Cole Valley Partners
Geotechnical Engineering Evaluation

Lancaster Drive Development
3271 Lancaster Drive NE
Salem, Oregon

True North Project No. 24-0194-1

August 2024

219 West 4th Street, Vancouver, WA 98660 - 360-984-6584 - tnorthgeo.com

August 12, 2024

Cole Valley Partners
2188 SW Park Place, Suite 100
Portland, OR 97205

Attention: Brooke Dunahugh
Phone: 503-866-5414
E-mail: (brooke.dunahugh@cvpre.com)

Subject: Geotechnical Engineering Evaluation
3271 Lancaster Drive NE
Salem, Marion County, Oregon
Tax Lot No. 072W18BB06000
True North Report No. 24-0194-1

Dear Ms. Dunahugh:

True North Geotechnical Services (True North) is pleased to submit our Geotechnical Engineering Evaluation for the above referenced project located at 3271 Lancaster Drive NE in Salem, Marion County, Oregon. This report was prepared in accordance with "True North Geotechnical - General Services Agreement P24-0194-1" dated May 30, 2024. This report summarizes the work accomplished and provides our geotechnical recommendations for design and construction of the proposed development.

PROJECT UNDERSTANDING

Our current understanding of the project is based on the information provided to True North by CVP. We have been provided the following documents related to the proposed project:

- A "Pre-application Infrastructure Summary" prepared by City of Salem Community Planning and Development, dated June 10, 2024.
- A one-page drawing titled "Salem, Oregon – 3271 Lancaster Drive NE – Sheet 3.7", prepared by Cole Valley Partners, dated July 22, 2024.

Two other site plans have been issued to us showing alternate locations, orientations, and sizes of the proposed building on each lot. These site plans were also prepared by Cole Valley Partners and dated May 9, 2024. However, it is our understanding that the drawing listed above and dated July 22, 2024 is the working, current site plan for the development.

Briefly, we understand that you intend to subdivide the existing property into two parcels. Based on the most recent drawing, Lot A (northern lot) will be approximately 13,000 sq ft and have a one-story, 1,738 sq ft oil change service with three bays. It is typical for oil change service buildings to have an oil change service pit below the building. The remainder of Lot A will have paved parking with 5 spaces, drive lane, and landscaping. Lot B (southern lot) will be approximately 14,000 sq ft and is planned to have an approximate 2,400 sq ft, presumably one-story building ,with a drive-thru lane. The remainder of the lot will be developed with a 7-space paved parking area, drive lane, and landscaping. Stormwater is planned to be infiltrated on site and/or discharged to the existing city storm system.

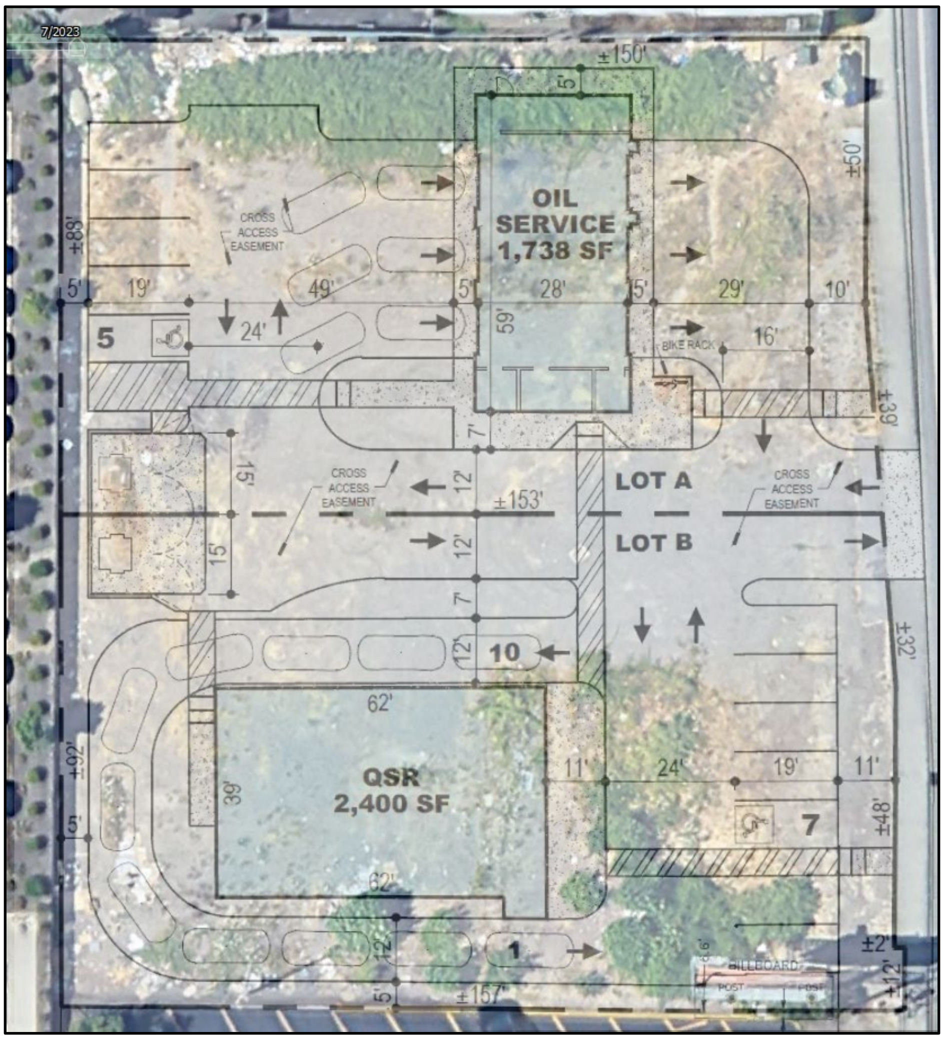


Exhibit 1: Proposed development from drawing noted above.

We have not been provided any grading plans, however, given the relatively level topography of this site we anticipate fills will be on the order of about 2 to 3 feet to achieve site grades. In terms of cuts, we anticipate that a 10 foot excavation (or deeper) may be required to construct the service pit under the oil change service building, as well as any required utilities. In terms of the building on Lot B we are unaware of the actual configuration of the proposed building in terms of depth of anticipated cuts. Other than the deeper cuts noted above we anticipate cuts of about 2 feet across the remainder of the two lots to achieve site grades. We have not been provided with structural drawings nor foundation loading information. Given the type of building(s) planned, we have assumed that maximum continuous wall footing, column footing, and floor loads will be on the order of 3 kips per linear foot, 25 kips, and 150 psf, respectively. Finally, we have assumed that the proposed development will be constructed in accordance with the provisions of the 2022 Oregon Structural Specialty Code (OSSC) as well as any additional jurisdictional code requirements.

SCOPE OF WORK

The purpose of our services was to explore the site surface and subsurface conditions in order to provide geotechnical recommendations for the proposed development. The following describes our specific scope of services:

- **Geologic Map Review**: We reviewed relevant available geologic maps of the site for information regarding geologic conditions and hazards at or near the site.
- **Subsurface Explorations**: We advanced 2 Standard Penetration Test (SPT) borings on Lot A (B-1 and B-2) at the northeast and southwest corners of the proposed building. We advanced two SPT borings on Lot B within the drive lane (B-3) and within the proposed building footprint (B-4). Soil samples were collected at regular intervals in the SPT borings, as well as at the infiltration test depths, and were returned to our office for laboratory testing. The locations of the explorations are shown on Figure 2. The boring logs with associated subsurface and lab data are attached in Appendix A.
- **Infiltration Testing:** At the request of the developer we performed infiltration testing at 4-feet bgs in B-1 and at 2.5-feet bgs in B-3.
- **Laboratory Testing:** Laboratory testing was performed on the samples in general accordance with ASTM procedures that included “Moisture Content” (ASTM D2488-06), “Soil Particle Size” (ASTM D2488-06), classification of soils “Unified Soil Classification System” (ASTM 2488), and Atterberg Testing “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils” (ASTM D4318).
- **Engineering Analyses:** All data collected during the subsurface exploration, literature research, and laboratory testing was evaluated and used to develop geotechnical design and construction recommendations.
- **Geotechnical Engineering Evaluation:** This document summarizes the available project information, describes the site and subsurface conditions, and presents recommendations regarding the following:
    - A site vicinity map and site plan showing the approximate locations of our explorations.
    - A discussion of subsurface conditions encountered including pertinent soil and rock properties as well as the encountered groundwater conditions.
    - The results of our infiltration testing.
    - Seismic design parameters in accordance with ASCE 7-16.

