PRELIMINARY GEOTECHNICAL REPORT

Roseville 183

6382 Phillip Road
APN 017-101-008-000
Roseville, California

May 5, 2021
Project No. 4838

REGISTERED PROFESSIONAL ENGINEER
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EXP. 12/31/21
GEOTECHNICAL
STATE OF CALIFORNIA

Prepared for

Panattoni Development Company, Inc.

by

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1 INTRODUCTION

Panattoni Development Company, Inc. has retained Gularte & Associates, Inc. to perform a preliminary geotechnical report for the proposed Roseville 183 industrial project located at 6382 Phillip Road in Roseville, California (APN: 017-101-008-000). To conduct our preliminary geotechnical report, we performed the following services:

- Reviewed the site geology and groundwater conditions.
- Performed 12 exploratory borings to a maximum depth of approximately 50 feet below ground surface (bgs) to classify the soil and obtain samples for laboratory testing.
- Performed 2 expansion index analyses on bulk samples to determine the expansion potential of the native soil.
- Performed 10 sieve wash analyses over the No. 200 screen on disturbed samples obtained during our exploratory borings.
- Performed 8 moisture-density analyses on tube samples obtained from our exploratory borings.
- Performed 4 Atterberg limit analyses on disturbed samples obtained from our exploratory borings.
- Performed 4 unconfined compressive strength analyses on tube samples.
- Performed 2 R-Value analyses for the pavement design.
- Performed 2 percolation tests to establish design percolation rates.
- Performed engineering analyses and used engineering judgment for earthwork and foundation recommendations in this report.
- Prepared this report with our findings, conclusions, and recommendations.

Civil and structural engineering plans were not available at the time of this report. We recommend that we be retained to review the project grading and structural plans at the 50 to 90 percent stage for compliance with our report. Additionally, we recommend that we be retained to perform soil compaction testing services for the proposed building pads and pavement areas, as well as, utility trench backfill.

2 LOCATION, DESCRIPTION, AND PHYSICAL SETTINGS

2.1 SITE LOCATION

Figure 1 shows the vicinity map for the proposed Roseville 183 industrial project located at 6382 Phillip Road in the planned development zone of northwest Roseville, California. The 237.3-acre site is bordered by Phillip road on the south and southwest, new residential development on the southeast, and agricultural land on the northwest, north and northeast.

2.2 SITE DESCRIPTION

The site is rectangular in shape with the north-south axis approximately 1 mile in length and the east-west axis approximately 1,986 feet in length. The westwardly flowing Pleasant Grove Creek, located in the northern portion of the site, has a total flood plain area of approximatley 23.8 acres. The area north of the flood plain has a total area of approximatley 81.6 acres and is currently used for presumably rice cultivation. The area south of the flood plain has a total area of approximatley 127.5 acres and is currently used for hay cultivation. A curved northwest trending fill slope was observed in the central portion of the site and leads towards a group of oak trees near the western property line. Riparian vegetation was observed within the Pleasant Grove Creek flood plain.

A project topographical map was not available at the time of our site subsurface exploration. Based on the 2018 US Geological Survey 7.5-minute Topographical Map of the Pleasant Grove Quadrangle, site topography dips north-northeast from the southwest corner (approximatley 100 feet MSL) towards Pleasant Grove Creek (approximately 75 feet MSL). The largest elevation change was observed along the northwest trending fill slope. North of Pleasant Grove Creek, site topography is relatively flat an average elevation of approximatley 85 feet MSL.

Panattoni Development Company, Inc. proposes nine industrial buildings in the southern 124.4-acre portion of the site, south of Pleasant Grove Creek. Footprints of the industrial buildings range between 135,000 SF and 300,000 SF. Paved parking areas and driveways are proposed between the industrial building complex. An alignment project for Placer Parkway is proposed northwest of the proposed industrial development and will cross Pleasant Grove Creek into the northern portion of the site.

2.3 PHYSICAL SETTINGS

2.3.1 Regional Geology

The site is located in the eastern portion of the Great Valley Province. The Great Valley is an asymmetrical synclinal trough with a gently dipping eastern limb and is filled with a thick (up to 40,000 feet thick) sequence of sedimentary units, which are Late Jurassic through Cretaceous in age [between 150 to 65 million years old, (Ma)]. The deepest part of the basin is near the western edge, west of the present axis. The thin eastern valley deposits overlap the metamorphic terrains of the Sierra Nevada foothills that have been intruded by Late Mesozoic granitic plutons. The older units of the Great Valley Province that form the eastern part of the Coast Ranges have become uplifted and deformed by a series of thrust faults underlying the western edge of the basin. Cenozoic sedimentary fill covers most of the California central valley.

2.3.2 Local Geology

The 2011 Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, prepared by the California Geological Survey, was reviewed prior to our subsurface exploration for the site. This source indicates that the site's surface is composed of three separate geologic formations. The oldest geologic unit, the Pleistocene age Turlock Lake Formation (Qtl), is mapped along the southern property line in the southwest corner of the site, as well as in the northeast portion of the site. The Turlock Lake Formation is characterized as a deeply weathered and dissected arkosic alluvial deposit that is composed of sand with some silt and minor gravel. Overlaying the Pleistocene alluvial deposits are the Middle and Upper units of the Middle to Late Pleistocene age Riverbank Formation (Qr_2 and Qr_3, respectively). These arkosic alluvial fan deposits have been dissected along streams and are composed of sand with silt. Within the Pleasant Grove Creek bed is undivided Holocene age alluvium (Qha) that is composed of poorly to moderately sorted sand, gravel, and silt. The surface soil observed during the exploratory subsurface exploration generally confers with the published 2011 CGS geologic interpretation. Underlaying the coarse grain alluvial deposits are tan to brown, very stiff to hard silts and lean clays, which suggests a pre-Pleistocene depositional environment consisting of a topographic low with standing or slow-moving water.

2.3.3 Faults and Seismicity

Based on our review of the 2010 Fault Activity Map of California prepared by the California Geological Survey, the nearest active faults within a 50-mile radius of the project site that have historic surface ruptures or evidence of surface displacements of Holocene age or younger (i.e., younger than 11,700 years before present), as well as, the nearest faults within a 50-mile radius that have evidence of surface displacement during Late Quaternary time (i.e. between 11,700 and 700,000 years before present), are presented in Table 1. The site is not located within a currently established Alquist-Priolo (AP) Earthquake Fault Zone.

Fault Name	Approximate Distance (miles)
Spenceville Fault	16.3 N-NE
Deadman Fault	17.7 E-NE
unnamed fault – Foothills Fault System	18.4 E-NE
Wolf Creek Fault Zone	20.3 E-NE
Bear Mountain Fault Zone	21.1 E-NE
Dunnigan Hills Fault	25.1 W-SW
unnamed fault – west of Dunnigan Hills Fault	30.8 W-SW
Swan Ravine Fault	38.6 N-NW
Cleveland Hill Fault	42.2 N-NW
Giant Gap Fault	43.3 E-NE
Melones Fault Zone	49.3 SE

Table 1 – Regional Fault Summary

We used the United States Geological Survey (USGS) *Unified Hazard Tool* to determine the deaggregated seismic source parameters including controlling magnitude and fault distance. The USGS estimated modal magnitude is 5.5 and the controlling distance is 10.47 kilometers. The estimated Peak Ground Acceleration (PGA) for the Maximum Considered Earthquake (MCE) with a 2,475-year return period is 0.24g.

2.3.4 Geologic Hazards

Risk of lateral spreading from landslides and liquefaction is considered low, as the site is located in a low seismic zone and the subsurface is composed predominately of dense fine-grained soil. Risk from landsliding is not considered likely, given the site is located in the central valley and has gently sloping topography.

The Pleasant Grove Creek streambed and floodway on site is designated as zone (AE), the base floodplain where base flood elevations are provided. The adjacent area on site south of the Pleasant Grove Creek floodway and north of the northwest trending fill slope is designated as zone (X) and has a 2 percent annual chance flood hazard.

2.3.5 Groundwater

Groundwater was not observed in the exploratory borings. Perched groundwater is possible during the rainy season. Per 2021 data obtained from the California Department of Water Resources, the depth to static groundwater is approximately 102 feet bgs in a well located approximatley 0.77 miles west from the project site.

According to the California Department of Water Resources, an active observation well is located near the western property line along Philip Road (**Local Well Name**: GEI Test 1; **Site Code**: 388000N1214000W002; 38.8 N, 121.4 W). No continuous or historic groundwater data was available.

3 FINDINGS AND CONCLUSIONS

3.1 SUBSURFACE CONDITIONS

Seven exploratory borings (B-1 through B-7), were advanced to a maximum depth of 50 feet below ground surface (bgs) within selected proposed building footprints and pavement areas in the southern portion of the site (south of Pleasant Grove Creek Bypass Channel) to record SPT N-Value, classify the soil profile and obtain samples for laboratory analysis. Five additional boring (B-8 through B-12) were advanced in the northern portion of the site (north of Pleasant Grove Creek) to a maximum depth of 50 feet bgs. Borings deeper than 10 feet bgs were cemented to surface. Boring locations are shown in the Site Plan, Figure 2, and boring logs are shown in detail in Appendix A.

The findings in the exploratory borings were not consistent across the site. In general, native soil in the southern portion of the site (B-1 through B-7) is composed of medium dense to dense coarse grain alluvial deposits to depths ranging between approximately the upper 6 to 13 feet bgs. These alluvial silty sands are underlain with very stiff to hard silt and silty clay with minor beds of very dense silty sand to approximatley 50 feet bgs. In general, the northern portion of the site (B-8 through B-12) is composed of interbedded stiff to hard silt, sandy silt, and silty clay with minor beds of very dense silty sand.

3.2 LABORATORY TESTING

Two Expansion Index (EI) analyses (ASTM D4829) was performed to evaluate the expansion potential of the onsite soil. The Expansion Index analysis for soil obtained from 1-foot bgs of boring B-1 resulted in an EI of 30.5. This indicates a low expansion potential. The Expansion Index analysis for soil obtained from 1-foot bgs of boring B-12 resulted in an EI of 20. This indicates a low expansion potential.

Four unconfined compressive strength analyses (ASTM D2166) were performed on 2.5-inch diameter stainless steel tube samples obtained during the subsurface exploration. The results of these analyses are shown in Table 2.

Boring	Depth (ft bgs)	Water Content (%)	Unconfined Compressive Strength (psf)
B-1	5.3’ - 5.8’	36.3	8,541
B-6	6’ - 6.5’	18.3	12,617
B-3	10.5’ - 11’	45.7	12,993
B-12	15.3’ - 15.8’	29.4	9,732

Table 2 – Unconfined Compressive Strength

Two R-Value analyses (ASTM D2844) were performed on bulk samples taken in the upper 15 inches of the proposed pavement areas. Analysis R-1, performed on a soil sample obtained within the proposed south parking area (Figure 2), resulted in an R-Value of 16 at 300 psi exudation pressure. Analysis R-2, performed on a soil sample obtained from the northeast portion of the site (Figure 2), resulted in an R-Value of 8 at 300 psi exudation pressure.

Ten sieve wash analyses over the No. 200 screen (ASTM D1140) were performed to further classify the native soil observed in our subsurface exploration. The results of these analyses confirmed our field classifications and are presented in Table 3.

Boring	Depth (ft bgs)	Percent Passing No. 200 Sieve (%)	Water Content (%)
B-4	2.5’ - 4’	52.3	4.3
B-9	2.5’ - 4’	67.6	4.8
B-7	3’ - 3.4’	69.7	14.4
B-1	3.9’	83.5	25.3
B-2	5’ - 6.5’	30.4	13.0
B-10	7.5’ - 9’	73.1	16.8
B-6	10’ - 11.5’	93.8	20.7
B-9	10.3’ - 11’	91.9	22.0
B-8	11.5’	59.2	16.7
B-4	45’ - 46.5’	69.8	27.0

Table 3 – Sieve Wash Analyses

Eight moisture-density analyses (ASTM D2216/2922) were performed on 2.5-inch diameter stainless steel tube samples obtained during the subsurface exploration. The results of these analyses are shown in Table 4.

Boring	Depth (ft bgs)	Water Content (%)	Dry Soil Density (pcf)
B-7	2.9’ - 3.4’	13.4	103.7
B-3	3’ - 3.5’	8.6	115.7
B-5	3’ - 3.5’	9.7	106.0
B-8	3’ - 3.5’	20.0	89.1
B-9	5’ - 5.5’	10.0	98.2
B-11	10.5’ - 11’	23.9	89.9
B-1	15’ - 15.5’	31.2	85.1
B-6	15.5’ - 16’	18.8	99.5

Table 4 – Moisture-Density

Four liquid and plastic limit analyses (ASTM D4318) were performed on disturbed samples obtained during the subsurface exploration. The results of these analyses are shown in Table 5.

Boring	Depth (ft bgs)	Liquid Limit	Plastic Limit	Plasticity Index
B-1	3'	42	28	14
B-6	10'	42	19	23
B-11	4'	38	20	18
B-12	10'	39	26	13

Table 5 – Atterberg Limit

3.3 EXISTING FILL

An existing northwest trending fill slope was observed during our subsurface exploration for the site (Figure 3). The fill slope is located in the southern portion of the site and separates two cultivated areas that have an approximatley 13-foot elevation change. Based on historical aerial photographs, a dry creek bed was filled with soil in the approximate location of the fill slope sometime between 1975 and 1984. Large mature oak trees were also removed along the backfilled dry creek bed. Compaction records for this fill material were not available for our review at the time of this report.

Based on the historical aerial photographs, the southern and southwest portions of the north side of the site (north of Pleasant Grove Creek) appear to have been filled and graded for agricultural purposes some time between 1975 and 1984. Compaction records for this fill material were not available for our review at the time of this report.

A floodway canal with an earthen levee has been constructed south of Pleasant Grove Creek Bypass Channel sometime after 2016.

3.4 EXCAVATION EFFORT

Based upon our exploratory borings, conventional grading equipment should be able to excavate the on-site soil with reasonable expectations.

3.5 SUITABILITY FOR CONSTRUCTION

From an earthwork, pavement, and foundations viewpoint, the soils at this site are considered suitable for support of the anticipated loads provided our recommendations are followed properly. Our primary concerns for the site are as follows:

1) The undocumented fill material observed in the northern and southern portions of the site. See Section 3.3 for fill descriptions, Figure 3 for approximate fill locations, as well as Sections 4.2 and 4.3 for over-excavation and compaction recommendations.

2) The location of the former agricultural structures in the western portion of the site. See Figure 3 for approximate former structure locations, as well as Sections 4.2 and 4.3 for over-excavation and compaction recommendations.
3) The existing active observation well located near the western property line along Phillip Road. See Section 2.3.5 for well details. This well should be marked in the field to prevent damage during site grading. If the well is to be abandoned, refer to the California Department of Water Resources Well Standards (Bulletins 74-81 and 74-90) for backfill guidelines.

3.6 PERCOLATION TESTING

Two percolation tests were performed in the southern and northern portions of the project site (Figure 2). Borings PT-1 and PT-2 were hand augured to 26 inches bgs and 32 inches bgs, respectively. Each boring was pre-soaked prior to testing. Water level drop measurements were taken at 30 minutes intervals until a stabilized rate of drop was obtained. The design infiltration rate for boring PT-1 in the southern portion of the site resulted in 0.02 in/hr (weakly cemented clayey sand). The design infiltration rate for boring PT-2 in the northern portion of the site resulted in 0.15 in/hr (non-cemented silty sand). Percolation test results are shown in Appendix C.

4 EARTHWORK RECOMMENDATIONS

4.1 NATIVE AND IMPORT FILL MATERIAL

On-site soil is considered suitable to be used as fill material, provided our recommendations are followed properly. Imported fill materials should have a plasticity index less than 12 and a maximum particle size of 3 inches. Allow Gularte & Associates 48 hours to sample and test proposed import fill materials prior to delivery at the site.

4.2 CLEARING AND GRUBBING

The majority of the site is currently used for agricultural purposes. The proposed building pads and pavement areas should be stripped of vegetation that is either hauled off site or placed in landscape areas prior to scarification and recompaction. If any trees are to be removed, ensure that the entire roots system has been removed and compact any voids to at least 90 percent relative compaction per ASTM D 1557.

4.3 OVER-EXCAVATION

We recommend the northwest trending fill slope within the southern portion of the site (Figure 3) be over-excavated to native soil and replaced as engineered fill. Maximum fill thickness is estimated between approximately 10 and 15 feet on the eastern end of the existing fill slope. Refer to Sections 4.4 and 4.7 for fill compaction and slope grading recommendations.

