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SUBSURFACE SOIL INVESTIGATION

8812 Cliff Allen Point
Lot 4, Amended Plat, Barbarick Sub.
Colorado Springs, Colorado

PREPARED FOR:

Vollmer Road Partners, LLLP
6035 Erin Park Drive, Ste. 101
Colorado Springs, CO 80918

JOB NO. 194534

October 23, 2023

Respectfully Submitted,	**Reviewed by,**
RMG – Rocky Mountain Group	**RMG – Rocky Mountain Group**
Jared McElmeel, E.I.	**Tony Munger, P.E.**
Geotechnical Staff Engineer	**Sr. Geotechnical Project Manager**

COLORADO REGISTERED PROFESSIONAL ENGINEER
ANTHONY P. MUNGER
10/25/23
39818

TABLE OF CONTENTS

GENERAL SITE AND PROJECT DESCRIPTION

Project Description and Scope of Work

RMG has completed a geotechnical investigation for the two proposed new structures at Cliff Allen Point in the eastern portion of Colorado Springs, El Paso County, Colorado. One new structure is to be a "transfer station" consisting of a one-story pre-engineered metal building (PEMB) located in the northwest corner of the site. It is our understanding that this structure is to consist of cast-in-place foundation walls for the structure, plus a concrete "ramp" consisting of retaining walls along the two sides and the "front" wall of the structure along the upper side of the "ramp". The lower side of the "ramp" is to taper down to meet the existing grade. The other new structure is to be a shed located north of the existing structure, between two new vehicle scales. The purpose of the investigation was to evaluate the subsurface soil conditions and provide geotechnical design and construction criteria for the project. These services were provided in accordance with our Proposal for RMG Job No. 194534 dated September 13, 2023.

RMG understands the proposed PEMB is to have a footprint of approximately 10,240 square feet and paved access. The shed is to be approximately 250 to 300 square feet.

Existing Site Conditions

The site is currently a partially developed parcel in a commercial complex. At the time of the subsurface investigation, the site appears to have been slightly modified from a natural state. An existing structure is located near the eastern portion of the site and is to remain. The proposed new PEMB is to be constructed near the northwest corner of the site. The shed is to be located north of the existing structure along the access road to the new structure. The site is currently utilized as a storage yard and vegetation is limited to outer edges of the property. The location of the site is shown on the Site Vicinity Map, Figure 1.

FIELD INVESTIGATION AND LABORATORY TESTING

Drilling

The subsurface conditions on the site were investigated by drilling three (3) exploratory test borings to depths of approximately 20 to 35 feet within the proposed PEMB footprint and one 15-foot test boring to a depth of approximately 15 feet within the proposed shed location. The approximate locations of the test borings are presented in the Test Boring Location Plan, Figure 2.

The test borings were advanced with a power-driven, continuous-flight auger drill rig. Soil samples were obtained in general accordance with ASTM D-1586 utilizing a 2-inch OD split-barrel sampler or in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. Samples were returned to RMG's materials testing laboratory for testing and analysis. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figures 4 and 5.

Laboratory Testing

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis, Atterberg Limits, and Denver Swell/Consolidation tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. A Summary of Laboratory Test Results is presented in Figure 6. Soil Classification Data are presented in Figure 7.

SUBSURFACE CONDITIONS

Subsurface Materials

The test borings revealed the soil strata across the site to be fairly consistent from boring to boring. The subsurface materials encountered in the test borings consisted of silty sand fill, native silty to clayey sand, silty to clayey sandstone, and sandy claystone.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon visual classification of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

Groundwater

Groundwater was observed at depths of approximately 3 feet to 14.5 feet in the test borings at the time of drilling, and at depths of approximately 2 feet to 2.5 feet when checked after letting the water level in the borings stabilize for one day. Groundwater is expected to be a significant factor in foundation design. Fluctuations in groundwater and subsurface moisture conditions may occur due to seasonal variations in rainfall and other factors not readily apparent at this time.

Soil Parameters

The following table presents estimated in-situ soil parameters.

Soil Description	Unit Weight (lb/ft^3)	Friction Angle (degree)	Active Earth Pressure Ka	Passive Earth Pressure Kp	At-Rest Earth Pressure Ko	Modulus of Elasticity E_s (lb/in^2)	Poisson's Ratio μ_s
Native Sand, Silty	120	28	0.361	2.77	0.531	1,200	0.20
Sandstone, Silty to Clayey	125	30	0.333	3.00	0.500	3,500	0.30

Seismic Design

In accordance with the Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE/SEI 7-16, seismic design parameters have been determined for this site. The seismic site class has been interpreted from the results of the soil test borings drilled within the project site. The Applied Technology Council seismic design tool has been used to determine the seismic response acceleration parameters. The soil on this site is not considered susceptible to liquefaction.

The following recommended seismic design parameters are based upon Seismic Site Class D, and a 2-percent probability of exceedance in 50 years. The Seismic Design Category is “B”.

