March 15, 2024
Project No. 502907001

Ms. Mindy Rietz
United Properties
1331 17th Street, Suite 604
Denver, Colorado 80202

Subject: Geologic Hazard Evaluation
Proposed Reagan Ranch Industrial Development
Marksheffel Road & Space Village Avenue
Colorado Springs, Colorado

Dear Ms. Rietz:

In accordance with your request and authorization, we have performed a geologic hazard evaluation for the Reagan Ranch Industrial Development located in Colorado Springs, Colorado. This letter presents our findings and conclusions regarding geologic hazards at the proposed project.

We appreciate the opportunity to be of service on this project.

Sincerely,
NINYO & MOORE

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1. INTRODUCTION

In accordance with your request and authorization, we have performed a geologic hazard evaluation for the proposed Reagan Ranch Industrial Development located northwest of the intersection of Marksheffel Road and Space Village Avenue in Colorado Springs, Colorado. The approximate location of the site is depicted on Figure 1.

The purpose of our study was to evaluate the subsurface conditions and to provide review of geologic and other hazards which could affect the proposed development.

2. SCOPE OF SERVICES

The geologic hazard evaluation scope of services for the project generally included:

- Review of referenced background information, including aerial photographs, published geologic and soil maps, in-house geotechnical data, review of the Colorado Springs Engineering Geology online database, and available topographical information pertaining to the project site and vicinity to identify potential geologic hazards.

- Site reconnaissance to document site conditions. Site photographs and descriptions are presented in Appendix C.

- Drilling, logging, and sampling of 10 small-diameter exploratory borings in general accordance with the American Society for Testing and Materials (ASTM) D-1586 within the project site. Borings were advanced to depths of approximately 25 feet below ground surface (bgs). The boring logs are presented in Appendix A and boring locations are presented on Figure 2.

- Performing laboratory tests on selected samples obtained from the borings to evaluate engineering properties including in-situ moisture content and dry density, Atterberg limits, percent materials passing the No. 200 sieve and gradation, swell/consolidation potential, direct shear, and soil corrosivity characteristics (including pH, resistivity, water-soluble sulfates and chlorides). The results of the laboratory testing are presented on the boring logs and in Appendix B.

- Compilation and analysis of the data obtained.

- Preparation of this letter presenting our geologic hazard findings and proposed mitigation methods.

3. SITE DESCRIPTION AND BACKGROUND REVIEW

The project consists of the development of an approximately 20.9-acre site located northwest of Marksheffel Road and East Space Village Avenue in Colorado Springs, Colorado. The site is bounded by State Highway 94 to the north, Marksheffel Road to the east, Space Village Avenue to the south, and commercial developments to the west. The approximate location of the site is depicted on Figure 1. Site photographs and descriptions are presented in Appendix C.

The site is currently vacant, but remnants of demolition debris and fill material was present at the southwest half of the site during Ninyo & Moore's site reconnaissance performed on February 14, 2024. The northeast half of the site was observed to be vegetated with native plants and grasses. A relatively rapid grade change of approximately 12 to 14 feet existed between the southwest and northeast half of the site. The grade change occurred where the observed fill material ended and native ground began.

Publicly available historical aerial photographs indicated that between 1999 and 2022, the southwest half of the site was occupied by several structures, stockpiled material, parked vehicles, and apparent refuse. Public aerial photographs prior to 1999 were not available for review. The below exhibit depicts the site in 2018. Ninyo & Moore opines that the dark gray material seen near the southeast corner of the site are asphalt millings.

Exhibit 1 – 2018 Site Conditions (Google Earth, 2018)

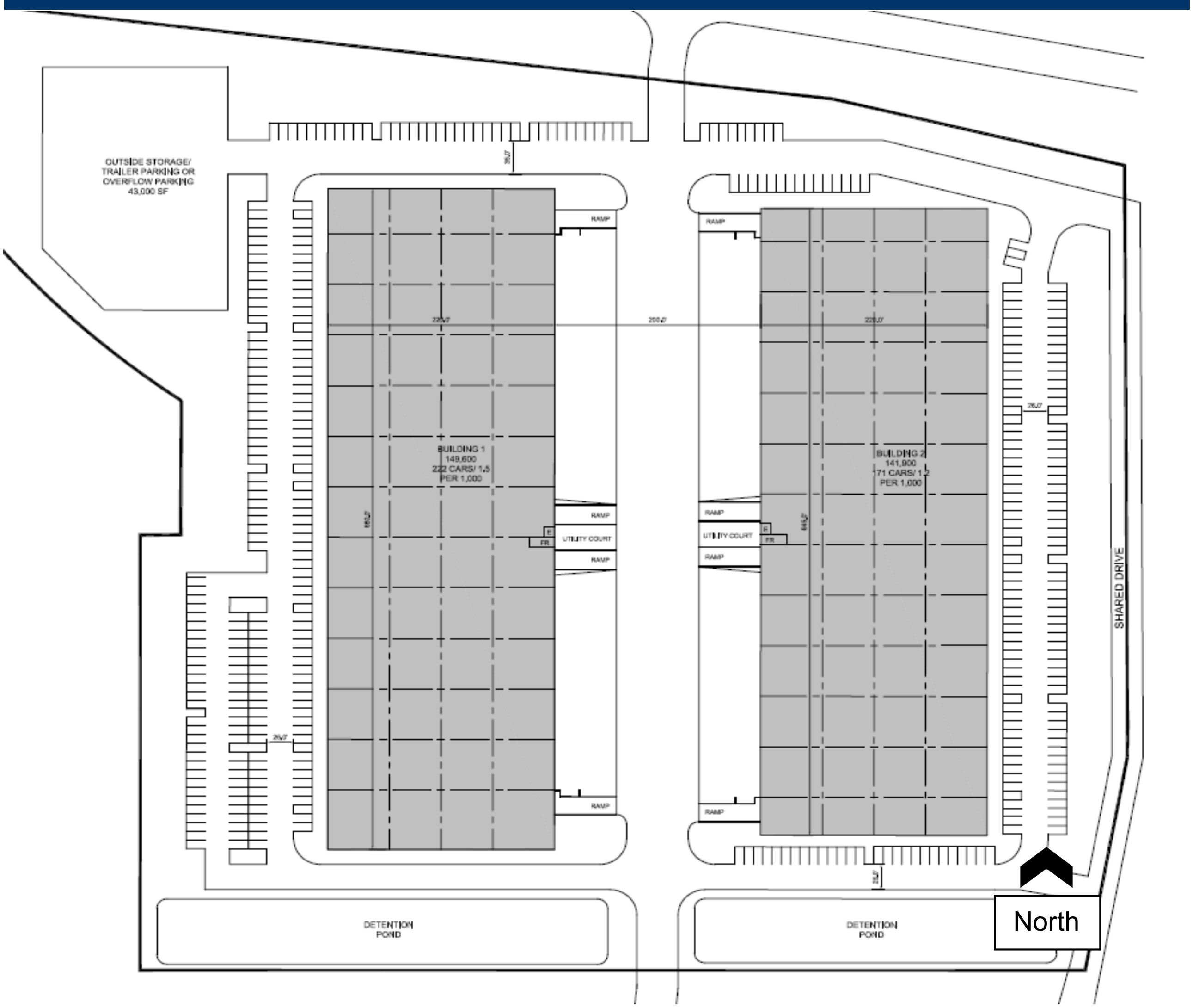
Aerial photographs between 2020 and 2022 indicate the millings were removed from the site. Since 2022, the project site has maintained a consistent condition.

4. PROPOSED CONSTRUCTION

The project is currently in its preliminary stage, however, may include the design and construction of two industrial buildings ranging in size from 141,900 to 149,600 square feet . We anticipate the buildings will be steel-framed with cast-in-place concrete wall panels. The overalsfl site development will encompass the design and construction of privately-maintained paved drive lanes, automobile and trailer parking areas, and landscaping enhancements. Construction may also include water storage/detention ponds located at the south edge of the site.

The preliminary site plan is portrayed on Exhibit 2. However, plans are still preliminary and building locations and improvements may change.

Exhibit 2 – Preliminary Site Plan – Option 2 (EV Studio, 2023)



Project specific site grading, finished floor elevation information, and structural loading information was not available at the time of report preparation. Based on the observed site topography, we anticipate moderate to significant site grading will be needed for the development.

5. FIELD EXPLORATION AND LABORATORY TESTING

On February 20, 2024, Ninyo & Moore conducted preliminary subsurface exploration services at the project site to evaluate the existing subsurface conditions and to collect soil samples for visual observation and laboratory testing. The evaluation consisted of the drilling, logging, and sampling of 10 exploratory borings using truck-mounted drill rigs equipped with 4-inch diameter, continuous-flight, solid-stem augers. The borings were advanced within the project site to depths of approximately 25 feet bgs. Relatively undisturbed and disturbed soil samples were collected at selected intervals. The locations of the borings are presented on Figure 2. The borings logs are presented in Appendix A. Approximate boring coordinates and ground elevations were measured in the field using a Trimble Model DA2-BT survey unit with a global navigation satellite system output of NAD83 (2011) and referencing Geoid model GEOID18.

The soil samples collected from the drilling activities were transported to the Ninyo & Moore laboratory for geotechnical laboratory analysis. Selected samples were analyzed to evaluate engineering properties including in-situ moisture content and dry density, Atterberg limits, percent fines passing the No. 200 sieve and gradation, direct shear, swell/consolidation potential, and soil corrosivity characteristics (including pH, resistivity, water soluble sulfates and chlorides). The results of the in-situ moisture content and dry density tests are presented on the boring logs in Appendix A. Descriptions of the laboratory test methods and the remainder of the test results are presented in Appendix B.

6. GEOLOGIC AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at this site are described in the following sections.

6.1. Geologic Setting

The site is located in Colorado Springs, Colorado, approximately 10 miles east of the Rocky Mountains, within the Colorado Piedmont section of the Great Plains Physiographic Province. The Laramide Orogeny uplifted the Rocky Mountains during the late Cretaceous and early Tertiary Periods. Subsequent erosion deposited sediments east of the Rocky Mountains. As a result of regional uplift approximately 5 to 10 million years ago, streams and rivers down-cut and excavated into the Great Plains forming the Colorado Piedmont section (Trimble, 1980).

The surficial geology of the site vicinity, which lies in the Elsmere quadrangle, is mapped by Madole and Thorson (2002) and as middle and early Holocene and late Pleistocene eolian deposits and alluvium. These deposits cover approximately 70 percent of the quadrangle and are derived from two major drainage basins. Much of the alluvial sand deposits are sourced from the Dawson Formation within the upland regions to the east. Windblown deposits, which tend to blanket the alluvium, resulted from transportation of fine- to coarse-grained sand, silt, and clay particles from the alluvial deposits within valley floors (Madole and Thorson, 2002). Nearly all the surficial deposits in the map area are poorly sorted to extremely poorly sorted (Madole and Thorson, 2002).

During the middle Pleistocene, streams in the region down cut to greater depths then aggraded, and as a result, an abandoned paleovalley formed which runs parallel to Sand Creek, East Fork Sand Creek, and Upper Jimmy Camp Creek (Madole and Thorson, 2002). The paleovalley is concealed by eolian deposits and exists within the site vicinity.

The eolian deposits within the site vicinity are described by Madole and Thorson (2002) as chiefly pale-brown to light-yellowish-brown coarse sand.

Bedrock in the area generally strikes southeast to northwest and dips between 3 and 11 degrees northeast. Laramie Formation and Fox Hills Sandstone bedrock is mapped underlying the project area at depth.

6.2. Subsurface Conditions

Our understanding of the preliminary subsurface conditions at the project site is based on our preliminary field exploration and laboratory testing, review of published geologic maps, historic aerial photographs, and our experience with the general geology of the area. The following sections provide a generalized description of the subsurface materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

6.2.1. Fill

Fill material was encountered at the surface in Borings B-1 through B-5, B-7, and B-10 and extended to depths ranging from approximately 3 to 13 feet bgs. The fill generally consisted of various shades of brown and gray, dry to moist, clayey gravel to clayey fine to coarse sand with variable amounts of gravel and demolition debris. Concrete debris was encountered in some of the samples, and considering the historic demolished structures at the site, demolition refuse or other features may be present below the ground surface which were not encountered in our preliminary borings.