Agricultural structures were observed in historical aerial photographs in the western portion of the site (Figure 3). We recommend a 1-foot vertical over-excavation in the area formerly occupied by these structures. Remove any remnant foundations and/or utilities. After this portion of the site has been over-excavated, scarify the bottom the excavation an addition 12 inches, moisture condition the soil to within 0 to +4 percent of optimum moisture content and recompact to at least 90 percent relative compaction per ASTM D1557. Compaction should be done with dedicated compaction equipment. Once compaction testing has been performed on the bottom of the over-excavation, structural fill placement may commence.

The remaining portions of the site north and south of Pleasant Grove Creek floodway are currently used for rice and hay cultivation. Based on our review of historical aerial photographs, dry creek beds and topographic lows have been infilled with soil to create a level surface (Figure 3). We recommend continued subsurface investigations, including trenching, to delineate fill thicknesses in these areas.

Areas with proposed building pads and pavement sections that do not have over-excavation recommendations listed above require scarification and recompaction after clearing and grubbing. Scarification should include ripping native grade to 12 inches below ground surface, moisture conditioning the soil to within 0 to +4 percent of optimum moisture content and recompacting to at least 90 percent relative compaction per ASTM D1557.

4.4 FILL COMPACTION/BUILDING PAD PREPARATION

Fill should be moisture conditioned to within 0 to +4 percent of optimum water content. Compact soil fills for structural areas such as pavements and building pads to at least 90 percent relative compaction per ASTM D1557.

Compact the upper 6 inches of pavement subgrade and aggregate baserock to at least 95 percent relative compaction per ASTM D1557.

We strongly recommend that you retain our firm to check that our over-excavation recommendations are properly executed, as well as, to test fill placement every 12 to 18 inches and check that the soil has been compacted adequately during the grading operation.

4.5 WET WEATHER BUILDING PAD CONSTRUCTION CONSIDERATIONS

Should the proposed construction commence during the rainy season, consider lime or cement treating the upper 15 to 18 inches of the building pad surfaces to reduce the deleterious effects of heavy precipitation.

4.6 TRENCH BACKFILL

The contractor is responsible for conducting all trenching and shoring in accordance with CALOSHA requirements. Place and compact trench backfill as follows:

- Trench backfill should have a maximum particle size of 2 inches.
- Moisture condition trench backfill to within 0 to +4 percent of optimum water content; moisture condition backfill outside the trench.
- Place fill in loose lifts not exceeding 12 inches for backhoes and 18 inches for large excavators.
- Compact fill to 90 percent relative compaction per ASTM D1557.
- Jetting of trench backfill is not acceptable except in joint utility trenches where damage to conduits makes mechanical compaction methods impractical.

4.7 SLOPES

Construct final slope gradients to 2:1 (horizontal:vertical) or flatter. Slope faces should be compacted and vegetated to reduce the effects of rutting from rainfall and overland water flow. Construct a keyway at the toe of the fill slope and at least 24 inches deep on the downhill side of the key. The keyway should be a minimum of 10 feet wide and sloped back into the slope at a minimum 5 percent slope. In order to remove loose soil/rock, excavate benches into competent material after engineered fill has been placed in the keyway per our recommendations. Benches should be cut into the existing slope as filling proceeds every 2 to 4 feet vertically and 4 to 8 feet wide into the slope, to remove loose soil/rock. We recommend that buildings have a minimum setback of 5 feet from ascending slopes and 10 feet from descending slopes, or as outlined in the

2019 California Building Code. The setback is measured from the outermost footing line closest to the toe/hinge point of slope. Gularte & Associates, Inc. should be retained to check footing dimensions, and their orientation to nearby slopes for conformance with the recommendations contained in this report.

4.8 SITE DRAINAGE

Surface drainage design should include the following:

1. Slope concrete pavement areas at least ½ percent and asphalt concrete pavements at least ½ and preferably 1 percent to extend pavement life. Do not allow water to pond on pavement areas.
2. If soil surrounds the building, discharge roof down spouts to storm drain system. Where soil surrounds the building, provide a 5 percent slope away from building exteriors for a distance of at least 10 feet.
3. Direct sprinklers away from buildings. Use drip irrigation near the structure and pavements. Excess watering increases to risk of premature pavement failure and shrink/swell underneath the structure.

5 PRELIMINARY FOUNDATION RECOMMENDATIONS

5.1 FOUNDATIONS

The proposed concrete tilt industrial buildings can be supported on continuous or isolated spread footings bearing in native soil or engineered fill per our recommendations in Section 4. Continuous footings should be a at least 24 inches wide, and at least 24 inches deep below finished pad grade. Spread footings should be at least 36 inches wide and 24 inches deep below finished pad grade (not including crushed rock or pavement).

Table 6 below provides maximum allowable bearing capacity for dead plus live loads. These bearing capacities may be increased by one-third for the short-term effects of wind or seismic loading.

Minimum Footing Dimensions	Allowable Bearing Capacity (PSF)
Strip Footings 24” W x 24” Deep	3,000
Spread Footing 36” W x 24” Deep	3,000
Spread Footing 48” W x 24” Deep	3,000
Spread Footing 60” W x 24” Deep	3,000

Table 6 – Building Footing Parameters

Provide minimum steel reinforcing in strip footings of two No. 5 bars top and two No. 5 bars bottom.

Lateral loads may be resisted by friction along the base of footings and by passive pressure along the face of footings. The passive pressure is based on an equivalent fluid pressure in pounds per cubic foot (pcf). We recommend a passive lateral pressure of 360 pcf and a coefficient of friction equal to 0.35 for design. If passive resistance and friction are combined to resist lateral loads, we recommend that the passive pressure be reduced by 33 percent.

Provided our recommendations are followed, total settlement beneath the footings should be no more than 1-inch, with an estimated maximum differential settlement of ½-inch over a distance of 60 feet.

Utility excavations parallel to footing lines should be clear of a 1:1 (horizontal:vertical) plane projected downward from the base of footings. Where utility lines cross footings, they should be sleeved and footings deepened as appropriate. We should review these conditions and provide specific recommendations.

5.2 SLAB ON GRADE FOR OFFICE AREAS

We recommend the following for slabs-on-grade:

1. Place 6 inches of Caltrans Class II aggregate baserock (AB) compacted to at least 95 percent relative compaction.
2. Place a minimum 15-mil Stego Wrap vapor barrier between the pad and AB or alternatively over the AB.
3. Provide a minimum concrete thickness of 5 inches.
4. Reinforce slabs with No. 4 reinforcing bars placed on 24-inch centers each way. Place dobies per ACI; we recommend a maximum dobie spacing of 6 feet on center, each way.
5. Use a concrete water-cement ratio of 0.50 or less for the slab; may be further modified by structural engineer requirements.
6. Use higher strength concrete, minimum 3,500 psi for the slab; may be further modified by structural engineer requirements.

5.3 SLAB ON GRADE FOR WAREHOUSE

We recommend the following for slabs-on-grade:

1. Place 6 inches of Caltrans Class II aggregate baserock (AB) compacted to at least 95 percent relative compaction.
2. Place a minimum 15-mil Stego Wrap vapor barrier between the pad and AB or alternatively over the AB. Pouring slab directly on vapor barrier in warm weather could be problematic for proper curing of slab; contractor to take necessary precautions. *Note: Where moisture migration is not a concern to the end user, vapor barrier may be omitted provided there will be no flooring over the concrete slab nor storing any boxes directly on the slab for extended periods. This is only applicable in warehouse areas.*
3. Provide a minimum concrete thickness of 7 inches.
4. Reinforce slabs with No. 4 reinforcing bars placed on 24-inch centers each way. Place dobies per ACI; we recommend a maximum dobie spacing of 6 feet on center, each way.
5. Use a concrete water-cement ratio of 0.50 or less for the slab; may be further modified by structural engineer requirements.
6. Use higher strength concrete, minimum 3,500 psi for the slab; may be further modified by structural engineer requirements.

We recommend a modulus of subgrade reaction of 200 pci (pounds per cubic inch) as an allowable value.

Slab thickness and reinforcing steel requirements above are provided for purposes of resisting soil expansion potential. The structural engineer may increase these parameters based on building loads or anticipated building use.

The structural engineer should provide final design thickness and additional reinforcement, if necessary, for the intended structural loads.

Exterior Flatwork: Exterior flatwork includes items such as concrete sidewalks, steps, and outdoor courtyards exposed to foot traffic only. Provide a minimum concrete flatwork thickness of 4 inches over 4 inches of aggregate base. Exterior flatwork subgrade should be moisture conditioned to within 0 to +4 percent of optimum water content and compacted between 87 and 93 percent relative compaction per ASTM D1557.

5.4 RETAINING WALL PARAMETERS

Provided that adequate drainage is included, we recommend that walls subjected to active soil pressure be designed to resist an equivalent fluid pressure of 45 pounds per cubic foot (pcf). For at-rest conditions, we recommend an at-rest fluid pressure of 66 pcf with level backfill conditions. Retaining wall backfill should be predominantly granular, non-expansive backfill. Generally, we expect horizontal movements for retaining walls under active pressure conditions to rotate laterally an amount equal to 1 percent of the height of the wall.

The above lateral earth pressures assume sufficient drainage behind the walls to prevent any build-up of hydrostatic pressures (i.e. sump) from surface water infiltration and/or a rise in the ground water level. Drainage of the walls may be accomplished by one of the following methods:

1. Clean drain rock wrapped in Mirafi 140N non-woven filter fabric or equivalent as approved by our office. Drain rock should be ¾ to 1-1/2 inch in size and should have less than 5 percent passing the No. 200 sieve. Rock can be crushed or rounded. Drain rock should be 12 inches wide and extend to within 12 inches of subgrade.
2. Caltrans Class II Permeable material placed 12 inches wide and extended to within 12 inches of subgrade. The Caltrans Class II Permeable is self filtering; and as such a geotextile filter fabric is not necessary.
3. Geocomposite drainage can be used in lieu of crushed rock. We commonly recommend Amerdrain C96 geocomposite drainage board. The product should be installed per the manufacturer's directions. We recommend the wider drainage board be placed in the lower 2 feet of the wall. It is important that the proper transition pieces are used to transition from the geocomposite to 4-inch tight pipe for outletting purposes.

In either of the above cases, we recommend waterproofing of the walls with a product such as Masterseal 5000-R or equivalent as reviewed and approved by our office in writing. Waterproofing should be applied per the manufacturer's instructions.

Water collected at the bottom of the drain system should be transmitted away from the wall by a perforated pipe or weep holes. The pipe should be at least four inches in diameter with the perforations placed down (lettering typically on top). The pipe should daylight to a lower grade or connect to a sump, storm drain, or other suitable disposal facility. If adequate drainage is not provided, we recommend that an additional equivalent fluid pressure of 40 pcf be added to the values recommended above.

5.5 2019 CBC SEISMIC PARAMETERS

We provide the 2019 California Building Code parameters in the table below.

Categorization	Design Value
Site Latitude	38.802597
Site Longitude	-121.396700
Site Class	C
Risk Category	II
MCE_R Ground Motion 0.2 second period (S_S)	0.47
MCE_R Ground Motion 1.0 second period (S_1)	0.23
Site Amplification Factor at 0.2 second (F_a)	1.3
Site Amplification Factor at 1.0 second (F_v)	1.5
Site Modified Spectral Acceleration (S_{MS})	0.611
Site Modified Spectral Acceleration (S_{M1})	0.346
Numeric Seismic Design Value (S_{DS})	0.407
Numeric Seismic Design Value (S_{D1})	0.23
Seismic Design Category	D

Table 7 – 2019 CBC Seismic Parameters

5.6 PAVEMENT DESIGN

5.6.1 Asphalt Concrete Pavement

Two native soil R-Value analyses were performed on bulk soil samples obtained from both the southern (R-1) and northern (R-2) portions of the site. Untreated soil in R-1 resulted in an R-Value of 16 at exudation pressure of 300 psi. Untreated soil in R-2 resulted in an R-Value of 8 at exudation pressure of 300 psi. We prepared several different asphalt concrete pavement sections that are presented in the table below. Our untreated subgrade pavement design is based on an R-value of 6, using Procedure 608 of the Caltrans Highway Design Manual. Contact our office for an alternative pavement design, if so desired.

	Traffic Index						
	4.5	5	6	7	8	9	10
Asphalt Concrete (in)	2.5	2.5	3	4	4.5	5	6
Aggregate Base (in) Untreated Subgrade	9	11	13	15	18	21	23

Table 8 – Pavement Sections

5.6.2 Trash Enclosure Portland Cement Concrete Pavement Design

Use concrete pavement sections to resist heavy loads and turning forces in trash enclosures. We recommend the following minimum design sections for trash enclosure rigid pavements:

- Place 6-inches of concrete over 6-inches of aggregate base compacted to at least 95 percent relative density per ASTM D1557.
- Concrete pavement should have a minimum 28-day compressive strength of 3,000 psi.
- Provide minimum control joint spacing in accordance with Portland Cement Association guidelines.
- Reinforce slabs with No. 4 reinforcing bars placed on 24-inch centers, each way, placed within the middle third of the slab. Place dobies per ACI. If shrinkage cracking is acceptable and the concrete is not subject to heavy truck traffic, then reinforcing bar could be replaced with the appropriate type and amount of fiber mesh.

Note, the above pavement section recommendation is designed for trash enclosures only and should not be used for Portland cement concrete trucking driveway or loading dock apron slabs. Please contact our office should you require a PC concrete slab design for trucking driveways or loading dock aprons.

5.7 SPECIAL INSPECTIONS

We recommend the following minimum special inspections as part of the grading and foundation portions of the project. The project architect, governing agency, or structural engineer may require other inspections.

- Observation of the over-excavation effort.
- Compaction testing during grading and trench backfill.
- Observation of footing excavations.
- Observation of reinforcing steel for foundations and slabs.
- Observation, sampling, and testing of concrete.

5.8 LIMITED SCOPE

The recommendations provided in this geotechnical engineering report are preliminary in scope, as a full analysis has not been completed. Little information regarding structure locations and construction type was provided at the time of this report. We recommend further location specific geotechnical analyses for continued phases of the project.

6 LIMITATIONS

The scope of this evaluation was limited to an evaluation of the load-carrying capabilities and stability of the subsoils. Oil, hazardous waste, radioactivity, irritants, pollutants, molds, or other dangerous substance and conditions were not the subject of this study. Their presence and/or absence is not implied or suggested by this report and should not be inferred.

The accompanying report summarizes the findings and opinions of Gularte & Associates, Inc. Our findings and opinions are based on information obtained on given dates by borings, laboratory testing, engineering judgment, and analyses.

The analyses, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our study, and further assume that probes such as exploratory borings are representative of the subsurface conditions throughout the site; i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the probes.

If during construction different subsurface conditions from those encountered during our exploration or different from those assumed in design are observed or appear to be present, or where variations from our design recommendations are made, we must be advised promptly so that we can review these conditions and modify the applicable recommendations if necessary. We cannot be held responsible for differing site conditions, changes in design, or modified geotechnical recommendations not brought to our attention.

Soil conditions cannot be fully determined by borings and, therefore, unanticipated soil conditions are commonly encountered. Such unexpected soil conditions often require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency funding is recommended to accommodate potential extra costs.

