated at about 6 feet bgs due practical refusal on hard soils.
· No caving encountered.
· Groundwater encountered at about 5 feet bgs.
· Test pit left open upon clients request.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A7

Test Pit TP-05

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 445 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
∇ **GROUNDWATER DURING DRILLING** 3.5 ft / El. 441.5 ft
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL ● MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
444		CL	**LEAN CLAY:** Medium stiff to stiff, brown, moist, medium plasticity, trace fine-grained sand, trace roots up to 2 inches in diameter. {Alluvium} No roots below 1½ feet bgs.		2				0.50 0.50 1.00 0.75		
442		MH	**ELASTIC SILT:** Stiff to very stiff, red/brown, moist, high plasticity. {Residual soil}	∇	4	GRAB 1	100		1.00 2.50 1.75 1.50		
440											
438											
436											

· Test pit terminated at about 4 feet bgs due to shallow groundwater.
· No caving encountered.
· Groundwater encountered at about 3½ feet bgs.
· Test pit left open upon clients request.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A8

Test Pit TP-06

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 441 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
▽ **GROUNDWATER DURING DRILLING** 2.5 ft / El. 438.5 ft
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
440		CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity, trace roots up to ½ inch in diameter. {Alluvium}			GRAB 1	100				
					2						
438			Wet below 2½ feet bgs.	▽		GRAB 2	100				
436											
434											
432											

· Test pit terminated at about 3 feet bgs due to shallow groundwater.
· No caving encountered.
· Groundwater encountered at about 3 feet bgs.
· Test pit left open upon clients request.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A9

Test Pit TP-07

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes

PROJECT NAME Kuebler Lot Partitions

PROJECT NUMBER G2406322

PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon

DATE STARTED 1/15/25

GROUND ELEVATION 440 ft

ELEVATION DATUM See Figure 2

WEATHER Cloudy, 40F

SURFACE Grass

LOGGED BY AFJ/MDL

REVIEWED BY AET

EXCAVATION CONTRACTOR Client

SEEPAGE ---

EQUIPMENT Kubota KX057-5 mini-excavator

GROUNDWATER DURING DRILLING ---

EXCAVATION METHOD Test Pit

GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0						
438		CL	**LEAN CLAY:** Medium stiff, dark brown, moist, medium plasticity. {Alluvium}		2				0.00 1.00 0.75 0.75		
436		MH	**ELASTIC SILT:** Medium stiff, red/brown, moist, high plasticity. {Residual soil}		4				0.75 1.00 1.00		
			Trace weathered, subround gravels and cobbles up to 5 inches in diameter below 4 feet bgs.			GRAB 1	100		2.00		
434 432 430			· Test pit terminated at about 5 feet bgs due to practical refusal on coarse particals. · No groundwater or caving encountered. · Test pit left open upon clients request.								

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A10

Test Pit TP-08

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 496 ft
ELEVATION DATUM See Figure 2
WEATHER Cloudy, 40F
SURFACE Grass
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
GROUNDWATER DURING DRILLING ---
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Brown, moist, medium plasticity, abundant rootlets.		0				0.00		
494		CL	**LEAN CLAY:** Medium stiff, dark brown, moist, medium plasticity, trace fine-grained sand. {Alluvium} Stiff below 2 feet bgs.		2	GRAB 1	100		0.50 0.75 1.75 2.00		
492 490		MH	**ELASTIC SILT:** Hard, red/brown, moist, high plasticity. {Residual Soil} Black mottling and increased digging effort below 5 feet bgs.		4 6	GRAB 2	100		4.00 4.50 4.50		
488											
486											

· Test pit terminated at about 6 feet bgs due to practical refusal on hard soils.
· No groundwater or caving encountered.
· Test pit left open upon clients request.

Carlson Geotechnical
A Division of Carlson Testing, Inc.
www.carlsontesting.com

FIGURE A11

Test Pit TP-09

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 440 ft
ELEVATION DATUM See Figure 2
WEATHER Fog, 40F
SURFACE Gravel
LOGGED BY AFJ/MDL
REVIEWED BY AET
EXCAVATION CONTRACTOR Client
SEEPAGE ---
EQUIPMENT Kubota KX057-5 mini-excavator
GROUNDWATER DURING DRILLING ---
EXCAVATION METHOD Test Pit
GROUNDWATER AFTER EXCAVATION ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL ● LL MC ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
	▨	GP FILL	**POORLY GRADED GRAVEL FILL:** Gray, moist, subangular to angular, up to ¾ inch in diameter.		0						
438	▨	CL FILL	**LEAN CLAY FILL:** Red, moist, medium plasticity, some to trace roots up to ¼ inch in diameter, trace angular gravel up to ¾ inch in diameter.		2						
	▨	GP FILL	**POORLY GRADED GRAVEL FILL:** Gray, moist, subangular to angular, up to ¾ inch in diameter, some clay fines.								
436	▨	CL	**LEAN CLAY:** *Hard*, brown, moist, medium plasticity. {Alluvium}		4	BULK 1	100				

- Test pit terminated at about 5 feet bgs.
- No groundwater or caving encountered.
- Test pit loosely backfilled with excavated material.

434
432
430