Additionally, asphalt millings were not encountered during drilling. As stated in Section 3, the millings appear to have been removed from the site between 2020 and 2022 based on aerial photography, but may still be present on-site in areas that were not explored. The extent of the millings should be further evaluated during the final geotechnical evaluation.

Information about how and when the existing fill was placed is unknown and fill material encountered contains various demolition debris. As a result, the fill material encountered in our borings and that will be encountered during the course of this development is considered undocumented.

6.2.2. Eolian Deposits

Eolian deposits were encountered at the surface in Borings B-6, B-8, and B-9, and below fill material in the remaining borings. Plant root zones within the eolian deposits were generally observed to extend 3 to 6 inches into the native soils. However, root zones may extend deeper in areas that were not explored or where vegetation consisted of grasses. The eolian deposits extended to the borings' termination depths of approximately 25 feet bgs.

The eolian deposits generally consisted of dry to moist, very loose to medium dense, fine to coarse sand with variable amounts of clay and silt. A layer of sandy lean clay was encountered between a depth of approximately 9 feet bgs and 14 feet bgs in Boring B-6, and between a depth of approximately 6 feet bgs and 11 feet bgs in Boring B-8.

6.3. Groundwater

Groundwater was not encountered during drilling the preliminary geotechnical investigation. Perched water can develop within or below the undocumented fill and within the higher permeability overburden deposits following periods of heavy or prolonged precipitation, or site irrigation. The detention ponds proposed may also create perched groundwater conditions in the vicinity of the detention ponds. The possibility of perched water should be considered when developing the design and construction plans for the project.

On a preliminary basis, based on our current understanding of the project, groundwater is not anticipated to be a constraint.

7. GEOLOGIC AND OTHER HAZARDS

The following sections describe geologic hazards required for evaluation by the City of Colorado Springs. Geologic and other hazards reviewed for the project site include seismicity and faulting, liquefaction, expansive soils, collapsible soils, undocumented fill, flooding, slope stability, steeply dipping bedrock, mine subsidence, and erosion.

7.1. Seismicity and Faulting

Historically, several minor earthquakes have been recorded along the Front Range. Based on our field observations and review of readily available published geological maps and literature, there are no known active faults underlying or directly adjacent to the subject site.

The Rampart Range Fault lies approximately 10 miles west of the site and trends north-south along the eastern margin of the Front Range (USGS, 2018). The fault formed during the Laramide orogeny and is considered a Class A fault by the USGS. Middle to late Quaternary offsets indicate the sense of movement is normal at an approximate dip of 50 degrees, however, there is no evidence of movement in Holocene time and damaging surface-rupture is considered low.

The Cheraw Fault lies approximately 75 miles southeast of the site and trends in a northeast-southwest direction (USGS, 2019). The fault is approximately 50 miles long and dips at an angle of about 66 degrees with a normal slip sense. Studies performed by Scott (1970) and Crone and others (1997) found record of late Quaternary surface rupture and confirmed that the fault could be a potential source of strong earthquakes. The Cheraw fault is only the second confirmed late Quaternary surface-rupturing fault in the west-central United States (USGS, 2019). However, due to the distance the fault lies from the project site, damaging surface-rupture is considered low.

7.2. Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated soils lose shear strength under short-term (dynamic) loading conditions. Ground shaking of sufficient duration results in the loss of grain-to-grain contact in potentially liquefiable soils due to a rapid increase in pore water pressure, causing the soil to behave as a fluid for a short period of time.

To be potentially liquefiable, a soil is typically cohesionless with a grain-size distribution generally consisting of sand and silt. It is generally loose to medium dense and has a relatively high moisture content, which is typical near or below groundwater level. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase. Potentially liquefiable soils need to be subjected to sufficient magnitude and duration of ground shaking for liquefaction to occur. Based on the absence of groundwater and the low peak ground accelerations, liquefaction is not a design consideration for the project.

7.3. Expansive Soils

One of the more significant geologic hazards in the Front Range area is the presence of swelling clays in bedrock or surficial deposits. Wetting and drying of bedrock or surficial deposits containing swelling clays can result in expansion and collapse of those units, which can cause major damage to structures. A review of a Colorado Geological Survey map delineating areas based on their relative potential for swelling in the Front Range by Hart (1973-1974) indicates that the soil in the site vicinity typically exhibits low swell potential.

Granular soils, with the exception of a layer of clay in Borings B-6 and B-8, were encountered during our subsurface exploration which generally do not exhibit swell, or exhibit low swell potential. A swell/consolidation test was performed on a select sample of clay from Boring B-8 which did not exhibit swell. Based on the granular subsurface soils encountered at this site and results of our laboratory swell testing, expansion potential is considered low within the fill and eolian deposits.

7.4. Collapsible Soils

Compressible soils are generally comprised of soils that undergo settlement when exposed to new loadings, such as fill or foundation loads. Undocumented fill material is susceptible to compression due to new loading conditions. Soil collapse (or hydrocollapse) is a phenomenon where soils undergo a significant decrease in volume due to rearrangement of soils particles to a more compact arrangement upon an increase in moisture content, with or without an increase in external loads. These soils are generally found in arid to semi-arid regions and have low in-situ unit weights and moisture contents. The depositional environments of collapsible soils commonly include colluvium and eolian deposits. Buildings, structures, and other improvements may be subject to excessive settlement-related distress when compressible or collapsible soils are present.

Eolian deposits were encountered within the native overburden soils. The eolian deposits generally consisted of dry to moist, loose to medium dense, fine to coarse sand with varying amounts of clay. The site soils were generally observed to be relatively dry with respect to their optimum moisture content. Selected samples of the eolian deposits had in-place moisture contents between approximately 3.4 and 16.7 percent and dry densities between approximately 95.7 and 123.8 pcf. Low dry unit-weight is associated with a loose soil structure in inorganic soils and is a good parameter for collapse susceptibility.

In addition to evaluating in-situ dry unit-weights and moisture content, Atterberg Limits are another commonly used test to help evaluate collapse potential. Many collapsible soils have liquid limits below 45 and plastic indexes below 25 to non-plastic (Bureau of Reclamation, 1992). Collapsible soils must also be unsaturated, with saturation values generally much lower than 100. Typically, the saturation percent for collapsible soils is 39 percent and below (Bureau of Reclamation, 1992). Saturation percentages within the eolian deposits ranged from 14.7 to 70.7 percent, and liquid limit and plastic indexes ranged from non-plastic to 27 and non-plastic to 9, respectively. Average saturation of eolian deposits was approximately 34 percent. The results of these index tests indicate the eolian deposits may be susceptible to collapse.

Relatively undisturbed samples were selected for one-dimensional consolidation tests at approximate representative overburden field conditions in general accordance with ASTM D4546. Selected samples of eolian deposits evaluated for consolidation in general accordance with ASTM D4546 exhibited collapse potentials of up to 0.7 percent, which also indicates low to moderate risk of collapse upon wetting.

Based on the results of our subsurface exploration, laboratory testing, and the information obtained from our background review, the eolian deposits are anticipated to pose a low to moderate risk of collapse. Collapse potential of the eolian deposits can be reduced by removing them and replacing them as moisture-conditioned and properly compacted engineered fill soils. Additional measures to manage concentrated flows and surface drainage will be needed to control the post-construction wetting of these potentially collapsible deposits.

7.5. Undocumented Fill and Landfill

Based on review of the Hazardous Materials and Waste Materials Division Map Portal and Records Search Tool (2024), a solid-waste transfer station is located just west of the project site at an address of 543 Air Lane, Colorado Springs. Landfill material was not encountered within the borings during the preliminary subsurface exploration, but we recommend test pits be excavated during the final geotechnical evaluation to further study the existing fill material.

Compressible soils are generally comprised of soils that undergo settlement when exposed to new loadings, such as fill or foundation loads. Undocumented fill material is susceptible to compression due to new loading conditions, and 3 to 13 feet of fill was encountered in Borings B-1 through B-5, B-7, and B-10.

Compression of existing undocumented fill material associated with site historic uses will occur due to new loads imparted by the proposed building foundations, floor systems, and other improvements. The undocumented fill materials encountered will provide risk of settlement to proposed improvements such as building foundations, slabs, and pavement areas. This risk cannot be eliminated without the removal and replacement of the existing fill materials. Removal of existing fill material and replacement with moisture conditioned and compacted engineered fill is recommended prior to development. Additionally, the suitability and extent of the fill material should be further evaluated during the final geotechnical evaluation by means of test pit excavation.

7.6. Flooding

Based on the flood rate insurance map (FIRM) prepared by the Federal Emergency Management Agency (FEMA, 2007), the proposed construction lies in Zone X, which is defined as an area determined to be outside the 0.2 percent annual chance flood plain (500-year flood zone). Therefore, flooding is not considered a hazard in the project area.

7.7. Slope Stability

Slope stability is not considered a design consideration for the project site due to the relatively gently sloping site topography and surrounding site topography. During the site reconnaissance a grade change of approximately 12 to 14 feet existed between the southwest and northeast half of the site. The grade change occurred where the observed fill material ended and native ground began and the slope was estimated to be at an approximate inclination of 2H (Horizontal):1V (Vertical) (Google Earth, 2024).

The fill material making the slope on-site is recommended to be removed and replaced with moisture-conditioned and compacted engineered fill.

7.8. Steeply Dipping Bedrock

Bedrock was not encountered during the preliminary subsurface exploration. Additionally, outcropping bedrock was not observed within the site vicinity. Bedrock in the area generally strikes southeast to northwest and dips between 3 and 11 degrees northeast (Madole and Thorson, 2002). Steeply dipping bedrock is not a geologic hazard at this site.

7.9. Mine Subsidence

The Howells, Cardiff, and Tudor Mine are mapped approximately 3.5 miles west to northwest of the project site. Based on review of the Colorado Springs Coal Field Map prepared for the Colorado Mined Land Reclamation Program (1988), the extent of these mines were minimal and do not undermine the project site. Mine subsidence is not considered a hazard at the project site.

7.10. Erosion

According to the United States Department of Agriculture Natural Resources Conservation Service (NRCS) the soils within the project site area represent a slight to moderate risk of erosion potential, on a scale of slight, moderate, severe, and very severe. Ratings are based on slope, soil erosion factor K, and an index of rainfall erosivity.

Erosion control should be developed in accordance with local, state, and Federal guidelines during construction. Fill or cut slopes should be vegetated to prevent slope erosion. Native vegetation is generally desirable (drought tolerant, variable root depth). Constructing a slope of 3H:1V or flatter will aid in vegetation establishment. On permanent slopes where vegetation is not established in a timely manner, rill and/or gully erosion can occur. Rill erosion is problematic in soils with low fines content, like the clayey, silty sand encountered near surface at this site.

8. CONCLUSIONS

Based on our geologic hazard evaluation, it is our opinion that no considerable geologic hazards exist at this site which cannot be mitigated during development and construction. Our review identified that existing fill material and potentially collapsible eolian deposits were the most significant geologic hazards and below is an outline of our conclusions and mitigation recommendations for these hazards based on our findings.

- Fill material was encountered at the surface in Borings B-1 through B-5, B-7, and B-10.
    - Fill extended to depths ranging from 3 to 13 feet bgs.
    - The fill generally consisted of various shades of brown and gray, dry to moist, clayey gravel to clayey fine to coarse sand with variable amounts of gravel and demolition debris.
    - Information about the existing fill regarding ground preparation, remedial excavation, and the degree of compaction during placement, is unknown to this firm. As a result, the fill material is considered undocumented.
    - Removal of existing fill material and replacement with moisture conditioned and compacted engineered fill is recommended prior to development.
- Eolian deposits were encountered at the surface in Borings B-6, B-8, and B-9, and below fill material in the remaining borings.
    - The eolian deposits extended to the borings' termination depths of approximately 25 feet bgs.
    - The eolian deposits generally consisted of dry to moist, very loose to medium dense, fine to coarse sand with variable amounts of clay and silt. A layer of sandy lean clay was encountered between a depth of approximately 9 feet bgs and 14 feet bgs in Boring B-6, and between a depth of approximately 6 feet bgs and 11 feet bgs in Boring B-8.
    - The eolian deposits exhibited low swell potential, although the laboratory testing performed indicated, the eolian deposits have low to moderate collapse potential upon wetting.
    - Collapse potential of the eolian deposits can be reduced by removing them and replacing them as moisture-conditioned and properly compacted engineered fill soils. Additional measures to manage concentrated flows and surface drainage will be needed to control the post-construction wetting of these potentially collapsible deposits.

9. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geologic hazard report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified, and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

10. REFERENCES

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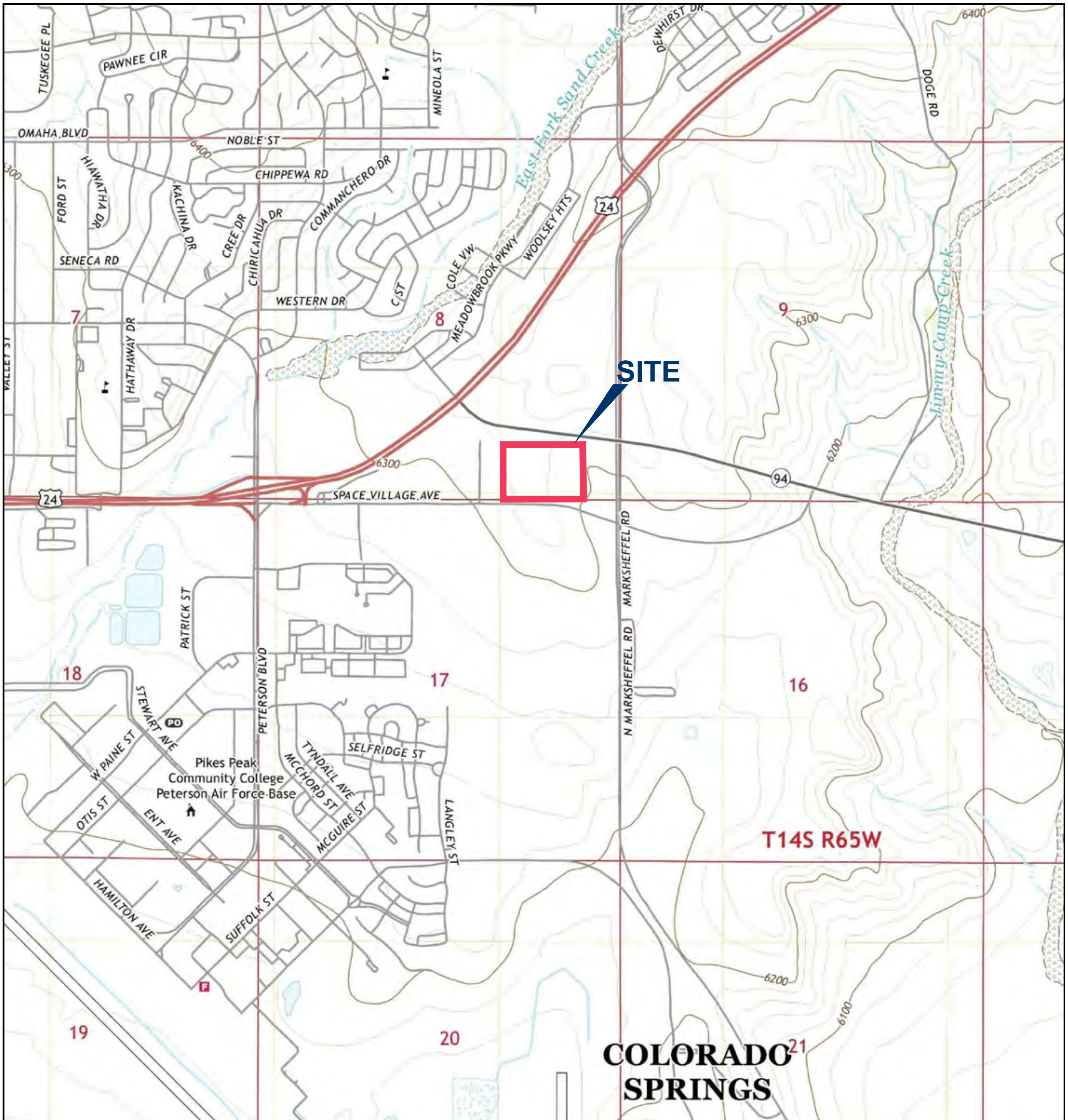
FIGURES



REFERENCE: USGS, 2022.

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

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FIGURE 1

SITE LOCATION

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD AND SPACE VILLAGE AVENUE
COLORADO SPRINGS, COLORADO

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Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

Source: NAVTEQ, 10/24/22.

SOURCE: EV STUDIO, 05/17/23.
NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

bsm file no: 2907blm0324

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

FIGURE 2

BORING LOCATIONS

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD AND SPACE VILLAGE AVENUE
COLORADO SPRINGS, COLORADO

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APPENDIX A

Boring Logs

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples
Disturbed soil samples were obtained in the field using the following method.

Bulk Samples
Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples
Relatively undisturbed soil samples were obtained in the field using the following method.

The California Drive Sampler
The sampler, with an external diameter of 2.4 inches, was lined with four 4-inch long, thin brass rings with inside diameters of approximately 1.9 inches. The sample barrel was driven into the ground with the weight of a hammer in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass liners, sealed, and transported to the laboratory for testing.

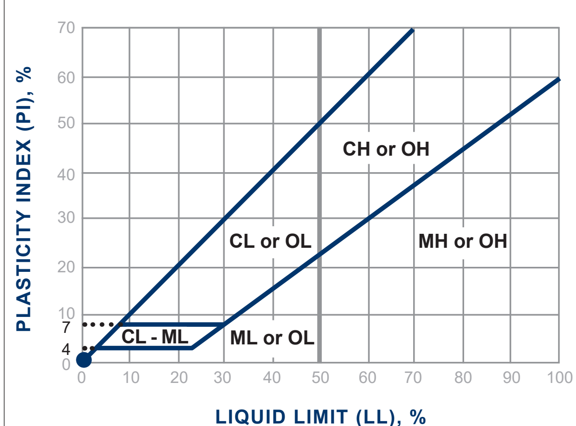
Soil Classification Chart Per ASTM D 2488

Primary Divisions			Group Symbol	Group Name
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	**GRAVEL** more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL less than 5% fines	GW	well-graded GRAVEL
			GP	poorly graded GRAVEL
		GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines	GW-GM	well-graded GRAVEL with silt
			GP-GM	poorly graded GRAVEL with silt
			GW-GC	well-graded GRAVEL with clay
			GP-GC	poorly graded GRAVEL with clay
		GRAVEL with FINES more than 12% fines	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND 50% or more of coarse fraction passes No. 4 sieve	CLEAN SAND less than 5% fines	SW	well-graded SAND
			SP	poorly graded SAND
		SAND with DUAL CLASSIFICATIONS 5% to 12% fines	SW-SM	well-graded SAND with silt
			SP-SM	poorly graded SAND with silt
			SW-SC	well-graded SAND with clay
			SP-SC	poorly graded SAND with clay
		SAND with FINES more than 12% fines	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS 50% or more passes No. 200 sieve	**SILT and CLAY** liquid limit less than 50%	INORGANIC	CL	lean CLAY
			ML	SILT
			CL-ML	silty CLAY
		ORGANIC	OL (PI > 4)	organic CLAY
			OL (PI < 4)	organic SILT
	SILT and CLAY liquid limit 50% or more	INORGANIC	CH	fat CLAY
			MH	elastic SILT
		ORGANIC	OH (plots on or above "A"-line)	organic CLAY
			OH (plots below "A"-line)	organic SILT
	Highly Organic Soils		PT	Peat

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		> 12"	> 12"	Larger than basketball-sized
Cobbles		3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4 - 3"	3/4 - 3"	Thumb-sized to fist-sized
	Fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10 - #4	0.079 - 0.19"	Rock-salt-sized to pea-sized
	Medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock-salt-sized
	Fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized
Fines		Passing #200	< 0.0029"	Flour-sized and smaller

Plasticity Chart



Apparent Density - Coarse-Grained Soil

Apparent Density	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Modified Split Barrel (blows/foot)	SPT (blows/foot)	Modified Split Barrel (blows/foot)
Very Loose	≤ 4	≤ 8	≤ 3	≤ 5
Loose	5 - 10	9 - 21	4 - 7	6 - 14
Medium Dense	11 - 30	22 - 63	8 - 20	15 - 42
Dense	31 - 50	64 - 105	21 - 33	43 - 70
Very Dense	> 50	> 105	> 33	> 70

Consistency - Fine-Grained Soil

Consis-tency	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Modified Split Barrel (blows/foot)	SPT (blows/foot)	Modified Split Barrel (blows/foot)
Very Soft	< 2	< 3	< 1	< 2
Soft	2 - 4	3 - 5	1 - 3	2 - 3
Firm	5 - 8	6 - 10	4 - 5	4 - 6
Stiff	9 - 15	11 - 20	6 - 10	7 - 13
Very Stiff	16 - 30	21 - 39	11 - 20	14 - 26
Hard	> 30	> 39	> 20	> 26

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USCS METHOD OF SOIL CLASSIFICATION

BORING LOG EXPLANATION SHEET

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0								Bulk sample.
								Modified split-barrel drive sampler.
								2-inch inner diameter split-barrel drive sampler.
								No recovery with modified split-barrel drive sampler or 2-inch inner diameter split-barrel drive sampler.
								Sample retained by others.
5								Standard penetration test (SPT).
								No recovery with SPT.
								Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
								No recovery with Shelby tube sampler.
								Continuous push sample.
10								Seepage.
								Groundwater encountered during drilling.
								Groundwater measured after drilling.
							SM	MAJOR MATERIAL TYPE (SOIL): Solid line denotes unit change.
							CL	Dashed line denotes material change. Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Shear Bedding Surface
15								
								The total depth line is a solid line that is drawn at the bottom of the boring.
20								

FIGURE 1

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BORING LOGS

DATE DRILLED: 2/20/2024 BORING NO.: B-1

GROUND ELEVATION: 6,323.69'± SHEET 1 OF 1

METHOD OF DRILLING: Diedrich 120, 4" Solid Stem Auger (Dakota Drilling)

DRIVE WEIGHT: 140 lbs. (Spooling Cathead) DROP: 30"

SAMPLED BY: MEO LOGGED BY: MEO REVIEWED BY: SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■	X	18	3.3	86.9			FILL: Brown, dry to moist, loose, clayey fine to coarse SAND; trace gravel.
	■	X	15	3.4	102.9		SM	EOLIAN DEPOSITS: Light brown, dry to moist, loose, silty fine to coarse SAND.
10		X	16	5.7	106.8			
		X	19					Brown; moist.
20		X	28	3.9	107.4			Dry; medium dense.
		X	50/11"					
30								Total Depth: 24.9 feet. Groundwater was not encountered during drilling. Borehole left open after drilling for delayed groundwater reading.
40								

Total Depth: 24.9 feet.
Groundwater was not encountered during drilling.
Borehole left open after drilling for delayed groundwater reading.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X							FILL: Brown, dry to moist, clayey fine to coarse SAND with gravel.
	X	X	16	4.3	106.2			
	X	X	36	7.1	118.1			Moist; trace gravel.
10		X	14	5.4	110.2		SP-SM	EOLIAN DEPOSITS: Light brown, dry to moist, loose, fine to medium SAND with silt.
		X	21	5.4	110.6			
20		X	15					
		X	17					Moist.
30								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.
40								

DATE DRILLED 2/20/2024 BORING NO. B-2

GROUND ELEVATION 6,313.03'± SHEET 1 OF 1

METHOD OF DRILLING Diedrich 120, 4" Solid Stem Auger (Dakota Drilling)

DRIVE WEIGHT 140 lbs. (Spooling Cathead) DROP 30"

