Architectural
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Engineers / Architects

Materials Testing
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Civil/Planning

SOIL AND GEOLOGY STUDY

Esteban Subdivsion
3 parcels totaling 496.25 acres
EL Paso County, Colorado

PREPARED FOR:

William Guman & Associates, Ltd
731 North Weber Street, Ste 10
Colorado Springs, CO 80903

JOB NO. 190388

April 27, 2023

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
4/27/23
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Sr. Geotechnical Project Manager

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1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the west half of Section 02, Township 13 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is generally located south and east of the intersection of Judge Orr Road and Elbert Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Existing and Proposed Land Use

The site currently consists of three parcels (per the El Paso County Assessor's website) for a combined 496.25 acres:

- Schedule No. 4300000534, currently labeled as Judge Orr Road, zoned A-35, consists of approximately 27.11 acres, and land use is classified as agricultural grazing land;
- Schedule No. 4300000537, currently labeled as 02-13-64, zoned A-35, consists of approximately 136.98 acres and land use is classified as agricultural grazing land.
- Schedule No. 4300000538, currently labeled as 02-13-64, zoned A-35, consists of approximately 332.16 acres and land use is classified as agricultural grazing land.

1.3 Project Description

It is our understanding that the parcels listed above are to be combined then subdivided into single family residential lots. A rezone from A-35 to RR-2.5 and/or RR-5 has been requested, this rezone will require all the included lots to have a minimum lot size of 2.5 to 5 acres.

It is anticipated the proposed lots are to be accessed from a new road extending south from Judge Orr Road. At this time, it is uncertain as how the lots south of the drainageway are to be accessed. One potential access could be an elevated roadway with a bridge across the drainageway. The lots are to utilize individual wells and On-site Wastewater Treatment Systems (OWTS). The Proposed Site Boundaries are presented in Figure 2.

1.4 Previous Investigations

Reports of previous geotechnical engineering/geologic investigations for this site were not available for our review.

2.0 QUALIFICATIONS OF PREPARERS

This Soil and Geology 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 Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 22 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.

Tony Munger, P.E. is a licensed professional engineer with over 22 years of experience in the construction engineering (residential) field. Mr. Munger holds a B.S. in Architectural Engineering from the University of Wyoming

3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical, geologic site conditions and present our opinions of the potential effect of these conditions on the proposed development within the Town of Peyton, El Paso County, Colorado. As such, our services exclude evaluation of the environmental and/or human, health related work products or recommendations previously prepared, by others, for this project.

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.

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-Rocky Mountain Group 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
- Geologic research and analysis

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 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 currently vacant undeveloped land. The site is generally located south and east of the intersection of Judge Orr Road and Elbert Road, within El Paso County, Colorado. The site is bound to the north by Judge Orr Road, to the west by undeveloped land, to the east by developed 35-acre residential lots and to the south by developed 5-acre residential lots within the Sage Creek North subdivision.

4.2 Topography

Based on our site reconnaissance on January 27, 2023 and USGS 2019 topographic map of the Falcon Quadrangle, the portion of the site north of the unnamed drainageway generally slopes down to the south and east to the drainageway. The portion of the site south of the unnamed drainageway generally slopes to the north and east towards the drainageway. The site consists of rolling hills. Minor erosional features were visible along the unnamed drainageway. At the time

of the site reconnaissance, the drainageway was dry. The water level in the drainageway is anticipated to vary, depending upon local precipitation events.

4.3 Vegetation

The site vegetation primarily consists of tall native grasses, cacti, weeds, and other prairie-type vegetation.

4.4 Aerial Photographs and Remote-Sensing Imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1985, Colorado Geological Survey (CGS) surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Other than the fluctuations of water in the drainageway, which traverses the site from northwest to southeast, historically, the site has remained vacant, undeveloped land.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

The subsurface conditions were explored by drilling twenty-six (26) exploratory borings on February 2, 3, and 6, 2023, extending to depths of approximately 20 to 35 feet below the existing ground surface. Eight (8) test pits to depths of 6 to 8 feet were observed on February 24, 2023. The test borings and test pits were spaced to provide preliminary soil information across the site for future residential foundations and on-site wastewater treatment systems. The Test Boring/Test Pit Layout Plan is presented in Figure 3.

The number of borings generally meets the minimum 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 required by 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. The test pits were performed with a mini-excavator, provided by others, and observed by RMG at the time of excavation. An Explanation of Test Boring Logs and the Test Boring Logs are presented in Figures 4 through 17.

5.1 Laboratory Testing

Soil laboratory testing was performed as part of this investigation. The laboratory tests included moisture content, grain-size analyses, Atterberg Limit tests and Swell/Consolidation Tests. A Summary of Laboratory Test Results is presented in Figure 18. Soils Classification Data is presented in Figures 19 through 24. The Swell/Consolidation Test Results are presented in Figures 25 and 26.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the central portion of the Great Plains Physiographic Province. The site exists within the southern portion of a large structural feature known as the Denver Basin. In general, the geology at the site consists of eolian deposits and alluvium composed of sand, silt, clay, gravel, and occasional boulders that overlies the Black Squirrel Formation.

6.1 Subsurface Soil Conditions

The subsurface materials encountered in the test borings were classified visually in the field and within the laboratory using the Unified Soil Classification System (USCS). The materials were identified and classified as silty to clayey sand (SM-SC), sandy clay (CL to CH), silty to clayey sandstone, and sandy claystone.

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

6.2 Bedrock Conditions

In general, the bedrock (as mapped by Colorado Geologic Survey - CGS) beneath the site is considered to be part of the Black Squirrel Formation. The sandstone and claystone bedrock was encountered in twenty-four of our test borings. Claystone at this site classifies as CL and CH. Foundation stability within the Black Squirrel sandstone generally is good and permeability is anticipated to be low. If claystone is encountered during construction, it is generally not considered suitable for foundations, and its permeability is anticipated to be very low.

Depending on the final site grading and depth of foundations, bedrock may be encountered in the majority of proposed basement foundation excavations across the entirety of the site. Bedrock may be encountered in the deeper utility trenches for the proposed development. Overall, the Black Squirrel sandstone and claystone can readily be excavated with standard construction equipment such as a front-end loader or excavator.

6.3 U.S. Soil Conservation Service

The USDA/NRCS soil survey identifies the site soils as:

- 8 – Blakeland loamy sand, 1 to 9 percent slopes. The Blakeland loamy sand was mapped by the USDA to encompasses the majority of the property. The properties of the Blakeland loamy sand include somewhat excessively drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be low and frequency of flooding or ponding is none. Landforms are flats and hills.
- 19 – Columbine gravelly sandy loam, 0 to 3 percent slopes. The Columbine gravelly sandy loam was mapped by the USDA and is only located in the southwest corner of the property.

Properties of the Columbine gravelly sandy loam include well drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be well drained and frequency of flooding or ponding is none. Landforms are fans and hills.

- 29 – Fluvaquentic Haplaquolls, 0 to 2 percent slopes. The Fluvaquentic Haplaquolls was mapped by the USDA and traverses from the western end of the property to the eastern end in the northern portion of the property. Properties of the Fluvaquentic Haplaquolls include poorly drained soil with a depth to water table of 0 to 24 inches. Runoff is anticipated to be very high and frequency of flooding is frequent. Frequency of ponding is none. Landforms are floodplains and swales. The hydrologic soil group of the unit is D.
- 95 – Truckton loamy sand, 1 to 9 percent slopes. The Truckton loamy sand was mapped by the USDA and is located in the middle of the southern end of the property. Properties of the Truckton loamy sand include well drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be low and frequency of flooding or ponding is none. Landforms are interfluves and fan remnants.
- 96 – Truckton sandy loam, 0 to 3 percent slopes. The Truckton sandy loam was mapped by the USDA and is located in the eastern portion along the southern end of the property. Properties of the Truckton sandy loam include well drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be very low and frequency of flooding or ponding is none. Landforms are interfluves and fan remnants.

The USDA Soil Survey Map is presented in Figure 27.

6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, we identified the geologic conditions (listed below) affecting the development, as shown on the Engineering and Geology Map, Figure 28.

The site generally consists of eolian and alluvium deposits of the Pleistocene and Holocene overlying the Black Squirrel Formation of the Paleocene. Eight geologic units were mapped at the site as:

- *Qa_1 – Alluvium one* (upper Holocene) – generally located in the lowest portions of the site where there is active drainage.
- *Qa_2 – Alluvium two* (lower Holocene) – generally located above the lower portions of the site above the modern floodplain.
- *Qa_3 – Alluvium three* (upper Pleistocene) – generally located above Alluvium two and above the modern floodplain.
- *Qes - Eolian Sand* (Holocene to upper Pleistocene) – windblown deposits composed of sand and silt. This unit comprises the majority of the surface material across the site.
- *Qsw – Sheetwash Deposits* (Holocene to upper Pleistocene) – local material deposited by sheetwash on moderate slopes (approximately 10 percent grade).
- *Tbs – Black Squirrel Formation* (Paleocene) – Moderately well sorted arkosic sandstone with beds of micaceous claystone. Claystone contained in this unit may be prone to swelling when wet.
- *psw – potential seasonally wet* - areas that may collect surface water during high moisture events.

- *Fp – Floodplain* – floodplain as mapped by FEMA.

6.5 Engineering Geology

Two engineering geology units were mapped at the site and are shown on the Engineering and Geology Map, Figure 28.

- *3B* – Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%).
- *7A* - Physiographic floodplain where erosion and deposition presently occurs and is generally subject to recurrent flooding. Includes the 100-year floodplain along major streams where floodplain studies have been conducted.

The map unit description for the above units were provided by Charles Robinson and Associates (1977).

One additional unit should also be noted:

- *Ut – Utility easement* – this area will likely need to be avoided for the placement of residences and OWTS.

6.6 Structural Features

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed by RMG on the site or in the surrounding area.

6.7 Surficial (Unconsolidated) Deposits

Lake and pond sediments, swamp accumulations, sand dunes, marine terrace deposits, talus accumulations, and creep was 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 Groundwater and Drainage of Surface Water

The portion of the site north of the unnamed drainageway generally slopes down to the south and east to the drainageway. The portion of the site south of the unnamed drainageway generally slopes to the north and east towards the drainageway. Groundwater was encountered at the time of drilling

in 8 of the test borings at depths ranging from 6 to 28 feet, respectively. Groundwater was also observed in follow-up groundwater checks performed on February 28, 2023 in 15 of the borings at depths ranging between 5 and 26 feet below the existing ground surface.

It should be noted that in granular soils and bedrock, some subsurface water conditions might be encountered due to the variability of the soil profile. Isolated sand and gravel layers within the soil, even those of limited thickness and width, can convey subsurface water. Subsurface water may also flow atop the interface between the upper soils and the underlying bedrock. While not indicative of a "groundwater" condition, these occurrences of subsurface water migration can (especially in times of heavy rainfall or snowmelt) result in water migration into the excavation or (once construction is complete) the building envelope. Builders and planners should be cognizant of the potential for the occurrence of subsurface water conditions during on-site construction, and be prepared to evaluate and mitigate each individual occurrence as necessary.

Based on our knowledge of the area and engineering design and construction techniques commonly employed in the El Paso County area at this time, it is our opinion that basements should be restricted in areas where groundwater was encountered at 15 feet or shallower. Additional recommendations are presented in **Section 8.4**. Shallow groundwater conditions are anticipated to be found at the time of the site-specific subsurface soil investigations.

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.

6.10 Flooding and Surface Drainage

A natural drainageway exists near the northern portion of the site running from west to east. The drainageway was dry at the time of the site reconnaissance visits performed by RMG. The USGS Topo Map is presented in Figure 29.

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0559G and the online ArcGIS El Paso County Risk Map, the majority of the site lies outside of a 100-year floodplain. The site is within the boundaries of Zone X and zone A.

Zone X is defined by FEMA as an area of minimal flood hazard that is determined to be outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. Zone A is considered a special flood hazard area with a regulatory floodway. The Base Flood Elevations (BFE) for the drainageway have not been defined. The FEMA Flood Map is presented in Figure 30.

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 deposits are composed of sand, gravel with silt and clay.

These deposits are remnants of older streams deposited on topographic highs or bench like features. The tract is underlain primarily by the Black Squirrel Formation and Dawson Arkose, a sedimentary formation of Tertiary age related to uplift and erosion of the Front Range.

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, the tract identifier is 41-02. However, the area of the site has been mapped "Poor" for coal resources. In this part of the Denver coal region, coal resources are locally present within the lower part of the Laramie Formation of Upper Cretaceous age. The area contains strata that may contain coal. This area is not prospective for metallic mineral resources. No oil and gas wells are drilled in the area, or within two miles of it. Alluvial deposits are commonly mined in the region for sand and gravel. There are no active or inactive gravel pits in the area, but there are several within a three-mile radius of it. Alluvial deposits containing gravel and/or sand cover approximately 112 acres of tract 41-02. Assuming a mineable thickness of 15 feet, this represents 4.1 million tons of potentially useable resource. The quality of the resource has not been determined. In the vicinity of this area, the coal-bearing beds of the Laramie Formation lie at a depth of approximately 1,500 feet (Kirkham and Ladwig, 1979). It is possible that the tract contains coal resources at this depth. The coal seams in the Laramie Formation tend to be lenticular and discontinuous in comparison to areas currently being mined in western Colorado.

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 and are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Ground Subsidence and Abandoned Mining Activity
- Landslides
- Rockfall
- Steeply Dipping Bedrock
- History of Landfill or Uncontrolled/Undocumented Fill Placement
- Valley Fill
- Downhill/Down-slope Creep
- Soil Slumps and Undercutting
- Corrosive Minerals

The following sections present the geologic conditions that have been identified on (or anticipated to be on) the property:

8.1 Expansive Soils

Based on the test borings performed for this investigation and our experience with similar soils in the area, the sandy clay and claystone bedrock generally possess low to high swell potential. It is anticipated expansive clay soils or claystone bedrock will be encountered at the time of the site-specific subsurface soil investigations, and that final mitigations and construction recommendations will be provided at that time. These materials are readily mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation

Sporadic areas of expansive soils and bedrock are anticipated. If expansive soils or bedrock are encountered beneath the foundations, mitigation will be required. Due to the variability of the soil/bedrock conditions across the site and the anticipated 2.5- to 5-acre lot sizes, "mass" subexcavation during land development is currently not proposed, nor are we proposing it at this time.

Localized overexcavation below the proposed foundations and replacement with structural fill is anticipated to be the preferred mitigation. Overexcavation is anticipated for the majority of the lots. Overexcavation depths of 3 to 6 feet are anticipated. Moisture-conditioning and recompacting the on-site clays (if desired) may also be considered for mitigation of expansive materials, but may result in differing overexcavation depths and foundation design parameters. Floor slabs bearing directly on expansive material should be expected to experience a higher degree of movement. Overexcavation and replacement below the floor slabs has been successful in reducing slab movement.

The final determination of mitigation alternatives and foundation design criteria are to be determined in site-specific subsurface soil investigations for each lot. Provided that appropriate mitigations and/or foundation design adjustments are implemented, the presence of expansive soils or bedrock is not considered to pose a risk to the proposed structures.

8.2 Compressible Soils

Based on the test borings performed for this investigation, the silty to clayey sands will be encountered within some of the building excavations. In some cases, loose sands may be encountered in the excavations. Overexcavation and recompaction is a suitable mitigation.

Mitigation

If loose soils are encountered beneath the foundations, mitigation will be required. Due to the variability of the soil/bedrock conditions across the site and the anticipated 2.5- to 5-acre lot sizes, "mass" subexcavation is not currently proposed, nor are we proposing it at this time.

Localized overexcavation below the proposed foundations and replacement with structural fill is anticipated to be the preferred mitigation. If loose soils are encountered during the open excavation observation, they may require additional compaction to achieve the allowable bearing pressure

indicated in this report. Fluctuations in material density may occur. In some cases, removal and recompaction of loose soil may be required. The use of track-mounted excavation equipment, or other low ground pressure equipment, is recommended on loose soils to reduce the likelihood of loss of stability during excavation.

The final determination of mitigation alternatives and foundation design criteria are to be determined in site-specific subsurface soil investigations for each lot. Provided that appropriate mitigations and/or foundation design adjustments are implemented, the presence of expansive soils or bedrock is not considered to pose a risk to the proposed structures.

