Applied Geotechnical Engineering
& Geologic Consulting

November 7, 2020

Urban Renewal Agency of the City of Talent
Attention: Jon Legarza
City of Talent, OR

SUBJECT: **Geotechnical Investigation**
Gateway Temporary Habitation
Talent, Oregon

At your request, Applied Geotechnical Engineering and Geologic Consulting LLC (AGEGC) has completed a geotechnical investigation for the proposed Gateway Temporary Habitation project in Talent, Oregon. The approximate location of the site is shown on the Vicinity Map, Figure 1. Our study consisted of a review of geotechnical information for the site and vicinity, subsurface explorations, and engineering studies and analyses. This report describes the work accomplished and summarizes our conclusions and recommendations regarding the proposed project.

PROJECT DESCRIPTION

We understand the project consists of construction of minor residential streets for access to the new residential spaces. We understand the new roadways will be asphaltic concrete construction. The residential spaces will include an asphaltic concrete driveway and most likely concrete slab-on-grade strips for support of the new manufactured homes. We anticipate that grading will be relatively minor.

SITE CONDITIONS

Based on our observations at the site, the site is relatively flat. The northern portion of the site was previously developed with three commercial buildings and associated parking. The buildings have been demolished and we assume the debris removed from the site. Based on our experience in this part of Talent, we anticipate that the site is mantled with expansive soils over silt soils. The silt soils are underlain by gravel/cobble soils typically at depths of less than 10 ft. We anticipate that groundwater occurs at a relatively shallow depths at the site

SUBSURFACE CONDITIONS

On November 3, 2020, five test pits were completed at the site. The approximate locations of the test pits are shown on the Site Plan, Figure 2. The locations of the test pits were estimated in the field using existing landmarks. The test pits were excavated to depth using a mini-excavator with a 2-ft-wide bucket. The backhoe was provided and operated by Copeland Construction of Eagle Point, Oregon. All field explorations were observed by an experienced/licensed geotechnical engineer/geologist provided by our firm, who maintained a detailed log of the materials disclosed during the course of the work. Representative soil samples were saved in airtight sample containers that were returned to our laboratory for further examination and physical testing. A summary of the field explorations and test pits logs are provided in Appendix A.

Test pits TP-3 and TP-4 encountered a surficial layer of uncontrolled (non-structural) fill. The fill encountered in the test pits is up to 1.5 ft thick and consists of variable materials including silt and imported crushed rock. The three building pad locations and the paved areas are underlain by a variable thickness of crushed rock fill.

Below the fill in test pits TP-3 and TP-4, and at the ground surface in the other three test pits, the test pit excavations encountered a layer of clayey silt soil. The clayey silt soil encountered in the test pits is up to 3 ft thick. The clayey silt soil is moderately expansive with an expansive index (EI) on the order of 60 to 80.

Below the expansive soils in test pit TP-2, the excavation encountered medium stiff, brown silt. The silt is slightly compressible under low stresses and moderately to highly compressible under higher stresses. Test pit TP-2 was terminated in the silt at a depth of 6 ft.

The other four test pits encountered very dense gravel/cobble below the expansive clayey silt soils. The gravel/cobble soil typically has a clay/silt matrix. The gravel/cobble is subangular. The test pits were terminated in the gravel/cobble at a depth of 6 ft.

Based on our experience in this area and our review of water well information, the site is underlain by siltstone and sandstone at a depth of less than 20 ft.

Groundwater was not encountered in the test pits. We anticipate that groundwater typically occurs at a depth of less than 10 ft and can approach the ground surface during periods of heavy or extended precipitation.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this investigation and our experience with similar projects, it is our opinion that the site is suitable for the proposed Gateway Temporary Habitat development, from a geotechnical standpoint. In our opinion, the most important geotechnical consideration associated with development of the site are the existing non-structural fills and expansive clayey silt soils.

Site Preparation. The existing fill soils are not suitable for support of roadway, building, and flatwork areas and should be removed within a horizontal distance of 2 ft of these structures. The existing expansive clayey silt soils are not suitable for direct support of buildings and flatwork. We recommend that the clayey silt soils be overexcavated to a depth of at least 30 in. below the bottom of the home foundations. Locally deeper overexcavation will likely be required to remove zones of desiccated clayey silt soils, material from demolition of the three buildings, and other deleterious materials encountered during construction. The overexcavated materials are not suitable for use as structural fill and should be removed from the site. Overexcavation of unsuitable soils should be completed using a trackhoe equipped with a smooth-lipped bucket.