SAMPLED BY MEO LOGGED BY MEO REVIEWED BY SS

DATE DRILLED 2/20/2024	BORING NO. B-3
GROUND ELEVATION 6,306.03'±	SHEET 1 OF 1
METHOD OF DRILLING Diedrich 120, 4" Solid Stem Auger (Dakota Drilling)	
DRIVE WEIGHT 140 lbs. (Spooling Cathead)	DROP 30"
SAMPLED BY MEO LOGGED BY MEO	REVIEWED BY SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X							FILL: Black to dark brown, moist, clayey GRAVEL with sand.
	X	X	30	9.8	113.2			
	X	X	28	5.9	118.3			Brownish gray, dry to moist, clayey fine to coarse SAND; trace gravel.
10		X	11	13.4	112.6			Dark gray; moist.
		X	22				SM	EOLIAN DEPOSITS: Light brown, dry to moist, medium dense, silty fine to coarse SAND.
20		X	15				SP-SM	Light brown, dry to moist, loose, fine to medium SAND with silt.
		X	34					Medium dense.
								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024.
30								Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.
40								

DATE DRILLED: 2/20/2024	BORING NO.: B-4	
GROUND ELEVATION: 6,323.23'±	SHEET 1 OF 1	
METHOD OF DRILLING: Diedrich 120, 4" Solid Stem Auger (Dakota Drilling)		
DRIVE WEIGHT: 140 lbs (Spooling Cathead)	DROP: 30"	
SAMPLED BY: MEO	LOGGED BY: MEO	REVIEWED BY: SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X	X	50/3"					FILL: Dark brown, dry, clayey GRAVEL with sand and demolition debris.
	X	X	30					
								Brown, dry to moist, clayey fine to coarse SAND with gravel.
		X	18	6.4	104.5			
10							SM	EOLIAN DEPOSITS: Light brown, dry to moist, loose, silty fine to coarse SAND.
		X	25	3.4	107.0		SP-SM	Light brown, dry to moist, medium dense, fine to medium SAND with silt.
20		X	17					Loose.
		X	34	5.1	109.7			Medium dense.
30								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024.
40								

Total Depth: 25 feet.
Groundwater was not encountered during drilling.
Backfilled with on-site soil after drilling on 2/20/2024.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.

DATE DRILLED	2/20/2024	BORING NO.	B-5
GROUND ELEVATION	6,319.06'±	SHEET 1 OF 1	
METHOD OF DRILLING	Diedrich 120, 4" Solid Stem Auger (Dakota Drilling)		
DRIVE WEIGHT	140 lbs. (Spooling Cathead)	DROP	30"
SAMPLED BY	MEO	LOGGED BY MEO	REVIEWED BY SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X	X	8	14.2	73.7			FILL: Dark brown, moist, clayey fine to coarse SAND with gravel.
	X	X	16	5.1	111.9		SP-SM	EOLIAN DEPOSITS: Light brown, moist, loose, clayey fine to coarse SAND with silt.
10		X	14	6.0	111.4			
		X	23					Medium dense.
20		X	20	5.1	109.1			Dry to moist; loose.
		X	40				SC	Light brown, dry to moist, medium dense, clayey fine to coarse SAND.
30								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024.
40								

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.

DATE DRILLED 2/20/2024	BORING NO. B-6	
GROUND ELEVATION 6,297.68'±	SHEET 1 OF 1	
METHOD OF DRILLING CME-55, 4" Solid Stem Auger (Dakota Drilling)		
DRIVE WEIGHT 140 lbs. (Spooling Cathead)	DROP 30"	
SAMPLED BY BRJ/CSD	LOGGED BY BRJ/CSD	REVIEWED BY SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	Bulk (0–5)						SP-SM	EOLIAN DEPOSITS: Light brown, moist, loose, fine to coarse SAND with silt.
		X	10	5.4	123.8			
		X	11	4.8	113.1			
10		X	15				CL	Light brown, moist, stiff, sandy lean CLAY.
		X	18	6.5	112.9		SC	Light brown, moist, loose, clayey fine to coarse SAND.
20		X	34					Medium dense.
		X	50	5.7	115.9			
30								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.
40								

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.

DATE DRILLED 2/20/2024 BORING NO. B-7

GROUND ELEVATION 6,328.09'± SHEET 1 OF 1

METHOD OF DRILLING CME-55, 4" Solid Stem Auger (Dakota Drilling)

DRIVE WEIGHT 140 lbs. (Spooling Cathead) DROP 30"

SAMPLED BY CSD LOGGED BY CSD REVIEWED BY SS

DESCRIPTION/INTERPRETATION

Depth (feet)	Blows/Foot	Moisture (%)	Dry Density (PCF)	Classification U.S.C.S.	Description/Interpretation
0					FILL: Light brown, moist, clayey SAND.
	28	6.1	121.6		
	8	11.8	109.4		Brown.
				SM	EOLIAN DEPOSITS: Light brown, moist, loose, silty fine to coarse SAND.
10	13	6.8	115.0		
	17			SP-SM	Light brown, moist, loose, fine to coarse SAND with silt.
20	15			SC	Light brown, moist, loose, clayey fine to coarse SAND.
	11				
30					
40					

Total Depth: 25 feet.
Groundwater was not encountered during drilling.
Backfilled with on-site soil after drilling on 2/20/2024.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.

DATE DRILLED	2/20/2024	BORING NO.	B-8
GROUND ELEVATION	6,316.26'±	SHEET 1 OF 1	
METHOD OF DRILLING	CME-55, 4" Solid Stem Auger (Dakota Drilling)		
DRIVE WEIGHT	140 lbs. (Spooling Cathead)	DROP	30"
SAMPLED BY	BRJ/CSD	LOGGED BY BRJ/CSD	REVIEWED BY SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X						SM	EOLIAN DEPOSITS: Brown, moist, loose, silty fine to coarse SAND.
	X	X	9	4.7	110.4			
	X	X	8					Very loose.
							CL	Light brown, moist, stiff, sandy lean CLAY.
10		X	11	16.7	95.7			
							SP-SM	Light brown, moist, loose, fine to medium SAND with silt.
		X	17					
20		X	17	8.9	108.5			
		X	20					
30								
40								

Total Depth: 25 feet.
Groundwater was not encountered during drilling.
Backfilled with on-site soil after drilling on 2/20/2024.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.

DATE DRILLED 2/20/2024 BORING NO. B-9

GROUND ELEVATION 6,307.19'± SHEET 1 OF 1

METHOD OF DRILLING CME-55, 4" Solid Stem Auger (Dakota Drilling)

DRIVE WEIGHT 140 lbs. (Spooling Cathead) DROP 30"

SAMPLED BY BRJ/CSD LOGGED BY BRJ/CSD REVIEWED BY SS

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	X						SM	EOLIAN DEPOSITS: Brown, moist, very loose, silty fine to coarse SAND.
	X	X	7	4.6	107.6			
	X	X	10	11.5	115.5			Loose.
							SP-SM	Light brown, moist, loose, fine to medium SAND with silt.
10		X	9					
		X	17	6.5	111.5			
20		X	20					
		X	20					
30								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024.
40								

Total Depth: 25 feet.
Groundwater was not encountered during drilling.
Backfilled with on-site soil after drilling on 2/20/2024.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0			21	5.2	114.3			FILL: Light brown, moist, loose, clayey fine to coarse SAND.
			25	5.3	115.3		SP-SM	EOLIAN DEPOSITS: Light brown, dry, medium dense, fine to coarse SAND with silt.
10			19					Loose.
			13	10.1	111.8			
20			13					
			16					
								Total Depth: 25 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil after drilling on 2/20/2024. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. Ground elevations were measured using a Trimble Model DA2-BT survey unit with global navigation satellite system (GNSS) output of NAD83 (2011) and referencing geoid model GEOID18.
30								
40								

DATE DRILLED 2/20/2024 BORING NO. B-10

GROUND ELEVATION 6,331.01'± SHEET 1 OF 1

METHOD OF DRILLING CME-55, 4" Solid Stem Auger (Dakota Drilling)

DRIVE WEIGHT 140 lbs. (Spooling Cathead) DROP 30"

SAMPLED BY CSD LOGGED BY CSD REVIEWED BY SS

APPENDIX B

Laboratory Testing

APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D 2937-04. The test results are presented on the logs of the exploratory borings in Appendix A.

Atterberg Limits
Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-1.

No. 200 Sieve Analysis
An evaluation of the percentage of particles finer than the No. 200 sieve in selected soil samples was performed in general accordance with ASTM D 1140. The results of the tests are presented on Figure B-2.

Gradation Analysis
Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 6913. The grain-size distribution curves are shown on Figures B-3 through B-7. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

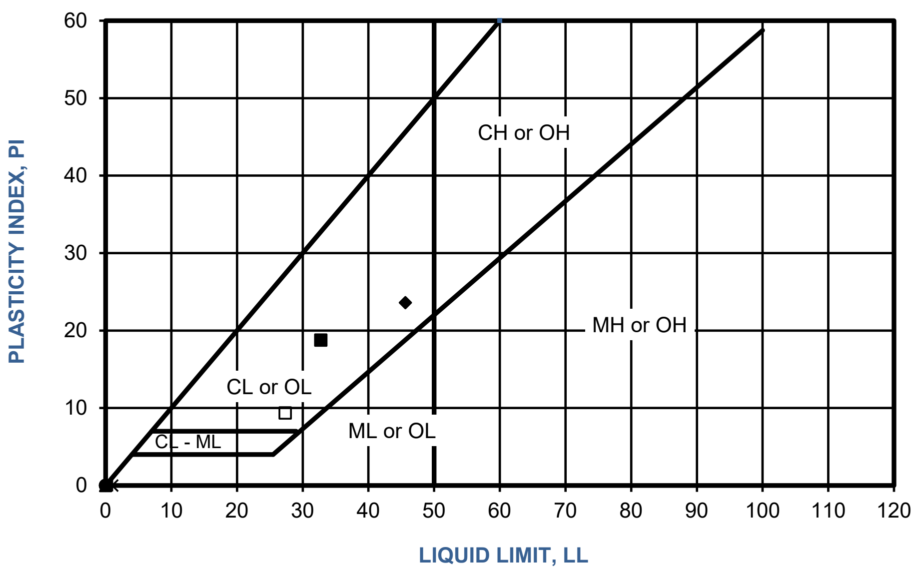
Swell/Consolidation Tests
The consolidation and/or swell potential of selected materials were evaluated in general accordance with ASTM D 4546. Specimens were loaded with a specified surcharge before inundation with water. Readings of volumetric consolidation/swell were recorded until completion of primary consolidation/swell. After the completion of primary swell, surcharge loads were increased incrementally to evaluate swell pressure. The results of the consolidation/swell tests are presented on Figures B-8 through B-13.

Direct Shear Tests
Direct shear tests were performed on relatively undisturbed samples in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-14 and B-15.

Soil Corrosivity Tests
A soil pH test was performed on a representative sample in general accordance with ASTM Test Method D 4972. A soil minimum resistivity test was performed on a representative sample in general accordance with AASHTO T288. The sulfate content of a selected sample was evaluated in general accordance with CDOT Test Method CP-L 2103. The chloride content of a selected sample was evaluated in general accordance with CDOT Test Method CP-L 2104. The test results are presented on Figure B-16.