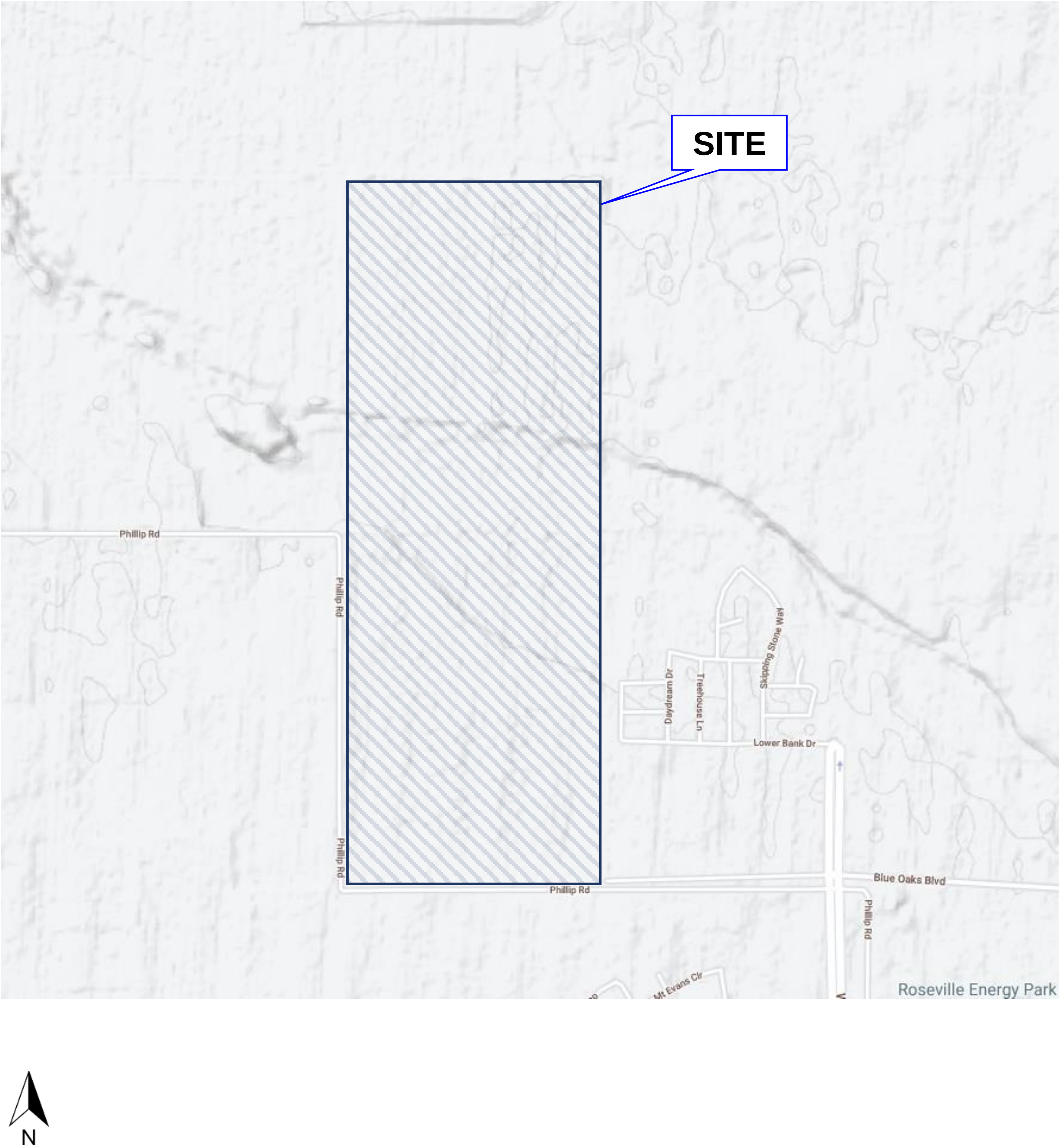
Foundation dimensions, minimum slab thickness, and reinforcing details recommended herein are based upon geotechnical and construction considerations and are not offered in lieu of foundation design by an engineer. A determination of flooding potential, the existence of wetlands, or corrosive soil was beyond the scope of this report.

This geotechnical study did not include an investigation regarding the existence, location, or type of possible hazardous materials. If an investigation is necessary, we should be advised. In addition, if any hazardous materials are encountered during construction of the project, the proper regulatory officials should be notified immediately.

This report was prepared for the specific use of our client and applies only to the subject property. We are not responsible for interpretations by others of data presented in this report. This report is not a legal opinion. No warranty is expressed or implied. We base our conclusions in this report on judgment and experience. We performed this work in accordance with generally accepted standards of practice existing in northern California at the time of the report.

Gularte & Associates, Inc. is not an expert on mold prevention. If particular recommendations are desired to prevent mold, we recommend that you contact an expert in that field.

FIGURES



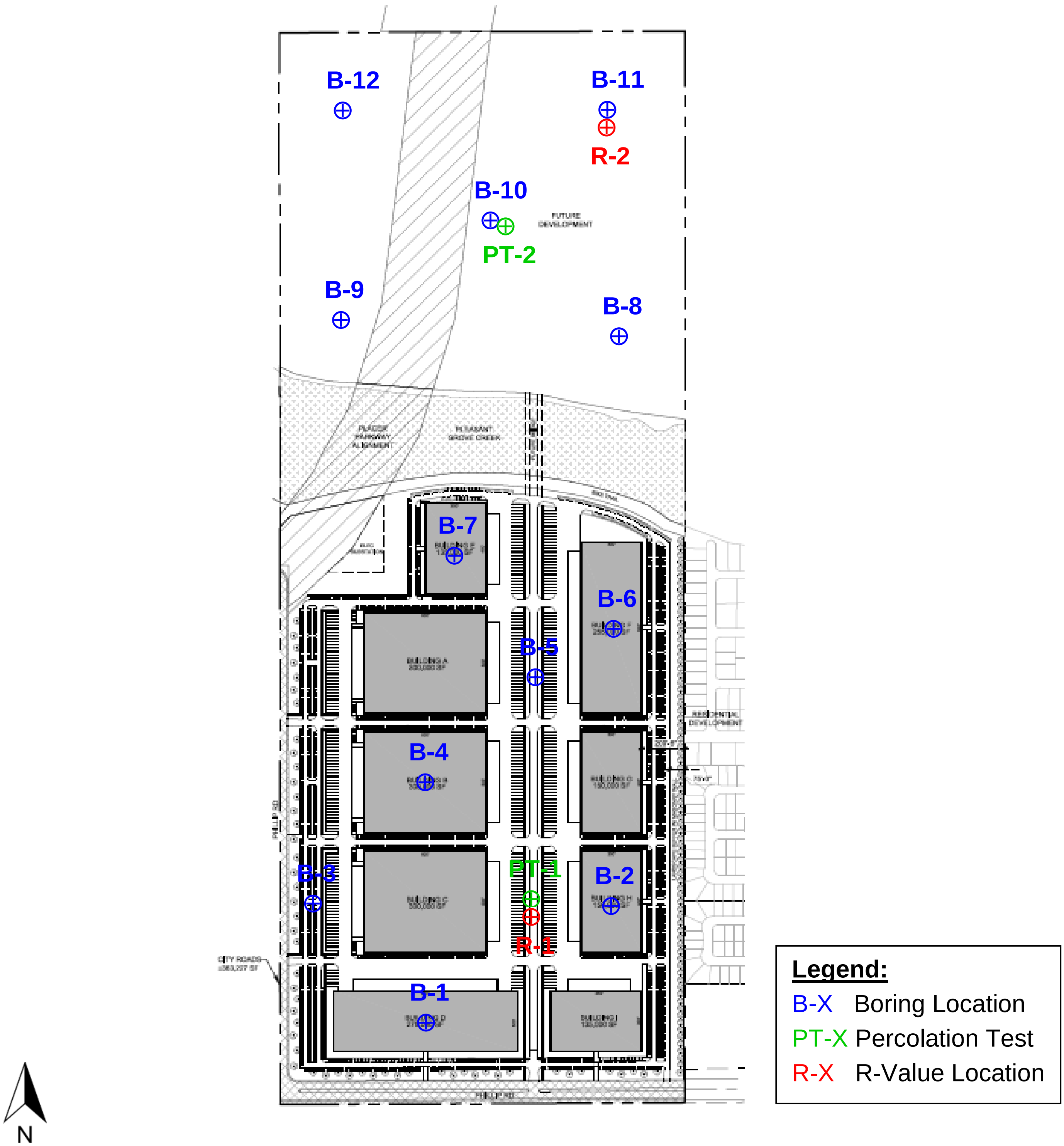
Vicinity Map

Roseville 183

(APN: 017-101-008-000)

Gularte & ASSOCIATES INC.
Geotechnical Consultants
P.O. Box 490 ▼ Lincoln, CA 95648
916.771.5051 FAX 916.771.5868

May 2021	Job No. 4838	Figure 1



Site Plan

Roseville 183

(APN: 017-101-008-000)

Gularte & ASSOCIATES INC. *Geotechnical Consultants*

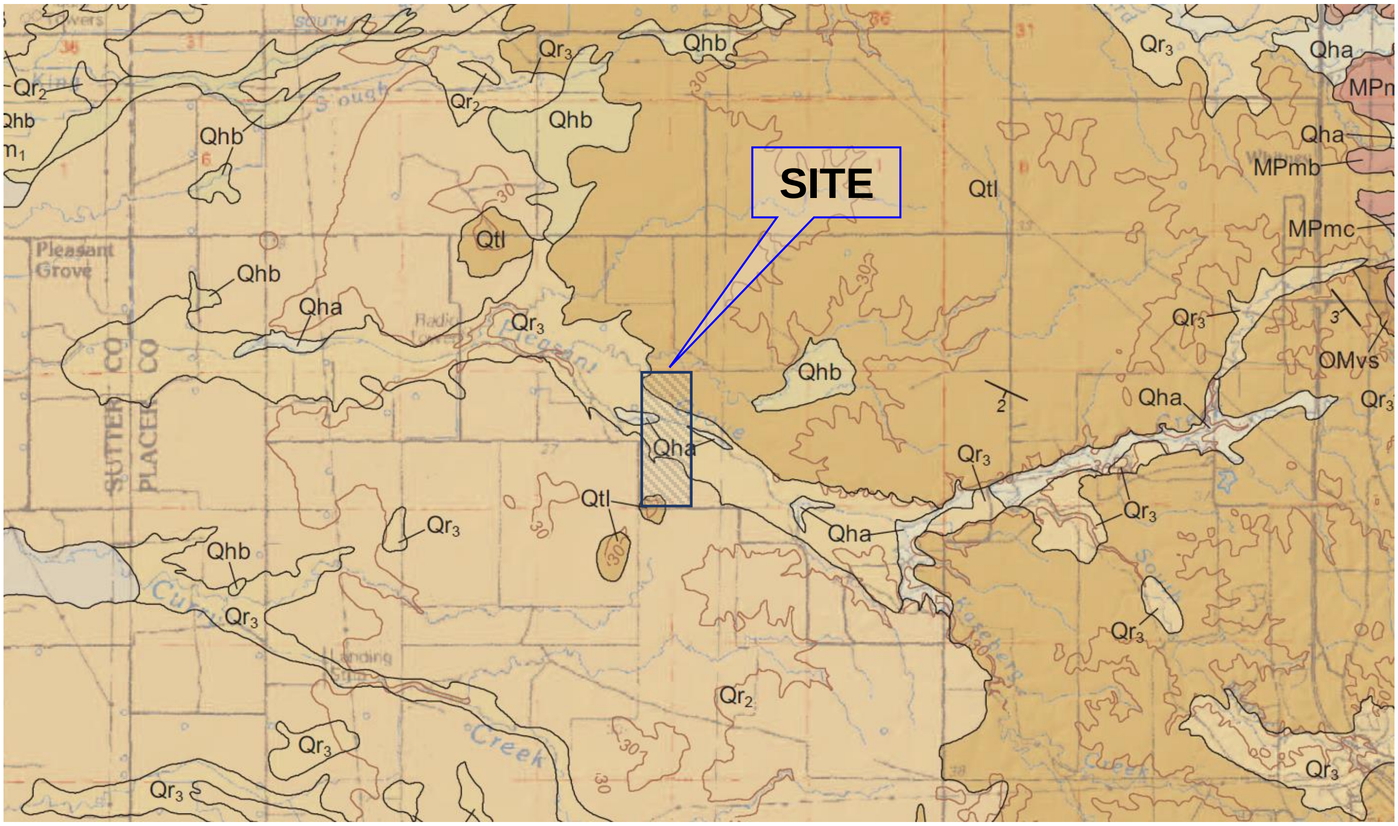
May 2021	Job No. 4838	Figure 2

Existing Fill Map

Roseville 183
(APN: 017-101-008-000)

Gularte & ASSOCIATES INC.
Geotechnical Consultants

May 2021	Job No. 4838	Figure 3



Explanation

Qha	Holocene alluvium
Qhb	Holocene basin deposits

Pleistocene

Riverbank Formation

Qr	Qr$_3$	Qr - Undivided
		Qr$_3$ - Upper unit
	Qr$_2$	Qr$_2$ - Middle unit
	Qr$_1$	Qr$_1$ - Lower unit

Qtl	Turlock Lake Formation

N

Adapted from the 2011 CGS Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, California.

Geologic Map

Roseville 183

(APN: 017-101-008-000)

Gularte & ASSOCIATES INC. *Geotechnical Consultants*

May 2021	Job No. 4838	Figure 4

APPENDIX A

Boring Logs

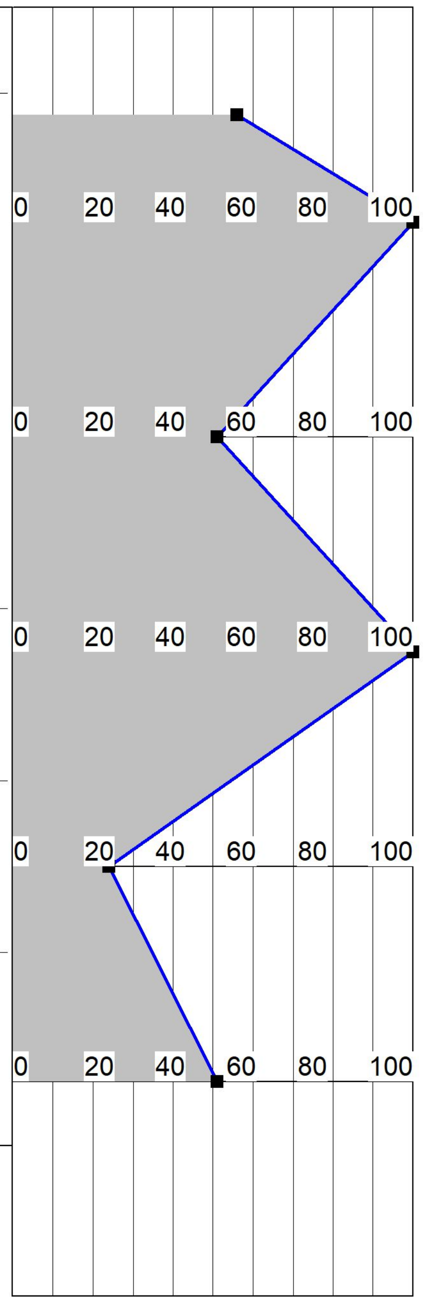
Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~90-ft MSL
Logged By	J. Zlotkowski	**Date**	April 6, 2021

Gularte & Associates, Inc.

Boring # B-1

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
0	1.1		Bulk		Sandy Clay: with silt (CL), brown, dry, stiff.
	1.2	15/26/30	SPT		Silt: with sand (ML), tan, moist, hard.
5	1.3	36/50 f/3"	CAL		UCS=4.3 tsf.
10	1.4	9/19/32	SPT		
15	1.5	25/50 f/6"	CAL		Silt: (ML), light gray, moist, hard. PP>4.5 tsf.
					Clayey Silt: (ML), pale olive gray, very moist, very stiff.
20	1.6	8/11/13	SPT		
					Sandy Silt: (ML), pale olive, very moist, hard.
25	1.7	8/24/27	SPT		No Groundwater, Cement t/Surface.
30					

SPT or Cal Mod "N" Value (Uncorrected)



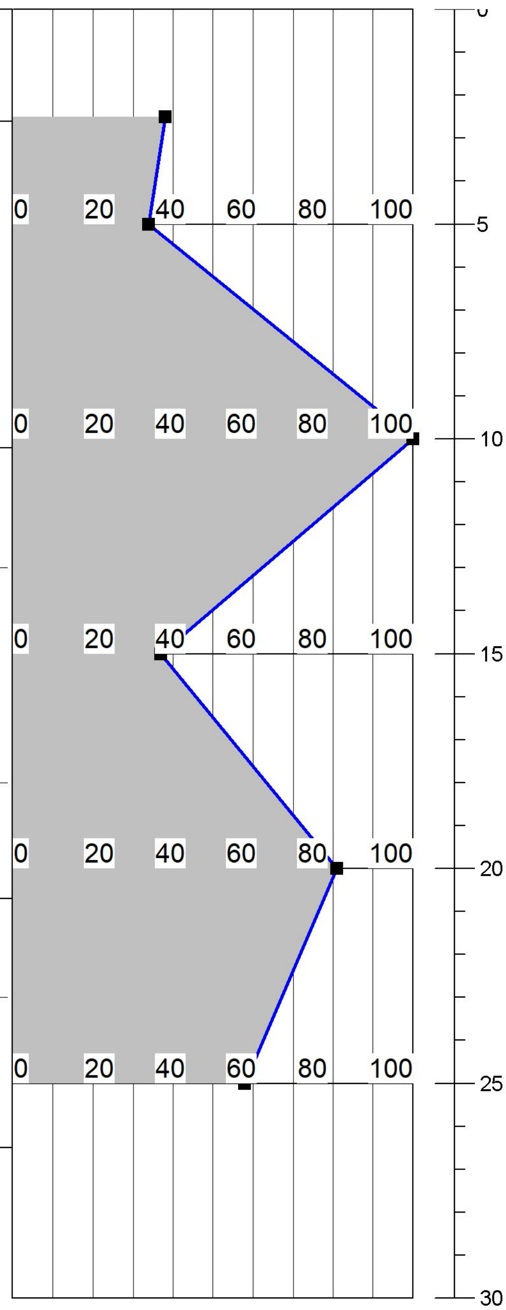
Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~90-ft MSL
Logged By	J. Zlotkowski	**Date**	April 6, 2021

Gularte & Associates, Inc.

