



Geotechnical Engineering Report

**Industrial Warehouse
Monument, Colorado**

October 2, 2020

Terracon Project No. 23205102

Prepared for:

Monument Industrial, LLC
Wichita, Kansas

Prepared by:

Terracon Consultants, Inc.
Colorado Springs, Colorado



October 2, 2020

Monument Industrial, LLC
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Wichita, Kansas 67206



Attn: Mr. Curtis Gibson
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Re: Geotechnical Engineering Report
Industrial Warehouse
Baptist Road and Old Denver Highway
Monument, Colorado
Terracon Project No. 23205102

Dear Mr. Gibson:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P23205102 dated September 2, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Tyler A. Compton, P.E.
Project Engineer

Robert M. Hernandez, P.E.
Geotechnical Services Manager



REPORT TOPICS

INTRODUCTION.....	1
SITE CONDITIONS.....	1
PROJECT DESCRIPTION.....	2
GEOTECHNICAL CHARACTERIZATION.....	3
GEOTECHNICAL OVERVIEW	6
EARTHWORK	7
SHALLOW FOUNDATIONS.....	12
SEISMIC CONSIDERATIONS	14
FLOOR SLABS	14
LATERAL EARTH PRESSURES	16
PAVEMENTS.....	18
CORROSIVITY	22
GENERAL COMMENTS.....	22
FIGURES	24

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the **GeoReport** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
PHOTOGRAPHY LOG
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic ¹	Overview Statement ²
Project Description	We understand the project includes construction of an approximately 130,000 to 140,000 square foot, single-story industrial warehouse. Other site development includes paved parking areas and underground site utilities.
Geotechnical Characterization	Sand soils to depths of about 12 to 22 feet in in Borings B-1 to B-4, and to the full depths of exploration in the remaining borings, depths of about 20.5 to 25.5 feet. Sandstone bedrock underlying sand soils in Borings B-1 to B-4. Groundwater was encountered at depths between 16 and 25.5 feet while drilling in some areas
Earthwork	On-site sand soils are considered acceptable for re-use as structural fill beneath foundations, floor slabs, and pavements. On-site sand soils may also be re-used as general fill outside of structural areas. Although not anticipated, if encountered, the on-site sandstone bedrock observed may be re-used as structural fill, and/or general fill outside of structural areas provided it is processed to a soil like consistency with a maximum particle size of 3 inches. Areas of loose and/or low strength soils could be encountered in excavations and will require corrective work at the time of construction. Groundwater could be encountered during construction, and if encountered, will likely need to be addressed with a dewatering system during construction.
Shallow Foundations	Shallow foundations bearing on a minimum of 3 feet of compacted structural fill are considered suitable for support of structures for the project. Allowable bearing pressure = 2,000 psf Expected movements: about 1-inch total, differential of about ½ to ¾ of total.
Deep Foundations	Deep foundations are not considered necessary for this site based on our understanding of the proposed development.
Pavements	With subgrade prepared as noted in Earthwork . Concrete: <ul style="list-style-type: none"> ■ 5 inches Portland Cement Concrete (PCC) in Light Duty areas placed on 12 inches of engineered fill ■ 6 inches PCC in Medium Duty areas placed on 12 inches of engineered fill ■ 8 inches PCC in Heavy Duty areas placed on 24 inches of engineered fill Asphalt: <ul style="list-style-type: none"> ■ 4 inches Asphaltic Concrete (AC) over 4 inches granular base in Light Duty areas placed on 12 inches of engineered fill ■ 4½ inches AC over 6 inches granular base in Medium Duty areas placed on 12 inches of engineered fill ■ 6½ inches AC over 8 inches granular base in Heavy Duty areas, placed on 24 inches of engineered fill

Topic ¹	Overview Statement ²
General Comments	This section contains important information about the limitations of this geotechnical engineering report.
<ol style="list-style-type: none">1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.	

Geotechnical Engineering Report
Industrial Warehouse
Baptist Road and Old Denver Highway
Monument, Colorado
Terracon Project No. 23205102
October 2, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Industrial Warehouse project to be located northeast of the intersection of Baptist Road and Old Denver Highway in Monument, Colorado. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil and rock conditions
- Groundwater conditions
- Site preparation and earthwork
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 19 test borings to depths ranging from approximately 4 to 25½ feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil and rock samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located northeast of the intersection of Baptist Road and Old Denver Highway in Monument, Colorado. Approximate 11-acre site. See Site Location

Item	Description
Existing Improvements	The site is currently undeveloped. The site is bordered to the north and west by relatively undeveloped land similar in appearance to the subject site, to the east by Interstate 25, and to the south by a Valero Gas Station.
Current Ground Cover	Earthen, light to moderate vegetation
Existing Topography	The ground surface appears to slope down to the southeast at an approximate 50H:1V (Horizontal:Vertical) gradient based on information available through Google Earth. Reportedly, there is about 10 feet of elevation change across the site

We also collected photographs at the time of our field exploration program. Representative photos are provided in our **Photography Log**.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Our understanding of the project comes from email correspondence between August 18 and September 2, 2020, that included an aerial image of the approximate site boundaries and a Conceptual Infrastructure Plan, dated August 28, 2020.
Project Description	We understand the project includes construction of an approximately 130,000 to 140,000 square foot, single-story industrial warehouse. Other site development includes paved parking areas and underground site utilities.
Building Construction	Reportedly the facility will be of concrete tilt-up construction. We anticipate that a shallow foundation system and a floor slab-on-grade is preferred.
Finished Floor Elevation	Unknown, anticipated to be within 4 feet of existing site grades
Maximum Loads (assumed)	<ul style="list-style-type: none"> ■ Columns: 150 kips ■ Walls: 5 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading/Slopes	Up to 4 feet of cut and fill is assumed to develop final grades. Final slope angles no steeper than 3H:1V (Horizontal: Vertical) up to 5 feet in height are assumed.
Below-Grade Structures	None reported as part of site development

Item	Description
Free-Standing Retaining Walls	None reported as part of site development
Detention Pond	A detention pond is shown off-site that our client may use for stormwater. However, an on-site detention pond may be constructed should our client not be able to utilize the off-site detention. The location of the potential on-site detention may be within the southern portion of the site shown as "Future Truck Parking" on the provided Site Plan. The planned depth of the pond is not known at this time but has been reported to be about 3 feet.
Pavements	<p>Paved drive lanes and parking areas will be constructed as part of site development. We expect both portland cement concrete and asphalt concrete sections will be utilized depending on the application. Specific traffic loading was not available at the time of our report preparation. We have assumed the following traffic at this site:</p> <ul style="list-style-type: none"> ■ Light Duty pavement areas (autos/light trucks): 27,000 ESALS ■ Medium Duty pavement areas (autos/light trucks drive lanes): 110,000 ESALS ■ Heavy Duty pavement areas (tractor trailers): 1,100,000 ESALS <p>Traffic values should be approved by the owner prior to paving operations.</p>

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Sand	Sand soils with varying amounts of silt, fine to coarse grained, loose to dense
2	Weathered Bedrock	Weathered sandstone bedrock, fine to coarse grained, medium hard
3	Bedrock	Sandstone bedrock, fine to coarse grained, hard to very hard

As noted in the **General Comments**, the characterization is based upon widely spaced borings at the site, and variations are likely. Stratification boundaries on the boring logs represent the

approximate location of changes in soil and material types; in situ, the transition between materials may be gradual.

Groundwater Conditions

The boreholes were observed while drilling and sampling for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in [Exploration Results](#) and are summarized on the following page.

Boring Number	Approximate Depth to Bottom of Boring (feet) ¹	Approximate Depth to Groundwater While Drilling (feet) ¹
B-1	24.5	17
B-2	20.5	Not observed
B-3	25	16
B-4	20.5	Not observed
B-5	25.5	25
B-6	20.5	Not observed
B-7	25.5	Not observed
B-8	20.5	Not observed
B-9	25.5	Not observed
B-10	20.5	Not observed
B-11	25.5	Not observed
B-12	10	Not observed
B-13	10	Not observed
B-14	15	Not observed
B-15	10	Not observed
B-16	10	Not observed

^{1.} Below ground surface

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Zones of perched and/or trapped groundwater may also occur at times in the subsurface soils overlying bedrock, on top of the bedrock surface or within permeable fractures in the bedrock materials. The location and amount of perched water is dependent upon several factors, including

hydrologic conditions, type of site development, irrigation demands on or adjacent to the site, seasonal fluctuations, and weather conditions.

Laboratory Testing

The results of laboratory testing completed for this project can be found in the **Exploration Results** section of this report. Selected laboratory test results are presented in the paragraphs below.

Laboratory test results indicate that the sand soils tested exhibit low compression when subjected to an applied load of 500 pounds per square foot (psf) at in-situ water contents. When exposed to increases in moisture content at an applied load of 500 psf, the sand soils tested exhibit low to high compression followed by further low to high compression at increased loadings up to 4,000 psf.

A sample of the sandstone bedrock tested exhibited low to moderate compression when subjected to an applied load of 500 pounds per square foot (psf) at in-situ water contents. When exposed to increases in moisture content at an applied load of 500 psf, the bedrock sample tested exhibited additional low to moderate compression followed by further low to moderate compression at increased loadings up to 4,000 psf.

Based on the relatively granular nature of the soils, it is our opinion the observed high compression within the tested sand soils may have been a result of sample disturbance, either during sampling or preparation for laboratory testing. Similarly, it is our opinion the sample of tested sandstone bedrock may have also been disturbed based on the observed moderate compression. It is our opinion the on-site sand soils would exhibit low to moderate compression and the sandstone bedrock would exhibit low compression under increased loading.

Bulk samples of the subgrade soils were collected from Boring B-13 at a depth of approximately 1 to 5 feet below existing site grade. The samples were tested for maximum dry density and optimum water content in accordance with ASTM D698. An R-value was also performed on the bulk sample of soils. The results of this testing are summarized in the table below.

Boring	Sample Depth (feet)	Maximum Dry Density (pcf)	Optimum Water Content (%)	Tested R-value	R-Value ¹
B-13	1-5	122.7	10.0	65.8	35

1. Value recommended for use based on the results of the laboratory tests and to account for variability of site soils.

Infiltration Testing using Percolation Test Method

One profile test hole and three percolation test holes were advanced to depths of about 15 feet and 4 feet, respectively, below existing site grades. A representative from Terracon performed percolation testing at depths of about 4 feet below existing site grade. The average of the last three percolation rates were used and a reduction factor was applied based on the City of Colorado Springs Infiltration Testing using Percolation Test Method requirements. The following table presents a summary of the infiltration rates as determined by the referenced procedure:

Boring Number	Profile	Infiltration Rate (min/in)
PT-1	Well Graded Sand with Silt	2.5
PT-2	Well Graded Sand with Silt	2.4
PT-3	Well Graded Sand with Silt	2.4

GEOTECHNICAL OVERVIEW

Based on the results of our field investigation, laboratory testing program and geotechnical analyses, development of the site is considered feasible from a geotechnical viewpoint provided that the conclusions and considerations provided herein are incorporated into the design and construction of the project. We have identified the following geotechnical conditions that could impact design and construction of the proposed project.

The building may be constructed on shallow foundations bearing on structural fill and floor slabs-on-grade bearing on structural fill are considered suitable. Additional foundation and floor slab information pertaining to the building can be found in the **Floor Slabs** and **Shallow Foundations** sections of this report.

Support of pavements on structural fill is also considered suitable. Additional information pertaining to the design and construction of pavements can be found in the **Pavements** section of this report. The **General Comments** section provides an understanding of the report limitations.

Compressible Soils

Potentially compressible soils are present on this site and this report provides recommendations to help mitigate the effects of soil compression. However, even if these procedures are followed, some movement and distress should be anticipated. The severity of distress will probably increase if any modification of the site results in excessive wetting or drying of the on-site soils or bedrock. Eliminating the risk of movement and distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. These measures could include the use of a deep foundation system or ground improvement methods, and we would be happy to discuss these measures if requested.

Low Strength and Loose Soils

Test boring data indicate that loose and low strength soils may also be encountered. Loose and low strength soils, where encountered in foundation, slab, utility, and pavement excavations, will likely require some corrective work. Corrective work could involve removal and re-compaction or replacement, the use of geotextiles, or deepening excavations to suitable bearing materials. In any event, Terracon should be contacted to observe excavations to evaluate conditions and to provide guidance concerning corrective work (if needed).

Existing Fill Materials

Previously placed man-made fill soils were not observed in our borings. However, based on the development to the south, man-made fill soils might be observed during mass grading activities. We do not possess information on if fill soils were placed at this site, or if they would have been placed under the observation and direction of a geotechnical engineer. If observed, it is our opinion the fill materials should not be used to support foundations, floor slabs, or pavements without complete removal and replacement with compacted structural fill. If observed, the fill soils would need to be evaluated at the time of construction to determine if they are suitable for reuse as structural or general fill.

Groundwater

During our field exploration groundwater was encountered at depths between 17 and 25 feet after completion of drilling. Groundwater could be encountered during construction, and if encountered, a temporary dewatering system consisting of well points or shallow trenches leading to a sump pit where the water could be removed by pumping will be necessary. The individual contractor(s) should be made aware of the possibility of encountering groundwater, and plan for dewatering during construction. If groundwater is encountered in foundation excavations, we recommend that a permanent foundation perimeter drain system be included in the design of the foundations.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed building and pavement areas. We anticipate root depths to extend to depths on the order of 6 to 12 inches in grass areas and on the order of 5 feet around trees and shrubs. Stripped materials consisting of vegetation, unsuitable fills, and organic materials should be wasted from the site or used to revegetate landscaped areas after completion of grading operations. All exposed surfaces to receive fill should be free of mounds and depressions that could prevent uniform compaction.

