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Report of
Geotechnical Investigation
Kuebler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322B

Prepared for

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

February 26, 2025

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Dear Andre Makarenko:

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing the results of our geotechnical investigation and infiltration testing for the proposed Kuebler 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 GP25-003, dated January 2, 2025. Written authorization for our services was received on January 9, 2025.

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

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ATTACHMENTS

1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing the results of our geotechnical investigation and infiltration testing for the proposed Kuebler 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 our client, the project civil engineer, Mark Grenz, P.E., of Multi/Tech Engineering Services, Inc., and project documents provided to us. We understand the project is in its preliminary stages of planning, but is anticipated to include:

- Subdividing the 34.23-acre site into 6 residential lots.
- Construction of a new single family residential structure on each lot. No details were provided regarding the future residences, but we anticipate each structure will be one to two stories, wood-framed, and incorporate slab on grade ground floors or post and beam floor construction (crawlspaces). For the purposes of this report, we have assumed maximum column, continuous wall, and uniform floor slab loads associated with the new residences will be on the order of 25 kips, 2 kips per lineal foot (klf), and 150 pounds per square foot (psf), respectively.
- Installation of appurtenant driveways and underground utilities to serve the new residences.
- Extension of a paved, public street (Croisan Creek Road South) within the central portion of the project to provide access to the residences. We anticipate the pavements will be surfaced with asphalt concrete (AC).
- Although no detailed stormwater management plans have been provided at this time, we understand that, if conditions allow, stormwater collected from new impervious areas of the site may be directed to on-site stormwater facilities. Infiltration testing was requested at three locations as part of this assignment. Design of stormwater facilities, if incorporated, will rest with others.
- The preliminary grading plan provided indicates permanent grade changes at the site will be minimal, with maximum cuts and fills on the order of about 2 feet in depth.

1.2 Scope of Services

Our scope of work included the following:

- Contact the Oregon Utilities Notification Center to mark the locations of public utilities within a 20-foot radius of our explorations at the site.
- Explore subsurface conditions at the site by observing the excavation of fifteen test pits to depths of up to about 8 feet below ground surface (bgs). Details of the subsurface investigation are presented in Appendix A.
- Conduct infiltration testing in one of the test pits. Results of the infiltration testing are presented in Appendix B.
- Perform seven DCP tests at the base of test pits excavated along the proposed extension of Croisan Creek Road South. DCP test results are presented in Appendix C.
- Classify the soils encountered in the explorations in general accordance with ASTM D2488 (Visual-Manual Procedure).

- Perform laboratory testing of selected soil samples to refine our field classifications and to determine in-situ properties.
- Provide a technical narrative describing surface and subsurface deposits, and local geology of the site, based on the results of our explorations and published geologic mapping.
- Provide recommendations for the Seismic Site Class, mapped maximum considered earthquake spectral response accelerations, and site seismic coefficients.
- Provide a qualitative evaluation of seismic hazards at the site, including earthquake-induced liquefaction, landsliding, and surface rupture due to faulting or lateral spread.
- Provide geotechnical recommendations for site preparation and earthwork.
- Provide geotechnical engineering recommendations for use in design and construction of shallow foundations, floor slabs, retaining walls, and pavements.
- Provide this written report summarizing the results of our geotechnical investigation and recommendations for the project.

2.0 SITE DESCRIPTION

2.1 Site Geology

Based on available geologic mapping[1] of the area, the site is located near a contact between Columbia River Basalt (Tcr), and Lower Terrace Bottomland deposits (Qltb). The west (upper) 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 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 (lower) 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 in the area of the site.

2.2 Site Surface Conditions

The 34.23-acre site is bordered by Kuebler Boulevard to the north, Croisan Creek Road to the east, Ballyntyne Road to the south, and residential properties to the west. Croisan Creek flows through the eastern (lower) portion of the property. At the time of our field investigation, a couple motorhomes were present in the northwestern portion of the site and some misc. storage structures were located in the center of the site. The remainder of the site was covered with short grasses and trees. In terms of topography, the eastern (lower) portion of the site was relatively level to gently ascending towards the west at gradients of up to about 6 horizontal to 1 vertical (6H:1V). The western portion of the site gently ascended to the west at gradients up to

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[1] 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.

5H:1V. Site layout and surface conditions at the time of our field investigation are shown on the attached Site Plan (Figure 2) and Site Photographs (Figure 3).

2.3 Subsurface Conditions

2.3.1 Subsurface Investigation & Laboratory Testing

Our subsurface investigation consisted of fifteen test pits (TP-1 through TP-15) 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 ½ to 8 feet bgs. Details regarding the subsurface investigation, logs of the explorations, and results of laboratory testing are presented in Appendix A. Subsurface conditions encountered during our investigation are summarized below.

2.3.2 Subsurface Materials

Logs of the explorations are presented in Appendix A. The following describes each of the subsurface materials encountered at the site.

Undocumented Poorly Graded Gravel Fill (GP Fill, GP/GC Fill)
Undocumented poorly graded gravel fill was encountered at the surface of TP-9 through TP-11. 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 ½ to 4 feet bgs in those test pits.

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-8, and TP-12 through TP-15. 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 those test pits.

Lean Clay (CL)
Native lean clay was encountered below the undocumented fill soil in TP-9 through TP-11, and below the organic soil in TP-2 through TP-8, and TP-12 through TP-13. This soil was typically medium stiff to stiff, dark brown, brown, or red, moist to wet, exhibited medium plasticity, and contained variable amounts of fine-grained sand. Trace to some roots up to 2 inches in diameter were encountered in TP-2, TP-3, TP-5, and TP-6. This soil extended to the full depths explored in TP-6 and TP-9 through TP-15, about ½ to 5 feet bgs, and extended to depths ranging from 2 to 3½ feet bgs in TP-2 through TP-5, TP-7, and TP-8.

Elastic Silt (MH)
Native elastic silt was encountered below the organic soil in TP-1, and below the lean clay soils in TP-2 through TP-5, TP-7, and TP-8. 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 4 to 7 feet bgs. This soil extended to the full depths explored in those test pits, about 3½ to 8 feet bgs.

2.3.3 Groundwater

Groundwater 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 at the site on January 15, 2025. To determine approximate regional groundwater levels in the area, we researched well logs available on the Oregon Water Resources Department (OWRD)[2] 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. It should be noted groundwater levels vary with local topography. In addition, the groundwater levels reported on the OWRD logs often reflect the purpose of the well, so water well logs may only report deeper, confined groundwater, while geotechnical or environmental borings will often report any groundwater encountered, including shallow, unconfined groundwater. Therefore, the levels reported on the OWRD well logs referenced above are considered generally indicative of local water levels and may not reflect actual groundwater levels at the project site. We anticipate that groundwater levels will fluctuate due to seasonal and annual variations in precipitation, changes in site utilization, or other factors.

3.0 SEISMIC CONSIDERATIONS

3.1 Seismic Design

The 2023 Oregon Residential Specialty Code (2023 ORSC) requires the determination of seismic site class be determined in accordance with Chapter 20 of the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE 7-16). We have assigned the site as Site Class D (“Stiff Soil”) based on geologic mapping and subsurface conditions encountered during our investigation.

Seismic ground motion values were determined in accordance with Section R301.2.2 of the 2023 ORSC using the ASCE Hazard Tool on the ASCE website[3]. The Seismic Design Category was determined from Table R301.2.2.1.1 of the 2023 ORSC. The site Latitude 44.881413° North and Longitude 123.083905° West were input as the site location. The following table shows the recommended seismic design parameters for the site.

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[2] 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/.

[3] American Society of Civil Engineers (ASCE), 2025. USGS seismic design parameters determined using “ASCE Hazard Tool,” *accessed January 2025*, from the ASCE website https://ascehazardtool.org/.

Table 1 Seismic Ground Motion Values (2023 ORSC)

Parameter		Value
Mapped Acceleration Parameters	Spectral Acceleration, 0.2 second (S_s)	0.839g
Coefficients (Site Class D)	Site Coefficient, 0.2 second (F_A)	1.164
Adjusted MCE Spectral Response Parameters	MCE Spectral Acceleration, 0.2 second (S_{MS})	0.977g
Design Spectral Response Accelerations	Design Spectral Acceleration, 0.2 second (S_{DS})	0.651g
Seismic Design Category (Risk Category II)		D_1

3.2 Seismic Hazards

3.2.1 Liquefaction

In general, liquefaction occurs when deposits of loose/soft, saturated, cohesionless soils, generally sands and silts, are subjected to strong earthquake shaking. If these deposits cannot drain quickly enough, pore water pressures can increase, approaching the value of the overburden pressure. The shear strength of a cohesionless soil is directly proportional to the effective stress, which is equal to the difference between the overburden pressure and the pore water pressure. When the pore water pressure increases to the value of the overburden pressure, the shear strength of the soil approaches zero, and the soil can liquefy. The liquefied soils can undergo rapid consolidation or, if unconfined, can flow as a liquid. Structures supported by the liquefied soils can experience rapid, excessive settlement, shearing, or even catastrophic failure.

For fine-grained soils, susceptibility to liquefaction is evaluated based on penetration resistance and plasticity, among other characteristics. Criteria for identifying non-liquefiable, fine-grained soils are constantly evolving. Current practice to identify non-liquefiable, fine-grained soils is based on moisture content and plasticity characteristics of the soils[4,5,6]. The susceptibility of sands, gravels, and sand-gravel mixtures to liquefaction is typically assessed based on penetration resistance, as measured using SPTs, CPTs, or Becker Hammer Penetration tests (BPTs).

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.

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[4] Seed, R.B. et al., 2003. Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework. Earthquake Engineering Research Center Report No. EERC 2003-06.

[5] Bray, Jonathan D., Sancio, Rodolfo B., et al., 2006. Liquefaction Susceptibility of Fine-Grained Soils, Journal of Geotechnical and Geoenvironmental Engineering, Volume 132, Issue 9, September 2006.

[6] Idriss, I.M., Boulanger, R.W., 2008. Soil Liquefaction During Earthquakes, Earthquakes Engineering Research Institute Monograph MNO-12.

3.2.2 Slope Instability

Review of the Statewide Landslide Information Database for Oregon (SLIDO), available at the DOGAMI website[7], 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[8] 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 later in this report regarding grading and drainage 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.

3.2.3 Surface Rupture

3.2.3.1 Faulting

Although the site is situated in a region of the country with known active faults and historic seismic activity, no known faults exist on or immediately adjacent to the site. Therefore, the risk of surface rupture at the site due to faulting is considered low.

3.2.3.2 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. Based on the non-liquefiable nature of the soils at the site, the risk of damage associated with lateral spread is negligible.

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[7] 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/.

[8] 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.

4.0 CONCLUSIONS

Based on the results of our field explorations and analyses, the site may be developed as described in Section 1.1 of this report, provided the recommendations presented in this report are incorporated into the design and development. The primary geotechnical considerations for the project are summarized in the following sections.

4.1 Expansion Potential

The near surface elastic silt (MH) exhibited high plasticity, with a plasticity index of approximately 36 percent. Based on its plasticity index, the elastic silt has a *very high or critical* expansive potential[9]. Foundations, floor slabs, and pavements founded directly on these soils may be subject to cyclic shrink-swell movements that can result in differential movements and distress. In the absence of supplemental testing, we recommend measures be taken to protect foundations, floor slabs, retaining walls, and pavements from the potentially damaging effects of shrink-swell movements of those soils. Geotechnical recommendations for foundation, retaining walls, floor slabs, and pavement subgrade preparation are presented in Sections 5.5, 5.6, 5.7, and 5.8, respectively.

4.2 Undocumented Fills

As indicated in Section 2.3 above, we encountered undocumented fill materials (GP Fill, CL Fill) in test pits TP-9 through TP-11. To the best of our knowledge, there are no records detailing the original placement and compaction of the existing fill materials at the site. Due to the lack of documentation and the inherent risk of excessive, total and differential, post-construction settlements, we do not recommend the existing fill materials be relied upon to support new shallow foundations, floor slabs, retaining walls, or pavements associated with the planned project. Where encountered at design subgrade elevations for these features, we recommend the existing fill materials be over-excavated and replaced with structural fill in conformance with the recommendations presented in Section 5.4 below. Re-use of those materials as structural fill at the site may require special consideration as discussed in Section 5.4.1 of this report.

4.3 Moisture Sensitive Soils

The near surface fine-grained soils (MH, CL) are susceptible to disturbance during wet weather. Trafficability of these soils may be difficult, and significant damage to the subgrade could occur, if earthwork is undertaken without proper precautions at times when the exposed soils are more than a few percentage points above optimum moisture content. In the event that construction occurs during wet weather, CGT recommends that measures be implemented to protect the fine-grained subgrade in areas of repeated construction traffic and within footing excavations. Geotechnical recommendations for wet weather construction are presented in Section 5.3 of this report.

5.0 RECOMMENDATIONS

The recommendations presented in this report are based on the information provided to us, results of our field investigation and analyses, laboratory data, and professional judgment. CGT has observed only a small portion of the pertinent subsurface conditions. The recommendations are based on the assumptions that the

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[9] Day, Robert W. 2005. Table 9.1 – Typical Soil Properties versus Expansion Potential *in* Foundation Engineering Handbook: Design and Construction with the 2006 International Building Code. Published by McGraw-Hill Companies, Inc.

subsurface conditions do not deviate appreciably from those found during the field investigation. CGT should be consulted for further recommendations if the design of the proposed development changes and/or variations or undesirable geotechnical conditions are encountered during site development.

5.1 Site Preparation

5.1.1 Demolition

Demolition of existing structures should include complete removal of all structural elements, including foundations and concrete slabs. Abandoned buried utilities should similarly be removed or grouted full. Concrete debris resulting from demolition activities may be re-used as structural fill, provided it is processed in accordance with the recommendations presented in Section 5.4.1 of this report. Alternatively, demolition debris should be hauled off site for disposal.

5.1.2 Stripping & Grubbing

Existing vegetation, rooted soils (OL), and undocumented fill (GP Fill, CL Fill) should be removed from within, and for a minimum 5-foot margin around, proposed building pads, structural fill areas, and pavement areas. Based on the results of our field explorations, stripping depths are anticipated to range from about ¼- to ¾-foot bgs. Undocumented fill extending to depths of up to 4 feet bgs was encountered in test pits TP-9 through TP-11, located in the north-central portion of the site. These materials may be deeper or shallower at locations away from the completed explorations. The geotechnical engineer's representative should provide recommendations for actual stripping depths based on observations during site stripping. Stripped surface vegetation and rooted soils should be transported off-site for disposal, or stockpiled for later use in landscaped areas. Stripped, inorganic fill materials should be transported off-site for disposal, or may be stockpiled for later use as structural fill as described in Section 5.4.1 of this report.

Grubbing of trees should include the removal of the root mass and roots greater than ½ inch in diameter. Grubbed materials should be transported off-site for disposal. Root masses from larger trees may extend greater than 3 feet bgs. Where root masses are removed, the resulting excavation should be properly backfilled with structural fill in conformance with Section 5.4 of this report.

5.1.3 Test Pit Backfills

Test pits TP-1 though TP-8 were left open at our client's request and test pits TP-9 through TP-15 were loosely backfilled during our field investigation. Where test pits are located within finalized building, structural fill, or pavement areas, the loose backfill materials should be re-excavated. The resulting excavations should be backfilled with structural fill in conformance with Section 5.4 of this report.

5.1.4 Existing Utilities & Below-Grade Structures

All existing utilities at the site should be identified prior to excavation. Abandoned utility lines beneath the new buildings, pavements, and hardscaping features should be completely removed or grouted full. Soft, loose, or otherwise unsuitable soils encountered in utility trench excavations should be removed and replaced with structural fill in conformance with Section 5.4 this report. Buried structures (i.e. footings, foundation walls, retaining walls, slabs-on-grade, tanks, etc.), if encountered during site development, should be completely removed and replaced with structural fill in conformance with Section 5.4 of this report.

5.1.5 Subgrade Preparation - Building Pads, Private Pavements & Areas to Receive Structural Fill

After site preparation as recommended above, but prior to placement of structural fill and/or aggregate base, the geotechnical engineer's representative should observe the exposed subgrade soils in order to identify areas of excessive yielding through either proof rolling or probing. Proof rolling of subgrade soils is typically conducted during dry weather using a fully-loaded, 10- to 12-cubic-yard, tandem-axle, tire-mounted, dump truck or equivalent weighted water truck. Areas of limited access or that appear too soft or wet to support proof rolling equipment should be evaluated by probing. During wet weather, subgrade preparation should be performed in general accordance with the recommendations presented in Section 5.3 of this report. If areas of soft soil or excessive yielding are identified, the affected material should be over-excavated to firm, unyielding subgrade, and replaced with imported granular structural fill in conformance with Section 5.4.2 of this report.

The elastic silt (MH) soils should be kept moist, near optimum moisture content, and not allowed to dry out. If allowed to dry below optimum moisture content, to a point where surface cracking appears in the subgrade, the affected material should be over-excavated and replaced with imported granular structural fill.

5.1.6 Erosion Control

Erosion and sedimentation control measures should be employed in accordance with applicable City, County, and State regulations.

5.2 Temporary Excavations

5.2.1 Overview

Conventional earthmoving equipment in proper working condition should be capable of making necessary excavations for the anticipated site cuts as described earlier in this report. All excavations should be in accordance with applicable OSHA and state regulations. It is the contractor's responsibility to select the excavation methods, to monitor site excavations for safety, and to provide any shoring required to protect personnel and adjacent improvements. A "competent person," as defined by OR-OSHA, should be on-site during construction in accordance with regulations presented by OR-OSHA. CGT's current role on the project does not include review or oversight of excavation safety.

5.2.2 OSHA Soil Type

For use in the planning and construction of temporary excavations up to 8 feet in depth, an OSHA soil type "B" may be used for the native fine-grained soils (MH, CL) encountered in the test pits.

5.2.3 Utility Trenches

Temporary trench cuts should stand near vertical to depths of approximately 4 feet in the native silty and clayey soils encountered near the surface of the site. If groundwater seepage undermines the stability of the trench, or if sidewall caving is observed during excavation, the sidewalls should be flattened or shored. Depending on the time of year trench excavations occur, trench dewatering may be required in order to maintain dry working conditions. Pumping from sumps located within the trench will likely be effective in removing water resulting from seepage. If groundwater is encountered, we recommend placing trench stabilization material at the base of the excavations. Trench stabilization material should be in conformance with Section 5.4.3.

5.2.4 Excavations Near Foundations

Excavations near footings should not extend within a 1 horizontal to 1 vertical (1H:1V) plane projected out and down from the outside, bottom edge of the footings. In the event excavation needs to extend below the referenced plane, temporary shoring of the excavation and/or underpinning of the subject footing may be required. The geotechnical engineer should be consulted to review proposed excavation plans for this design case to provide specific recommendations.

5.2.5 Draping of Cut Slopes

In wet weather conditions, we recommend temporary cut slopes in excess of 4 feet in height (created during construction) be draped with minimum 10-mil plastic sheeting (e.g. polyethylene). Draping of cut slopes less than 4 feet in height may also be performed. The draping should extend from the base of the cut slope and back from the top of the cut slope sufficient to limit runoff from flowing under the covering. The plastic sheets should be lapped sufficiently to prevent water from flowing directly onto the slope and should extend at least several feet beyond each side of the cut area. The plastic should be weighted or otherwise anchored so that it remains on the slope during construction. Runoff from the sheeting should not be allowed to pond or infiltrate into the subsurface at the toe of the slope, but should be collected and diverted away from the cut slope to a suitable discharge point.

