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SOILS AND GEOLOGY STUDY

Lots 1-224, Paint Brush Hills, Filing No. 14
El Paso County, Colorado

PREPARED FOR:

Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

JOB NO. 179012

October 16, 2020

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

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Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

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Add PCD File No.
SP206 & SF2024

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1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the NE¼ of Section 26, Township 12 South, Range 65 West, of the 6th Principal Meridian in El Paso County, Colorado. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Existing Land Use

The site currently consists of one parcel. The total area of the proposed site is 88.6 acres as recorded on the Paint Brush Hills Filing No. 14, Preliminary Plan, prepared by Matrix Design Group, Inc. The parcel included is:

- Schedule No. 5226101007

The current zoning is *"RS-200000" - Residential Suburban.* The proposed zoning is to be *RS-6000 – Residential Suburban*. The parcel is currently not developed.

1.3 Project Description

The proposed site development is to consist of single-family residential construction on a total of 224 lots. Minimum lot size is to be 6,000 SF. Entrance into the subdivision is to be provided from existing Keating Drive and Devoncove Drive, located along the eastern boundary of the site. Additional proposed land usage includes landscaped easements, parks, open space, trail corridors, utility easements, drainage and detention facilities. The Proposed Lot Layout is presented in Figure 2.

All streets within the subdivision are to be public Local Residential with a 50’ R.O.W and constructed to El Paso County standards. The streets are to be maintained by El Paso County Department of Transportation.

The development is to utilize sewer and water services provided by Paint Brush Hills Metropolitan District. Neither individual wells nor on-site wastewater treatment systems are proposed.

2.0 QUALIFICATIONS OF PREPARERS

This Geology and Soils Study was prepared by a professional geologist as defined by Colorado Revised Statures section 34-1-201(3) and by a qualified geotechnical engineer as defined by policy statement 15, "Engineering in Designated Natural Hazards Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. (Ord. 96-74; Ord. 01-42)

The principle investigators for this study are Kelli Zigler P.G., and Geoff Webster, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 19 years of experience in the geological and geotechnical engineering field. Ms. Kelli Zigler holds a B.S. in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations throughout Colorado.

Geoff Webster, P.E. is a licensed Professional Engineer with 35 years of experience in the civil and geotechnical engineering fields. Mr. Webster holds a Master's degree from the University of Central Florida. Mr. Webster has supervised and performed numerous geological and geotechnical field investigation programs in Colorado and other states.

3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical and geologic site conditions, and present our opinions of the potential effect of these conditions on the proposed residential development within the referenced site.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC) specifically Chapter 8, last updated August 27, 2019. Applicable sections include 8.4.8 and 8.4.9., and the El Paso County Engineering Criteria Manual (ECM), specifically Appendix C last updated July 9, 2019.

3.1 Scope and Objective

The scope of this study is to include a physical reconnaissance of the site and a review of pertinent, publically available documents including, but not limited to, previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc. Our services exclude evaluation of environmental and/or human, health-related work products, or recommendations previously prepared by others for this project.

The objectives of our study are to:

- Identify geologic conditions present on the site
- Analyze potential negative impacts of these conditions on the proposed site development
- Analyze potential negative impacts to surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic conditions
- Provide our opinion of suitable techniques that may be utilized to mitigate any potential negative impacts identified herein

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document

3.2 Site Evaluation Techniques

The information included in this report has been compiled from several sources, including:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Subsurface exploration
- Laboratory testing of representative site soil and rock samples
- Geologic research and analysis
- Site development plans prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

3.3 Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for nearby sites were available for our review and are listed below:

1. *Soil, Geology and Geologic Hazard Study, Paint Brush Hills, Phase 2, El Paso County, Colorado*, prepared by Entech Engineering, Inc., Entech Job No. 11274, last dated March 5, 2004.

3.4 Additional Documents

Additional documents reviewed during the performance of this study are included in Appendix A.

4.0 SITE CONDITIONS

4.1 Existing Site Conditions

The site is undeveloped. Existing Keating Drive borders the property on the east, Paint Brush Hills, Filing No. 3 borders the property to the north. Paint Brush Hills, Filing No. 12 borders the south, Paint Brush Hills, Filing No. 13E borders the east and undeveloped land to the west.

4.2 Topography

Based on our site reconnaissance on September 14, 2020, site topography is generally level, moderately rolling terrain. The elevation varies approximately 60-feet across the entire site from the north to the south.

4.3 Vegetation

The majority of the site consists of low lying native grasses and weeds. Shrubs and deciduous trees are not present on the site.

4.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site has remained undeveloped land.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

The subsurface conditions within the property were explored by drilling ten (10) exploratory test borings to depths of 20-feet below the existing ground surface. The number of borings included in this study meets and exceeds the minimum criteria of one test boring per 10 acres of development up to 100 acres and one additional boring for every 25 acres of development above 100 acres as stipulated in the ECM, Section C.3.3.

The test borings were drilled with a power-driven, continuous-flight auger drill rig. Samples were obtained during drilling of the test boring in general accordance with ASTM D-1586 and D-3550, utilizing a 2-inch O.D. Split Barrel Sampler and a 2½-inch O.D. California sampler, respectively. Results of penetration tests are shown on the drilling logs. The test boring locations are presented in the Proposed Lot Layout with Test Boring Locations, Figure 2. An Explanation of Test Boring Logs are presented in Figure 3, and the Test Boring Logs are presented in Figures 4 through 8.

5.1 Laboratory Testing

Soil laboratory testing was performed as part of this investigation. Laboratory testing included moisture content, grain-size analysis, Atterberg Limits and one Swell/Consolidation test. A Summary of Laboratory Test Results is presented in Figure 9 (two pages). Soil Classification Data is presented in Figures 10 and 11, Denver/Consolidation Test Results are presented in Figure 12.

5.2 Shallow Groundwater

Groundwater was not encountered in the test borings during the field exploration for this investigation nor by Entech Engineering, Inc. in 2004. However, in the Entech Engineering, Inc. 2004 report, they reference a boring drilled by Earth Engineering Consultants, report dated May 5, 2000. One boring by Earth Engineering reported groundwater at 4 feet. Entech also stated the Earth Engineering Consultants boring was drilled in a drainageway onsite. The location of the Earth Engineering Consultant boring is unknown due to a lack of information and may not be located on this site. It is referenced here for completeness.

The upper site soil appears to be well draining, and natural moisture contents were low. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the western portion of the Great Plains Physiographic Province. A major structural feature known as the Rampart Range Fault is located approximately 13 miles west of the site. Rampart Range Fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northerly direction. The rocks in the area of the site are typically sedimentary in nature and from the Tertiary to Upper Cretaceous in age. The bedrock underlying the site is the Dawson formation. Overlying the Dawson formation are unconsolidated deposits of alluvium, man-made and residual soils.

6.1 Subsurface Soil Conditions

The subsurface materials encountered in the test borings were classified within the laboratory using the Unified Soil Classification System (USCS). The materials classify primarily as native silty to clayey sand (SC, SM) and sandy clay (CL). Sandstone and claystone bedrock were encountered in the test borings.

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

6.2 Bedrock Conditions

Bedrock was encountered in the test borings performed for this study. In general, bedrock (as mapped by Colorado Geologic Survey - CGS) is considered part of the Dawson formation and consists of silty sandstone with interbedded layers of claystone. The Dawson formation is thick-bedded to massive, generally light colored arkose, pebbly, and pebble conglomerate. The sandstone is generally poorly sorted with various amounts of clay content. The sandstone is generally permeable, well drained, and has good foundation characteristics. The claystone is generally well sorted with high sand content. The claystone is less permeable than the sandstone and is generally not suitable for direct bearing of shallow foundations. Bedrock is anticipated in the excavations and utility trenches for the proposed development.

6.3 U.S. Soil Conservation Service

The U.S. Soil Conservation Service along with United States Department of Agriculture (USDA) identifies the site soils as:

- 71 – Pring coarse sandy loam, 3 to 8 percent slopes. The Pring coarse sandy loam was mapped by the USDA to encompass the majority of the property. Properties of the sandy loam include, some-what excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soils Survey Map is presented in Figure 13.

6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, a geologic map was prepared which identifies the geologic conditions affecting the development. The identified geologic conditions affecting the development are presented in the Engineering and Geology Map, Figure 14.

The site generally consists of eolian deposits overlying sandstone bedrock. Five geologic units were mapped at the site as:

- *TKda3 – Dawson formation, facies unit three* – white to light-gray, cross-bedded or massive, very coarse arkosic sandstone or pebbly conglomerate. Occasional interbedded thin to very thinly bedded sandy claystone. Estimate thickness varies from 25 to 200 feet. The Dawson formation was encountered in all the test borings.
- *da – disturbed area* – area that has been disturbed from past activity on the site, presumed to be associated with the lot and roadway development of Paint Brush Hills, Filing No. 13E, located to the east of the property.
- *Vi – Valley infill* – existing drainageway that appears to have been filled in during the development of Paint Brush Hills, Filing No. 13E, located to the east of the property. Fill was encountered in TB-2 and extended to approximately 4 feet.
- *psw* – area mapped by Entech Engineering, Inc. (2004) as potentially seasonal wet area
- *sw* – area mapped by Entech Engineering, Inc. (2004) as seasonal wet area

The test borings performed by Entech Engineering Inc., that fell within this study area are included in Appendix B.

6.5 Engineering Geology

Charles Robinson and Associates (1977) have mapped two environmental engineering units at the site as:

- *1A* – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).

6.6 Structural Features

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed on the site, in the surrounding area, or in the soil samples collected for laboratory testing.