- Structural fill recommendations, including an evaluation of whether the in-situ soils can be used as structural fill.
- Geotechnical related recommendations for shallow foundation design including allowable bearing capacity and estimated settlements.
- Mat foundation/slab-on grade support recommendations.
- Comments on potential ground improvement.
- Flexible pavement design recommendations using assumed traffic load and CBR value.
- General comments regarding site grading and drainage.
- Discussions on other geotechnical issues that may impact the project.

SITE CONDITIONS

Surface Description

The subject property to be subdivided is located at 3217 Lancaster Drive NE in Salem, Marion County, Oregon. The property is bounded to the north and south by restaurants, to the east by apartment buildings, and to the west by Lancaster Drive NE. Based on historic aerial photographs retrieved from Google Earth, the property (as a whole) was previously occupied by small commercial buildings on the north side and at the southeast corner of the property which were demolished sometime between 2014 and 2016. The property has remained vacant since then and is currently covered with surficial gravel, cobbles, and concrete chunks (construction debris that appears to have been spread across the site after demolition of the previous structures). It appears the wood and other building demolition debris as well as the previous asphalt surfacing has been removed from the site. Vegetation consists of weeds, blackberries, and grass. In terms of topography the site is level.

Photo 1: Looking north from southeast corner of property.

Geologic Setting

The underlying geologic unit at the subject property is mapped by the NGMDB website (MapView (beta) | NGMDB (usgs.gov)) as "Qff_2 – Main body of fine-grained Missoula Flood deposits – Stratified silt and clay with minor sand. Underlies much of the Willamette Valley lowland floor. (O'Connor, J.E., Sarna-Wojcicki, Andrei, Wozniak, K.C., and Polette, D.J., 2001, Origin, extent, and thickness of Quaternary geologic units in the Willamette Valley, Oregon, U.S. Geological Survey, Professional Paper 1620, 1:250,000).

The majority of surface soils at the site are mapped by the USDA Soil Survey as the "WuA: Woodburn silt loam, 0 to 3 percent slopes. The Woodburn series consists of very deep, moderately well drained soils that formed in silty stratified glacio-lacustrine deposits. This soil is moderately well drained, has slow to medium runoff, and has moderately slow permeability".

Subsurface Conditions

Our site investigation consisted of advancing two Standard Penetration Test (SPT) borings on Lot A (B-1 and B-2) at the northeast and southwest corners of the proposed building to a depth of 26.5 feet below existing ground surface (bgs). We advanced two SPT borings on Lot B within the drive lane (B-3) and within the proposed building footprint (B-4) to a depth of 31.5 and 26.5 feet bgs, respectively. We performed infiltration testing in an immediately adjacent borehole at B-1 and B-3 at depths of 4 and 2.5 feet bgs, respectively.

The SPT borings were advanced with a trailer mounted Big Beaver drill rig (with CAT head hammer) utilizing solid stem drilling techniques subcontracted from Dan Fischer Excavating of Forest Grove, Oregon. Samples were obtained from the SPT borings at 2.5-foot intervals in the upper 15 feet and at 5-foot intervals below that to the terminal depths of the borings. Descriptions of field and lab procedures and the exploration logs are included in Appendix A. See Figure 2 - Site Exploration Plan for the locations of our borings.

We encountered 1.5 to 2.5 feet of crushed rock gravel fill in all borings. Underlying the upper fill soils we encountered interlayered fine grained soils consisting of generally medium stiff (with thin soft zones), silt, clay, and clayey silt that extended to the maximum explored depths of all our borings between 26.5 and 31.5 feet bgs. Moisture content of the fine grained, native soils ranged from about 32 to 47 percent indicating they are moist to wet in terms of moisture content. The fines content ranged from about 89 to 98 percent as reflected on the boring logs.

Groundwater

We initially encountered groundwater between 11.5 and 13 feet which rose to between 7 and 8 feet bgs in all borings. As such, depending on the time of year of construction, groundwater may be within the depth of excavations for utilities as well as the excavation for the service pit associated with the proposed oil change facility on Lot A. It should be noted that water table elevations can fluctuate seasonally, especially during periods of extended wet or dry weather or from changes in land use.

Geologic Hazards Review

The following provides a geologic hazard review for the subject site. The geologic hazard review is based on our site reconnaissance, explorations, analysis, and a review of publicly available published literature and maps.

Mapped Hazards: As part of due diligence, we reviewed the Oregon Department of Geology and Mineral Industries (DOGAMI) Oregon HazVu: Statewide Geohazards Viewer website (Oregon HazVu: Statewide Geohazards Viewer) to gather general information regarding mapped geologic hazards at the property. According to the website, the property has a low to moderate liquefaction susceptibility and is mapped as an NEHRP Site Class D. No other geologic hazards are mapped for this site.

Ground Motion Amplification: In accordance with ASCE 7-16, we recommend a Site Class D-E (stiff to soft soil profile) with an average N-value of 14.5 for this site when considering the average of the upper 100 feet of bearing material beneath the foundations. This recommendation is based on the results of our subsurface investigation as well as our understanding of the local geology.

Inputting our recommended Site Class as well as the site latitude and longitude into the ACSE 7 website (ASCE 7 Hazard Tool), we obtained the seismic design parameters shown in Table 2 below. We provide the site parameters for Site Class E as they are the controlling and therefore most conservative values. Note that the values for F_a and F_v in the table below were obtained from ASCE's Supplement 3 dated November 5, 2021 and issued for ASCE 7-16 to correct some seismic design issues in the original publication.

Table 1. 2021 IBC (ASCE 7-16, Supplement 3) Seismic Design Parameters		
Location	**Short Period**	**1-Second**
Maximum Credible Earthquake Spectral Acceleration	S_s = 0.811g	S_1 = 0.404g
Site Class	E	
Site Coefficient	F_a = 1.248	F_v= 2.392
Adjusted Spectral Acceleration	S_{MS} = 1.012g	S_{M1} = 0.966g*
Design Spectral Response Acceleration Parameters	S_{DS} = 0.675g	S_{D1} = 0.644 g
Design PGA	Design PGA=0.270	
MCE_G Peak Ground Acceleration	MCE_G PGA = 0.375 g	
Site Amplification Factor at PGA	$F_{PGA=}$1.450	
Site Modified Peak Ground Acceleration	PGA_M = 0.544 g	

Site Latitude: 44.967124 Site Longitude: -122.983940

g – acceleration due to gravity, * See note below.

The return interval for the ground motions reported in the table above is a 2 percent probability of exceedance in 50 years.

*Note: Per Section 11.4.8 of ASCE 7-16 a site-specific seismic site response analysis (i.e. SHAKE software or equivalent) is required for structures on Site Class D and E sites with S_1 greater than or equal to 0.2g. The S_1 value for this site is greater than 0.2g as shown in Table 1 above. Therefore a site response analysis is required as part of the design phase. However, Section 11.4.8 does provide an exception for not requiring a site response analysis (reference Sections 11.4.8.1, 11.4.8.2 and 11.4.8.3). The project Structural Engineer should determine if the proposed building will meet any of the exceptions—if the building does not meet the exception requirements, then True North should be retained to perform a site-specific site response analysis.