Boring # B-2

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	LITHOLOGIC DESCRIPTION
0				Silty Sand: (SM), light brown, dry, medium dense.
	2.1	15/18/20	CAL	Clayey Sand: with silt (SC), reddish brown, very moist to wet, medium dense to very dense, well graded.
5	2.2	11/13/21	SPT	
10	2.3	21/50 f/4"	CAL	Sand: (SW), pale red, very moist, well graded, very dense.
				Silt: (ML), pale olive gray, very moist, hard.
15	2.4	11/16/21	SPT	
				Silty Clay: (CL), olive, wet, hard.
20	2.5	20/31/50 f/6"	CAL	Silt: with sand (ML), pale olive, moist, hard. PP>4.5 tsf.
				Silty Sand: (SM), orangish brown, very moist, very dense.
25	2.6	15/21/37	SPT	No Groundwater; Cement t/Surface.
30				

SPT or Cal Mod "N" Value (Uncorrected)



Client Panattoni Development

Project Roseville 183

Sheet 1 of 1

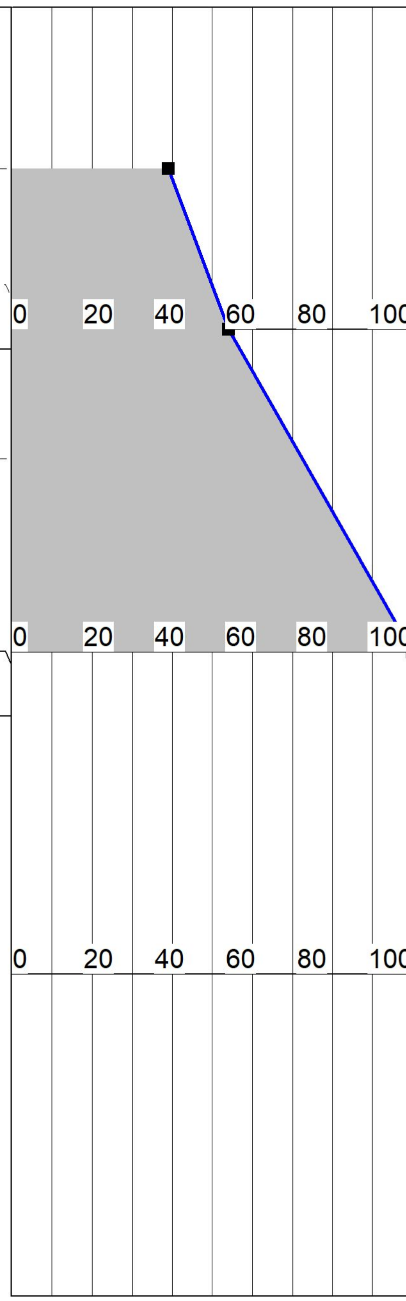
Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~90-ft MSL
Logged By	J. Zlotkowski	**Date**	April 6, 2021

Gularte & Associates, Inc.

Boring # B-3

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
0					Silty Sand: (SM), pale reddish brown, damp, medium dense.
	3.1	11/14/25	CAL		Sandy Silt: with clay (ML), light brown, moist, stiff. PP>4.5 tsf.
					Silty Sand: (SM), light brown, moist, dense.
5	3.2	18/25/29	SPT		Sand: with silt (SP-SM), pale reddish tan, damp, very dense.
					Clayey Sand: (SC), reddish brown, very moist, dense.
10	3.3	25/50 f/4"	CAL		Silty Clay: (CL), grayish brown, damp, hard. UCS=6.5 tsf.
15					
20					

SPT or Cal Mod "N" Value (Uncorrected)



Depth (feet): 0, 5, 10, 15, 20

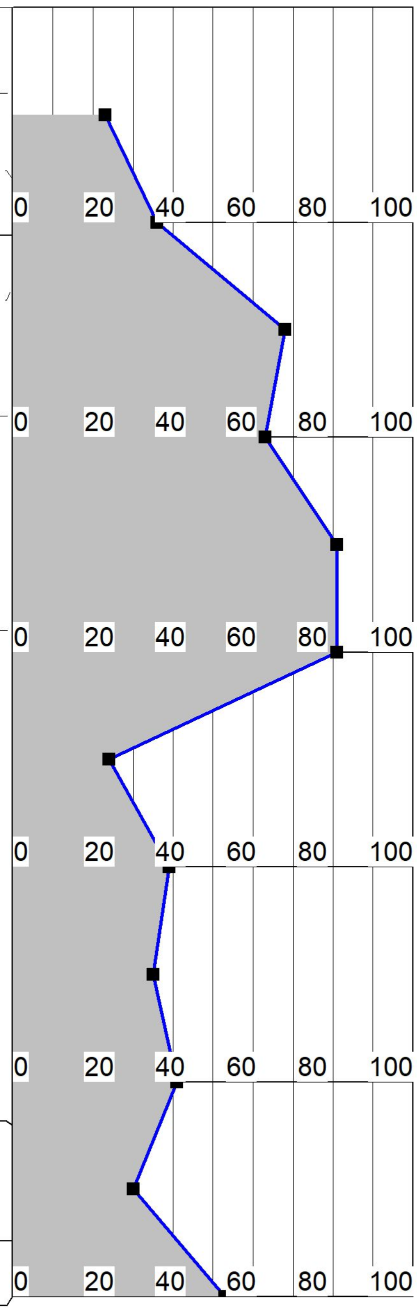
Client	**Project**	**Sheet**
Panattoni Development	Roseville 183	1 of 1

Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~90-ft MSL
Logged By	J. Zlotkowski	**Date**	April 6, 2021

Boring # B-4

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	LITHOLOGIC DESCRIPTION
0				Silty Sand: (SM), reddish brown, dry to damp, medium dense.
	4.1	10/11/12	SPT	Sandy Silt: (ML), reddish brown, damp, very stiff.
				Silty Sand: (SM), reddish brown, damp, medium dense.
5	4.2	11/16/20	SPT	Clayey Sand: (SC), reddish brown, moist, well graded, dense.
	4.3	25/35/33	SPT	Silty Sand: (SM), olive, moist, weakly cemented, very dense.
10	4.4	17/25/38	SPT	Sandy Silt: (ML), pale olive, moist, hard. Thin silty sand seams.
	4.5	20/31/50 f/2.5"	SPT	
15	4.6	18/31/50 f/5"	SPT	Silt: with sand (ML), pale olive to olive, moist to very moist, very stiff to hard.
	4.7	7/11/13	SPT	
20	4.8	12/18/27	SPT	
	4.9	9/12/23	SPT	
25	4.10	9/15/26	SPT	
				Silty Sand: (SM), orangish brown, very moist, dense to medium dense. Thin interbeds of poorly graded and well graded sands.
	4.11	10/12/18	SPT	
30				Silt: with sand (ML), reddish olive, very moist, hard.

SPT or Cal Mod "N" Value (Uncorrected)



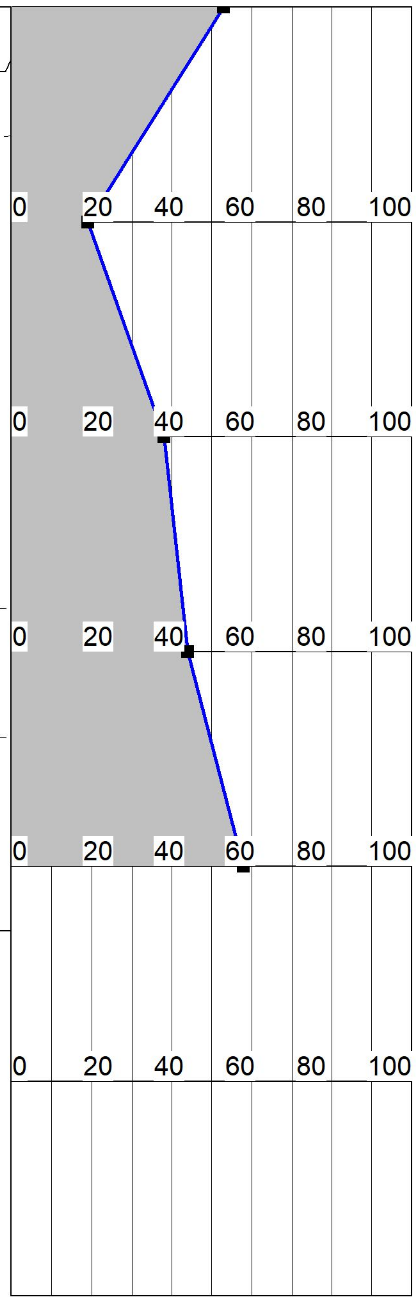
Client	**Project**	**Sheet**
Panattoni Development	Roseville 183	1 of 2

Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~90-ft MSL
Logged By	J. Zlotkowski	**Date**	April 6, 2021

Boring # B-4

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
30	4.12	10/15/38	SPT		Silt: with sand and clay (ML), reddish olive, very moist, very stiff.
					Silty Sand: (SM), dark olive, very moist, very dense.
					Silt: with sand (ML), olive brown, very moist, very stiff to hard.
35	4.13	6/7/12	SPT		
40	4.14	8/17/21	SPT		
					Sandy Silt: (ML), orangish brown, very moist, hard. Silty sand seams.
45	4.15	11/17/27	SPT		
					Silt: with sand (ML), dark olive, moist, hard.
50	4.16	14/20/38	SPT		No Groundwater; Cement t/Surface.
55					
60					

SPT or Cal Mod "N" Value (Uncorrected)



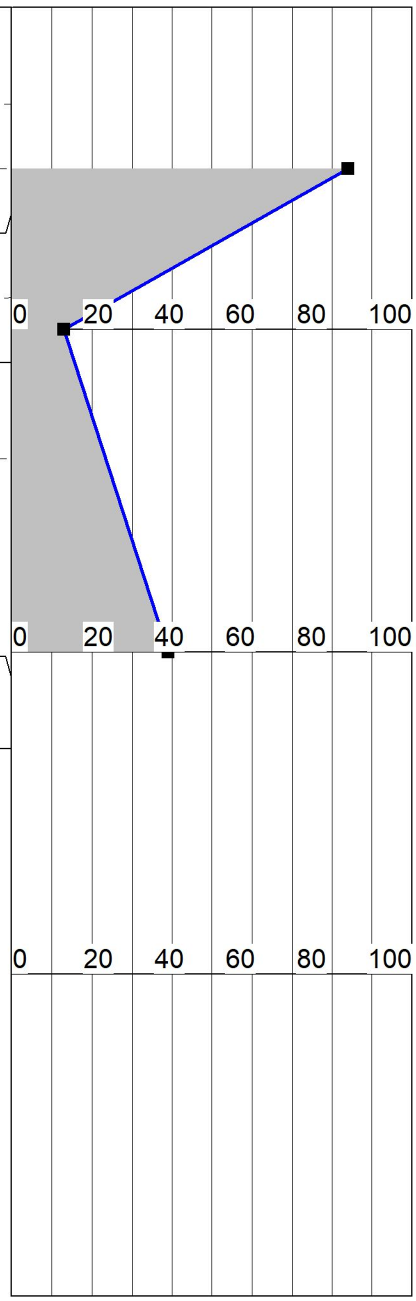
Client	**Project**	**Sheet**
Panattoni Development	Roseville 183	2 of 2

Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~77-ft MSL
Logged By	J. Zlotkowski	**Date**	April 7, 2021

Boring # B-5

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	LITHOLOGIC DESCRIPTION
0				Silty Sand: (SM), light brown, damp, medium dense.
				Sandy Silt: with clay (ML), brown, damp, very stiff.
	5.1	22/34/50 f/5"	CAL	Sand: with silt (SW-SM), brown, damp, medium dense.
				Silty Clay: (CL), brown, damp, hard. PP>4.5 tsf.
5	5.2	9/7/6	SPT	Silty Sand: (SM), light brown, coarse grain sand, moist, medium dense.
				Sand: (SP), orangish brown, very moist, medium dense.
				Clayey Sand: (SC), brown, wet, well sorted, medium dense.
10	5.3	14/19/20	CAL	Sand: with silt (SP-SM), pale orange, wet, medium dense. No Groundwater.
15				
20				

SPT or Cal Mod "N" Value (Uncorrected)



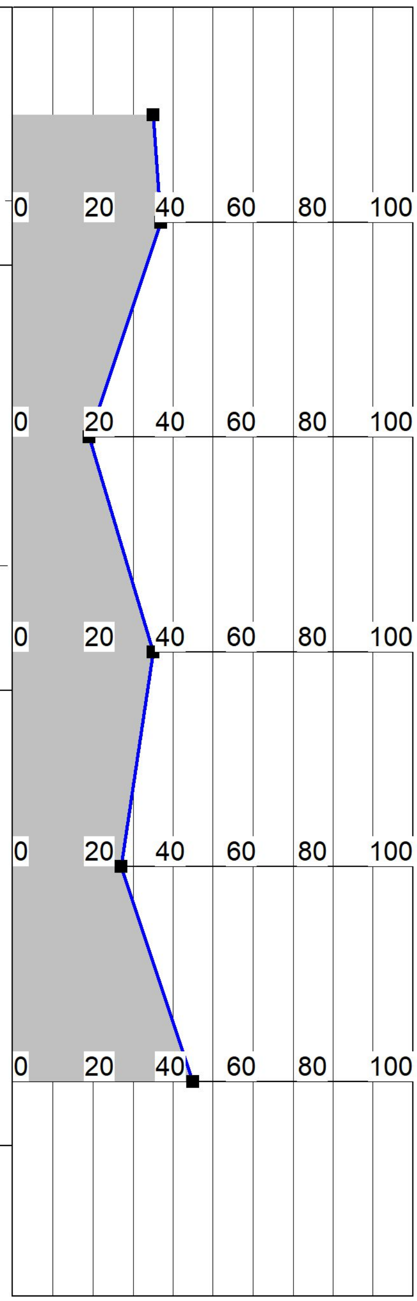
Client	Project	Sheet
Panattoni Development	Roseville 183	1 of 1

Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~77-ft MSL
Logged By	J. Zlotkowski	**Date**	April 6, 2021

Boring # B-6

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
0					Silty Sand: (SM), light brown, dry, medium dense to dense, weakly cemented at 3-ft bgs.
	6.1	24/20/15	SPT		
5	6.2	17/17/20	CAL		Clayey Sand: (SC), brown, very moist, medium dense.
					Silty Clay: with sand (CL), dark olive, very moist, hard. UCS=6.3 tsf.
10	6.3	6/7/12	SPT		dark olive, very moist, very stiff.
					Silty Sand: (SM), reddish brown, wet, poorly sorted, medium dense.
15	6.4	11/15/20	CAL		
					Sandy Silt: (ML), light olive, very moist, stiff. PP=2.75 tsf.
20	6.5	6/11/16	SPT		very stiff
25	6.6	12/18/27	SPT		reddish brown, hard No Groundwater; Cement t/Surface.
30					

SPT or Cal Mod "N" Value (Uncorrected)



Depth (feet): 0, 5, 10, 15, 20, 25, 30

Client	**Project**	**Sheet**
Panattoni Development	Roseville 183	1 of 1

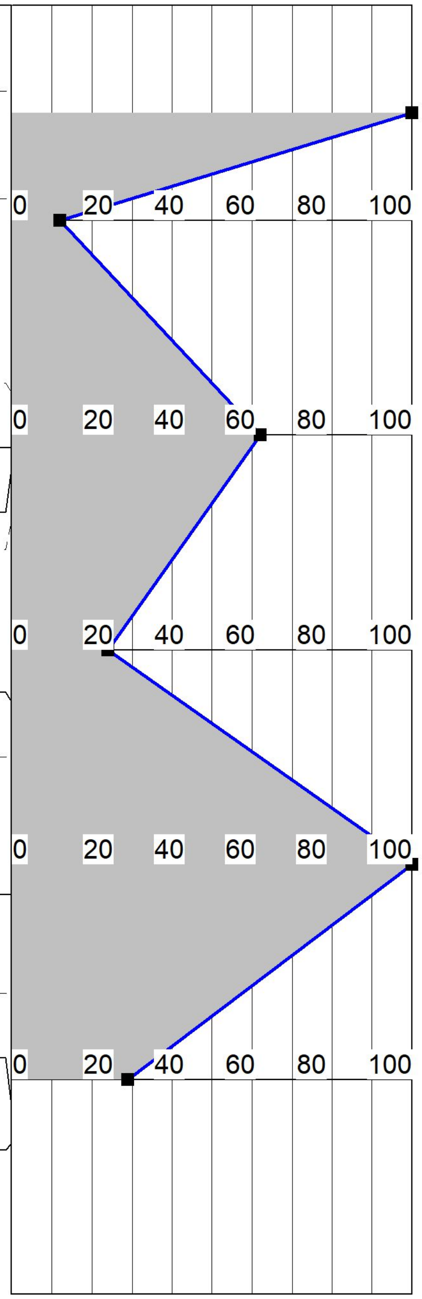
Auger	Solid Stem Auger
Size	4-inch
Drill	CME 75
Logged By	J. Zlotkowski