6.7 Surficial (Unconsolidated) Deposits

Lake and pond sediments, swamp accumulations, sand dunes, marine terrace deposits, talus accumulations, creep, or slope wash were not observed on the site. Slump and slide debris were also not observed on the site.

6.8 Features of Special Significance

Features of special significance such as accelerated erosion, (advancing gully head, badlands, or cliff reentrants) were not observed on the property. Features indicating settlement or subsidence such as fissures, scarplets, and offset reference features were not observed on the study site or surrounding areas. Features indicating creep, slump, or slide masses in bedrock and surficial deposits were not observed on the property.

6.9 Drainage of Surface Water and Groundwater

The overall topography of the site slopes down from the north to the south. It is anticipated the direction of surface water and groundwater is anticipated to flow in the same direction. Groundwater was not encountered in the test borings performed for this study and is not anticipated to affect shallow foundations.

Two minor drainage ways run from the north to the south along the eastern and central portion of the site. The drainage ways have been "filled in" with what appears to be onsite soils prior to this investigation. It is our understanding the drainage ways are to be rerouted to the detention pond located near the southwest corner of the property. Based on the aerial photo review it appears the rerouting of the minor drainage ways began prior to 2005. It is uncertain if a pipe was installed within the drainage way during the fill process.

7.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 2* indicates the site is identified as Upland Deposits. The overburden upland deposits consist of sand and gravel with silt and clay deposited by older stream deposits on topographic highs or beach like features. Extraction of the sand and gravel more than likely would not be considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped "Poor" for coal resources, no active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site.

8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between geologic hazards and constraints. A *geologic hazard* is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A *geologic constraint* is one of several types of adverse geologic conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic constraints were considered in the preparation of this report. They are not are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Floodplains
- Ground Subsidence
- Landslides
- Rockfall
- Ponding water
- Hydrocompactive Soils
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainage ways
- Springs and High Groundwater
- Corrosive Minerals

The following sections present geologic constraints that have been identified on the property:

8.1 Expansive Soils and Bedrock

Based on the test borings performed by RMG for this investigation, the silty to clayey sand generally possesses nil swell potential and the sandy clay and claystone generally possess low swell potential. The Dawson formation is known to have moderate to high swell potential in some locations. It is anticipated that expansive soil/bedrock may be encountered at depths anticipated to affect residential foundations. These materials are readily mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation

Foundation design and construction are typically adjusted for expansive soils. Mitigation of expansive soils may include a 3 to 4 foot overexcavation and replacement with non-expansive structural fill at 95% of Modified Proctor Dry Density, ASTM D-1557. Drilled piers are not anticipated. Floor slabs bearing directly on expansive soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils has been successful in minimizing slab movement.

If expansive soils or bedrock are encountered during construction, mitigation of these expansive materials should follow the recommendations presented in a lot-specific subsurface soil investigation performed for each proposed structure.

8.2 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that period. The nearest recorded earthquakes over 1.6 occurred in December of 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes over 1.6 occurred between 1926 and 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are located near the Ute Pass Fault, which is greater than 10 miles from the subject site.

Earthquakes felt at this site will most likely result from minor shifting of the granite mass within the Pikes Peak Batholith, which includes pull from minor movements along faults found in the Denver basin. It is our opinion that ground motions resulting from minor earthquakes may affect structures (and the surrounding area) at this site if minor shifting were to occur.

Mitigation

In accordance with the International Building Code, 2018, seismic design parameters have been determined for this site. The Seismic Site Class has been interpreted from the results of the soil test borings drilled within the project site. The Applied Technology Council seismic design tool has been used to determine the seismic response acceleration parameters using ASCE 7-16. The soil on this site is not considered susceptible to liquefaction. The following recommended Seismic Design Parameters are based upon Seismic Site Class C, and a 2 percent probability of exceedance in 50 years. The Seismic Design Category is "A".

Period (sec)	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S_s	0.165	F_a	1.3	S_{ms}	0.214	S_{ds}	0.143
1.0	S_1	0.051	F_v	1.5	S_{m1}	0.077	S_{d1}	0.051

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

8.3 Radon

***"Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels".*

Central El Paso County and the 80915 zip code in which the site is located, has an EPA assigned Radon Zone of *1*. A radon Zone of *1* predicts an average indoor radon screening level greater than 0.4 pCi/L (picocuries per liter), which is above the recommended levels assigned by the EPA. *The EPA recommends corrective measures to reduce exposure to radon gas.*

All of the State of Colorado is considered EPA Zone 1 based on the information provided at https://county-radon.info/CO/El_Paso.html. Elevated hazardous levels of radon from naturally occurring sources are not anticipated at this site.

Mitigation

Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards. Passive radon mitigation systems are also available.

8.4 History of Landfill or Uncontrolled/Undocumented Fill Placement

The site does not have a known history of landfill activity. Fill soils were encountered in TB-2 to a depth of approximately 4 feet. It is assumed the fill was placed during the development of Paint Brush Hills, Filing No. 13E to the east of the site. As of the issue date of this report, no documentation has been provided to RMG indicating that the existing fill identified above was placed in a controlled manner, or that it was observed or tested during placement. Until such documentation is provided, the fill soils encountered on the site are considered non-engineered and are not suitable for direct support of foundation components.

Mitigation

Undocumented/uncontrolled fill located below the proposed residences will require removal and replacement with structural fill that has been selected, placed, and compacted in accordance with the recommendations **12.1 Structural Fill – General** of this report.

Lot-specific Subsurface Soil Investigations performed prior to construction should consider fill depths at that time. If fill placed subsequent to this report is encountered in the lot-specific soil investigations, documentation of the fill placement and compaction should be evaluated to determine the suitability of that fill to support the proposed foundation. If no such documentation is available, that fill should also be removed and replaced as described above.

8.5 Proposed Grading, Erosion Control, Cuts and Masses of Fill

Based on the test borings for this investigation, the excavations are anticipated encounter silty to clayey sand and sandstone with interbedded claystone. The on-site soils are suitable for use as site-grading fill.

An Overlot Grading Plan was available for review during this study. Based on our review, minor cuts and fills are proposed. Prior to placement of overlot fill or removal and recompaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned to within 2% of the optimum moisture content, and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by competent personnel.

If unsuitable fill soils are encountered at the time of construction, they should be removed (overexcavated) and replaced with compacted structural fill. The zone of overexcavation shall extend to the bottom of the unsuitable fill zone and shall extend at least that same distance beyond the building perimeter (or lateral extent of any fill, if encountered first).

We anticipate that the deepest excavation cuts for the proposed residential construction utilizing a shallow spread footing foundation will be approximately 3 to 4-feet below the existing ground surface. If basements are proposed, excavation cuts could range up to 8 feet below the existing surface. We believe the surficial soils will classify as Type C materials as defined by OSHA in 29CFR Part 1926, dated January 2, 1990. OSHA requires temporary slopes made in Type C materials be laid back at ratios no steeper than 1.5:1 (horizontal to vertical) unless the excavation is shored or braced.

Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long-term fill slopes be no steeper than 3:1 (horizontal to vertical).

Additional Guideline Site Grading Specifications are included in the Appendix B.

9.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 8.0 of this report) found to be present at this site include seismicity and radon. Geologic constraints (as described in section 8.0 of this report) found to be present at this site include potentially expansive soils and bedrock and fill soils were found on the site. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering design and construction practices.

10.0 BURIED UTILITIES

Based upon the conditions encountered in the test borings, we anticipate that the soils encountered in individual utility trench excavations will consist mostly of native silty to clayey sand and sandstone with interbedded claystone. It is anticipated the sands will be encountered at loose to medium dense relative densities. Sandstone and claystone bedrock are anticipated within the utility trenches and to be encountered at hard to very hard densities.

We believe the sand will classify as Type C materials and perhaps as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type B and C materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) and 1½:1 (horizontal to vertical), respectively, unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

11.0 PAVEMENTS

The proposed pavement areas within this development will most likely be driveways and public streets. As such, they will require a site-specific pavement design prepared in accordance with the El Paso County Engineering Criteria Manual. All pavement design, however, should consider the criteria presented in the Engineering Criteria Manual.

For purposes of this report, we anticipate the subgrade soils will have American Association of State Highway and Transportation Officials (AASHTO) Soil Classifications primarily of A-1-b (0) and A-2-6(1), which are considered “excellent to good” for use as subgrade material. The claystone classified as

A-7-6(13) which is considered "poor" for use as subgrade material.

The ECM notes that mitigation measures may be required for expansive soils/bedrock, shallow groundwater, subgrade instability, etc. Based on the AASHTO classification of the soils in the subdivision and laboratory swell testing, the majority of the subgrade soils are expected to encounter nil to low expansive potential. Therefore, special mitigation measures are not anticipated for subgrade preparation.

Pavement materials should be selected, prepared, and placed in accordance with the El Paso County specification and the Pikes Peak Region Asphalt Paving Specifications. Tests should be performed in accordance with the applicable procedures presented in the final design.

12.0 ANTICIPATED FOUNDATION SYSTEMS

Based on the information presented previously, conventional shallow foundation systems are anticipated to be suitable for proposed residential and commercial structures. Typical foundation cuts are anticipated to be approximately 3 to 8-feet below the final ground surface. The following are general foundation recommendations. Structure specific investigations should be performed prior to structure design.

Due to the swell potential of the sandy clay and claystone, they are generally not suitable for support of shallow foundations or floor slabs. Where expansive soils are encountered near foundation or floor slab levels, they should be removed and replaced with granular, non-expansive structural fill. Where expansive soils are encountered near spread footing foundation or floor slab levels, they should be removed and replaced with granular, non-expansive structural fill.