Liquefaction: Liquefaction occurs because of the increased pore pressure and reduced effective stress between solid particles generated by the presence of liquid, resulting in saturated sand and silt soils behaving like a liquid. It is often caused by severe ground shaking, especially that associated with earthquakes. The Oregon HazVu website lists property as having a low to moderate liquefaction susceptibility. While the upper soils (on the order of 25 feet) consist of interlayered soft to medium stiff clay and silt the relatively high fines content (especially the clay) of this soil makes the risk of liquefaction induced settlement on the low end of the risk noted above. Therefore it is our opinion that, in terms of seismically induced settlement, no additional consideration for foundation design need be considered. Additionally, it is our opinion that if dynamic settlement does occur during a seismic event the settlement would be areal, meaning the entire property and surrounding area would settle uniformly, thus limiting differential settlement (and potential collapse) of the structure. Mitigation for potential static settlement is discussed later in this report.

Infiltration Testing

We performed one infiltration test (IT-1) at 4 feet bgs in boring B-1 at the northeast corner of the proposed building on Lot A. A second infiltration test (IT-2) was performed in boring B-3 at a depth of 2.5 feet bgs within the drive lane on Lot B. These tests were requested by the developer, at depths and locations determined by the field engineer. Soil samples were collected from the bottom of each infiltration test location and returned to our office for examination and index testing. The infiltration tests were conducted within a 6-inch outside diameter PVC pipe embedded into the underlying soils. Infiltration testing was conducted in general accordance with the “Marion County Stormwater Quality Treatment Engineering Standards – Appendix B: Infiltration Testing Requirements” using the encased falling head method. Water was placed in the pipe and the soil was allowed to presoak for a period of about 4 hours. After the presoak period, water was placed into the pipe to achieve a minimum 6-inch-high column of water (head). The height of the water column in the pipe was measured initially and at regular timed intervals to determine the observed rate of infiltration into the soil. Results of the field infiltration testing are presented in Table 2 below.

Table 2. Infiltration Testing Results				
Exploration	**Soil Description**	**Depth of Test (ft)**	**Fines Content (%)**	**Observed Infiltration Rate (in/hr)**
IT-1	Gray and brown, lean clay (CL)	4	98	0.31
IT-2	Brown and gray, silty clay with gravel (CL-ML).	2.5	98	0.40

The results of our infiltration tests are shown in Table 2 above and should be considered ultimate values that do not include a safety factor. The infiltration test data table, as required by Marion County, is included at the end of this report in Appendix B. We recommend the project Civil Engineer apply an appropriate factor-of-safety (typically 2) to the ultimate values, as well as correction factors to account for the level of maintenance, system type, vegetation, siltation, etc. We also recommend that during construction, a field verification test be performed to ensure the infiltration rates during construction are consistent with the values noted.

CONCLUSIONS AND RECOMMENDATIONS

Geotechnical Design and Construction Considerations

Based on the results of our Geotechnical Engineering Evaluation, construction of the proposed development is feasible provided the recommendations in this report are included in the project design and implemented during construction. The primary geotechnical concerns associated with the project are:

1. **Presence of relatively high groundwater** - As stated above, we initially encountered groundwater between 11.5 and 13 feet bgs which rose to between 7 and 8 feet bgs in all borings. The contractor will need to consider options to dewater excavations for utilities as well as the excavation for the service pit associated with the proposed oil change facility on Lot A. This may include pumping the water and/or creating a low point for water to collect outside of subgrade areas. Depending on the amount of groundwater encountered, shoring may be needed, depending on the contractor means and methods (i.e. the side slopes may be laid back as described below).

2. **Potential need for shoring** – In addition to the relatively shallow groundwater (as high as 7 feet bgs) we encountered soft to medium stiff clay/silt soils within the anticipated depth of utility trenches and the service pit on Lot A. Again, the contractor may need to install temporary shoring in deep excavations such as utility trenches and the service pit excavation for the oil change building. Alternatively, the contractor may lay the side slopes back to the appropriate angle based on soil type, time of year of construction, groundwater, as well as other factors as discussed below. True North is available to assist in temporary shoring design if requested with an amended scope of services.

3. **Potential static settlement greater than 1-inch.** The soft to medium stiff soils encountered within the expected depths of footing excavation may experience total static settlement in excess of 1-inch. In order to reduce the amount of potential static settlement we recommend all footings for structures be supported on a minimum 16-inches of compacted crushed rock structural fill placed atop approved subgrade. Footing/foundation overexcavations shall extend horizontally from all sides of footings/foundations a distance equal to one-half the depth of the crushed rock structural backfill in order to distribute the vertical loading into the structural rock section. Meaning, a 16-inch overexcavation should extend 8-inches laterally on all sides of the footing.

4. **Presence of surficial fill soils.** As stated above, the lots are covered with 1.5 to 2.5 feet of gravel, cobbles, concrete fill soils likely spread across the lots after demolition of the previous structures. All fill soils in footing foundation areas will be removed to expose the underlying native medium stiff clay/silt soils. In pavement areas and under slab-on-grade it may be possible to strip only the fill soils necessary to place the recommended thickness of crushed rock gravel recommended below. This is provided the remaining fill consists of inorganic, granular material with particle sizes not exceeding 3-inches. Additionally, slab and pavement areas must pass a proofroll under observation of the Geotechnical Engineer.

5. **Temporary Excavations.** – As stated above, the upper soils are granular in nature (i.e. sand) and in some areas consist of fill. OSHA classifies these soils as Type C. Excavations in Type C soils should have their side slopes laid back to 1:5H:1V at a minimum. No vertical cut is allowed at the bottom of the excavation. The contractor should be aware that placing surcharges such as vehicle traffic, stockpiles, or other equipment loads within the zone of influence of the excavation could cause sudden collapse of the sidewalls. Additionally, if wet weather is anticipated the side slopes should be covered with plastic to prevent erosion and potential collapse.

In summary, provided the recommendations in this report are adhered to, we do not foresee any major issues that would preclude the proposed construction. The above-mentioned factors are listed to draw the attention of the reader to the issues to address during design and construction.

Site Preparation

We envision that topsoil, surficial organics, previous construction debris/gravel fill, and other deleterious soils will be stripped from the site to expose the underlying native, medium stiff clay in footing areas. It may be possible to (as described above) to place slabs and pavement sections on the granular fill soils. True North should assess the building and pavement subgrades by means of a proofroll (as described below) to identify any soft spots and unsuitable soils that will need to be over excavated. In the building footing/foundation areas, the majority of existing construction debris gravel will be removed by excavating the footings to design grade plus a minimum 16-inch overexcavation for imported crushed rock structural fill. In parking and slab areas, the existing crushed rock and/or silt fill soil are adequate for subgrade provided it free of organic or other deleterious materials and it passes a proofroll. Slab-on-grade shall have a minimum 6-inches of crushed rock beneath it and pavement areas will have the recommended pavement section described below.

As stated above, we recommend proofrolling the site (including the building footprint) with a fully loaded dump truck to identify any excessively soft spots and/or unsuitable pockets of deleterious materials, under the observation of the Geotechnical Engineer during various phases of construction to ensure proper fill placement and to ensure the subgrade is capable of supporting the design loads. Areas not able to be adequately proofrolled (or where not practical such as footing excavations) will be evaluated by the Geotechnical Engineer using a ½-inch diameter steel probe rod. In the areas where overexcavation for placement of structural fill occurs, the excavation will need to be widened on all sides of the footing by a lateral distance equal to one-half the depth of fill placed (i.e. a 2 foot over excavation and replacement with structural fill would need to extend laterally 1 foot beyond the edge of the footing on all sides). A representative of the Geotechnical Engineer should determine the depth of removal at the time of construction.