Although evidence of underground facilities such as grease pits and septic tanks were not observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

The bottom of foundation, floor slab, and pavement over-excavations should be proof-rolled and/or probed with a metal T-probe, as appropriate, to aid in locating loose, soft, or otherwise undesirable areas. The poof-rolling should be performed under the direction of the Geotechnical Engineer with an adequately loaded vehicle such as a fully loaded tandem-axle dump truck. Areas excessively deflecting 1-inch or greater under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Unacceptable areas delineated by the proof-roll or probing should be removed or mitigated in place prior to placing fill, foundation and slab concrete, and/or pavements. Such areas should either be removed or modified by stabilizing with geotextile. Material that is determined to be excessively wet or dry should be removed, or moisture conditioned and re-compacted.

Fill Material Types

Fill required to achieve design grades should be classified as structural fill and general fill. Structural fill is material used below or within 10 feet of structures and within 2 feet of drive lane and parking area subgrade. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Type ¹	USCS Classification	Acceptable Locations for Placement
On-site sand soils	SW-SM, SP-SM, SM	On-site sand soils are considered acceptable for re-use as structural fill beneath foundations, floor slabs, and pavements. The on-site sand soils may also be re-used as general fill outside of structural areas.

Soil Type ¹	USCS Classification	Acceptable Locations for Placement
Bedrock	N/A	If encountered, the on-site sandstone bedrock may be re-used as structural and general fill provided it is processed to a soil like consistency with a maximum particle size of 3 inches. However, based on the observed depth to top of bedrock, we don't anticipate this would occur for shallow foundation excavations.
Imported soils	Varies	Imported soils meeting the gradation outlined herein can be considered suitable for use as structural and/or general fill.

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Imported soils for use as structural and/or general fill should conform to the following CDOT Class I Structure Backfill requirements:

Gradation	Percent finer by weight (ASTM C136)
2"	100
No. 4 Sieve	30-100
No. 50 Sieve	10-60
No. 200 Sieve	5-20

Soil Properties	Value
Liquid Limit	35 (max)
Plastic Index	6 (max)

Imported soils for use as structural fill within 2 feet of pavement subgrade should also have a minimum laboratory tested R-value of 35.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill
Maximum lift thickness	8 to 10 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack, plate compactor) is used

Item	Structural Fill
Minimum compaction requirements 1, 2, 3	98% of the materials maximum dry density within the upper 12 inches of pavement subgrade 95% of the materials maximum dry density for support of foundations, slabs, at depths greater than 12 inches from pavement subgrade, outside of structural areas and native surfaces to receive fill
Water content range 2, 4	Within three percent of optimum water content (granular soils)

1. We recommend that engineered fill be tested for water content and compaction during placement. Should the results of the in-place density tests indicate the specified water or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified water and compaction requirements are achieved.
2. Maximum dry density and optimum water content as determined by the Standard Proctor test (D698).
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 85% relative density (ASTM D4253 and D4254) beneath foundations, floor slabs, and pavements, and for fills 6 feet in thickness or greater, and 75% relative density outside of structural areas and for native surfaces to receive fill.
4. Water contents should be maintained low enough to allow for satisfactory compaction to be achieved without the compacted fill material becoming unstable under the weight of construction equipment or during proof-rolling. Indications of unstable soil can include pumping or rutting.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of foundations, floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to foundation, floor slab or pavement construction.

Depending on seasonal groundwater fluctuations, groundwater may be encountered during construction and if encountered will likely cause difficulties. Groundwater should be expected in utility trench excavations depending on planned depths. Dewatering of excavations and utility trenches may be required during construction. Groundwater seeping into excavations at this site could most likely be controlled by the use of well points or shallow trenches leading to a sump pit where the water could be removed by pumping; however, the requirements for properly dewatering excavations are beyond the scope of services provided for this project.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing pressure ^{1, 2}	2,000 psf (foundations bearing on structural fill)
Required Bearing Stratum ³	Minimum 3 feet of compacted structural fill.
Foundation Dimensions	<u>Column</u>
	Minimum width: 18 inches
	Maximum width: 9 feet
	<u>Continuous</u>
	Minimum width: 16 inches
	Maximum width: 5 feet
Ultimate Passive Resistance ⁴ (equivalent fluid pressures)	330 pcf
Ultimate Coefficient of Sliding Friction ⁵	0.35
Minimum Embedment below Finished Grade ⁶	Exterior and/or unheated areas: 30 inches Interior heated areas: 18 inches
Estimated Total Movement from Structural Loads ²	About 1 inch
Estimated Differential Movement ^{2, 7}	About ½ to ¾ of total movement

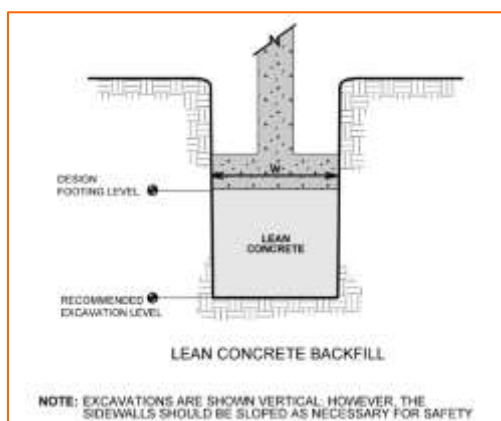
1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. Values assume that exterior grades are no steeper than 20% within 10 feet of structures.
2. Value provided is based on our project understanding noted in the **Project Description**. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, the quality of the earthwork operations, and maintaining uniform soil water content throughout the life of the structure. The estimated

Item	Description
	movements are based on maintaining uniform soil water content during the life of the structure. Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage and irrigation practices should be incorporated into the design and operation of the facility. Failure to maintain soil water content and positive drainage will nullify the movement estimates provided above.
3.	Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the Earthwork .
4.	Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5.	Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6.	Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7.	Differential movements are as measured over a span of 50 feet.

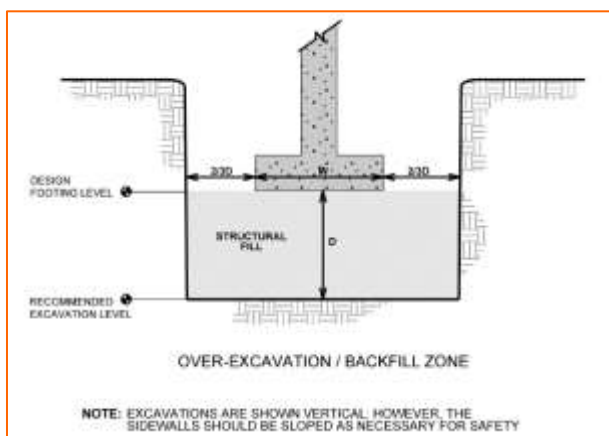
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation with structural fill placed as recommended in the **Earthwork** section.



SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil/bedrock properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 25.5 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure.

Floor Slab Design Parameters

Item	Description
Floor Slab Support ¹	Minimum 3 feet of compacted structural fill.

Item	Description
Estimated Modulus of Subgrade Reaction ²	150 pounds per square inch per inch (psi/in) for point loads
<ol style="list-style-type: none"> 1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. 2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in Earthwork, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower. 	

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

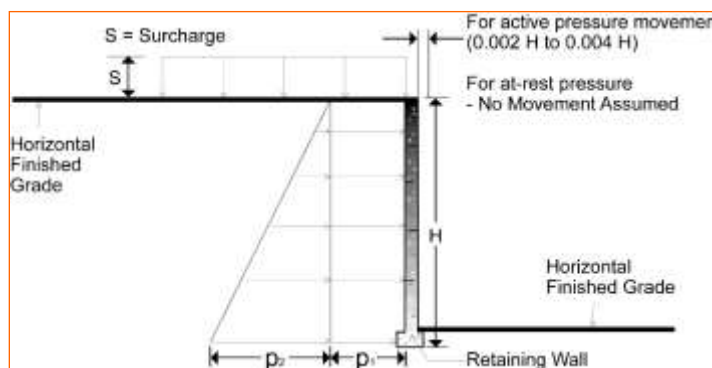
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

LATERAL EARTH PRESSURES

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The “at-rest” condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters				
Earth Pressure Condition ¹	Coefficient for Backfill Type ²	Surcharge Pressure ^{3, 4, 5} p_1 (psf)	Effective Fluid Pressures (psf) ^{2, 4, 5}	
			Unsaturated ⁶	Submerged ⁶
Active (K_a)	Granular - 0.36	$(0.36)S$	$(45)H$	$(85)H$
At-Rest (K_o)	Granular - 0.53	$(0.53)S$	$(65)H$	$(95)H$
Passive (K_p)	Granular - 2.77	---	$(330)H$	$(225)H$

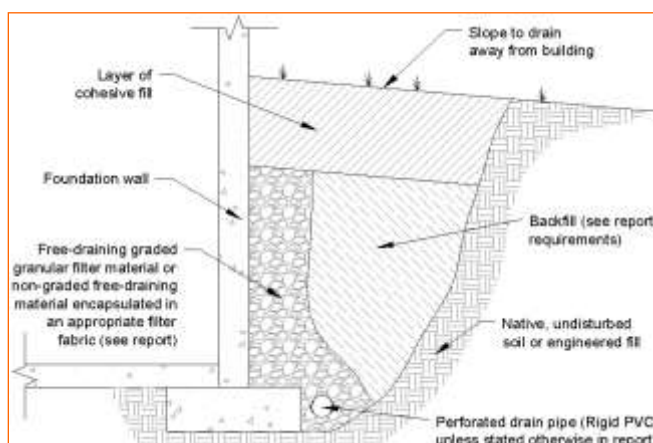
1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95% of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. To achieve “Unsaturated” conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. “Submerged” conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by free-draining granular material having less than 5% passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

The preceding data are applicable only to cast-in-place concrete or modular block walls up to 5 feet in height. **If taller single walls, tiered walls, or Mechanically Stabilized Earth (MSE) walls will be included in the proposed development, additional site-specific studies and laboratory testing will be required.** In addition, the wall designer should perform standard wall design practices including analysis for overturning, sliding, bearing capacity, and global stability, and results of these analyses should be provided for our review. Additional sampling, laboratory

testing and document review associated with retaining walls is beyond the original scope of work but can be performed as a separate scope, for a separate fee.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the assumed traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Subgrade Preparation

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the proposed pavement subgrades be proofrolled within one day prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompact. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in the **Earthwork** section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

Pavement Design Parameters

Design of pavements for the project has been based on the procedures outlined in the National Asphalt Pavement Association (NAPA) Information Series 109 (IS-109) and the American Concrete Institute (ACI) 330R-08; Guide for Design and Construction of Concrete Parking Lots. The following 18-kip equivalent single-axle loads (ESALs) for the life of the pavement were assumed based on experience with similar projects for pavement thickness design:

- **Light Duty (Automobile Parking Area):** 27,000 ESALs.
- **Medium Duty (Automobile Drive Lanes):** 110,000 ESALs
- **Heavy Duty (Entrance Drive, Yard, and Industrial Pavement):** 1,100,000 ESALs

Based on laboratory test results and our experience with similar soils, an R-value of 35 was used in our design. A modulus of subgrade reaction of 150 pci was used for the PCC pavement designs. The values were empirically derived based upon our experience with the sand subgrade soils and our understanding of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. A modulus of rupture of 600 psi was used for pavement concrete.

As part of our design, we recommend light duty and medium duty pavement sections be supported on a minimum of 12 inches of structural fill and heavy duty entrance drives, yard pavements, and areas where industrial truck traffic are anticipated be supported on a minimum of 24 inches of structural fill. The anticipated soils at pavement subgrade have an estimated design class of “medium” according to Table B of NAPA IS-109.

Pavement Section Thicknesses

As a minimum, we suggest the following AC and PCC pavement sections be considered based on the results of our field exploration, laboratory testing, and our experience in the area:

Traffic Classification	Alternative	Asphalt Concrete (in.)	Portland Cement Concrete (in.)	Base Course (in.)	Compacted on-site soils (in.)
Light Duty	A	4	---	4	12
	B	---	5	---	
Medium Duty	A	4½	---	6	
	B		6	---	
Heavy Duty	A	6½	---	8	24
	B	---	8	---	

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular sections below pavement. We recommend pavement subgrades be crowned at least 2% to promote the flow of water and to reduce the potential for ponding of water on the subgrade.

Pavement Maintenance and Construction Considerations

Asphalt concrete should be composed of a mixture of aggregate, filler and additives, if required, and approved bituminous material. The asphalt concrete should conform to approved mix designs

stating the Hveem properties, optimum asphalt content, job mix formula and recommended mixing and placing temperatures and designed to the minimum gyrations as determined by CDOT Superpave. For traffic loads of less than 300,000 ESALs a minimum 50 gyrations should be used for design and for traffic loads between 300,000 and 3,000,000 ESALs a minimum 75 gyrations should be used for design. Aggregate used in plant-mixed asphalt concrete should meet Colorado Department of Transportation Grading S or SX specifications. Mix designs should be submitted prior to construction to verify their adequacy. Asphalt material should be placed in maximum 3-inch lifts and should be compacted to a minimum of 92 to 96 percent of the maximum theoretical density as determined by CP 51.

Where rigid pavements are used, the concrete should be based on an approved CDOT mix design. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Control joints should be 1/4 of the depth of the concrete, and should be cut as soon as the slab can support the weight of a man and saw (usually 24 hours). Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area. The following comments should be considered for the indicated concrete pavement design options.