8.3 Flood Prone Areas

Based on our review of the FEMA map and the online ArcGIS El Paso County Risk Map the majority of the site lies outside the 100-year floodplain. However, portions of the site surrounding the unnamed drainageway do lie within a Regulatory Floodway. Per the latest approved edition of the Pikes Peak Regional Building Code, the lowest finished floor elevation (including basement together with attendant utility and sanitary facilities) shall be elevated one-foot or more above the designated Base Floor elevation (BFE).

Mitigation

We recommend that the proposed residences be located outside the designated Regulatory Floodway. If new development and/or construction are proposed near the floodway, additional investigations should be performed to determine the feasibility of construction within the streamside outer buffer zone and, if necessary, develop mitigation recommendations.

Per the latest approved edition of the Pikes Peak Regional Building Code, the lowest finished floor elevation (including basement together with attendant utility and sanitary facilities) shall be elevated one-foot or more above the BFE.

Builders should be advised that mitigation may be required for the potential floodwater and any resulting debris. Designs may be required to include (but are not limited to) openings to automatically equalize hydrostatic pressure, anchorage to resist buoyancy, "breakaway" panels, etc.

At the time of permit submittal, although not anticipated, the building department may require the preparation of either a Zero Rise Certification or a Less Than One Foot Rise Certification to demonstrate that the proposed structures will cause zero or less than one foot of rise (respectively) in the established BFE. If this certification cannot be obtained, more extensive submittals to FEMA may be required.

The presence of the floodplain is not believed to pose a high risk if the structures and OWTS's are located appropriately on the lots Provided that the recommendations presented herein, as well as any requirements stipulated by the governing regulatory agencies, are followed, the presence of the revised floodplain/floodway is not anticipated to preclude the proposed construction

8.4 Ponding Water, Springs and Groundwater

Based on the site observations, review of USGS topographic maps dating back to 1951, and review of Google Earth images dating back to September 1999, springs do not appear to originate on the subject site. However, ponding water and areas of seasonal shallow groundwater were encountered during our investigation. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. These areas lie within low-lying portions of the site.

Ponding surface water is likely to be encountered in the low lying drainageway that traverses the northern portion of the site. These areas are denoted as *psw – potential seasonally wet* on the Engineering and Geology Map, Figure 29.

Drilling occurred in March, generally when seasonal groundwater levels are considered slightly higher than the winter months (November through February). The presence of groundwater was observed in 15 of the test borings and 1 of the test pits performed for this investigation. Groundwater measurements are limited to the time of years measured and are considered snapshots only. The depth of groundwater was erratic due to the presence of the existing drainageway and the varying soil conditions on-site. Groundwater and/or perched water should be anticipated on a majority of the lots within the subdivision

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Groundwater information obtained at the time of the preliminary investigations performed prior to the land development phase may or may not be representative of the conditions present at the time of construction. Furthermore, the development processes (reshaping of the ground surface, installation of buried utilities, installation of an underdrain below the roadways, etc.) can significantly alter the depth and flow paths of the subsurface water. The construction of surrounding lots can also alter the amount and depth of subsurface groundwater below a given lot. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas, the following mitigations should be followed.

<u>Mitigation</u>
The feasibility of basement construction should be evaluated prior to the site-specific subsurface soil investigation for each lot. Seasonal variations in underground water conditions are expected due to the unnamed drainageway. It is assumed underground water beneath the subject site predominates in fractured weathered consolidated sedimentary bedrock located at depth. If shallow underground water conditions are encountered during the site-specific subsurface soil investigations and/or open excavation observations, mitigations may include restricting basement construction, raising the grade of the residence and/or a combination of surface and subsurface drainage systems, vertical drainboard, etc.

To date, RMG has not been provided with a sketch plan of the lot layout. The cut/fill plans or a site grading plan are not required at the time of the Sketch Plan submittal. As such, we are unable to map areas where groundwater is anticipated to be within 15 feet of the proposed ground surface. Therefore, basement construction should be restricted except where one of the following conditions apply:

This study should be done beforehand to determine where grading is feasible

- A year-long groundwater monitoring study is undertaken, and the results indicate that groundwater is sufficiently deep (greater than 15 feet) to allow basement construction;
- The proposed construction will result in at least 15 feet of separation between the proposed ground surface and the groundwater elevation. Where groundwater encroaches shallower than 15 feet, the ground surface may be modified (raised) to increase the separation to meet this criteria.

A Basement Feasibility Map is included in Figure 31. This map shows the areas where groundwater was encountered at depths less than 15 feet.

Foundations must have a minimum 30-inch depth for frost protection. Perimeter drains are recommended around portions of the structures which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable. Perimeter drains help prevent the intrusion of water into areas below grade. A typical perimeter drain detail is presented in Figure 32.

State that the groundwater district has requirements regarding removal of groundwater

If groundwater is encountered at the time of the site-specific subsurface soil investigations within 4 to 6 feet of the proposed basement slab elevation, an underslab drain would be considered in conjunction with the perimeter drain. It must be understood that subsurface drains are designed to intercept some types of subsurface moisture and not others. Therefore, the drain(s) could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area. A typical underslab drain detail is presented if Figure 33.

8.5 Scour, Erosion, Accelerated Erosion Along Creek Banks and Drainage ways

Scour generally refers to a localized loss of soil, often around a foundation element(s). Erosion generally refers to lowering the ground surface over a wide area.

Visible evidence of ongoing erosion/scour along the drainageway was not observed. Due to the current alignment of the drainageway and the configuration of the site, the drainageway traverses the northern portion of the site. As such, depending on the lot layout, additional drainage improvements may be required

Signs of significant and ongoing surface erosion were not observed on the site. It is our understanding that silt fencing (during construction) and vegetative cover (post-construction) are generally installed along that banks to reduce the potential for erosion. Personnel of RMG have not reviewed the designs of these individual improvements for adequacy to support the anticipated design flows. However, these improvements appear to be intended to reduce the potential for significant erosion across the surface of the site.

Note, further disturbance and/or long term exposure without vegetative cover will increase the potential for erosion across the site.

<u>Mitigation</u>
Significant care should be taken, both during construction and in the final grading of the lots to divert surface drainage and downspout discharge water around the structures to a location that will

not significantly alter the overall drainage of the development or result in the need for additional drainage mitigation measures at the time of construction on nearby lots.

Any landscaping in the immediate vicinity of the proposed structures should utilize xeriscape techniques in order to minimize needed irrigation to maintain landscaping. Further, stormwater and snowmelt runoff from parking (driveway) areas should be directed towards drainage channels and away from slopes, both during construction activities and upon completion of site development.

8.6 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

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.213g for a short period (S_s) and 0.059g for a 1-second period (S_1). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

8.7 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".*

Northern El Paso County and the 80831 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.

Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after the residence is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, it is recommended that the residence be tested after they are enclosed and commonly utilized techniques are in place to minimize the risk.

9.0 ON-SITE WASTEWATER TREATMENT SYSTEMS

It is our understanding that On-site Wastewater Treatment Systems (OWTS) are proposed for the subdivision. The site was evaluated in general accordance with the El Paso Land Development Code, specifically sections 8.4.8. Eight test pits ranging in depth from 6 to 8 feet were performed across the site to obtain a general understanding of the soil and bedrock conditions. The Test Pit Logs are presented in the Wastewater Study, Appendix B.

he soil on-site as classified by the United States Department of Agriculture (USDA), discussed in section 6.3, consisted of sandy loam and loamy sand. A limiting layer was encountered in one of the test pits at 6 feet, in the form of groundwater. Signs of seasonal groundwater were not observed in the remaining test pits. The long term acceptance rates (LTAR) associated with the soils observed in the test pits range from 0.2 to 0.80 gallons per day per square foot (soil types 1 to 4, respectively).

Contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated and installed according to the El Paso County Board of Health Guidelines and property maintained.

Treatment areas at a minimum, must achieve the following:

- Treatment areas must be 4 feet above groundwater or bedrock as defined by the Definitions 8.3.4 of the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations, most recently amended May 23, 2018;
- Each lot (after purchase but prior to construction of an OWTS) will require an OWTS site evaluation report prepared per *the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations*. During the site reconnaissance, a minimum of two 8-foot deep test pits will need to be excavated in the vicinity of the proposed treatment area;
- Comply with any physical setback requirements of Table 7-1 of the El Paso County Department of Health and Environment (EPCHDE);
- Treatment areas are to be located a minimum 100 feet from any well (existing or proposed), including those located on adjacent properties per Table 7-2 per the EPCHDE;

- Each lot shall be designed to insure that a minimum of 2 sites are appropriate for a OWTS and do not fall within the restricted areas, potentially seasonally wet and floodplain, as identified on the Engineering and Geology Map, Figure 29.

It is our opinion that if the EPCHDE physical setback requirements (both horizontal and vertical) are met for each lot, there are no restrictions on the placement of the individual On-site Wastewater Treatment Systems.

Soil and groundwater conditions at the site are suitable for individual treatment systems. It should be noted that the LTAR values stated above are for the test pit locations performed for this report only. The LTAR values may change throughout the site. If an LTAR value of less than 0.35 (or soil types 3A to 5) or greater than 0.80 (soil type 0) are encountered at the time of the site specific OWTS evaluation an "engineered system" will be required. Engineered systems should be anticipated for the majority of the lots within this subdivision due to the groundwater and bedrock conditions encountered.

10.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in section 8 of this report) found to be present at this site include faults, seismicity and radon. Geologic conditions (as described in section 8 of this report) found to be present at this site include potentially expansive and compressible soils, ponding water, shallow groundwater and flood prone areas. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

11.0 ANTICIPATED FOUNDATION SYSTEMS

Based on the information presented previously, conventional shallow foundation systems consisting of standard spread footings/stemwalls or conventionally-reinforced stiffened slabs-on-grade, drilled pier (caisson) foundations with or without structural floors, etc. are anticipated to be suitable for the proposed residential structures. It is assumed that the deepest excavation cuts will be approximately 7 to 10 feet below the final ground surface, not including overexcavation which may be required on a lot-by-lot basis.

Due to the swell potential, the clay and claystone are generally not suitable for support of spread footing foundations or floor slabs unless mitigated. Where expansive soils are encountered near spread footing foundation or floor slab levels, they should be removed. After compaction of the in-situ soil, the foundation construction should then be backfilled in compacted lifts to bottom of footing elevation with approved 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. All fill material should be selected, moisture-conditioned, placed, and compacted as indicated in the site-specific subsurface soil

investigation and/or open excavation observation. The structural fill should be density tested to verify compaction meets the specified 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 generally occurs relatively rapidly with construction loads. Long-term consolidation settlement should not be an issue if the fill materials are prepared as recommended above.

The foundation system for each lot should be designed and constructed based upon recommendations developed in a detailed subsurface soil investigation completed after site development activities are complete. The recommendations presented in the subsurface soil investigations should be verified by an open excavation observation following the excavation on each lot.

11.1 Granular Structural Fill - General

The processed sandstone (maximum particle size of 3 inches) is suitable for use as structural fill. Claystone is not considered suitable for use as structural fill. 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 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Structural fill should be placed in thin lifts not to exceed 6 inches and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the 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.

11.2 Moisture-Conditioned Structural Fill – General

Areas to receive moisture-conditioned expansive soils used as structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 95 percent

of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

Moisture-conditioned 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.

Moisture conditioned structural fill shall consist of a moisture-conditioned, on-site cohesive fill material. The fill material shall be moisture conditioned and replaced as follows:

- Fill shall be free of deleterious material and shall not contain rocks or cobbles greater than 6 inches in diameter.

- Claystone fill shall be thoroughly "pulverized" and shall not contain claystone chunks greater than 1 1/2 inches in diameter.

- When claystone is to be incorporated, the fill materials shall be processed in a stockpile **(processing these materials in the excavations will not be permitted)**. These stockpiled fill materials shall be moisture-conditioned to a minimum of 1 percent to 4 percent above optimum moisture content (as determined by the Standard Proctor test, ASTM D-698), with an average of not less than 1 1/2 percent above optimum moisture content. These materials, once moisture conditioned and thoroughly mixed, should rest in the stockpile a minimum of 24 hours to ensure proper distribution of the moisture through the material. After resting, the materials should be re-wet and re-mixed to replace the surficial moisture lost to evaporation during the resting period. Fill materials not containing claystone do not require processing in a stockpile.

- Fill materials shall be moisture-conditioned to a minimum of 1 percent to 4 percent above optimum moisture content (as determined by the Standard Proctor test, ASTM D-698), with an average of not less than 1 1/2 percent above optimum moisture content.

- The moisture-conditioned materials should be placed in maximum 6" compacted lifts. These materials should be compacted to a minimum of 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698). 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.

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

It is anticipated that the existing soils will require the addition of water to achieve the required moisture content. The fill soils should be thoroughly mixed or disked to provide uniform moisture content through the fill. It should be noted, that the clay soils compacted at the above moisture

contents are likely to result in wet, slick conditions. We recommend that the excavation contractor retained to perform this work have significant experience processing subexcavation and moisture-conditioned soils.

Frequent moisture content and density tests shall be performed in the field to verify conformance with the above specifications. Furthermore, representative samples of the moisture-conditioned fill shall be obtained by personnel of RMG on a daily basis for follow-up swell testing to demonstrate that the swell potential has been reduced to not more than 1 percent swell when saturated under a 1,000 psf surcharge pressure. Areas where the follow-up swell tests indicate swells higher than that value shall have the fill material removed, reprocessed, recompacted, and retested.

RMG should be contacted a minimum of 3 days prior to initiation of subexcavation and moisture conditioning processes in order to schedule appropriate field services. Fill shall not be placed on frozen subgrade or allowed to freeze during processing. The time of the year when night temperatures are above freezing are the most optimal period for a sub-excavation operation.

Following completion of the subexcavation and moisture conditioning process, it is imperative that the "as-compacted" moisture content be maintained prior to construction and establishment of landscape irrigation. This may require reprocessing of materials and addition of supplemental water to prevent remobilization of swell potential within the fill.

11.3 Exterior Backfill

Backfill should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to 85 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557 on exterior sides of walls in landscaped areas. In areas where backfill supports pavement and/or concrete flatwork, the materials should be compacted to 92 percent of the maximum dry density.

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

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

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

11.4 Surface Detention 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.

11.5 Foundation Stabilization

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

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

11.6 Foundation Drains

A subsurface perimeter drain is required around portions of the structure which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable.

Groundwater was encountered during this investigation. Depending on the conditions encountered during the lot-specific subsurface soil investigation and the conditions observed at the time of the open excavation observation, additional subsurface drainage systems may be recommended.

One such system is an underslab drainage layer to help intercept groundwater before it enters the slab area should the groundwater levels rise. In general, if groundwater was encountered within 4 to 6 feet of the proposed basement slab elevation, an underslab drain should be anticipated. Another such system would consist of a subsurface drain and/or vertical drain board placed around the perimeter of the overexcavation to help intercept groundwater and allow for proper placement and compaction of the replacement structural fill. Careful attention should be paid to grade and discharge of the drain pipes of these systems.

11.7 Design Parameters

The allowable bearing pressure of the subsurface soils should be determined by a detailed site specific subsurface soil investigation and verified by and open excavation observation, as noted above.

12.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test borings, test pits, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction. ***A site-specific subsurface soil investigation will be required for all proposed structures including (but not limited to) residences and any proposed retaining walls, etc.***

To develop recommendations for construction of the proposed roadways, a pavement design investigation should be performed. This investigation should consist of additional test borings, soil laboratory testing and specific recommendations for the design and construction of roadway pavement sections.

13.0 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.

Basement construction should be restricted except where one of the following conditions apply:

- A year-long groundwater monitoring study is undertaken, and the results indicate that groundwater is sufficiently deep to allow basement construction;
- The proposed construction will result in at least 15 feet of separation between the proposed ground surface and the groundwater elevation. Where groundwater encroaches shallower than 15 feet, the ground surface may be modified (raised) to increase the separation to meet this criteria.

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.

We believe the sandy clay and claystone will classify as Type A material OSHA in 29 CFR Part 1926. OSHA required that temporary excavations made in Type A materials be laid back at ratios

no steeper than 1:3/4 (horizontal to vertical), unless the excavation is shored and braced. We believe the silty to clayey sand and sandstone will classify as Type B material as defined by OSHA. OSHA requires that temporary excavations made in Type B materials be laid back at ratios no steeper than 1:1 (horizontal to vertical), 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.

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).

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.

It is important for the Owner(s) of each lot read and understand this report, and to carefully familiarize themselves with the geologic hazards associated with construction in this area. This report only addresses the geologic constraints contained within the boundaries of the site referenced above.