5.3 Wet Weather Considerations

For planning purposes, the wet season should be considered to extend from late September to late June. It is our experience that dry weather working conditions should prevail between early July and mid-September. Notwithstanding the above, soil conditions should be evaluated in the field by the geotechnical engineer's representative at the initial stage of site preparation to determine whether the recommendations within this section should be incorporated into construction.

5.3.1 Overview

Due to their fines content, the on-site silty and clayey soils (MH, CL) are susceptible to disturbance during wet weather. Trafficability of these soils may be difficult, and significant damage to subgrade soils could occur, if earthwork is undertaken without proper precautions at times when the exposed soils are more than a few percentage points above optimum moisture content. For wet weather construction, site preparation activities may need to be accomplished using track-mounted equipment, loading removed material onto trucks supported on granular haul roads, or other methods to limit soil disturbance. The geotechnical engineer's representative should evaluate the subgrade during excavation by probing rather than proof rolling. Soils that have been disturbed during site preparation activities, or soft or loose areas identified during probing, should be over-excavated to firm, unyielding subgrade, and replaced with imported granular structural fill in conformance with Section 5.4.2.

5.3.2 Geotextile Separation Fabric

We recommend a geotextile separation fabric be placed to serve as a barrier between the prepared subgrade and granular fill/base rock in areas of repeated or heavy construction traffic. The geotextile fabric should meet the requirements presented in the current Oregon Department of Transportation (ODOT) Standard Specification for Construction (ODOT SSC), Section 02320.

5.3.3 Granular Working Surfaces (Haul Roads & Staging Areas)

Haul roads subjected to repeated heavy, tire-mounted, construction traffic (e.g. dump trucks, concrete trucks, etc.) will require a minimum of 18 inches of imported granular material. For light staging areas, 12 inches of imported granular material is typically sufficient. Additional granular material, geo-grid reinforcement, or cement amendment may be recommended based on site conditions and/or loading at the time of construction. The imported granular material should be in conformance with Section 5.4.2 and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. The prepared subgrade should be covered with geotextile fabric (Section 5.3.2) prior to placement of the imported granular material. The imported granular material should be placed in a single lift (up to 24 inches deep) and compacted using a smooth-drum, non-vibratory roller until well-keyed.

5.3.4 Cement Amendment

It is sometimes less costly to amend near-surface, moisture-sensitive, fine-grained soils with Portland cement than to remove and replace those soils with imported granular material. Successful use of soil cement amendment depends on use of correct techniques and equipment, soil moisture content, and the amount of cement added to the subgrade (mix design). We anticipate the on-site native fine-grained soils (CL, MH) are conducive for cement amendment based on our experience with similar soils.

The recommended percentage of cement is based on soil moisture contents at the time the work is performed. Based on our experience, 3 percent cement by weight of dry soil can generally be used when the soil moisture content does not exceed approximately 20 percent. If the soil moisture content is in the range of 25 to 35 percent, 4 to 6 percent by weight of dry soil is recommended. It is difficult to accurately predict field performance due to the variability in soil response to cement amendment. The amount of cement added to the soil may need to be adjusted based on field observations and performance.

If cement amendment is considered, we recommend additional sampling, laboratory testing, and a mix design be performed to determine the level of improvement in engineering properties (strength, stiffness) of the on-site soils when blended with Portland cement. We recommend project scheduling allow for a minimum of 4 weeks for this testing and design to be completed, prior to initiating cement amendment.

5.3.5 Footing Subgrade Protection

A minimum of 3 inches of imported granular material (crushed rock) is recommended to protect fine-grained (clayey), footing subgrades from foot traffic during inclement weather. The imported granular material should be in conformance with Section 5.4.2. The maximum particle size should be limited to 1 inch. The imported granular material should be placed in one lift over the prepared, undisturbed subgrade, and compacted using non-vibratory equipment until well keyed.

Surface water should not be allowed to collect in footing excavations. The excavations should be draped and/or provided with sumps to preclude water accumulation during inclement weather.

5.4 Structural Fill

The geotechnical engineer should be provided the opportunity to review all materials considered for use as structural fill (prior to placement). Samples of the proposed fill materials should be submitted to the geotechnical engineer a minimum of 5 business days prior their use on site[10]. The geotechnical engineer's representative should be contacted to evaluate compaction of structural fill as the material is being placed. Evaluation of compaction may take the form of in-place density tests and/or proof roll tests with suitable equipment. Structural fill should be evaluated at intervals not exceeding every 2 vertical feet as the fill is being placed.

5.4.1 On-Site Soils – General Use

5.4.1.1 Concrete Debris

Concrete debris resulting from the demolition of existing features (foundations, floor slabs, sidewalks, driveways, etc.) can be re-used as structural fill if processed/crushed into material that is fairly well-graded between coarse and fine. The processed/crushed concrete should contain no organic matter, debris, or particles larger than 4 inches in diameter. Moisture conditioning (wetting) should be expected in order to achieve adequate compaction. When used as structural fill, this material should be placed and compacted in general accordance with Section 5.4.2.

5.4.1.2 Poorly Graded Gravel Fill (GP Fill)

Re-use of the on-site, relatively clean, gravelly fill soils as structural fill is feasible, provided the materials are kept clean of organics, and debris. If reused as structural fill, these materials should be prepared in general accordance with Section 5.4.2.

5.4.1.3 Elastic Silt (MH)

Recognizing its moisture sensitivity and expansive potential, we do not recommend the on-site elastic silt be re-used as structural fill at the site.

5.4.1.4 Lean Clay Fill (CL Fill), Native Lean Clay (CL)

Re-use of these soils as structural fill may be difficult because these soils are sensitive to small changes in moisture content and are difficult, if not impossible, to adequately compact during wet weather. We anticipate the moisture content of these soils will be higher than the optimum moisture content for satisfactory compaction. Therefore, moisture conditioning (drying) should be expected in order to achieve adequate compaction. If used as structural fill, these soils should be free of organic matter, debris, and particles larger than 4 inches. When used as structural fill, these soils should be placed in lifts with a maximum pre-compaction thickness of about 8 inches at moisture contents within –1 and +3 percent of optimum, and compacted to not less than 90 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor).

If the on-site materials cannot be properly moisture-conditioned and/or processed, we recommend using imported granular material for structural fill.

5.4.2 Imported Granular Structural Fill – General Use

Imported granular structural fill should consist of angular pit or quarry run rock, crushed rock, or crushed gravel that is fairly well graded between coarse and fine particle sizes. The granular fill should contain no organic matter, debris, or particles larger than 4 inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. For fine-grading purposes, the maximum particle size should be limited to 1½ inches. The percentage of fines can be increased to 12 percent of the material passing the U.S. Standard

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[10] Laboratory testing for moisture density relationship (Proctor) is required. Tests for gradation may be required.

No. 200 Sieve if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary, for proper compaction. Imported granular fill material should be placed in lifts with a maximum thickness of about 12 inches, and compacted to not less than 95 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). Proper moisture conditioning and the use of vibratory equipment will facilitate compaction of these materials.

Granular fill materials with high percentages of particle sizes in excess of 1½ inches are considered non-moisture-density testable materials. As an alternative to conventional density testing, compaction of these materials should be evaluated by proof roll test observation (deflection tests), where accepted by the geotechnical engineer.

5.4.3 Trench Base Stabilization Material

If groundwater is present at the base of utility excavations, trench base stabilization material should be placed. Trench base stabilization material should consist of a minimum of 1 foot of well-graded granular material with a maximum particle size of 4 inches and less than 5 percent material passing the U.S. Standard No. 4 Sieve. The material should be free of organic matter and other deleterious material, placed in one lift, and compacted until well-keyed.

5.4.4 Trench Backfill Material

Trench backfill for the utility pipe base and pipe zone should consist of granular material as recommended by the utility pipe manufacturer. Trench backfill above the pipe zone should consist of well-graded granular material containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. As a guideline, trench backfill should be placed in maximum 12-inch-thick lifts. The earthwork contractor may elect to use alternative lift thicknesses based on their experience with specific equipment and fill material conditions during construction in order to achieve the required compaction. The following table presents recommended relative compaction percentages for utility trench backfill.

Table 2 Utility Trench Backfill Compaction Recommendations

Backfill Zone	**Recommended Minimum Relative Compaction**	
	Structural Areas[1,2]	**Landscaping Areas**
Pipe Base and Within Pipe Zone	90% ASTM D1557 or pipe manufacturer's recommendation	85% ASTM D1557 or pipe manufacturer's recommendation
Above Pipe Zone	92% ASTM D1557	88% ASTM D1557
Within 3 Feet of Design Subgrade	95% ASTM D1557	90% ASTM D1557

[1] Includes proposed buildings, pavements, structural fill areas, exterior hardscaping, etc.
[2] Or as specified by the local jurisdiction, where located in the public right of way.

5.4.5 Controlled Low-Strength Material (CLSM)

CLSM is a self-compacting, cementitious material that is typically considered when backfilling localized areas. CLSM is sometimes referred to as "controlled density fill" or CDF. Due to its flowable characteristics, CLSM typically can be placed in restricted-access excavations where placing and compacting fill is difficult. If chosen for use at this site, we recommend the CLSM be in conformance with Section 00442 of the most recent, ODOT

SSC. The geotechnical engineer’s representative should observe placement of the CLSM and obtain samples for compression testing in accordance with ASTM D4832. As a guideline, for each day’s placement, two compressive strength specimens from the same CLSM sample should be tested. The results of the two individual compressive strength tests should be averaged to obtain the reported 28-day compressive strength. If CLSM is considered for use on this site, please contact the geotechnical engineer for site-specific and application-specific recommendations.

5.5 Permanent Slopes

5.5.1 Overview

Permanent cut or fill slopes constructed at the site should be graded at 2H:1V or flatter. Constructed slopes should be overbuilt by a few feet depending on their size and gradient so that they can be properly compacted prior to being cut to final grade. The surface of all slopes should be protected from erosion by seeding, sodding, or other acceptable means. Adjacent on-site and off-site structures should be located at least 5 feet from the top of slopes.

5.5.2 Placement of Fill on Slopes

New fill should be placed and compacted against horizontal surfaces. Where slopes exceed 5H:1V, the slopes should be keyed and benched prior to structural fill placement in general accordance with the attached Fill Slope Detail, Figure 4. If subdrains are needed on benches, subject to the review of the CGT geotechnical representative, they should be placed as shown on the attached Fill Slope Detail. In order to achieve well-compacted slope faces, slopes should be overbuilt by a few feet and then trimmed back to proposed final grades. A representative from CGT should observe the benches, keyways, and associated subdrains, if needed, prior to placement of structural fill.

5.6 Shallow Foundations

5.6.1 Subgrade Preparation

Satisfactory subgrade support for shallow foundations can be obtained from:

- A minimum of 12 inches of imported granular structural fill (granular pad) that is properly placed and compacted on the native, medium stiff to better, elastic silt (MH) during construction. Once over excavations are made, the silty subgrade soils should not be exposed to periods of wetting or drying, but should be backfilled as soon as possible.
- The native, medium stiff to better lean clay (CL), or new structural fill that is properly placed and compacted on that material during construction.

The geotechnical engineer’s representative should be contacted to observe subgrade conditions prior to placement of forms, reinforcement steel, or granular pads (if required). If soft, loose, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the geotechnical representative at the time of construction. The resulting over-excavation should be brought back to grade with imported granular structural fill in conformance with Section 5.4.2. The maximum particle size of over-excavation backfill should be limited to 1½ inches. All granular pads for footings should be constructed a minimum of 6 inches wider on each side of the footing for every vertical foot of over-excavation.

5.6.2 Minimum Footing Width & Embedment

Minimum footing widths should be in conformance with the most recent Oregon Residential Structural Code (ORSC). As a guideline, CGT recommends individual spread footings have a minimum width of 24 inches. For one-story, light-framed structures, we recommend continuous wall footings have a minimum width of 12 inches. Similarly, for two- to three-story, light-framed structures, we recommend continuous wall footings have a minimum width of 15 inches and 18 inches, respectively. All footings should be founded at least 18 inches below the lowest, permanent adjacent grade for frost protection.

5.6.3 Horizontal Setback from Descending Slopes

Foundations constructed within or near descending slopes should be setback a minimum of 5 feet from the slope surface. This distance should be measured between the face of the slope and the bottom, outside edge of the respective foundation. Organic topsoil and loose surface soils (if present) should not be included when determining this distance. The geotechnical engineer or his representative should be contacted to observe foundation subgrade conditions and confirm this recommended minimum setback is achieved.

5.6.4 Bearing Pressure & Settlement

Footings founded as recommended above should be proportioned for a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf). This bearing pressure is a net bearing pressure, applies to the total of dead and long-term live loads, and may be increased by one-third when considering seismic or wind loads. For foundations founded as recommended above, total settlement of foundations is anticipated to be less than 1 inch. Differential settlements between adjacent columns and/or bearing walls should not exceed ½ inch. If an increased allowable soil bearing pressure is desired, the geotechnical engineer should be consulted.

5.6.5 Lateral Capacity

A maximum passive (equivalent fluid) earth pressure of 150 pounds per cubic foot (pcf) is recommended for design of footings cast neat into excavations in suitable native soil or confined by imported granular structural fill that is properly placed and compacted during construction. The recommended earth pressure was computed using a factor of safety of 1½, which is appropriate due to the amount of movement required to develop full passive resistance. In order to develop the above capacity, the following should be understood:

1. Concrete must be poured neat in excavations or the foundations must be backfilled with imported granular structural fill,
2. The adjacent grade must be level,
3. The static ground water level must remain below the base of the footings throughout the year.
4. Adjacent floor slabs, pavements, or the upper 12-inch-depth of adjacent, unpaved areas should not be considered when calculating passive resistance.

An ultimate coefficient of friction equal to 0.35 may be used when calculating resistance to sliding for footings founded on the native clayey soils as described above. An ultimate coefficient of friction equal to 0.45 may be used when calculating resistance to sliding for footings founded on a minimum of 6 inches of imported granular structural fill (crushed rock) that is properly placed and compacted during construction.

5.6.6 Subsurface Drainage

Recognizing the near-surface fine-grained (silty, clayey) soils encountered at this site, we recommend placing foundation drains at the exterior, base elevations of perimeter continuous wall footings[11]. Foundation drains should consist of a minimum 4-inch diameter, perforated, PVC drainpipe wrapped with a non-woven geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet of open graded drain rock per lineal foot of pipe. The drain rock should also be encased in a geotextile fabric in order to provide separation from the surrounding fine-grained soils. Foundation drains should be positively sloped and should outlet to a suitable discharge point. The geotechnical engineer's representative should observe the drains prior to backfilling. Roof drains should not be tied into foundation drains.

5.7 Rigid Retaining Walls

5.7.1 Footings

Retaining wall footings should be designed and constructed in conformance with the recommendations presented in Section 5.6, as applicable.

5.7.2 Wall Drains

We recommend placing retaining wall drains at the base elevation of the heel of retaining wall footings. Retaining wall drains should consist of a minimum 4-inch-diameter, perforated, HDPE (High Density Polyethylene) drainpipe wrapped with a non-woven geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet of open graded drain rock per lineal foot of pipe. The drain rock should be encased in a geotextile fabric in order to provide separation from the surrounding soils. Retaining wall drains should be positively sloped and should outlet to a suitable discharge point. The geotechnical engineer's representative should be contacted to observe the drains prior to backfilling. Roof or area drains should not be tied into retaining wall drains.

5.7.3 Wall Backfill

Retaining walls should be backfilled with imported granular structural fill in conformance with Section 5.4.2 and contain less than 5 percent passing the U.S. Standard No. 200 Sieve. The backfill should be compacted to a minimum of 90 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). When placing fill behind walls, care must be taken to minimize undue lateral loads on the walls. Heavy compaction equipment should be kept at least "H" feet from the back of the walls, where "H" is the height of the wall. Light mechanical or hand tamping equipment should be used for compaction of backfill materials within "H" feet of the back of the walls.

5.7.4 Design Parameters & Limitations

For rigid retaining walls founded, backfilled, and drained as recommended above, the following table presents parameters recommended for design.

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[11] Where expansive soils are encountered, foundation drains should be placed at the bottom, lower corner of the granular pads and beyond (above) a 1H:1V line projected down and away from the lower outer corner of the continuous wall foundation.

Table 3 Design Parameters for Rigid Retaining Walls

Retaining Wall Condition	Modeled Backfill Condition	Static Equivalent Fluid Pressure (S_A)[1]	Seismic Equivalent Fluid Pressure (S_{AE}) [1,2]	Surcharge from Uniform Load, q, Acting on Backfill Behind Retaining Wall
Not Restrained from Rotation	Level (i=0)	28 pcf	38 pcf	0.22*q
Restrained from Rotation	Level (i=0)	50 pcf	52 pcf	0.38*q

[1] Refer to the attached Figure 5 for a graphical representation of static and seismic loading conditions. Seismic resultant force acts at 0.6H above the base of the wall.

[2] Seismic (dynamic) lateral loads were computed using the Mononobe-Okabe Equation as presented in the 1997 Federal Highway Administration (FHWA) design manual. Static and seismic equivalent fluid pressures are <u>not</u> additive.

The above design recommendations are based on the assumptions that:

- The walls consist of concrete cantilevered retaining walls ($\beta = 0$ and $\delta = 24$ degrees, see Figure 5).
- The walls are 10 feet or less in height.
- The backfill is drained and consists of imported granular structural fill ($\phi = 38$ degrees).
- No line, strip, or point load surcharges are imposed behind the walls.
- The grade behind the wall is level, or sloping down and away from the wall, for a distance of 10 feet or more from the wall.
- The grade in front of the walls is level or ascending for a distance of at least 5 feet from the wall.

Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

5.7.5 Surcharge Loads

Where present, surcharges from adjacent site features (i.e. buildings, slabs, pavements, etc.) should be evaluated in design of retaining walls at the site. Methods for calculating lateral pressures on rigid retaining walls from strip, line, and vertical point loads are presented on the attached Figure 6.

5.8 Floor Slabs

5.8.1 Subgrade Preparation

Satisfactory subgrade support for slabs constructed on grade, supporting up to 150 psf area loading, can be obtained from:

- A minimum of 12 inches of imported granular structural fill (granular sub-base) that is properly placed and compacted on the native, medium stiff to better, elastic silt (MH) during construction. Once over excavations are made, the silty subgrade soils should not be exposed to periods of wetting or drying, but should be backfilled as soon as possible.
- The native, medium stiff to better lean clay (CL), or new structural fill that is properly placed and compacted on that material during construction.

The geotechnical engineer's representative should be contacted to observe subgrade conditions prior to placement of structural fill or aggregate base. If soft, loose, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the geotechnical representative at the time of construction. The resulting over-excavation should be brought back to grade with imported granular structural fill in conformance with Section 5.4.2.

5.8.2 Crushed Rock Base

Concrete floor slabs should be supported on a minimum 6-inch-thick layer of crushed rock (base rock) that is properly placed on the native clayey soils (or the granular sub-base) as described in the preceding section.