- Contraction joints should have a maximum spacing no greater than 15 feet for 6-inch thick or greater concrete, as per ACI 330-08.
- At construction joints an adequately designed keyed construction joint or a butt end construction joint is recommended. For a butt end construction joint, an adequate number of deformed tie bars should be provided.
- Tie bars are also recommended along the first longitudinal joint from the pavement edge to keep the outside slab from separating from the pavement.
- Isolation joints are recommended for concrete pavement areas that abut fixed objects such as around light poles, curb inlets, etc.
- Dowels at joints should be spaced at 12-inch on-center and meet the following requirements:
 - Pavement thickness of 6-inches or less dowels should have a minimum of 3/4 inch diameter, be 14 inches in length with a minimum 6-inch embedment, and placed at mid-depth of slab
 - Pavement thickness of more than 6-inches, dowels should have a minimum of 1 1/8 inch diameter, be 16 inches in length with a minimum 7-inch embedment, and placed at mid-depth of slab

The light duty parking lot concrete pavement section should be reinforced with 6-inch by 6-inch, 6-gauge wire mesh. Reinforcement of concrete with wire mesh does not prevent cracking of the concrete. However, the wire mesh aids in preventing shrinkage cracks that occur in concrete

from continuing to open up. Wire mesh should be located approximately 2 inches from the surface of the slab, which will require lifting the mesh during placement or using chairs to support the mesh.

Sealing of construction joints is essential to protect the subgrade and promote long term performance of concrete pavement. Joints should be sealed with a sealant designed especially for pavements subject to truck and car traffic. The joints should be sealed as soon as possible (in accordance with sealant manufacturer's instructions) to minimize infiltration of water into the soil.

The performance of all pavements can be enhanced by reducing excess water, which can reach the subgrade soils. The following recommendations should be considered at minimum:

- Site grading at a minimum 2 percent grade away from the pavements
- Compaction of any utility trenches for landscaped areas to the same criteria as the pavement subgrade
- Snow management plans should be developed designating areas outside pavement and planter areas for stockpiling of snow
- Sealing or providing area drains and curb cuts in all landscaped areas in, or adjacent to pavements to reduce or prevent water migration to subgrade soils
- Placing compacted backfill against the exterior side of curb and gutter, and
- Placing curb, gutter and/or sidewalk directly on subgrade soils without the use of base course materials

Preventative maintenance should be planned and provided for through an on-going pavement management program in order to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration.

Preventive maintenance consists of both localized maintenance (e.g. crack sealing and patching) and global maintenance (e.g. surface sealing). Preventative maintenance is usually the first priority when implementing a planned pavement maintenance program. Recommended preventative maintenance policies for asphalt concrete pavements, based upon type and severity of distress, can be provided.

Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventative maintenance.

CORROSIVITY

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary						
Boring	Sample Depth (feet)	Soil Description	Soluble Sulfate (%)	Soluble Chloride (%)	Electrical Resistivity (Ω -cm)	pH
B-6	1-5	Silty Sand	<0.001	0.0006	7,628	6.4
B-15	1-5	Poorly Graded Sand	<0.001	0.0018	7,994	6.1

Results of water-soluble sulfate testing indicate that samples of the on-site soils have an exposure class of S0 when classified in accordance with Table 19.3.1.1 of the American Concrete Institute (ACI) Design Manual. The results of the testing indicate ASTM Type I Portland Cement is suitable for project concrete in contact with on-site soils. However, if there is no (or minimal) cost differential, use of ASTM Type II Portland Cement is recommended for additional sulfate resistance of construction concrete. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 19. We also recommend retaining a corrosion expert to review the results and provide recommendations for corrosion protection at this site.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Geotechnical Engineering Report

Industrial Warehouse ■ Monument, Colorado

October 2, 2020 ■ Terracon Project No. 23205102



Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

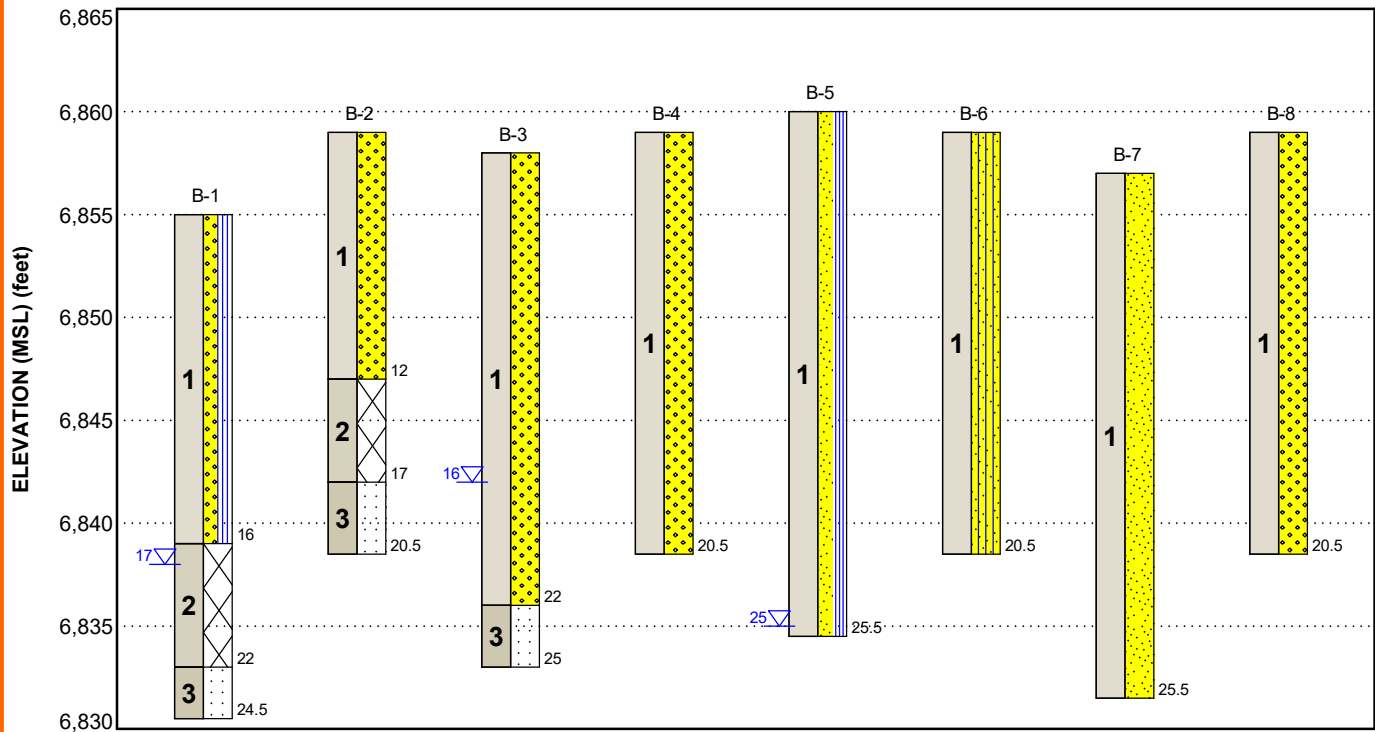
FIGURES

Contents:

GeoModel (2 pages)

GEOMODEL

Industrial Warehouse ■ Monument, CO
Terracon Project No. 23205102



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Sand	Sand soils with varying amounts of silt, fine to coarse grained, loose to dense.
2	Weathered Bedrock	Weathered sandstone bedrock, fine to coarse grained, medium hard.
3	Bedrock	Sandstone bedrock, fine to coarse grained, hard to very hard.

LEGEND

Well-graded Sand with Silt	Well-graded Sand	Poorly-graded Sand
Weathered Rock	Poorly-graded Sand with Silt	
Sandstone	Silty Sand	

First Water Observation

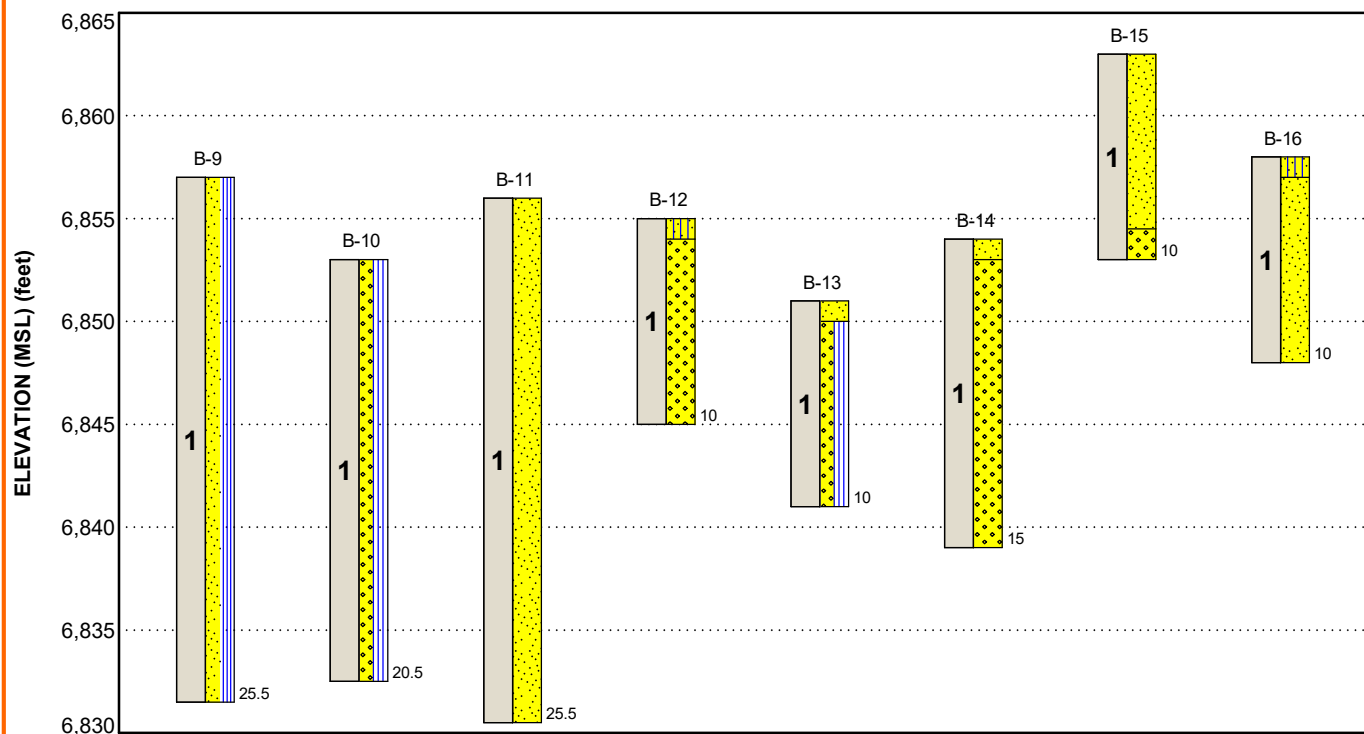
NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

GEOMODEL

Industrial Warehouse ■ Monument, CO
Terracon Project No. 23205102



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Sand	Sand soils with varying amounts of silt, fine to coarse grained, loose to dense.
2	Weathered Bedrock	Weathered sandstone bedrock, fine to coarse grained, medium hard.
3	Bedrock	Sandstone bedrock, fine to coarse grained, hard to very hard.

LEGEND

	Poorly-graded Sand with Silt		Silty Sand
	Well-graded Sand with Silt		Well-graded Sand
	Poorly-graded Sand		

First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Location
11	20.5 to 25.5	Building area
1	15	Future truck parking area/potential detention pond area
4	10	Pavement area
3	4	Percolation test holes within potential detention pond area

Boring Layout and Elevations: We used handheld GPS equipment to locate borings with an estimated horizontal accuracy of ± 20 feet. Approximate elevations were obtained by estimation using Google Earth.

Subsurface Exploration Procedures: We advanced the soil borings with a truck-mounted drill rig using continuous flight augers. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch outer diameter split-barrel sampling spoon with 2.5-inch inner diameter ring lined sampler was used for sampling in the upper 14 feet. Ring-lined, split-barrel sampling procedures were similar to standard split spoon sampling procedure; however, blow counts were recorded for 6-inch intervals for a total of 12 inches of penetration. The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. The depth to groundwater was observed in the borings during drilling and sampling.

Our exploration team prepared field boring logs as part of standard drilling operations which included the sampling depths, penetration distances, and other relevant sampling information. Field logs include visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil and rock strata, as necessary, for this project. The following testing was performed:

- Water content
- Unit dry weight
- Atterberg limits
- Grain size analyses
- Consolidation/expansion
- Standard Proctor
- R-value
- Chemical Analyses – pH, Sulfates, Chloride Ion, Electrical Resistivity

The laboratory testing program included examination of the soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System. Rock classification was performed using locally accepted procedures.

PHOTOGRAPHY LOG



Site Facing North



Site Facing South



Site Facing East



Site Facing West

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan

Exploration Plan with Aerial Overlay

Exploration Plan with Site Plan Overlay

Note: All attachments are one page unless noted above.