Project No.	4838
Project Name	Roseville 183
Elevation	~77-ft MSL
Date	April 7, 2021

Boring # B-7

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	LITHOLOGIC DESCRIPTION
0				Sandy Clay: with silt (CL), brown, very moist, stiff.
	7.1	45/50 f/4"	CAL	Sandy Silt: (ML), pale olive brown, moist, hard.
5	7.2	4/5/7	SPT	Clayey Silt: with sand (ML), dark olive brown, very moist, stiff.
				Clayey Sand: (SC), brown, wet, medium dense.
10	7.3	16/26/36	CAL	Silty Sand: (SM), light brown, wet, dense.
				Sand: (SP), orangish red, wet, dense.
				Silt: (ML), pale orangish brown, very moist, very stiff.
15	7.4	6/10/14	SPT	
				Silty Sand: (SM), pale yellowish brown, wet, medium dense.
				Sandy Silt: (ML), olive, very moist, hard. PP>4.5 tsf.
20	7.5	32/50 f/5"	CAL	Silty Sand: (SM), orangish brown, very moist, very dense.
				Silt: with sand (ML), pale olive to tan, very moist, very stiff.
25	7.6	8/12/17	SPT	Silty Sand: with clay (SM), orangish red, moist, fine grain sand, dense. No Groundwater; Cement t/Surface.
30				

SPT or Cal Mod "N" Value (Uncorrected)



Client	Project	Sheet
Panattoni Development	Roseville 183	1 of 1

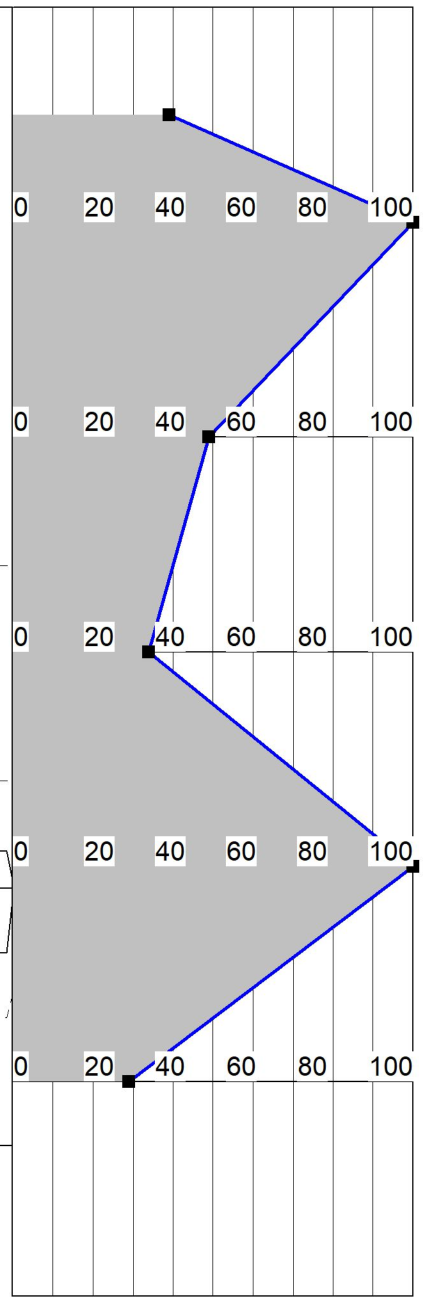
Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~77-ft MSL
Logged By	J. Zlotkowski	**Date**	April 7, 2021

Gularte & Associates, Inc.

Boring # B-8

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
0					Sandy Silt: with clay (ML), brown, dry, medium stiff.
	8.1	13/17/22	CAL		(ML), light olive, damp, very stiff, PP=4.5 tsf.
5	8.2	50 f/3"	SPT		(ML), brown, dry, hard.
10	8.3	15/23/26	CAL		(ML), olive, damp, hard. PP=4 tsf.
					Silt: (ML), orangish olive, very moist, hard.
15	8.4	7/13/21	SPT		
					Clayey Silt: (ML), orange, wet, hard.
20	8.5	23/50 f/5"	CAL		Sand: (SP), orange, wet, dense.
					Silty Sand: (SM), pale olive, very moist, well sorted, very dense.
					Sandy Silt: (ML), olive, very moist, hard.
					Silt: with sand (ML), pale olive, very moist, very stiff.
25	8.6	7/12/17	SPT		No Groundwater; Cement t/Surface.
30					

SPT or Cal Mod "N" Value (Uncorrected)



Depth (feet)

Client	**Project**	**Sheet**
Panattoni Development	Roseville 183	1 of 1

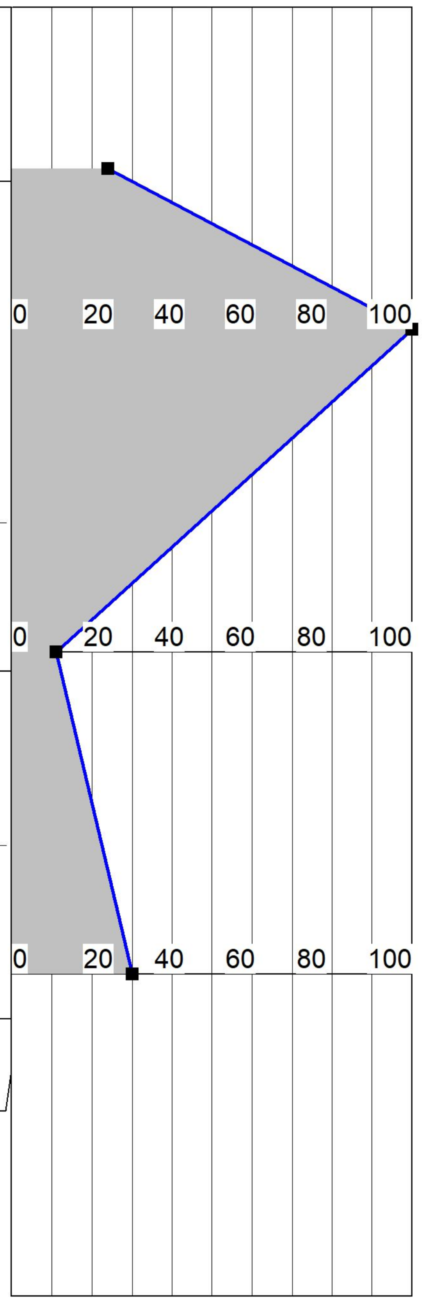
Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~79-ft MSL
Logged By	J. Zlotkowski	**Date**	April 7, 2021

Gularte & Associates, Inc.

Boring # B-9

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	LITHOLOGIC DESCRIPTION
0				Sandy Clay: (CL), brown, wet, soft to medium stiff.
	9.1	12/13/11	SPT	Sandy Silt: with clay (ML), dry to damp, very stiff.
5	9.2	50 f/5"	CAL	damp, hard. PP>4.5 tsf.
				Sand: with clay (SP-SC), orngish brown, wet, medium dense.
10	9.3	8/5/6	SPT	Silty Clay: (CL), olive brown, wet, stiff.
				Clayey Sand: (SC), brown, wet, medium dense.
15	9.4	11/12/18	CAL	Silty Sand: (SM), light brown, poorly sorted, wet, medium dense. No Groundwater; Cement t/Surface.
20				

SPT or Cal Mod "N" Value (Uncorrected)



Client	Project	Sheet
Panattoni Development	Roseville 183	1 of 1

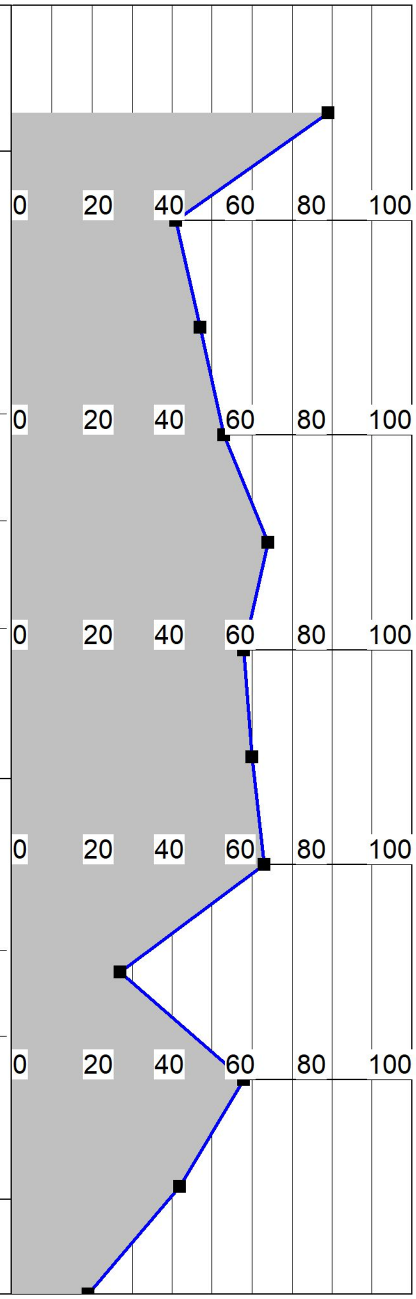
Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~77-ft MSL
Logged By	J. Zlotkowski	**Date**	April 7, 2021

Gularte & Associates, Inc.

Boring # B-10

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
0					Silty Sand: (SM), light olive, damp, dense to very dense.
	10.1	20/36/43	SPT		
					Silt: with sand (ML), pale olive, moist, hard.
5	10.2	11/17/24	SPT		
	10.3	6/20/27	SPT		
					Sandy Silt: (ML), pale olive, moist, hard.
10	10.4	11/20/33	SPT		
					Silt: with sand (ML), olive, very moist, hard.
	10.5	13/24/40	SPT		
					Silty Sand: (SM), orangish brown, moist, very dense.
15	10.6	17/25/33	SPT		
	10.7	14/22/38	SPT		
					Clayey Silt: with sand (ML), pale olive, very moist, hard.
20	10.8	14/23/40	SPT		
					Silt: (ML), pale olive, wet, very stiff.
	10.9	7/12/15	SPT		
					Sand: (SP-SC), dark orangish red, very moist, very dense.
25	10.10	14/30/28	SPT		
	10.11	6/17/25	SPT		
					Silt: with sand and clay (ML), light brown, very moist, hard to very stiff.
30					

SPT or Cal Mod "N" Value (Uncorrected)



Client	Project	Sheet
Panattoni Development	Roseville 183	1 of 2

Auger	Solid Stem Auger	**Project No.**	4838
Size	4-inch	**Project Name**	Roseville 183
Drill	CME 75	**Elevation**	~77-ft MSL
Logged By	J. Zlotkowski	**Date**	April 7, 2021

Boring # B-10

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
30	10.12	6/7/12	SPT		Sandy Silt: (ML), orangish brown, very moist, very stiff.
					Silt: with sand (ML), orangish brown, very moist, very stiff.
35	10.13	4/10/19	SPT		
					Silty Sand: (SM), orangish olive, very moist, dense.
40	10.14	11/17/32	SPT		
					Sand: (SW), light brown, moist, well graded, very dense.
					Silt: (ML) light olive, moist, hard.
45	10.15	13/28/46	SPT		
50	10.16	15/31/35	SPT		No Groundwater; Cement t/Surface.
55					
60					

SPT or Cal Mod "N" Value (Uncorrected)

Auger Solid Stem Auger
Size 4-inch
Drill CME 75
Logged By J. Zlotkowski

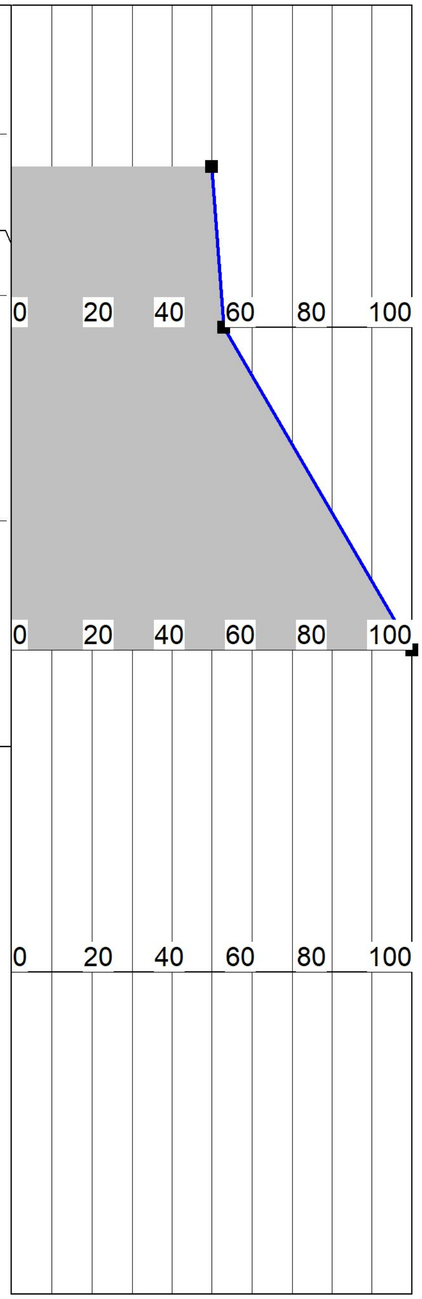
Gularte & Associates, Inc.

Project No. 4838
Project Name Roseville 183
Elevation ~79-ft MSL
Date April 7, 2021

Boring # B-11

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	LITHOLOGIC DESCRIPTION
0				Sandy Clay: (CL), olive brown, moist, stiff.
	11.1	12/23/27	CAL	Silty Sand: with clay (SM), reddish brown, moist, medium dense.
				Sandy Clay: with silt (CL), olive brown, damp, hard. PP>4.5 tsf.
5	11.2	21/26/27	SPT	Sandy Silt: with clay (ML), light olive, moist, hard.
				Silt: with sand (ML), light olive, moist, hard. PP>4.5 tsf.
10	11.3	30/50 f/6"	CAL	
15				
20				

SPT or Cal Mod "N" Value (Uncorrected)



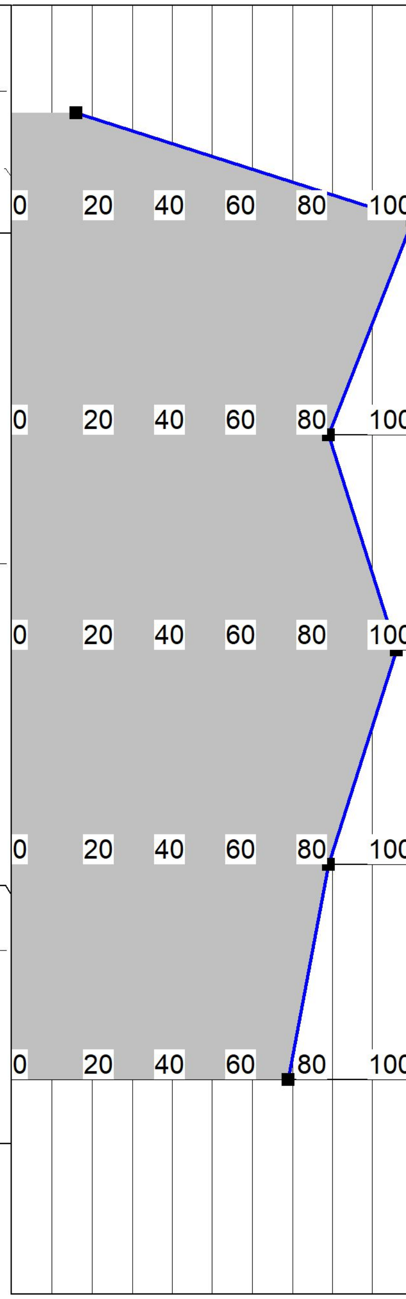
Auger Solid Stem Auger
Size 4-inch
Drill CME 75
Logged By J. Zlotkowski

Project No. 4838
Project Name Roseville 183
Elevation ~77-ft MSL
Date April 7, 2021

Boring # B-12

Depth (feet)	Sample No.	SPT/Cal Mod N-Value	Sample Type	Lithology	LITHOLOGIC DESCRIPTION
0					Silt: (ML), tan, damp, stiff.
	12.1		Bulk		
	12.2	9/8/8	SPT		Silty Clay: (CL), dark brown, damp, very stiff.
					Silty Sand: (SM), olive, dry, coarse grain sand, dense.
5	12.3	24/50 f/3"	CAL		Silt: with sand (ML), pale olive, moist, hard. PP>4.5 tsf.
10	12.4	17/31/48	SPT		
					Silty Clay: with sand (CL), dark olive brown, moist, hard. PP>4.5 tsf. UCS=4.9 tsf.
15	12.5	16/46/50 f/3"	CAL		
20	12.6	10/29/50 f/6"	SPT		Silty Sand: (SM), pale olive, moist, medium grain sand, very dense.
					Silt: (ML), pale olive tan, moist, hard.
25	12.7	16/26/43	SPT		No Groundwater; Cement t/Surface.
30					

SPT or Cal Mod "N" Value (Uncorrected)



Client Panattoni Development

Project Roseville 183

APPENDIX B

Laboratory Test Results

Expansion Index Test; ASTM D4829

Gularte & ASSOCIATES, INC.