5.8.2.1 Conventional Base Rock

Floor slab base rock should consist of well-graded granular material (crushed rock) containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. Floor slab base rock should be placed in one lift and compacted to not less than 90 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). We recommend "choking" the surface of the base rock with sand just prior to concrete placement. Choking means the voids between the largest aggregate particles are filled with sand, but does not provide a layer of sand above the base rock. Choking the base rock surface reduces the lateral restraint on the bottom of the concrete during curing. Choking the base rock also reduces punctures in vapor retarding membranes due to foot traffic where such membranes are used.

5.8.2.2 Gas Permeable Base Rock

Floor slab base rock in areas where radon gas mitigation is desired should consist of open-graded crushed rock containing no organic matter or debris, with all material passing through a 2-inch sieve and retained on the ¼-inch sieve, in accordance with 2023 ORSC Appendix F, Section AF103.2, Bullet 1.

CGT recommends that a minimum 10-mil polyethylene sheeting or equivalent material with equal or greater tensile strength, resistance to puncture, resistance to deterioration, and resistance to water-vapor transmission be placed on top of the gas-permeable base rock to act as a soil-gas-retarder. Placement and installation of this sheeting should be in conformance with that indicated in 2023 ORSC Appendix F, Section AF103.3.

The geotechnical engineer or their representative should be contacted to observe gas-permeable base rock conditions prior to placement of the soil-gas-retarder.

5.8.3 Design Considerations

For floor slabs constructed as recommended, an effective modulus of subgrade reaction of 150 pounds per cubic inch (pci) is recommended for the design of the floor slab. A higher effective modulus of subgrade reaction can be obtained by increasing the base rock thickness. Please contact the geotechnical engineer for additional recommendations if a higher modulus is desired. Floor slabs constructed as recommended will likely settle less than ½ inch. For general floor slab construction, slabs should be jointed around columns and walls to permit slabs and foundations to settle differentially.

5.8.4 Subgrade Moisture Considerations

Liquid moisture and moisture vapor should be expected at the subgrade surface. The recommended crushed rock base is anticipated to provide protection against liquid moisture. Where moisture vapor emission through the slab must be minimized, e.g. impervious floor coverings, storage of moisture sensitive materials directly on the slab surface, etc., a vapor retarding membrane or vapor barrier below the slab should be considered. Factors such as cost, special considerations for construction, floor coverings, and end use suggest that the decision regarding a vapor retarding membrane or vapor barrier be made by the architect and owner.

If a vapor retarder or vapor barrier is placed below the slab, its location should be based on current American Concrete Institute (ACI) guidelines, ACI 302 Guide for Concrete Floor and Slab Construction. In some cases, this indicates placement of concrete directly on the vapor retarder or barrier. Please note that the placement of concrete directly on impervious membranes increases the risk of plastic shrinkage cracking and slab curling in the concrete. Construction practices to reduce or eliminate such risk, as described in ACI 302, should be employed during concrete placement.

5.9 Pavements

5.9.1 Private Pavements - Subgrade Preparation

Satisfactory subgrade support for pavements can be obtained from:

- A minimum of 12 inches of imported granular structural fill (granular sub-base) that is properly placed and compacted on the native, medium stiff to better, elastic silt (MH) during construction. Once over excavations are made, the silty subgrade soils should not be exposed to periods of wetting or drying, but should be backfilled as soon as possible.
- The native, medium stiff to better lean clay (CL), or new structural fill that is properly placed and compacted on that material during construction.

Pavement subgrade preparation should be performed in general accordance with the recommendations presented in Section 5.1.5 above. Subgrade surfaces should be crowned (or sloped) for proper drainage in accordance with specifications provided by the project civil engineer.

5.9.2 Public Pavements – Subgrade Preparation

5.9.2.1 Dry Weather Construction

In dry weather conditions, after site stripping as described in Section 5.1 above, but prior to placement of base course material or structural fill, the prepared subgrade should be scarified to a minimum depth of 12 inches below design subgrade elevation and re-compacted with suitable equipment. The subgrade should be compacted to at least 95 percent of the material’s maximum dry density as determined by ASTM D1557 (Modified Proctor). The geotechnical representative should perform in-place density testing of the compacted subgrade to confirm proper compaction. In addition, a proof roll test of the compacted subgrade should be performed with a fully-loaded, tandem-axle, 10- to 12-cubic yard dump truck (or equivalent weighted water truck) in order to identify areas of excessive yielding. The geotechnical engineer or his representative should witness the proof roll test(s). If areas of soft soil or excessive yielding are identified, the affected material should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill in conformance with Section 5.4.2 above.

5.9.2.2 Wet Weather Construction

Preparation of pavement subgrade soils during wet weather should be in conformance with Section 5.3 above. As indicated therein, increased base rock sections and a geotextile separation fabric may be required in wet conditions in order to support construction traffic and protect the subgrade. Cement amendment may also be considered to help stabilize fine-grained subgrade soils during wet weather as discussed in Section 5.3.4 above.

5.9.3 Input Parameters

Design of the asphalt concrete (AC) pavement sections presented below was based on the parameters presented in the following table, the American Association of State Highway and Transportation Officials (AASHTO) 1993 "Design of Pavement Structures" manual, and pavement design manuals presented by the City of Salem (Salem)[12] and ODOT[13]. If any of the items listed need revision, please contact us and we will reassess the provided design sections.

Table 4 Input Parameters Used in AC Pavement Design

Input Parameter		Design Value		Input Parameter		Design Value
Pavement Design Life[1]	Local Street	25 years		Resilient Modulus – Subgrade (psi)	In-Situ Native Soils (Not compacted)[2]	4,000 psi
	Collector	20 years				
Annual Percent Growth		0 percent			Compacted Native Soils[4]	12,000 psi
Initial Serviceability[1]		4.2			Crushed Aggregate Base[3]	20,000 psi
Terminal Serviceability[1]		2.5		Structural Coefficient[1]	Crushed Aggregate Base	0.10
Reliability[1]		90 percent			Asphalt	0.41
Standard Deviation[3]		0.49		Design 18-kip ESAL[5]	Local	100,000
Drainage Coefficient – Asphalt[1]		0.10			Collector	1,000,000
Drainage Coefficient – Aggregate Base[1]		0.08		---	---	---

[1] Value based on on design procedures indicated in Section 6.24(e) of the referenced City of Salem manual.

[2] Value selected represents the approximate average resilient modulus value correlated from the DCP tests shown in Appendix C.

[3] Value based on guidelines presented by the referenced ODOT design manual for flexible pavements.

[4] Value based on results of laboratory CBR test, published AASHTO correlations with resilient modulus, and seasonal effects.

[5] ESAL = Total 18-Kip equivalent single axle load. Value derived from Table 6-23 of the referenced City of Salem manual.

5.9.4 Recommended Minimum Section

The following tables presents the minimum AC pavement sections for the functional street classifications indicated in the preceding table, based on the referenced AASHTO procedures and parameters shown above.

Table 5 Recommended Minimum AC Pavement Sections – DRY Weather Construction

Material	Material Thickness (inches)	
	"Local" Streets[1]	Collector[2]
AC Pavement	4	6
Aggregate Base	7	8
Subgrade Soils	Prepared in conformance with Section 5.9.2.1 of this report	

[1] Table 6-24 of the referenced City of Salem manual indicates at least 6 inches of base rock is required for this street classification.

[2] Table 6-24 of the referenced City of Salem manual indicates at least 8 inches of base rock is required for this street classification.

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[12] City of Salem Administrative Rules Pavement Design Manual 109-006 (January 2016).

[13] Oregon Department of Transportation (ODOT) Pavement Design Guide, January 2019.

Table 6 Recommended Minimum AC Pavement Sections – WET Weather Construction

Material	**Material Thickness (inches)**		
	“Local” Streets[1]	**Collector[2,3]**	
AC Pavement	4	6	8
Aggregate Base	7	8	8
Granular Sub-Base[4]	11	18	8
Geotextile Separation Fabric[4]	In conformance with Section 5.3.2 of this report		
Subgrade Soils	Prepared in conformance with Section 5.9.2.2 of this report		

[1] Table 6-24 of the referenced City of Salem manual indicates at least 6 inches of base rock is required for this street classification.

[2] Table 6-24 of the referenced City of Salem manual indicates at least 8 inches of base rock is required for this street classification.

[3] Two pavement sections of equivalent structural capacity are presented for consideration.

[4] Cement amendment of subgrade soils may be considered as an alternative to installation of granular sub-base and fabric. If cement amendment is considered, the geotechnical engineer should be consulted to provide specific recommendations.

5.9.5 AC Pavement Materials

Aggregate Sub-Base: We recommend aggregate sub-base consist of durable, relatively well-graded, granular fill in conformance with Section 00641.10.b of the most recent ODOT SSC, with the following considerations. We recommend the material have a maximum particle size of 3 inches and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. Aggregate sub-base should be compacted to not less than 95 percent of the material’s maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor), or visual equivalent as identified by deflection (proof roll) testing.

Aggregate Base: We recommend aggregate base consist of dense-graded aggregate in conformance with Section 02630.10 of the most recent ODOT SSC (or as specified by the City of Salem), with the following additional considerations. We recommend the material consist of crushed rock or gravel, have a maximum particle size of 1½ inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. Aggregate base should be compacted to not less than 95 percent of the material’s maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor), or as specified by the City of Salem.

AC Pavement: We recommend AC pavement consist of Level 2, ½-inch, dense-graded AC in conformance with the most recent ODOT SSC or as specified by the City of Salem. AC pavement should be compacted to at least 91 percent of the material’s theoretical maximum density as determined in general accordance with ASTM D2041 (Rice Specific Gravity), or as specified by the City of Salem.

5.10 Additional Drainage Considerations

Subsurface drains should be connected to the nearest storm drain or other suitable discharge point. Paved surfaces and grading near or adjacent to the buildings should be sloped to drain away from the buildings. Surface water from paved surfaces and open spaces should be collected and routed to a suitable discharge point. Surface water should not be directed into foundation drains, retaining walls, or onto site slopes.

6.0 RECOMMENDED ADDITIONAL SERVICES

6.1 Design Review

Geotechnical design review is of paramount importance. We recommend the geotechnical design review take place prior to releasing bid packets to contractors.

6.2 Observation of Construction

Satisfactory earthwork, foundation, floor slab, retaining wall, and pavement performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during subsurface explorations, and recognition of changed conditions often requires experience. We recommend that qualified personnel visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those observed to date and anticipated in this report. We recommend geotechnical engineer's representative attend a pre-construction meeting coordinated by the contractor and/or developer. The project geotechnical engineer's representative should provide observations and/or testing of at least the following earthwork elements during construction:

- Site Stripping and Grubbing
- Subgrade Preparation for Shallow Foundations, Retaining Walls, Structural Fills, Floor Slabs, and Pavements
- Compaction of Structural Fill, Retaining Wall Backfill, and Utility Trench Backfill
- Compaction of Base Rock for Floor Slabs and Pavements
- Compaction of Asphalt Concrete for Pavements

It is imperative that the owner and/or contractor request earthwork observations and testing at a frequency sufficient to allow the geotechnical engineer to provide a final letter of compliance for the earthwork activities.

7.0 LIMITATIONS

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 forwarded to assist in the planning and design process and are not intended to be, nor should they be construed as, a warranty of subsurface conditions.

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 our explorations. If subsurface conditions vary from those encountered in our site explorations, CGT should be alerted to the change in conditions so that we may provide additional geotechnical recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process.

The owner/developer is responsible for ensuring that the project designers and contractors implement our recommendations. When the design has been finalized, prior to releasing bid packets to contractors, we recommend that the design drawings and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification. Design review and construction phase testing and observation services are beyond the scope of our current assignment, but will be provided for an additional fee.

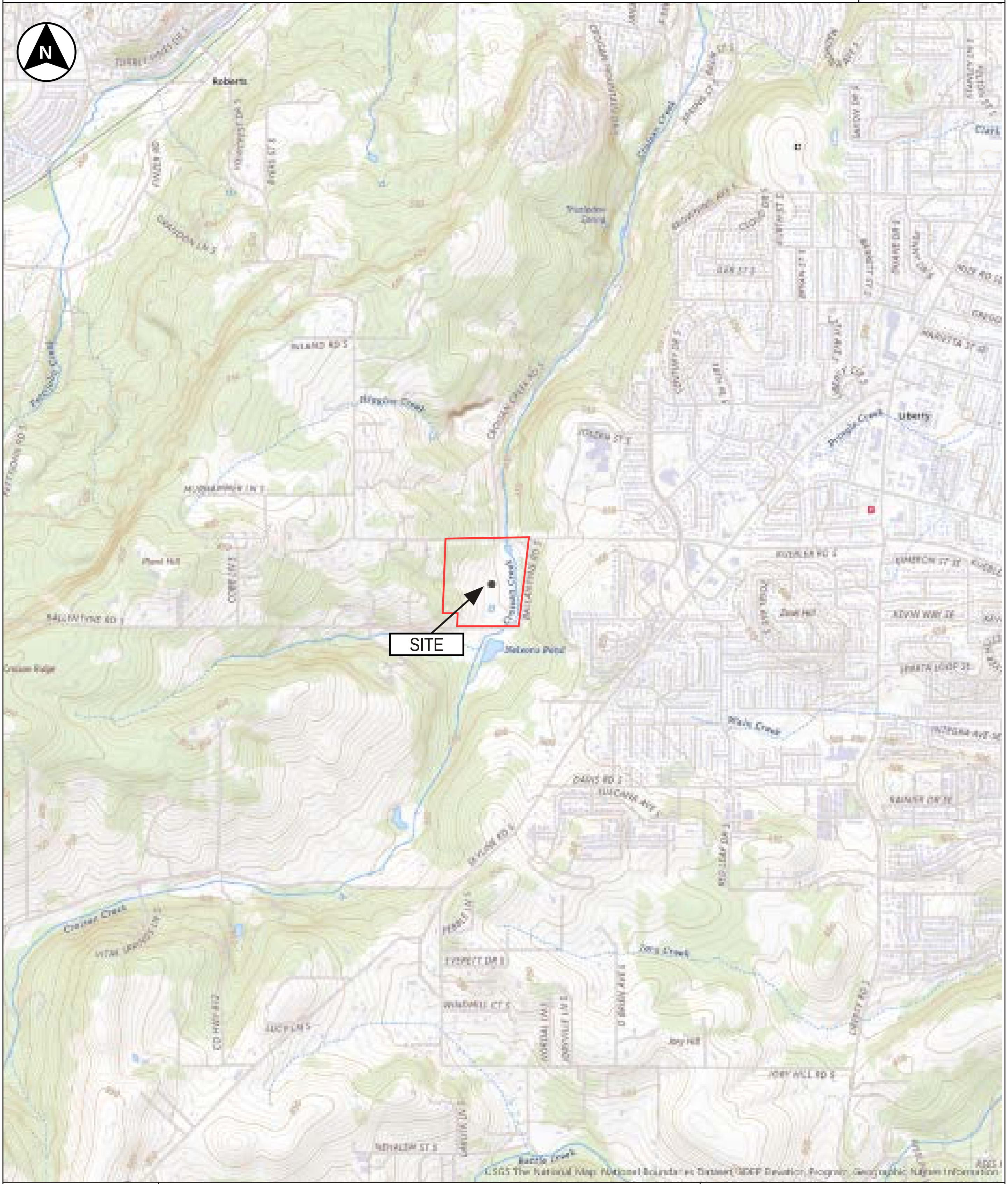
The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Geotechnical engineering and the geologic sciences are characterized by a degree of uncertainty. Professional judgments presented in this report are based on our understanding of the proposed construction, familiarity with similar projects in the area, and on general experience. 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, expressed or implied, is made. 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 G2406322B

FIGURE 1

Site Location



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information

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Drafted by: MDI

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

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

Latitude: 44.881413° North
Longitude: 123.083905° West

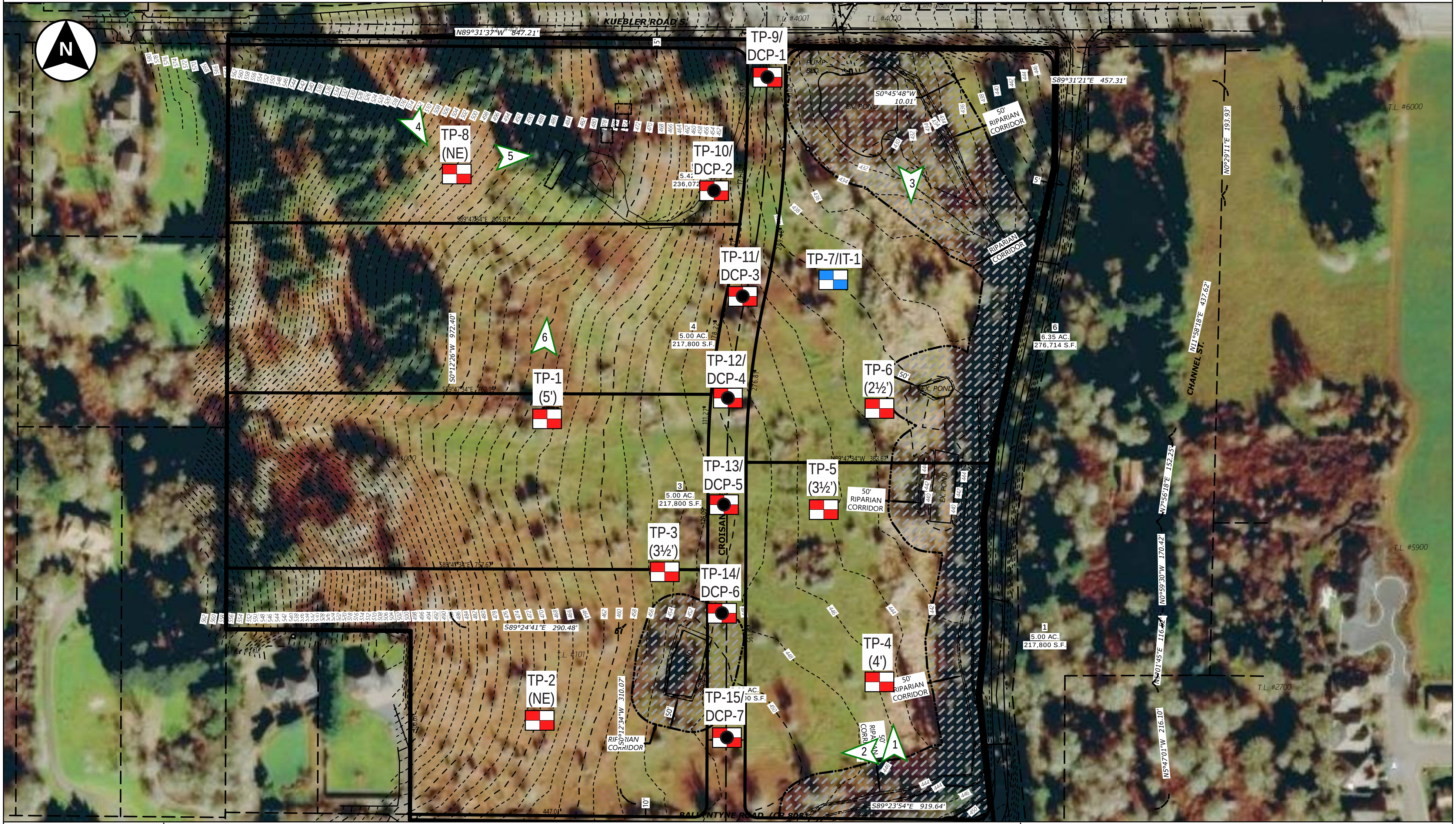
1 Inch = 2,000 feet

0 2000 4000

KEUBLER LOT PARTITONS - SALEM, OREGON
Project Number G2406322B

FIGURE 2

Site Plan



![CARLSON CGT GEOTECHNICAL 503-601-8250]

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: EEH/AFJ

LEGEND

TP-1 (5')	🟥	Test pit exploration. Depth of water indicated in (). (NE) = not encountered.
TP-7/IT-1	🟦	Test pit and infiltration test exploration.
TP-9/ DCP-1	●	Test pit and dynamic cone penetrometer test.
1	◁	Orientation of site photographs shown on Figure 3.