14.0 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 **William Guman & Associates, Ltd** 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

NOT TO SCALE

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Geotechnical

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Forensics
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SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

SITE VICINITY MAP

ESTEBAN SUBDIVISION

EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

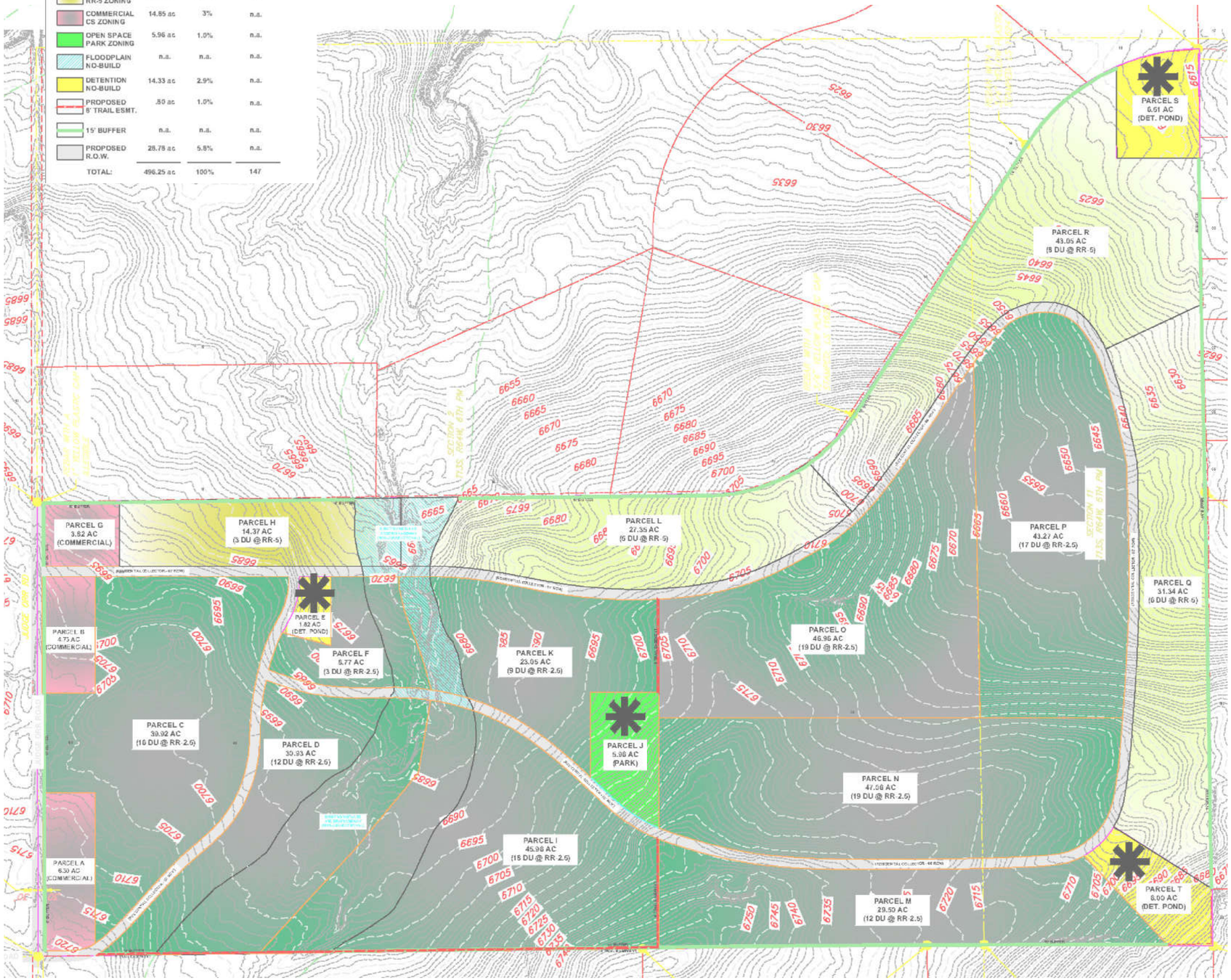
JOB No. 190388

FIG No. 1

DATE 4-27-2023

LAND USE SUMMARY TABLE:

LAND USE CATEGORY	ACREAGE	% OF SITE	MAXIMUM UNITS
LOW DENSITY RR-2.5 ZONING	315.42 ac	63.3%	125
LOW DENSITY RR-5 ZONING	116.11 ac	23%	22
COMMERCIAL CS ZONING	14.85 ac	3%	n.a.
OPEN SPACE PARK ZONING	5.96 ac	1.0%	n.a.
FLOODPLAIN NO-BUILD	n.a.	n.a.	n.a.
DETENTION NO-BUILD	14.33 ac	2.9%	n.a.
PROPOSED 8' TRAIL ESMT.	.50 ac	1.0%	n.a.
15' BUFFER	n.a.	n.a.	n.a.
PROPOSED R.O.W.	28.78 ac	5.8%	n.a.
TOTAL:	496.25 ac	100%	147



NOT TO SCALE

BASE MAP PROVIDED BY
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2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
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ESTEBAN SUBDIVISION

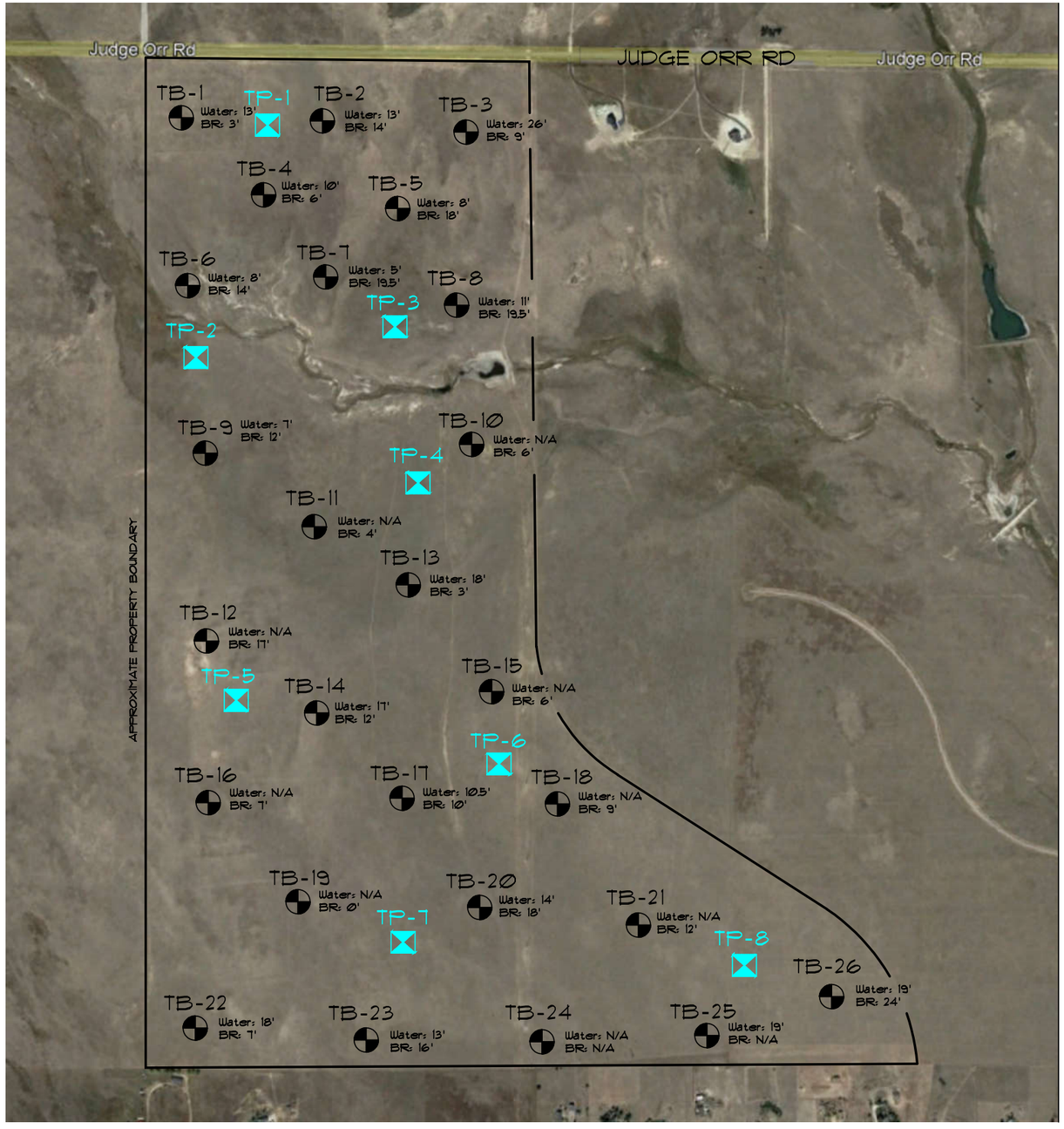
EL PASO COUNTY, COLORADO

WILLIAM GUMAN AND ASSOCIATES, LTD

ENGINEER:	TM
DRAWN BY:	NM
CHECKED BY:	TM
ISSUED:	4-27-2023

PROPOSED SITE BOUNDARIES

SHEET No.
FIG-2



DENOTES APPROXIMATE LOCATION OF TEST BORINGS

DENOTES APPROXIMATE LOCATION OF TEST PITS

Water: Groundwater Depth on 2/28/23
BR: Bedrock depth at time of drilling

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DRAWN BY:	NM
CHECKED BY:	TM
ISSUED:	4-27-2023

TEST BORING/TEST PIT LAYOUT PLAN

SHEET No.
FIG-3

SOILS DESCRIPTION


CLAYEY SAND


CLAYSTONE


SANDSTONE


SANDY CLAY

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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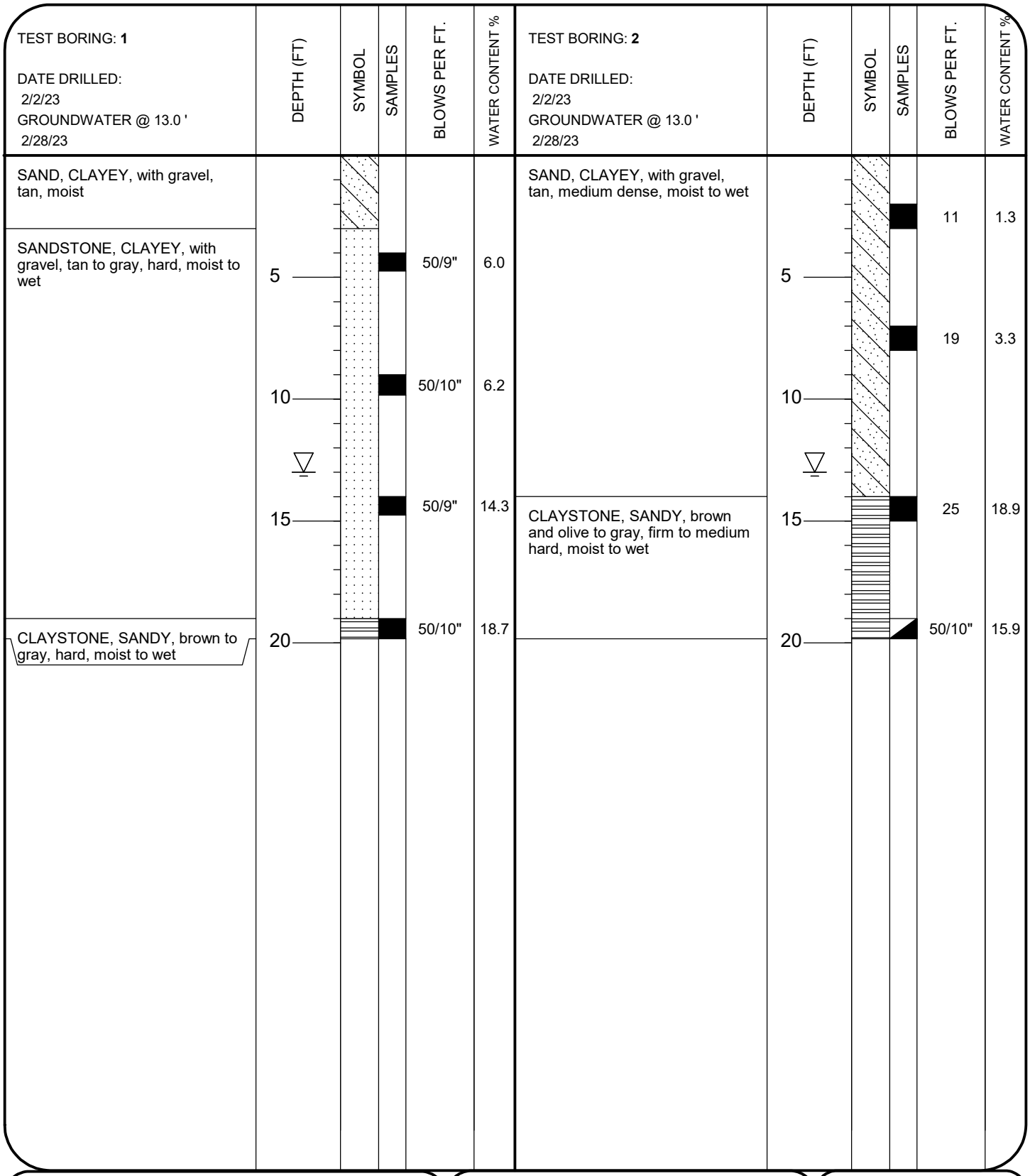
EXPLANATION OF TEST BORING LOGS

JOB No. 190388

FIGURE No. 4

DATE Apr/27/2023



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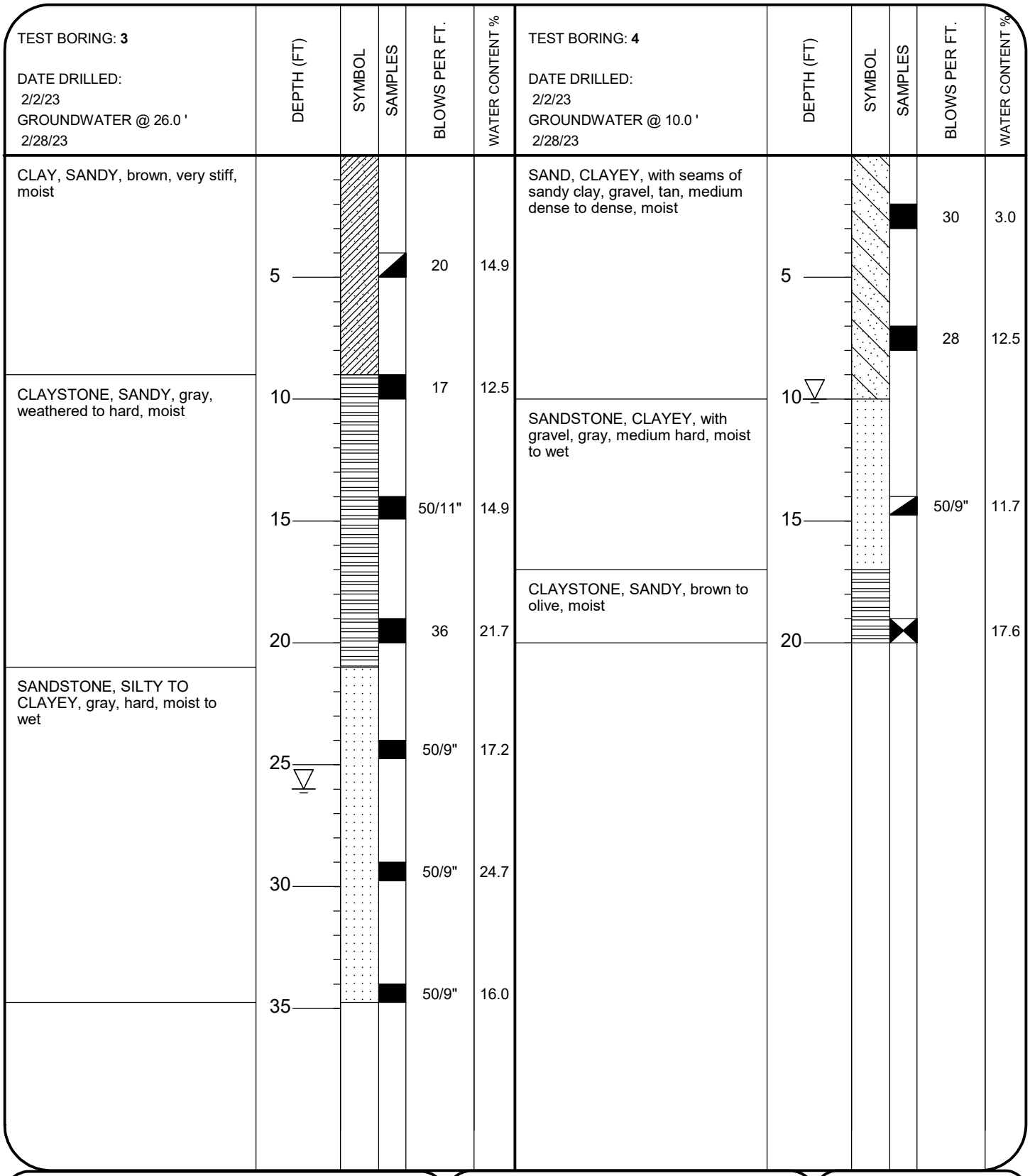
TEST BORING LOG