Period (sec)	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S_s	0.193	F_a	1.6	S_{ms}	0.309	S_{ds}	0.206
1.0	S_1	0.056	F_v	2.4	S_{m1}	0.135	S_{d1}	0.09

Notes: MCE = Maximum Considered Earthquake
g = acceleration due to gravity

CONCLUSIONS AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the test borings and the project characteristics previously described. If conditions are different from those described in this report or the project characteristics change, RMG should be retained to review and revise our recommendations as necessary.

Geotechnical Considerations

Based on the subsurface soil conditions encountered in our test borings, it is our opinion that a shallow foundation system is suitable for the proposed structures. Soil improvements required to achieve the allowable bearing capacity presented herein are discussed below. Deep foundation systems, while not anticipated to be necessary, are also a suitable alternative for the proposed structure(s). If a deep foundation system is desired, please contact personnel of RMG for revised recommendations.

Site Preparation

We recommend removing (overexcavating) the foundation areas and backfilling with compacted structural fill. The on-site material is suitable as structural fill. Site preparation should include clearing and grubbing the site of all vegetation, topsoil, and any other deleterious material within the construction area and disposing this material appropriately. Following clearing and grubbing, the area within the foundation footprint and a 2-foot perimeter beyond should be excavated to 1 foot below the bottom of footing elevation. The excavated material may be stockpiled for reuse as structural fill. An Open Excavation Observation should be made at this point to verify soil conditions are as reported in the soil boring logs herein.

Prior to the Open Excavation Observation, the upper 6 inches of the exposed subsurface soils should then be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) prior to placing structural fill.

Upon verification, the native material previously removed may be used as structural fill. The material should not be excessively wet, should be free of organic matter and construction debris, and should not contain rock fragments greater than 3-inches in any dimension. The fill material should be moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and placed in lifts of not more than 10 inches. Each loose lift should be compacted to a minimum of 95 percent of Modified Proctor maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698). The first density tests should be conducted when 12 inches of compacted fill have been placed.

Groundwater conditions are anticipated to be encountered at the time of foundation excavation and may result in either water flow into the excavation or destabilization of the foundation bearing soils, stabilization techniques should be implemented. Various stabilization methods can be employed and can be discussed at the time of construction. However, a method that affords potentially a reduced amount of overexcavation (versus other methods) and provides increased performance under moderately to severely unstable conditions is the use of a layered geogrid and structural fill system.

Additionally, dependent upon the rate of groundwater flow into the excavation, a geosynthetic vertical drain and/or perimeter drain may be required around the lower portions of the excavation to allow for installation of the layered geogrid and structural fill system.

Foundation Recommendations

Structures may be supported on shallow foundations bearing on approved soils when prepared in accordance with the recommendations above. When so prepared, a maximum allowable bearing pressure of 2,000 psf with no minimum dead load requirement may be used for design. The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection. When prepared and properly compacted, total settlement of 1-inch or less with differential settlement on the order of ½ inch or less is estimated. Settlement in granular material generally occurs relatively rapidly with construction loads. Long term consolidation settlement should not be an issue, provided that the site material is prepared as recommended above.

Retaining Wall Parameters

It is our understanding that two retaining walls along the sides of the new "ramp" that is to be constructed along one side of the new "transfer station", but that the type of retaining wall construction has not been determined yet. Based on the intended usage, we assume that the retaining walls will be constructed as either cast-in-place concrete retaining walls or mechanically-stabilized earth (MSE) retaining walls. Our recommendations for those two types of retaining walls are presented below. If an alternate retaining wall construction is to be used, contact personnel of RMG for revised recommendations.

Cast-in-Place Concrete Retaining Walls:

Foundation Soils

Retaining walls should be excavated to the design bearing elevation. An open excavation observation should be made at this point to verify soil conditions are as reported in the report referenced above and that the retaining wall is not bearing on existing fill or deleterious material. Upon verification the upper 6-inches of the exposed subsurface soils should then be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing concrete forms. When so prepared, a maximum allowable bearing pressure of 2,000 psf with no minimum dead load requirement may be used for design. The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. If these retaining walls are to be mechanically attached to (or poured monolithically with) the "transfer station" foundation, the bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection.

Retained Soils

On-site (undisturbed) sand soils:
Unit weight = 120 pcf
Active Equivalent Fluid Pressure = 40 pcf
Friction angle, ϕ = 28 deg.
Cohesion, c = 0 psf

Mechanically-Stabilized Earth (MSE) Retaining Walls:

Foundation Soils

Retaining walls should be excavated to the design bearing elevation. An open excavation observation should be made at this point to verify soil conditions are as reported in the report referenced above and that the retaining wall is not bearing on existing fill or deleterious material. Upon verification the upper 6-inches of the exposed subsurface soils should then be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing concrete forms.

On-site (undisturbed) sand soils or structural fill compacted as indicated herein:

Maximum allowable bearing pressure:	2,000 psf
Minimum dead load pressure:	None

It should be noted that MSE walls are generally designed and constructed with the expectation that some movement will occur. Compared to structurally reinforced retaining walls, MSE walls can tolerate a larger magnitude of movement. The amount of movement is dependent on several factors including (but not limited to) the wall height, construction methods, backfill selection and placement, and foundation soils.