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
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FIGURE 3

Site Photographs

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

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Drafted by: AFJ

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

KUEBLER LOT PARTITIONS - SALEM, OREGON
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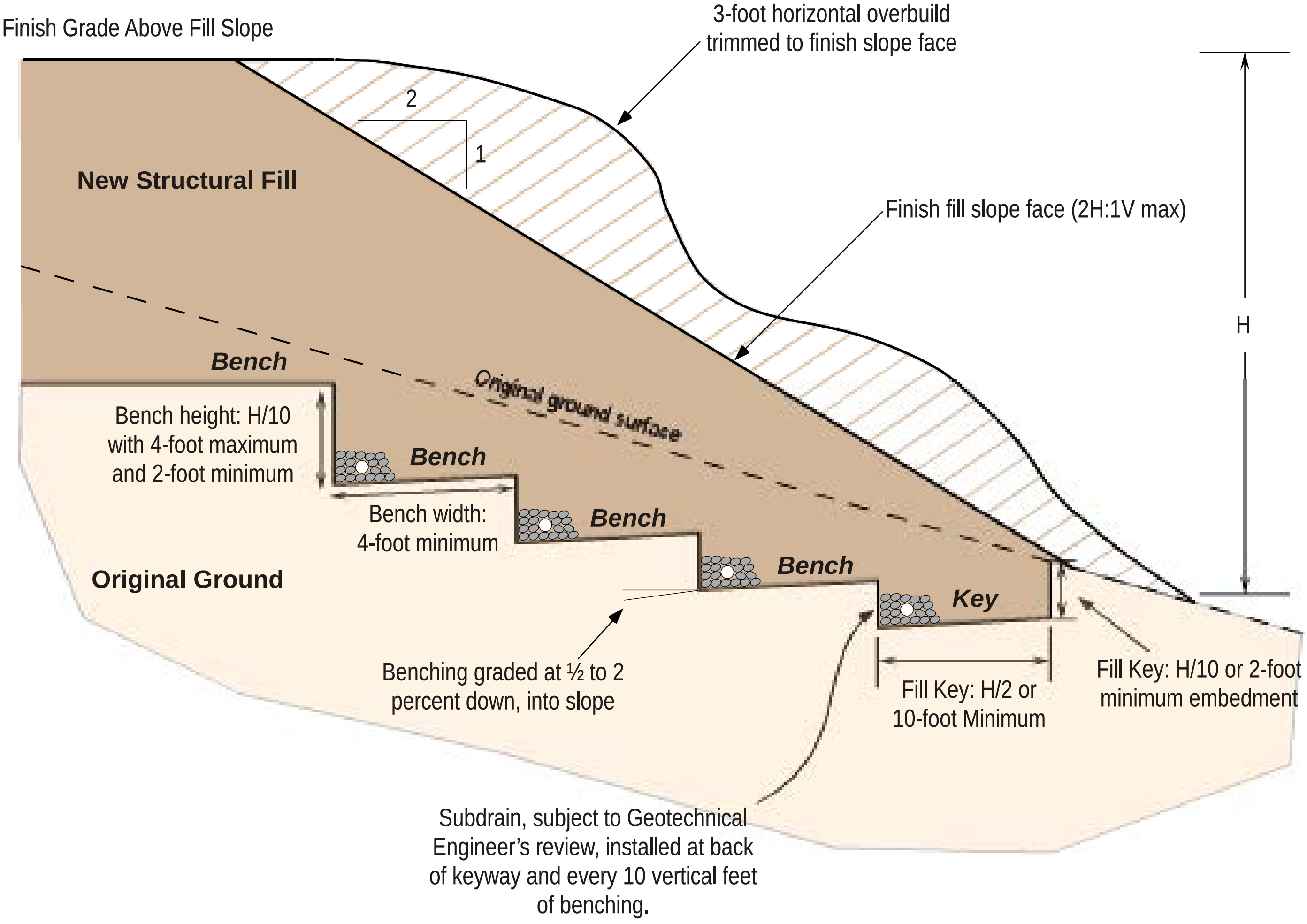
FIGURE 4

Fill Slope Detail



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NOTE: Surfaces to receive fill with slopes steeper than 5H:1V (horizontal:vertical) should be benched and keyed as shown.

KUEBLER LOT PARTITIONS - SALEM, OREGON
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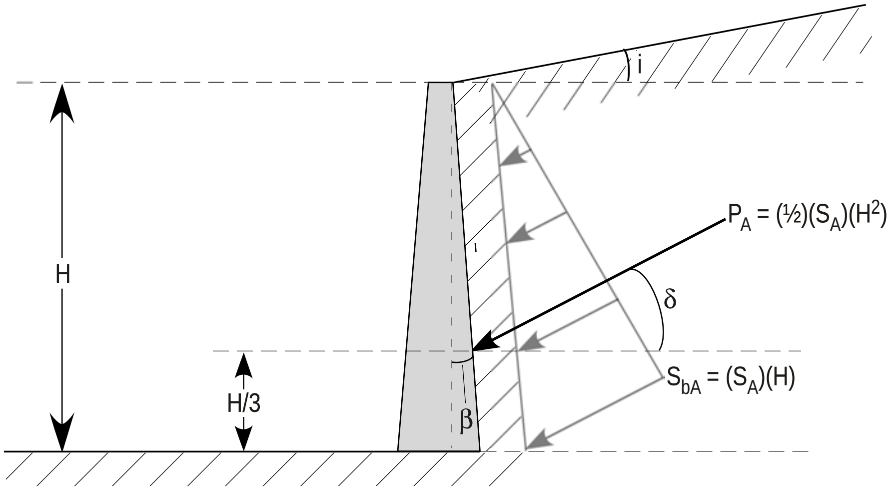
FIGURE 5

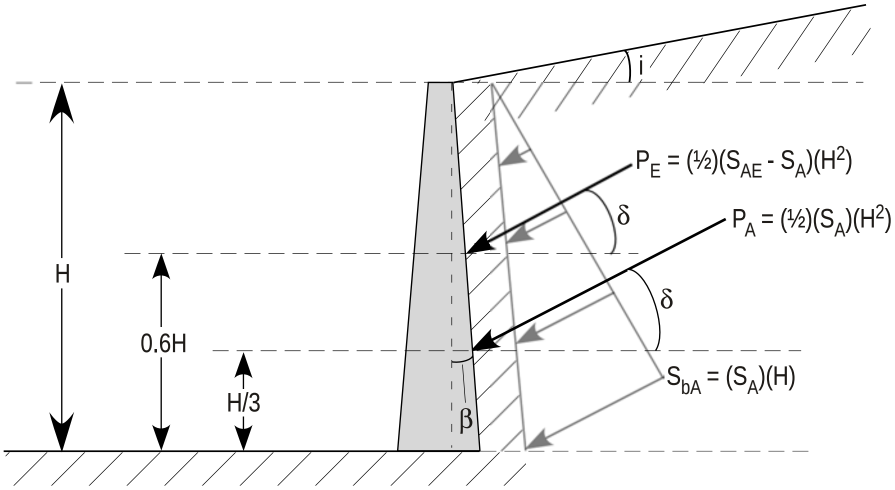
Retaining Walls

ACTIVE LATERAL PRESSURE DISTRIBUTION

STATIC LOADING CONDITIONS



SEISMIC LOADING CONDITIONS



LEGEND

S_A = Active lateral equivalent fluid pressure (lb/ft^3)*

S_{bA} = Active lateral earth pressure (static) at the bottom of wall (lb/ft^3)

S_{AE} = Active total (static + seismic) equivalent fluid pressure (lb/ft^3)*

i = Slope of backfill, relative to horizontal (degrees)**

β = Slope of back of wall, relative to vertical (degrees)**

P_A = Static active thrust force acting at H/3 from bottom of retaining wall (lb/ft)

P_E = Dynamic active thrust force acting at 0.6H from bottom of retaining wall (lb/ft)

δ = Angle from normal of back of wall (degrees). Based on friction developing between wall and backfill**

*Refer to report text for calculated values **Refer to report text for modeled/assumed values

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Notes

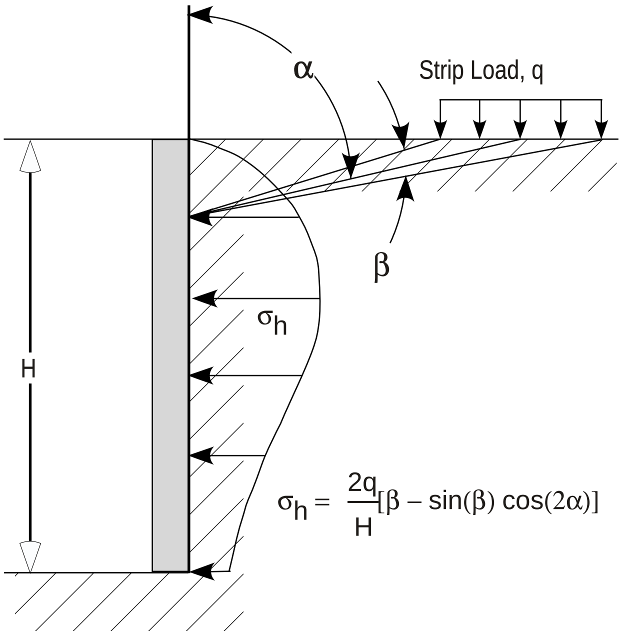
1. Uniform pressure distribution of seismic loading is based on empirical evaluations [Sherif et al, 1982 and Whitman, 1990].
2. Placement of seismic resultant force at 0.6H is based on wall behavior and model test results [Whitman, 1990].

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322B

FIGURE 6

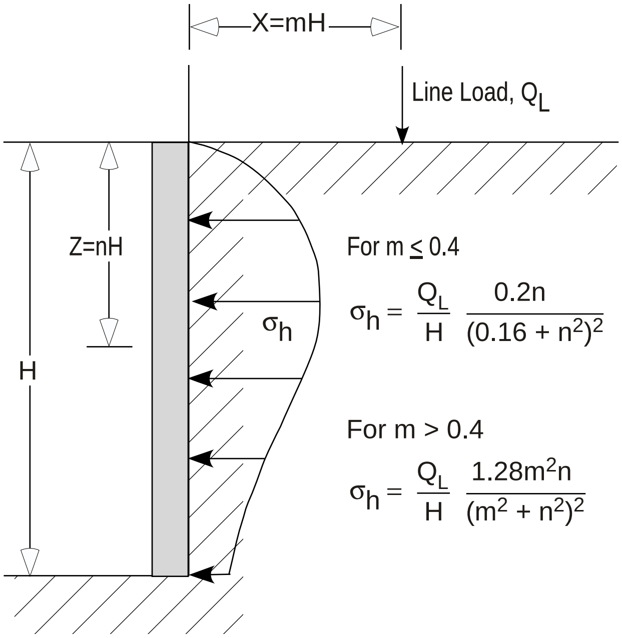
Retaining Wall Surcharge

STRIP LOAD PARALLEL TO WALL[1]



$$\sigma_h = \frac{2q}{H}[\beta - \sin(\beta)\cos(2\alpha)]$$

LINE LOAD PARALLEL TO WALL[2]



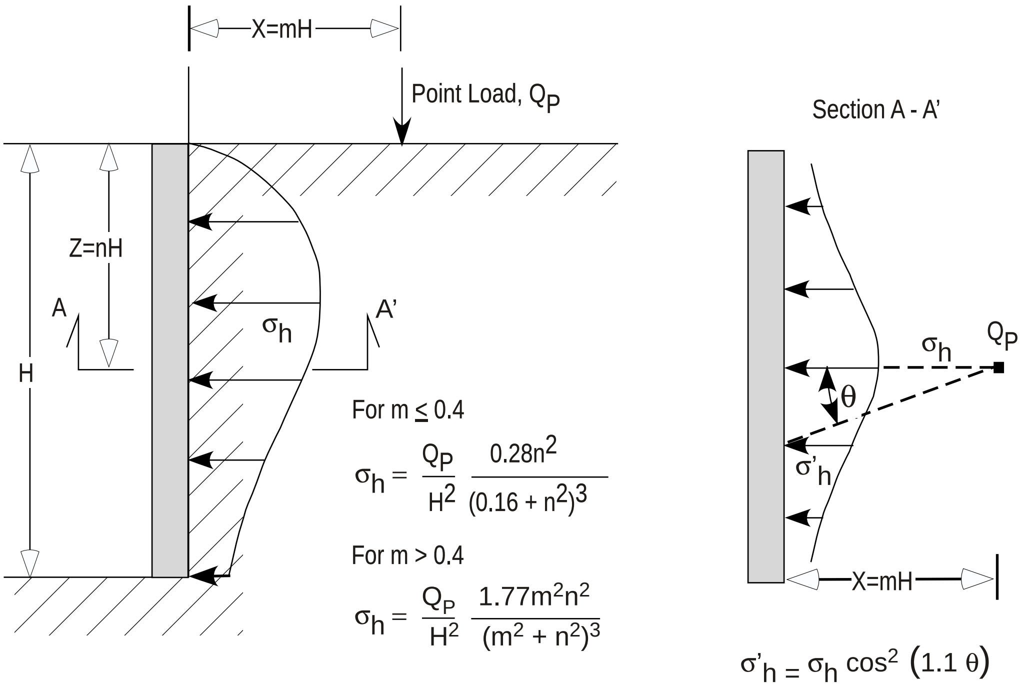
For m ≤ 0.4

$$\sigma_h = \frac{Q_L}{H}\,\frac{0.2n}{(0.16 + n^2)^2}$$

For m > 0.4

$$\sigma_h = \frac{Q_L}{H}\,\frac{1.28m^2n}{(m^2 + n^2)^2}$$

VERTICAL POINT LOAD[2]



For m ≤ 0.4

$$\sigma_h = \frac{Q_P}{H^2}\,\frac{0.28n^2}{(0.16 + n^2)^3}$$

For m > 0.4

$$\sigma_h = \frac{Q_P}{H^2}\,\frac{1.77m^2n^2}{(m^2 + n^2)^3}$$

$$\sigma'_h = \sigma_h \cos^2(1.1\,\theta)$$

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Notes: 1. Das, Principles of Geotechnical Engineering, 1990 Edition.
2. NAVFAC Design Manual 7.06.

Refer to the referenced design manuals for additional guidance. Contact CGT if there are any questions with modeling surcharge loads.

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Tigard Office	**(503) 684-3460**

Appendix A: Subsurface Investigation and Laboratory Testing

Kuebler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322B

February 26, 2025

Prepared For:

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

Prepared by
Carlson Geotechnical

A.1.0 SUBSURFACE INVESTIGATION

Our field investigation consisted of fifteen test pits completed on January 15, 2025. The exploration locations are shown on the Site Plan, attached to the geotechnical 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 A17), as discussed below.

A.1.1 Test Pits

CGT observed the excavation of fifteen test pits (TP-1 through TP-15) at the site to depths of about ½ 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 the 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 located in proposed infiltration testing areas, and 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. The test pits were loosely backfilled with the excavated materials upon completion.

A.1.2 In-Situ Testing

A.1.2.1 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, TP-7, 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.1.2.2 Infiltration Test

CGT performed one infiltration test (IT-1) at the site within test pit TP-7. Details regarding the test procedure and results of the test are presented in Appendix B.

A.1.2.3 Dynamic Cone Penetrometer (DCP) Testing

In test pits TP-9 through TP-15, we performed dynamic cone penetrometer (DCP) tests. The DCP tests (DCP-1 through DCP-7) were conducted on the native soils exposed at the base of those test pits. DCP testing was performed in general accordance with ASTM D6951, and consists of driving a 20-mm diameter, hardened steel cone on 16-mm diameter steel rods into the ground using an 8-kg drop hammer with a 460-mm, free-fall height. The number of hammer blows required to drive the DCP tip is typically recorded in 10-mm increments. The DCP index (defined as the amount of penetration per blow) is calculated by dividing the incremental penetration by the number of blows. The DCP index can be correlated to subgrade resilient modulus (M_R)[1]. Results of the DCP tests, including the DCP index and correlated resilient modulus values, are presented in the attached Appendix C. The following table presents the average correlated resilient modulus value for the clayey subgrade soils at the tested locations.

---

[1] Oregon Department of Transportation (ODOT) Pavement Services Unit, January 2019.

Table A1 Correlated Resilient Modulus Values

DCP Test	Correlated Resilient Modulus, M_r (psi)[1]
DCP-1	4621
DCP-2	5931
DCP-3	3870
DCP-4	3210
DCP-5	3926
DCP-6	3403
DCP-7	3676

[1] Average value calculated within the upper 12 inches of the pavement subgrade.

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 geotechnical and 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 soils laboratory for further examination and testing. 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 2.3 of the geotechnical report. Detailed logs of the explorations are presented on the attached exploration logs, Figures A3 through A17.

A.2.0 LABORATORY TESTING

Laboratory testing was performed on samples collected in the field to refine our initial field classifications and determine in-situ parameters. Laboratory testing included the following:

- Twelve moisture content determinations (ASTM D2216).
- Two percentage passing the U.S. Standard No. 200 Sieve tests (ASTM D1140).
- Two Atterberg limits (plasticity) tests (ASTM D4318).
- Two moisture-density relationship (standard Proctor) tests (ASTM D698/D1557).
- Two 3-point laboratory California Bearing Ratio (CBR) tests (ASTM D1883).

Results of the laboratory tests are shown on the exploration logs and the attached Appendix D.

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322B

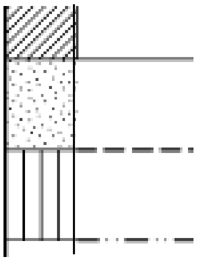
FIGURE A1
Exploration Key

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 G3550) 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 })

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All measurements are approximate.

KUEBLER LOT PARTITIONS - SALEM, OREGON
Project Number G2406322B

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

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

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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.

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FIGURE A3

Test Pit TP-01

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 467 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. 462.0 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						
		MH	**ELASTIC SILT:** Medium stiff to stiff, red/brown, moist, high plasticity, trace fine-grained sand. {Residual soil}						1.00		
466									1.50		
									3.50		
					2				3.50		
						GRAB 1	100				
			Hard below about 2½ feet bgs.						4.50		
464									4.50		
									4.00		
					4				4.00		
462				▽							
			Wet below 5 feet bgs.			GRAB 2	100				
			Black mottling below 5½ feet bgs.								
					6						
460											
						GRAB 3	100				
					8						
458											

- · 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 at client's request.