JOB No. 190388

FIGURE No. 5

DATE Apr/27/2023



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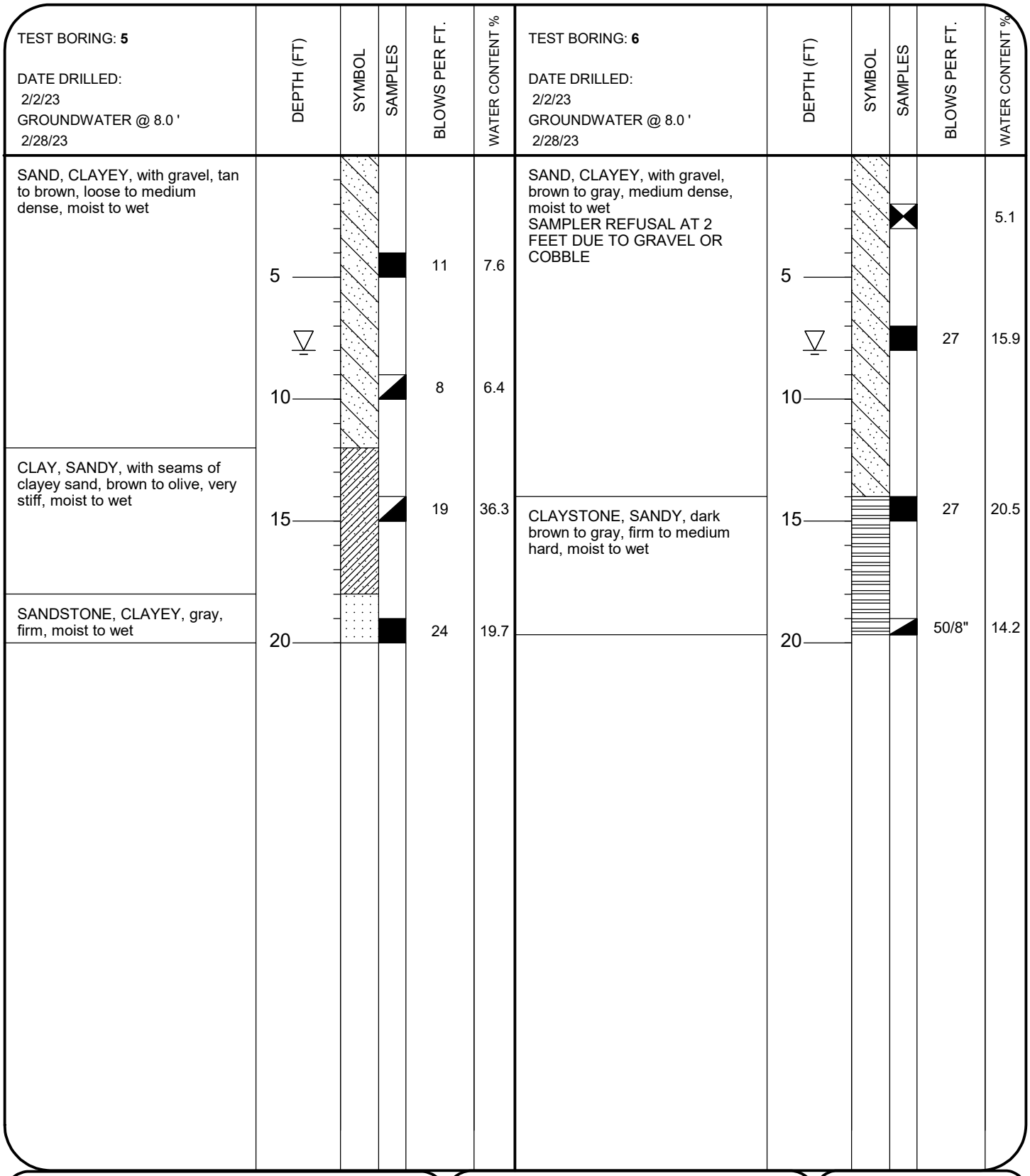
TEST BORING LOG

JOB No. 190388

FIGURE No. 6

DATE Apr/27/2023



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2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
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TEST BORING LOG

JOB No. 190388

FIGURE No. 7

DATE Apr/27/2023

TEST BORING: **7** DATE DRILLED: 2/2/23 GROUNDWATER @ 5.0 ' 2/28/23	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with gravel, tan to gray, loose to medium dense, moist to wet	5			5	23.9
	10			5	24.1
	15			14	20.9
CLAYSTONE, SANDY, brown, firm, moist to wet	20			21	31.1

TEST BORING: **8** DATE DRILLED: 2/2/23 GROUNDWATER @ 11.0 ' 2/28/23	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with seams of sandy clay, tan to gray, very loose to medium dense, moist to wet	5			9	5.9
				9	16.6
	10				
	15			3	24.9
CLAYSTONE, SANDY, brown, firm, moist to wet	20			20	37.5

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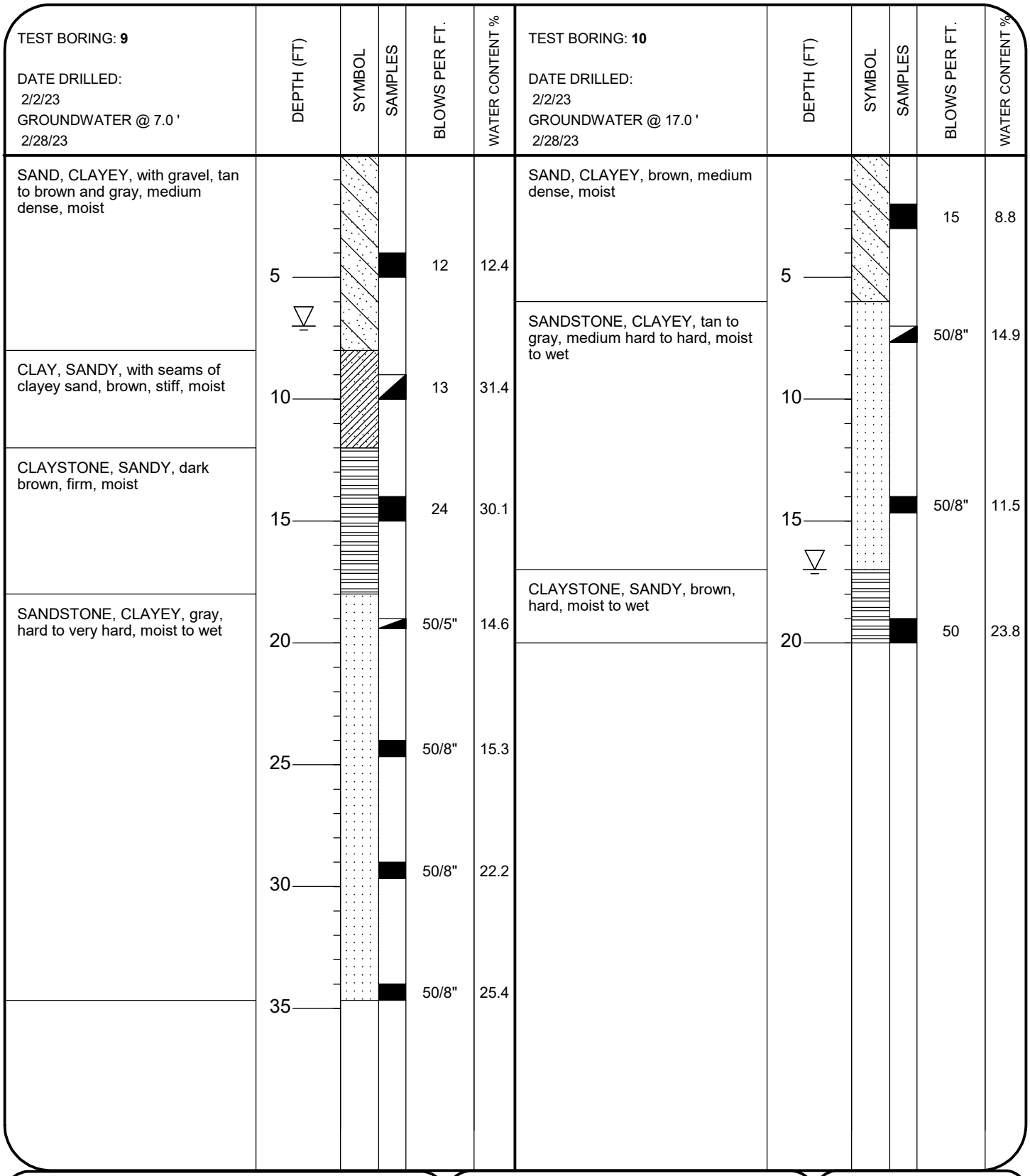
TEST BORING LOG

JOB No. 190388

FIGURE No. 8

DATE Apr/27/2023



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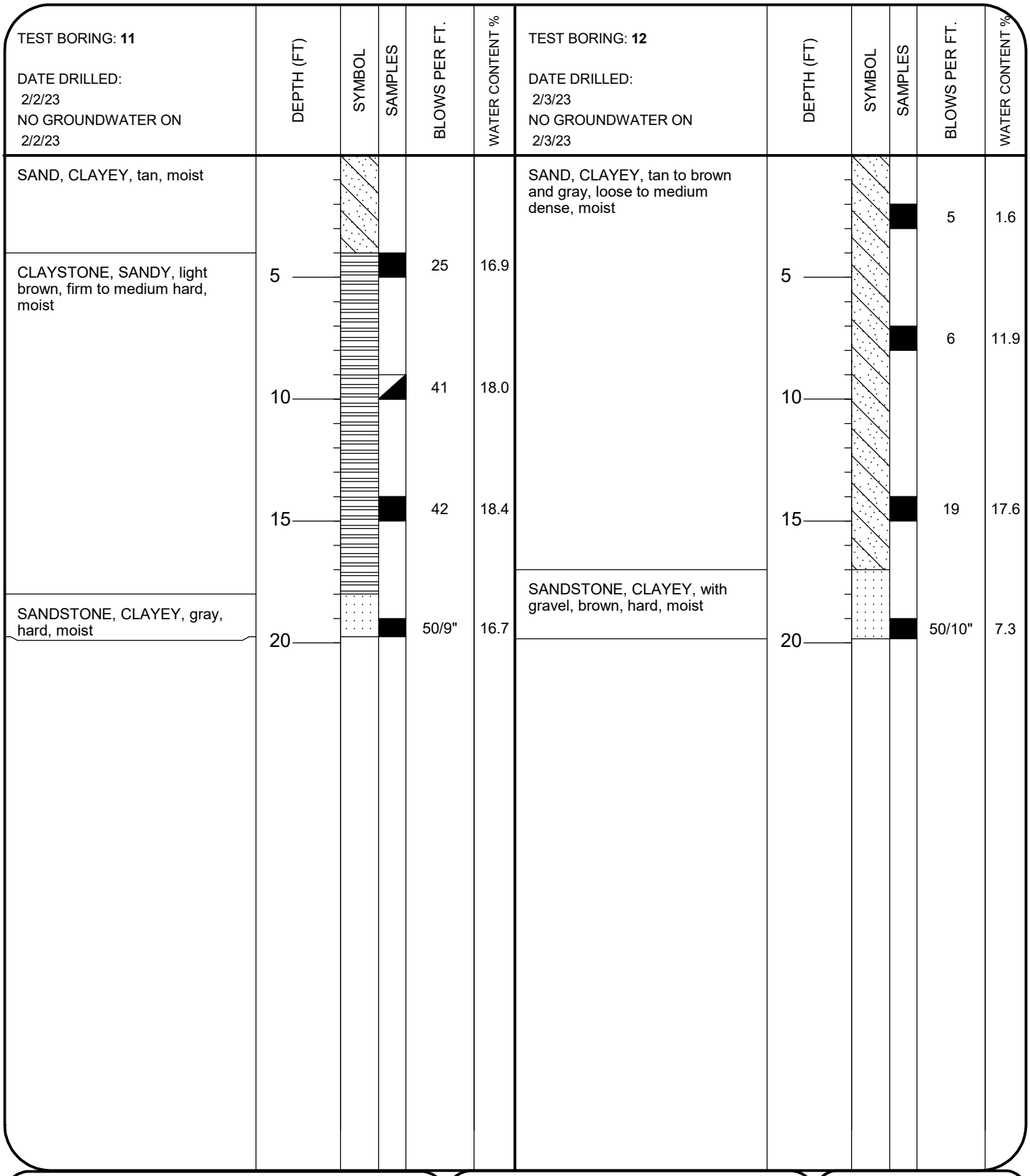
TEST BORING LOG

JOB No. 190388

FIGURE No. 9

DATE Apr/27/2023



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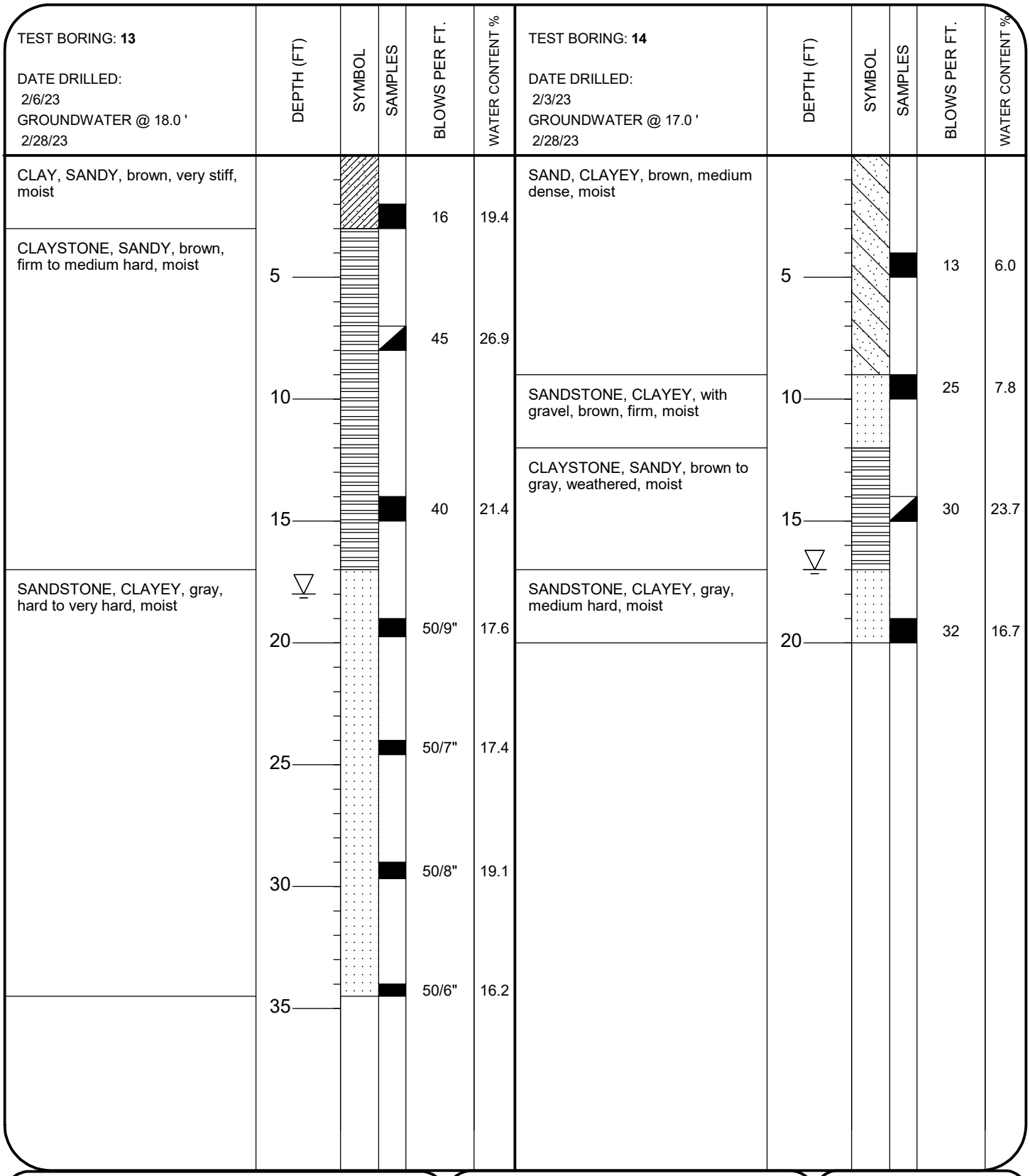
TEST BORING LOG