Retained Soils

On-site (undisturbed) sand soils:
Unit weight = 120 pcf
Active Equivalent Fluid Pressure = 40 pcf
Friction angle, ϕ = 28 deg.
Cohesion, c = 0 psf

Reinforced Backfill Zone

Backfill materials placed within the Reinforced Backfill Zone shall consist of granular, non- or low-expansive soil containing no particles larger than 1½" in diameter, no more than 30% (by weight) passing through a #200 sieve screen, and a liquid limit of 25 or less and a plasticity index of 6 or less. The on-site sand soils are anticipated to be suitable for use in the Reinforced Backfill Zone.

Backfill should generally be free of topsoil, organics, particles greater than 4 inches in diameter, debris, or other deleterious material. Backfill should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 85 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Backfill soils prepared as indicated herein:
Unit weight = 120 pcf
Active Equivalent Fluid Pressure = 40 pcf
Friction angle, ϕ = 28 deg.
Cohesion, c = 0 psf

Retaining Wall Drainage

To reduce hydrostatic loading on retaining walls, a subsurface drain system should be placed behind the walls. The drain system should consist of free-draining granular soils containing less than five percent fines (by weight) passing a No. 200 sieve placed adjacent to the wall. The free-draining granular material should be graded to prevent the intrusion of fines or be encapsulated in a suitable filter fabric. A drainage system consisting of perforated drain lines (placed near the base of the wall) should be used to intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs for periodic maintenance. An impervious soil should be used in the upper layer of backfill to reduce the potential for water infiltration. As an alternative, a prefabricated drainage structure, such as geocomposite, may be used as a substitute for the granular backfill adjacent to the wall.

Open Excavation Observations

As referenced above, foundation excavations should be observed by RMG prior to placing structural fill, forms, or concrete to verify the foundation bearing conditions for each structure. Based on the conditions observed in the foundation excavation, the recommendations made at the time of construction may vary from those contained herein. In the case of differences, the Open Excavation Observation report shall be considered to be the governing document to be used to modify the site preparation recommendations as necessary.

Floor Slabs

The in-situ native sand soil should be stable at its natural moisture content. However, if the groundwater table is encountered, the native soils may need to “dry out” prior to being used under the foundation components and slabs. Any fill material placed below slabs should be granular, non-expansive material to reduce the potential for slab movement.

Areas under floor slabs should be overexcavated a minimum of 1-foot and the upper 6 inches of the exposed subsurface soils should then be scarified and moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) prior to placing structural fill. Floor slabs should bear upon a minimum of 1-foot of structural fill compacted to a minimum of 95 percent of Modified Proctor maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698). Non-structural slabs should be isolated from foundation members with expansion material. To reduce the possibility of capillary rise of groundwater into the floor slab, and to reduce the potential for concrete curling, a minimum 3-inch layer of ¾-inch crushed stone over 6-mil vapor retarder may be placed atop the compacted structural fill. A conventionally-reinforced or post-tensioned slab supported on stemwalls or grade beams may also be considered for strength and to reduce the potential for movement, curling, and differential settlement.

Exterior Concrete Flatwork

Reinforced concrete exterior slabs should be constructed similarly to floor slabs on compacted structural fill, with the additional caveat they be isolated from the building with expansion material and have a downturned reinforced thickened edge. Conventionally-reinforced or post-tensioned slabs supported on stemwalls or grade beams may also be considered to reduce the potential for movement, curling, and differential settlement.

Lateral Earth Pressures

Foundation and basement walls should be designed to resist lateral pressures. For non-expansive backfill materials, we recommend an equivalent fluid pressure of 40 pcf for design. Expansive soils or bedrock should not be used as backfill against walls. The above lateral pressure applies to level, drained backfill conditions. Equivalent Fluid Pressures for sloping/undrained conditions should be determined on an individual basis.

CONSTRUCTION CONSIDERATIONS

Surface Grading and Drainage

A contributing factor to foundation settlement and floor slab heave in Colorado Front Range soils is the introduction of excess water. Improper site grading and irrigation water are respectively the most common cause and source of excess water. The ground surface should be sloped from the building with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. Where a 10-foot zone cannot be achieved, a well-defined swale should be created a minimum 5 feet from the foundation and parallel with the wall, with a minimum slope of 2 percent to collect the surface water and transport it around and away from the structure. Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure(s). Future maintenance operations should include activities to maintain the surface grading and drainage recommendations herein to help prevent water from being directed toward and/or ponding near the foundations.

Landscaping should be selected to reduce irrigation requirements. Plants used close to foundation walls should be limited to those with low moisture requirements and irrigated grass should not be located within 5 feet of the foundation. To help control weed growth, geotextiles should be used below landscaped areas adjacent to foundations. Impervious plastic membranes are not recommended. Irrigation devices should not be placed within 5 feet of the foundation. Irrigation should be limited to the amount sufficient to maintain vegetation. Application of excess water will increase the likelihood of slab and foundation movements.

Perimeter Drain

The site soil is generally anticipated to be well-draining, and groundwater was encountered at depths anticipated to impact the proposed construction. A subsurface perimeter drain is recommended around portions of the structure which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas if applicable. Where slab-on-grade foundation systems are utilized, a subsurface perimeter drain will not be required around the foundation. An underslab drain should be anticipated.