In general, the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

After compaction of the in situ soil, the foundation construction should then be backfilled in compacted lifts to bottom of footing elevation with native soil or structural fill consisting of well-graded non-cohesive granular material. The material should not be excessively wet, should be free of organic matter and construction debris, and contain no rock fragments greater than 2-inches in any dimension. Structural fill material should be placed in 8-inch loose lifts with moisture content within 2 percent of optimum as determined by ASTM D-1557. Each loose lift should be compacted to a minimum of 95 percent of Modified Proctor maximum dry density as determined by ASTM D-1557. Each lift of soil should be density tested to verify compaction meets these requirements.

The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection. When prepared and properly compacted, total settlement of 1-inch or less with differential settlement of ½ inch or less is estimated. Settlement in granular material will occur relatively rapidly with construction loads. Long-term consolidation settlement should not be an issue in the site material if prepared as recommended above.

12.1 Structural Fill - General

Except as described above for foundations, areas to receive structural fill should have topsoil, organic material, and debris removed. The upper 6-inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Structural fill should be placed in loose lifts not exceeding 8 to 10-inches and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. To verify the condition of the compacted soils, density tests should be performed during placement.

12.2 Surface Grading and Drainage

The ground surface should be sloped from structures with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. If a 10-foot zone is not possible on the upslope side of the structure, then a well-defined swale should be created a minimum 5 feet from the foundation and sloped parallel with the wall with a minimum slope of 2 percent to intercept the surface water and transport it around and away from the structure. Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure. Water should be kept from ponding near the foundations.

Landscaping should be selected to reduce irrigation requirements. Plants used close to foundation walls should be limited to those with low moisture requirements and irrigated grass should not be located within 5 feet of the foundation. To help control weed growth, geotextiles should be used below landscaped areas adjacent to foundations. Impervious plastic membranes are not recommended.

Irrigation devices should not be placed within 5 feet of the foundation. Irrigation should be limited to the amount sufficient to maintain vegetation. Excess surface water may increase the likelihood of slab and foundation movements.

12.3 Foundation Drains

A subsurface perimeter drain is recommended around portions of the structures that will have habitable or storage space located below the finished ground surface. This includes crawlspace areas if applicable.

Shallow groundwater conditions were not encountered in the test borings performed for this study and additional subsurface drainage systems are not anticipated.

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

13.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for the proposed development. The test borings, laboratory test results, conclusions and recommendations presented in this report are for preliminary evaluations, and not intended for use for final design and construction. We recommend that a *lot-specific* subsurface soil investigation be performed for the proposed structures. The extent of any fill soils encountered during the lot-specific investigations should be evaluated for suitability to support the proposed structures prior to construction. Additionally, the groundwater conditions encountered in the lot-specific investigation should be evaluated to determine the feasibility of basement construction on that lot.

The lot-specific subsurface soil investigation should consider the proposed structure type, anticipated foundation loading conditions, location within the property, and local construction methods. Recommendations resulting from the investigations should be used for design and confirmed by on-site observation and testing during development and construction.

14.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified are considered typical for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and suitable construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be considered. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

It is our understanding the drainage ways are to be rerouted to the detention pond located near the southwest corner of the property.

Hard sandstone bedrock was encountered on site and may require the use of specialized heavy-duty equipment to facilitate rock break-up and removal.

The foundation systems for the proposed single-family residential structures and any retention/detention facilities should be designed and constructed based upon recommendations developed in a site-specific subsurface soil investigation.

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction, which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

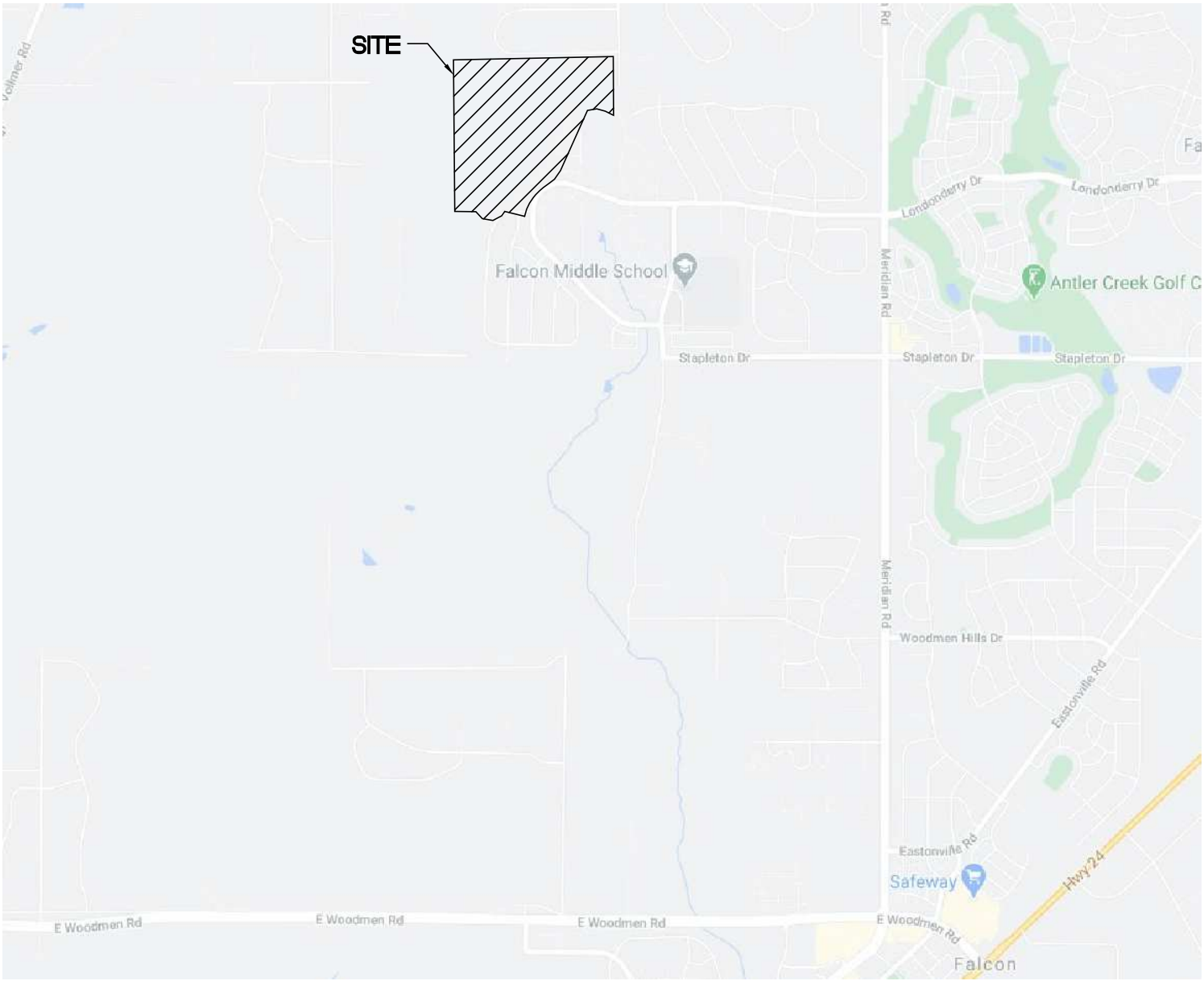
15.0 CLOSING

This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to, biological or toxicological issues, are beyond the scope of this report. If the owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **Landhuis Company** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

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

FIGURES



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SITE VICINITY MAP

PAINT BRUSH HILLS, FILING NO. 14
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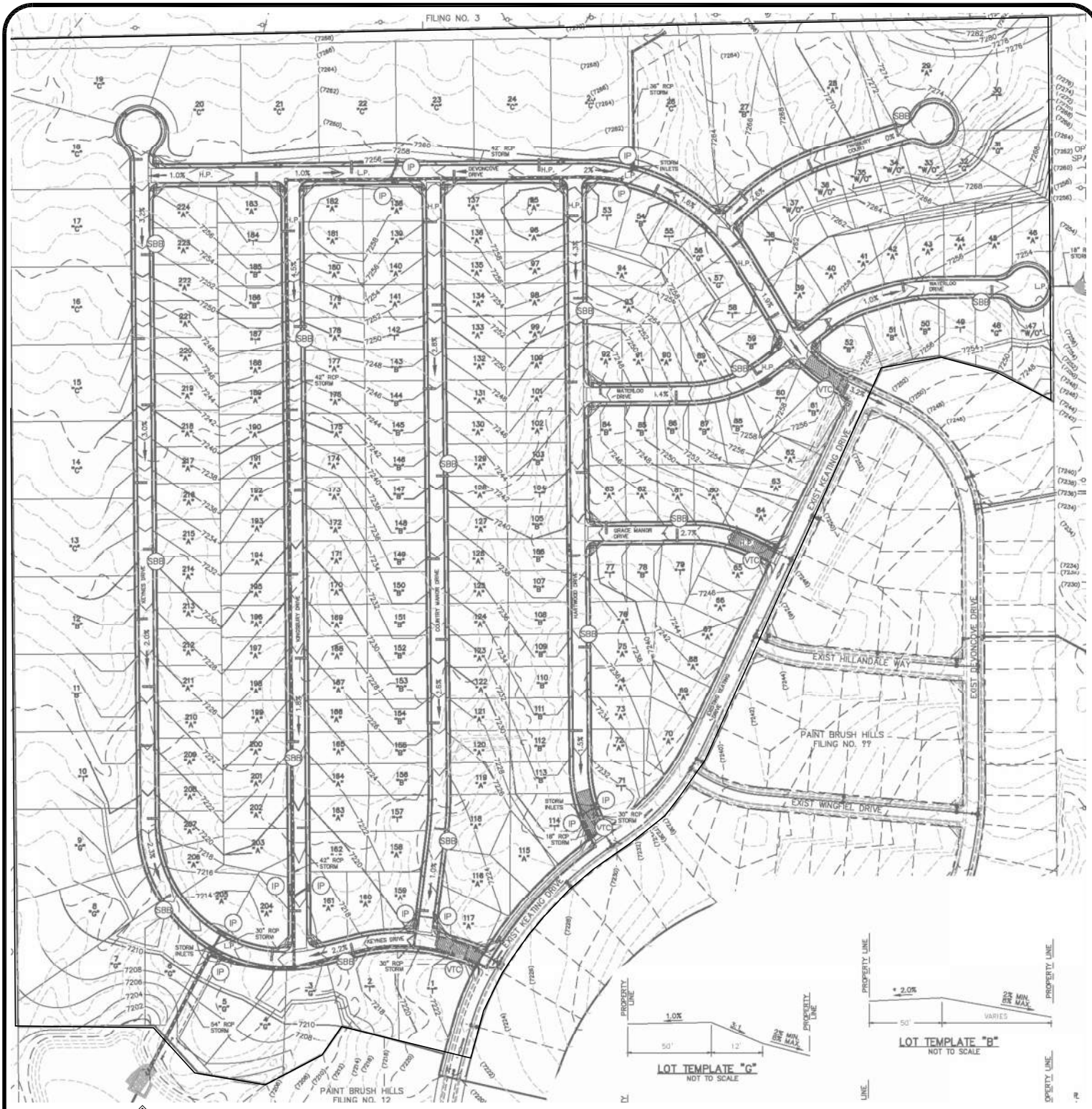
JOB No. 179012