SITE LOCATION

Industrial Warehouse ■ Monument, Colorado

October 2, 2020 ■ Terracon Project No. 23205102



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN WITH AERIAL OVERLAY

Industrial Warehouse ■ Monument, Colorado

October 2, 2020 ■ Terracon Project No. 23205102

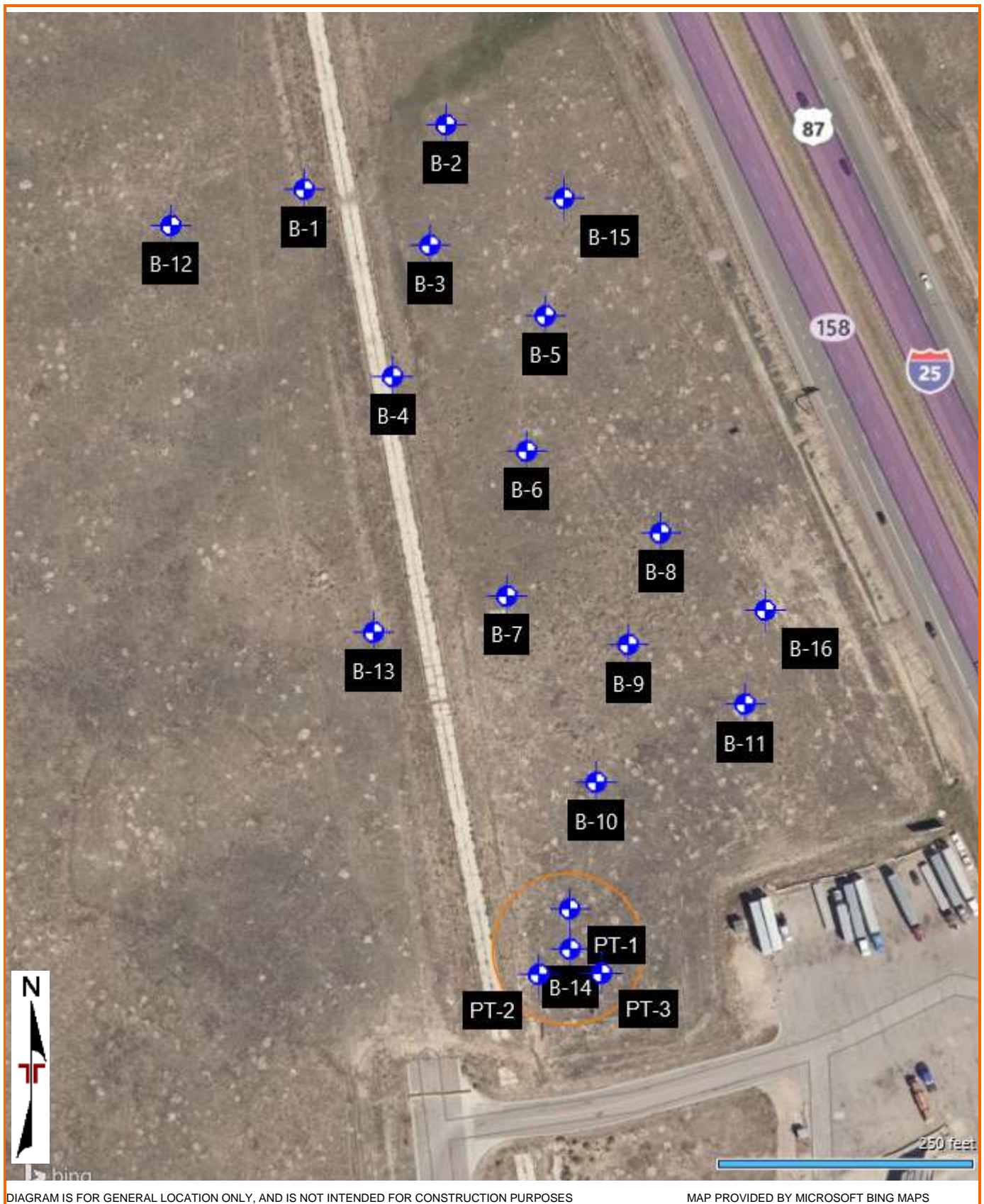
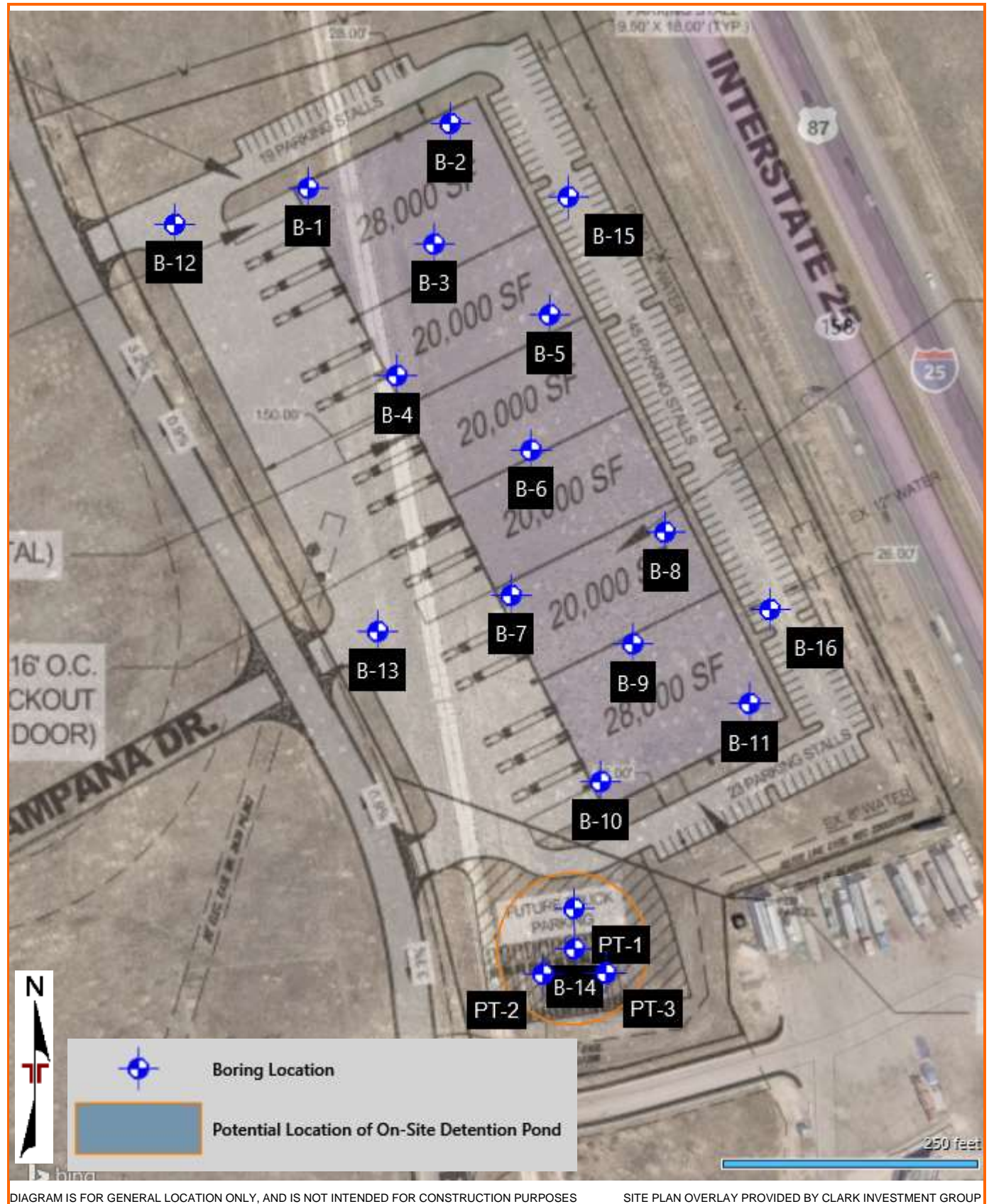


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Industrial Warehouse ■ Monument, Colorado
October 2, 2020 ■ Terracon Project No. 23205102



EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through B-16)

Atterberg Limits

Grain Size Distribution (2 pages)

Consolidation/Swell (7 pages)

Moisture Density Relationship

R-value

Corrosivity (2 pages)

Percolation Test Results (3 pages)

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0604° Longitude: -104.8554° Approximate Surface Elev.: 6855 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		WELL GRADED SAND WITH SILT (SW-SM) , fine to coarse grained, brown, loose to medium dense, with iron staining	16.0			9-8	1.4	103	NP	6
			5			7-8	1.3	104		
			10			12-13	4.8	104		
			15			13-17	6.9	108		
			16.0			19-25	6.7	108		
2		WEATHERED SANDSTONE , fine to coarse grained, gray, medium hard, with iron staining	22.0			13-14-16 N=30	21.1			
3		SANDSTONE , fine to coarse grained, gray, very hard	24.5			50/5" N=50/5"	12.7			
		Boring Terminated at 24.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater encountered at 17 feet while drilling

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20




BORING LOG NO. B-2

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0606° Longitude: -104.8549° Approximate Surface Elev.: 6859 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		WELL GRADED SAND (SW) , fine to coarse grained, brown, loose to medium dense 12.0 6847+/-	5			7-7	1.5	102		
						7-8	4.4	98		
						11-16	5.6	108		
						14-14	9.5	107		
2		WEATHERED SANDSTONE , fine to coarse grained, gray, medium hard, trace iron staining 17.0 6842+/-	15			9-24	18.6	102	37-28-9	34
3		CLAYEY SANDSTONE , fine to medium grained, gray, very hard, with iron staining 20.5 6838.5+/-	20			25-40-50/3" N=90/9"	16.8			
		Boring Terminated at 20.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a
description of field and laboratory procedures
used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of
symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20



BORING LOG NO. B-3

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0602° Longitude: -104.855° Approximate Surface Elev.: 6858 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		WELL GRADED SAND (SW) , fine to coarse grained, light brown, loose to dense								
			5			9-11	1.1	106		
						9-13	2.7	102		
			10			10-14	4.1	106		
						15-17	4.1	104		
			15			6-7	17.0			
			20			13-17-24 N=41	13.1			
3		SANDSTONE , fine to coarse grained, gray, very hard								
			25			24-50/2" N=50/2"	17.2			
		Boring Terminated at 25 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).


Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

 Groundwater encountered at 16 feet while drilling

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20


BORING LOG NO. B-4

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0599° Longitude: -104.8551° Approximate Surface Elev.: 6859 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		WELL GRADED SAND (SW) , fine to medium grained, brown, loose to medium dense, with iron staining								
						7-7	3.9	105		
			5			8-10	3.8	104		
						11-18	3.0	107		
			10			15-18	5.9	104		
			15			15-20	4.9	104		
			20			9-9-12 N=21	8.8			
		Boring Terminated at 20.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a
description of field and laboratory procedures
used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of
symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20

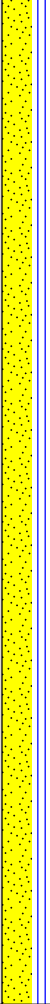
BORING LOG NO. B-5

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0601° Longitude: -104.8546° Approximate Surface Elev.: 6860 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		POORLY GRADED SAND WITH SILT (SP-SM) , fine to coarse grained, brown, medium dense to very dense, with iron staining	5			11-13	1.6	108		
						10-11	3.7	103		
						12-16	3.6	109	NP	7
			10			13-20	5.8	108		
			15			14-20	4.6	107		
			20			6-7-8 N=15	10.3			
			25			24-45-50/4" N=95/10"	17.2			
		possible sandstone at 24.5 feet Boring Terminated at 25.5 Feet	25.5							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).


Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

 Groundwater encountered at 25 feet while drilling

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

BORING LOG NO. B-6

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0597° Longitude: -104.8546° Approximate Surface Elev.: 6859 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
									LL-PL-PI	
1		SILTY SAND (SM) , fine grained, light brown, loose to medium dense								
						9-8	1.5	96		
			5			8-9	1.8	93	NP	13
						9-8	4.3	101		
			10			15-19	3.0	104		
						14-18	3.0	104		
			15							
			20			8-7-11 N=18	5.8			
		Boring Terminated at 20.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102


BORING LOG NO. B-8

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0595° Longitude: -104.8542° Approximate Surface Elev.: 6859 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		WELL GRADED SAND (SW) , fine to coarse grained, brown to light brown, loose to medium dense, with iron staining	5			12-11	2.5	100		
			6-6				1.5	103		
			10-9				5.8	99		
			7-12				3.1	104		
			12-14				4.2	108		
			10-9-9 N=18				8.6			
		Boring Terminated at 20.5 Feet	20.5							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

BORING LOG NO. B-10

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0588° Longitude: -104.8544° Approximate Surface Elev.: 6853 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
									LL-PL-PI	
1		WELL GRADED SAND WITH SILT (SW-SM) , fine grained, light brown, loose to medium dense								
						5-4	1.4	102		
			5			5-6	3.4	107	NP	8
						8-8	10.4	102		
			10			6-8	9.3	94		
			15			15-18	4.2	103		
			20			9-11-14 N=25	5.8			
		Boring Terminated at 20.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-15-2020

Boring Completed: 09-15-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20

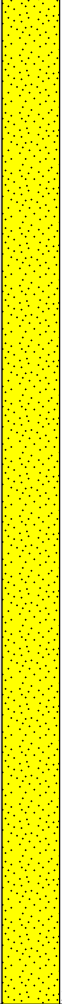
BORING LOG NO. B-11

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.059° Longitude: -104.8539° Approximate Surface Elev.: 6856 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		POORLY GRADED SAND (SP) , fine grained, light brown, loose to medium dense	25.5							
			5			8-10	3.1	89		
						9-11	3.5	104		
						11-7	3.3	100	NP	4
			10			14-14	5.2	112		
			15			11-16	3.8	107		
			20			9-9-10 N=19	6.0			
			25			4-5-5 N=10	17.8			
		Boring Terminated at 25.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-15-2020

Boring Completed: 09-15-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102


BORING LOG NO. B-12

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0603° Longitude: -104.8559° Approximate Surface Elev.: 6855 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		1.0 SILTY SAND (SM) , fine grained, brown, loose, trace rootlets 6854+/-	1.0			4-6	2.1	89	NP	13
		WELL GRADED SAND (SW) , fine to medium grained, light brown, medium dense				13-12	1.4	107		
						11-13	7.0	103		
						14-15	2.9	101		
						14-22	5.0	107		
		10.0 6845+/-	10.0							
		Boring Terminated at 10 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