JOB No. 190388

FIGURE No. 10

DATE Apr/27/2023



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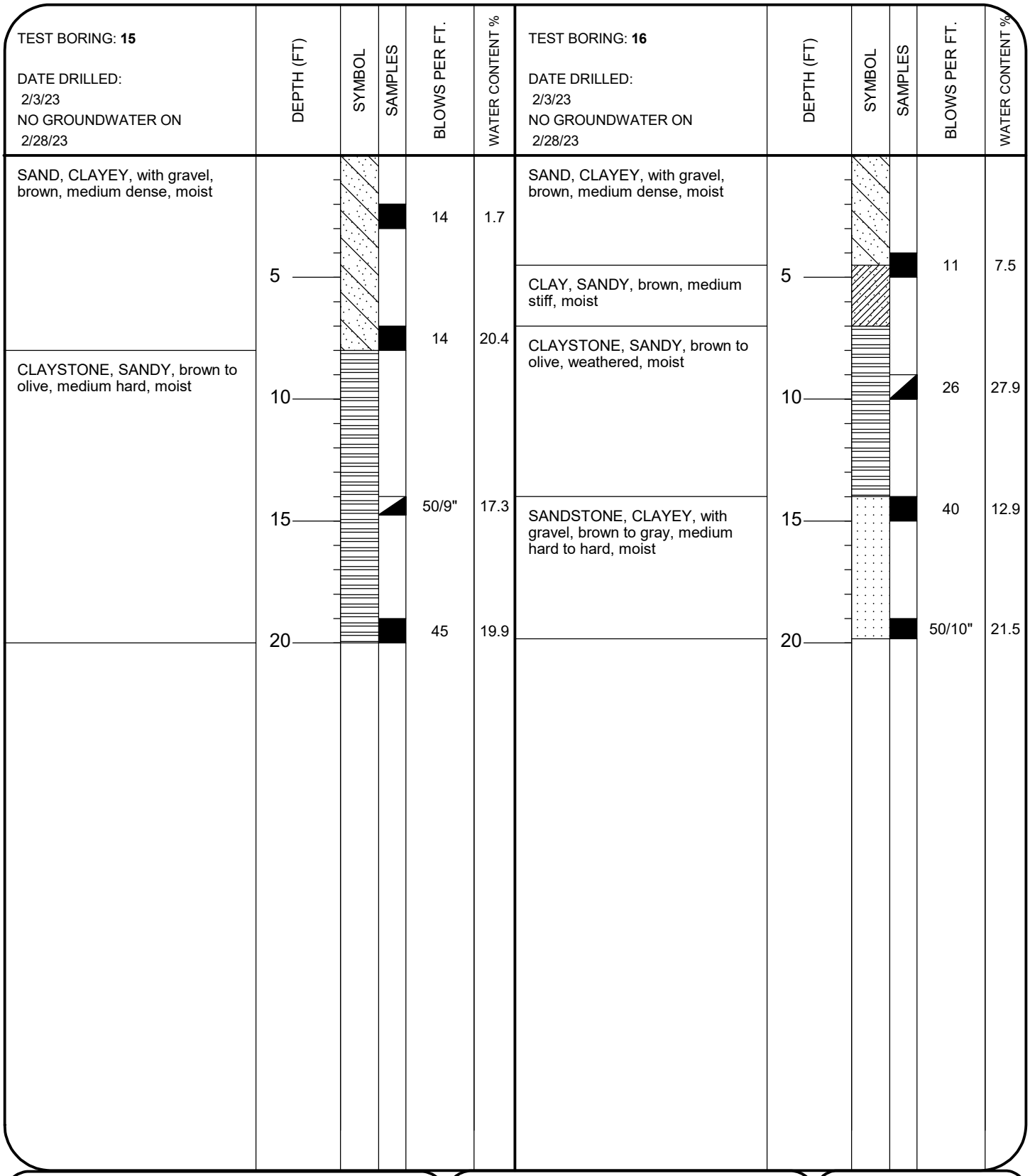
TEST BORING LOG

JOB No. 190388

FIGURE No. 11

DATE Apr/27/2023



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TEST BORING LOG

JOB No. 190388

FIGURE No. 12

DATE Apr/27/2023

TEST BORING: **17**

DATE DRILLED:
2/3/23
GROUNDWATER @ 10.5 '
2/28/23

SAND, CLAYEY, with gravel, tan, medium dense, moist

CLAYSTONE, SANDY, brown to gray, medium hard to hard, moist to wet

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
		20	4.3
5		11	6.9
10 ▽			
15		50	18.1
20		50/10"	18.6

TEST BORING: **18**

DATE DRILLED:
2/3/23
NO GROUNDWATER ON
2/28/23

SAND, CLAYEY, with seams of sandy clay, brown, medium dense, moist

SANDSTONE, CLAYEY, with gravel and seams of sandy claystone, tan to brown and olive, firm to hard, moist

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5		17	26.9
10		25	15.4
15		50/9"	17.8
20		50/10"	18.4

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TEST BORING LOG

JOB No. 190388

FIGURE No. 13

DATE Apr/27/2023

TEST BORING: **19**

DATE DRILLED:
2/6/23
NO GROUNDWATER ON
2/28/23

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5			18	20.8
10			50/9"	16.2
15			50/11"	18.9
20			50/9"	13.2
25			50/9"	16.6
30			50/7"	13.4
35			50/6"	12.9

CLAYSTONE, SANDY, brown, weathered, moist

SANDSTONE, CLAYEY, tan to brown and olive, medium hard to very hard, moist

TEST BORING: **20**

DATE DRILLED:
2/3/23
GROUNDWATER @ 14.0 '
2/28/23

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5			22	3.2
10			15	2.4
15			26	12.9
20			26	20.9

SAND, CLAYEY, with gravel, tan, medium dense, moist to wet

SANDSTONE, CLAYEY, gray, firm, moist to wet

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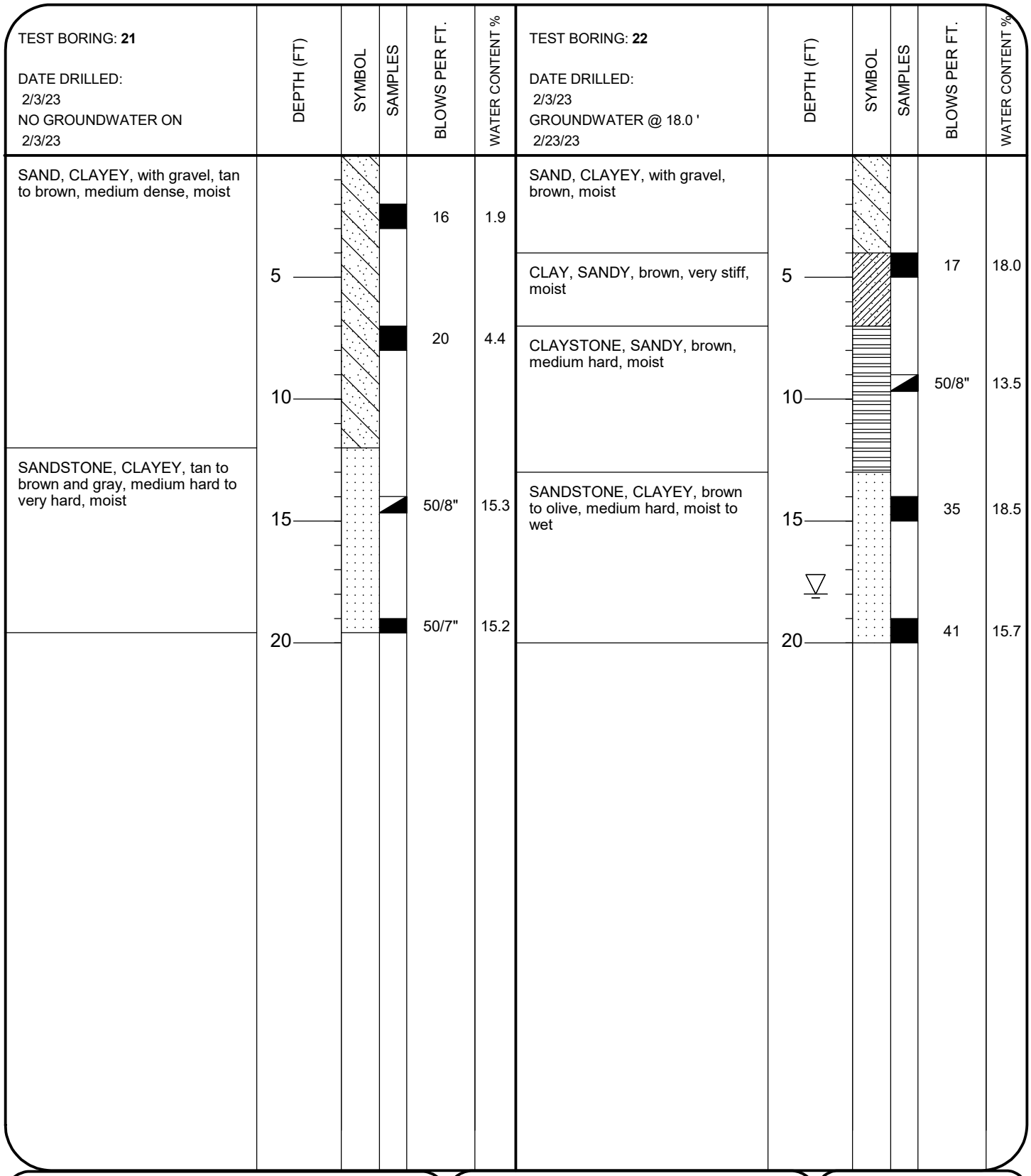
TEST BORING LOG

JOB No. 190388

FIGURE No. 14

DATE Apr/27/2023



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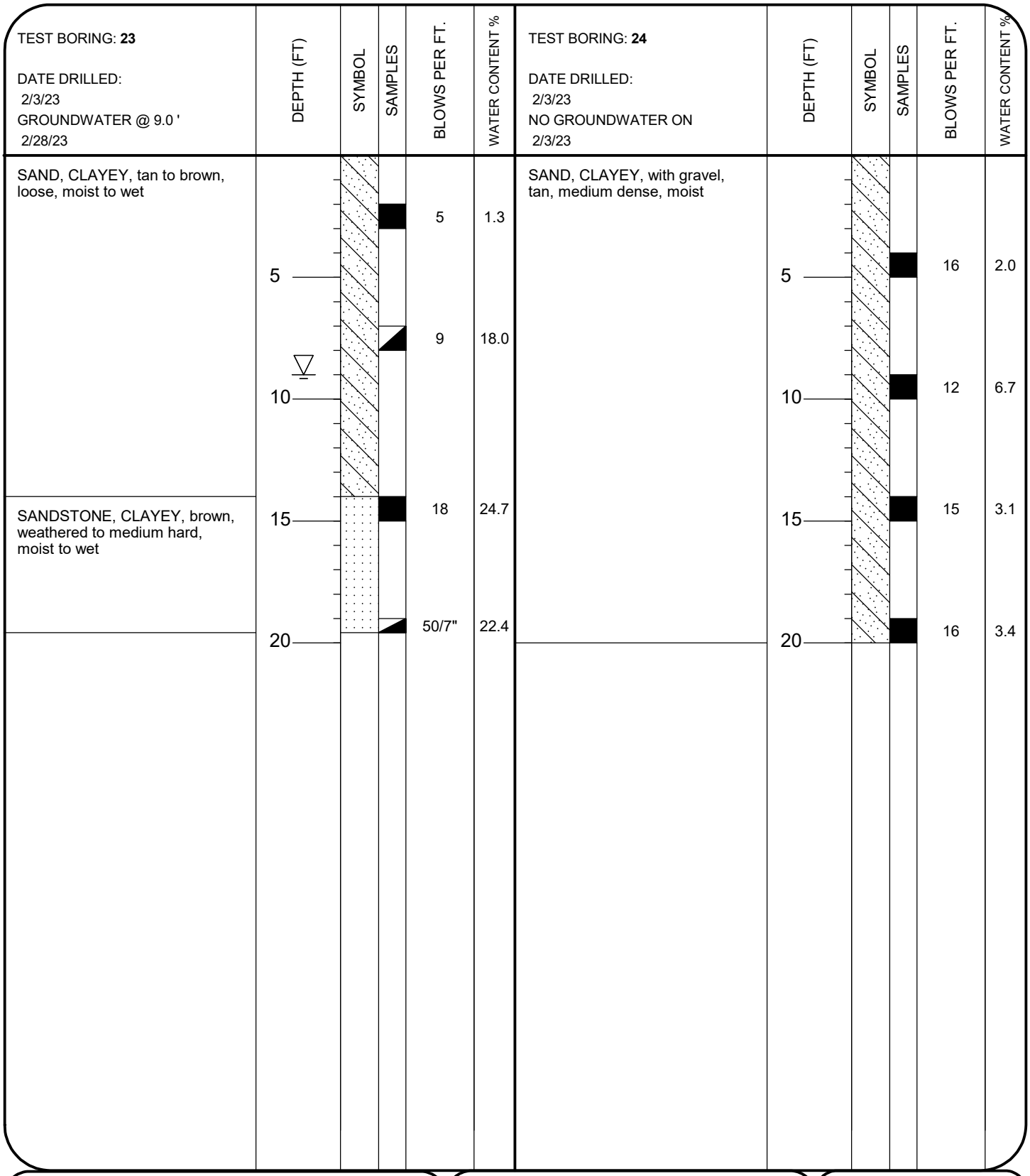
TEST BORING LOG

JOB No. 190388

FIGURE No. 15

DATE Apr/27/2023



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TEST BORING LOG

JOB No. 190388

FIGURE No. 16

DATE Apr/27/2023

TEST BORING: **25**

DATE DRILLED:
2/3/23
GROUNDWATER @ 19.0 '
2/28/23

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	CLAY, SANDY, tan, very stiff, moist		16	7.9
	SAND, CLAYEY, with gravel, tan to brown, medium dense, moist to wet			
5			15	2.8
10				
15			11	7.3
20	▽		10	32.0
	CLAY, SANDY, brown to olive, medium stiff, moist to wet			

TEST BORING: **26**

DATE DRILLED:
2/6/23
GROUNDWATER @ 19.0 '
2/28/23

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, CLAYEY, with gravel, tan to brown, medium dense, moist to wet		13	3.2
5			11	4.3
10				
15			10	7.1
20	▽		14	14.1
25	CLAYSTONE, SANDY, olive, weathered to medium hard, moist to wet		17	38.7
30			38	30.6
35	SANDSTONE, CLAYEY, gray, hard, moist to wet		50/8"	26.8

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TEST BORING LOG

JOB No. 190388

FIGURE No. 17

DATE Apr/27/2023

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
1	4.0	6.0								
1	9.0	6.2		NP	NP	5.4	15.2			SM
1	14.0	14.3								
1	19.0	18.7								
2	2.0	1.3								
2	7.0	3.3								
2	14.0	18.9		51	35		75.6			CH
2	19.0	15.9								
3	4.0	14.9	112.8	43	24				5.1	
3	9.0	12.5								
3	14.0	14.9								
3	19.0	21.7								
3	24.0	17.2								
3	29.0	24.7		NP	NP	14.2	16.0			SM
3	34.0	16.0								
4	2.0	3.0								
4	7.0	12.5		28	17	9.8	47.7			SC
4	14.0	11.7								
4	19.0	17.6								
5	4.0	7.6								
5	9.0	6.4								
5	14.0	36.3	84.7	47	28		42.1		- 0.8	SC
5	19.0	19.7								
6	2.0	5.1		NP	NP	10.1	10.3			SP-SM
6	7.0	15.9								
6	14.0	20.5								
6	19.0	14.2								
7	4.0	23.9		NP	NP	0.0	8.6			SP-SM
7	9.0	24.1								
7	14.0	20.9								
7	19.0	31.1								
8	2.0	5.9								
8	7.0	16.6					24.1			
8	14.0	24.9								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 190388
FIGURE No. 18