FIG No. 1

DATE 10-16-2020



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Base map provided by M&S Civil.

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PROPOSED LOT LAYOUT

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FIG No. 2

DATE 10-16-2020

SOILS DESCRIPTION


CLAYSTONE


FILL: CLAY, SANDY


SANDSTONE


SILTY SAND

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES


XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


FREE WATER TABLE


DEPTH AT WHICH BORING CAVED


BULK — DISTURBED BULK SAMPLE


AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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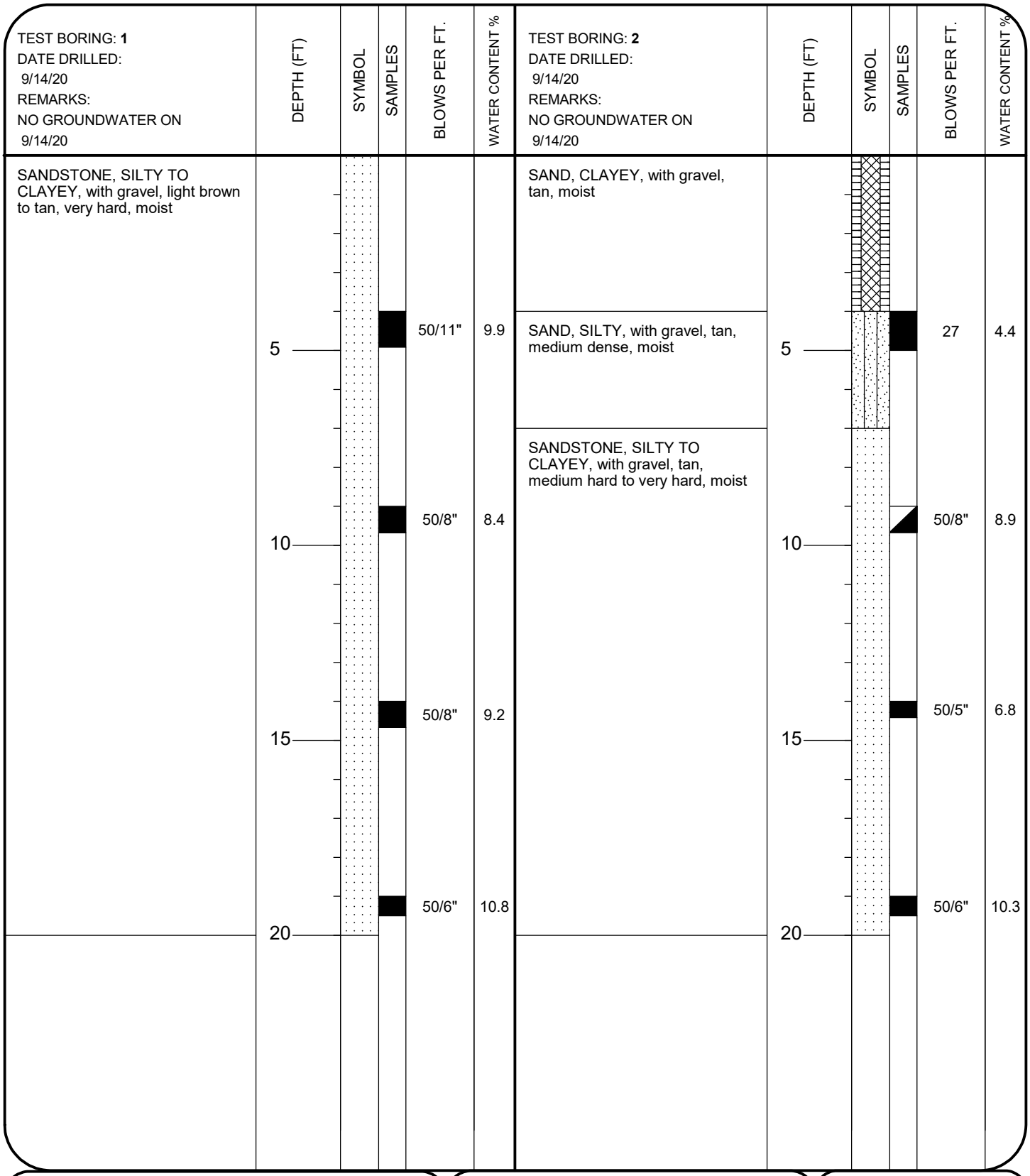
EXPLANATION OF TEST BORING LOGS

JOB No. 179012

FIGURE No. 3

DATE Oct/16/2020



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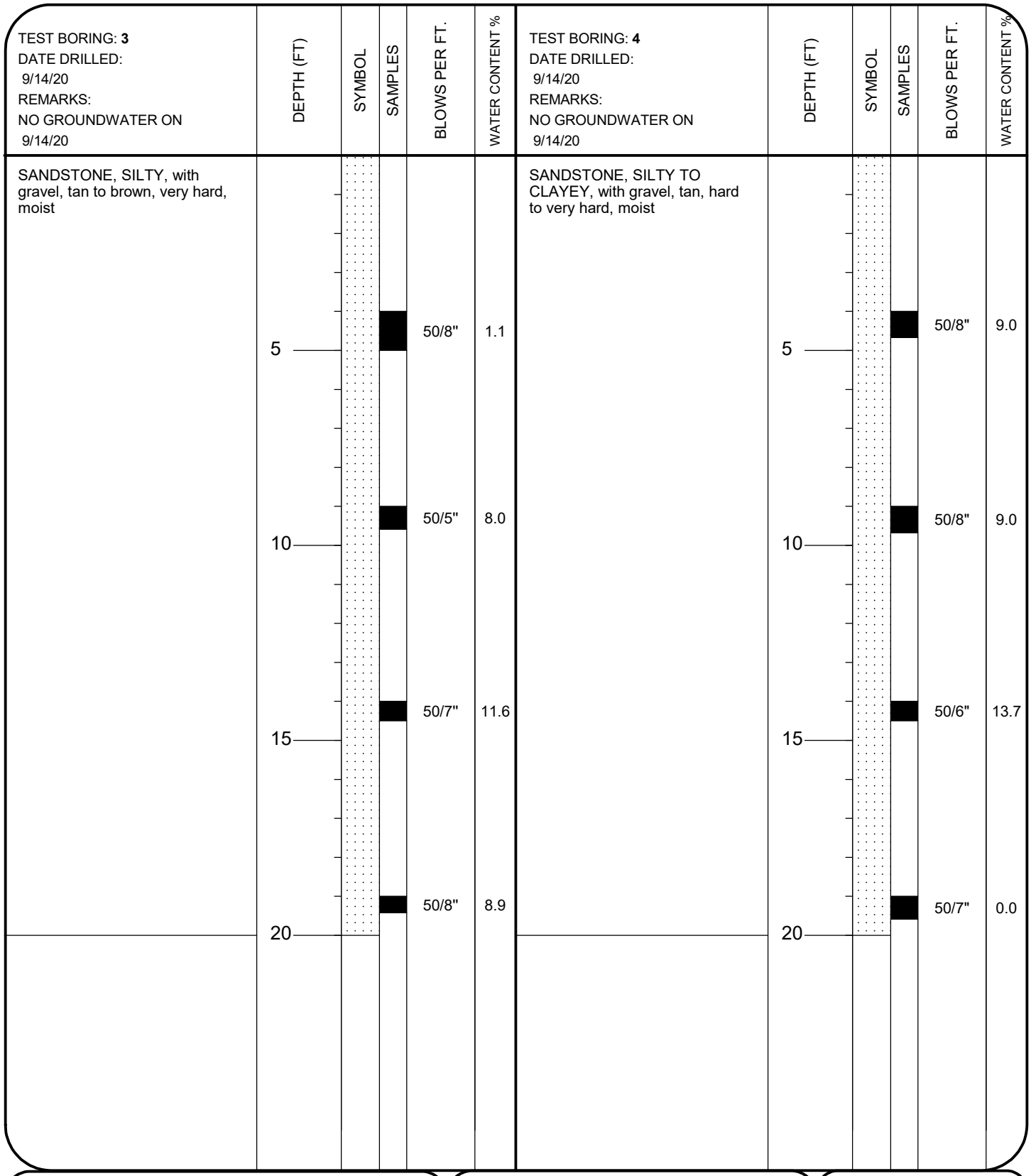
TEST BORING LOGS