BORING LOG NO. B-13

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0592° Longitude: -104.8552° Approximate Surface Elev.: 6851 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH ELEVATION (Ft.)								
		1.0 POORLY GRADED SAND (SP) , fine grained, brown, loose	6850+/-			6-7	1.9	103		
		WELL GRADED SAND WITH SILT (SW-SM) , fine to coarse grained, light brown, loose to medium dense				7-7	4.0	103	NP	8
						7-11	5.1	106		
						9-12	5.5	101		
						11-13	5.8	107		
		10.0 Boring Terminated at 10 Feet	6841+/-							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-15-2020

Boring Completed: 09-15-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20


BORING LOG NO. B-14

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0584° Longitude: -104.8545° Approximate Surface Elev.: 6854 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH ELEVATION (Ft.)								
1		1.0 POORLY GRADED SAND (SP) , fine grained, brown, loose, trace rootlets 6853+/- WELL GRADED SAND (SW) , fine to coarse grained, light brown, loose to medium dense	5			5-8	3.2	109		
						8-9	2.0	81		
						10-14	1.2	102		
						10-14	1.2	113		
						11-12	3.5	105		
						15-18	3.0	106		
		15.0 Boring Terminated at 15 Feet 6839+/-	15							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-15-2020

Boring Completed: 09-15-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102



BORING LOG NO. B-15

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0604° Longitude: -104.8545° Approximate Surface Elev.: 6863 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		POORLY GRADED SAND (SP) , fine to medium grained, dark brown, loose, trace rootlets to 1 foot 8.5 6854.5 +/-	5			6-4	1.7	97		
						7-9	1.4	109		
						7-7	1.4	110		
						6-6	1.6	84		
		WELL GRADED SAND (SW) , fine to medium grained, light brown, medium dense 10.0 6853 +/-	10			14-15	3.5	110		
		Boring Terminated at 10 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-14-2020

Boring Completed: 09-14-2020

Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

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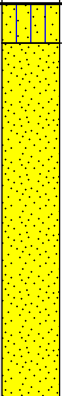
BORING LOG NO. B-16

Page 1 of 1

PROJECT: Industrial Warehouse

CLIENT: Clark Investment Group
Wichita, KS

SITE: Baptist Road and Old Denver Highway
Monument, CO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0593° Longitude: -104.8538° Approximate Surface Elev.: 6858 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		1.0 SILTY SAND (SM) , fine grained, dark brown, loose, trace rootlets 6857+/- POORLY GRADED SAND (SP) , fine grained, light brown, loose to medium dense 10.0 6848+/-	5			4-4	2.4	86		
						6-8	2.3	105		
						5-6	2.9	100		
						10-16	5.7	113		
						15-16	4.6	117		
		Boring Terminated at 10 Feet	10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations obtained from Google Earth

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon

4172 Center Park Dr
Colorado Springs, CO

Boring Started: 09-15-2020

Boring Completed: 09-15-2020

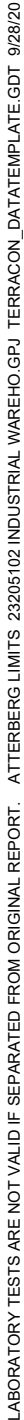
Drill Rig: CME 55

Driller: Odell

Project No.: 23205102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20

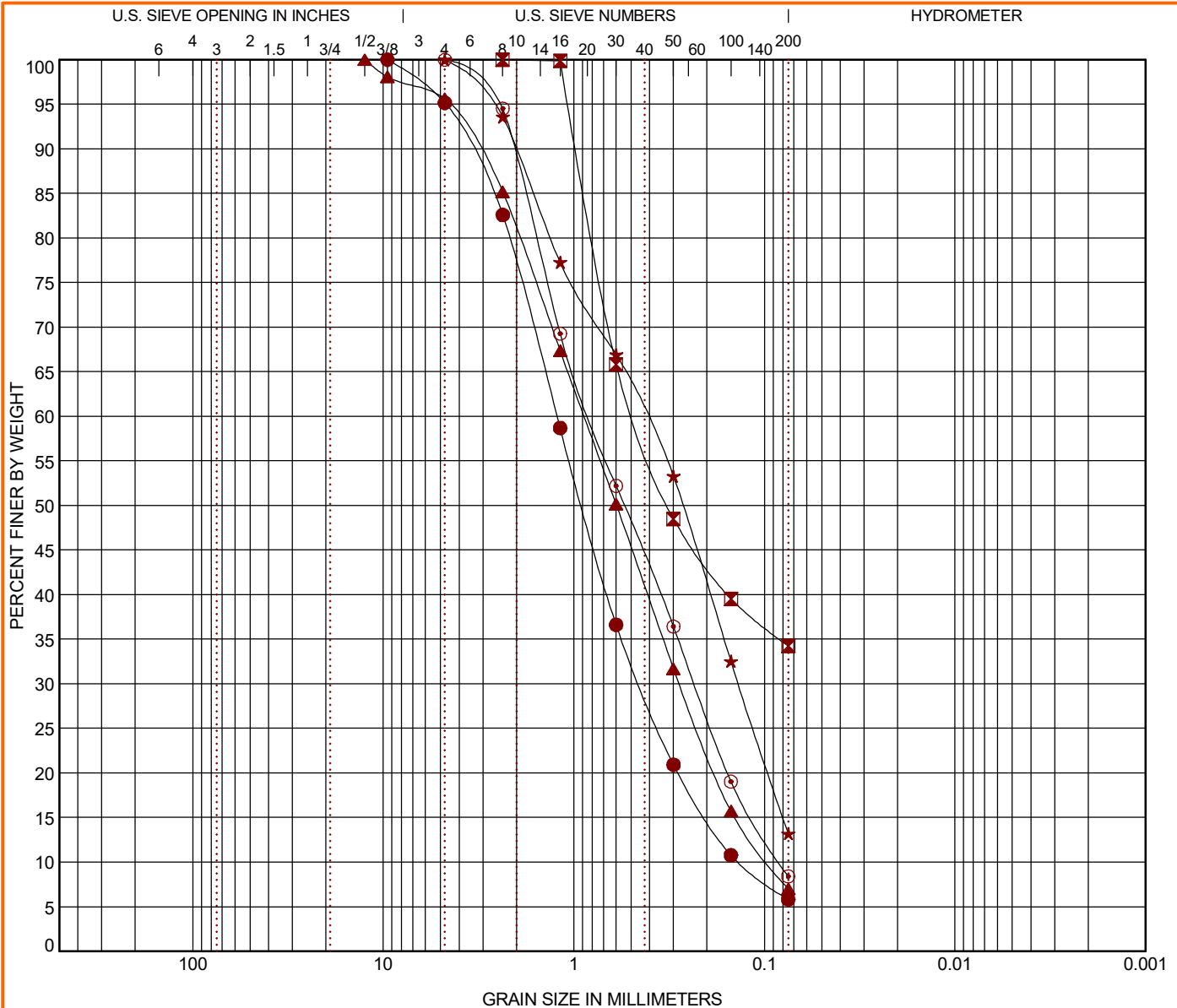
ASTM D4318



CLIENT: Clark Investment Group
Wichita, KS

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification				WC (%)	LL	PL	PI	Cc	Cu
● B-1	2 - 3	WELL-GRADED SAND with SILT (SW-SM)				1.4	NP	NP	NP	1.21	9.09
⊠ B-2	14 - 15	SILTY SAND (SM)				18.6	37	28	9		
▲ B-5	7 - 8	POORLY GRADED SAND with SILT (SP-SM)				3.6	NP	NP	NP	0.92	9.28
★ B-6	4 - 5	SILTY SAND (SM)				1.8	NP	NP	NP		
⊙ B-7	2 - 3	POORLY GRADED SAND with SILT (SP-SM)				2.8	NP	NP	NP	0.79	9.81
Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
● B-1	2 - 3	9.5	1.226	0.448	0.135	0.0	4.8	89.4		5.8	
⊠ B-2	14 - 15	2.36	0.475			0.0	0.0	65.8		34.2	
▲ B-5	7 - 8	12.5	0.884	0.279	0.095	0.0	4.4	88.6		7.0	
★ B-6	4 - 5	4.75	0.422	0.137		0.0	0.0	86.8		13.2	
⊙ B-7	2 - 3	4.75	0.817	0.232	0.083	0.0	0.0	91.6		8.4	

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23205102

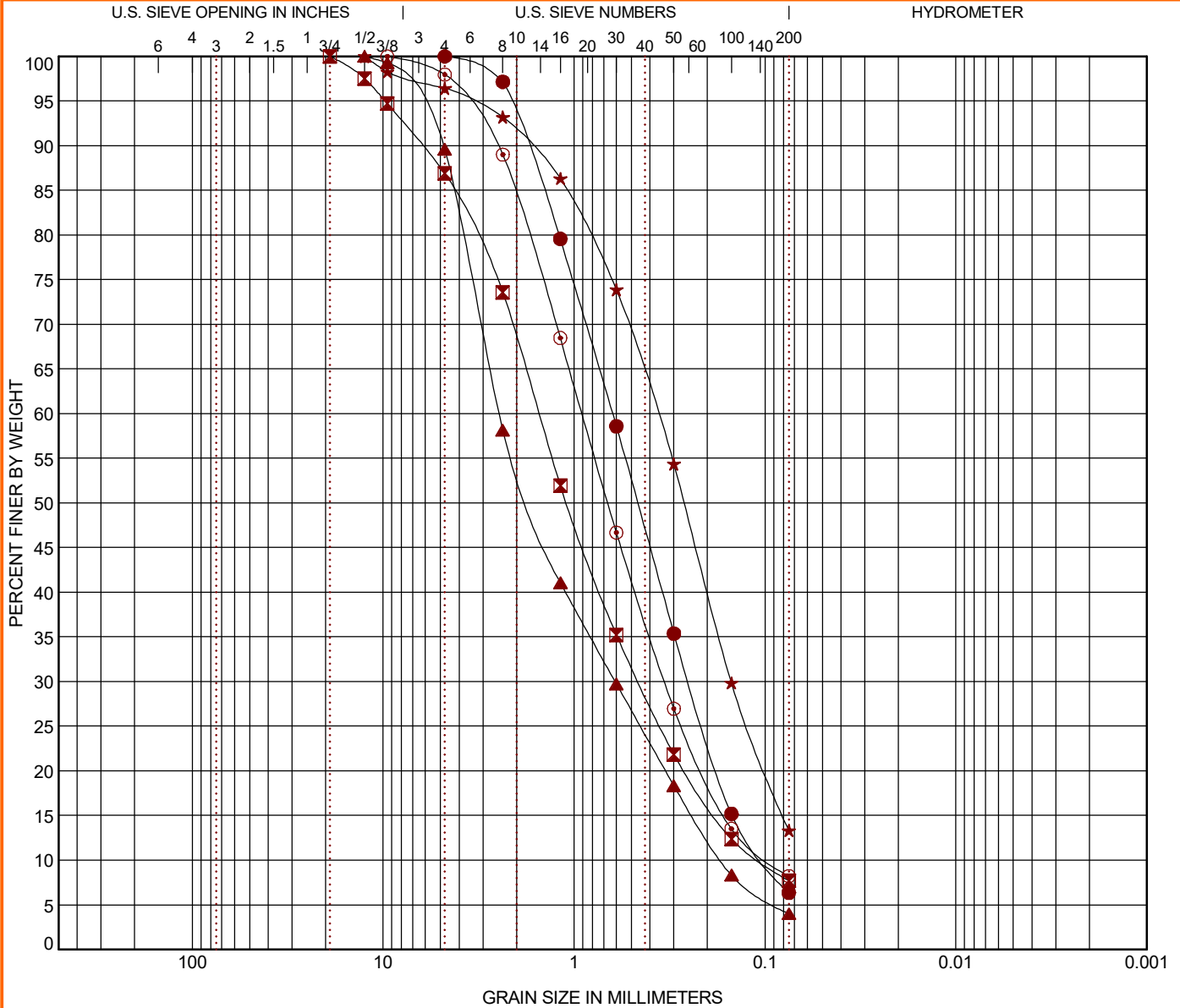
CLIENT: Clark Investment Group
Wichita, KS

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 23205102 INDUSTRIAL WAREHO.GPJ TERRACON.DATATEMPLATE.GDT 9/25/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 23205102 INDUSTRIAL WAREHO.GPJ TERRACON.DATATEMPLATE.GDT 9/25/20



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification				WC (%)	LL	PL	PI	Cc	Cu
● B-9	4 - 5	POORLY GRADED SAND with SILT (SP-SM)				4.9	NP	NP	NP	0.99	6.29
✠ B-10	4 - 5	WELL-GRADED SAND with SILT (SW-SM)				3.4	NP	NP	NP	1.30	14.48
▲ B-11	7 - 8	POORLY GRADED SAND (SP)				3.3	NP	NP	NP	0.90	14.58
★ B-12	0 - 1	SILTY SAND (SM)				2.1	NP	NP	NP		
⊙ B-13	1 - 5	WELL-GRADED SAND with SILT (SW-SM)					NP	NP	NP	1.30	9.56
Boring ID	Depth	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
● B-9	4 - 5	4.75	0.628	0.25	0.1	0.0	0.0	93.7		6.3	
✠ B-10	4 - 5	19	1.527	0.458	0.105	0.0	13.1	79.2		7.7	
▲ B-11	7 - 8	12.5	2.458	0.61	0.169	0.0	10.4	85.6		4.0	
★ B-12	0 - 1	12.5	0.366	0.151		0.0	3.6	83.1		13.3	
⊙ B-13	1 - 5	9.5	0.907	0.334	0.095	0.0	2.0	89.8		8.2	

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway
Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