To limit damage of the subgrade due to wetting or drying of the silt soils, the clayey silt soil should be covered with a minimum 1-ft-thick layer of structural fill within 4 hours of excavation to final grades.

Construction equipment should not be allowed to traffic directly on exposed silt subgrade soils.

Exposed subgrade should be observed by the geotechnical engineer to identify areas of unsuitable soil that may require overexcavation. Proof rolling with a loaded 10 yd^3 dump truck may be part of the evaluation. Soft areas that exhibit pumping or rutting should be overexcavated and replaced with structural fill as described below. During and following stripping and excavation, the contractor should use care to protect the subgrade from disturbance by construction activities. If the subgrade is disturbed during construction, disturbed soils should be overexcavated to firm soil and the excavation backfilled with structural fill.

Past experience indicates the silt soils are sensitive to moisture content. Typically, when these soils are in excess of 4 to 5% of their optimum moisture content, construction traffic will remold, rut, and soften the subgrade soils and limit its use as a subgrade material for roads, parking areas, slabs, or foundations. For this reason, we recommend that, if practical, all site preparation and earthwork be accomplished during the dry summer months, typically extending from mid-May to mid-October of any given year.

If construction occurs during wet weather conditions, construction traffic should be limited to movement on granular work pads. In our opinion, a 24-in.-thick granular work pad should be sufficient to prevent disturbance of the subgrade by construction equipment.

Site Grading. Final grades for the site have not been provided; however, we anticipate that only minor cuts and fills will be required for development of the site.

The ground surface within 10 ft of each home should be sloped away from the building to prevent ponding of surface water and to promote drainage of surface water away from the building.

Structural Fill. All fill placed within 2 ft of any building and within 1 ft of concrete flatwork should consist of structural fill. Structural fill for the building pad, concrete flatwork and any other settlement-sensitive structure should consist of imported crushed rock up to ¾ in. in size. Because of the potential to disturb/damage the silt subgrade soils, we do not recommend use of crushed rock greater than ¾ in. in size as structural fill. The crushed rock should be hard, durable and meet ODOT requirements for aggregate base. Structural fill should be compacted to at least 95% of the maximum dry density as determined by ASTM D 698 at a moisture content within 3% of optimum at the time of compaction. The excavation contractor must use means and methods for structural fill placement and compaction to minimize the risk of damage to the subgrade.

In our opinion, on-site soils are not suitable for use as structural fill and should be removed from the site.

Utilities. All utility trench excavations within building and concrete flatwork areas should be backfilled with relatively clean, granular material, such as sand, sandy gravel, or crushed rock of up to ¾ in. maximum size and having less than 5% passing the No. 200 sieve (washed analysis). The granular backfill material should be compacted to at least 95% of the maximum dry density as determined by ASTM D 698. Jetting or flooding of the trench backfill should not be allowed. Trench backfill should be limited to placement and compaction in lifts of less than 12 in. thick (loose thickness).

Foundation Support Recommendations. Based on the results of our investigation and our understanding of the proposed new homes, it is our opinion that foundation support can be provided by conventional continuous spread footing foundations designed using an allowable soil bearing pressure of up to 1,500 psf for footings established on structural fill over firm, undisturbed native soils.

Foundations should be underlain by a minimum of 30 in. of imported crushed rock. The intent of this layer of crushed rock is to minimize the risk of differential movement due to the expansive clayey silt soils.

Excavations for foundations should be completed using a trackhoe equipped with a smooth-lipped bucket. Construction equipment should not be allowed to traffic on the exposed subgrade soils.

Footings should be established at a minimum depth of 18 in. below the lowest adjacent finished grade. The width of footings should not be less than 15 in. for continuous spread footing foundations. All footing excavations should be observed by a qualified geotechnical engineer prior to placement of rebar and concrete.

We estimate that the total, long-term settlement of spread footings designed in accordance with the above recommendations and imposing a real bearing pressure of 1,500 psf will be less than ½ in. for continuous spread footing foundation loads of up to 2 kips/lf.

For design purposes, the real bearing value refers to the total of dead load plus frequently and/or permanently applied live loads and can be increased by one-third for the total of all loads; dead, live, and wind or seismic.

Lateral Load Resistance. Horizontal shear forces can be resisted by frictional forces developed between the base of spread footings and the underlying soil and by passive soil resistance. The total frictional resistance between the footing and the soil is the normal force times the coefficient of friction between the soil and the base of the footing. We recommend an ultimate value of 0.4 for the coefficient of friction; the normal force is the sum of the vertical forces (dead load plus real live load). If additional lateral resistance is required, passive earth resistance against embedded footings or walls can be computed using a pressure based on an equivalent fluid with a unit weight of 300 pcf. This design passive earth pressure is appropriate only if granular structural fill is to be used for the backfill around footings.