Any utilities present beneath the proposed construction will need to be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed to inhibit the potential for subsurface erosion. Pipes shall be abandoned by full removal and backfilled with structural fill. Alternatively, the pipes may be cut at both ends and backfilled with grout. Utility trench excavations should be backfilled with properly compacted structural fill in accordance with the structural fill recommendations in this report.

Moisture Sensitive Soils/Weather Related Concerns

The fine grained, clayey nature of the soils at this site are extremely sensitive to changes in moisture. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. Additionally, depending on the moisture of the fine grained soils, heavy construction traffic will cause softening of subgrades and may make operating equipment on site very difficult. It will therefore be advantageous to perform earthwork and foundation construction activities during dry weather.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document and subsequent updates were issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. True North does not assume responsibility for construction site safety or the contractor's compliance with local, state, and federal safety or other regulations.

Structural Fill

Structural fill should be granular, free of organics or other deleterious materials, have a maximum particle size less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. In our professional opinion the onsite soils are not suitable for use as structural backfill beneath footings, pavement, or other structural elements given the fine-grained component of the site soils. As such, the contractor will need to import granular, crushed rock, structural fill. The site strippings and clean fill soils may be used in landscape areas but shall not be used to raise site grades (or as structural backfill) under slab-on-grade, pavement, footings, behind walls, or in other structural subgrade areas. We recommend all crushed rock structural fill be moisture conditioned to within 3 percentage points below and 2 percentage points above optimum moisture as determined by ASTM D1557 (modified proctor). If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying.

Fill should be placed in relatively uniform horizontal lifts on the prepared subgrade which has been stripped of deleterious materials (i.e. topsoil and fill) and approved by the Geotechnical Engineer or his representative. Each loose lift should be about 1-foot thick. The type of compaction equipment used will ultimately determine the maximum lift thickness. Structural fill should be compacted to at least 95 percent of modified proctor maximum dry density as determined by ASTM D1557. Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts.

Utility Trench Backfill

Trench backfill for the utility pipe base and pipe zone should consist of well-graded granular material with a maximum particle size of ¾ inch and less than 8 percent by weight passing the U.S. Standard No. 200 Sieve. The material should be free of roots, organic matter, and other unsuitable materials.

Trench backfill should be compacted to at least 90 percent of the maximum dry density at depths greater than 4 feet below finished grade and to 95 percent of the maximum dry density within 4 feet of finished grade. Compaction is based on ASTM D1557/AASHTO T-180, the modified proctor test, or as recommended by the pipe manufacturer.

Foundation Recommendations

Once the lots have been properly prepared as discussed above, the planned construction can be supported on a conventional shallow foundation system. All foundations should bear on a minimum 16-inches of crushed rock structural fill placed atop firm and unyielding subgrade soils that will consist primarily of native, medium stiff clay/silt soils. Overexcavation and replacement with structural fill shall be accomplished as described above. Spread footings for building columns and continuous footings for bearing walls supported on the above-mentioned materials can be designed for an allowable soil bearing pressure of 1,800 psf based on dead load plus design live load and can be increased by one-third when including short-term wind or seismic loads. The above allowable soil bearing pressures can be increased by one-third when including short-term wind or seismic loads. Minimum footing dimensions should be in compliance with the 2022 Oregon Structural Specialty Code (OSSC) as well as any local jurisdictional codes.

Lateral frictional resistance between the base of footings and the subgrade can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.36 for concrete foundations bearing on compacted structural fill placed atop the native soils noted above. In addition, lateral loads may be resisted by passive earth pressures based on an equivalent fluid pressure of 250 pounds per cubic foot (pcf) for footings poured “neat” against the above-mentioned soil/rock strata. These are ultimate values—we recommend a factor of safety of 1.5 be applied to the equivalent fluid pressure, which is appropriate due to the amount of movement required to develop full passive resistance.

Exterior footings and foundations in unheated areas should be located at a depth of at least 18 inches below the final exterior grade to provide adequate frost protection. If the construction takes place during the winter months and the foundation soils will likely be subjected to freezing temperatures after foundation construction, then the foundation soils should be adequately protected from freezing. Otherwise, interior foundations can be located at nominal depths compatible with architectural and structural considerations.

The foundation excavations should be observed by a representative of the Geotechnical Engineer prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Unsuitable soil zones encountered at the bottom of the foundation excavations should be removed and replaced with properly compacted structural fill as directed by the Geotechnical Engineer.

The fine-grained soils at this site are moisture sensitive. As such, they should be kept to as close to their in-situ moisture content as possible. This should be accomplished during construction by covering the soil subgrade the same day it is exposed with crushed rock structural fill. Surface run-off water should be drained away from the excavations and not be allowed to pond.

Based on the known subsurface conditions we anticipate that properly designed and constructed foundations supported on the above-mentioned materials could experience maximum total settlement on the order of 1-inch and differential settlement on the order of 1/2-inch over 20 horizontal feet.

Retaining Walls

We were not provided any construction drawings that would indicate if site retaining walls are necessary to complete the grading of the site. As noted above, we anticipate the oil change service facility will have a below grade service pit. We provide the following recommendations for use in the design of service pit basement walls and site concrete structural walls if any are required for the proposed building or site development.

The foundations for the proposed walls should be designed in accordance with foundation recommendations above. Lateral earth pressures on walls, which are not restrained at the top, may be calculated on the basis of an “active” equivalent fluid pressure of 35 pcf for level backfill, and 60 pcf for sloping backfill with a maximum 2H:1V slope. Lateral earth pressures on walls that are restrained from yielding at the top (i.e. stem walls) may be calculated on the basis of an “at-rest” equivalent fluid pressure of 55 pcf for level backfill, and 90 pcf for sloping backfill with a maximum 2H:1V slope. The stated equivalent fluid pressures do not include surcharge loads, such as foundation, vehicle, equipment, etc., adjacent to walls, hydrostatic pressure buildup, or earthquake loading. Surcharge loads on walls should be calculated based on the attached calculations/formulas shown in Figure 3.

For seismic loading on retaining walls with level backfill, new research indicates that the seismic load is to be applied at 1/3 H of the wall instead of 2/3 H, where H is the height of the wall. We recommend that a Mononobe-Okabe earthquake thrust per linear foot of 5.4 psf* H^2 be applied at 1/3 H, where H is the height of the wall measured in feet. For a maximum 2H:1V slope we recommend 23.1 psf*H^2. This assumes a combination of soil and granular backfill retained by the walls within the active wedge.

All backfill for retaining walls should be select granular material, such as sand or crushed rock with a maximum particle size between ¾ and 1 ½ inches, having less than 5 percent material passing the No. 200 sieve. Because of their silt content, the native soils do not meet this requirement, and it will be necessary to import material to the project for wall backfill. Silty soils can be used for the last 18 to 24 inches of backfill, thus acting as a seal to the granular backfill. All backfill behind retaining walls should be moisture conditioned to within ± 2 percent of optimum moisture content and compacted to a minimum of 90 percent of the material's maximum dry density as determined in accordance with ASTM D1557. Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. Care in the placement and compaction of fill behind retaining walls must be taken in order to ensure that undue lateral loads are not placed on the walls. An adequate subsurface drain system will need to be designed and installed behind retaining walls to prevent hydrostatic buildup.

Slab-on-grade Floors

Support for lightly loaded floor slabs can be obtained on the undisturbed native soil or on engineered structural fill. A minimum 4-inch-thick layer of imported granular material should be placed and compacted over the prepared, approved subgrade. The crushed rock will serve to uniformly distribute loads to the subgrade and will act as a capillary break beneath the slab.