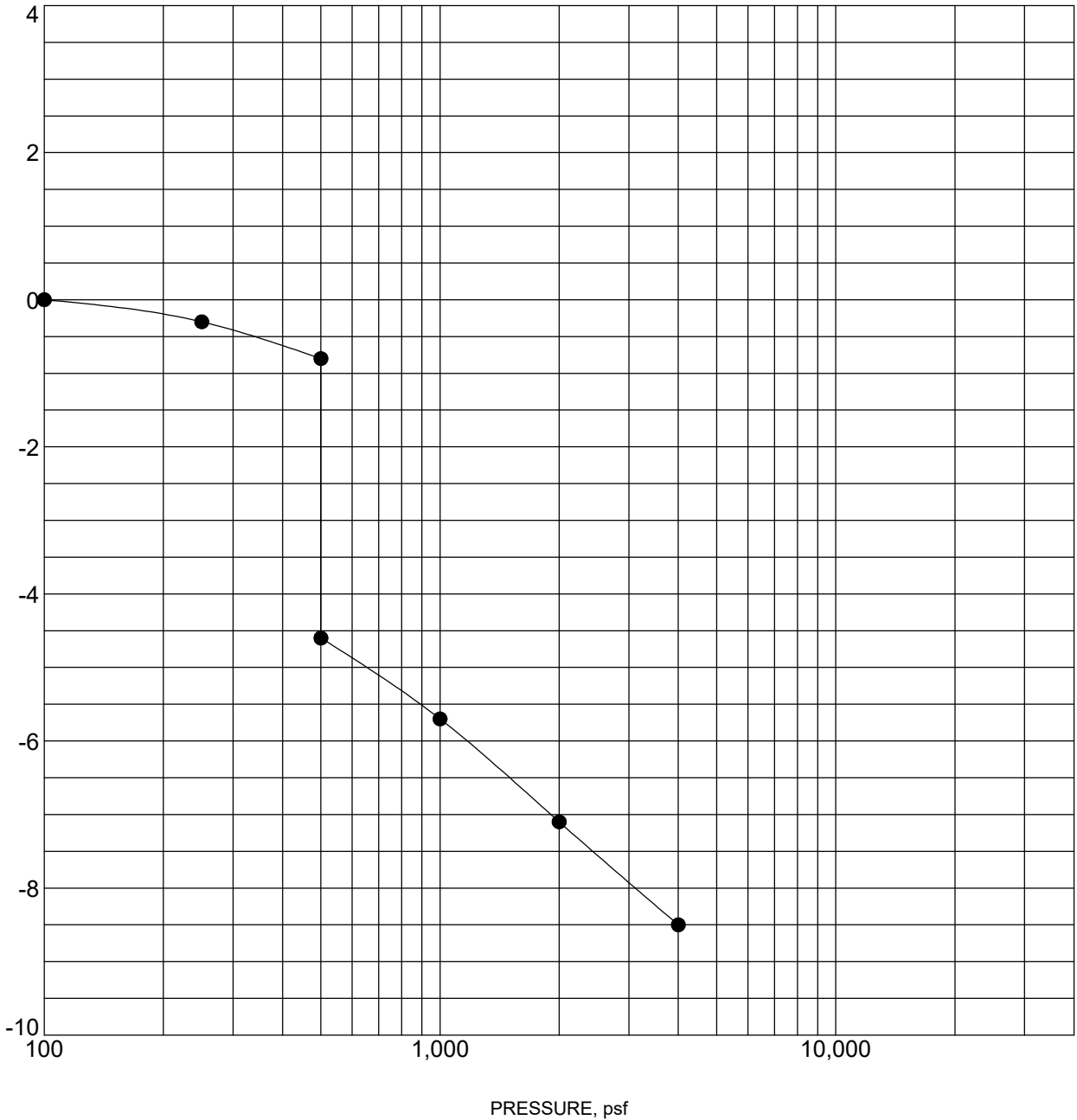
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 9/28/20

AXIAL STRAIN, %



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-1	2 - 3 ft	WELL-GRADED SAND with SILT(SW-SM)	103	1.4

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

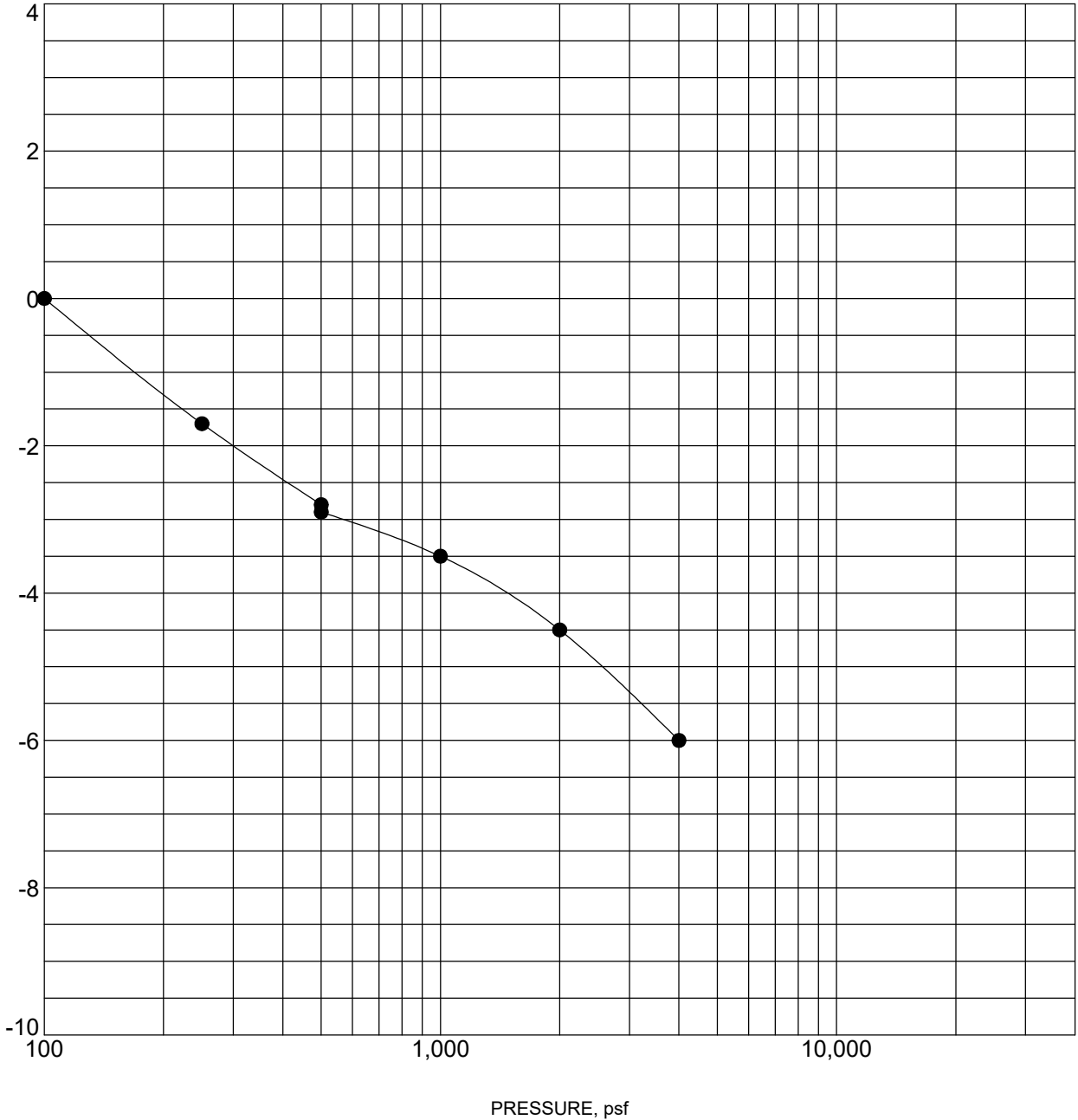
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 10/2/20

AXIAL STRAIN, %



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-2	14 - 15 ft	SANDSTONE	102	18.6

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

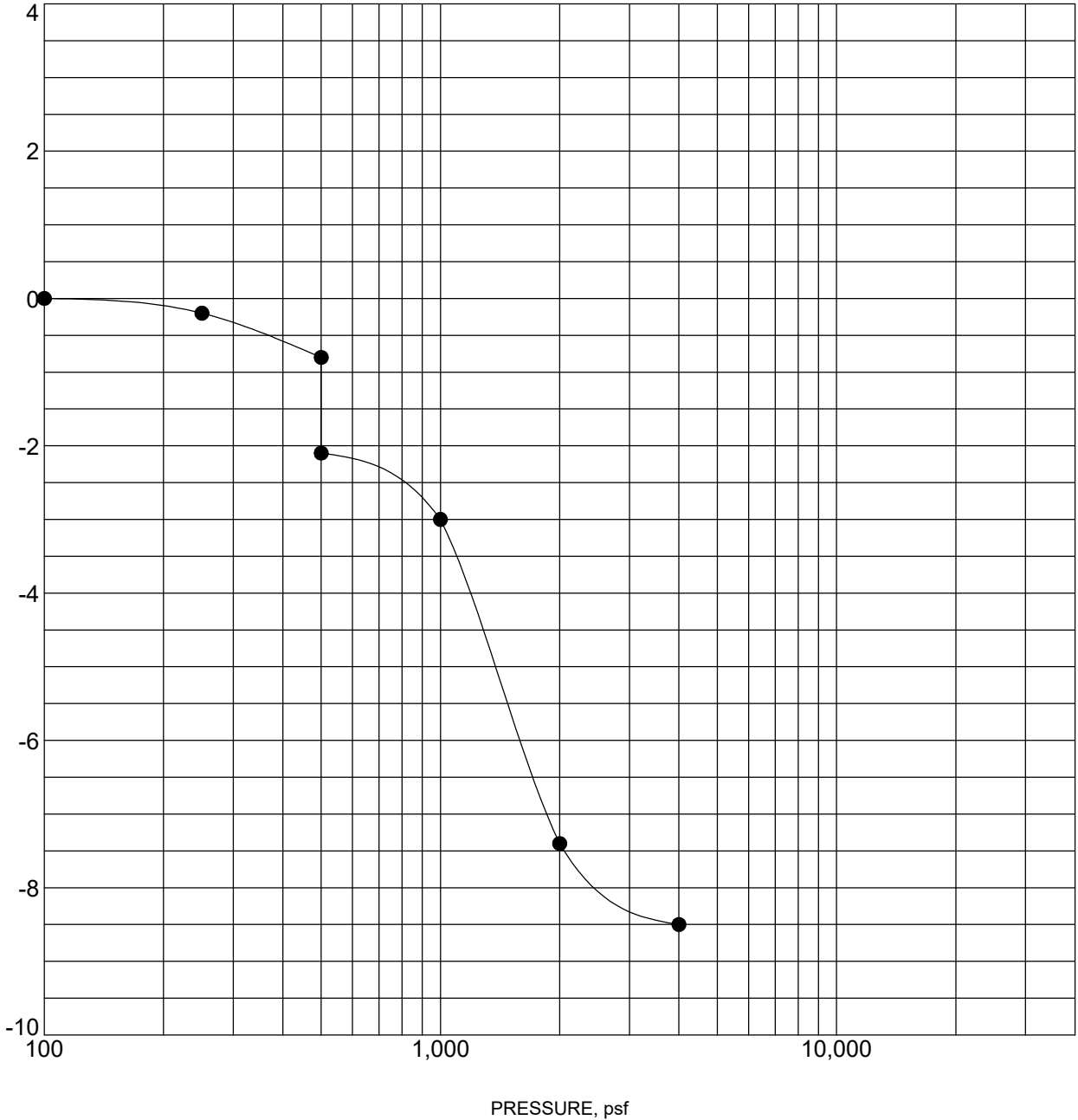
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 9/28/20

AXIAL STRAIN, %



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-5	7 - 8 ft	POORLY GRADED SAND with SILT(SP-SM)	109	3.6