Seismic Considerations. The foundations for the new homes will be founded on structural fill over a thin layer of medium stiff silt. The silt is underlain by a thin zone (less than 15 ft thick) of very dense gravel/cobble soil. Below a depth of about 15 to 20 ft, the site is underlain by relatively competent sedimentary rock, predominately sandstone and siltstone. Based on the 2019 Oregon Structural Specialty Code and the 2018 International Building Code, subsurface conditions that average greater than 50 blows/ft in the upper 100 ft of material can be classified as a Site Class B for seismic design purposes. In our opinion, structural design assuming a Site Class B is appropriate for this site.

Based on the site location, we recommend an S_S of 0.61 and an S_1 of 0.35. Based on the results of our study, we recommend an S_{MS} value of 0.55 and an S_{M1} value of 0.28. We also recommend an S_{DS} value of 0.36 and an S_{D1} value of 0.18.

Based on the results of our investigation, the location of the site, and the nature of the underlying soil/rock, we anticipate that the potential for earthquake-induced fault displacement, subsidence, significant liquefaction-induced settlement and/or lateral displacement, or seiches at this site is very low.

Pavement. As a minimum, the upper 12 in. of soil under pavement and sidewalk areas should be stripped. Locally deeper stripping will be required to remove non-structural fill soils, desiccated clayey silt soils, and other deleterious materials. Site stripping should be completed using a trackhoe equipped with a smooth-lipped bucket. Site strippings should be removed from the property.

Excavation for the roadways should be completed using a trackhoe equipped with a smooth-lip bucket. The subgrade should be covered with geotextile fabric and the rock section as soon as practical after the excavation is completed to design subgrade elevation. Construction traffic should not be allowed to traffic on the exposed silt subgrade soils.

For design purposes, the silt subgrade soils can be assumed to have an R-value of 2.

The thickness of the rock section is to minimize the movement of the pavement and associated damage due to shrink-swell of the clayey silt soils.

Based on the above design considerations, we recommend a roadway pavement section of 3 in. of asphaltic concrete over 18 in. of aggregate base rock. For driveways or light parking areas, the asphaltic concrete section may be decreased to 2.5 in. thick. Pavement sections should be underlain by a woven geotextile (5 oz minimum weight).

The clayey silt subgrade soils in roadway areas should not be exposed for longer than 8 hours. Soils that desiccate due to dry conditions or soften due to moisture will need to be overexcavated and replaced with structural fill.

The rock section (¾-in.-minus crushed rock) should be placed in a single 18-in.-thick lift then compacted using a moderate-sized smooth-drum vibratory compactor. The rock should be compacted to at least 95% of the maximum dry density as determined by ASTM D 698. The aggregate base should be within 3% of the optimum moisture content at the time of compaction. We anticipate that a minimum of 4 passes with the vibratory roller will be required (a pass includes both the forward and reverse trips over the rock section by the compactor).

The subgrade soils and road section should be evaluated by the geotechnical engineer of record prior to placement of the woven geotextile and prior to paving.

During winter and spring construction (when the subgrade soils are relatively wet or saturated), the aggregate base rock section should be increased to a minimum of 24 in. to allow some trafficking of construction equipment on the aggregate base rock section prior to paving. The thicker rock section will decrease the risk of damage to the subgrade due to construction activity.

Except for the ADA ramps, the rock section under sidewalks should be 12 in. thick. This section does not allow trafficking of equipment on the sidewalk. To reduce the risk of differential movements between the roadways and flatwork for the ADA ramps, the ADA ramps should have the same rock section as the adjacent roadway.

Construction Observation Services. In our opinion, construction operations dealing with earthwork and foundations should be observed by the geotechnical engineer of record. This includes overexcavation of unsuitable soils, placement and compaction of structural fill, and foundation subgrade. AGEGC would be pleased to provide these services. If we do not have the opportunity to confirm our interpretations, assumptions, and analyses during construction, we cannot be responsible for the application of our recommendations to subsurface conditions that are different from those described in this report.

LIMITATIONS

This report has been prepared to aid the design team for the proposed Gateway Temporary Habitat project in Talent, Oregon. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of the proposed improvements for this project. The conclusions and recommendations submitted in this report are based on the information described above. It should be understood that subsurface conditions can vary. If conditions substantially different than those described in this report are encountered, AGEGC should be notified at once to evaluate our recommendations and modify them if necessary.