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FIGURE A4

Test Pit TP-02

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes

PROJECT NAME Kuebler Lot Partitions

PROJECT NUMBER G2406322B

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

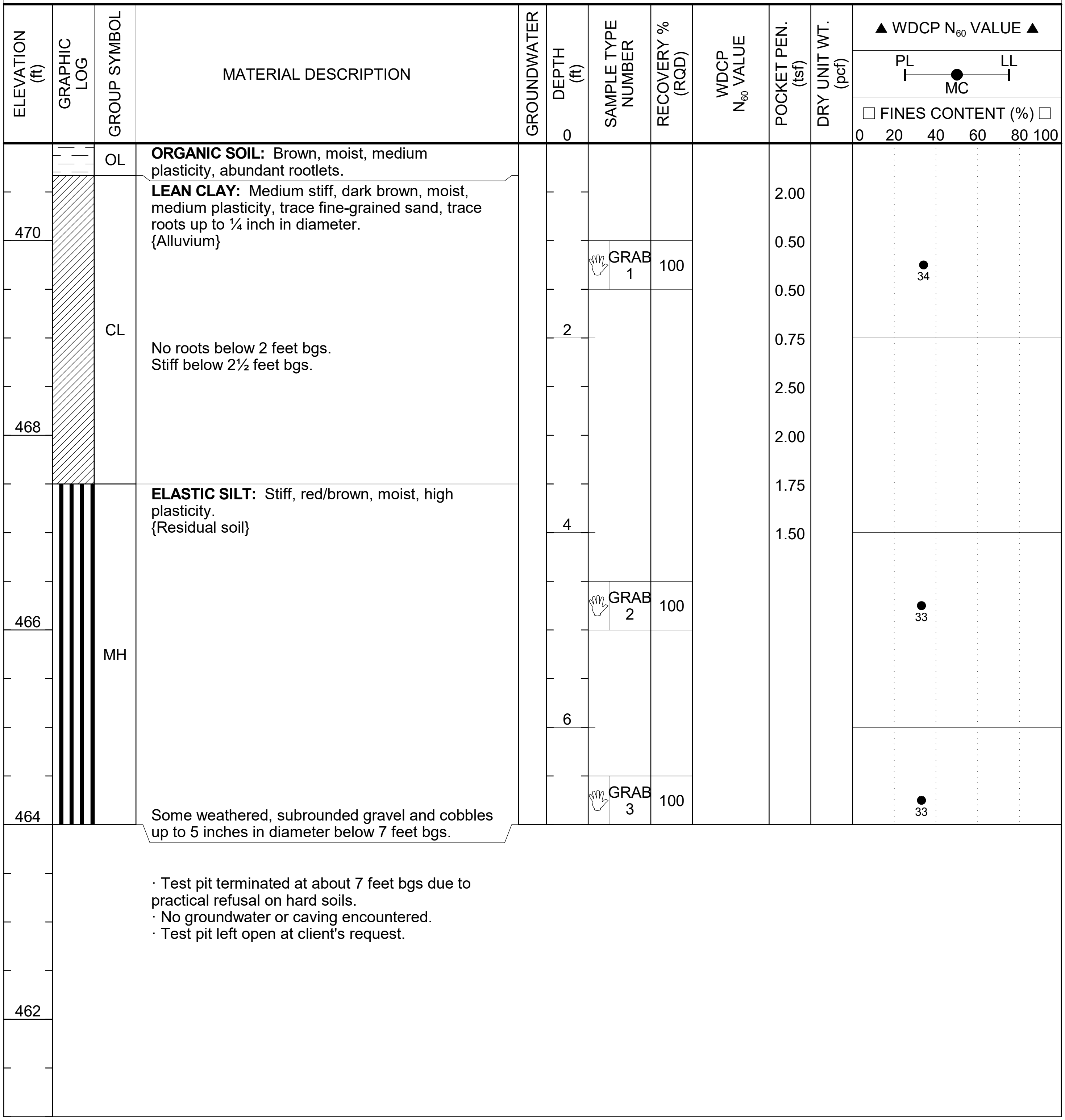
SEEPAGE ---

EQUIPMENT Kubota KX057-5 mini-excavator

GROUNDWATER DURING DRILLING ---

EXCAVATION METHOD Test Pit

GROUNDWATER AFTER EXCAVATION ---



ELEVATION (ft)	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MC
	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		34
								0.50		
		No roots below 2 feet bgs. Stiff below 2½ feet bgs.		2				0.75		
								2.50		
468								2.00		
	MH	**ELASTIC SILT:** Stiff, red/brown, moist, high plasticity. {Residual soil}						1.75		
				4				1.50		
466					GRAB 2	100				33
				6						
464		Some weathered, subrounded gravel and cobbles up to 5 inches in diameter below 7 feet bgs.			GRAB 3	100				33
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 at client's request.

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FIGURE A5

Test Pit TP-03

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes

PROJECT NAME Kuebler Lot Partitions

PROJECT NUMBER G2406322B

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		● 37
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 at client's request.

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FIGURE A6

Test Pit TP-04

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes

PROJECT NAME Kuebler Lot Partitions

PROJECT NUMBER G2406322B

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						
		CL	**LEAN CLAY:** Medium stiff, brown, moist, medium plasticity, trace fine-grained sand. {Alluvium}						0.50		
444									0.75		
			Stiff to very stiff below 2 feet bgs.			GRAB 1	100		1.50		32
					2				2.00		
		MH	**ELASTIC SILT:** Stiff, red/brown, moist, high plasticity. {Residual soil}						3.00		
442									1.75		
									1.50		
					4				2.00		
						GRAB 2	100				34 37 70
440			Wet below 5 feet bgs.	▽							
					6	GRAB 3	100				47
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 at client's request.

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FIGURE A7

Test Pit TP-05

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
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		● 37

· 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 at client's request.

440

438

436

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FIGURE A8

Test Pit TP-06

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
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 ─●─ LL MC ☐ 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				37
					2						
438			Wet below 2½ feet bgs.	∇		GRAB 2	100				

· 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 at client's request.

436

434

432

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FIGURE A9

Test Pit TP-07

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
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						
		CL	**LEAN CLAY:** Very soft, dark brown, moist, medium plasticity. {Alluvium} Stiff below 1 foot bgs.						0.00 1.00 0.75		
438		MH	**ELASTIC SILT:** Medium stiff, red/brown, moist, high plasticity. {Residual soil}		2				0.75 0.75 1.00 1.00		
436			Trace weathered, subround gravels and cobbles up to 5 inches in diameter below 4 feet bgs.		4	GRAB 1	100		2.00		● 32 ☐ 87
434											
432											
430											

· Test pit terminated at about 5 feet bgs due to practical refusal on coarse particles.
· Infiltration test IT-1 performed in test pit at about 4 feet bgs. See Appendix B for infiltration test results.
· Grab sample 1 taken after infiltration testing was completed.
· No groundwater or caving encountered.
· Test pit left open at client's request.

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FIGURE A10

Test Pit TP-08

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
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 N60 VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N60 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		27 30 47
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		28
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 at client's request.

FIGURE A11

Test Pit TP-09

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)
		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/GC 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			
434			· Test pit terminated at about 5 feet bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.	6				
432								
430								

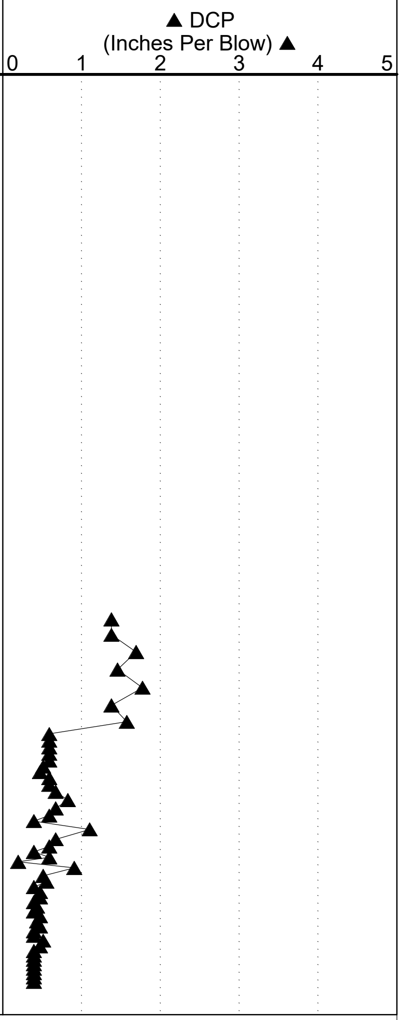

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FIGURE A12

Test Pit TP-10

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 454 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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)
		GP FILL	**POORLY GRADED GRAVEL FILL:** Gray, moist, subrounded, up to ¾ inch in diameter.	0				
		CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity. {Alluvium} · Test pit terminated at about ½ foot bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.					
452				2				
450								
448								
446								
444								

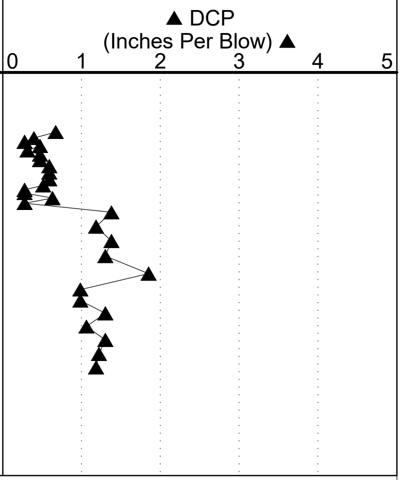

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FIGURE A13

Test Pit TP-11

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 448 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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)
	▩	GP FILL	**POORLY GRADED GRAVEL FILL:** Gray, moist, subrounded, up to ¾ inch in diameter.	0				
	▨	CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity, some fine-grained sand. {Alluvium}					
446			· Test pit terminated at about 1 foot bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.	2				
444								
442								
440								
438								

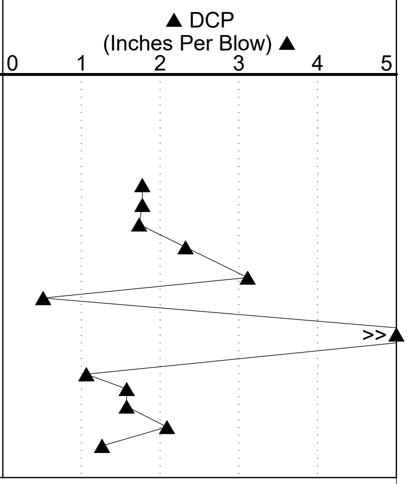

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FIGURE A14

Test Pit TP-12

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 449 ft
ELEVATION DATUM See Figure 2
WEATHER Fog, 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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)
		OL	**ORGANIC SOIL:** Brown, moist, low plasticity, abundant rootlets.	0				
448		CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity. {Alluvium}					
			· Test pit terminated at about ¾ foot bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.	2				
446								
444								
442								
440								

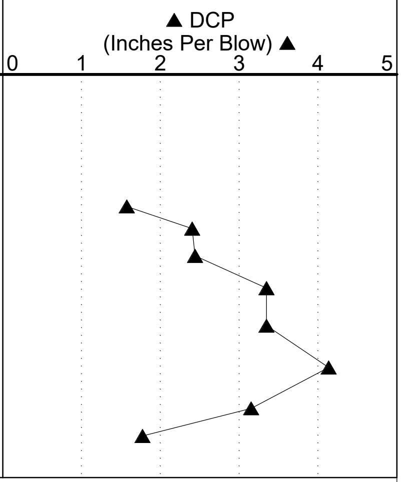

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FIGURE A15

Test Pit TP-13

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 451 ft
ELEVATION DATUM See Figure 2
WEATHER Fog, 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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)
		OL	**ORGANIC SOIL:** Brown, moist, low plasticity, abundant rootlets.	0				
450	▨	CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity. {Alluvium}	2	BULK 1			
448			· Test pit terminated at about 2 feet bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.					
446								
444								
442								

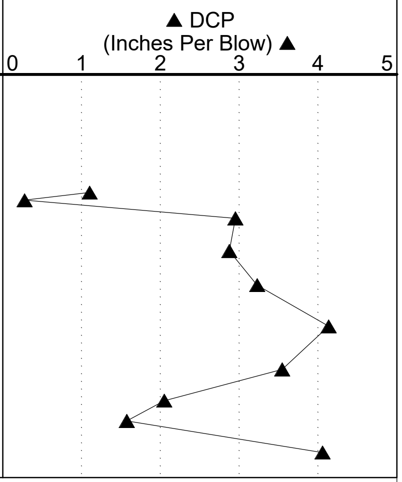

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FIGURE A16

Test Pit TP-14

PAGE 1 OF 1

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 449 ft
ELEVATION DATUM See Figure 2
WEATHER Fog, 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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)
		OL	**ORGANIC SOIL:** Brown, moist, low to medium plasticity, abundant rootlets, some roots up to ½ inch in diameter.	0				
448		CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity, some fine-grained sand. {Alluvium}					
			· Test pit terminated at about ¾ foot bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.	2				
446								
444								
442								
440								

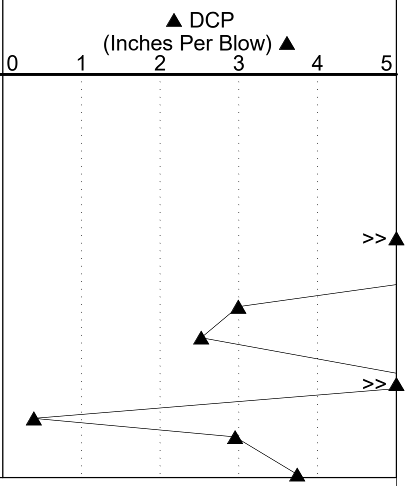

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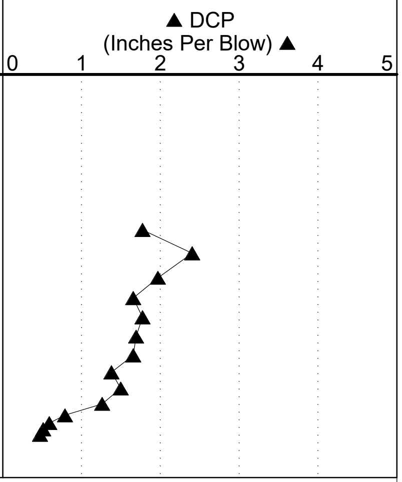
FIGURE A17

Test Pit TP-15

CLIENT Andre Makarenko - Comfort Homes
PROJECT NAME Kuebler Lot Partitions
PROJECT NUMBER G2406322B
PROJECT LOCATION 2592 Kuebler Road South - Salem, Oregon
DATE STARTED 1/15/25
GROUND ELEVATION 451 ft
ELEVATION DATUM See Figure 2
WEATHER Fog, 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	DEPTH (ft)	SAMPLE TYPE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	FINES CONTENT (%)	▲ DCP (Inches Per Blow) ▲
		OL	**ORGANIC SOIL:** Brown, moist, low plasticity, abundant rootlets.	0					
450		CL	**LEAN CLAY:** *Medium stiff*, brown, moist, medium plasticity, some fine-grained sand. {Alluvium}	2	BULK 1				
448			· Test pit terminated at about 2 feet bgs. · No groundwater or caving encountered. · Test pit loosely backfilled with excavated material.						
446									
444									
442									



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Appendix B: Results of Infiltration Testing

Kuebler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322B

February 26, 2025

Prepared For:

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

Prepared by
Carlson Geotechnical

B.1.0 INTRODUCTION

The project civil engineer, Mark Grenz, P.E., of Multi/Tech Engineering Services, Inc., requested infiltration testing at three locations on a site map provided to CGT. Groundwater was encountered at two of the locations (TP-3 and TP-5) during our explorations, at depths of about 3½ feet bgs, so infiltration testing was not performed at those locations. An infiltration test was performed within test pit TP-7.

B.2.0 TEST PROCEDURE

The infiltration test (IT-1) was performed in general accordance with the Encased Falling Head Test Method described in Chapter 4C.3 of the 2016 City of Salem Department of Public Works Administrative Rules Design Standards.

Once the test pit was excavated to the infiltration test depth, a 6-inch-inner-diameter PVC pipe was pushed about 6 inches into the soil at the base of the test pit. A thin layer of clean gravel was placed within the pipe to prevent scouring the soil with water during testing. The test pipe was filled with about 12 inches of water twice on January 15, 2025 and allowed to soak overnight. The test pipe was refilled with about 12 inches of water on January 16, 2025, which seeped away in about 30 minutes. We adjusted the water level so that there was approximately 6 inches of water in the pipe, and the drop in water level was recorded at 10 minute intervals until all of the water had drained. A total of four trials were conducted. Measurements were taken with a tape measure and recorded to the nearest one-eighth of an inch.

B.3.0 TEST RESULTS

The following table presents the details, raw data, and calculated infiltration rates observed during testing. Please note that the calculated infiltration rates do not include any safety or correction factors.

Table 1 Results of Infiltration Test IT-1

Location:	Salem, Oregon	Date:	1-16-25	Exploration Number:	**TP-7**
Test Method:	Encased Falling Head Infiltration Test	Inner Diameter of Pipe:	6 inches	Infiltration Test Depth:	**4 feet**
Soil at infiltration test depth:	Elastic Silt (MH)	see exploration log for detail			
Presaturation Start Time:	1:05	Presaturation Notes:	Soaked overnight, 12 inches of water added twice and seeped away in about 30 minutes each time.		
Presaturation End Time:	1:35				

Time (PM)	Time Interval (Minutes:Seconds)	Measurement (inches)*	Drop in Water level (inches)	Infiltration Rate** (inches per hour)	Remarks
1:57	0	60⅝	---	---	Water added to provide 6-inch head.
2:07	10	63½	2⅞	---	
2:17	10	65⅝	2⅛	---	
2:27	10	66⅝	1	6	Trial 1 concluded
Trial 2 Initiated					
2:28	0	60⅝	---	---	Water added to provide 6-inch head.
2:38	10	62½	1⅞	---	
2:48	10	65	2½	---	
2:58	10	66⅝	1⅝	9¾	Trial 2 concluded
Trial 3 initiated					
3:00	0	60⅝	---	**---**	Water added to provide 6-inch head.
3:10	10	63⅛	2½	**---**	
3:20	10	65⅜	2¼	**---**	
3:30	10	66⅝	1¼	7½	Trial 3 concluded
Trial 4 initiated					
3:31	0	66⅝	---	**---**	Water added to provide 6-inch head.
3:41	10	63½	2⅞	**---**	
3:51	10	65⅝	2⅛	**---**	
4:01	10	66⅝	1	**6**	Trial 4 concluded

* Measured to nearest 1/8 inch using a measuring tape

** Values calculated are raw (unfactored) rates.

B.4.0 GEOTECHNICAL REVIEW & DISCUSSION

B.4.1 Review of Test Results

Per the referenced test procedure: *"The result of the last water level drop is used to calculate the tested infiltration rate".* Accordingly, the raw (unfactored) tested infiltration test rate is 6 inches per hour for infiltration test IT-1 per the manual.