Project No.:	4838
Project Name:	Roseville 183
Date:	4/14/2021
Sampling Location:	B-1 (1')
Sample Description	brown Sandy CLAY

Water Content	**No. 1**	
Mass of pan	195.3	grams
Mass of wet soil+pan	534.7	grams
Mass of dry soil+pan	496.8	grams
Water Content (%)	**12.6**	percent

Dial Readings	
Time (hrs)	Reading (in)
18:09	0.0167
18:13	0.0230
18:43	0.0430
9:15	0.0486
18:13	0.0502

Delta	0.0335

Dry Soil Density		
Weight of Ring	368.5	grams
Weight of Ring + Soil	724.4	grams
Height of Ring	1	inches
Ring Diamenter	4	inches
Volume of Ring	12.6	in^3
Wet Soil Density	107.7	pcf
Dry Soil Density	**95.6**	**pcf**

EI	**Classification**
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
> 130	Very High

Saturation and Expansion Index	
Percent Saturation	44.6
Uncorrected EI	33.5
Corrected EI	**30.5**

Notes:

Expansion Index Test; ASTM D4829

Project No.:	4838
Project Name:	Roseville 183
Date:	4/13/2021
Sampling Location:	B-12 (1')
Sample Description	tan SILT

Water Content	**No. 1**	
Mass of pan	195.4	grams
Mass of wet soil+pan	478.6	grams
Mass of dry soil+pan	435.7	grams
Water Content (%)	**17.9**	percent

Dial Readings	
Time (hrs)	Reading (in)
14:36	0.0191
14:41	0.0200
18:10	0.0372
17:17	0.0382

Delta	0.0191

Dry Soil Density

Weight of Ring	368.5	grams
Weight of Ring + Soil	704.4	grams
Height of Ring	1	inches
Ring Diamenter	4	inches
Volume of Ring	12.6	in^3
Wet Soil Density	101.6	pcf
Dry Soil Density	**86.2**	**pcf**

EI	Classification
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
> 130	Very High

Saturation and Expansion Index

Percent Saturation	50.5
Uncorrected EI	19.1
Corrected EI	**19.4**

Notes:

ASTM D2216/2922 Moisture/Density Test

Project No.: 4838
Project Name: Roseville 183
Sampling Locations: See Site Plan

Soil Description: See Boring Logs

Gularte & Associates, Inc.

Boring Location	**B-7**	**B-3**	**B-5**	**B-8**	**B-9**	**B-11**	**B-1**	**B-6**
Sample Depth	2.9'-3.4'	3'-3.5'	3'-3.5'	3'-3.5'	5'-5.5'	10.5'-11'	15'-15.5'	15.5'-16'

Water Content Calculations	**No. 1**	**No. 2**	**No. 3**	**No. 4**	**No. 5**	**No. 6**	**No. 7**	**No. 8**
Obtain Mass of Container	188.4	186.0	192.6	193.6	190.8	257.6	192.6	182.6
Obtain Mass of Wet Specimen+Container	1032.4	1097.6	1034.6	947.0	966.4	1032.8	1002.2	1039.2
Obtain Mass of Dry Specimen+Container	932.8	1025.4	960.4	821.2	895.6	883.2	809.6	903.4
Water Content (%)	**13.4**	**8.6**	**9.7**	**20.0**	**10.0**	**23.9**	**31.2**	**18.8**

Soil Density Calculations	**No. 1**	**No. 2**	**No. 3**	**No. 4**	**No. 5**	**No. 6**	**No. 7**	**No. 8**
Obtain Mass of Mold:	1119.8	1185.6	1116.6	1037.4	1058.2	1082.6	1082.8	1131.2
Obtain Mass of Soil and Mold:	274.0	274.0	273.0	274.2	273.8	274.2	272.6	273.4
Total Mass of Soil	845.8	911.6	843.6	763.2	784.4	808.4	810.2	857.8
Length of sample	5.95	6.0	6.0	5.9	6.0	6.0	6.0	6.0
Wet Soil Density	117.5	125.6	116.3	107.0	108.1	111.4	111.7	118.2
Dry Soil Density	**103.7**	**115.7**	**106.0**	**89.1**	**98.2**	**89.9**	**85.1**	**99.5**

Notes

ASTM D1140 Sieve Wash Over The No. 200 Screen

Project No.: 4838
Project Name: Roseville 183
Date: 4/13/21

Soil Description: See Logs

Gularte & Associates, Inc.

Basic Information

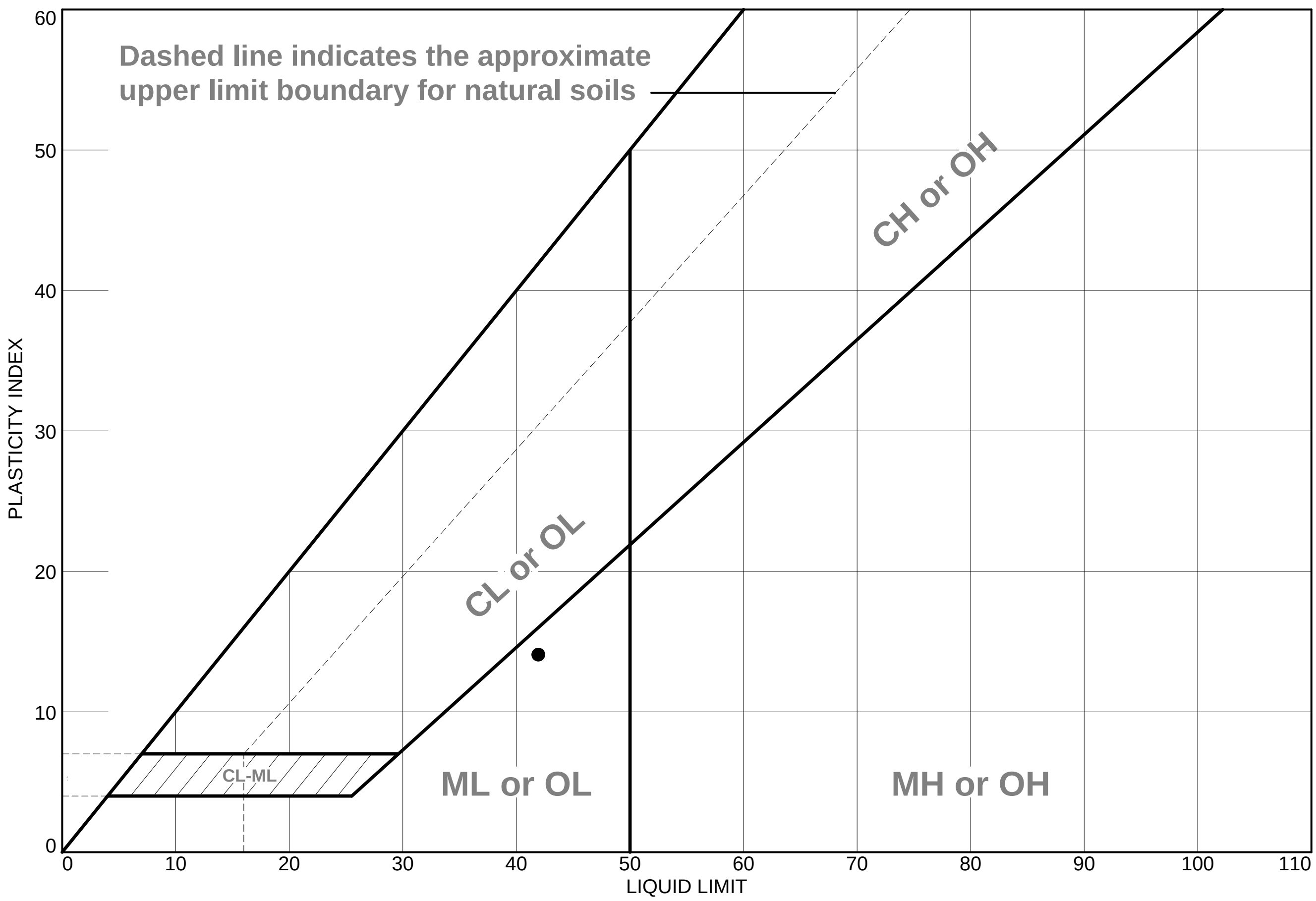
Procedure Used (A or B): A
Preparation Method Used (Wet or Dry): Wet

Boring No.	**B-4**	**B-9**	**B-7**	**B-1**	**B-2**	**B-10**	**B-6**	**B-9**	**B-8**	**B-4**
Depth	2.5'-4'	2.5'-4'	3'-3.4'	3.9'	5'-6.5'	7.5'-9'	10'-11.5'	10.3'-11'	11.5'	45'-46.5'

Pan #	38	25	59	62	16	60	57	BB	8	77
Mass of Container	190.4	197.6	188.0	188.8	193.0	192.8	188.6	191.8	195.8	188.6
Mass of Dry Specimen+Container	246.2	292.6	243.4	294.0	282.4	246.4	234.0	243.6	241.4	251.6
Mass of Dry Washed+Container	217.0	228.4	204.8	206.2	255.2	207.2	191.4	196.0	214.4	207.6
Percent Passing No. 200 Sieve	**52.3**	**67.6**	**69.7**	**83.5**	**30.4**	**73.1**	**93.8**	**91.9**	**59.2**	**69.8**

Mass of Container+Wet Specimen	248.6	297.2	251.4	320.6	294.0	255.4	243.4	255.0	249.0	268.6
Mass of Container+Dry Specimen	246.2	292.6	243.4	294.0	282.4	246.4	234.0	243.6	241.4	251.6
Water Content %	**4.3**	**4.8**	**14.4**	**25.3**	**13.0**	**16.8**	**20.7**	**22.0**	**16.7**	**27.0**

LIQUID AND PLASTIC LIMITS TEST REPORT



	Material Description	Sampled	Tested	Technician	LL	PL	PI	%<#40	USCS
●	tan SILT w/sand	4/6/2021	4/22/21	JZ	42	28	14		ML

Project No. 4838 **Client:** Panattoni Development Company

Project: Roseville 183

Location: B-1 (3') **Sample Number:** 1.2

GULARTE & ASSOCIATES, INC.

Rocklin, CA

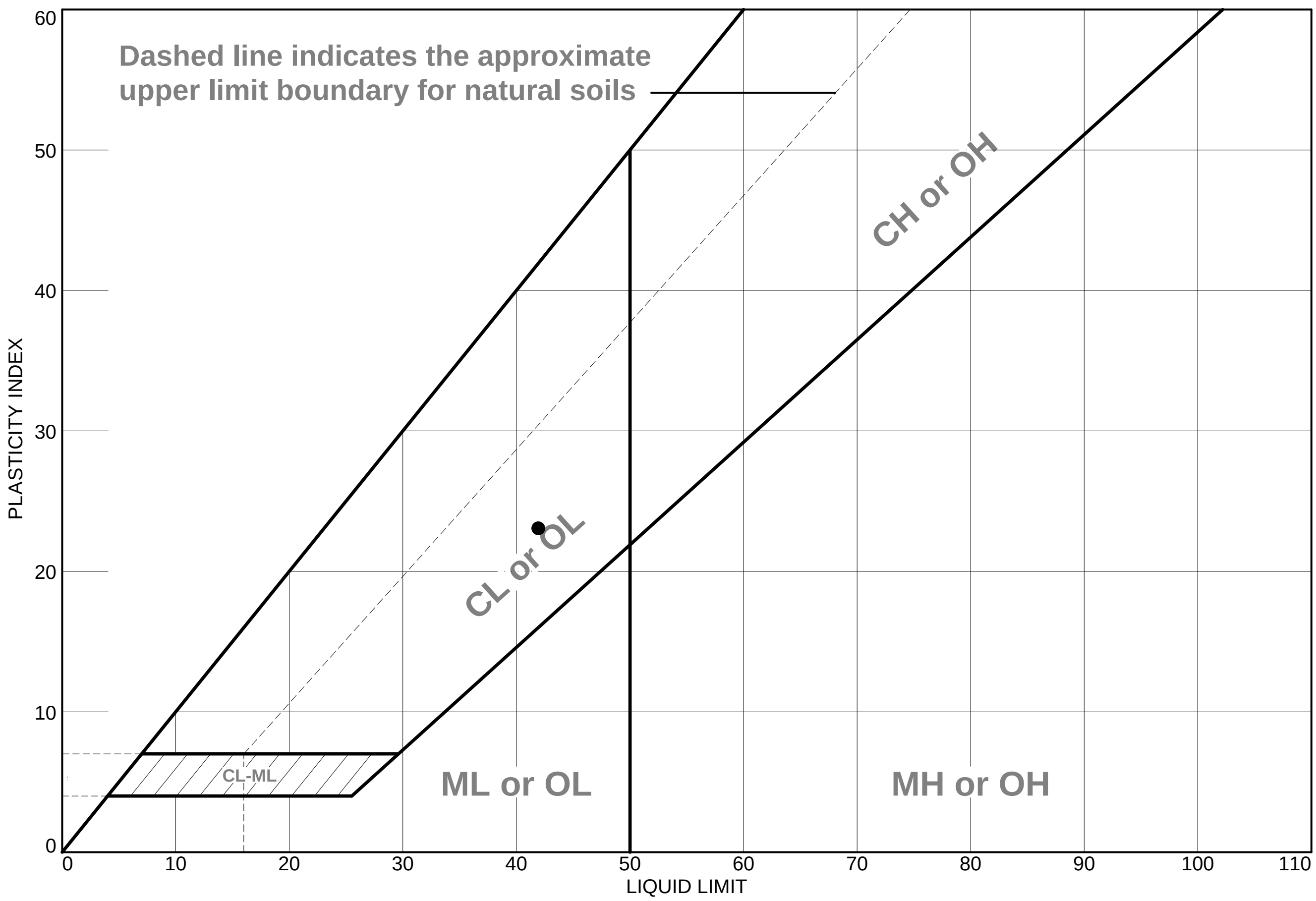
Checked by:

Title:

Figure

Tested By: JZ

LIQUID AND PLASTIC LIMITS TEST REPORT



	Material Description	Sampled	Tested	Technician	LL	PL	PI	%<#40	USCS
●	dark olive Silty CLAY	4/6/21	4/22/21	JZ	42	19	23		CL

Project No. 4838 **Client:** Panattoni Development Company

Project: Roseville 183

○**Location:** B-6 (10') **Sample Number:** 6.3

GULARTE & ASSOCIATES, INC.