We have performed these services in accordance with generally accepted geotechnical engineering practices in southern Oregon, at the time the study was accomplished. No other warranties, either expressed or implied are provided.

Respectfully Submitted,

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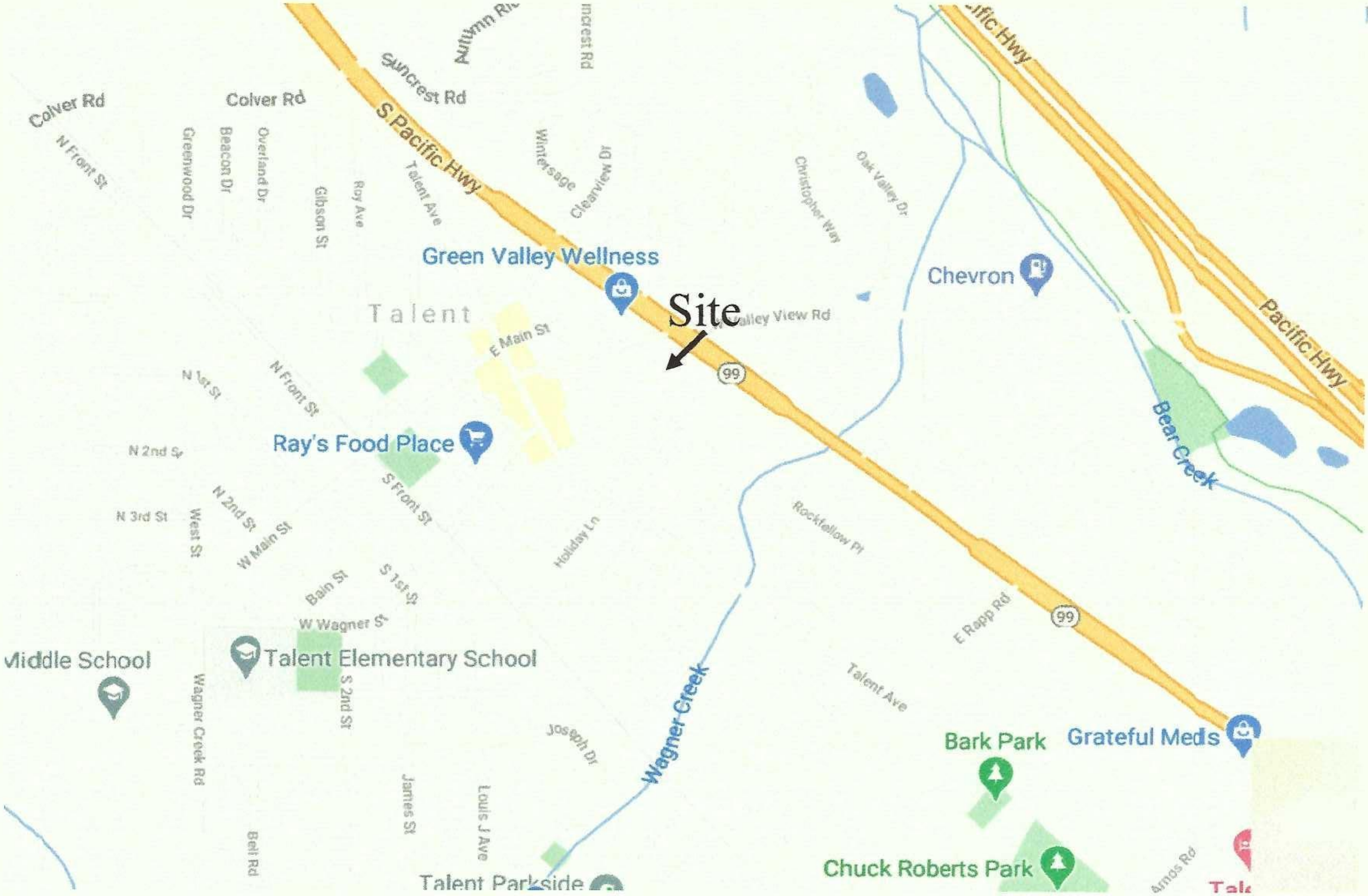
Renewal: June 2022



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Vicinity Map
Figure 1

Project No. 5256-20
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Figure 2
Site Plan

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APPENDIX A
FIELD EXPLORATIONS

The subsurface conditions and materials at the site were investigated on November 3, 2020, with five test pits, designated TP-1 through TP-5. The approximate locations of the test pits are shown on the attaches Site Plan, Figure 2. The locations were estimated based on existing field conditions. The test pits were backfilled with the excavation spoils at the completion of our fieldwork. A detailed description of the field exploration program completed for this project is provided below.