As indicated above, the infiltration test performed as part of this assignment is considered preliminary and was performed to assist with assessing feasibility of infiltrating stormwater at relatively shallow depths at this site. Supplemental infiltration testing is recommended in the event that plans include construction of stormwater infiltration facilities; such testing should be performed reasonably close to and at/near the base of the facility(ies) in accordance with the referenced stormwater manual. CGT would be pleased to perform supplemental infiltration testing at the project site, if required, for an additional fee.

B.4.2 Seasonal High Groundwater Level

Groundwater was encountered at depths of about 2½ to 5 feet bgs in TP-1 and TP-3 through TP-6. Groundwater was not encountered at the depths explored the remaining test pits excavated at the site in January 2025.

Based on our explorations and site observations, the groundwater levels within the eastern (lower) portion of the site is interpreted to be strongly influenced by Croisan Creek. For general planning and design, we do not recommend siting stormwater infiltration facilities within that portion of the site (i.e., areas of test pits TP-4 through TP-6). In the event that stormwater infiltration facilities are considered in that portion of the site, additional explorations and/or installation of piezometer(s) may be recommended. Such work is outside the scope of this current assignment but could be performed, upon request, for an additional fee.

With regard to the remainder of the site (i.e., portion of the site not influenced by Croisan Creek), based on our observations and review of publicly available water well logs in the site’s vicinity, we recommend the “seasonal high groundwater level” at this site be assigned at a depth of 30 feet bgs. The geotechnical engineer should be contacted to review proposed facility locations and depths and perform additional infiltration testing, if warranted.

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 C: Results of DCP Tests

Kuebler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322B

February 26, 2025

Prepared For:

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

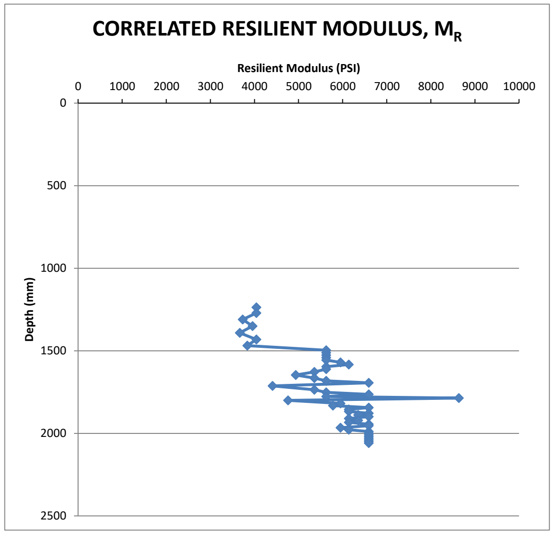
Prepared by
Carlson Geotechnical

Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-09

Type of Pavement:	N	C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)
Thickness of Pavement:		inches
Thickness of Base Rock:		inches
Seating Depth:	48	(inches from ground surface to bottom of excavation)
Initial DCP reading:	320	mm

Table 2 - C_f for DCP and FWD to

Layer Type & Location	C_f
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33



Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 4621

Reading No.	No. of Blows	Depth Reading (mm)	Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)	Hammer Blow Index	Accumulative Penetration (mm)	Middle of interval (mm)	Middle of interval (inches)	Material Type	Material Type Coefficient C_f	DCP Index mm/blow	CBR (correlation from user manual) %	Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf
1	1	355	A	1	35	1237	48.7	Subgrade	0.33	35.00	5	4043
2	1	390		1	70	1272	50.1	Subgrade	0.33	35.00	5	4043
3	1	433		1	113	1311	51.6	Subgrade	0.33	43.00	4	3731
4	1	470		1	150	1351	53.2	Subgrade	0.33	37.00	5	3957
5	1	515		1	195	1392	54.8	Subgrade	0.33	45.00	4	3666
6	1	550		1	230	1432	56.4	Subgrade	0.33	35.00	5	4043
7	1	590		1	270	1469	57.8	Subgrade	0.33	40.00	5	3838
8	1	605		1	285	1497	58.9	Subgrade	0.33	15.00	14	5626
9	1	620		1	300	1512	59.5	Subgrade	0.33	15.00	14	5626
10	1	635		1	315	1527	60.1	Subgrade	0.33	15.00	14	5626
11	1	650		1	330	1542	60.7	Subgrade	0.33	15.00	14	5626
12	1	665		1	345	1557	61.3	Subgrade	0.33	15.00	14	5626
13	1	678		1	358	1571	61.8	Subgrade	0.33	13.00	17	5949
14	1	690		1	370	1583	62.3	Subgrade	0.33	12.00	18	6138
15	1	705		1	385	1597	62.9	Subgrade	0.33	15.00	14	5626
16	1	720		1	400	1612	63.5	Subgrade	0.33	15.00	14	5626
17	1	737		1	417	1628	64.1	Subgrade	0.33	17.00	12	5358
18	1	758		1	438	1647	64.8	Subgrade	0.33	21.00	10	4935
19	1	775		1	455	1666	65.6	Subgrade	0.33	17.00	12	5358
20	1	790		1	470	1682	66.2	Subgrade	0.33	15.00	14	5626
21	1	800		1	480	1694	66.7	Subgrade	0.33	10.00	22	6590
22	1	828		1	508	1713	67.4	Subgrade	0.33	28.00	7	4411
23	1	845		1	525	1736	68.3	Subgrade	0.33	17.00	12	5358
24	1	860		1	540	1752	69.0	Subgrade	0.33	15.00	14	5626
25	1	870		1	550	1764	69.5	Subgrade	0.33	10.00	22	6590
26	1	885		1	565	1777	69.9	Subgrade	0.33	15.00	14	5626
27	1	890		1	570	1787	70.3	Subgrade	0.33	5.00	48	8636
28	1	913		1	593	1801	70.9	Subgrade	0.33	23.00	9	4763
29	1	926		1	606	1819	71.6	Subgrade	0.33	13.00	17	5949
30	1	940		1	620	1832	72.1	Subgrade	0.33	14.00	15	5780
31	1	950		1	630	1844	72.6	Subgrade	0.33	10.00	22	6590
32	1	962		1	642	1855	73.0	Subgrade	0.33	12.00	18	6138
33	1	974		1	654	1867	73.5	Subgrade	0.33	12.00	18	6138
34	1	984		1	664	1878	73.9	Subgrade	0.33	10.00	22	6590
35	1	995		1	675	1889	74.4	Subgrade	0.33	11.00	20	6350
36	1	1005		1	685	1899	74.8	Subgrade	0.33	10.00	22	6590
37	1	1017		1	697	1910	75.2	Subgrade	0.33	12.00	18	6138
38	1	1028		1	708	1922	75.7	Subgrade	0.33	11.00	20	6350
39	1	1040		1	720	1933	76.1	Subgrade	0.33	12.00	18	6138
40	1	1050		1	730	1944	76.5	Subgrade	0.33	10.00	22	6590
41	1	1060		1	740	1954	76.9	Subgrade	0.33	10.00	22	6590
42	1	1073		1	753	1966	77.4	Subgrade	0.33	13.00	17	5949
43	1	1085		1	765	1978	77.9	Subgrade	0.33	12.00	18	6138
44	1	1095		1	775	1989	78.3	Subgrade	0.33	10.00	22	6590
45	1	1105		1	785	1999	78.7	Subgrade	0.33	10.00	22	6590
46	1	1115		1	795	2009	79.1	Subgrade	0.33	10.00	22	6590
47	1	1125		1	805	2019	79.5	Subgrade	0.33	10.00	22	6590
48	1	1135		1	815	2029	79.9	Subgrade	0.33	10.00	22	6590
49	1	1145		1	825	2039	80.3	Subgrade	0.33	10.00	22	6590
50	1	1155		1	835	2049	80.7	Subgrade	0.33	10.00	22	6590
51	1	1165		1	845	2059	81.1	Subgrade	0.33	10.00	22	6590

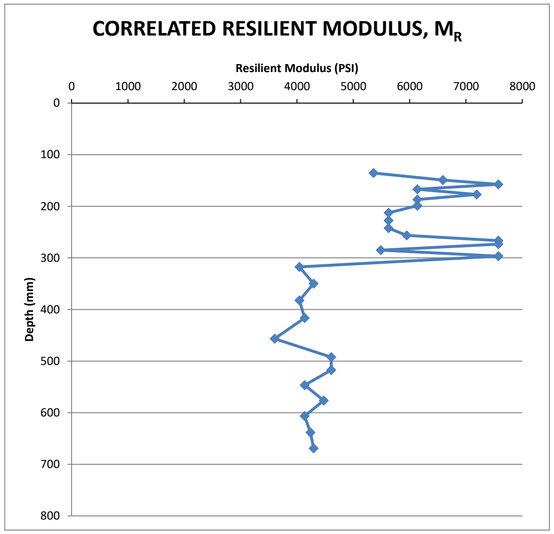
Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-10

Type of Pavement:	N	**C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)**
Thickness of Pavement:		**inches**
Thickness of Base Rock:		**inches**
Seating Depth:	5	**(inches from ground surface to bottom of excavation)**
Initial DCP reading:	477	**mm**

Table 2 - C_f for DCP and FWD to

Layer Type & Location	C_f
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33

Reading No.	No. of Blows	Depth Reading (mm)	Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)	Hammer Blow Index	Accumulative Penetration (mm)	Middle of interval (mm)	Middle of interval (inches)	Material Type	Material Type Coefficient C_f	DCP Index mm/blow	CBR (correlation from user manual) %	Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf
1	1	494	A	1	17	136	5.3	Subgrade	0.33	17.00	12	5358
2	1	504		1	27	149	5.9	Subgrade	0.33	10.00	22	6590
3	1	511		1	34	158	6.2	Subgrade	0.33	7.00	33	7574
4	1	523		1	46	167	6.6	Subgrade	0.33	12.00	18	6138
5	1	531		1	54	177	7.0	Subgrade	0.33	8.00	28	7190
6	1	543		1	66	187	7.4	Subgrade	0.33	12.00	18	6138
7	1	555		1	78	199	7.8	Subgrade	0.33	12.00	18	6138
8	1	570		1	93	213	8.4	Subgrade	0.33	15.00	14	5626
9	1	585		1	108	228	9.0	Subgrade	0.33	15.00	14	5626
10	1	600		1	123	243	9.5	Subgrade	0.33	15.00	14	5626
11	1	613		1	136	257	10.1	Subgrade	0.33	13.00	17	5949
12	1	620		1	143	267	10.5	Subgrade	0.33	7.00	33	7574
13	1	627		1	150	274	10.8	Subgrade	0.33	7.00	33	7574
14	1	643		1	166	285	11.2	Subgrade	0.33	16.00	13	5487
15	1	650		1	173	297	11.7	Subgrade	0.33	7.00	33	7574
16	1	685		1	208	318	12.5	Subgrade	0.33	35.00	5	4043
17	1	715		1	238	350	13.8	Subgrade	0.33	30.00	6	4294
18	1	750		1	273	383	15.1	Subgrade	0.33	35.00	5	4043
19	1	783		1	306	417	16.4	Subgrade	0.33	33.00	6	4137
20	1	830		1	353	457	18.0	Subgrade	0.33	47.00	4	3604
21	1	855		1	378	493	19.4	Subgrade	0.33	25.00	8	4610
22	1	880		1	403	518	20.4	Subgrade	0.33	25.00	8	4610
23	1	913		1	436	547	21.5	Subgrade	0.33	33.00	6	4137
24	1	940		1	463	577	22.7	Subgrade	0.33	27.00	7	4474
25	1	973		1	496	607	23.9	Subgrade	0.33	33.00	6	4137
26	1	1004		1	527	639	25.1	Subgrade	0.33	31.00	6	4239
27	1	1034		1	557	669	26.3	Subgrade	0.33	30.00	6	4294



Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 5931

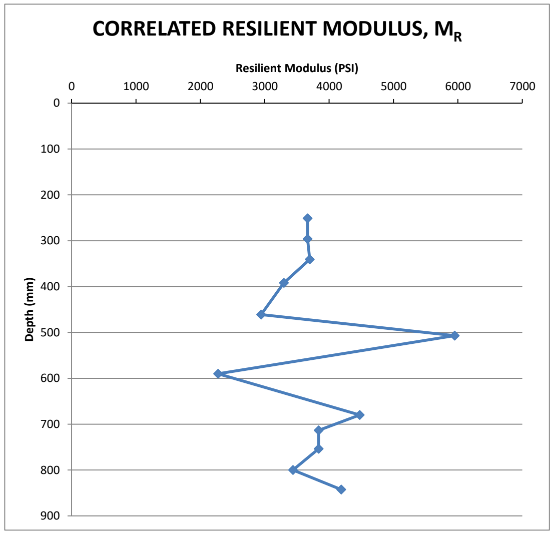
Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-11

Type of Pavement:	N	C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)
Thickness of Pavement:		inches
Thickness of Base Rock:		inches
Seating Depth:	9	(inches from ground surface to bottom of excavation)
Initial DCP reading:	415	mm

Table 2 - C_f for DCP and FWD to

Layer Type & Location	C_f
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33

Reading No.	No. of Blows	Depth Reading (mm)	Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)	Hammer Blow Index	Accumulative Penetration (mm)	Middle of interval (mm)	Middle of interval (inches)	Material Type	Material Type Coefficient C_f	DCP Index mm/blow	CBR (correlation from user manual) %	Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf
1	1	460	A	1	45	251	9.9	Subgrade	0.33	45.00	4	3666
2	1	505		1	90	296	11.7	Subgrade	0.33	45.00	4	3666
3	1	549		1	134	341	13.4	Subgrade	0.33	44.00	4	3698
4	1	608		1	193	392	15.4	Subgrade	0.33	59.00	3	3298
5	1	687		1	272	461	18.2	Subgrade	0.33	79.00	2	2943
6	1	700		1	285	507	20.0	Subgrade	0.33	13.00	17	5949
7	1	853		1	438	590	23.2	Subgrade	0.33	153.00	1	2274
8	1	880		1	465	680	26.8	Subgrade	0.33	27.00	7	4474
9	1	920		1	505	714	28.1	Subgrade	0.33	40.00	5	3838
10	1	960		1	545	754	29.7	Subgrade	0.33	40.00	5	3838
11	1	1013		1	598	800	31.5	Subgrade	0.33	53.00	3	3439
12	1	1045		1	630	843	33.2	Subgrade	0.33	32.00	6	4187
13												
14												
15												



Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 3870

Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-12

Type of Pavement:	N	**C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)**
Thickness of Pavement:		**inches**
Thickness of Base Rock:		**inches**
Seating Depth:	11	**(inches from ground surface to bottom of excavation)**
Initial DCP reading:	482	**mm**

Table 2 - C_f for DCP and FWD to

Layer Type & Location	C_f
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33

Reading No.	No. of Blows	Depth Reading (mm)	Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)	Hammer Blow Index	Accumulative Penetration (mm)	Middle of interval (mm)	Middle of interval (inches)	Material Type	Material Type Coefficient C_f	DCP Index mm/blow	CBR (correlation from user manual) %	Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf
1	1	522	A	1	40	299	11.8	Subgrade	0.33	40.00	5	3838
2	1	583		1	101	350	13.8	Subgrade	0.33	61.00	3	3256
3	1	645		1	163	411	16.2	Subgrade	0.33	62.00	3	3235
4	1	730		1	248	485	19.1	Subgrade	0.33	85.00	2	2860
5	1	815		1	333	570	22.4	Subgrade	0.33	85.00	2	2860
6	1	920		1	438	665	26.2	Subgrade	0.33	105.00	2	2634
7	1	1000		1	518	757	29.8	Subgrade	0.33	80.00	2	2929
8	1	1045		1	563	820	32.3	Subgrade	0.33	45.00	4	3666
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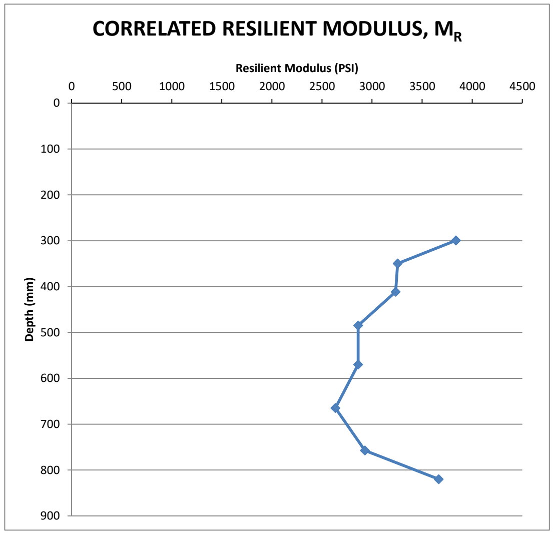

Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 3210

Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-13

Type of Pavement:	N	**C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)**
Thickness of Pavement:		**inches**
Thickness of Base Rock:		**inches**
Seating Depth:	10	**(inches from ground surface to bottom of excavation)**
Initial DCP reading:	390	**mm**

Table 2 - C_f for DCP and FWD to

Layer Type & Location	**C_f**
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33

Reading No.	**No. of Blows**	**Depth Reading (mm)**	**Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)**	**Hammer Blow Index**	**Accumulative Penetration (mm)**	**Middle of interval (mm)**	**Middle of interval (inches)**	**Material Type**	**Material Type Coefficient C_f**	**DCP Index mm/blow**	**CBR (correlation from user manual) %**	**Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf**
1	1	418	A	1	28	268	10.6	Subgrade	0.33	28.00	7	4411
2	1	425		1	35	286	11.2	Subgrade	0.33	7.00	33	7574
3	1	500		1	110	327	12.9	Subgrade	0.33	75.00	2	3004
4	1	573		1	183	401	15.8	Subgrade	0.33	73.00	2	3035
5	1	655		1	265	478	18.8	Subgrade	0.33	82.00	2	2901
6	1	760		1	370	572	22.5	Subgrade	0.33	105.00	2	2634
7	1	850		1	460	669	26.3	Subgrade	0.33	90.00	2	2797
8	1	902		1	512	740	29.1	Subgrade	0.33	52.00	3	3465
9	1	942		1	552	786	30.9	Subgrade	0.33	40.00	5	3838
10	1	1045		1	655	858	33.8	Subgrade	0.33	103.00	2	2654
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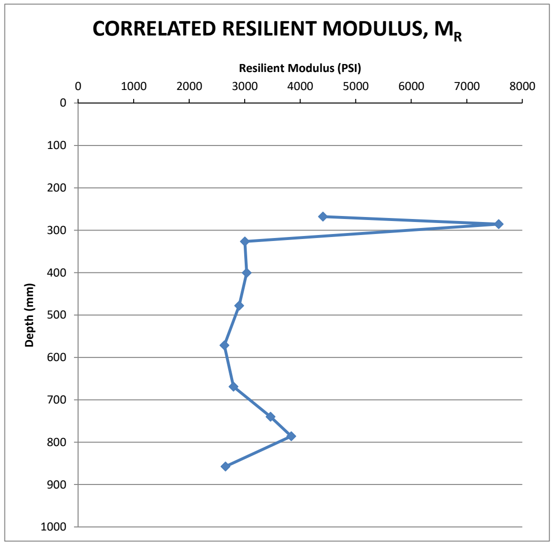
12												
13												
14												
15												



Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 3926

Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-14

Type of Pavement:	N	**C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)**
Thickness of Pavement:		**inches**
Thickness of Base Rock:		**inches**
Seating Depth:	10	**(inches from ground surface to bottom of excavation)**
Initial DCP reading:	344	**mm**

Table 2 - C_f for DCP and FWD to

Layer Type & Location	**C_f**
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33

Reading No.	No. of Blows	Depth Reading (mm)	Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)	Hammer Blow Index	Accumulative Penetration (mm)	Middle of interval (mm)	Middle of interval (inches)	Material Type	Material Type Coefficient C_f	DCP Index mm/blow	CBR (correlation from user manual) %	Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf
1	1	579	A	1	235	372	14.6	Subgrade	0.33	235.00	1	1924
2	1	655		1	311	527	20.7	Subgrade	0.33	76.00	2	2988
3	1	719		1	375	597	23.5	Subgrade	0.33	64.00	3	3195
4	1	865		1	521	702	27.6	Subgrade	0.33	146.00	1	2316
5	1	875		1	531	780	30.7	Subgrade	0.33	10.00	22	6590
6	1	950		1	606	823	32.4	Subgrade	0.33	75.00	2	3004
7	1	1045		1	701	908	35.7	Subgrade	0.33	95.00	2	2739
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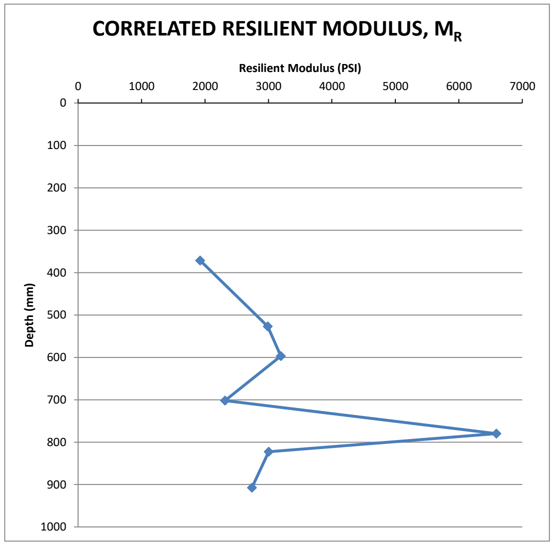


Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 3403

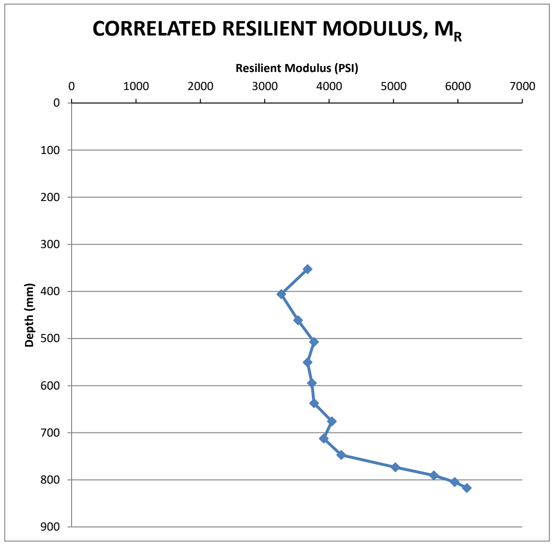
Project:	Kuebler Lot Partions
Project Number:	G2406322B
Date:	1/15/2025
Exploration Name:	TP-15

Type of Pavement:	N	**C/AC/N (C = Portland Cement Concrete, AC = Asphaltic Concrete, N = None)**
Thickness of Pavement:		**inches**
Thickness of Base Rock:		**inches**
Seating Depth:	13	**(inches from ground surface to bottom of excavation)**
Initial DCP reading:	432	**mm**

Table 2 - C_f for DCP and FWD to

Layer Type & Location	**C_f**
Subgrade Below AC & Aggregate Base	0.35
Aggregate Base or Subbase Below AC	0.62
Subgrade Below PCC or CTB	0.25
Aggregate Base or Subbase Below PCC	0.62
None (no pavement)	0.33

Reading No.	No. of Blows	Depth Reading (mm)	Type of Hammer A=17.6 lb hammer B=10.1 lb hammer (only need to note change in hammer)	Hammer Blow Index	Accumulative Penetration (mm)	Middle of interval (mm)	Middle of interval (inches)	Material Type	Material Type Coefficient C_f	DCP Index mm/blow	CBR (correlation from user manual) %	Subgrade Modulus (Pg. 21 ODOT Pavement Design Guide) psf
1	1	477	A	1	45	353	13.9	Subgrade	0.33	45.00	4	3666
2	1	538		1	106	406	16.0	Subgrade	0.33	61.00	3	3256
3	1	588		1	156	461	18.2	Subgrade	0.33	50.00	4	3518
4	1	630		1	198	507	20.0	Subgrade	0.33	42.00	4	3766
5	1	675		1	243	551	21.7	Subgrade	0.33	45.00	4	3666
6	1	718		1	286	595	23.4	Subgrade	0.33	43.00	4	3731
7	1	760		1	328	637	25.1	Subgrade	0.33	42.00	4	3766
8	1	795		1	363	676	26.6	Subgrade	0.33	35.00	5	4043
9	1	833		1	401	712	28.0	Subgrade	0.33	38.00	5	3916
10	1	865		1	433	747	29.4	Subgrade	0.33	32.00	6	4187
11	1	885		1	453	773	30.4	Subgrade	0.33	20.00	10	5029
12	1	900		1	468	791	31.1	Subgrade	0.33	15.00	14	5626
13	1	913		1	481	805	31.7	Subgrade	0.33	13.00	17	5949
14	1	925		1	493	817	32.2	Subgrade	0.33	12.00	18	6138
15												



Mr (average) within upper 300 mm (12 inches) of subgrade (psi) = 3676

Carlson Geotechnical
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Phone: (503) 601-8250
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Bend Office (541) 330-9155
Eugene Office (541) 345-0289
Salem Office (503) 589-1252
Tigard Office (503) 684-3460

Appendix D: Results of Proctors and CBR Tests

Kuebler Lot Partitions
2592 Kuebler Road South
Salem, Oregon

CGT Project Number G2406322B

February 26, 2025

Prepared For:

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

Prepared by
Carlson Geotechnical

Carlson Testing, Inc.

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Salem Office	(503) 589-1252
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Moisture - Density Relationship

Client: COMFORT HOMES LLC

2/19/2025

Project: KUEBLER LOT PARTITIONS

Job Number: G2406322.B

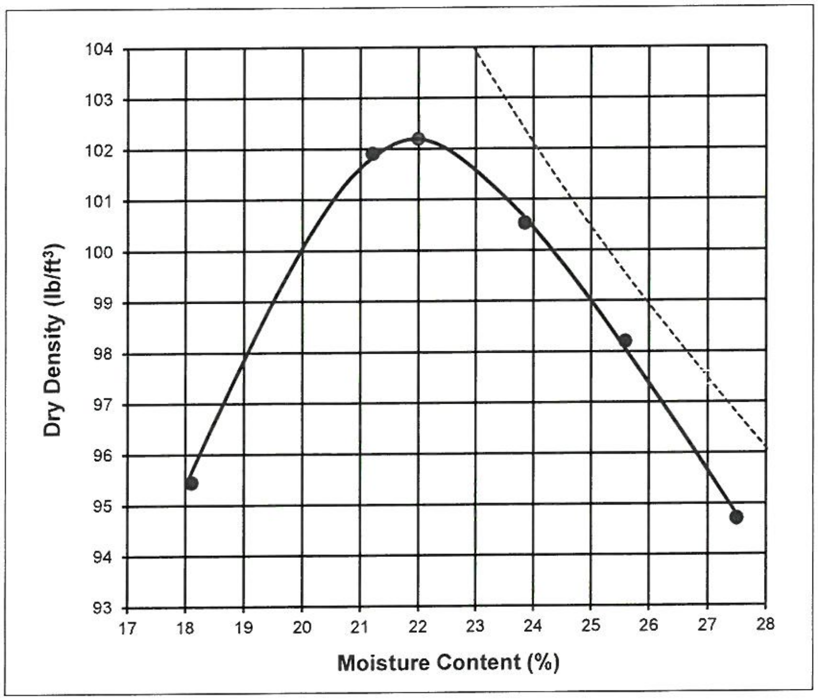
Lab Number: G25-0005

Material Type: LEAN CLAY (CL)

Sampled from: TP-9

Source: NATIVE ON-SITE SOILS

Test Method:	ASTM D-1557 A, C-136, D-2216, D-2488,	**Date Sampled:**	01/14/25
Sample Method:	D-75	**Date Tested:**	01/23/25
Preparation Method:	Moist	**Oversized Material:**	Removed
Compacting Method:	Manual	**Hammer Type:**	Circular



Assumed 100% Saturation Curve: 2.700

Optimum Moisture: **22.0%**

Max. Dry Density: **102.2** **lbs/ft³**

Percent Passing #4 Sieve: 100.0%

EEH

CC: COMFORT HOMES LLC - ANDRE MAKARENKO

COMFORTHOMESPNW@GMAIL.COM

Reviewed By: M. O J J.

David Irish - Project Manager

Moisture - Density Relationship

Client: COMFORT HOMES LLC

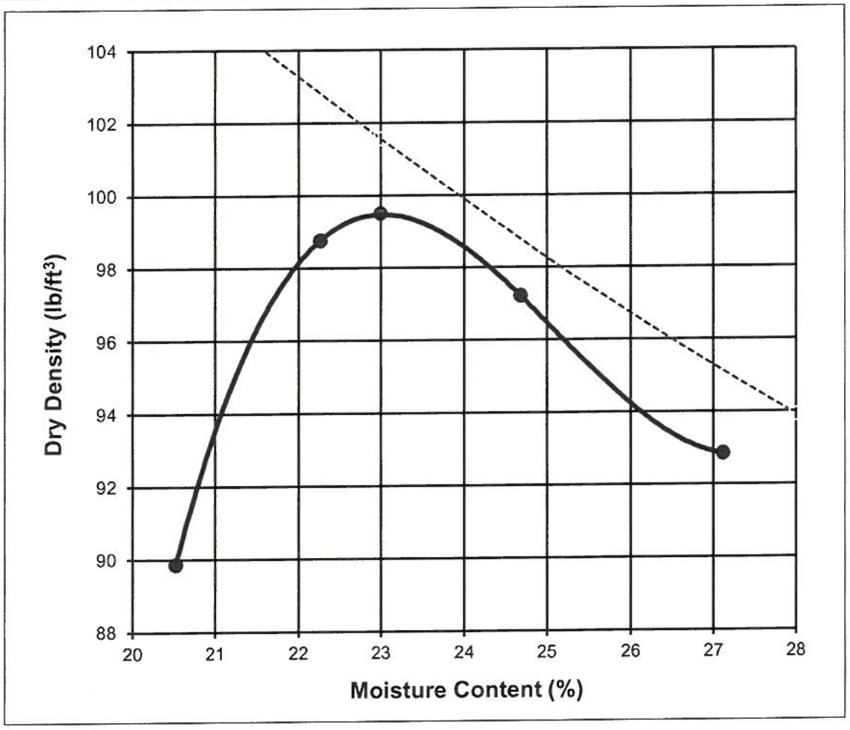
2/5/2025

Project: KUEBLER LOT PARTIONS

Job Number: G2406322.B
Lab Number: G25-0004
Sampled from: TP-15

Material Type: LEAN CLAY (CL)
Source: NATIVE ON-SITE SOILS

Test Method:	ASTM D-1557 A, C-136, D-2216, D-2488,	**Date Sampled:**	01/14/25
Sample Method:	D-75	**Date Tested:**	01/23/25
Preparation Method:	Moist	**Oversized Material:**	Removed
Compacting Method:	Manual	**Hammer Type:**	Circular



Assumed 100% Saturation Curve: 2.600

Optimum Moisture: 23.0%

Max. Dry Density: 99.5 **lbs/ft³**

Percent Passing #4 Sieve: 100.0%

AS

CC: COMFORT HOMES LLC - ANDRE MAKARENKO

COMFORTHOMESPNW@GMAIL.COM

Reviewed By: Ethan M
(for) David Irish - Project Manager

CTI JOB #: G2406322-B

CALIFORNIA BEARING RATIO

PROJECT: Kuebler Lot Partitions SAMPLE METHOD: ASTM D75 BILL CODE: 256S
CLIENT: Comfort Homes LLC SAMPLED BY: MDL DATE: 1/14/2025
SUPPLIER/SOURCE: Native On-site Soil SAMPLED FROM: TP-9
MATERIAL TYPE: Lean Clay (CL) DATE RECEIVED IN LAB: 1/14/2025
DATE STARTED: 2/6/2025 DATE FINISHED: 2/11/2025 LAB LOG #: 25-0005 TESTED BY: JB

BALANCE #: 3560 OVEN #: 4012 RAMMER #: 4307 SWELL INDICATOR #:
PROVING RING #: 3640 DIAL INDICATOR #: 4014 COMPRESSION MACHINE #: 191

METHOD OF TESTING

☐ AASHTO T193 ☐ AASHTO T265 ☑ ASTM D1883 ☑ ASTM D2216 ☑ ASTM D4429
☑ LABORATORY PREPARED ☑ FIELD SAMPLE ☐ IN-PLACE TEST
☑ SOAKED DURATION OF SOAK (HOURS): 96 ☐ UNSOAKED

COMPACTION METHOD

☐ AASHTO T99 ☐ AASHTO T180 ☐ ASTM D698 ☑ ASTM D1557 ☐ OTHER:

Maximum Density, lb/ft^3: 102.2 Optimum Moisture, %: 22.0 Target, %: 95 Target Density, lb/ft^3: 97.1
Piston Area, in^2 : 2.96 3/4" Oversize Replacement: 0 % Surcharge Weight, lbs: 10

	NUMBER OF BLOWS PER LAYER		10 Blows	25 Blows	56 Blows
AT COMPACTION	Tare ID		1	2	3
	(E) Tare weight, g		118.1	121.0	119.0
	(F) Wet and tare weight, g		534.9	540.3	549.8
	(G) Dry and tare weight, grams		458.1	465.1	466.8
	(H) Initial Water content, %	100x[(F-G)/(G-E)]	22.6	21.9	23.9
AFTER TEST TOP	Tare ID		1	2	3
	(I) Tare weight, g		118.1	121.0	119.0
	(J) Wet and tare weight, g		586.7	466.0	500.9
	(K) Dry and tare weight, grams		464.6	382.8	411.0
	(L) Initial Water content, %	100x[(J-K)/(K-I)]	35.2	31.8	30.8
SWELL DATA	(M) Sample height, in		4.584	4.548	4.584
	Date & Time Immersed		2/6/25 2:15 PM	2/6/25 2:15 PM	2/6/25 2:15 PM
	Date & Time Removed		2/10/25 1:00 PM	2/10/25 1:00 PM	2/10/25 1:00 PM
	(N) Initial Swell Reading, in		0.0520	0.0520	0.0400
	(O) Final Swell Reading, in		0.0600	0.0610	0.0490
	Total Swell, %	100x[(O-N)/M)]	0.17	0.20	0.20
DENSITY	Mold #		3547	3906	3548
	Surcharge #		1 10	2 10	3 10
	Mold Volume, ft^3		0.0750	0.0750	0.0750
	(Q) Mold weight, lb		15.31	15.81	15.73
	(R) Presoak wet weight with mold, lb		23.28	24.50	25.24
	(T) Presoak wet weight, lb	R-Q	7.97	8.69	9.51
	(U) Wet density, lb/ft^3	T/Mold Volume	106.3	115.9	126.8
	Dry density, lb/ft^3	U/[1+(H/100)]	86.7	95.1	102.3
	Compaction, %		84.8	93.1	100.1

CTI JOB #: G2406322-B

CALIFORNIA BEARING RATIO

PROJECT: Kuebler Lot Partitions SAMPLE METHOD: ASTM D75 BILL CODE: 256S

CLIENT: Comfort Homes LLC SAMPLED BY: MDL DATE: 1/14/2025

SUPPLIER/SOURCE: Native On-site Soil SAMPLED FROM: TP-9

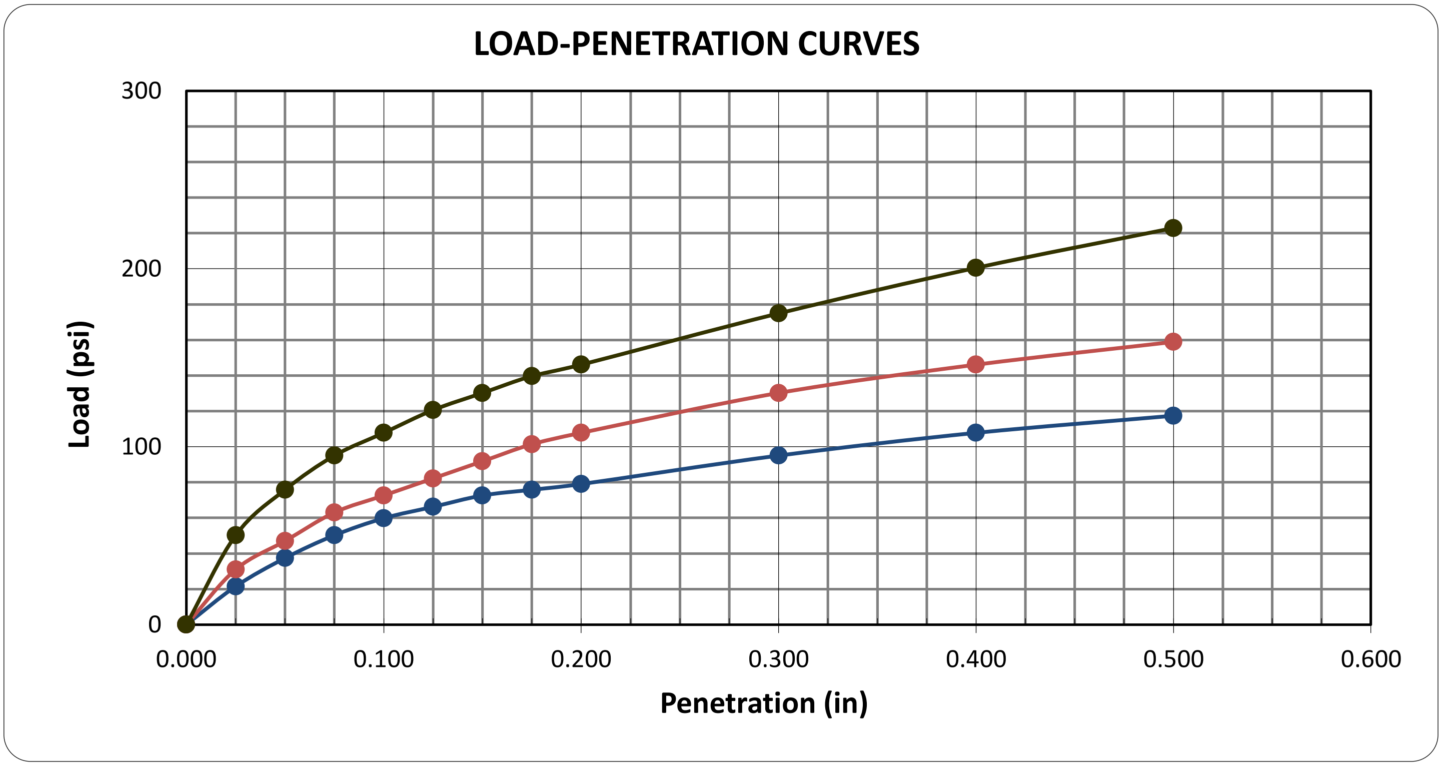
MATERIAL TYPE: Lean Clay (CL) DATE RECEIVED IN LAB: 1/14/2025