A subgrade modulus of 150 pounds per cubic inch may be used to design floor slabs. Imported granular material should be crushed rock or crushed gravel and sand that is well-graded between coarse and fine, contain no deleterious materials, have a maximum particle size of 1½ inches, and have less than 5% by weight passing the U.S. Standard No. 200 Sieve. The imported granular material may be placed in one lift and should be compacted until well-keyed, about 95% of the maximum dry density as determined by ASTM D1557 (AASHTO T-180).

Pavement

Traffic Load: We base our pavement recommendations on previous experience with buildings that have drive-thrus for Lot B. We assume less daily traffic for the oil change service facility. As such, the pavement recommendations below are based on the conservative assumption of the higher traffic count at the Lot B facility and may not be applicable to Lot A. We recommend True North be provided the actual daily anticipated traffic count so that we may refine/revise our pavement design.

We assumed a traffic loading of 300 equivalent 18,000 pound equivalent single axle loads (ESAL) per day for drive lanes/heavy traffic areas and 70 ESAL's for parking/light traffic areas. The Civil Engineer for the project may have more traffic and project design data available than is presently known and may wish to modify and refine our pavement section thickness recommendations. We are available, upon request, to provide a more detailed pavement design if more definitive traffic plans are available.

Flexible Pavement (Asphalt): We have assumed the following design parameters: a design life of approximately 20 years, a Terminal Serviceability Index (P_t) of 2 (i.e. poor condition), and a Regional Factor (R) of 3. Additionally, this design is based off an assumed California Bearing Ratio (CBR) value of 4 for the existing loose sand soil based on our subsurface investigation and experience with this types of subgrade soil. The above parameters result in a required Structural Number of 3.3 for light duty/parking and 4.1 for heavy duty/drive lanes. The table below represents our proposed flexible pavement section thickness based on the parameters noted above:

Table 3. Minimum Flexible Pavement Section Thickness Recommendations		
Pavement Materials	**Thickness Recommendations (inches)**	
-	Light Duty/Parking Stalls (70 ESALs Per Day)	Heavy Duty/Drive Lanes (300 ESALs per Day)
Asphalt Surface	3	4
Crushed Aggregate Base Course	14	16

Prior to placing the crushed rock base course pavement subgrade should be prepared as discussed in this report. We recommend the subgrade be proofrolled with a fully loaded tandem axle dump truck to confirm subgrade adequacy (firm and unyielding). It is possible that there will be areas that are observed to yield that will require correction prior to pavement construction (i.e. ripping wet subgrade soils with the teeth of a dozer to dry them out, and/or re-compacting soils that are soft). Areas found to be deficient by the Geotechnical Engineer during the proof-rolling activities (i.e. deflecting/rutting more than about 1-inch under the weight of the truck) should be overexcavated to expose firm and unyielding soils and replaced with structural fill as defined in this report.

We recommend the placement of a woven geotextile fabric (Mirafi HP270 or equivalent) over the native soil subgrade (after it has been approved) to reduce the risk of contaminating the base course with the native soil.

Asphalt pavement base course material should consist of a well-graded 1½-inch or ¾-inch-minus crushed rock having less than 5 percent material passing the No. 200 sieve. The base course and asphaltic concrete materials should conform to the requirements of the governing jurisdiction. Base course material should be moisture conditioned to within ± 2 percent of optimum moisture content and compacted to a minimum of 95 percent of the material's maximum dry density as determined in accordance with ASTM D1557 (Modified Proctor). Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. Asphaltic concrete material should be compacted to at least 91 percent of the material's theoretical maximum density as determined in accordance ASTM D2041 (Rice Specific Gravity).

In order to achieve the assumed 20-year design life, pavement does need regular maintenance to protect the underlying subgrade from being damaged. The primary concern is subgrade saturation which can cause it to weaken. Proper site drainage should be maintained to protect pavement areas. In addition, cracks that develop in the pavement should be sealed on a regular basis. Water should not be allowed to pond behind curbs and saturate the base materials. If the base material consists of granular fill, it should extend through the section and underneath the curb to allow any water entering the base stone a path to exit. If water is allowed to sheet flow off of the edge of the pavement; the pavement edges shall be armored to prevent erosion at the edge of the pavement.

Concrete Pavement Section: We are not aware of whether the owner will opt for concrete paving in some areas such as the drive-thru (which based on experience has been observed in most drive-thru lanes at various fast food restaurants) or in the waiting lanes at the oil change service facility. The likely reason for concrete in lieu of asphalt pavement is due to the dynamic load applied to the pavement when vehicles repeatedly start and stop. This results in excessive stress/strain on the pavement resulting in rutting, cracking, etc. To that end we recommend a minimum 6-inches of reinforced concrete atop a minimum 8 inches of crushed rock structural fill. Again we recommend placement of a woven geotextile fabric (Mirafi HP270 or equivalent) between the baserock and subgrade to prevent contamination of the base rock.

The thickness recommendations presented above are considered typical and minimum for the assumed parameters. We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, the owner, and the project principals should be aware that thinner pavement sections might result in increased maintenance costs and lower than anticipated pavement life.

Drainage and Groundwater Considerations

Water should not be allowed to collect in the foundation excavations or on prepared subgrades for the foundations/slabs/roadway during construction. Positive site drainage should be maintained throughout construction activities. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff.

The site grading plan should be developed to provide rapid drainage of surface water away from the building areas and to inhibit infiltration of surface water around the perimeter of the buildings and beneath the floor slabs. The final grades should be sloped away from the building area. We anticipate stormwater will be routed to the existing public stormwater system or disposed of onsite via infiltration.

CONSTRUCTION OBSERVATIONS

Satisfactory project performance depends on the quality of construction. Sufficient monitoring of the contractor’s activities is a key part of ensuring that work is completed in accordance with the recommendations contained within this report as well as the construction drawings and associated specifications. We recommend that True North observe that the subsurface conditions observed during our site investigation are consistent with those encountered during construction, and that foundation subgrades are suitable for placement of structural fill, rebar, or concrete for the new structures.

Marion County and/or the City of Salem may require a final letter of geotechnical compliance before they will finalize a permit. In order to provide such a letter, a representative from True North MUST observe foundation subgrades PRIOR to concrete being poured for the foundation. If True North does not perform this observation, we cannot provide a final letter of geotechnical compliance, and a permit will not be eligible for final sign-off. It is the owner’s responsibility to ensure that True North be notified in a timely manner (i.e., at least 48 hours prior to the required site observation) of the need for our services on site during construction.

LIMITATIONS

This report was prepared for the exclusive use of Cole Valley Partners and members of the design team for specific application to the proposed development (Lot A and Lot B) located at 3271 Lancaster Drive NE in Salem, Marion County, Oregon. It should be made available to prospective contractors for information on the factual data only, and not as a warranty of subsurface conditions such as those interpreted from the explorations and presented in the discussions of the subsurface conditions included in this report.

The recommendations contained in this report are based on information derived through subsurface sampling. No matter how effective subsurface sampling may be, variations between exploration locations and the presence of unsuitable materials are possible and cannot be determined until exposed during construction. Accordingly, this report is considered preliminary. True North's recommendations can be finalized only through True North's observation of the project's earthwork construction. True North accepts no responsibility or liability for any party's reliance on True North's preliminary recommendations.

Once construction plans are finalized and a grading plan has been prepared, True North should be retained to review those plans, and modify our existing recommendations related to the proposed construction, if determined to be necessary.

Within the limitations of the scope, schedule and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no warranty, either express or implied.

CLOSING

We appreciate the opportunity to be of service to you. If you have any questions, or if we can be of further assistance to you, please contact us at (360) 984-6584.