JOB No. 179012

FIGURE No. 4

DATE Oct/16/2020



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TEST BORING LOGS

JOB No. 179012

FIGURE No. 5

DATE Oct/16/2020

TEST BORING: **5**
DATE DRILLED:
9/14/20
REMARKS:
NO GROUNDWATER ON
9/14/20

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY, with gravel, tan, hard to very hard, moist			
5			50/8"	6.7
10			50/5"	7.0
15			50/7"	6.6
20			50/8"	10.3

TEST BORING: **6**
DATE DRILLED:
9/14/20
REMARKS:
NO GROUNDWATER ON
9/14/20

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY, with gravel, tan, hard to very hard, moist			
5			50/10"	6.7
10			50/9"	8.7
15			50/8"	8.4
20			50/5"	6.1

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TEST BORING LOGS

JOB No. 179012

FIGURE No. 6

DATE Oct/16/2020

TEST BORING: **7** DATE DRILLED: 9/14/20 REMARKS: NO GROUNDWATER ON 9/14/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY, with gravel, tan, hard to very hard, moist	5			50/9"	7.2
	10			50/7"	8.4
	15			50/7"	12.5
	20			50/6"	7.3

TEST BORING: **8** DATE DRILLED: 9/14/20 REMARKS: NO GROUNDWATER ON 9/14/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY, with gravel, tan, hard to very hard, moist	5			50/8"	5.3
	10			50/6"	7.7
	15			50/6"	7.2
	20			50/6"	9.5

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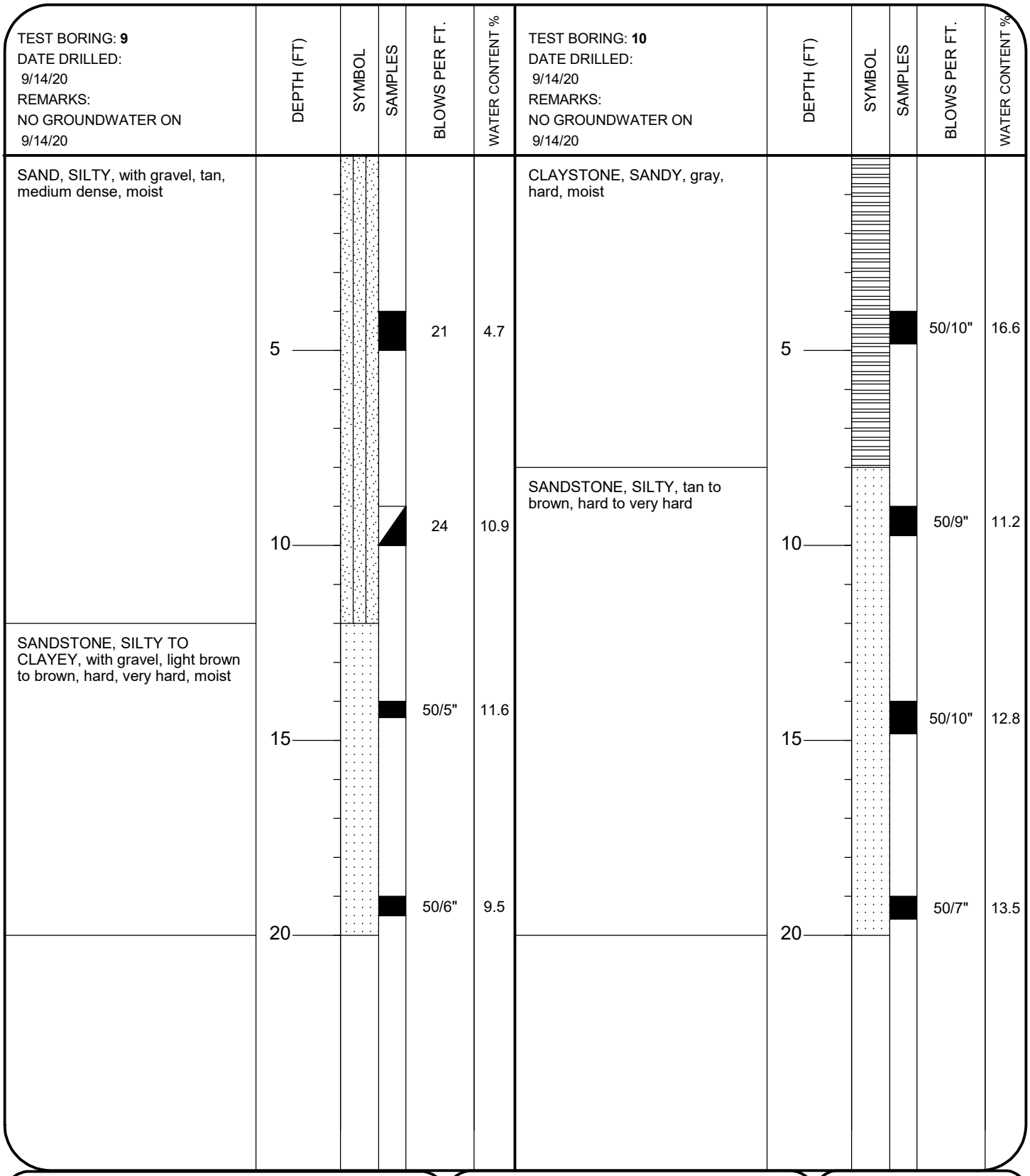
TEST BORING LOGS

JOB No. 179012

FIGURE No. 7

DATE Oct/16/2020



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TEST BORING LOGS

JOB No. 179012

FIGURE No. 8

DATE Oct/16/2020

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load (psf)	% Swell/ Collapse	USCS Classification
1	4.0	9.9		29	16		34.7			SC
1	9.0	8.4								
1	14.0	9.2								
1	19.0	10.8								
2	4.0	4.4								
2	9.0	8.9								
2	14.0	6.8		NP	NP	6.0	15.4			SM
2	19.0	10.3								
3	4.0	1.1								
3	9.0	8.0		NP	NP	7.4	15.5			SM
3	14.0	11.6								
3	19.0	8.9								
4	4.0	9.0		NP	NP		8.7			SP-SM
4	9.0	9.0								
4	14.0	13.7								
4	19.0	0.0								
5	4.0	6.7								
5	9.0	7.0		NP	NP	4.1	12.0			SW-SM
5	14.0	6.6								
5	19.0	10.3								
6	4.0	6.7		NP	NP	15.4	16.8			SM
6	9.0	8.7								
6	14.0	8.4								
6	19.0	6.1								
7	4.0	7.2								
7	9.0	8.4		NP	NP	5.8	11.8			SW-SM
7	14.0	12.5								
7	19.0	7.3								
8	4.0	5.3		NP	NP	7.0	9.9			SW-SM
8	9.0	7.7								
8	14.0	7.2								
8	19.0	9.5								
9	4.0	4.7								
9	9.0	10.9								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 179012
FIGURE No. 9

DATE Oct/16/2020

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load (psf)	% Swell/ Collapse	USCS Classification
9	14.0	11.6	115.6	31	14	0.3	51.2		- 0.1	CL
9	19.0	9.5								
10	4.0	16.6		43	24	0.0	64.3			CL
10	9.0	11.2								
10	14.0	12.8								
10	19.0	13.5								

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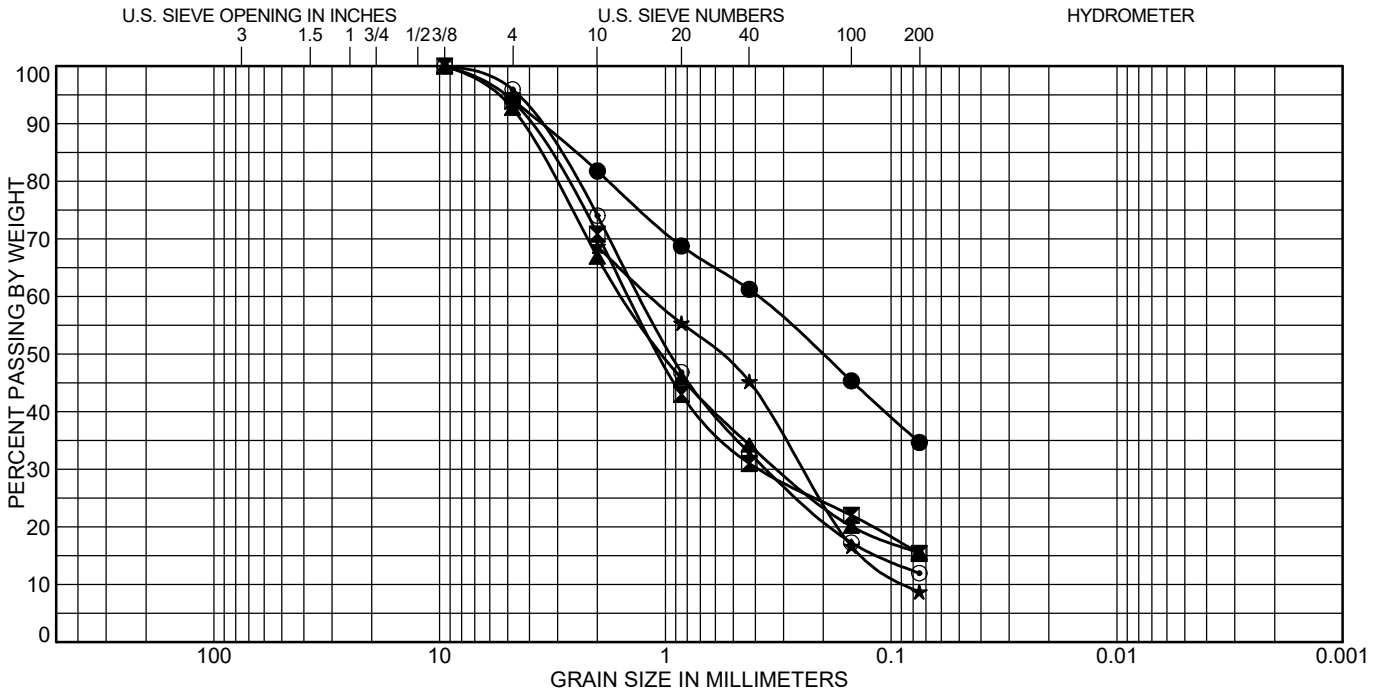
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 179012
FIGURE No. 9
PAGE 2 OF 2
DATE Oct/16/2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	1	4.0	CLAYEY SAND(SC)	29	13	16
⧓	2	14.0	SILTY SAND(SM)	NP	NP	NP
▲	3	9.0	SILTY SAND(SM)	NP	NP	NP
★	4	4.0	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP
⊙	5	9.0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0		59.5	34.7	
⧓	2	14.0	6.0	78.6	15.4	
▲	3	9.0	7.4	77.1	15.5	
★	4	4.0		60.0	8.7	
⊙	5	9.0	4.1	84.0	12.0	