DATE STARTED: 2/6/2025 DATE FINISHED: 2/11/2025 LAB LOG #: 25-0005 TESTED BY: JB

TEST MEASUREMENTS

PENETRATION	10 Blows			25 Blows			56 Blows		
	READING	LOAD	PSI	READING	LOAD	PSI	READING	LOAD	PSI
0.000	0	0	0	0	0	0	0	0	0
0.025	5	64	22	8	92	31	14	149	50
0.050	10	111	37	13	139	47	22	224	76
0.075	14	149	50	18	187	63	28	281	95
0.100	17	177	60	21	215	73	32	319	108
0.125	19	196	66	24	243	82	36	357	121
0.150	21	215	73	27	272	92	39	385	130
0.175	22	224	76	30	300	101	42	414	140
0.200	23	234	79	32	319	108	44	433	146
0.300	28	281	95	39	385	130	53	518	175
0.400	32	319	108	44	433	146	61	594	201
0.500	35	347	117	48	470	159	68	660	223

PROVING RING CORRECTION: 9.4633 + 16.19



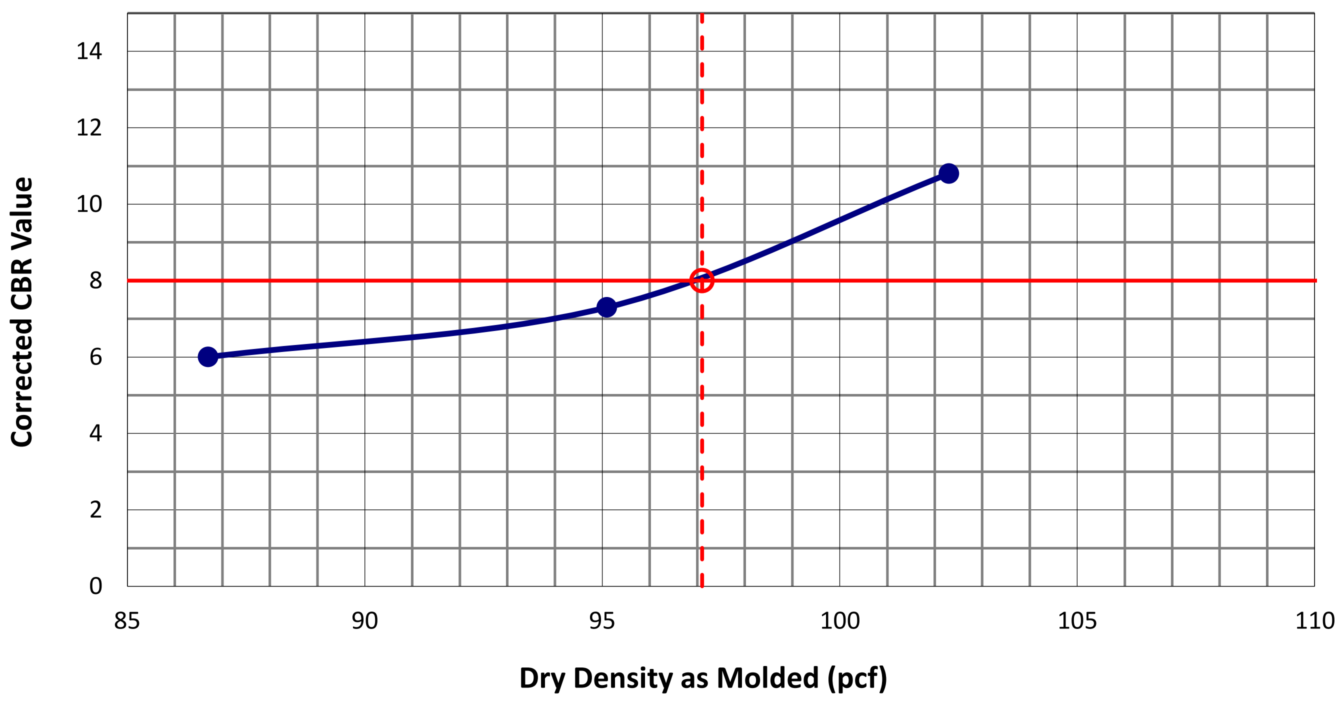
CTI JOB #: G2406322-B

CALIFORNIA BEARING RATIO

PROJECT: Kuebler Lot Partitions
SAMPLE METHOD: ASTM D75
BILL CODE: 256S
CLIENT: Comfort Homes LLC
SAMPLED BY: MDL
DATE: 1/14/2025
SUPPLIER/SOURCE: Native On-site Soil
SAMPLED FROM: TP-9
MATERIAL TYPE: Lean Clay (CL)
DATE RECEIVED IN LAB: 1/14/2025
DATE STARTED: 2/6/2025
DATE FINISHED: 2/11/2025
LAB LOG #: 25-0005
TESTED BY: JB

CBR DATA

BLOWS/LAYER	MOISTURE CONTENT, %	DRY DENSITY, lb/ft^3	CBR VALUE AT 0.100 INCH PENETRATION	CBR VALUE AT 0.200 INCH PENETRATION
10 Blows	22.6	86.7	6.0	5.3
25 Blows	21.9	95.1	7.3	7.2
56 Blows	23.9	102.3	10.8	9.7



EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	MOISTURE CONTENT (%)	MAXIMUM DRY DENSITY (PCF)	DESIGN % COMPACTION	CBR VALUE	SAMPLE DESCRIPTION
TP-9		22.0	102.2	95	8	Lean Clay (CL)

DEVIATIONS/COMMENTS

REVIEWED BY:
Jason Bryant, Laboratory Manager

DATE: 2/11/2025

Carlson Testing, Inc. - 4060 Hudson Avenue NE, Salem OR 97301

CTI JOB #: G2406322-B

CALIFORNIA BEARING RATIO

PROJECT: Kuebler Lot Partitions
SAMPLE METHOD: ASTM D75
BILL CODE: 256S
CLIENT: Comfort Homes LLC
SAMPLED BY: MDL
DATE: 1/14/2025
SUPPLIER/SOURCE: Native On-site Soil
SAMPLED FROM: TP-15
MATERIAL TYPE: Lean Clay (CL)
DATE RECEIVED IN LAB: 1/14/2025
DATE STARTED: 2/6/2025
DATE FINISHED: 2/11/2025
LAB LOG #: 25-0005
TESTED BY: JB

BALANCE #: 3560
OVEN #: 4012
RAMMER #: 4307
SWELL INDICATOR #:
PROVING RING #: 3640
DIAL INDICATOR #: 4014
COMPRESSION MACHINE #: 191

METHOD OF TESTING

☐ AASHTO T193 ☐ AASHTO T265 ☑ ASTM D1883 ☑ ASTM D2216 ☑ ASTM D4429
☑ LABORATORY PREPARED ☑ FIELD SAMPLE ☐ IN-PLACE TEST
☑ SOAKED DURATION OF SOAK (HOURS): 96 ☐ UNSOAKED

COMPACTION METHOD

☐ AASHTO T99 ☐ AASHTO T180 ☐ ASTM D698 ☑ ASTM D1557 ☐ OTHER:

Maximum Density, lb/ft^3: 101.9
Optimum Moisture, %: 21.4
Target, %: 95
Target Density, lb/ft^3: 96.8
Piston Area, in^2 : 2.96
3/4" Oversize Replacement: 0 %
Surcharge Weight, lbs: 10

	NUMBER OF BLOWS PER LAYER		10 Blows	25 Blows	56 Blows
AT COMPACTION	Tare ID		1	2	3
	(E) Tare weight, g		118.1	121.0	119.0
	(F) Wet and tare weight, g		534.9	540.3	549.8
	(G) Dry and tare weight, grams		458.1	465.1	466.8
	(H) Initial Water content, %	100x[(F-G)/(G-E)]	22.6	21.9	23.9
AFTER TEST TOP	Tare ID		1	2	3
	(I) Tare weight, g		118.1	121.0	119.0
	(J) Wet and tare weight, g		586.7	466.0	500.9
	(K) Dry and tare weight, grams		464.6	382.8	411.0
	(L) Initial Water content, %	100x[(J-K)/(K-I)]	35.2	31.8	30.8
SWELL DATA	(M) Sample height, in		4.584	4.548	4.584
	Date & Time Immersed		2/6/25 2:15 PM	2/6/25 2:15 PM	2/6/25 2:15 PM
	Date & Time Removed		2/10/25 1:00 PM	2/10/25 1:00 PM	2/10/25 1:00 PM
	(N) Initial Swell Reading, in		0.0520	0.0520	0.0400
	(O) Final Swell Reading, in		0.0600	0.0610	0.0490
	Total Swell, %	100x[(O-N)/M)]	0.17	0.20	0.20
DENSITY	Mold #		3547	3906	3548
	Surcharge #		1 10	2 10	3 10
	Mold Volume, ft^3		0.0750	0.0750	0.0750
	(Q) Mold weight, lb		15.31	15.81	15.73
	(R) Presoak wet weight with mold, lb		23.28	24.50	25.24
	(T) Presoak wet weight, lb	R-Q	7.97	8.69	9.51
	(U) Wet density, lb/ft^3	T/Mold Volume	106.3	115.9	126.8
	Dry density, lb/ft^3	U/[1+(H/100)]	86.7	95.1	102.3
	Compaction, %		85.1	93.3	100.4

CTI JOB #: G2406322-B

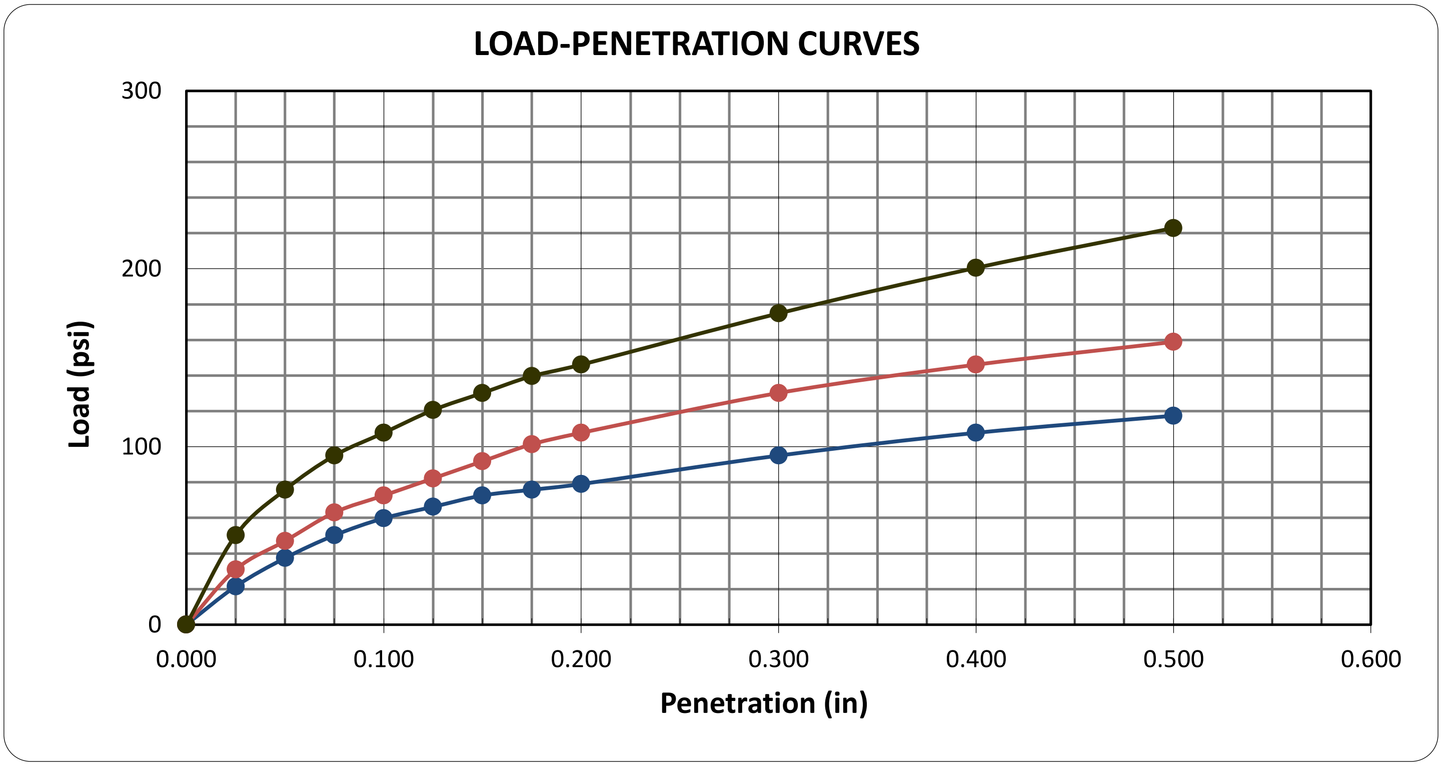
CALIFORNIA BEARING RATIO

PROJECT: Kuebler Lot Partitions SAMPLE METHOD: ASTM D75 BILL CODE: 256S
CLIENT: Comfort Homes LLC SAMPLED BY: MDL DATE: 1/14/2025
SUPPLIER/SOURCE: Native On-site Soil SAMPLED FROM: TP-15
MATERIAL TYPE: Lean Clay (CL) DATE RECEIVED IN LAB: 1/14/2025
DATE STARTED: 2/6/2025 DATE FINISHED: 2/11/2025 LAB LOG #: 25-0005 TESTED BY: JB

TEST MEASUREMENTS

PENETRATION	10 Blows			25 Blows			56 Blows		
	READING	LOAD	PSI	READING	LOAD	PSI	READING	LOAD	PSI
0.000	0	0	0	0	0	0	0	0	0
0.025	5	64	22	8	92	31	14	149	50
0.050	10	111	37	13	139	47	22	224	76
0.075	14	149	50	18	187	63	28	281	95
0.100	17	177	60	21	215	73	32	319	108
0.125	19	196	66	24	243	82	36	357	121
0.150	21	215	73	27	272	92	39	385	130
0.175	22	224	76	30	300	101	42	414	140
0.200	23	234	79	32	319	108	44	433	146
0.300	28	281	95	39	385	130	53	518	175
0.400	32	319	108	44	433	146	61	594	201
0.500	35	347	117	48	470	159	68	660	223

PROVING RING CORRECTION: 9.4633 + 16.19



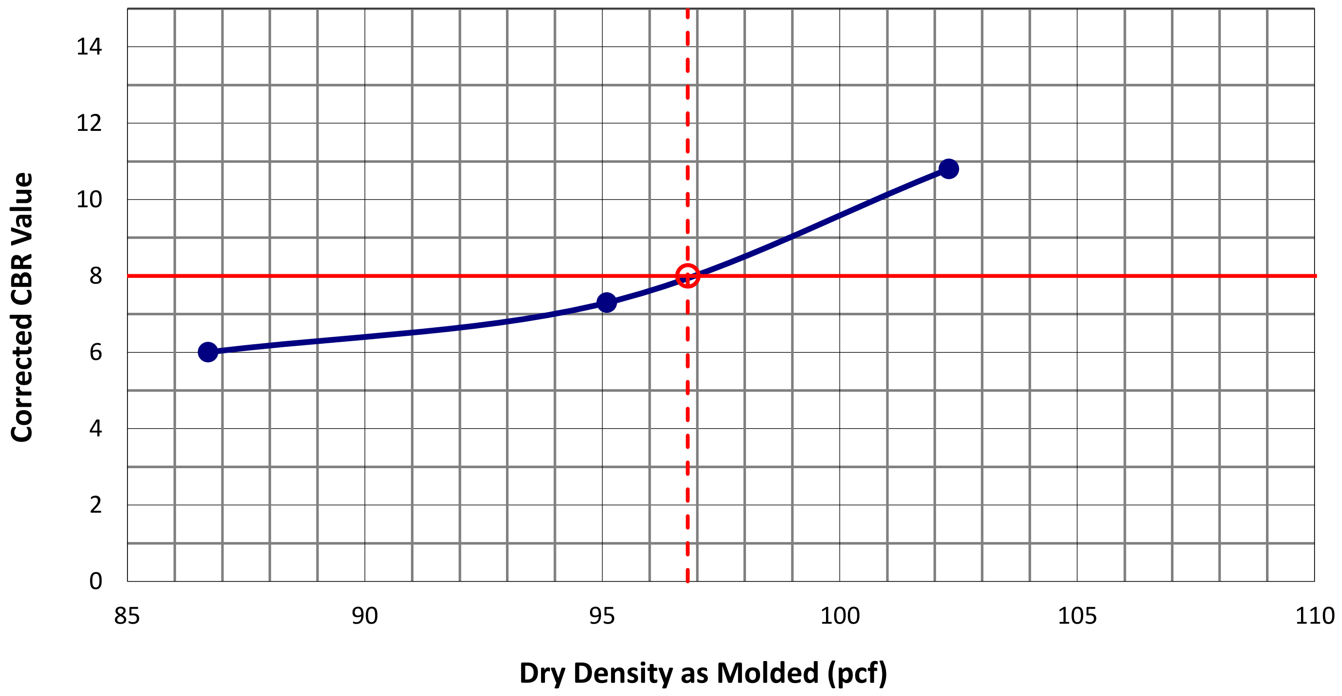
CTI JOB #: G2406322-B

CALIFORNIA BEARING RATIO

PROJECT: Kuebler Lot Partitions SAMPLE METHOD: ASTM D75 BILL CODE: 256S
CLIENT: Comfort Homes LLC SAMPLED BY: MDL DATE: 1/14/2025
SUPPLIER/SOURCE: Native On-site Soil SAMPLED FROM: TP-15
MATERIAL TYPE: Lean Clay (CL) DATE RECEIVED IN LAB: 1/14/2025
DATE STARTED: 2/6/2025 DATE FINISHED: 2/11/2025 LAB LOG #: 25-0005 TESTED BY: JB

CBR DATA

BLOWS/LAYER	MOISTURE CONTENT, %	DRY DENSITY, lb/ft^3	CBR VALUE AT 0.100 INCH PENETRATION	CBR VALUE AT 0.200 INCH PENETRATION
10 Blows	22.6	86.7	6.0	5.3
25 Blows	21.9	95.1	7.3	7.2
56 Blows	23.9	102.3	10.8	9.7



EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	MOISTURE CONTENT (%)	MAXIMUM DRY DENSITY (PCF)	DESIGN % COMPACTION	CBR VALUE	SAMPLE DESCRIPTION
TP-2		21.4	101.9	95	8	Lean Clay (CL)

DEVIATIONS/COMMENTS

REVIEWED BY: DATE: 2/11/2025
Jason Bryant, Laboratory Manager

Carlson Testing, Inc. - 4060 Hudson Avenue NE, Salem OR 97301