Underslab Drain

Shallow groundwater conditions were encountered in the test borings at the time of field exploration. An underslab drainage layer is also be recommended to help intercept groundwater before it enters the slab area should the groundwater levels rise. Careful attention should be paid to grade and discharge of the drain pipe. A typical drain detail is presented in Figure 8.

It must be understood that the drain is designed to intercept some types of subsurface moisture and not others. Therefore, the drain could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area.

Foundation Stabilization

If groundwater conditions encountered at the time of foundation excavation result in either water flow into the excavation or destabilization of the foundation bearing soils, stabilization techniques should be implemented. Various stabilization methods can be employed and can be discussed at the time of construction. However, a method that affords potentially a reduced amount of overexcavation (versus other methods) and provides increased performance under moderately to severely unstable conditions is the use of a layered geogrid and structural fill system.

Additionally, dependent upon the rate of groundwater flow into the excavation, a geosynthetic vertical drain and an overexcavation perimeter drain may be required around the lower portions of the excavation to allow for installation of the layered geogrid and structural fill system.

Concrete

Sulfate testing was performed on selected samples based on ASTM C1580. Test results showed 0.0% by weight, indicating the soils present Class 0 (negligible) sulfate exposure. Based on these results Type I/II cement or an equivalent mixture according to ACI 201.2R-10 is suggested for concrete in contact with the subsurface materials. Cement type shall be designed and approved by a licensed Colorado Professional Engineer and Foundation Designer. Calcium chloride should not be used for the onsite soils. The concrete should not be placed on frozen ground. If placed during periods of cold temperatures, the concrete should be kept from freezing. This may require covering the concrete with insulated blankets and heating. Concrete work should be completed in accordance with the latest applicable guidelines and standards published by ACI.

Exterior Backfill

Backfill around foundation stemwalls and other buried structures should be placed in loose lifts of not more than 10-inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to 85 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or to 92 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) on exterior sides of walls in landscaped areas. In areas where backfill supports pavement and concrete flatwork, the materials should be compacted to 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or to 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698).

Fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

The appropriate government/utility specifications should be used for fill placed in utility trenches. If material is imported for backfill, the material should be approved by the Geotechnical Engineer prior to hauling it to the site.

The backfill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. Backfill should be compacted by mechanical means, and foundation walls should be braced during backfilling and compaction.

Structural Fill - General

Areas to receive structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or to 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) prior to placing structural fill. Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

Structural fill should be placed in loose lifts of not more than 10-inches, moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) or to 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698). The materials should be compacted by mechanical means.

Materials used for structural fill should be approved by the RMG prior to use. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement.

To verify the condition of the compacted soils, density tests should be performed during placement. The first density tests should be conducted when 24 inches of fill have been placed.

CLOSING

This report has been prepared for the exclusive purpose of providing geotechnical engineering information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

This report has been prepared for the exclusive use by **Vollmer Road Partners, LLLP** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG must be retained to review and revise the recommendations presented in this report as appropriate.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES

NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects

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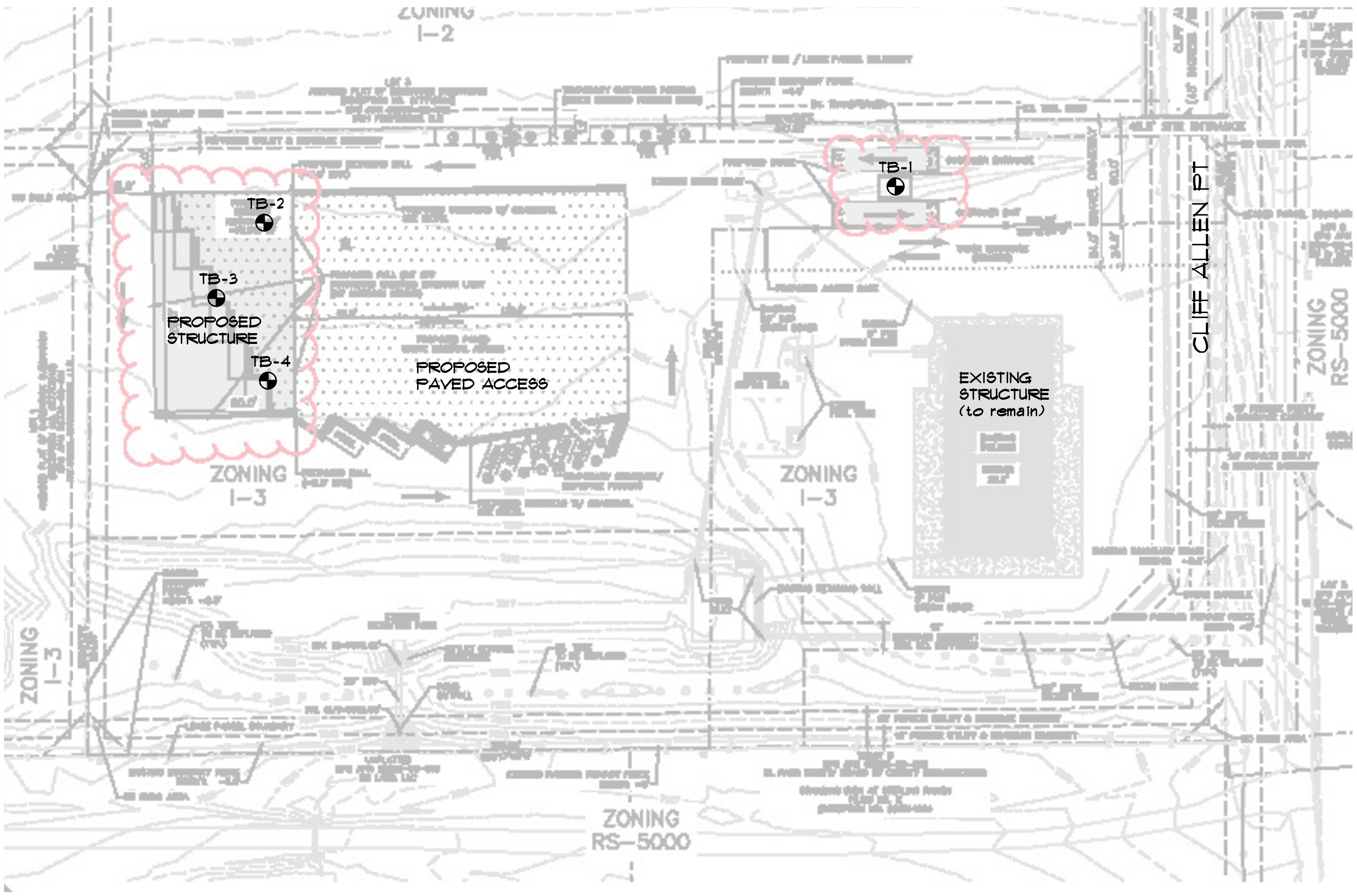
SITE VICINITY MAP