SYMBOL	LOCATION	DEPTH (ft)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	EQUIVALENT USCS
●	B-1	4.0-5.0	NP	NP	NP	ML	SM
■	B-3	1.0-2.0	33	14	19	CL	GC
◆	B-5	1.0-2.0	46	22	24	CL	SC
○	B-6	4.0-5.0	NP	NP	NP	ML	SP-SM
□	B-8	9.0-10.0	27	18	9	CL	CL
Δ	B-9	14.0-15.0	NP	NP	NP	ML	SP-SM

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

FIGURE B-1

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ATTERBERG LIMITS TEST RESULTS

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

502907001 | 3/24

SAMPLE LOCATION	SAMPLE DEPTH (ft)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	EQUIVALENT USCS
B-2	4.0-5.0	Brown Clayey SAND	100	20	SC
B-3	1.0-2.0	Black to Dark Brown Clayey GRAVEL with Sand	57	17	GC
B-3	9.0-10.0	Dark Gray Clayey SAND; Trace Gravel	96	25	SC
B-5	1.0-2.0	Dark Brown Clayey SAND with Gravel	66	16	SC
B-8	9.0-10.0	Light Brown Sandy Lean CLAY	100	56	CL

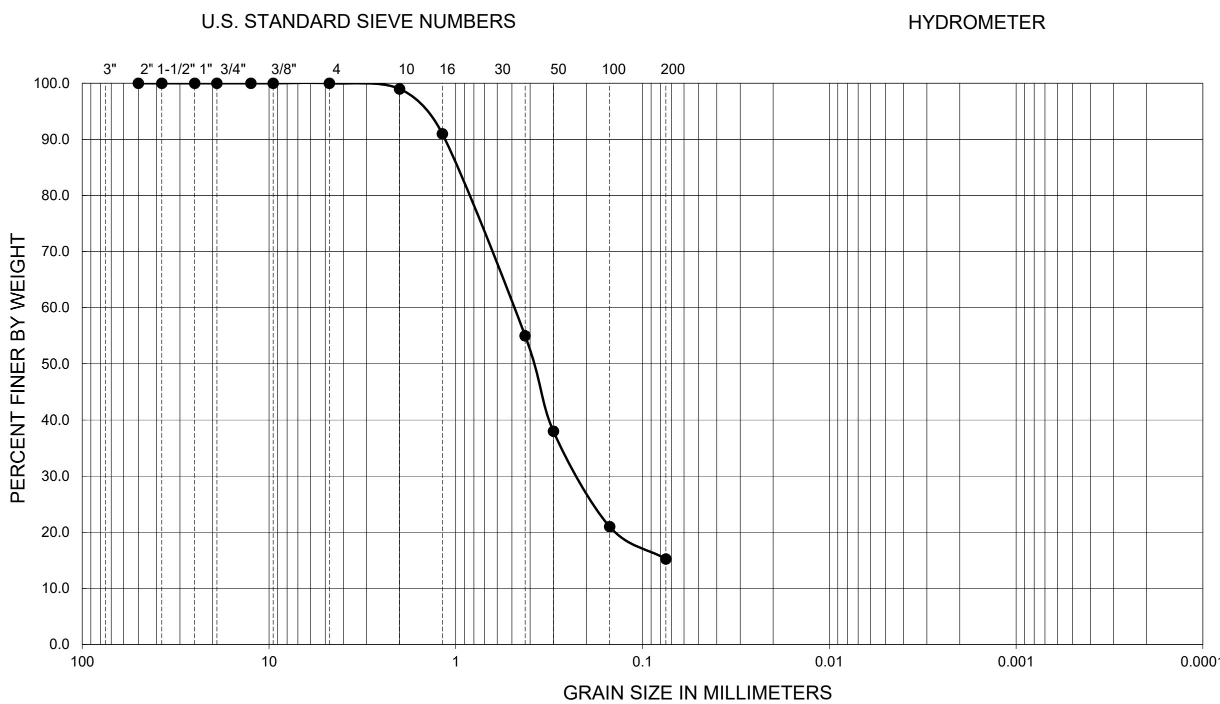
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140

NO. 200 SIEVE ANALYSIS TEST RESULTS

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

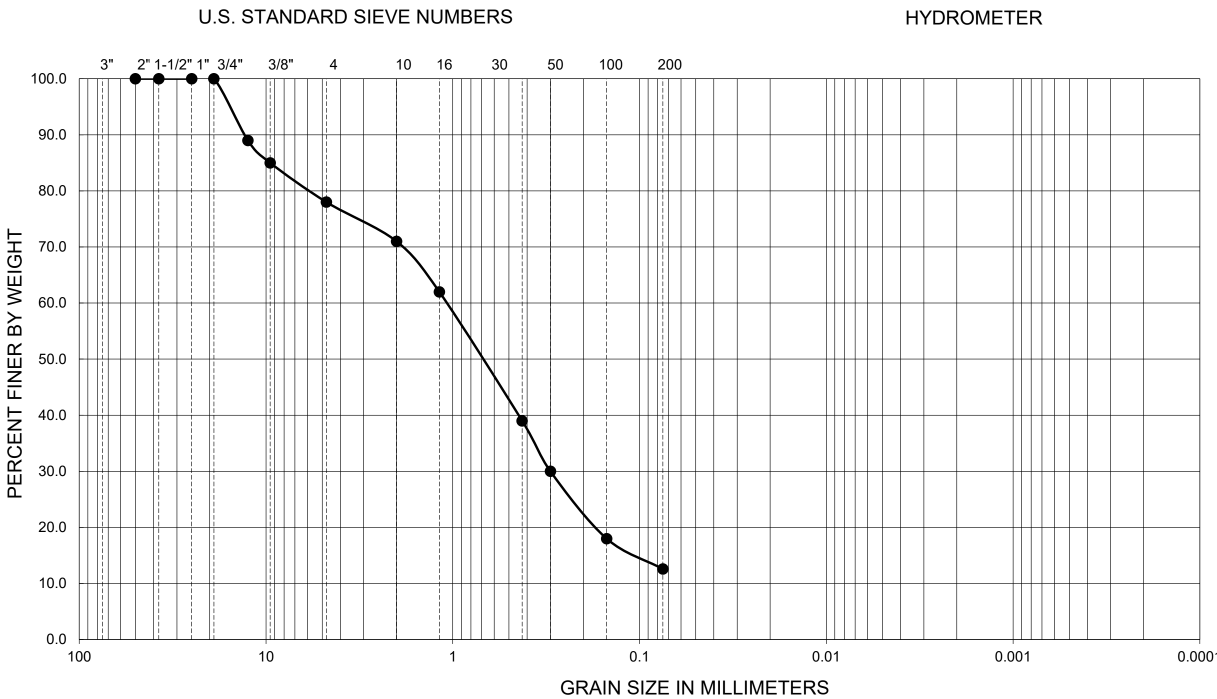


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	Equivalent USCS
●	B-1	4.0-5.0	NP	NP	NP	--	--	--	--	--	15	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913

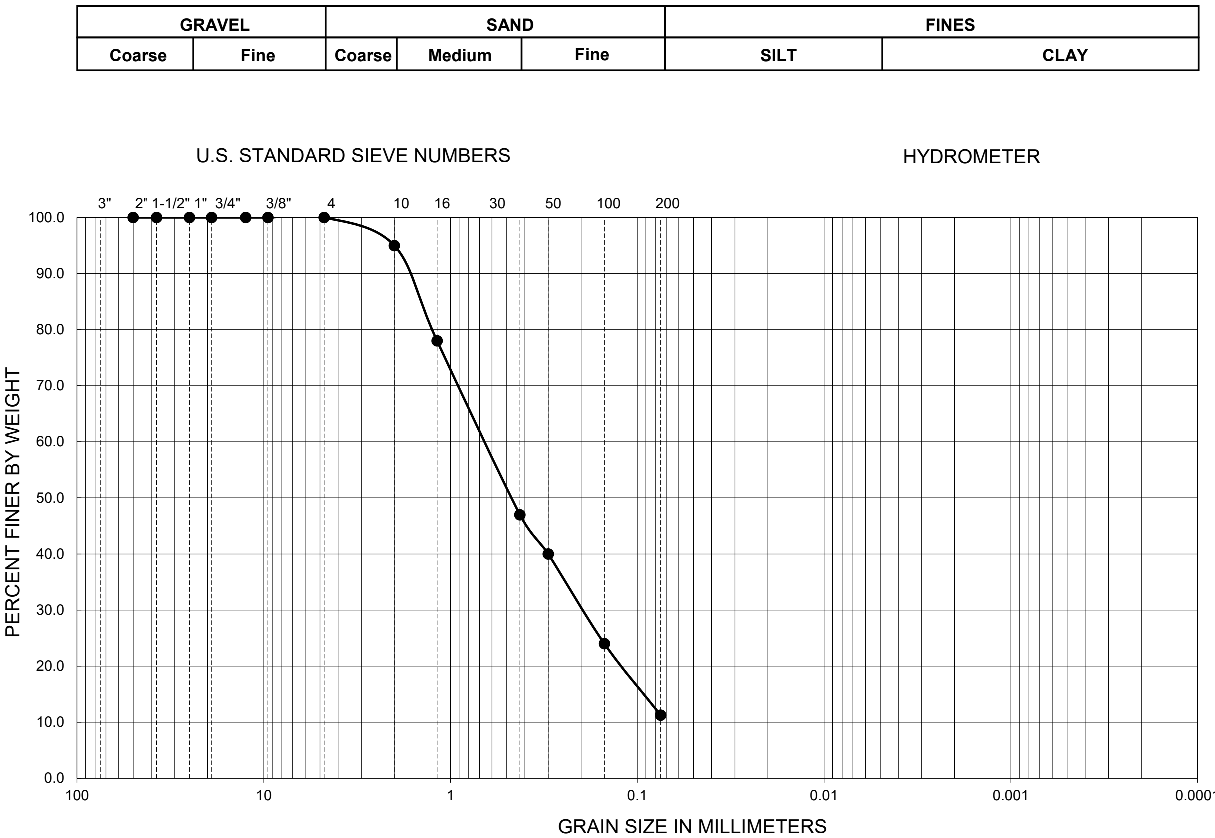
NP - INDICATES NON-PLASTIC

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	Equivalent USCS
●	B-2	1.0-2.0	--	--	--	--	--	--	--	--	13	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	Equivalent USCS
●	B-5	9.0-10.0	--	--	--	--	--	--	--	--	11	SP-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913

FIGURE B-5

GRADATION TEST RESULTS

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

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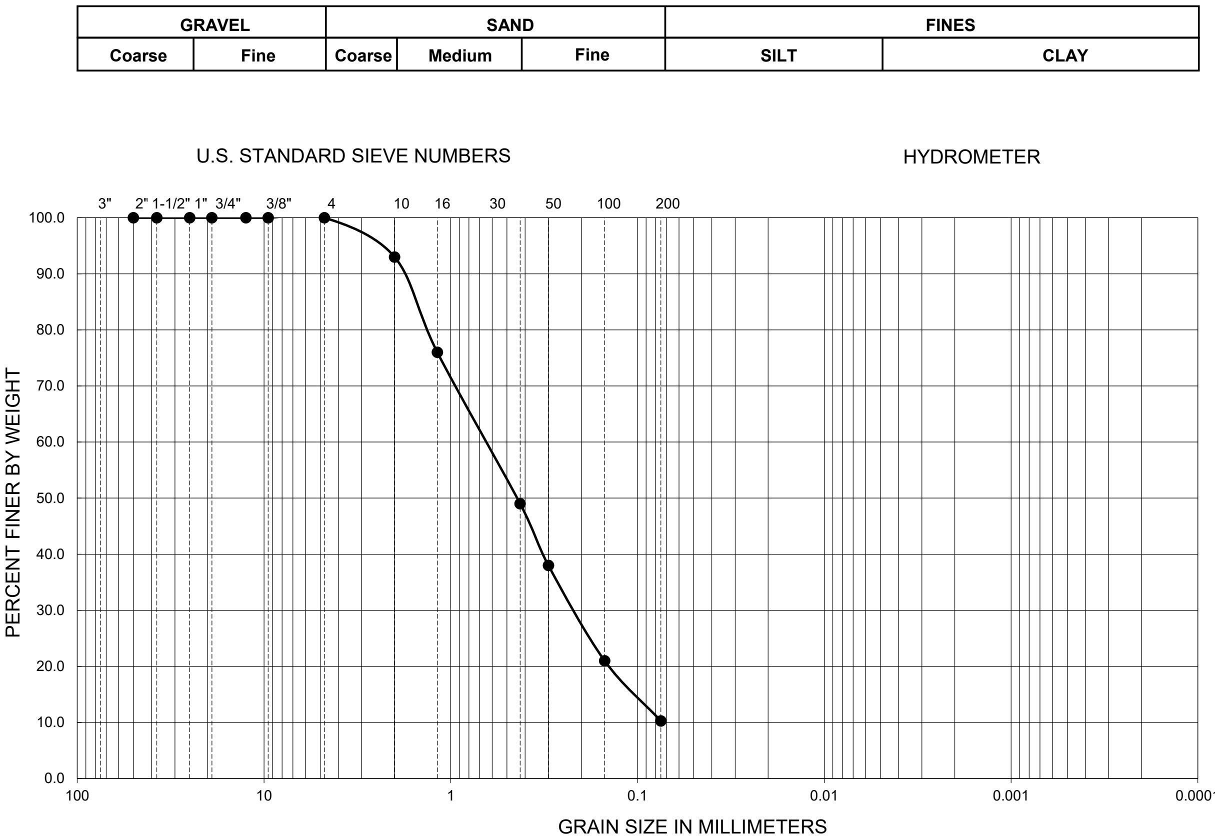