DATE Apr/27/2023

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
8	19.0	37.5								
9	4.0	12.4								
9	9.0	31.4	83.9	53	28	0.0	92.6		0.1	CH
9	14.0	30.1								
9	19.0	14.6								
9	24.0	15.3								
9	29.0	22.2								
9	34.0	25.4								
10	2.0	8.8								
10	7.0	14.9		42	17	0.0	34.5			SC
10	14.0	11.5								
10	19.0	23.8								
11	4.0	16.9		51	31		62.9			CH
11	9.0	18.0								
11	14.0	18.4								
11	19.0	16.7								
12	2.0	1.6		NP	NP	0.0	6.4			SP-SM
12	7.0	11.9								
12	14.0	17.6								
12	19.0	7.3								
13	2.0	19.4								
13	7.0	26.9				0.0	83.2			
13	14.0	21.4								
13	19.0	17.6								
13	24.0	17.4								
13	29.0	19.1								
13	34.0	16.2								
14	4.0	6.0								
14	9.0	7.8								
14	14.0	23.7	102.5	53	34	0.0	59.4		1.7	CH
14	19.0	16.7								
15	2.0	1.7								
15	7.0	20.4		46	23		34.0			SC
15	14.0	17.3								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 190388
FIGURE No. 18

DATE Apr/27/2023

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
15	19.0	19.9								
16	4.0	7.5		43	29		19.5			SC
16	9.0	27.9								
16	14.0	12.9								
16	19.0	21.5								
17	2.0	4.3								
17	7.0	6.9		NP	NP	1.4	14.8			SM
17	14.0	18.1								
17	19.0	18.6								
18	4.0	26.9								
18	9.0	15.4		35	23	0.0	52.7			CL
18	14.0	17.8								
18	19.0	18.4								
19	4.0	20.8		61	41	1.7	62.6			CH
19	9.0	16.2								
19	14.0	18.9								
19	19.0	13.2								
19	24.0	16.6								
19	29.0	13.4								
19	34.0	12.9								
20	4.0	3.2								
20	9.0	2.4								
20	14.0	12.9		NP	NP	1.3	14.2			SM
20	19.0	20.9								
21	2.0	1.9								
21	7.0	4.4				0.0	20.7			
21	14.0	15.3								
21	19.0	15.2								
22	4.0	18.0		43	24	1.1	57.6			CL
22	9.0	13.5								
22	14.0	18.5								
22	19.0	15.7								
23	2.0	1.3								
23	7.0	18.0								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 190388
FIGURE No. 18

DATE Apr/27/2023

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
23	14.0	24.7		36	13	0.0	28.8			SC
23	19.0	22.4								
24	4.0	2.0								
24	9.0	6.7								
24	14.0	3.1		NP	NP	1.1	4.3			SP
24	19.0	3.4								
25	2.0	7.9		33	21	0.0	52.0			CL
25	7.0	2.8								
25	14.0	7.3								
25	19.0	32.0								
26	2.0	3.2								
26	7.0	4.3		NP	NP	0.0	16.5			SM
26	14.0	7.1								
26	19.0	14.1								
26	24.0	38.7		61	31	0.0	60.3			CH
26	29.0	30.6								
26	34.0	26.8								

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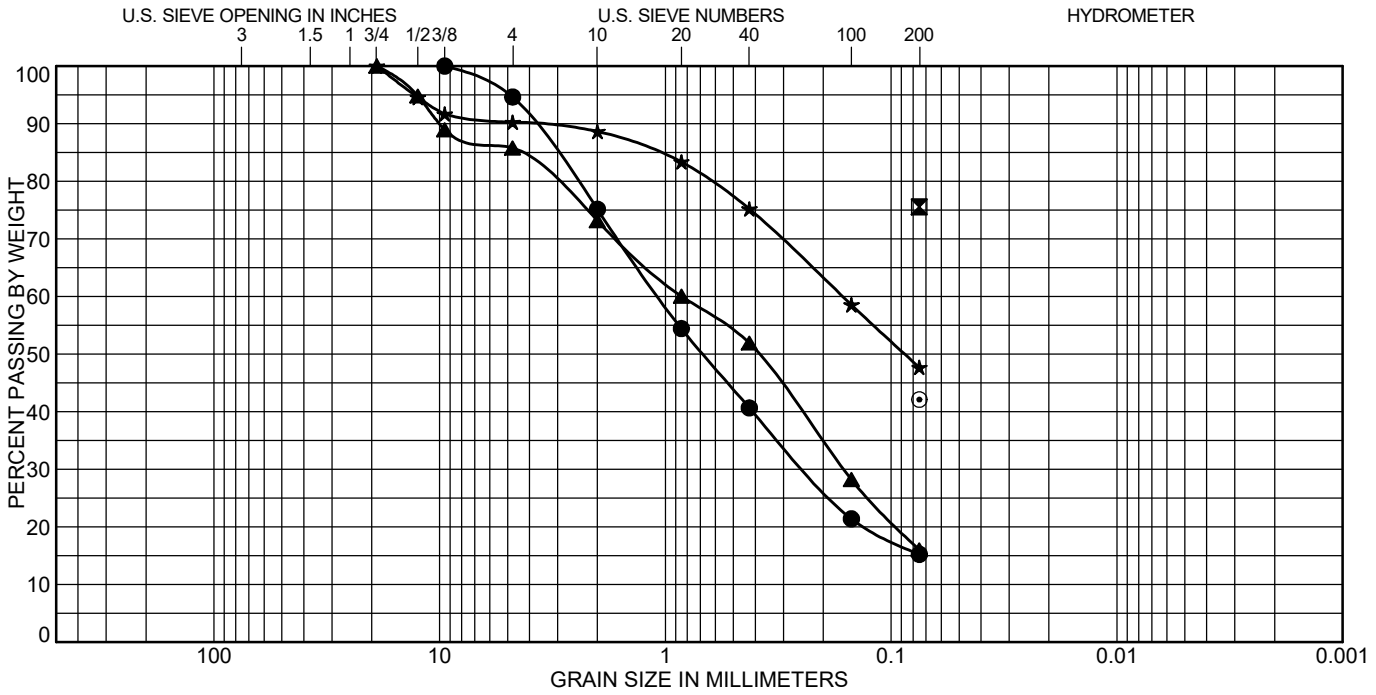
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 190388
FIGURE No. 18

DATE Apr/27/2023



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	9.0	SILTY SAND(SM)	NP	NP	NP
⊠	2	14.0	FAT CLAY with SAND(CH)	51	16	35
▲	3	29.0	SILTY SAND(SM)	NP	NP	NP
★	4	7.0	CLAYEY SAND(SC)	28	11	17
⊙	5	14.0	CLAYEY SAND(SC)	47	19	28

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	9.0	5.4	79.4	15.2	
⊠	2	14.0			75.6	
▲	3	29.0	14.2	69.8	16.0	
★	4	7.0	9.8	42.6	47.7	
⊙	5	14.0			42.1	

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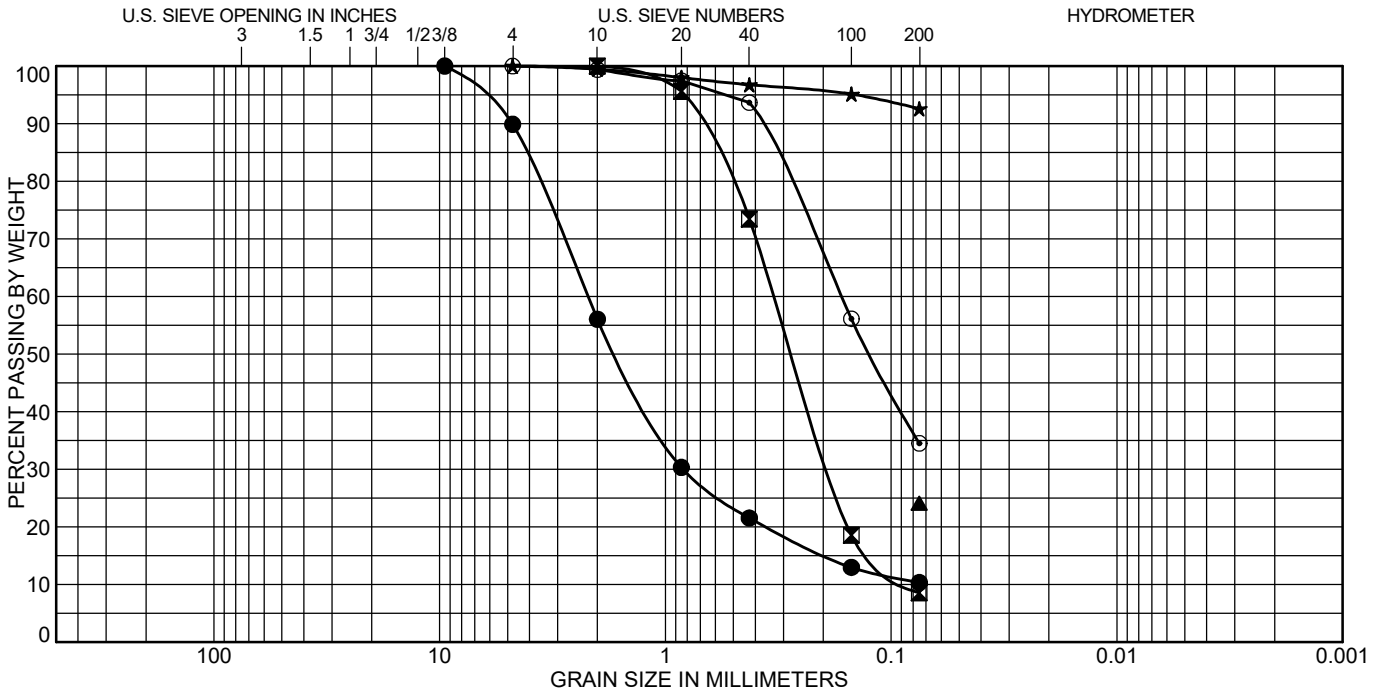
SOIL CLASSIFICATION DATA

JOB No. 190388

FIGURE No. 19

DATE Apr/27/2023



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	6	2.0	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP
⊠	7	4.0	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP
▲	8	7.0				
★	9	9.0	FAT CLAY(CH)	53	25	28
⊙	10	7.0	CLAYEY SAND(SC)	42	25	17

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	6	2.0	10.1	79.6	10.3	
⊠	7	4.0	0.0	91.4	8.6	
▲	8	7.0			24.1	
★	9	9.0	0.0	7.4	92.6	
⊙	10	7.0	0.0	65.5	34.5	

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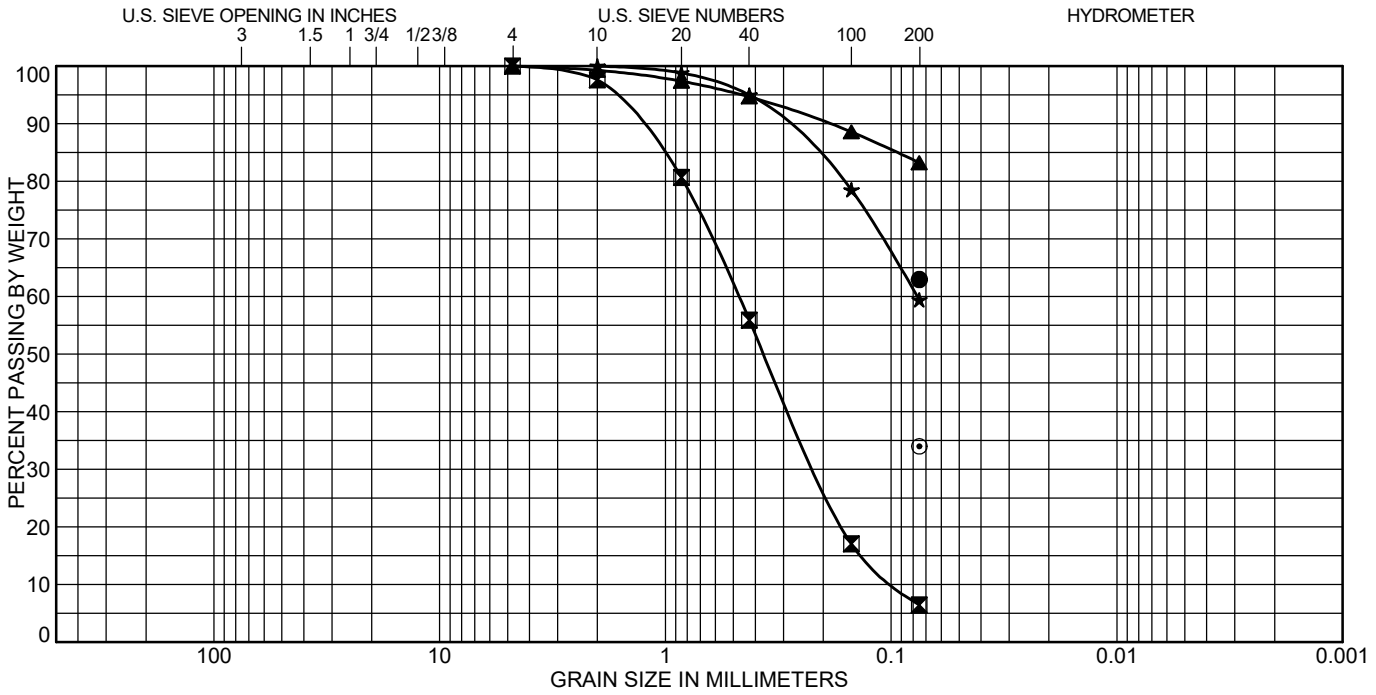
SOIL CLASSIFICATION DATA

JOB No. 190388

FIGURE No. 20

DATE Apr/27/2023



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	11	4.0	SANDY FAT CLAY(CH)	51	20	31
⊠	12	2.0	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP
▲	13	7.0				
★	14	14.0	SANDY FAT CLAY(CH)	53	19	34
⊙	15	7.0	CLAYEY SAND(SC)	46	23	23

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	11	4.0			62.9	
⊠	12	2.0	0.0	93.6	6.4	
▲	13	7.0	0.0	16.8	83.2	
★	14	14.0	0.0	40.6	59.4	
⊙	15	7.0			34.0	

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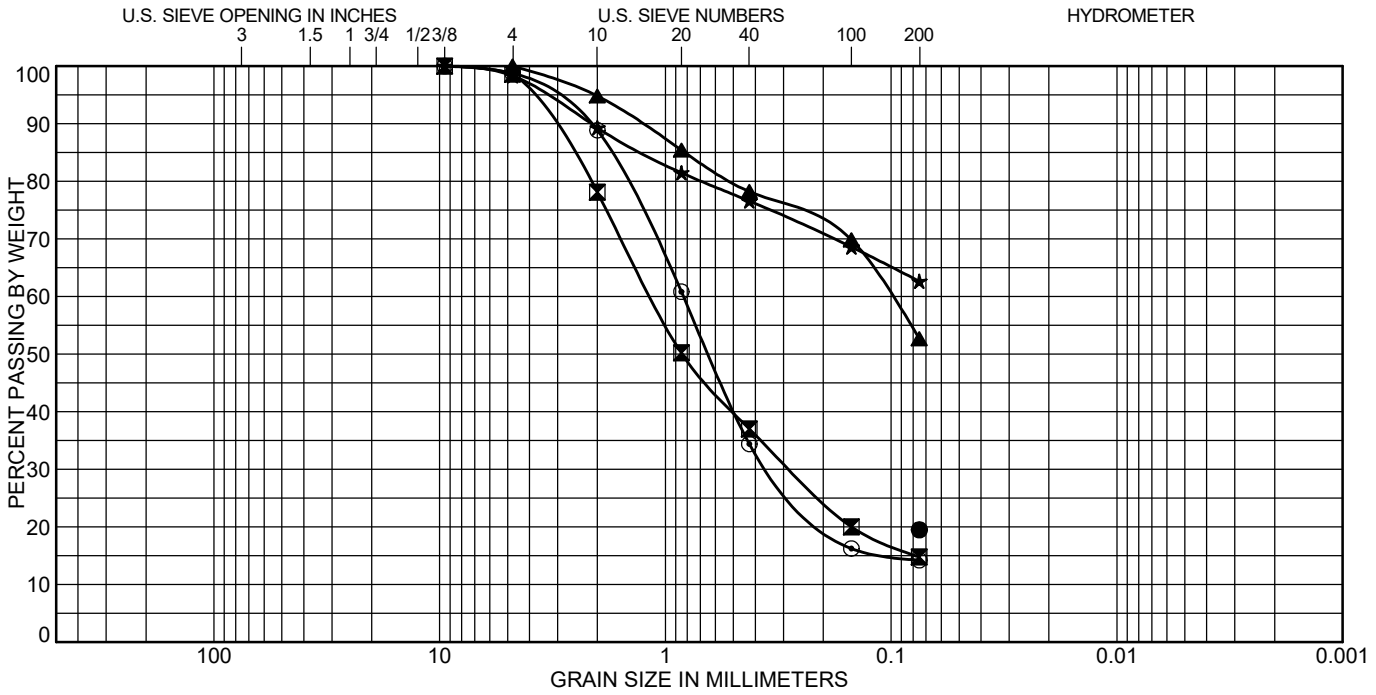
SOIL CLASSIFICATION DATA