8812 CLIFF ALLEN POINT
LOT 4, AMENDED PLAT BARBARICK SUB
EL PASO COUNTY, CO
VOLLMER ROAD PARTNERS, LLLP

JOB No. 194534

FIG No. 1

DATE 10-23-2023



REFERENCE
NOT TO SCALE

BASE MAP PROVIDED BY KIMLEY HORN

● DENOTES APPROXIMATE
LOCATION OF TEST BORINGS

JOB No. 194534

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8812 CLIFF ALLEN POINT
LOT 4, AMENDED PLAT
BARBARIK SUB

EL PASO COUNTY, CO
VOLLMER ROAD PARTNERS, LLLP

ENGINEER: TM
DRAWN BY: KZ
CHECKED BY: TM
ISSUED: 10-23-2023

REVISION:	DATE:	JOB #:

TEST BORING
LOCATION MAP

SHEET No.
FIG-2

SOILS DESCRIPTION

▤	CLAYSTONE
▩	FILL: SAND, SILTY TO CLAYEY
⁙	SANDSTONE
▥	SILTY SAND
▧	SILTY TO CLAYEY SAND

SYMBOLS AND NOTES

■ XX	STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL INTO THE SOIL/ROCK BY DROPPING A 140 LB. HAMMER 30", ASTM D-1556. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).
▽	MEASURED GROUNDWATER LEVEL
⧗ BULK	DISTURBED BULK SAMPLE
◪ XX	CALIFORNIA SAMPLE - PENETRATION TESTS MADE BY DRIVING SAMPLER INTO THE SOIL/ROCK BY DROPPING A 140 LB. HAMMER 30", ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).
⊠	DIRECT PUSH SAMPLE.

ROCKY MOUNTAIN GROUP

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EXPLANATION OF TEST BORING LOGS

JOB No. 194534

FIGURE No. 3

DATE Oct/23/2023

TEST BORING: **1**

DATE DRILLED:
9/25/23
GROUNDWATER @ 2.0 '
9/26/23

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, with asphalt fragments, dark gray, moist	∇	▩			
SAND, SILTY, with gravel, tan to gray, medium dense, moist to wet		▨	■	18	12.8
	5	▨			
SANDSTONE, SILTY TO CLAYEY, with gravel, tan to gray, hard to very hard, moist to wet		⁞	■	50/9"	16.1
	10	⁞			
	15	⁞	■	50/7"	14.0

TEST BORING: **2**

DATE DRILLED:
9/25/23
GROUNDWATER @ 2.0 '
9/26/23

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, with asphalt fragments, dark gray, moist	∇	▩			
SAND, SILTY TO CLAYEY, with gravel, tan, moist to wet		▨			
SANDSTONE, SILTY TO CLAYEY, with gravel, tan to gray, medium hard to very hard, moist to wet	5	⁞	■	41	11.9
	10	⁞	■	50/10"	18.4
	15	⁞	■	50/10"	12.6
	20	⁞	■	50/7"	12.4