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	Equivalent USCS
●	B-6	4.0-5.0	NP	NP	NP	0.08	0.22	0.75	10.0	0.9	10	SP-SM

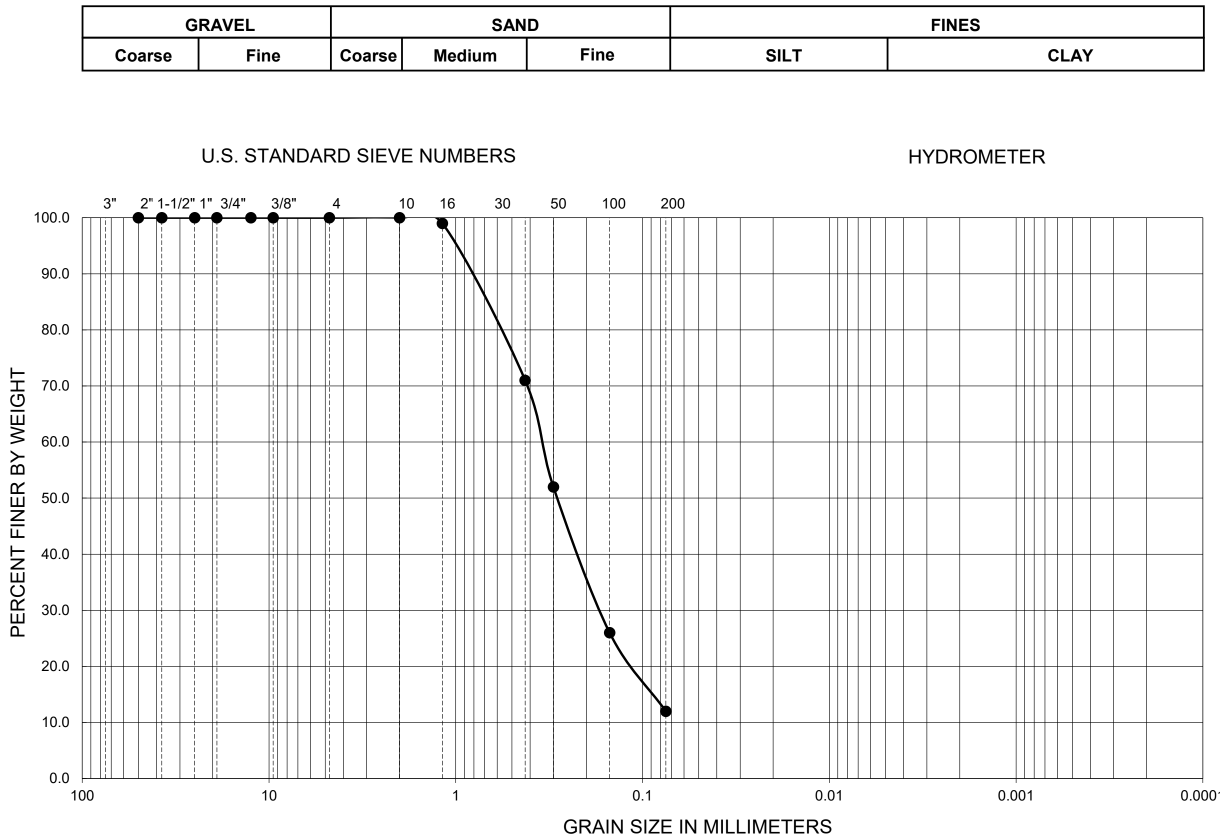
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913

NP - INDICATES NON-PLASTIC

FIGURE B-6

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

GRADATION TEST RESULTS
PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	Equivalent USCS
●	B-9	14.0-15.0	NP	NP	NP	--	--	--	--	--	12	SP-SM

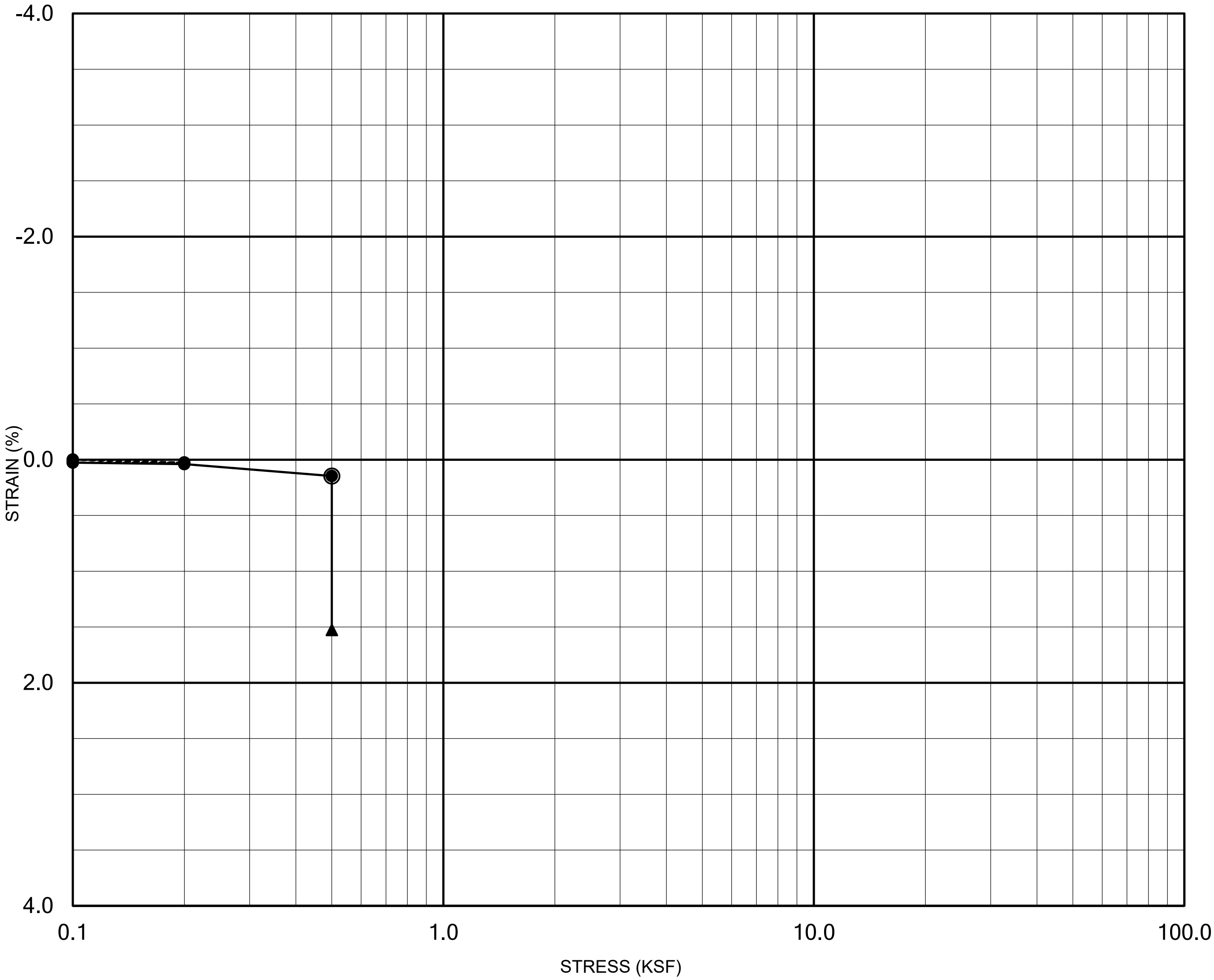
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913

NP - INDICATES NON-PLASTIC

FIGURE B-7

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

GRADATION TEST RESULTS
PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO
502907001 | 3/24



Moisture Increase (%): 7.6
Swell Percentage (%): -1.4
Swell Pressure (psf): --

Sample Location: B-2
Depth: 4.0-5.0
Soil Type: SC (Fill)

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

FIGURE B-8

CONSOLIDATION TEST RESULTS

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT

MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

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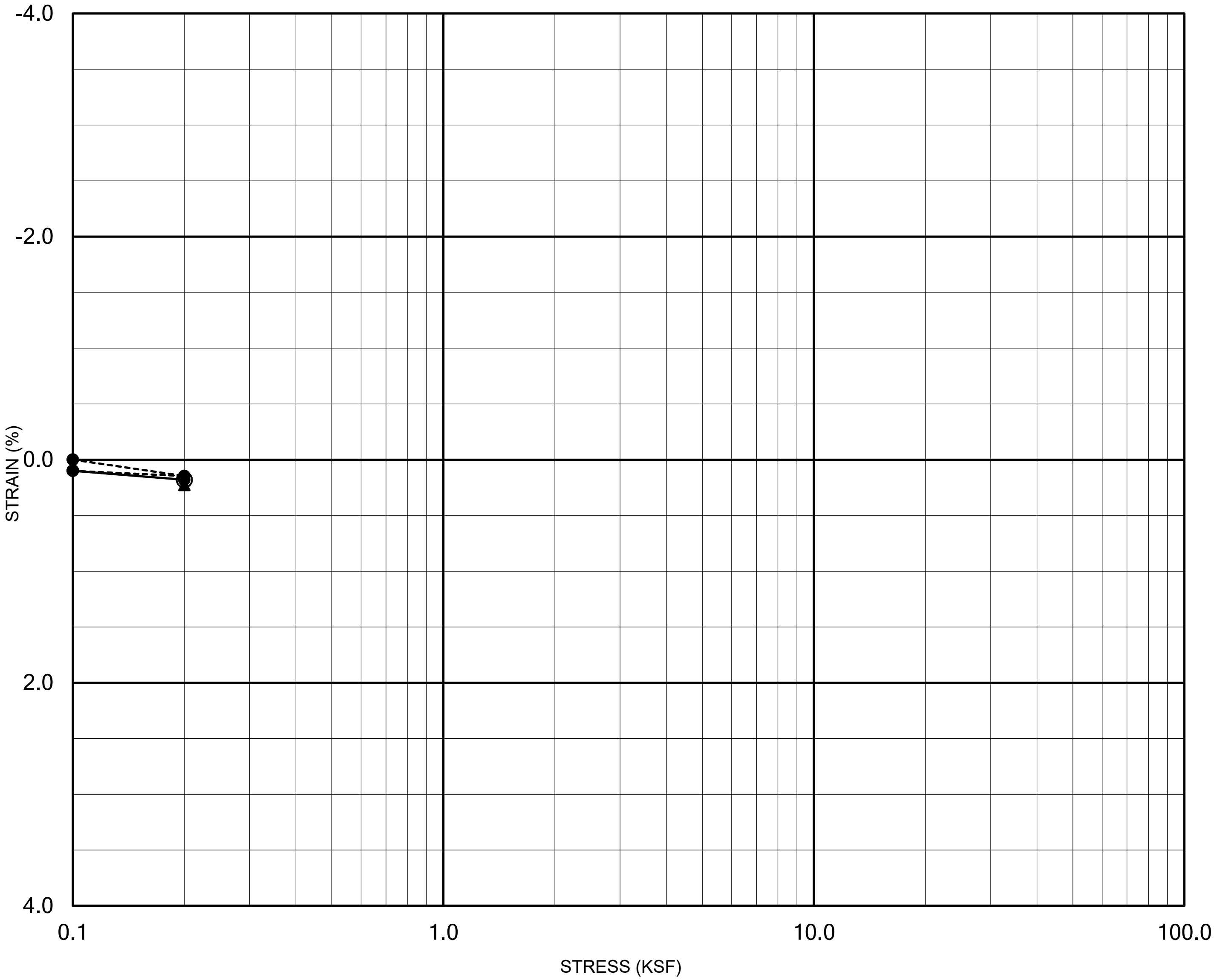