Rocklin, CA

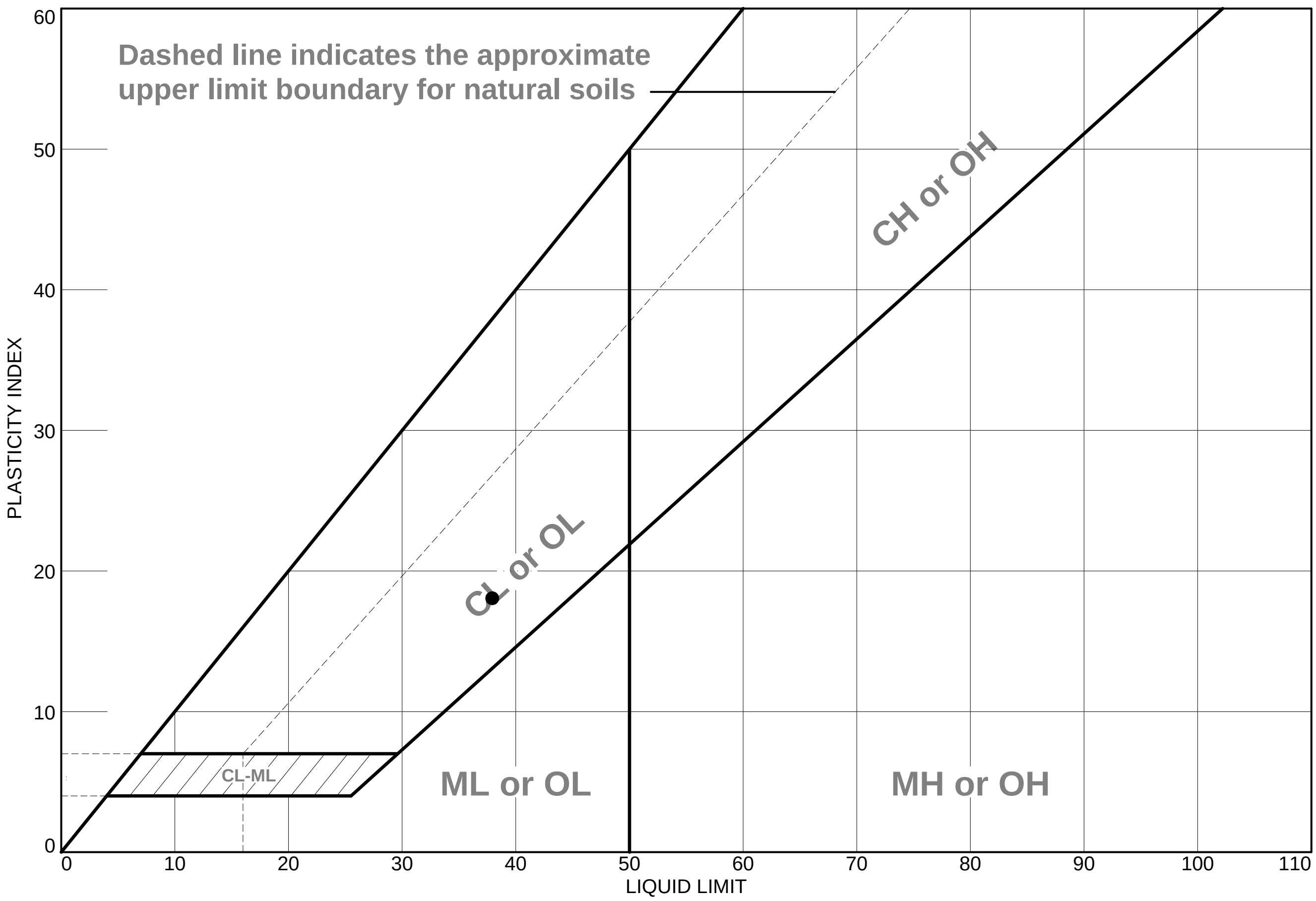
Checked by:

Title:

Figure

Tested By: JZ

LIQUID AND PLASTIC LIMITS TEST REPORT



	Material Description	Sampled	Tested	Technician	LL	PL	PI	%<#40	USCS
●	olive brown Sandy CLAY	4/7/21	4/22/21	JZ	38	20	18		CL

Project No. 4838 **Client:** Panattoni Development Company

Project: Roseville 183

○**Location:** B-11 (4') **Sample Number:** 11.1

GULARTE & ASSOCIATES, INC.

Rocklin, CA

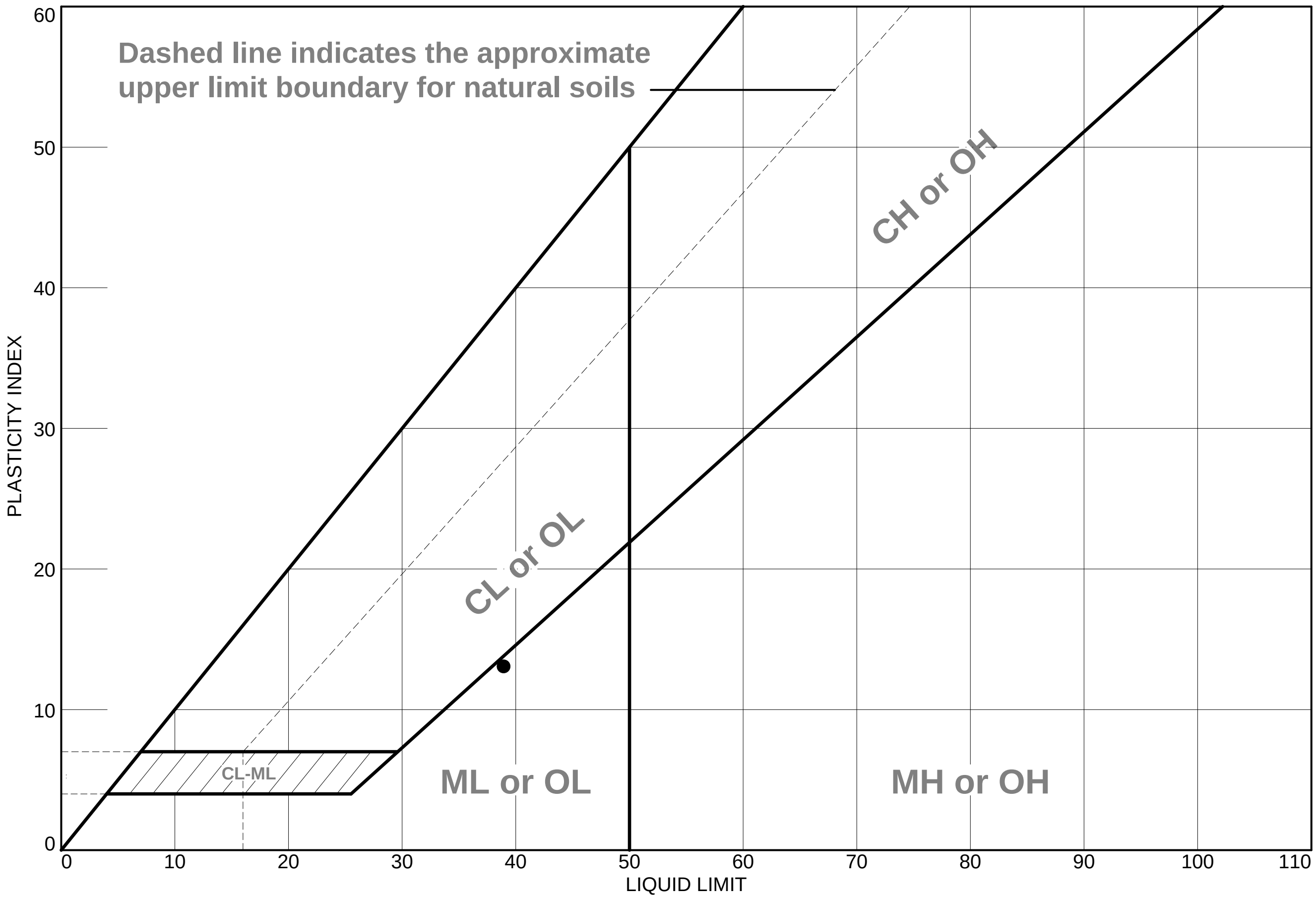
Checked by:

Title:

Figure

Tested By: JZ

LIQUID AND PLASTIC LIMITS TEST REPORT



	Material Description	Sampled	Tested	Technician	LL	PL	PI	%<#40	USCS
●	pale olive SILT w/sand	4/7/21	4/22/21	JZ	39	26	13		ML

Project No. 4838 **Client:** Panattoni Development Company

Project: Roseville 183

○ **Location:** B-12 (10') **Sample Number:** 12.4

GULARTE & ASSOCIATES, INC.

Rocklin, CA

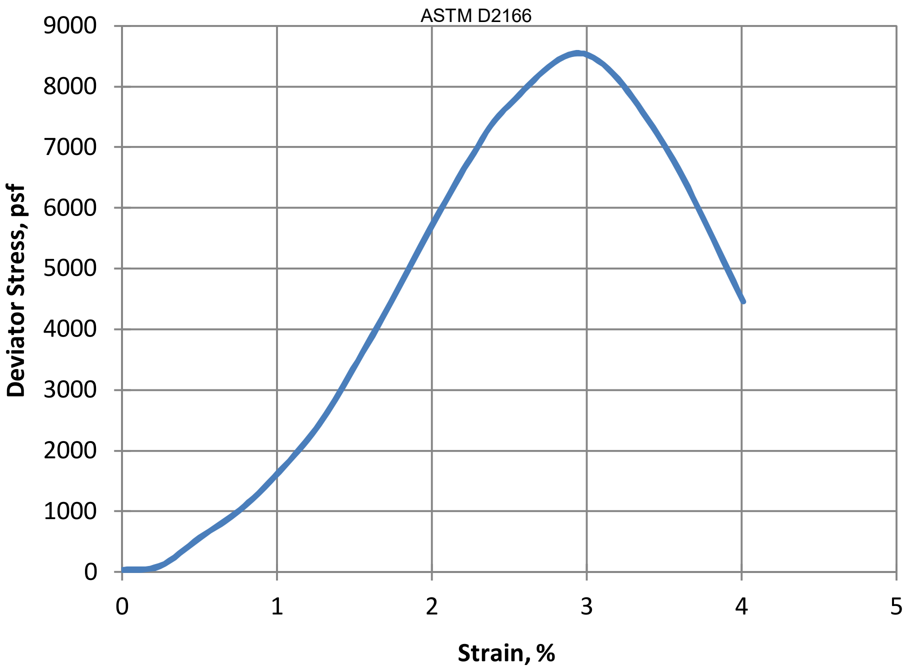
Checked by:

Title:

Figure

Tested By: JZ

STRESS-STRAIN



Failure Photo

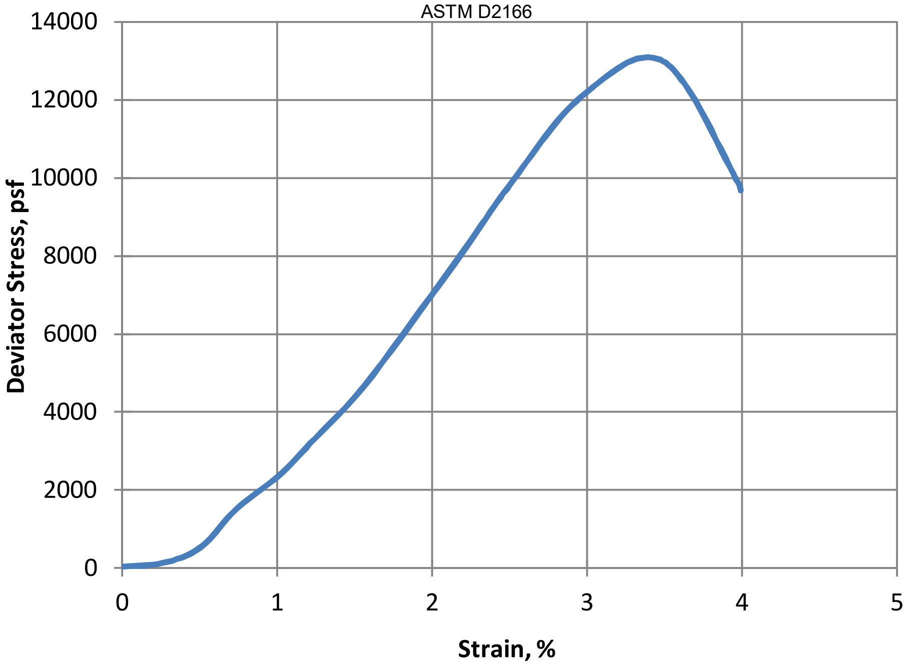
Sample Description	
Sample ID	B1-5.3-5.8
Sample Depth (feet)	5.3-5.8
Material Description	Olive Brown SILT
Initial Conditions at Start of Test	
Height (inch) average of 3	4.82
Diameter (inch) average of 3	2.40
Moisture Content (%)	36.3
Dry Density (pcf)	83.3
Estimated Specific Gravity	2.7
Saturation (%)	96.0
Shear Test Conditions	
Strain Rate (%/min)	0.9930
Major Principal Stress at Failure (psf)	8540
Strain at Failure (%)	3.0
Test Results	
Unconfined Compressive Strength (tons/ft^2)	4.3
Unconfined Compressive Strength (lbs/ft^2)	8541
Unconfined Compressive Strength (psi)	59
Shear Strength (tons/ft^2)	2.1
Shear Strength (lbs/ft^2)	4270

GEOCON CONSULTANTS, INC.
Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, California 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

Unconfined Compressive Strength (ASTM D2166)

Project: Gularte #4838
Location:
Number: S1739-05-01
Figure:

STRESS-STRAIN



Failure Photo

Sample Description	
Sample ID	B3-10.5-11
Sample Depth (feet)	10.5-11
Material Description	Grayish brown Silty CLAY
Initial Conditions at Start of Test	
Height (inch) average of 3	4.84
Diameter (inch) average of 3	2.41
Moisture Content (%)	45.7
Dry Density (pcf)	73.6
Estimated Specific Gravity	2.7
Saturation (%)	95.7
Shear Test Conditions	
Strain Rate (%/min)	0.9568
Major Principal Stress at Failure (psf)	12990
Strain at Failure (%)	3.5
Test Results	
Unconfined Compressive Strength (tons/ft^2)	6.5
Unconfined Compressive Strength (lbs/ft^2)	12993
Unconfined Compressive Strength (psi)	90
Shear Strength (tons/ft^2)	3.2
Shear Strength (lbs/ft^2)	6497

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Unconfined Compressive Strength (ASTM D2166)

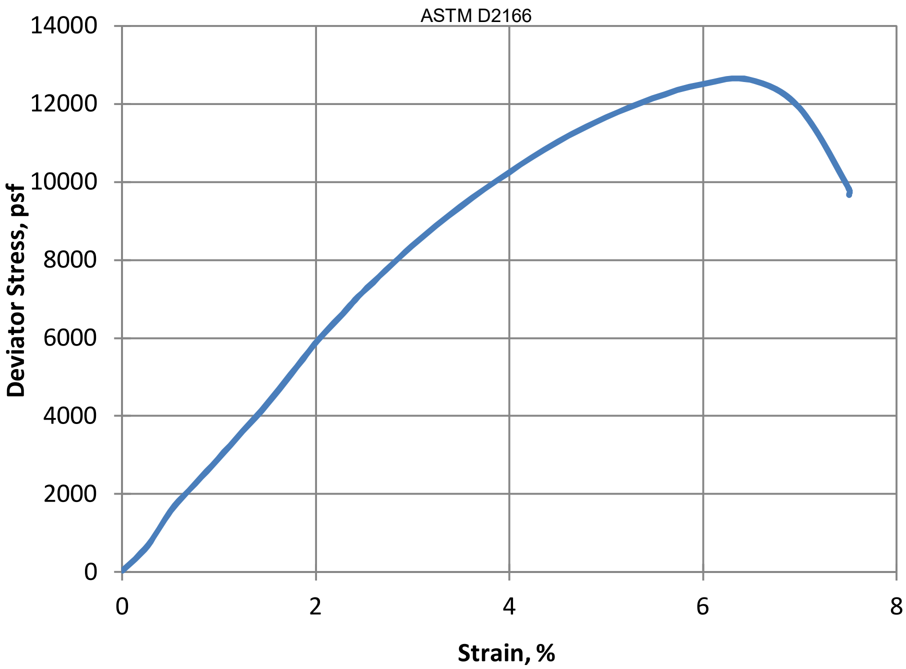
Project: Gularte #4838

Location:

Number: S1739-05-01

Figure:

STRESS-STRAIN



Failure Photo

Sample Description	
Sample ID	B6
Sample Depth (feet)	6-6.5
Material Description	Dark yellowish brown Sandy lean CLAY
Initial Conditions at Start of Test	
Height (inch) average of 3	4.82
Diameter (inch) average of 3	2.39
Moisture Content (%)	18.3
Dry Density (pcf)	111.1
Estimated Specific Gravity	2.7
Saturation (%)	95.7
Shear Test Conditions	
Strain Rate (%/min)	0.9914
Major Principal Stress at Failure (psf)	12620
Strain at Failure (%)	6.5
Test Results	
Unconfined Compressive Strength (tons/ft^2)	6.3
Unconfined Compressive Strength (lbs/ft^2)	12617
Unconfined Compressive Strength (psi)	88
Shear Strength (tons/ft^2)	3.2
Shear Strength (lbs/ft^2)	6308