ROCKY MOUNTAIN GROUP

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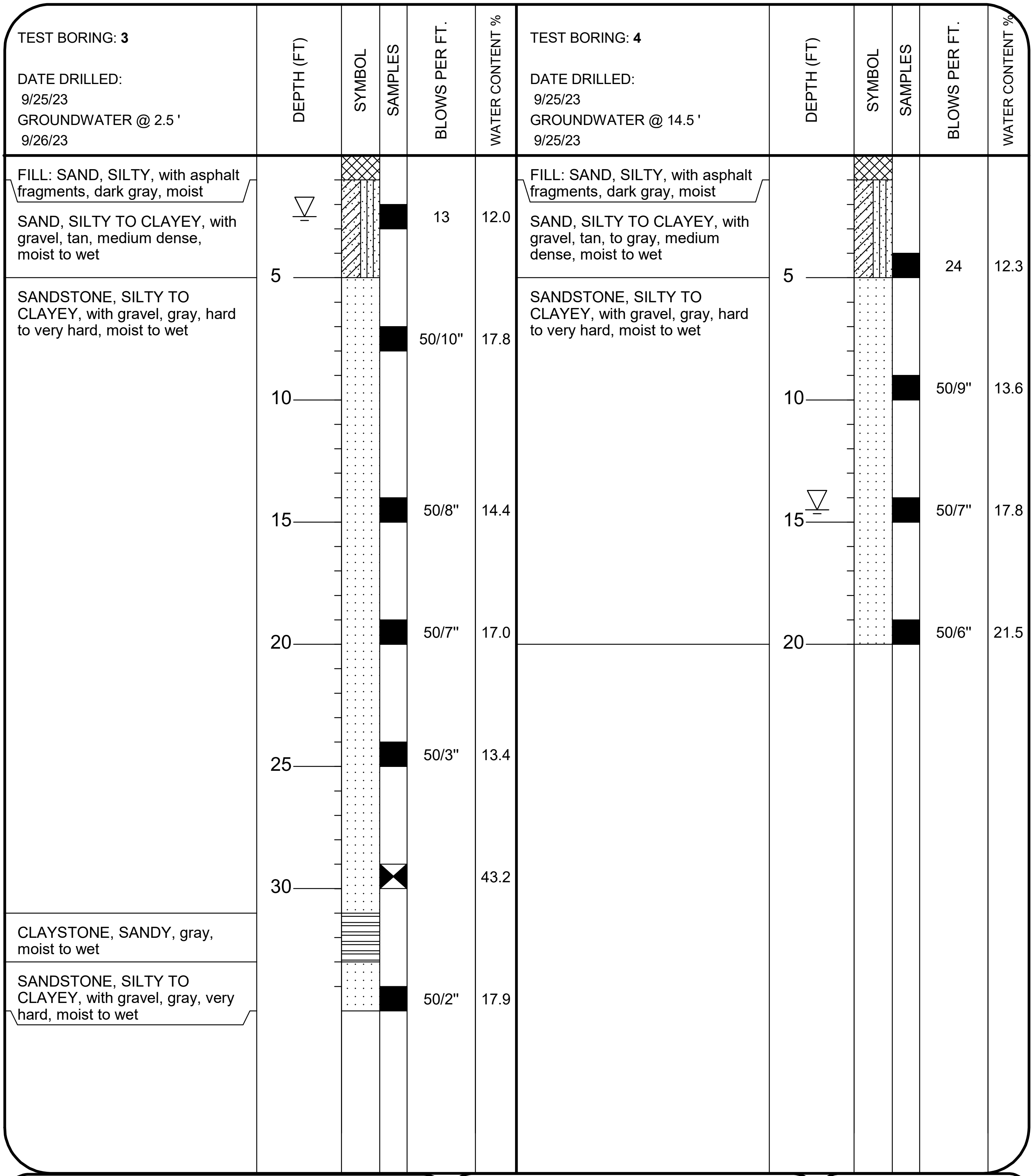
TEST BORING LOG

JOB No. 194534

FIGURE No. 4

DATE Oct/23/2023



TEST BORING: **3**

DATE DRILLED:
9/25/23
GROUNDWATER @ 2.5 '
9/26/23

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, with asphalt fragments, dark gray, moist					
SAND, SILTY TO CLAYEY, with gravel, tan, medium dense, moist to wet	▽			13	12.0
	5				
SANDSTONE, SILTY TO CLAYEY, with gravel, gray, hard to very hard, moist to wet				50/10"	17.8
	10				
	15			50/8"	14.4
	20			50/7"	17.0
	25			50/3"	13.4
	30				43.2
CLAYSTONE, SANDY, gray, moist to wet					
SANDSTONE, SILTY TO CLAYEY, with gravel, gray, very hard, moist to wet				50/2"	17.9

TEST BORING: **4**

DATE DRILLED:
9/25/23
GROUNDWATER @ 14.5 '
9/25/23

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, with asphalt fragments, dark gray, moist					
SAND, SILTY TO CLAYEY, with gravel, tan, to gray, medium dense, moist to wet	5			24	12.3
SANDSTONE, SILTY TO CLAYEY, with gravel, gray, hard to very hard, moist to wet					
	10			50/9"	13.6
	▽ 15			50/7"	17.8
	20			50/6"	21.5