Moisture Increase (%): 4.3
Swell Percentage (%): 0.0
Swell Pressure (psf): --

Sample Location: B-3
Depth: 1.0-2.0
Soil Type: GC (Fill)

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

FIGURE B-9

CONSOLIDATION TEST RESULTS

Ninyo & Moore
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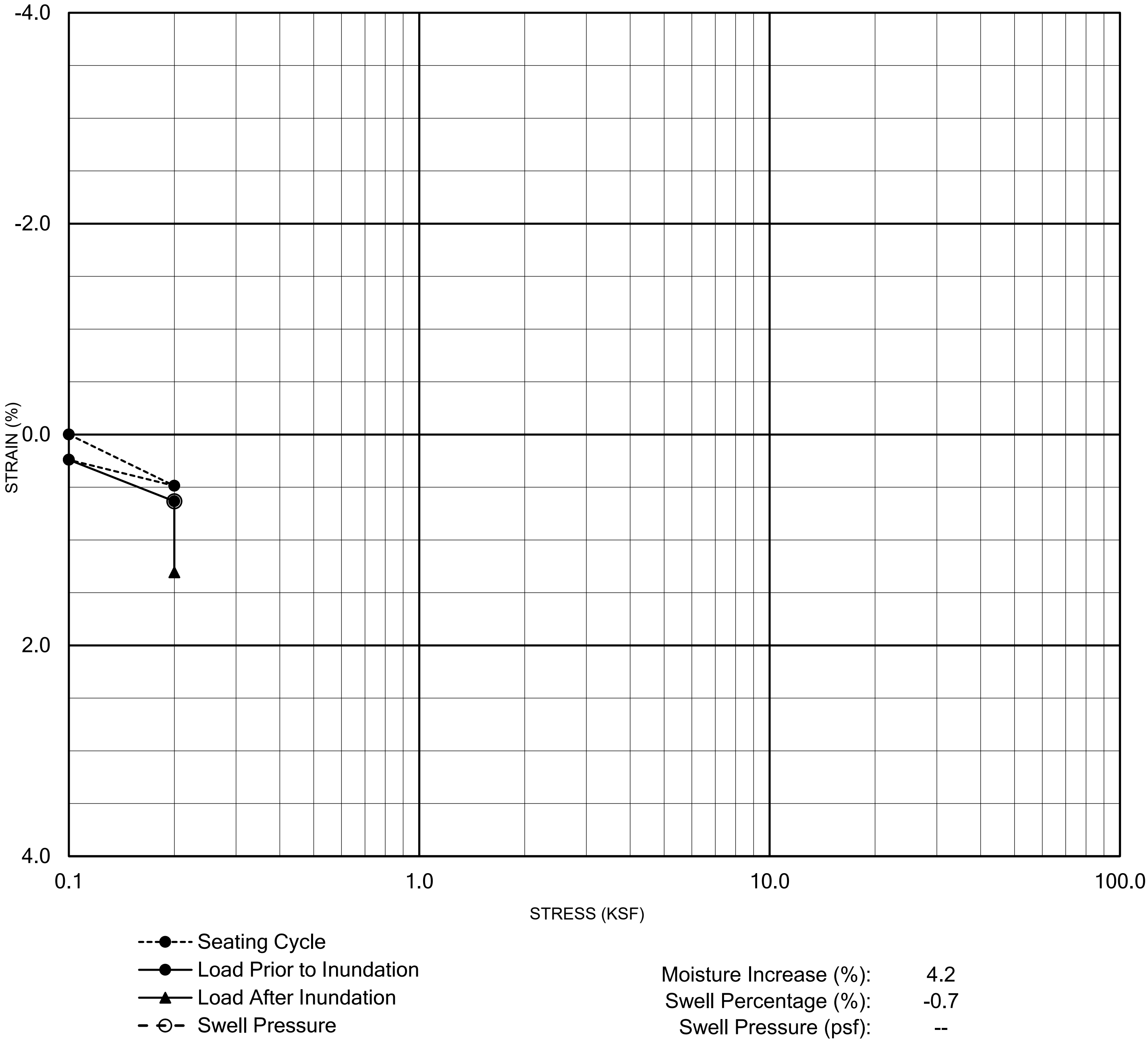
PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO



Moisture Increase (%): 4.2
Swell Percentage (%): -0.7
Swell Pressure (psf): --

Sample Location: B-5
Depth: 1.0-2.0
Soil Type: SC (Fill)

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

FIGURE B-10

CONSOLIDATION TEST RESULTS

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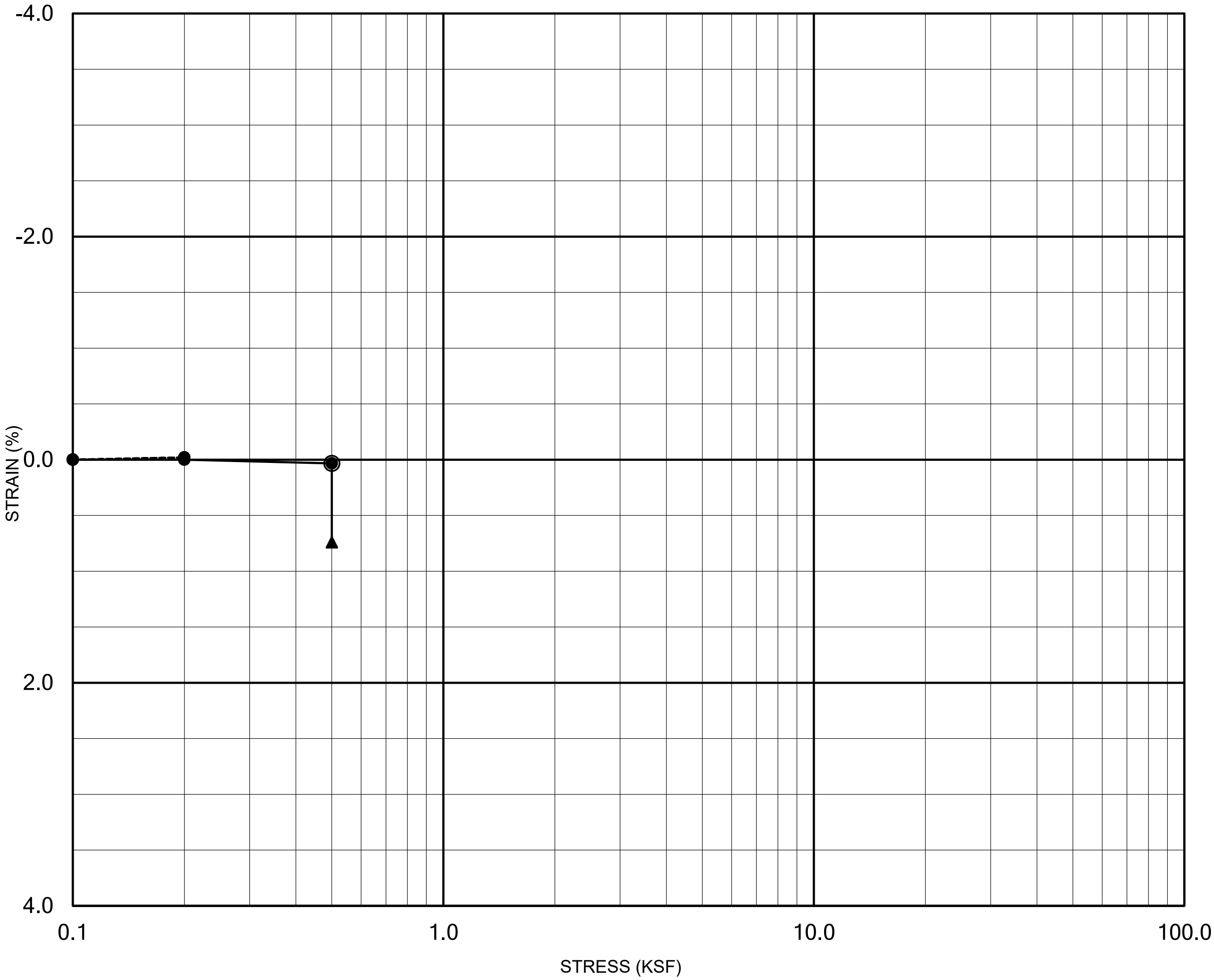
PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

502907001 | 3/24



Seating Cycle
Load Prior to Inundation
Load After Inundation
Swell Pressure

Moisture Increase (%):	11.0
Swell Percentage (%):	-0.7
Swell Pressure (psf):	--

Sample Location: B-6
Depth: 4.0-5.0
Soil Type: SP-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

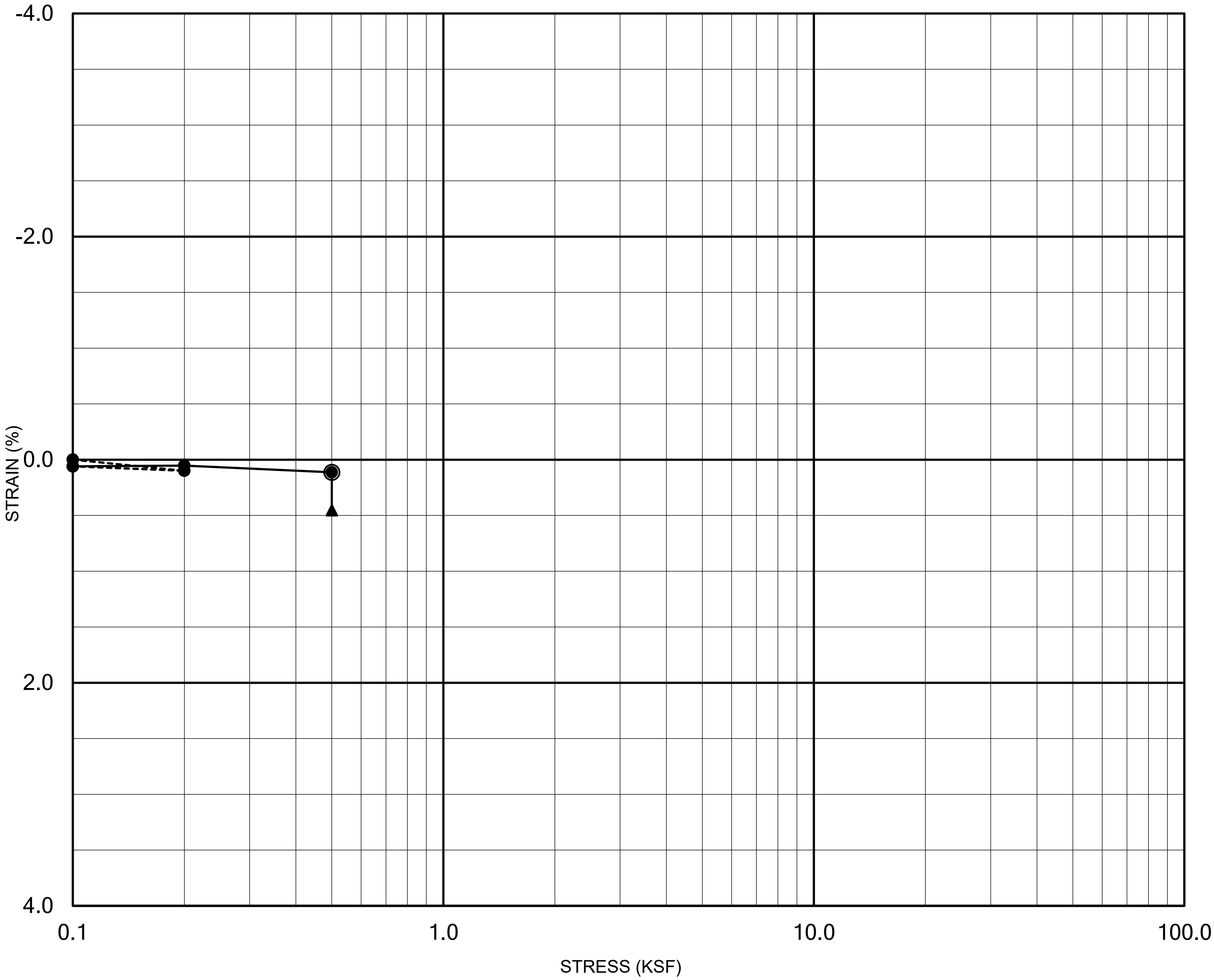
FIGURE B-11

CONSOLIDATION TEST RESULTS

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

502907001 | 3/24



- - -●- - - Seating Cycle
—●— Load Prior to Inundation
—▲— Load After Inundation
- ⊖ - Swell Pressure