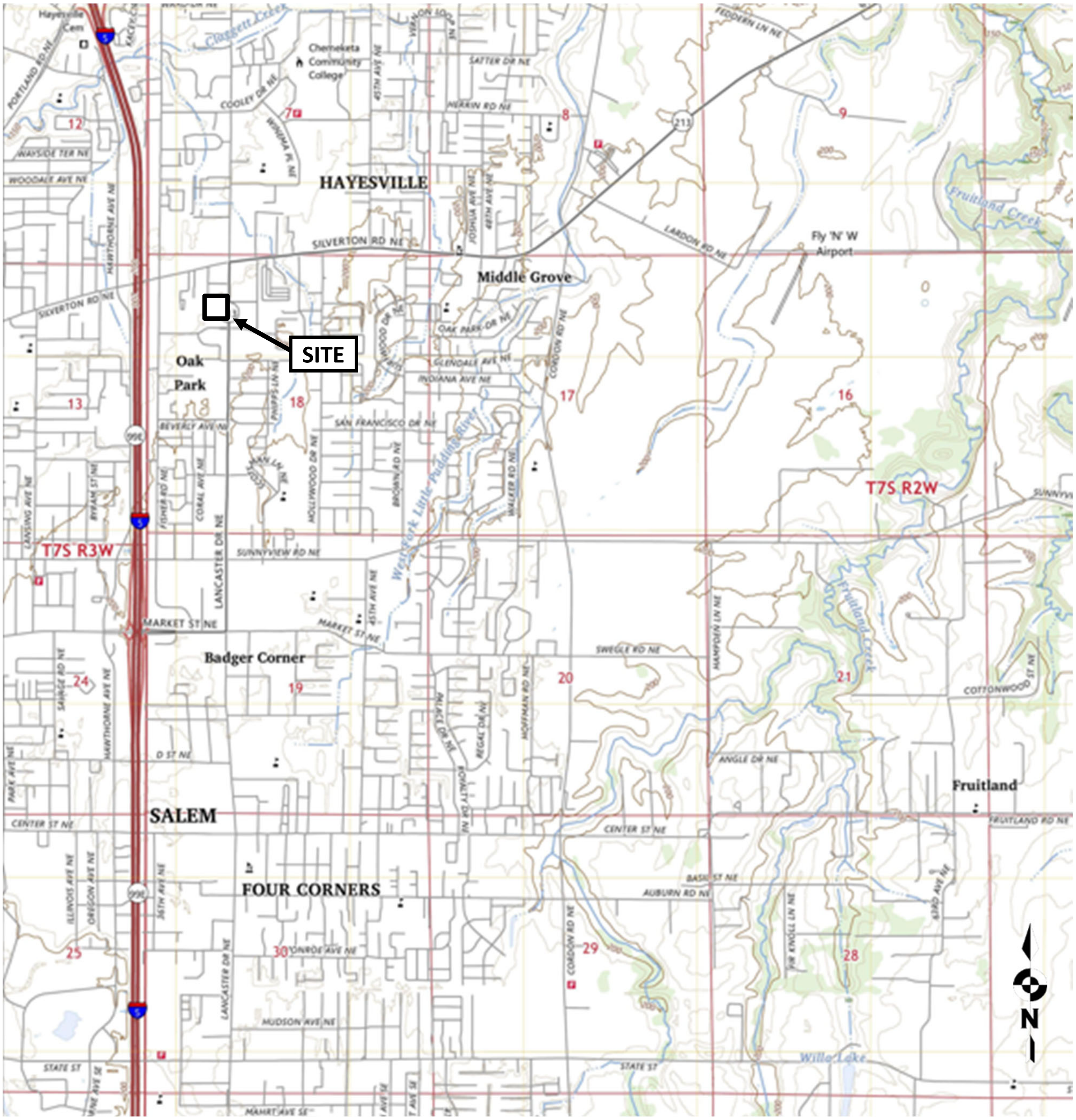
Respectfully Submitted,

Daniel Watkins, P.E.
Senior Geotechnical Engineer

Lauren Shepherd, E.I.T.
Staff Geotechnical Engineer

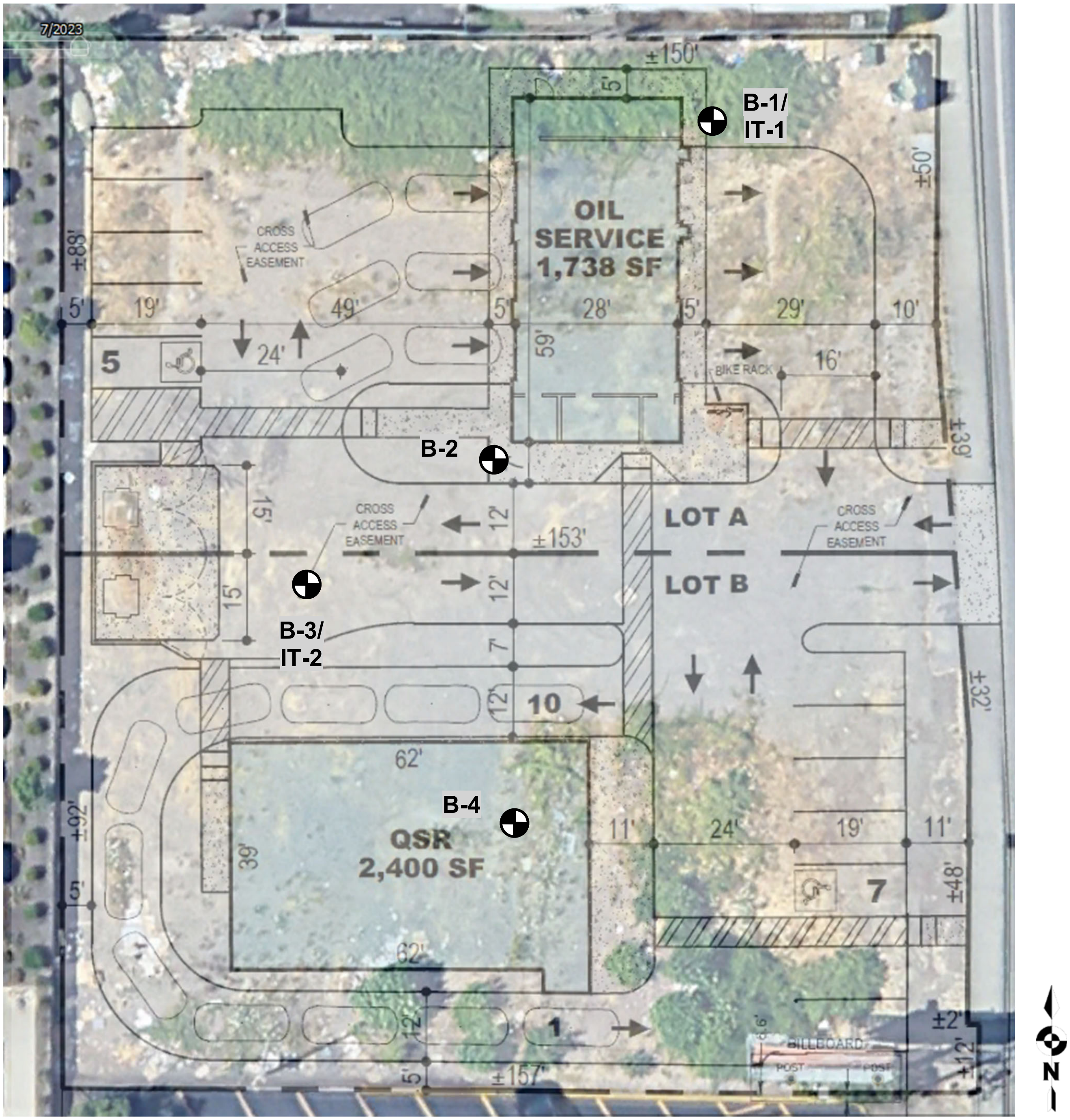
Attachment: Figure 1 – Site Vicinity
Figure 2 – Site and Exploration Plan
Appendix A – Field Exploration Methods, Lab Testing Procedures, Boring Logs
Appendix B – Infiltration Test Data Table

FIGURES



Source: "Topographic Map of the Salem East Quadrangle, 7.5 minute series" 2023, United States Geological Survey (USGS).