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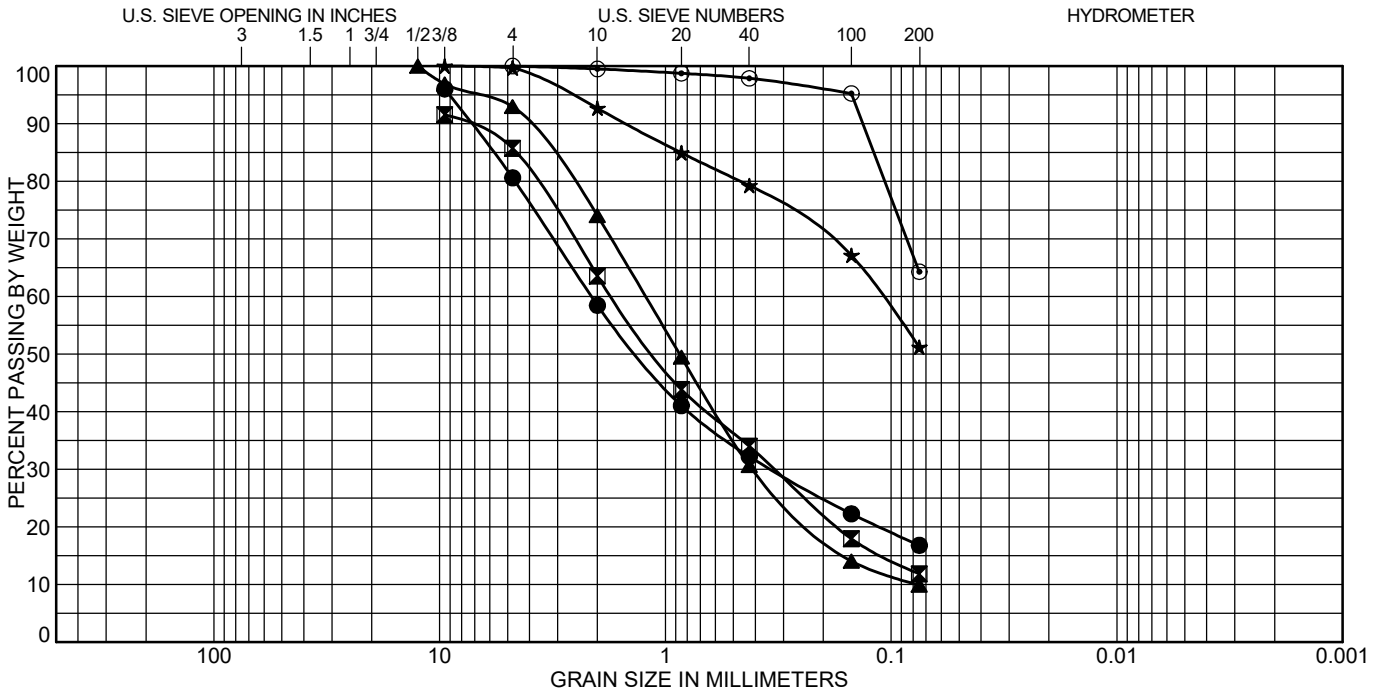
SOIL CLASSIFICATION DATA

JOB No. 179012

FIGURE No. 10

DATE Oct/16/2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	6	4.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP
⊠	7	9.0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP
▲	8	4.0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP
★	9	14.0	SANDY LEAN CLAY(CL)	31	17	14
⊙	10	4.0	SANDY LEAN CLAY(CL)	43	19	24

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	6	4.0	15.4	63.8	16.8	
⊠	7	9.0	5.8	73.9	11.8	
▲	8	4.0	7.0	83.1	9.9	
★	9	14.0	0.3	48.5	51.2	
⊙	10	4.0	0.0	35.7	64.3	

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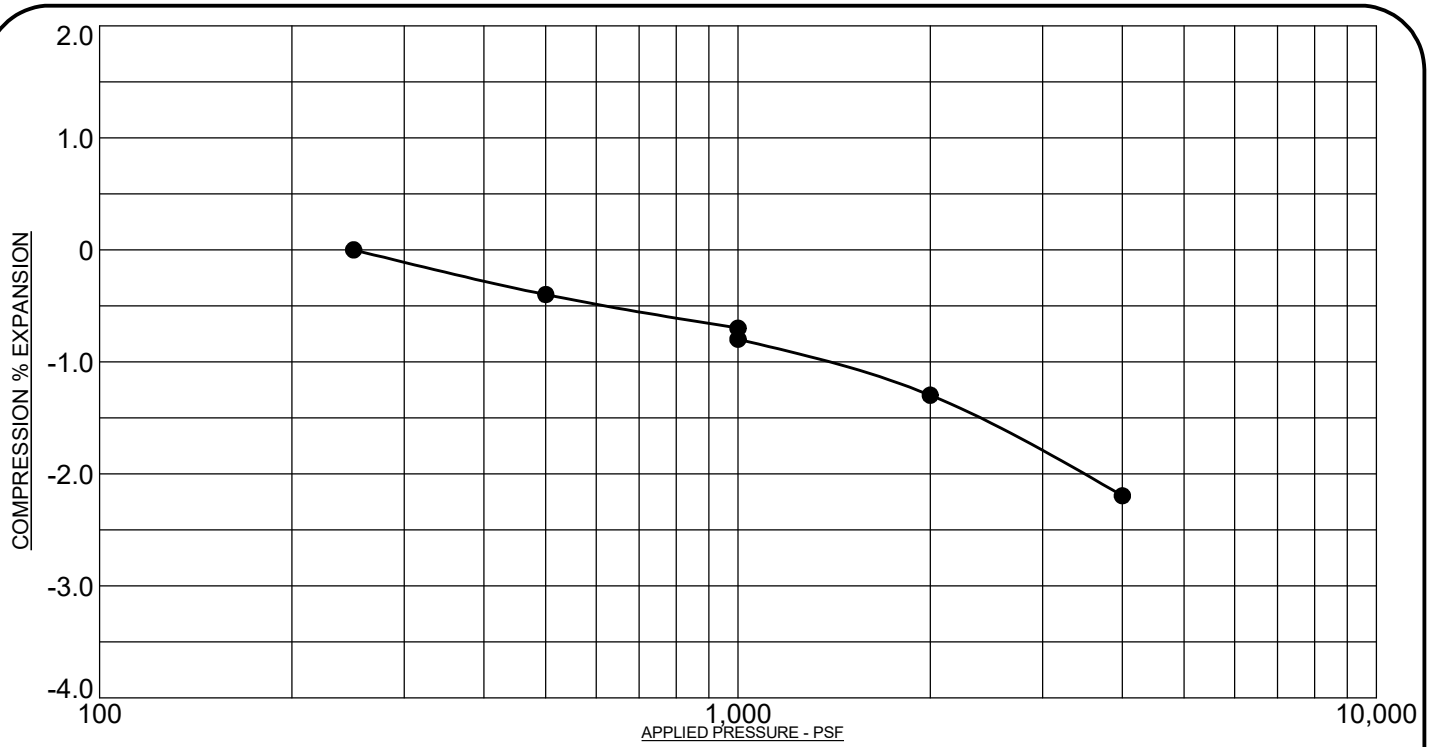
SOIL CLASSIFICATION DATA

JOB No. 179012

FIGURE No. 11

DATE Oct/16/2020



PROJECT: **Paint Brush Hills, Filing No. 14 El Paso County, Colorado**
SAMPLE DESCRIPTION: **SANDSTONE, SILTY TO CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **9 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **115.6 PCF**
NATURAL MOISTURE CONTENT: **11.6%**
PERCENT SWELL/COMPRESSION: **- 0.1**