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

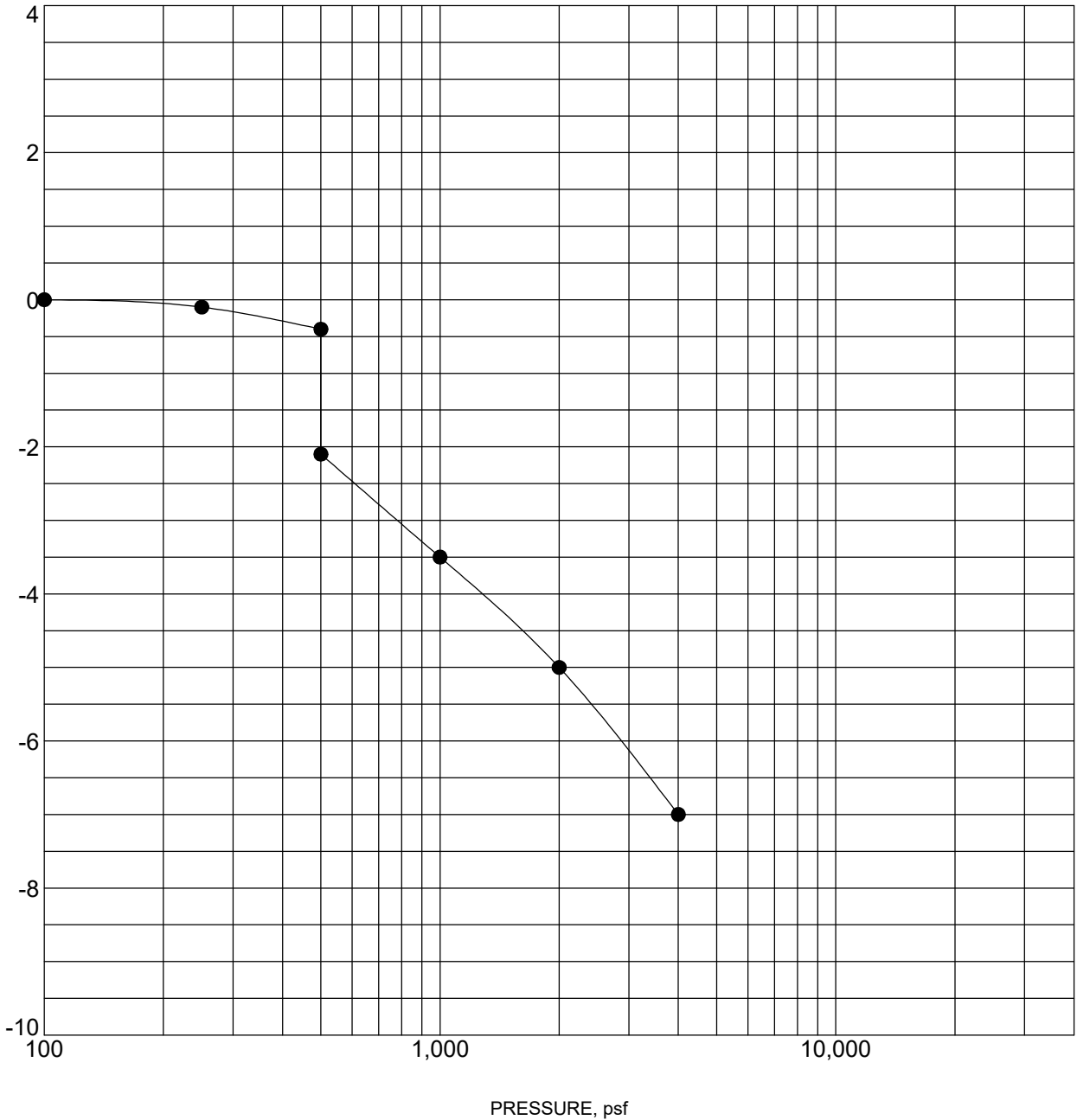
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 9/28/20

AXIAL STRAIN, %



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-7	2 - 3 ft	POORLY GRADED SAND with SILT(SP-SM)	102	2.8

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

PROJECT: Industrial Warehouse

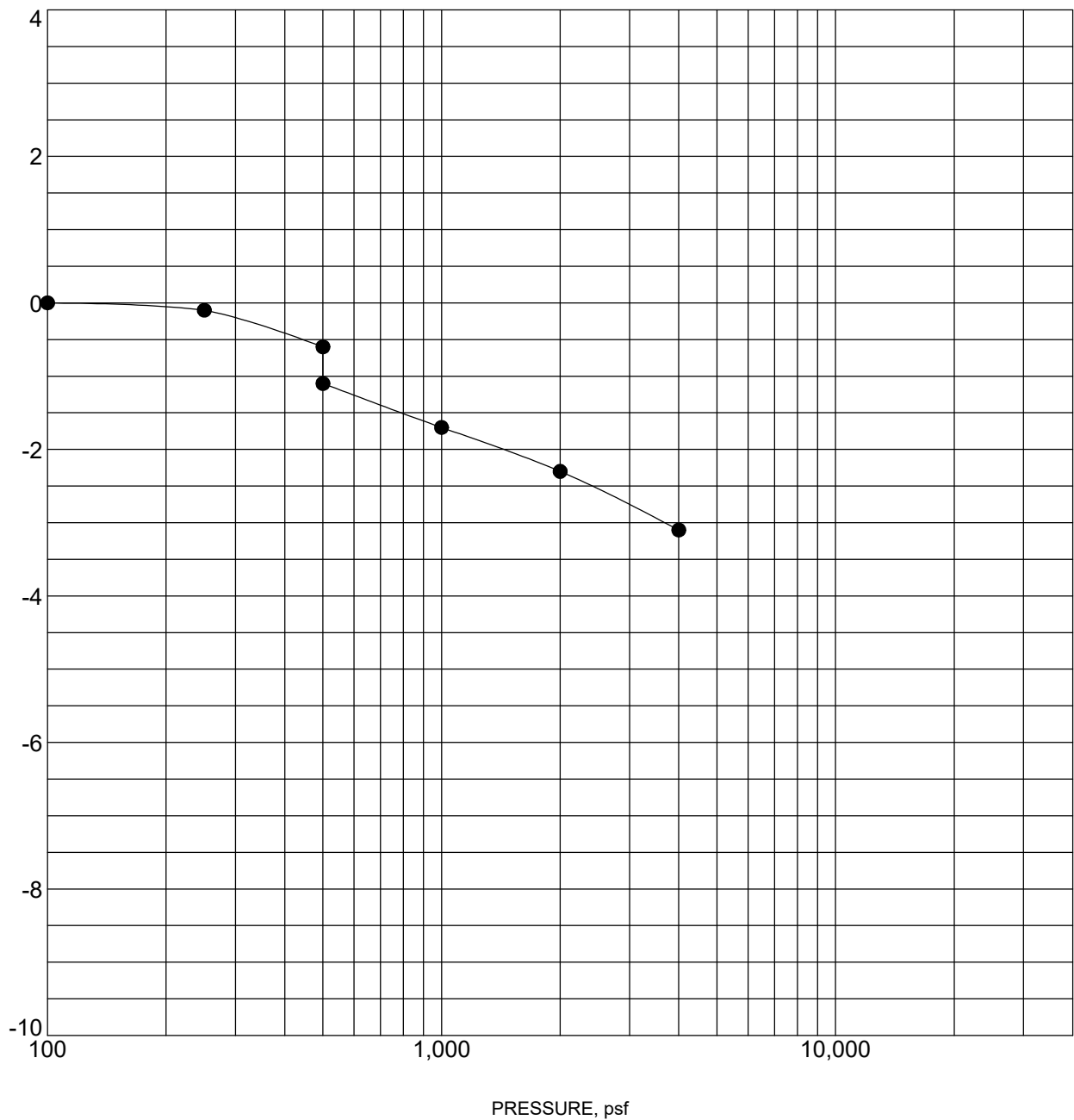
SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-9	4 - 5 ft	POORLY GRADED SAND with SILT(SP-SM)	101	4.9

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 9/28/20

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

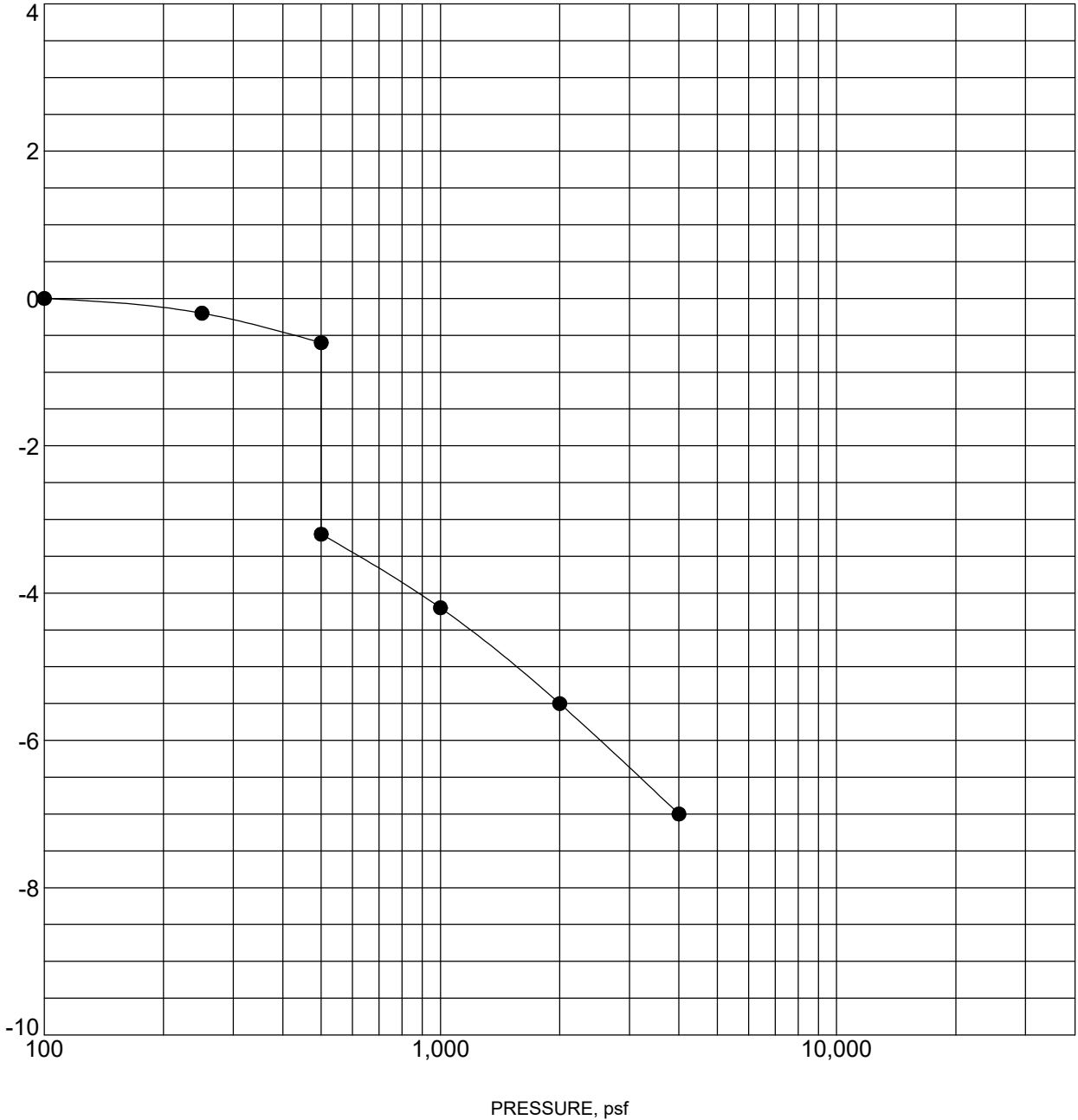
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 9/28/20

AXIAL STRAIN, %



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-10	4 - 5 ft	WELL-GRADED SAND with SILT(SW-SM)	107	3.4

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

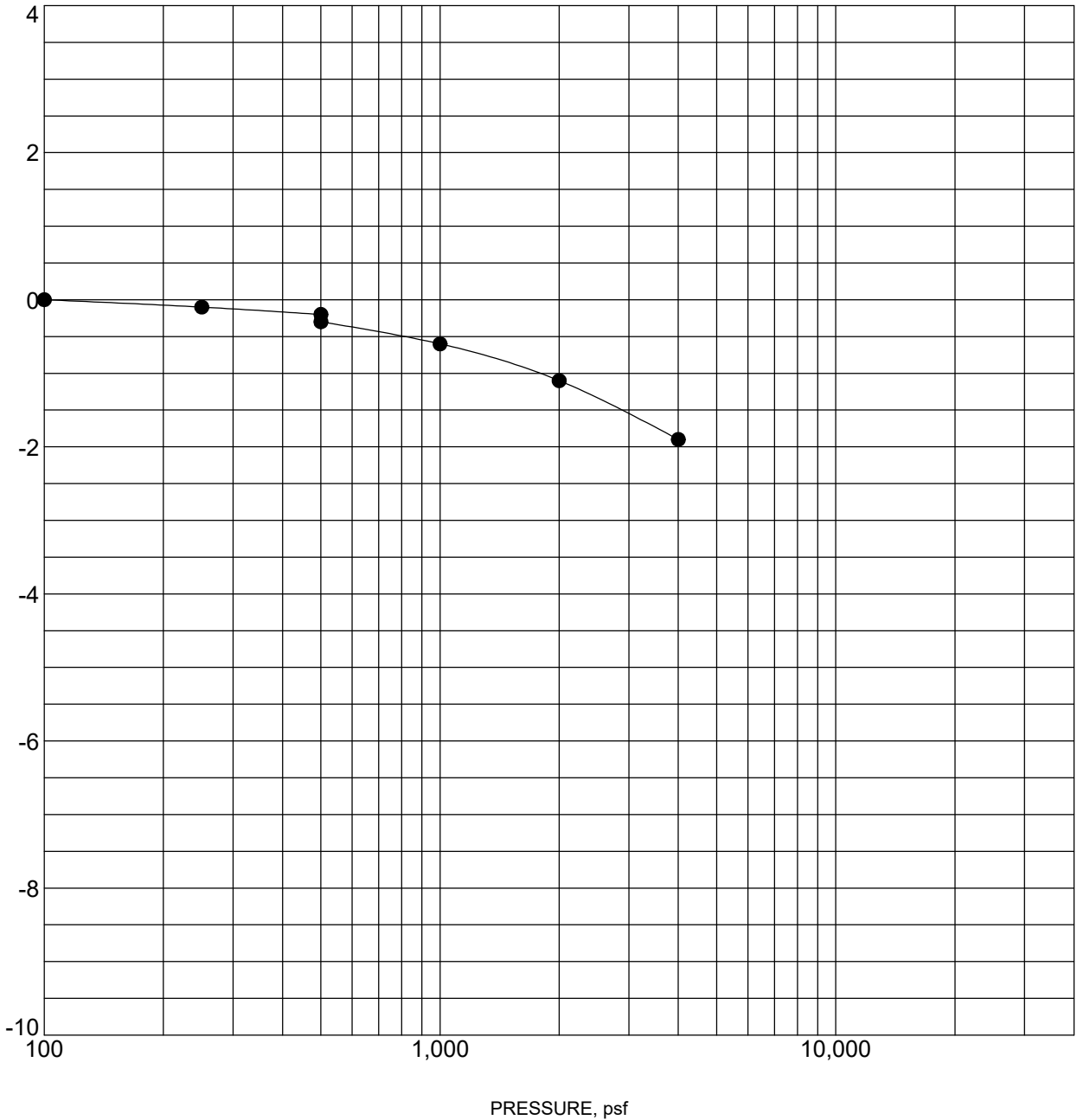
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

SWELL CONSOLIDATION TEST
ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 23205102 INDUSTRIAL WAREHO.GPJ TERRACON_DATATEMPLATE.GDT 9/28/20

AXIAL STRAIN, %



Specimen Identification			Classification	γ_d , pcf	WC, %
●	B-11	7 - 8 ft	POORLY GRADED SAND(SP)	100	3.3

NOTES: Sample inundated with water at 500 pounds per square foot (psf.)

PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

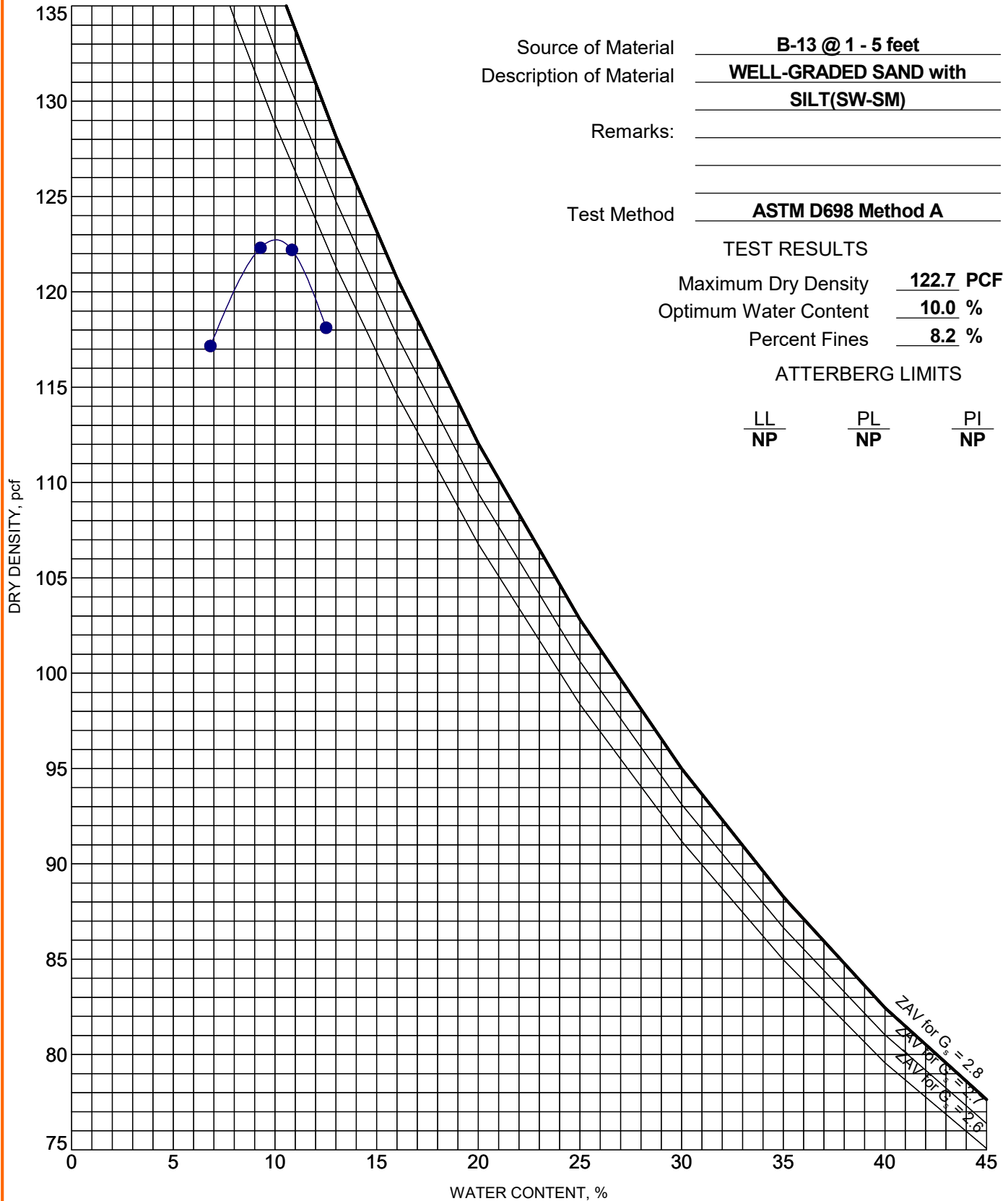
PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 23205102 INDUSTRIAL WAREHO.GPJ TERRACON DATATEMPLATE.GDT 9/28/20



PROJECT: Industrial Warehouse

SITE: Baptist Road and Old Denver Highway Monument, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23205102

CLIENT: Clark Investment Group
Wichita, KS



1901 Sharp Point Drive, Suite C
Fort Collins, Colorado 80525
(970) 484-0359 FAX (970) 484-0454

RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL ASTM D2844

CLIENT: Monument Industrial, LLC
PROJECT: Industrial Warehouse
LOCATION: B-13 1'-5', Sample No. 2
TERRACON NO. 23205102

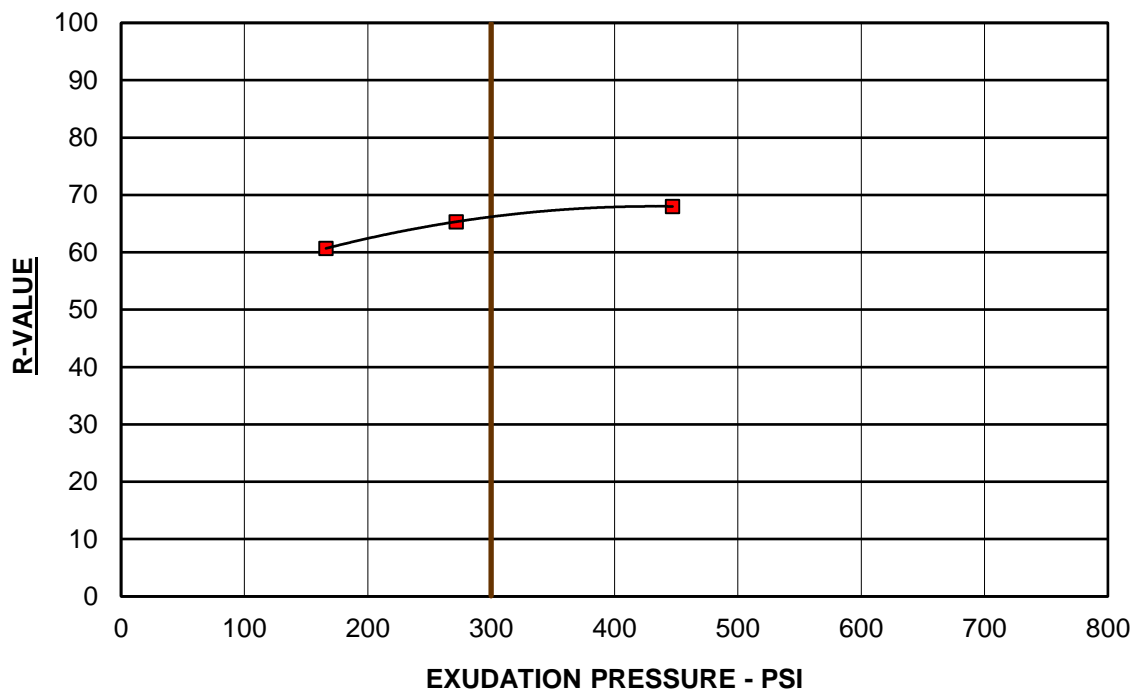
DATE OF TEST: 28-Sep-20

CLASSIFICATION: Well Graded Sand with Silt (SW-SM)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	180	210	250
DENSITY (PCF)	117.1	119.1	120.6
MOISTURE CONTENT (%)	11.0	9.3	8.4
EXPANSION PRESSURE (PSI)	0.00	0.00	0.00
HORIZONTAL PRESSURE @ 160 PSI	48	43	39
SAMPLE HEIGHT (INCHES)	2.48	2.50	2.50
EXUDATION PRESSURE (PSI)	166.1	271.7	447.1
CORRECTED R-VALUE	60.7	65.3	68.0
UNCORRECTED R-VALUE	60.7	65.3	68.0

R-VALUE @ 300 PSI EXUDATION PRESSURE = **65.8**



Analytical Results

TASK NO: 200918029

Report To: Rob Hernandez

Company: Terracon, Inc. - Colo Springs
4172 Center Park Drive
Colo. Springs CO 80916

Bill To: Rob Hernandez

Company: Terracon, Inc. - Accounts Payable
18001 W. 106th St
Suite 300
Olathe KS 66061

Task No.: 200918029

Client PO:

Client Project: Industrial Warehouse 23205102

Date Received: 9/18/20

Date Reported: 9/25/20

Matrix: Soil - Geotech

Customer Sample ID B6 @ 1ft-5ft

Lab Number: 200918029-01

Test	Result	Method
Chloride - Water Soluble	0.0006 %	AASHTO T291-91/ ASTM D4327
pH	6.4 units	AASHTO T289-91
Resistivity	7628 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	< 0.001 %	AASHTO T290-91/ ASTM D4327

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.

ASTM - American Society for Testing and Materials.

ASA - American Society of Agronomy.

DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.



DATA APPROVED FOR RELEASE BY

Analytical Results

TASK NO: 200918030

Report To: Rob Hernandez

Company: Terracon, Inc. - Colo Springs
4172 Center Park Drive
Colo. Springs CO 80916

Bill To: Rob Hernandez

Company: Terracon, Inc. - Accounts Payable
18001 W. 106th St
Suite 300
Olathe KS 66061

Task No.: 200918030

Client PO:

Client Project: Industrial Warehouse 23205102

Date Received: 9/18/20

Date Reported: 9/25/20

Matrix: Soil - Geotech

Customer Sample ID B15 @ 1ft-5ft

Lab Number: 200918030-01

Test	Result	Method
Chloride - Water Soluble	0.0018 %	AASHTO T291-91/ ASTM D4327
pH	6.1 units	AASHTO T289-91
Resistivity	7994 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	< 0.001 %	AASHTO T290-91/ ASTM D4327

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.


ASTM - American Society for Testing and Materials.


ASA - American Society of Agronomy.


DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.



DATA APPROVED FOR RELEASE BY

Field Percolation Rate Test						
					Test Hole	PT-1
Project Name		Industrial Warehouse			Date	9/15/2020
Project #		23205102			Hole Diameter (in)	4
Engineer/Tech		KTH			Hole Depth (in)	48
Time	Length of Interval (min)	Total Time (min)	Beginning Water Level (in)	Ending Water Level (in)	Water Level Drop During Interval (in)	Notes
2:35	10	10	6	0	6	
2:45	10	20	6	0	6	
2:55	10	30	6	0	6	
3:05	10	40	7	0	7	
3:15	10	50	7	0	7	
3:25	10	60	7	0	7	
3:35	10	70	7	0	7	

Field Percolation Rate Test						
					Test Hole	PT-2
Project Name		Industrial Warehouse			Date	9/15/2020
Project #		23205102			Hole Diameter (in)	4
Engineer/Tech		KTH			Hole Depth (in)	48
Time	Length of Interval (min)	Total Time (min)	Beginning Water Level (in)	Ending Water Level (in)	Water Level Drop During Interval (in)	Notes
2:35	10	10	6	0	6	
2:45	10	20	6	0	6	
2:55	10	30	6	0	6	
3:05	10	40	6	0	6	
3:15	10	50	6	0	6	
3:25	10	60	6	0	6	
3:35	10	70	6	0	6	

Field Percolation Rate Test						
					Test Hole	PT-3
Project Name		Industrial Warehouse			Date	9/15/2020
Project #		23205102			Hole Diameter (in)	4
Engineer/Tech		KTH			Hole Depth (in)	48
Time	Length of Interval (min)	Total Time (min)	Beginning Water Level (in)	Ending Water Level (in)	Water Level Drop During Interval (in)	Notes
2:35	10	10	6	0	6	
2:45	10	20	6	0	6	
2:55	10	30	6	0	6	
3:05	10	40	6	0	6	
3:15	10	50	6	0	6	
3:25	10	60	6	0	6	

SUPPORTING INFORMATION

Contents:

General Notes

Unified Soil Classification System



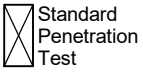




Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Industrial Warehouse ■ Monument, CO

Terracon Project No. 23205102

SAMPLING	WATER LEVEL	FIELD TESTS
 Modified Dames & Moore Ring Sampler  Grab Sample  Standard Penetration Test	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered <p>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.</p>	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See [Exploration and Testing Procedures](#) in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance				BEDROCK		
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu, (tsf)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Ring Sampler Blows/Ft.	Standard Penetration or N-Value Blows/Ft.	Descriptive Term (Consistency)
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3	< 30	< 20	Weathered
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4	30 - 49	20 - 29	Firm
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9	50 - 89	30 - 49	Medium Hard
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18	90 - 119	50 - 79	Hard
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42	> 119	> 79	Very Hard
			Hard	> 4.00	> 30	> 42			

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F	
			$Cu < 4$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	GP	Poorly graded gravel ^F	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	SP	Poorly graded sand ^I	
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}	
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots on or above “A”	CL	Lean clay ^{K, L, M}	
			$PI < 4$ or plots below “A” line ^J	ML	Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K, L, M, N}
			Liquid limit - not dried			Organic silt ^{K, L, M, O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line	CH	Fat clay ^{K, L, M}	
			PI plots below “A” line	MH	Elastic Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K, L, M, P}
			Liquid limit - not dried			Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat	

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