TRUE NORTH GEOTECHNICAL	Lancaster Drive Development 3271 Lancaster Drive NE Salem, OR	Project # 24-0194-1
219 West 4th Street Vancouver, WA 98660 360-984-6584	August 2024	Figure 1 – Vicinity Map



Not to Scale

B-1/ IT-1 Approximate Boring Location, drilled July 17, 2024.

Source: "Proposed Site Plan – Sheet 3.7" by CVP, dated 7-22-24, overlain on Google Earth aerial imagery.

TRUE NORTH GEOTECHNICAL	Lancaster Drive Development 3271 Lancaster Drive NE Salem, OR	Project # 24-0194-1
219 West 4th Street Vancouver, WA 98660 360-984-6584	August 2024	Figure 2 – Site & Exploration Plan

APPENDIX A

Field Exploration Procedures
Laboratory Testing Procedures
Boring Logs

FIELD EXPLORATION PROCEDURES

General

Our site investigation consisted of advancing two Standard Penetration Test (SPT) borings on Lot A (B-1 and B-2) at the northeast and southwest corners of the proposed building to a depth of 26.5 feet below existing ground surface (bgs). We advanced two SPT borings on Lot B within the drive lane (B-3) and within the proposed building footprint (B-4) to a depth of 31.5 and 26.5 feet bgs, respectively. We performed infiltration testing (prior to advancing the borings deeper) in B-1 and B-3 at a depth of 4 and 2.5 feet bgs, respectively. The SPT borings were advanced with a trailer mounted Big Beaver drill rig (with CAT head hammer) utilizing solid stem drilling techniques subcontracted from Dan Fischer Excavating of Forest Grove, Oregon. Samples were obtained from the SPT borings at 2.5-foot intervals in the upper 15 feet and at 5-foot intervals below that to the terminal depths of the borings. Descriptions of field and lab procedures and the exploration logs are included in Appendix A. See Figure 2 - Site Exploration Plan for the locations of our borings.

Field Classification

Soil samples were initially classified visually in the field. Consistency, color, relative moisture, degree of plasticity, peculiar odors, and other distinguishing characteristics of the soil samples were noted. The terminology used is described in the key and glossary that follow.

Summary Exploration Logs

Results from the explorations are shown in the summary exploration logs. The left-hand portion of a log provides our interpretation of the soil encountered, sample depths, and groundwater information. The right-hand, graphic portion of a log shows SPT blow counts and the results of laboratory testing. Soil descriptions and interfaces between soil types shown in summary logs are interpretive, and actual transitions may be gradual.

LABORATORY TESTING PROCEDURES

Soil samples obtained during field explorations are examined in our laboratory, and representative samples may be selected for further testing.

Visual-Manual Classification

Soil samples are classified in general accordance with guidelines presented in ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The physical characteristics of the samples are noted and the field classifications are modified, where necessary, in accordance with ASTM terminology, though certain terminology that incorporates current local engineering practice may be used. The term which best described the major portion of the sample is used to describe the soil type.

Fines Content

Fines content testing is performed in general accordance with guidelines presented in ASTM D1140, *Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No.200) Sieve in Soils by Washing*. The fines content is the fraction of soil that passes the U.S. Standard Number 200 Sieve. This sieve differentiates fines (silt and clay) from sand and gravel. Soil material that remains on the Number 200 sieve is sand. Material that passes the sieve is fines. The test is used to refine soil type.

Natural Moisture Content

Natural moisture content is determined in general accordance with guidelines presented in ASTM D2216, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.* The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

Atterberg Limits

The Atterberg limits are a basic measure of the critical water contents of a fine-grained soil. The behavior of fine-grained soil can change markedly at different water contents, and this analysis aids in soil classification. Atterberg Limits are determined in general accordance with guidelines presented in ASTM D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*.

True North Geotechnical

219 W. 4th Street Vancouver, WA 98660

Phone: +1(360) 984-6584

Geotechnical Log - Borehole

B-1

UTM	: 10T	Drill Rig	: Big Beaver	Job Number	: 24-0194-1
Latitude	: 44.967337	Driller Supplier	: Dan Fischer Excavating	Client	: Cole Valley Partners
Longitude	: -122.983823	Logged By	: LS	Project	: Lancaster Dr Commercial Development
Ground Elevation	: Not Surveyed	Reviewed By	: DHW	Location	: 3271 Lancaster Dr NE, Salem, OR 97305, USA
Total Depth	: 26.5 ft BGL	Date	: 07/17/2024	Loc Comment	:

Depth (ft)	Samples: SPT	SPT (N-Value)	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Notes
0–1.5					Fill- loose, gray, SILTY GRAVEL medium to coarse sized, dry.			
1.5–5				CL	Medium stiff, gray brown with red mottling, LEAN CLAY trace silt; medium plasticity; moist.			Unable to take sample at 2.5 feet bgs due to caving Infiltration testing performed at 4 feet bgs
5–6.5	S-1	3,3,4 (N=7)				37		
6.5–7.5								
7.5–9	S-2	2,3,3 (N=6)				39	98	
9–10								
10–11.5	S-3	2,3,3 (N=6)		CL		38		
11.5–15								
15–16.5	S-4	4,4,5 (N=9)				33		
16.5–20								
20–21.5	S-5	2,3,3 (N=6)		SC	Medium stiff, blue gray, SILTY CLAY WITH SAND medium plasticity; fine grained sand; wet.	37	91	
21.5–25								
25–26.5	S-6	8,5,7 (N=12)				32		

B-1 Terminated at 26.5ft (Groundwater encountered at 11.5 feet bgs during drilling, rising to 8 feet bgs after 2 hours. Boring backfilled with bentonite chips.)

True North Geotechnical

219 W. 4th Street Vancouver, WA 98660
Phone: +1(360) 984-6584

Geotechnical Log - Borehole

B-2

UTM	: 10T	Drill Rig	: Big Beaver	Job Number	: 24-0194-1
Latitude	: 44.967176	Driller Supplier	: Dan Fischer Excavating	Client	: Cole Valley Partners
Longitude	: -122.983976	Logged By	: LS	Project	: Lancaster Dr Commercial Development
Ground Elevation	: Not Surveyed	Reviewed By	: DHW	Location	: 3271 Lancaster Dr NE, Salem, OR 97305, USA
Total Depth	: 26.5 ft BGL	Date	: 07/17/2024	Loc Comment	:

Depth (ft)	Samples SPT	SPT (N-Value)	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Notes
1, 2					Fill- gray, SILTY GRAVEL fine to medium sized, dry.			
3, 4	S-1	3,4,4 (N=8)		CL-ML	Medium stiff to stiff, brown to gray-brown with orange-red mottling, SILTY CLAY medium plasticity; dry. with pockets of very stiff black clay.	17		
5								
6	S-2	3,4,5 (N=9)				36		
7								
8	S-3	2,3,3 (N=6)		CL	Medium stiff, blue gray, LEAN CLAY WITH SAND medium plasticity; fine grained sand; moist.	41	97	PL = 27, LL = 37, PI = 10
9								
10, 11	S-4	2,1,2 (N=3)		CL	Soft, brown with orange and dark brown mottling, LEAN CLAY WITH SAND medium plasticity; fine grained sand; wet.	42		
12, 13, 14								
15, 16	S-5	2,4,8 (N=12)		CL	Stiff, brown, LEAN CLAY WITH SAND medium plasticity; fine grained sand; wet.	47		
17, 18, 19								
20, 21	S-6	3,2,3 (N=5)		CL	Medium stiff to stiff, blue gray, LEAN CLAY WITH SAND medium plasticity; fine grained sand; wet.	36	90	
22, 23, 24								
25, 26	S-7	5,4,7 (N=11)				32		
27, 28, 29					**B-2 Terminated at 26.5ft (Groundwater encountered at 13 feet bgs during drilling, rising to 7 feet bgs after 2 hours. Boring backfilled with bentonite chips.)**			