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TEST BORING LOG

JOB No. 194534

FIGURE No. 5

DATE Oct/23/2023

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
1	2.0	12.8		39	24	12.3	20.2			SC
1	7.0	16.1								
1	14.0	14.0		36	20					
2	4.0	11.9								
2	9.0	18.4				3.6	11.3			
2	14.0	12.6								
2	19.0	12.4								
3	2.0	12.0								
3	7.0	17.8		42	25	0.3	19.1			SC
3	14.0	14.4								
3	19.0	17.0								
3	24.0	13.4		30	10		27.2			SC
3	29.0	43.2								
3	34.0	17.9								
4	4.0	12.3		40	24	4.0	22.5			SC
4	9.0	13.6								
4	14.0	17.8								
4	19.0	21.5								

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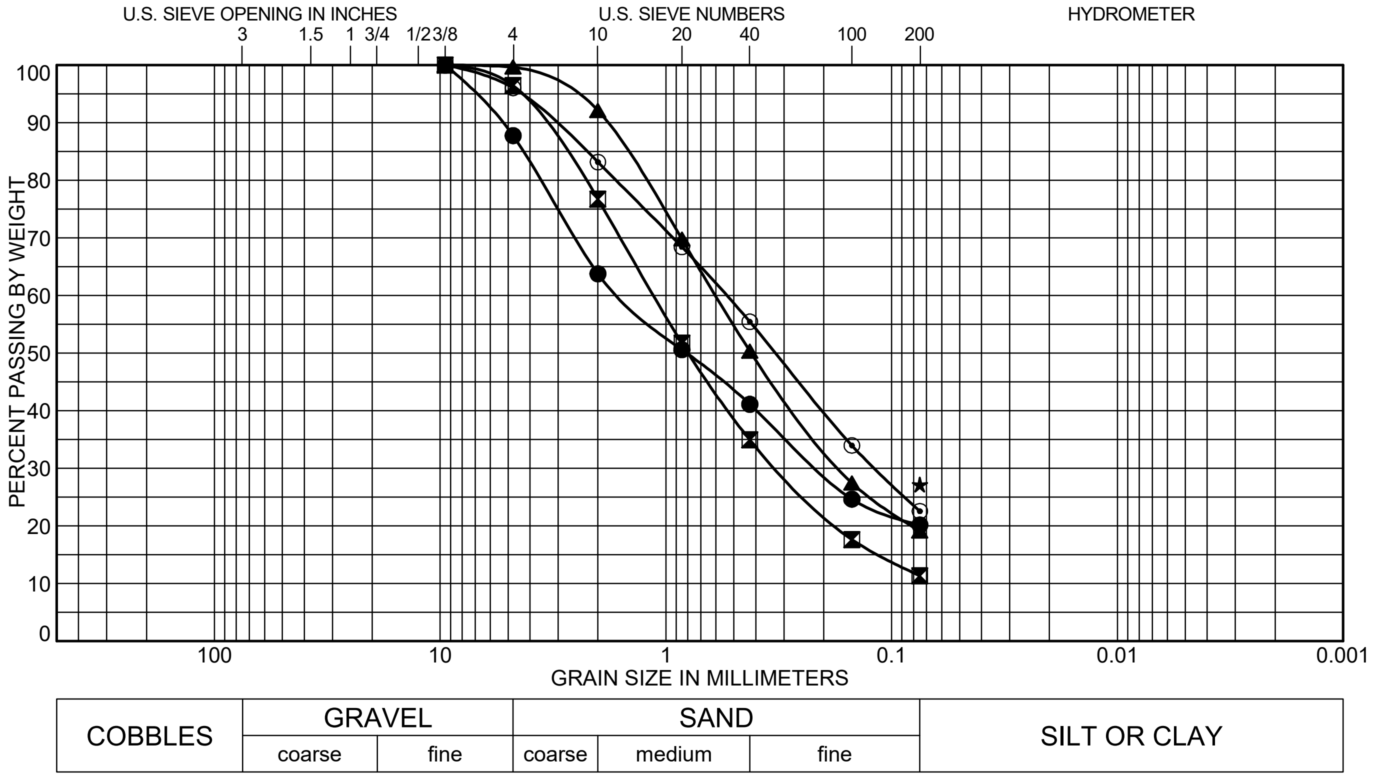
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 194534
FIGURE No. 6
PAGE 1 OF 1
DATE Oct/23/2023



	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**1**	**2.0**	**CLAYEY SAND(SC)**	**39**	**15**	**24**
⧗	**2**	**9.0**				
▲	**3**	**7.0**	**CLAYEY SAND(SC)**	**42**	**17**	**25**
★	**3**	**24.0**	**CLAYEY SAND(SC)**	**30**	**20**	**10**
⦿	**4**	**4.0**	**CLAYEY SAND(SC)**	**40**	**16**	**24**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**1**	**2.0**	**12.3**	**67.6**	**20.2**	
⧗	**2**	**9.0**	**3.6**	**85.1**	**11.3**	
▲	**3**	**7.0**	**0.3**	**80.5**	**19.1**	
★	**3**	**24.0**			**27.2**	
⦿	**4**	**4.0**	**4.0**	**73.5**	**22.5**	