The test pits were excavated to a depth of 6 ft below the ground surface using a Kubota KX 080 mini-excavator with a 2-ft-wide bucket. The backhoe was provided and operated by Copeland Construction of Eagle Point, Oregon. All field explorations were observed by an experienced geotechnical engineer/geologist provided by our firm, who maintained a detailed log of the materials disclosed during the course of the work. Representative soil samples were saved in airtight sample containers that were returned to our laboratory for further examination and physical testing.

Logs of the test pits are provided below. Each log presents a descriptive summary of the various types of material encountered in the test pits and notes the depths where the materials and/or characteristics of the material change. The terms used to describe the materials encountered in the test pits are defined in Table 1A.

Test Pit TP-1

0.0 to 2.0 ft	Medium stiff, black Clayey SILT; blocky structure, moderately expansive, rooted.
2.0 to 6.0 ft	Very dense, brown GRAVEL/COBBLE in a silt/clay matrix, subangular.

Groundwater seepage not observed.
No significant caving of test pit sidewalls.
Completed November 3, 2020.

Test Pit TP-2

0.0 to 3.0 ft	Medium stiff, black Clayey SILT; blocky structure, moderately expansive, rooted.
3.0 to 6.0 ft	Medium stiff, brown SILT; trace clay, low moisture content to 5 ft.

Groundwater seepage not observed.
No significant caving of test pit sidewalls.
Completed November 3, 2020.

Test Pit TP-3

0.0 to 1.5 ft	FILL: Loose, brown SILT; trace clay.
1.5 to 4.0 ft	Medium stiff, black Clayey SILT; blocky structure, moderately expansive.
4.0 to 6.0 ft	Very dense, brown GRAVEL/COBBLE in a silt/clay matrix, subangular.

Groundwater seepage not observed.
No significant caving of test pit sidewalls.
Completed November 3, 2020.

Test Pit TP-4

0.0 to 1.5 ft FILL: Loose, brown SILT; trace clay, pavement section of 2 in. of asphaltic concrete over 4 in. of concrete.
1.5 to 3.5 ft Medium stiff, gray Clayey SILT; moderately expansive.
3.5 to 6.0 ft Very dense, brown GRAVEL/COBBLE in a silt/clay matrix, subangular.

Groundwater seepage not observed.
No significant caving of test pit sidewalls.
Completed November 3, 2020.

Test Pit TP-5

0.0 to 1.5 ft Medium stiff, black Clayey SILT; moderately expansive.
1.5 to 6.0 ft Very dense, brown GRAVEL/COBBLE in a silt/clay matrix, subangular.

Groundwater seepage not observed.
No significant caving of test pit sidewalls.
Completed November 3, 2020.

TABLE 1A: SOIL DESCRIPTION TERMINOLOGY

Coarse-Grained Soils (Sand Size and Larger)

Relative Density	Standard Penetration Resistance (N-Values)
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Fine-Grained (Cohesive) Soils

Consistency	Standard Penetration Resistance (N-Value)	Torvane Undrained Shear Strength, tsf	Field Identification
Very Soft	2	Less than 0.125	• Easily penetrated by fist.
Soft	2-4	0.125-0.25	• Easily penetrated by thumb.
Medium Stiff	5-8	0.25-0.50	• Penetrated by thumb with moderate effort.
Stiff	9-15	0.50-1.0	• Readily indented by thumb but penetrated only with great effort.
Very Stiff	16-30	1.0-2.0	• Readily indented by thumbnail.
Hard	Over 30	Over 2.0	• Indented with difficulty by thumbnail.

Grain Shape

Term	Description
Angular	Corners and edges sharp.
Subangular	Corners worn off, angles not worn off
Subrounded	Corners and angles worn off, flat surfaces remain.
Rounded	Worn to almost spherical shape.

Grain Size Classification

Boulders	6 to 36 inches
Cobbles	3 to 6 inches
Gravel	¼-¾ inch (fine)
	¾-3 inches (coarse)
Sand	No. 200-No. 40 sieve (fine)
	No. 40-No. 10 sieve (medium)
	No. 10-No. 4 sieve (coarse)
Silt/Clay	Pass No. 200 sieve

Modifier for Subclassification

Adjective	Percentage of Other Material in Total Sample
Clean	0 – 1.5
Trace	1.5 - 10
Some	10 - 30
Sandy, Silty, or Clayey	30 - 50