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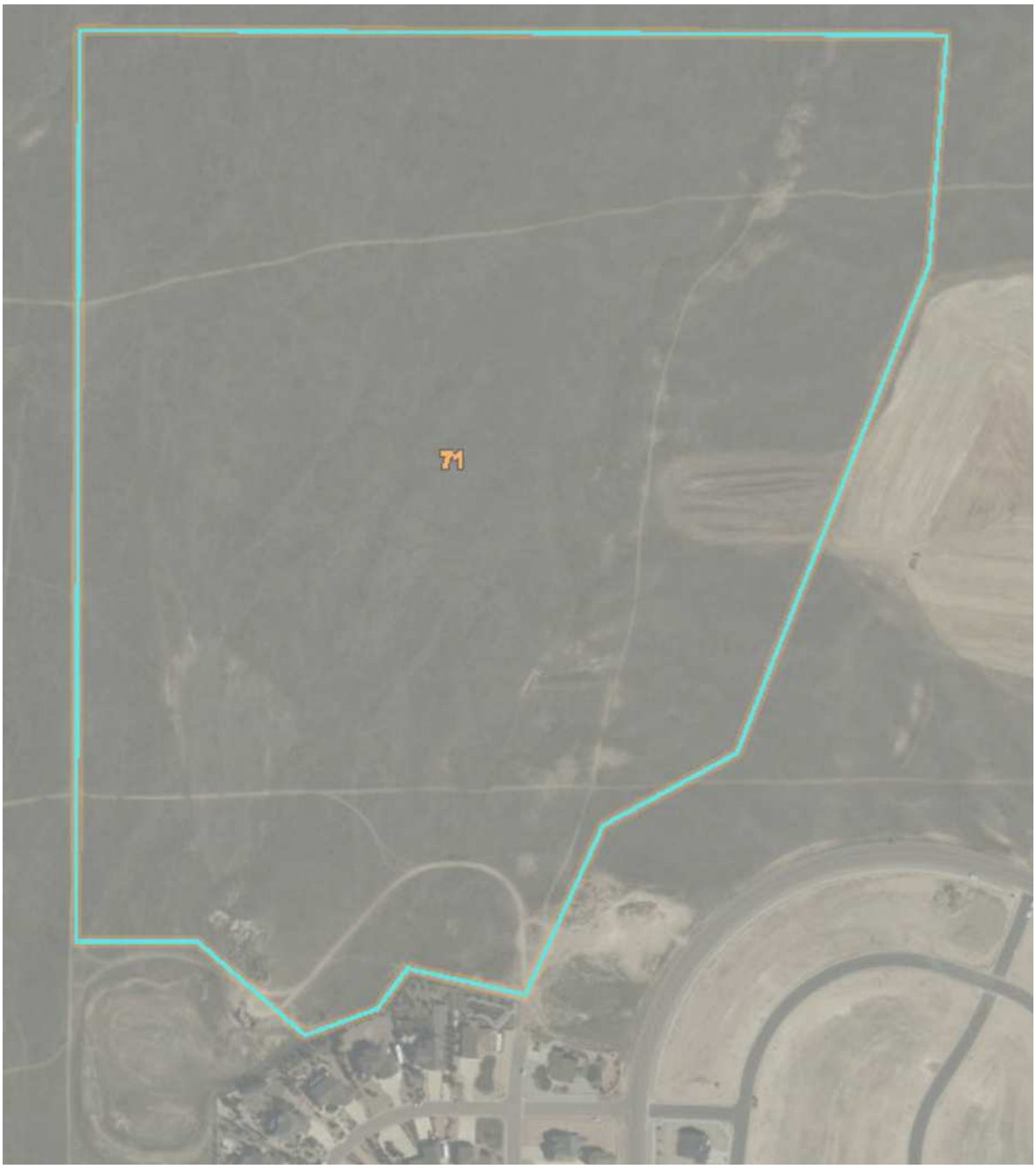
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 179012

FIGURE No. 12

DATE Oct/16/2020



- 71 - Pring coarse sandy loam, 3 to 8 percent slopes

NOT TO SCALE
BASE MAP PROVIDED BY: CGS

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USDA SOILS SURVEY MAP

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FIG No. 13

DATE 10-16-2020

NOT TO SCALE

BASE MAP PROVIDED BY: FEMA

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FEMA MAP

PAINT BRUSH HILLS, FILING NO. 14
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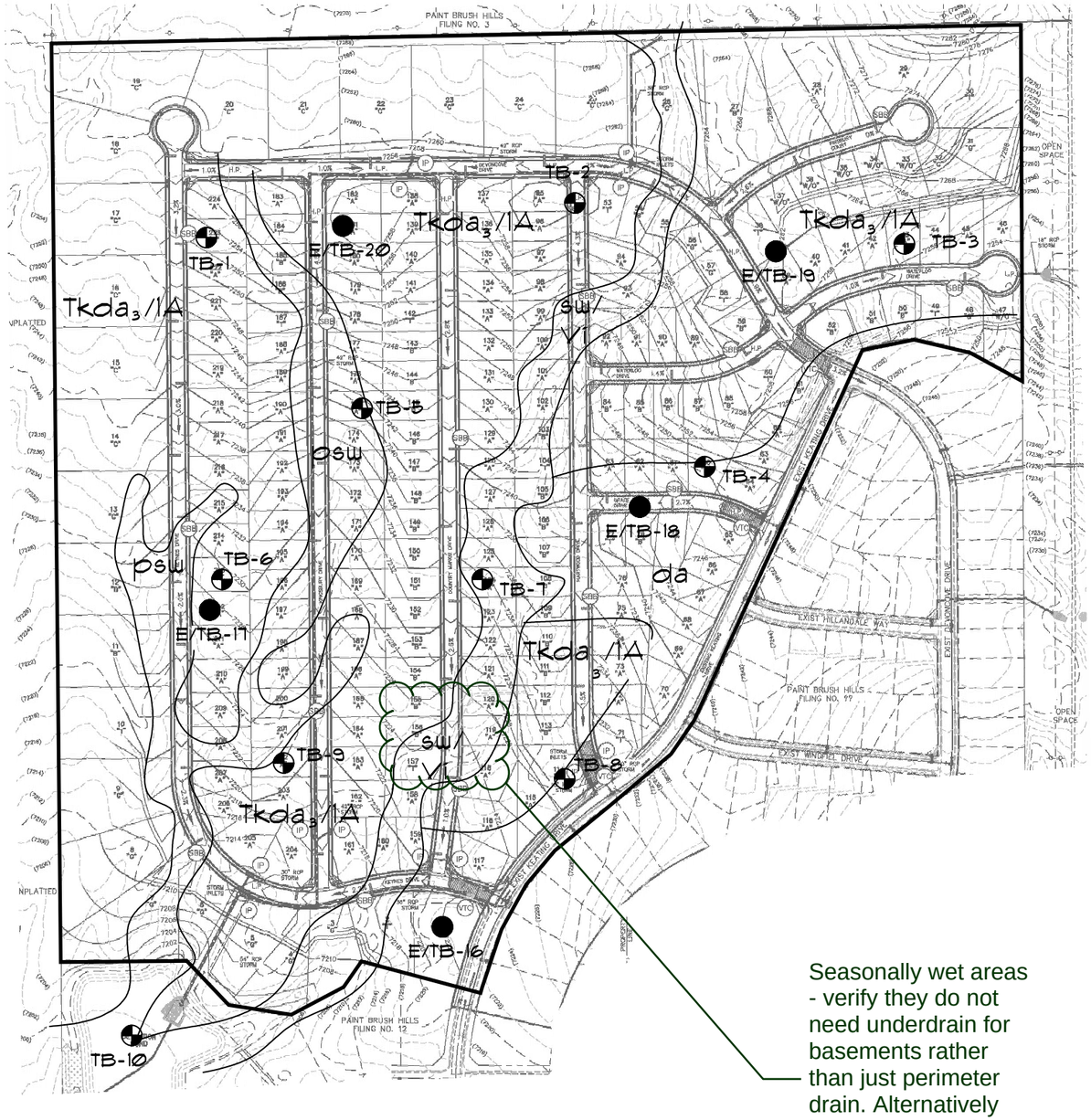
JOB No. 179012

FIG No. 15

DATE 10-16-2020



Seasonally wet areas - verify they do not need underdrain for basements rather than just perimeter drain. Alternatively basements can be prohibited on affected lots.

Geologic

- *Tkda3 - Dawson formation, facies unit three* - white to light-gray, cross-bedded or massive, very coarse arkosic sandstone or pebbly conglomerate. Occasional interbedded thin to very thinly bedded sandy claystone. Estimate thickness varies from 25 to 200 feet. The Dawson formation was encountered in all the test borings.
- *da - disturbed area* - area that has been disturbed from past activity on the site, presumed to be associated with the lot and roadway development of Paint Brush Hills, Filing No. 13E, located to the east of the property.
- *Vi - Valley infill* - existing drainageway that appears to have been filled in during the development of Paint Brush Hills, Filing No. 13E, located to the east of the property. Fill was encountered in TB-2 and extended to approximately 4 feet.
- *psw* - area mapped by Entech Engineering, Inc. (2004) as potentially seasonal wet area
- *sw* - area mapped by Entech Engineering, Inc. (2004) as seasonal wet area

Engineering

1A - Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).