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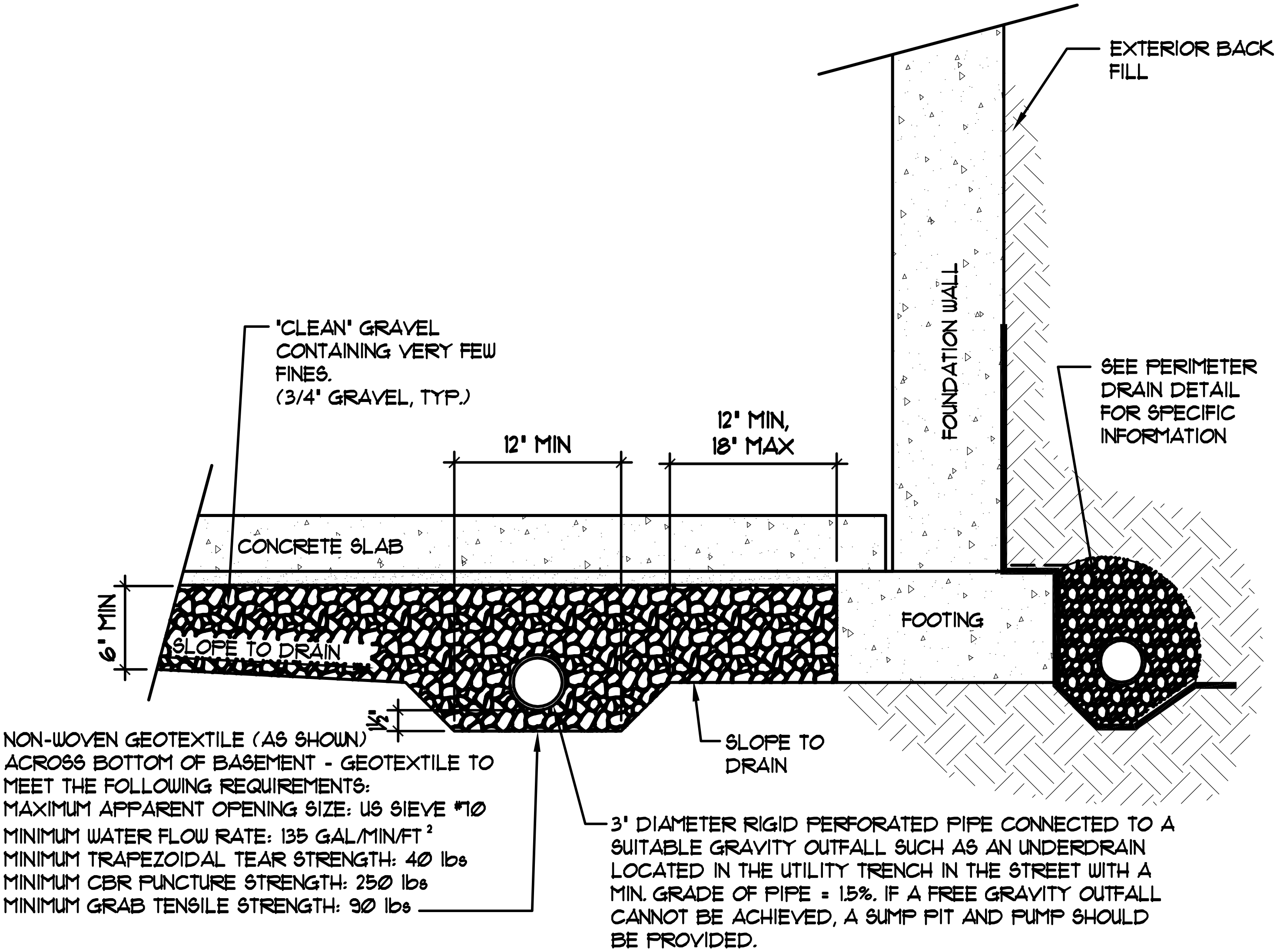
SOIL CLASSIFICATION DATA

JOB No. 194534

FIGURE No. 7

DATE Oct/23/2023



NON-WOVEN GEOTEXTILE (AS SHOWN) ACROSS BOTTOM OF BASEMENT - GEOTEXTILE TO MEET THE FOLLOWING REQUIREMENTS:
MAXIMUM APPARENT OPENING SIZE: US SIEVE #70
MINIMUM WATER FLOW RATE: 135 GAL/MIN/FT ^{2}
MINIMUM TRAPEZOIDAL TEAR STRENGTH: 40 lbs
MINIMUM CBR PUNCTURE STRENGTH: 250 lbs
MINIMUM GRAB TENSILE STRENGTH: 90 lbs

3" DIAMETER RIGID PERFORATED PIPE CONNECTED TO A SUITABLE GRAVITY OUTFALL SUCH AS AN UNDERDRAIN LOCATED IN THE UTILITY TRENCH IN THE STREET WITH A MIN. GRADE OF PIPE = 1.5%. IF A FREE GRAVITY OUTFALL CANNOT BE ACHIEVED, A SUMP PIT AND PUMP SHOULD BE PROVIDED.

GENERAL NOTES:

1. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.

2. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.

3. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.

4. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION

5. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.

UNDERSLAB DRAIN

FIG No. 8