Moisture Increase (%):	5.1
Swell Percentage (%):	-0.3
Swell Pressure (psf):	--

Sample Location: B-7
Depth: 4.0-5.0
Soil Type: SC (Fill)

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

FIGURE B-12

CONSOLIDATION TEST RESULTS

PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO

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- Seating Cycle
- Load Prior to Inundation
- Load After Inundation
- Swell Pressure

Moisture Increase (%):	3.3
Swell Percentage (%):	-0.3
Swell Pressure (psf):	--

Sample Location: B-8
Depth: 9.0-10.0
Soil Type: CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

FIGURE B-13

CONSOLIDATION TEST RESULTS

Ninyo & Moore
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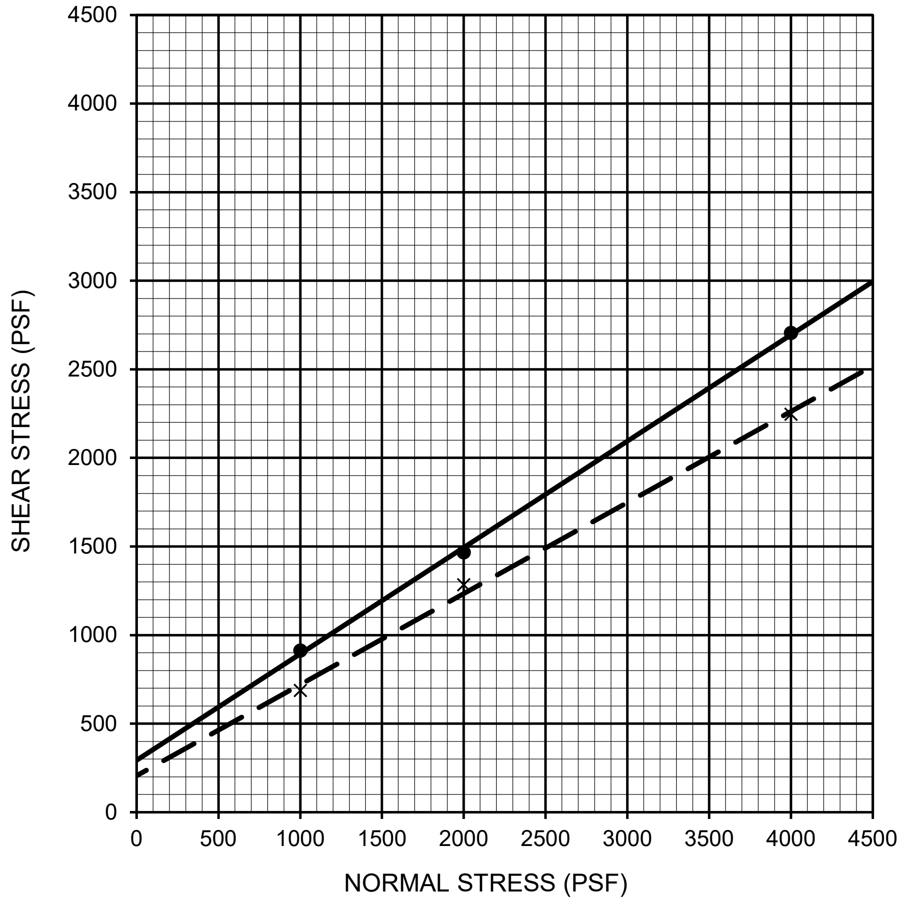
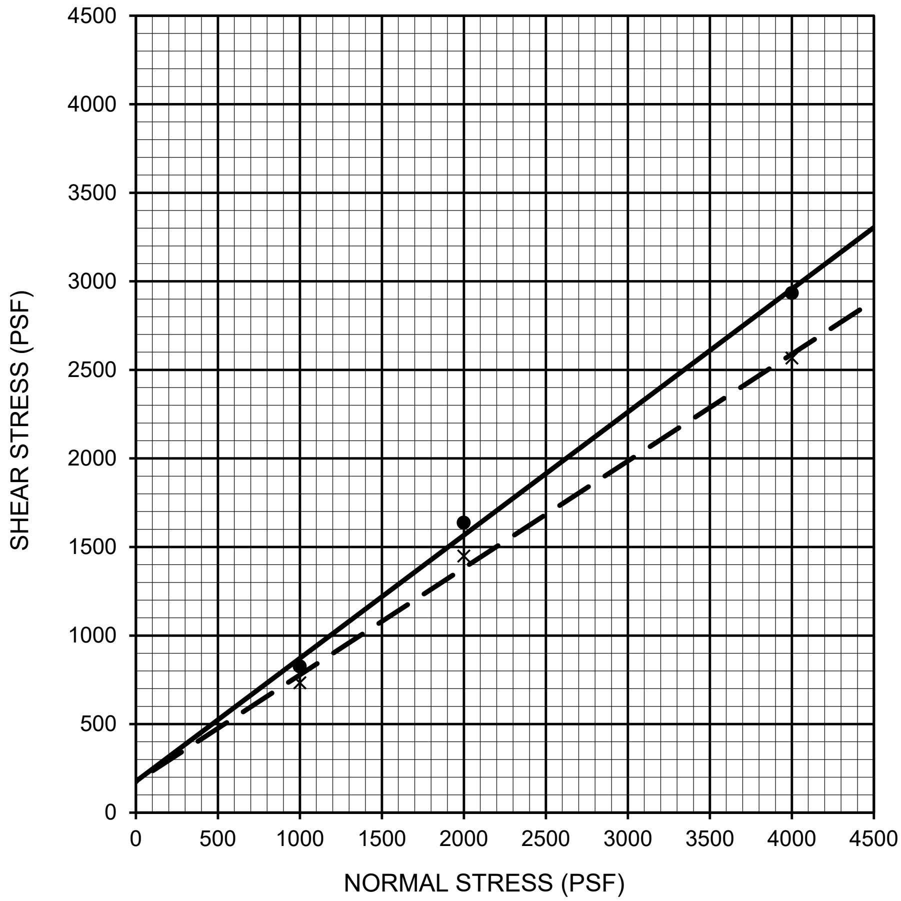
PROPOSED REAGAN RANCH INDUSTRIAL DEVELOPMENT
MARKSHEFFEL ROAD & SPACE VILLAGE. COLORADO SPRINGS, COLORADO



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Equivalent USCS
Brownish Gray Clayey SAND; Trace Gravel	——●——	B-3	4.0-5.0	Peak	293	31	SC
Brownish Gray Clayey SAND; Trace Gravel	– – x – –	B-3	4.0-5.0	Ultimate	206	27	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Equivalent USCS
Light Brown Silty SAND	—●—	B-4	14.0-15.0	Peak	176	35	SM
Light Brown Silty SAND	– – x – –	B-4	14.0-15.0	Ultimate	174	31	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

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SAMPLE LOCATION	SAMPLE DEPTH (ft)	pH [1]	RESISTIVITY [2] (ohm-cm)	SULFATE CONTENT IN SOIL [3] (ppm)	(%)	CHLORIDE CONTENT [4] (ppm)
B-2	0.0-5.0	7.3	1,600	14	0.001	40
B-9	0.0-5.0	6.4	14,000	12	0.001	20

[1] PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4972
[2] PERFORMED IN GENERAL ACCORDANCE WITH AASHTO T288
[3] PERFORMED IN GENERAL ACCORDANCE WITH CDOT TEST METHOD CP-L 2103 METHOD B
[4] PERFORMED IN GENERAL ACCORDANCE WITH CDOT TEST METHOD CP-L 2104

APPENDIX C

Site Photographs and Descriptions

Project Name: REAGAN RANCH **Project No. 502907001**

Photo No. 1 **Location: Boring B-2** **Date: 02/14/2024**

Overview of Boring B-2, looking north to northwest. Fill was observed at the surface.

Photo No. 2 **Location: Boring B-3** **Date: 02/14/2024**

Demolition refuse was typical throughout the southwest half of the site.

Project Name: REAGAN RANCH **Project No. 502907001**

Photo No. 3 **Location: Boring B-5** **Date: 02/14/2024**

Overview of Boring B-5, looking south. A relatively rapid topographic change was observed between the fill area and native area.

Photo No. 4 **Location: Boring B-8** **Date: 02/14/2024**

Survey markers were observed throughout the site.

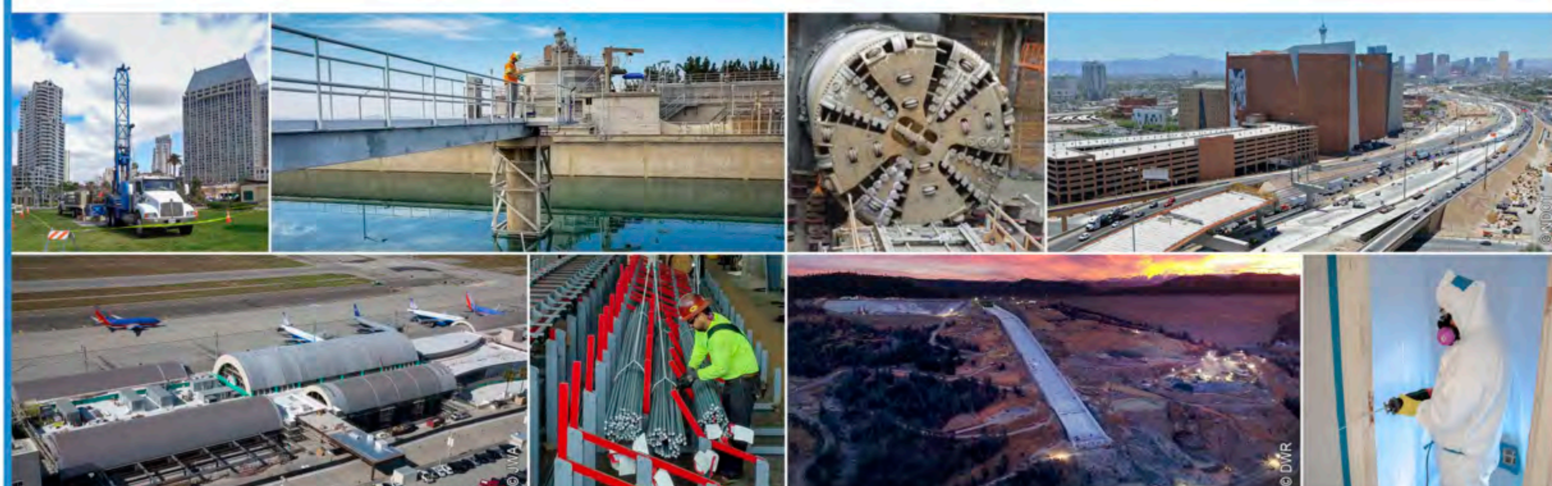
Project Name: REAGAN RANCH **Project No.** 502907001

Photo No. 5 **Location:** Boring B-10 **Date:** 02/14/2024

Apparent stockpiled material and an excavation pit was observed near Boring B-10.

Photo No. 6 **Location:** Boring B-1 **Date:** 02/14/2024

Two truck mounted drill rigs equipped with solid stem augers were used for drilling. Samples were collected utilizing California barrel samplers.



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