◒ DENOTES APPROXIMATE LOCATION OF TEST BORING PERFORMED FOR THIS INVESTIGATION

● DENOTES APPROXIMATE LOCATION OF ENTECH ENGINEERING, INC. TEST BORINGS PERFORMED ON 01/21/02 JOB NO. 11274, DATED MARCH 5, 2004

NOT TO SCALE

BASE MAP PROVIDED BY: M&S Civil Consultants

JOB No. 162062

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Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	GGW
DRAWN BY:	KZ
CHECKED BY:	GGW
ISSUED:	10-9-2020
REVISION:	DATE: / JOB #:

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-14

APPENDIX A
Additional Reference Documents

1. *Preliminary Plan, Paint Brush Hills, Filing No. 14, El Paso County, Colorado*, prepared by Matrix., Project No. 20.1129.003, last dated August 24 2020.
2. *Paint Brush Hills, Filing No. 14, Preliminary Grading and Erosion Control Plan, El Paso County Colorado,* prepared by Matrix, Project No. 10-014, last dated January 15, 2020.
3. *Preliminary Drainage Plan, Creekside at Lorson Ranch, PUD SP-20-X*, prepared by Core Engineering Group, Project No. 100.051, last dated August 12, 2020.
4. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0535G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
5. *Geologic Map of the Falcon NW 7.5 Minute Quadrangle, El Paso County, Colorado*, Madole, R.F., 2003, Colorado Geological Survey Open-File Report OF03-08.
6. *Falcon NW Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
7. *Falcon NW Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
8. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
9. https://property.spatialest.com/co/elpaso/#/property/5522105006 Schedule No.: 5522105006.
10. *Colorado Geological Survey, USGS Geologic Map Viewer*: http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
11. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1955, 1960, 1969, 1999, 2005, 2009, 2011, 2013, 2015, and 2017.
12. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs, Falcon and Falcon NW Quadrangles dated 1898, 1909, 1948, 1969, 1981 and 1989.
13. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2011, 2013, 2015, 2017 and 2019.

APPENDIX B

Entech Engineering Inc., Test Boring Logs 16-20, Entech Job No. 11274, report dated March 5, 2004.

TEST BORING NO. 15
DATE DRILLED 1/22/02
Job # 41642

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 9.5', 1/24/02						
SAND, SILTY, BROWN						1
SANDSTONE, VERY CLAYEY, FINE GRAINED, OLIVE BROWN, VERY DENSE, MOIST				19	11.6	2
	5			50	7.3	2
SANDSTONE, CLAYEY, COARSE GRAINED, OLIVE BROWN, VERY DENSE, MOIST				7"		
	10			50	7.4	2
				5"		
	15					
	20					

TEST BORING NO. 16
DATE DRILLED 1/21/02
CLIENT SIX NINETY NINE PROPERTIES
LOCATION FALCON HILLS, 560 ACRE SITE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 9.5', 1/24/02						
SAND, SILTY, MEDIUM GRAINED, BROWNISH GRAY, DENSE, MOIST				42	5.3	1
SANDSTONE, CLAYEY, MEDIUM TO COARSE GRAINED, BROWNISH GRAY, VERY DENSE, MOIST	5			50	8.0	2
				8"		
	10			50	8.6	2
				6"		
	15					
	20					

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAA	3/5/04

JOB NO.: 11274
FIG NO.: B-8

TEST BORING NO. 17
DATE DRILLED 1/21/02
Job # 41642

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 9.5', 1/24/02						
SAND, SILTY, MEDIUM GRAINED						1
SAND, VERY CLAYEY, MEDIUM TO COARSE GRAINED, BROWNISH GRAY TO OLIVE GRAY, MEDIUM DENSE TO DENSE, MOIST				14	9.4	1
	5			40	10.1	1
SANDSTONE, CLAYEY, MEDIUM TO COARSE GRAINED, LIGHT BROWN, VERY DENSE, MOIST	10			50/6"	7.9	2
	15					
	20					

TEST BORING NO. 18
DATE DRILLED 1/21/02
CLIENT SIX NINETY NINE PROPERTIES
LOCATION FALCON HILLS, 560 ACRE SITE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 9.5', 1/21/02						
SAND, CLAYEY, MEDIUM TO COARSE GRAINED, OLIVE GRAY, DENSE, MOIST				42	6.2	1
						2
SANDSTONE, CLAYEY TO SILTY, MEDIUM TO COARSE GRAINED, GRAY, VERY DENSE, MOIST	5			50/8"	9.1	2
	10			50/5"	7.5	2
	15					
	20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/5/04

JOB NO.: 11274
FIG NO.: B-9

TEST BORING NO. 19
DATE DRILLED 1/21/02
Job # 41642

REMARKS

DRY TO 9.5', 1/21/02

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			43	9.0	1
5			50/7"	8.0	2
10			50/4"	7.6	2
15					
20					

SAND, CLAYEY, MEDIUM GRAINED, OLIVE BROWN, DENSE, MOIST

SANDSTONE, CLAYEY, MEDIUM TO COARSE GRAINED, OLIVE BROWN, VERY DENSE, MOIST

TEST BORING NO. 20
DATE DRILLED 1/21/02
CLIENT SIX NINETY NINE PROPERTIES
LOCATION FALCON HILLS, 560 ACRE SITE

REMARKS

DRY TO 10', 1/21/02

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50	5.9	2
5			50/8"	8.2	2
10			50/5"	12.6	2
15					
20					

SANDSTONE, CLAYEY, MEDIUM TO COARSE GRAINED, BROWNISH ORANGE, VERY DENSE, MOIST

SANDSTONE, VERY SILTY, VERY FINE GRAINED, LIGHT OLIVE, VERY DENSE, MOIST

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ENGINEERING, INC.
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COLORADO SPRINGS, CO. 80907 (719) 531-5599

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/5/04

JOB NO.: 11274
FIG NO.: B-1D

APPENDIX C
GUIDELINE SITE GRADING SPECIFICATIONS

Guideline Site Grading Specifications

Description: Unless specified otherwise by local or state regulatory agencies, these guideline specifications are for the excavation, placement and compaction of material from locations indicated on the plans, or staked by the Engineer, as necessary to achieve the required elevations. These specifications shall also apply to compaction of materials that may be placed outside of the project.

General: The Geotechnical Engineer shall approve fill materials, method of placement, moisture contents and percent compactions, and shall give written approval of the compacted fill.

Clearing Site: The Contractor shall remove trees, brush, rubbish, vegetation, topsoil and existing structures before excavation or fill placement is commenced. The Contractor shall dispose of the cleared material to provide the Owner with a clean job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures. Clearing shall also include removal of existing fills that do not meet the requirements of this specification and existing structures.

Preparation of Slopes or Drainage Areas to Receive Fill: Natural slopes or slopes of drainage gullies where grades are 20 percent (5:1, horizontal to vertical) or steeper shall be benched prior to fill placement. Benches shall be at least 10 feet wide. Benches may require additional width to accommodate excavation or compaction equipment. At least one bench shall be provided for each 5 feet or less of vertical elevation difference. The bench surface shall be essentially horizontal perpendicular to the slope or at a slight incline into the slope.

Scarifying: Topsoil and vegetation shall be removed from the ground surface in areas to receive fill. The surface shall be plowed or scarified a minimum of 12 inches until the surface is free from ruts, hummocks or other uneven features which would prevent uniform compaction by the equipment to be used.

Compacting Area to Receive Fill: After the area to receive fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, moisture conditioned to a proper moisture content and compacted to the maximum density as specified for the overlying fill. Areas to receive fill shall be worked, stabilized, or removed and replaced, if necessary, in accordance with the Geotechnical Engineer's recommendations in preparation for fill.

Fill Materials: Fill material shall be free from organic material or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer or imported to the site and shall be approved by the Geotechnical Engineer prior to placement. It is recommended that the fill materials have nil to low expansion potential, i.e., consist of silty to slightly clayey sand.

- The moisture-conditioned materials should be placed in maximum 6" compacted lifts. These materials should be compacted to a minimum of 92 percent of the maximum Modified Proctor dry density or 95 percent of the maximum Standard Proctor dry density. Material not meeting the above requirements shall be reprocessed.

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

Moisture Content: Fill materials shall be moisture conditioned to within limits of optimum moisture content specified. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Geotechnical Engineer, it is not possible to obtain uniform moisture content by adding water to the fill material during placement. The Contractor may be required to rake or disk the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with watering equipment, approved by the Geotechnical Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are eroded.

Should too much water be added to the fill, such that the material is too wet to permit the desired compaction to be obtained, compacting and work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework the wet material in an approved manner to hasten its drying.

Compaction of Fill Areas: Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose material does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Geotechnical Engineer. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Geotechnical Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area.

Moisture Content and Density Criteria:

A. Fill placed in roadways and utility trenches should be moisture conditioned and compacted in accordance with El Paso County Specifications.
B. Fill placed outside of roadways and utility trenches should be compacted to at least 92% of the maximum Modified Proctor density (ASTM D-1557) or at least 95% of

the maximum Standard Proctor density (ASTM D-698) at a moisture content within 2% of optimum.

Compaction of Slopes: Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and such that there is no appreciable amount of loose soil on the slopes. Compaction of slopes may be done progressively in increments of three to five feet in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

Density Testing: Field density testing shall be performed by the Geotechnical Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

Observation and Testing of Fill: Observation by the Geotechnical Engineer shall be sufficient during the placement of fill and compaction operations so that he can declare the fill was placed in general conformance with Specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

Seasonal Limits: No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Geotechnical Engineer indicates the moisture content and density of previously placed materials are as specified.

Reporting of Field Density Tests: Density tests made by the Geotechnical Engineer shall be submitted progressively to the Owner. Dry density, moisture content, percent compaction, and approximate location shall be reported for each test taken.

Soils and Geology Report_v1_redlines.pdf Markup Summary

Cloud+ (1)

Subject: Cloud+
Page Label: 35
Author: Lindsay Darden
Date: 11/9/2020 12:53:32 PM
Status:
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Seasonally wet areas - verify they do not need underdrain for basements rather than just perimeter drain. Alternatively basements can be prohibited on affected lots.

Text Box (1)

ct Engineer

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Subject: Text Box
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