JOB No. 190388

FIGURE No. 21

DATE Apr/27/2023



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	16	4.0	CLAYEY SAND(SC)	43	14	29
⧓	17	7.0	SILTY SAND(SM)	NP	NP	NP
▲	18	9.0	SANDY LEAN CLAY(CL)	35	12	23
★	19	4.0	SANDY FAT CLAY(CH)	61	20	41
⊙	20	14.0	SILTY SAND(SM)	NP	NP	NP

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	16	4.0			19.5	
⧓	17	7.0	1.4	83.9	14.8	
▲	18	9.0	0.0	47.3	52.7	
★	19	4.0	1.7	35.7	62.6	
⊙	20	14.0	1.3	84.5	14.2	

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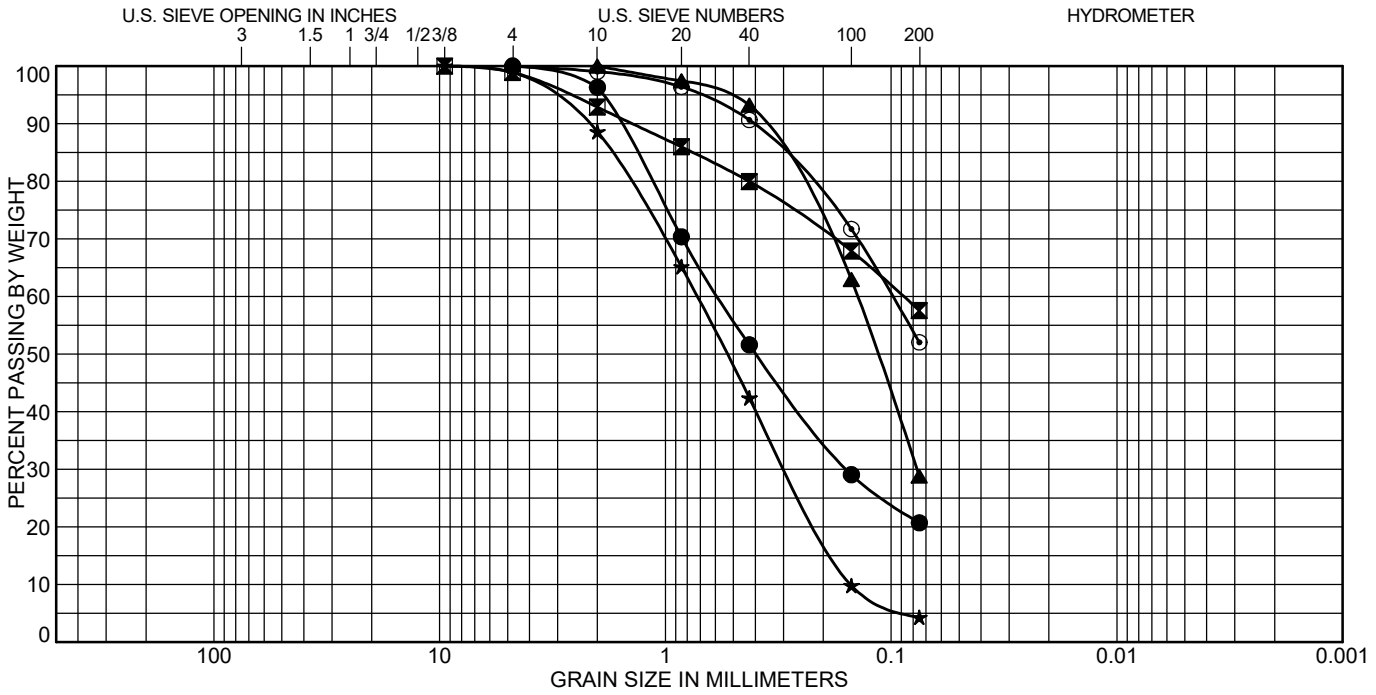
SOIL CLASSIFICATION DATA

JOB No. 190388

FIGURE No. 22

DATE Apr/27/2023



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	21	7.0				
⧓	22	4.0	SANDY LEAN CLAY(CL)	43	19	24
▲	23	14.0	CLAYEY SAND(SC)	36	23	13
★	24	14.0	POORLY GRADED SAND(SP)	NP	NP	NP
⊙	25	2.0	SANDY LEAN CLAY(CL)	33	12	21

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	21	7.0	0.0	79.3	20.7	
⧓	22	4.0	1.1	41.3	57.6	
▲	23	14.0	0.0	71.2	28.8	
★	24	14.0	1.1	94.6	4.3	
⊙	25	2.0	0.0	48.0	52.0	

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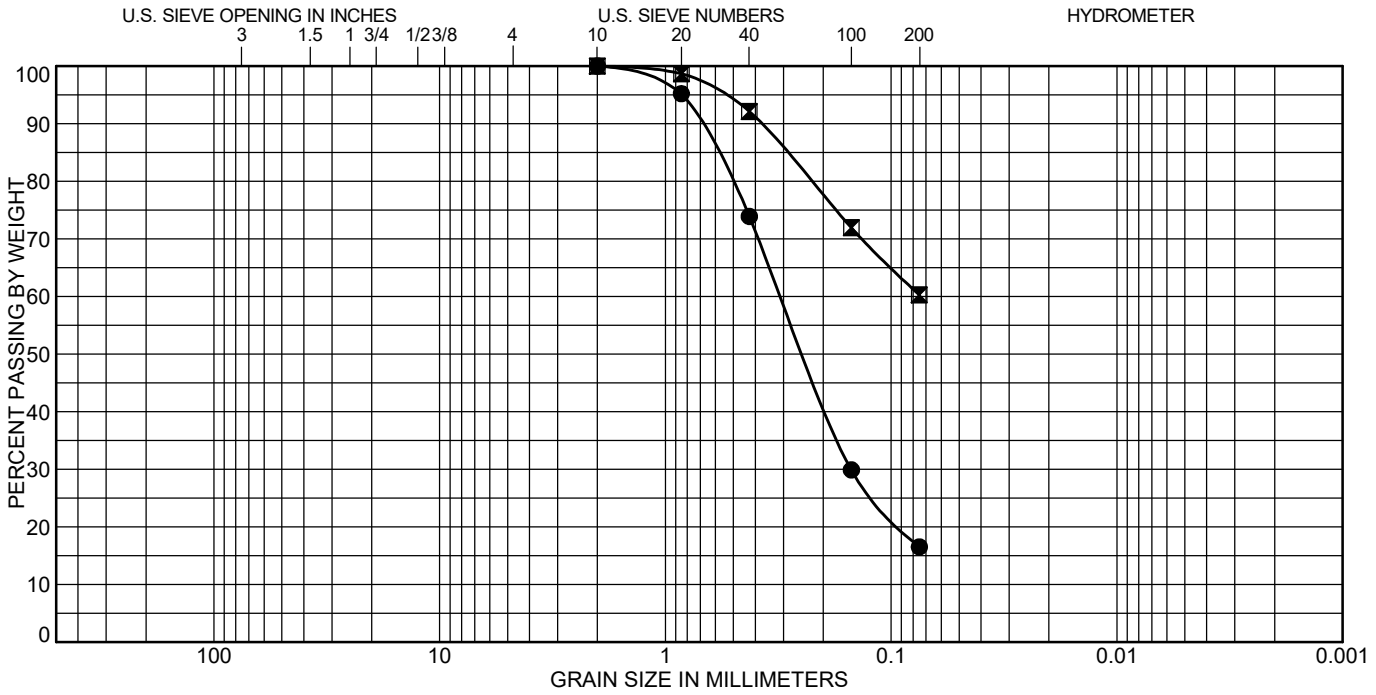
SOIL CLASSIFICATION DATA

JOB No. 190388

FIGURE No. 23

DATE Apr/27/2023



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	26	7.0	SILTY SAND(SM)	NP	NP	NP
⧓	26	24.0	SANDY FAT CLAY(CH)	61	30	31

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	26	7.0	0.0	83.5	16.5	
⧓	26	24.0	0.0	39.7	60.3	

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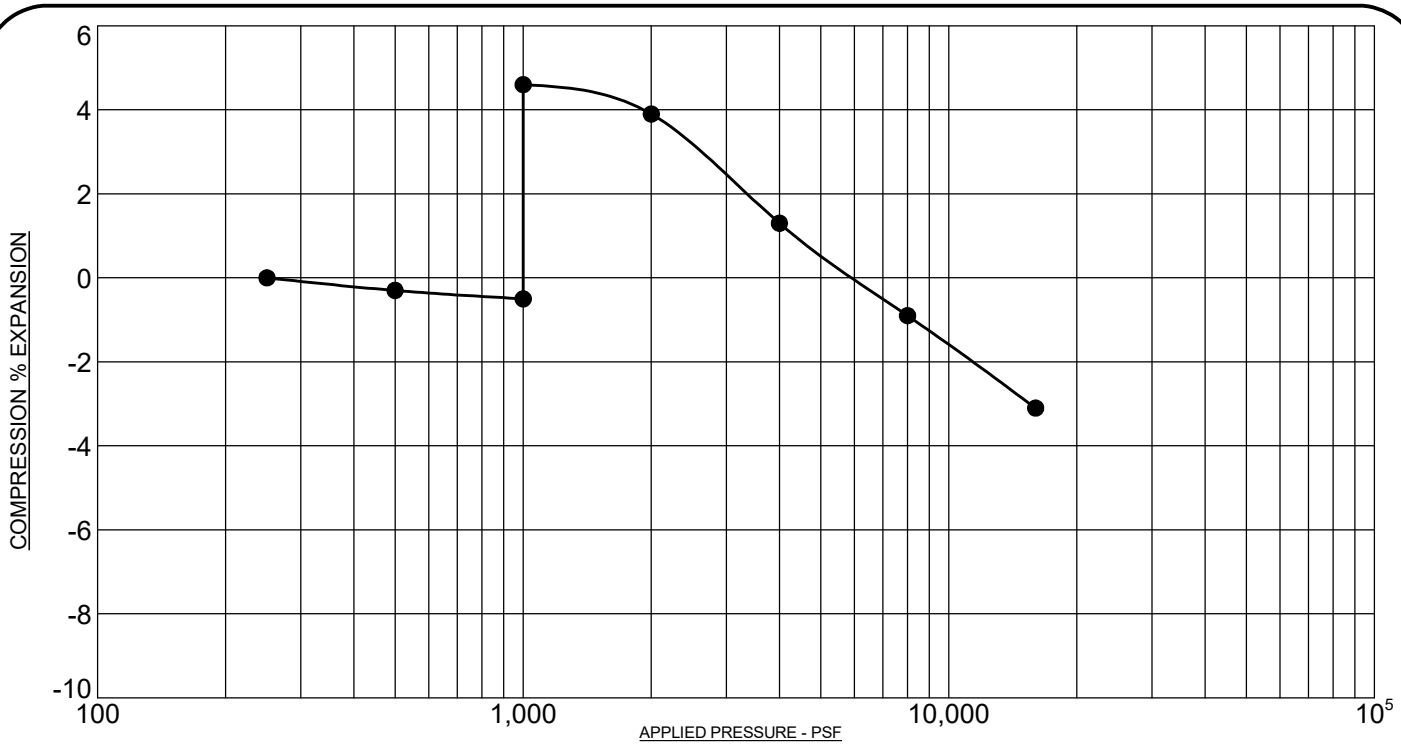
SOIL CLASSIFICATION DATA

JOB No. 190388

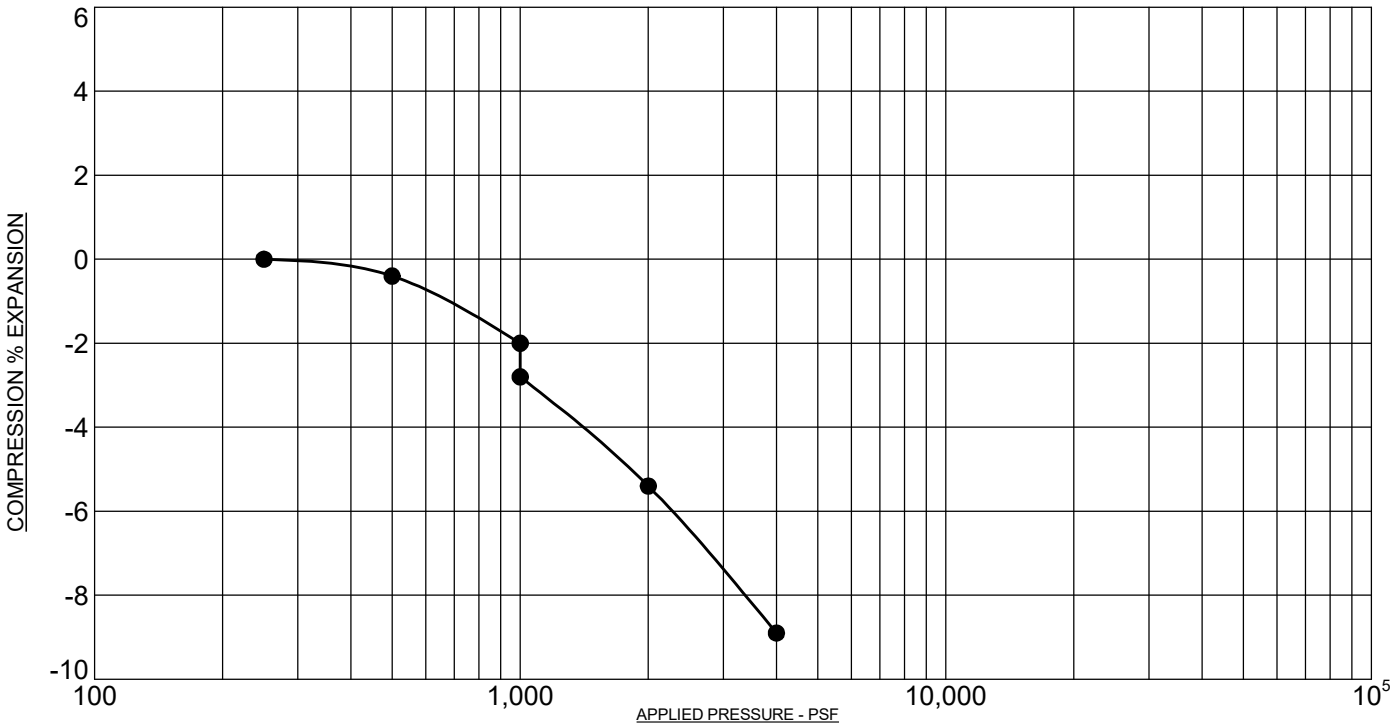
FIGURE No. 24

DATE Apr/27/2023



PROJECT: **Judge Orr Rd, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **3 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **112.8 PCF**
NATURAL MOISTURE CONTENT: **14.9%**
PERCENT SWELL/COMPRESSION: **5.1**



PROJECT: **Judge Orr Rd, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **5 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **84.7 PCF**
NATURAL MOISTURE CONTENT: **36.3%**
PERCENT SWELL/COMPRESSION: **- 0.8**