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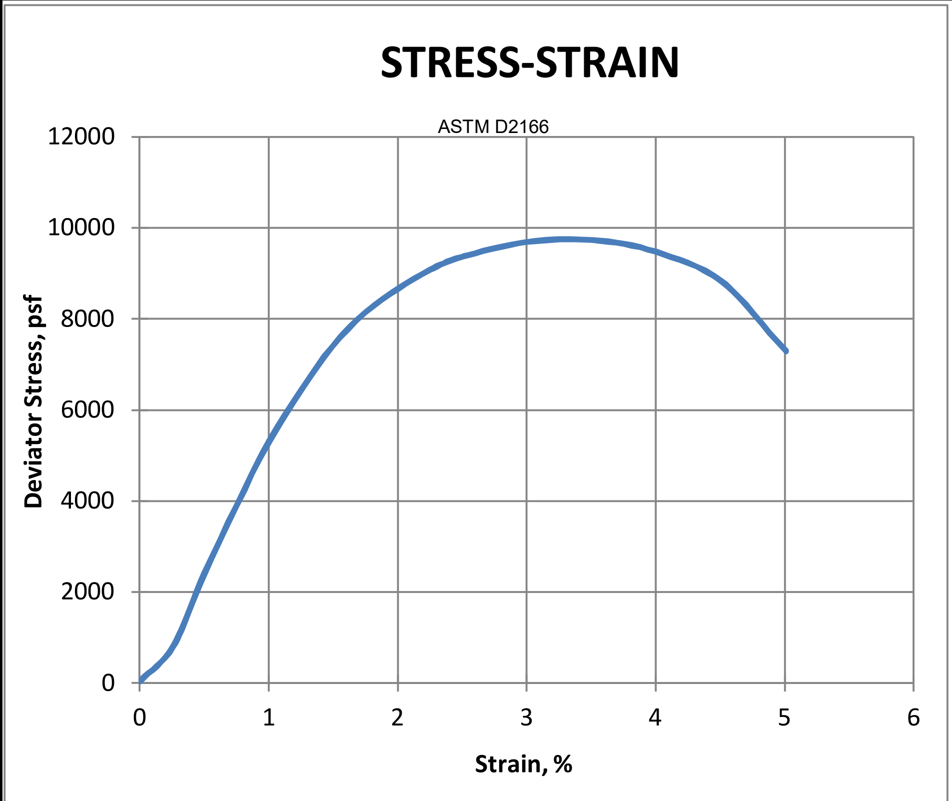
Unconfined Compressive Strength (ASTM D2166)

Project: Gularte #4838
Location:
Number: S1739-05-01
Figure:



Failure Photo

Sample Description	
Sample ID	B12
Sample Depth (feet)	15.3-15.8
Material Description	Brown lean CLAY
Initial Conditions at Start of Test	
Height (inch) average of 3	4.83
Diameter (inch) average of 3	2.40
Moisture Content (%)	29.4
Dry Density (pcf)	89.7
Estimated Specific Gravity	2.7
Saturation (%)	90.5
Shear Test Conditions	
Strain Rate (%/min)	0.9938
Major Principal Stress at Failure (psf)	9730
Strain at Failure (%)	3.5
Test Results	
Unconfined Compressive Strength (tons/ft^2)	4.9
Unconfined Compressive Strength (lbs/ft^2)	9732
Unconfined Compressive Strength (psi)	68
Shear Strength (tons/ft^2)	2.4
Shear Strength (lbs/ft^2)	4866

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Unconfined Compressive Strength (ASTM D2166)

Project: Gularte #4838
Location:
Number: S1739-05-01
Figure:

MPE MID PACIFIC ENGINEERING

R-Value

(ASTM D2844, CT 301)

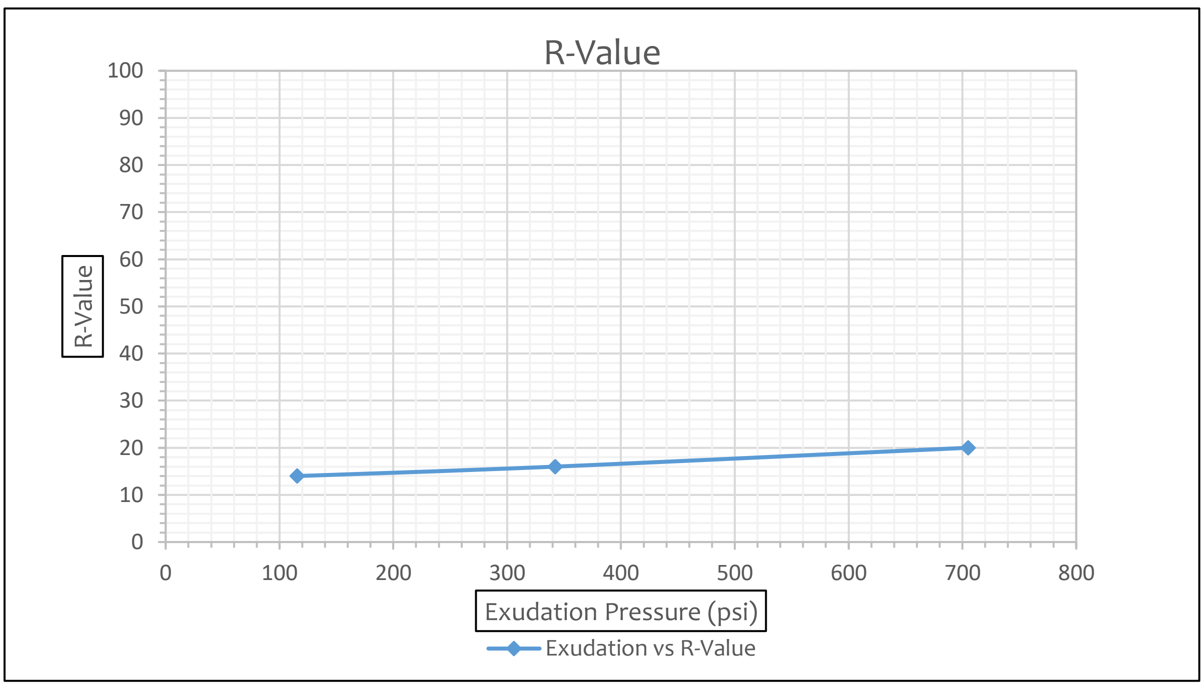
Revised 7/30/18

Project Name:	GULARTE & ASSOCIATES	MPE No.:	02122-00
Sample ID:	R1	Lab No.:	87114
Sample Description:	RED BROWN SANDY CLAY (CL)	Date:	4/21/2021
Sample Location:	NP	Tested By:	KB

Test Results

Specimen	R12	R4	R8	
Exudation Pressure (psi)	705	342	115	0
Expansion Pressure (psf)	65	9	0	
Resistance Value (Corr.)	20	16	14	
% Moisture at Test	13.6%	15.6%	16.7%	
Dry Density at Test (pcf)	117.4	112.6	110.8	

"R" Value (at Exudation Pressure of 300 psi):	**16**



Comments:

Reviewed By:

August Smarkel

August Smarkel, Lab Engineer

6310 State Highway 273, Anderson California 96007
840 Embarcadero Drive Suite 20 West Sacramento, California 95605

MPE Mid Pacific Engineering

R-Value

(ASTM D2844, CT 301)

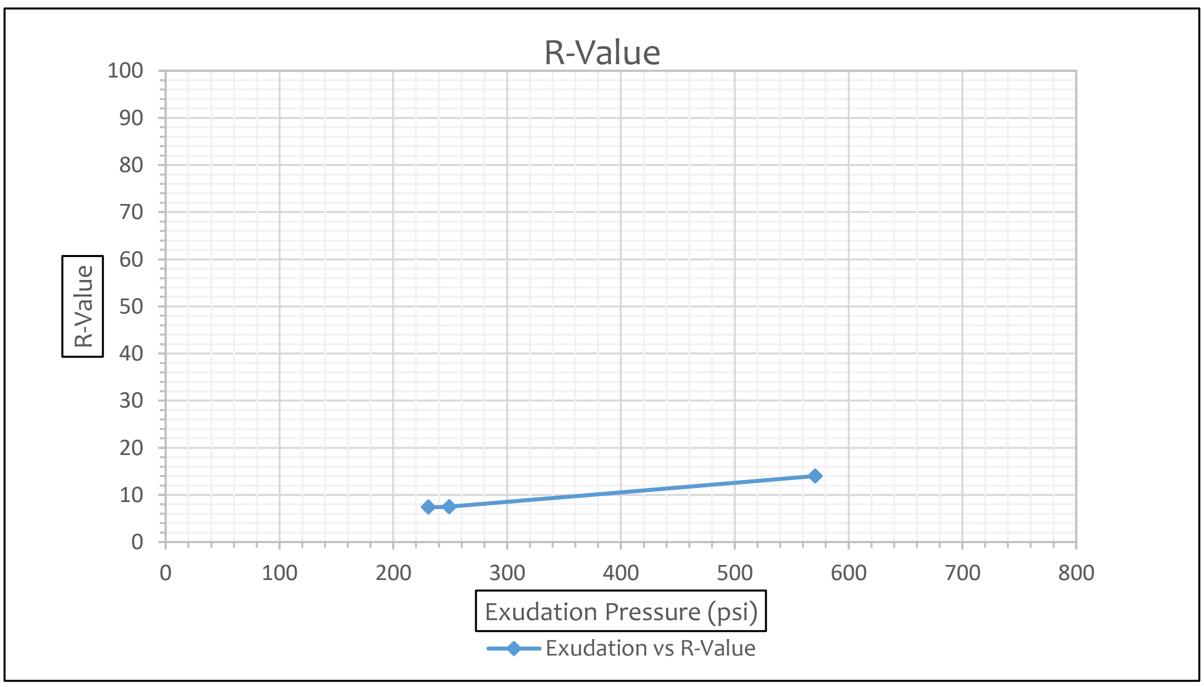
Revised 7/30/18

Project Name:	GULARTE & ASSOCIATES	MPE No.:	02122-00
Sample ID:	R2	Lab No.:	87114
Sample Description:	OLIVE BROWN SANDY CLAY (CL)	Date:	4/20/2021
Sample Location:	NP	Tested By:	KB

Test Results

Specimen	R12	R9	R4	
Exudation Pressure (psi)	249	571	231	0
Expansion Pressure (psf)	0	0	0	
Resistance Value (Corr.)	8	14	7	
% Moisture at Test	19.4%	15.8%	21.0%	
Dry Density at Test (pcf)	102.9	110.0	98.9	

"R" Value (at Exudation Pressure of 300 psi):	8



Comments:

Reviewed By:

August Smarkel

August Smarkel, Lab Engineer

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840 Embarcadero Drive Suite 20 West Sacramento, California 95605

APPENDIX C

Percolation Test Results

Percolation Test Results

Boring: PT-1
Date: 4/15/2021
Job # 4838
Job Name Roseville 183

Percolation Test

Borehole Diameter, D (in.)	Total Boring Depth (in.)	Initial Water Depth, d_i (in.)	Drop, Δd (in.)	Time Start / End	Time, Δt (min.)	Percolation Rate (in/hr)	Reduction Factor	Adjusted Percolation Rate (in/hr)
4.00	26.00	24.00	0.50	12:06 PM 12:36 PM	30	1.00	12.88	0.08
4.00	26.00	24.25	0.25	12:40 PM 13:10 PM	30	0.50	13.06	0.04
4.00	26.00	24.00	0.125	13:13 PM 13:43 PM	30	0.25	12.97	0.02
4.00	26.00	24.25	0.125	13:46 PM 14:16 PM	30	0.25	13.09	0.02

Percolation Rate = 60/Δt * Δd
Reduction Factor = (2 * d_i - Δd)/D + 1

CFt = Rf 13.09
CFv 1 Good coverage, Borings, Lab Testing
CFs 1 Correction for no pre-treatment

Design Infiltration Rate = Percolation Rate/(CFt*CFv*CFs) = 0.02 in/hr

Percolation Test Results

Boring: PT-2
Date: 4/15/2021
Job # 4838
Job Name Roseville 183

Percolation Test

Borehole Diameter, D (in.)	Total Boring Depth (in.)	Initial Water Depth, d_i (in.)	Drop, Δd (in.)	Time Start / End	Time, Δt (min.)	Percolation Rate (in/hr)	Reduction Factor	Adjusted Percolation Rate (in/hr)
4.00	32.00	23.00	3.00	12:25 PM / 12:55 PM	30	6.00	11.75	0.51
4.00	32.00	22.00	1.00	12:57 PM / 13:27 PM	30	2.00	11.75	0.17
4.00	32.00	22.50	1.00	13:30 PM / 14:00 PM	30	2.00	12.00	0.17
4.00	32.00	23.00	1.50	14:02 PM / 14:48 PM	46	1.96	12.13	0.16
5.00	32.00	23.00	0.75	14:50 PM / 15:20 PM	30	1.50	10.05	0.15

Percolation Rate = 60/Δt * Δd
Reduction Factor = (2 * d_i - Δd)/D + 1

CFt = Rf 10.05
CFv 1 Good coverage, Borings, Lab Testing
CFs 1 Correction for no pre-treatment

Design Infiltration Rate = Percolation Rate/(CFt*CFv*CFs) = 0.15 in/hr

APPENDIX D

Geotechnical Terms/Definitions

Referenced Geotechnical Terms

ASTM: **A**merican **S**ociety for **T**esting and **M**aterials is one of the largest voluntary standards development systems in the world. Soils and materials tests are described in detail in their annual books of standards.

Bench: A relatively level step, excavated into acceptable material of a slope face, against which fill is to be placed. Its purpose is to provide a firm and stable contact between the existing material and the new fill to be placed.

Buttress: An engineered fill designed and built to support or retain a weak or unstable Slope.

Compaction: The densification of soil through mechanical manipulation (tamping, rolling, vibrating, etc.). The addition of optimum amounts of water can be crucial to obtaining adequate densification of the material.

Cut: The depth to which a material is to be removed/excavated to reach final grade elevation.

Consolidation: The gradual reduction in volume of a soil mass due to an increase in compressive stress (load).

Daylight Line: The surface contact of *cut* and *fill* soil.

Density Test: A field test used to determine compaction of a fill or native soil. The test is typically performed by the nuclear gauge method.

Expansive Soil: A soil (usually clayey) that increases in volume when water is added (expands), and shrinks when water content is reduced.

Geotechnical: Pertaining to the practical applications of soil science and civil Engineering.

Geotextile Fabric: A permeable fabric used during grading to stabilize, allow for drainage, filtration, or add reinforcement beneath a pavement or structure.

Maximum Density Test: ("curve", "max"," or "proctor") A laboratory test used to determine the optimum moisture and maximum dry density of a soil type (typically ASTM standard test method D 1557).

Native Soil (Natural Ground, NG): (1) Soil deposited by the forces of nature through weathering, erosion, etc.; soil that has not been moved by man. (2) The undisturbed surface prior to the commencement of grading, sometimes referred to as Original Ground (OG).

Nesting: Oversized material (typically >6" size) that has been placed in a manner that leaves voids between the piled boulder or rock fragments, and these voids are not infilled with solid material (soil, fine gravel/sand, etc). The <u>absence</u> of nesting rock is required in a *rock fill*.

NICET: National **I**nstitute for **C**ertification in **E**ngineering **T**echnologies. Engineering technicians that are tested by NICET may be certified at various levels of expertise (Levels I through IV) in different fields of construction.

Optimum Moisture: The moisture content at which the maximum density of a soil can be achieved during the compaction process. Each soil type (or blend of soil types) has its own specific optimum moisture content that is used as a guide for moisture conditioning during the grading process.

Over-excavation: The removal of the upper portion of soil on site. Usually performed under roadways or building pads and combined with replacement of structural fill

Pass: One trip or movement across a designated area by a piece of compaction equipment or machinery.

Percent Compaction: The ratio (expressed as a percentage) of the dry density of a soil (as determined by the nuclear gauge) to the maximum density of a soil (as determined by the maximum density test).

Pre-Saturation: The moisture conditioning (above optimum) of a pad subgrade or footing excavation prior to placing/pouring a foundation. Pre-saturation is usually performed on expansive soils to help limit future swelling that may be caused by seasonal rains or heavy landscape watering.

Pumping: May be observed as a rolling motion in soils compacted in an over-optimum condition (too wet). These pumping soils may, during the rolling process, become rutted or indented by rubber-tired equipment, usually leaving a bulging path in the soil parallel to the tire print.

Relative Compaction: A means of comparing the dry soil density in the field to the laboratory compaction curve. It equals the field dry density divided by the lab max dry density, and then is multiplied by 100 and expressed as a percentage.

Rock Fill: “Oversized material” (typically 6” or larger diameter) mixed/compacted during placement with a soil matrix in such a manner as to limit voids and nesting, allowing for a homogeneous, well-compacted fill.

Scarify (Rip): The act of loosening the exposed surface material (usually the upper 8-12 inches by ripper teeth on a dozer or blade) to mix, blend, moisten, or prepare for fill placement.

Structural Fill: Fill that is supporting manmade structures, including buildings, roadways, levees, and slopes. Structural Fill is typically compacted to 90 percent relative compaction.

Subdrain: A drainage system placed beneath the surface to drain surface water, or relieve hydrostatic pressure (such as water buildup behind a fill slope). It typically consists of filter material (rock and/or fabric) and a perforated drainpipe.

Toe: The contact point of the bottom of a fill or cut slope with a relatively level or pre-existing ground surface.

Transition Lot: A lot which a portion is to be cut (excavated) and a portion is to be filled (raised) to reach pad grade.

Unified Soil Classification System (USCS): A system used by soil engineers to classify soil for engineering purposes. A kind of a shorthand for describing soil types.