True North Geotechnical

219 W. 4th Street Vancouver, WA 98660

Phone: +1(360) 984-658

Geotechnical Log - Borehole

B-3

UTM	: 10T	Drill Rig	: Big Beaver	Job Number	: 24-0194-1
Latitude	: 44.967129	Driller Supplier	: Dan Fischer Excavating	Client	: Cole Valley Partners
Longitude	: -122.984119	Logged By	: LS	Project	: Lancaster Dr Commercial Development
Ground Elevation	: Not Surveyed	Reviewed By	: DHW	Location	: 3271 Lancaster Dr NE, Salem, OR 97305, USA
Total Depth	: 31.5 ft BGL	Date	: 07/17/2024	Loc Comment	:

Depth (ft)	Samples: SPT	SPT (N-Value)	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Notes
0–2.5				GM	Fill- loose, gray, SILTY GRAVEL coarse sized, with cobbles up to 6" diameter; dry.			
2.5–5	S1			CL-ML	Medium stiff, dark brown to brown with gray mottling, SILTY CLAY WITH GRAVEL medium plasticity; slightly moist to dry. some inclusions of black stiff clay, >1/4".	29	98	Infiltration testing performed at 2.5 feet bgs
5–15	S2			CL	Medium stiff, gray brown with orange mottling, LEAN CLAY trace silt; medium plasticity; slightly moist. moisture increasing with depth.	35	98	PL = 28, LL = 29, PI = 1
	S3					39		
	S4					36		
15–30	S5			CL	Stiff, blue gray, LEAN CLAY trace fine grained sand; medium plasticity; wet.	40	97	
	S6					35		
	S7					34		

True North Geotechnical

219 W. 4th Street Vancouver, WA 98660
Phone: +1(360) 984-658

Geotechnical Log - Borehole

B-3

UTM	: 10T	Drill Rig	: Big Beaver	Job Number	: 24-0194-1
Latitude	: 44.967129	Driller Supplier	: Dan Fischer Excavating	Client	: Cole Valley Partners
Longitude	: -122.984119	Logged By	: LS	Project	: Lancaster Dr Commercial Development
Ground Elevation	: Not Surveyed	Reviewed By	: DHW	Location	: 3271 Lancaster Dr NE, Salem, OR 97305, USA
Total Depth	: 31.5 ft BGL	Date	: 07/17/2024	Loc Comment	:

Depth (ft)	Samples SPT	SPT (N-Value)	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Notes
31	S8			CL	Stiff, blue gray, LEAN CLAY trace fine grained sand; medium plasticity; wet.	36		
32					**B-3 Terminated at 31.5ft (Groundwater encountered at 12.5 feet bgs during drilling, rising to 7 feet bgs after 2 hours. Boring backfilled with bentonite chips.)**			
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								
54								
55								
56								
57								
58								
59								

True North Geotechnical

219 W. 4th Street Vancouver, WA 98660

Phone: +1(360) 984-658

Geotechnical Log - Borehole

B-4

UTM	: 10T	Drill Rig	: Big Beaver	Job Number	: 24-0194-1
Latitude	: 44.967013	Driller Supplier	: Dan Fischer Excavating	Client	: Cole Valley Partners
Longitude	: -122.983964	Logged By	: LS	Project	: Lancaster Dr Commercial Development
Ground Elevation	: Not Surveyed	Reviewed By	: DHW	Location	: 3271 Lancaster Dr NE, Salem, OR 97305, USA
Total Depth	: 26.5 ft BGL	Date	: 07/17/2024	Loc Comment	:

Depth (ft)	Samples: SPT	SPT (N-Value)	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Notes
0–2.5				GM	Fill- gray, SILTY GRAVEL fine to medium sized, dry.			
2.5–5	S-1			CL	Medium stiff, dark brown to brown with gray mottling, LEAN CLAY some silt; medium plasticity; dry.	34		
5–7.5	S-2			CL	Medium stiff, brown to gray-brown with orange-red mottling, LEAN CLAY trace silt; medium plasticity; moist to slightly moist.	14	98	
7.5–10	S-3			CL-ML	Soft, brown, SILTY CLAY medium plasticity; very moist.	40		
10–15	S-4			CL	Soft to medium stiff, brown gray, LEAN CLAY WITH SAND medium plasticity; fine grained sand; very moist.	38		
15–20	S-5			CL	Soft to medium stiff, brown, LEAN CLAY WITH SAND medium plasticity; fine grained sand; wet.	36	89	
20–25	S-6			CL	Medium stiff to stiff, blue gray, LEAN CLAY trace fine grained sand; medium plasticity; wet.	35	92	
25–26.5	S-7			CL	As above, but very stiff.	29		

B-4 Terminated at 26.5ft (Groundwater encountered at 11.5 feet bgs during drilling, rising 7 feet bgs after 2 hours. Backfilled with bentonite chips.)

APPENDIX B

Infiltration Test Data Table

Location: Lancaster Dr Development – Salem, OR	**Date:** 07/17/24	**Test Hole Number:** IT-1
Depth to bottom of hole: 48 inches	**Dimension of hole:** 6" diameter	**Test Method:** Encased Falling Head

Tester's Name: Lauren Shepherd
Tester's Company: True North Geotechnical, LLC
Tester's Contact Number: 541-760-3872

Depth (feet):	Soil Texture:
0-4.5	Medium stiff, gray brown lean CLAY; moist

Pre-Saturation Start Time: 7:25 AM
Pre-Saturation End Time: 11:28 AM

Time:	Time Interval (minutes):	Water depth below ground surface (inches):	Drop in water level (inches):	Infiltration rate (inches per hour):	Remarks:
11:28:00	0	10.45	-	-	
11:48:00	20	10.35	0.09	0.29	
12:08:00	20	10.2	0.1	0.37	
12:28:00	20	10.1	0.09	0.22	
12:48:00	20	9.98	0.12	0.37	
1:08:00	20	9.88	0.1	0.37	
1:28:00	20	9.78	0.1	0.31	
			Average Infiltration Rate =	0.32	
			Tested Infiltration Rate =	**0.31**	

Location: Lancaster Dr Development – Salem, OR	**Date:** 07/17/24	**Test Hole Number:** IT-2
Depth to bottom of hole: 30 inches	**Dimension of hole:** 6" diameter	**Test Method:** Encased Falling Head
Tester's Name: Lauren Shepherd **Tester's Company:** True North Geotechnical, LLC **Tester's Contact Number:** 541-760-3872		

Depth (feet):	Soil Texture:
0-3	Medium stiff, dark brown to brown Silty CLAY with Gravel; moist to dry

Pre-Saturation Start Time: 8:07 AM
Pre-Saturation End Time: 12:08 PM

Time:	Time Interval (minutes):	Water depth below ground surface (inches):	Drop in water level (inches):	Infiltration rate (inches per hour):	Remarks:
12:08:00	0	11.22	-	-	
12:28:00	20	11.22	0	0	
12:48:00	20	11.2	0.02	0.1	
1:08:00	20	11.2	0	0	
1:28:00	20	11.1	0.01	0.1	
1:48:00	20	11.05	0.05	0.17	
2:08:00	20	10.9	0.15	0.40	
			Average Infiltration Rate =	0.13	
			Tested Infiltration Rate =	**0.40**	