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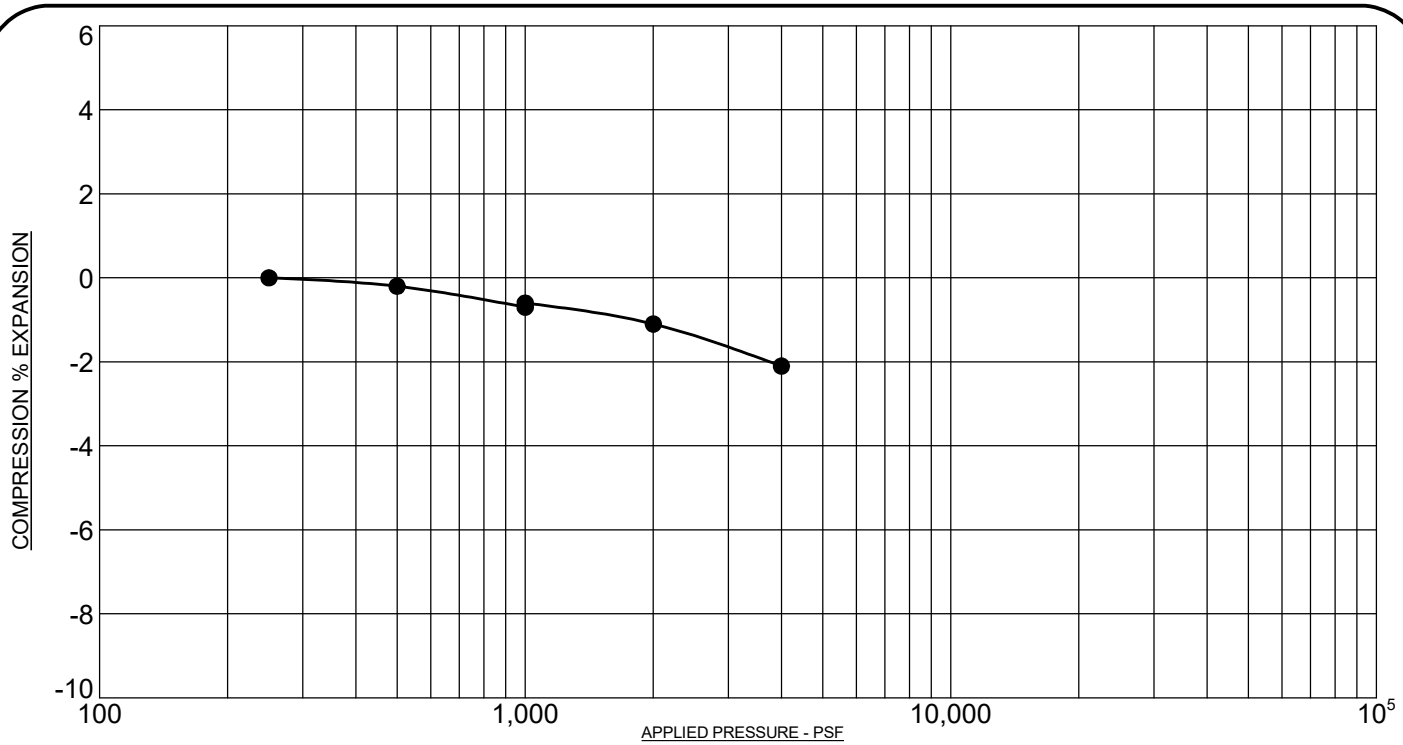
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 190388

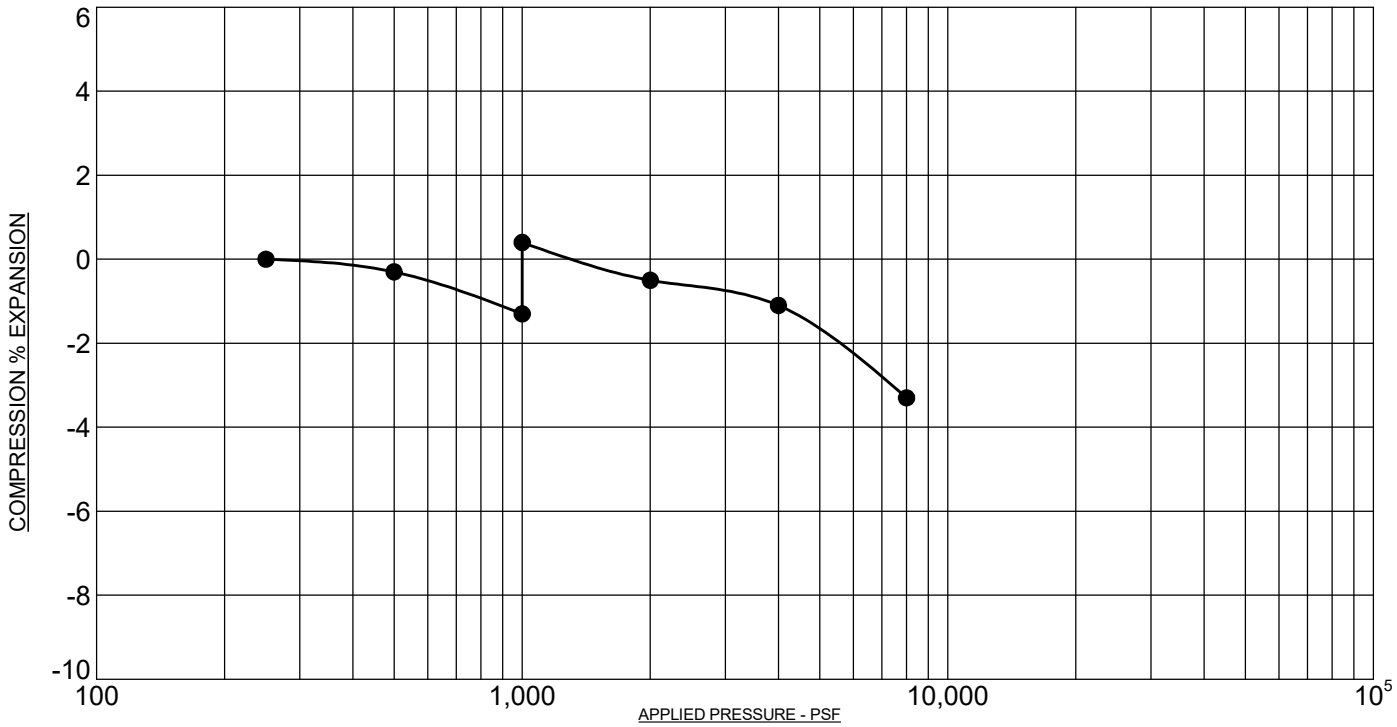
FIGURE No. 25

DATE Apr/27/2023



PROJECT: **Judge Orr Rd, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **9 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **83.9 PCF**
NATURAL MOISTURE CONTENT: **31.4%**
PERCENT SWELL/COMPRESSION: **0.1**



PROJECT: **Judge Orr Rd, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **14 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **102.5 PCF**
NATURAL MOISTURE CONTENT: **23.7%**
PERCENT SWELL/COMPRESSION: **1.7**

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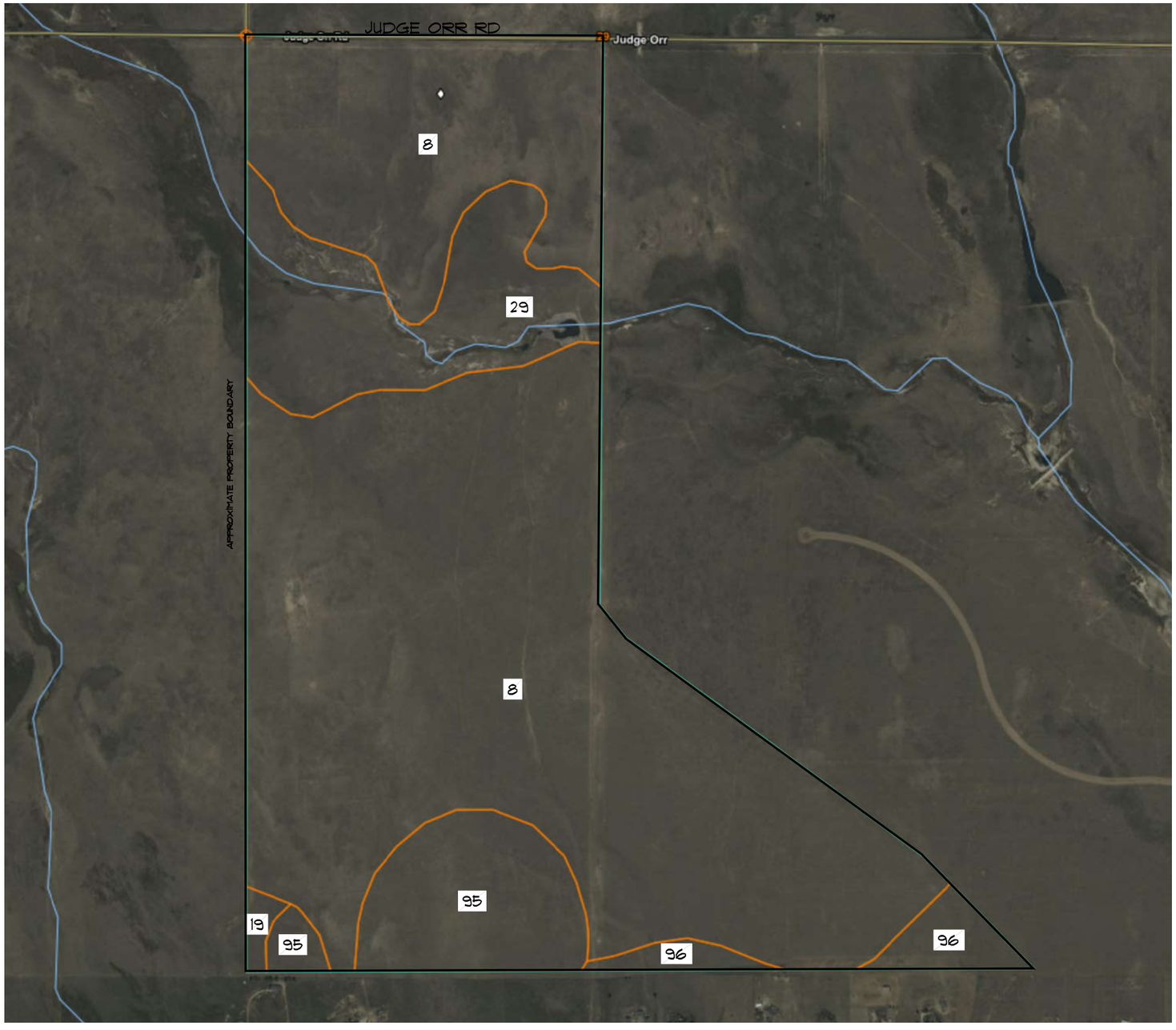
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 190388

FIGURE No. 26

DATE Apr/27/2023



8 - Blakeland Loamy Sand, 1 to 9 percent slopes

19 - Columbine Gravelly Sandy Loam, 0 to 3 percent slopes

29 - Fluvaquentic Haplaquolls, 0 percent slopes

95 - Truckton Loamy Sand, 1 to 9 percent slopes

96 - Truckton Sandy Loam, 0 to 3 percent slopes

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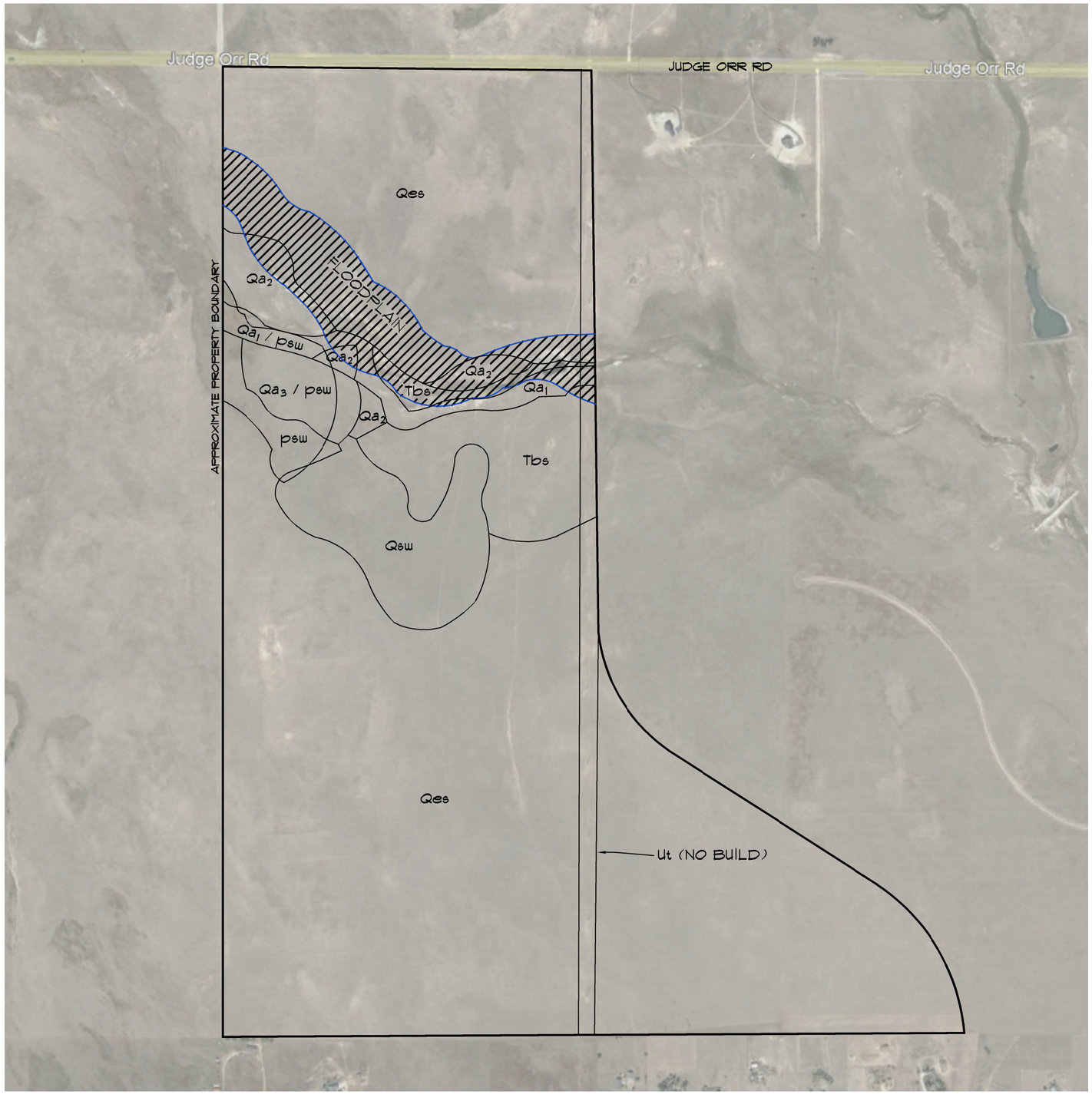
USDA SOIL SURVEY MAP

SHEET No.
FIG-27



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GEOLOGIC CONDITIONS

Qes - Eolian Sand (Holocene to upper Pleistocene) Fine to coarse grained sand. Unit is faintly stratified, non-cohesive, and drains well. Unit may exceed 5 feet in thickness

Qa_2 - Alluvium two (Lower Holocene) Moderately consolidated silt, sand, gravel, clay and occasional boulders. Units is subject to occasional flooding with a local maximum exposed thickness of over 20 feet.

Qa_3 - Alluvium three (Upper Pleistocene) Poorly sorted silt, sand, gravel, and cobbles with occasional boulders. Clays in this unit are potentially expansive. Maximum exposed thickness locally exceeds 20 feet.

Qa_1 - Alluvium one (Upper Holocene) Poor to moderately sorted sand, gravel, silt and minor clay with occasional boulders. Predominantly sandy gravel with sandy silt matrix. Unit is subject to frequent flooding. Maximum local exposed thickness exceeds 5 feet.

Tbs - Black Squirrel Formation (Paleocene) Moderately-well sorted cross-bedded sandy arkose interbedded with sandy claystones. Exposed thickness is approximately 130 feet. Claystones in this unit may swell when wet.

psw - Potentially seasonally wet areas where groundwater can fluctuate to be at or near the surface.

psw - Potentially seasonally wet areas where groundwater can fluctuate to be at or near the surface.

Fp - floodplain as mapped by FEMA

Ut - Utility Easement - Existing overhead utility easement. This area is to be a "No Build Zone" for single-family residences and OWTS

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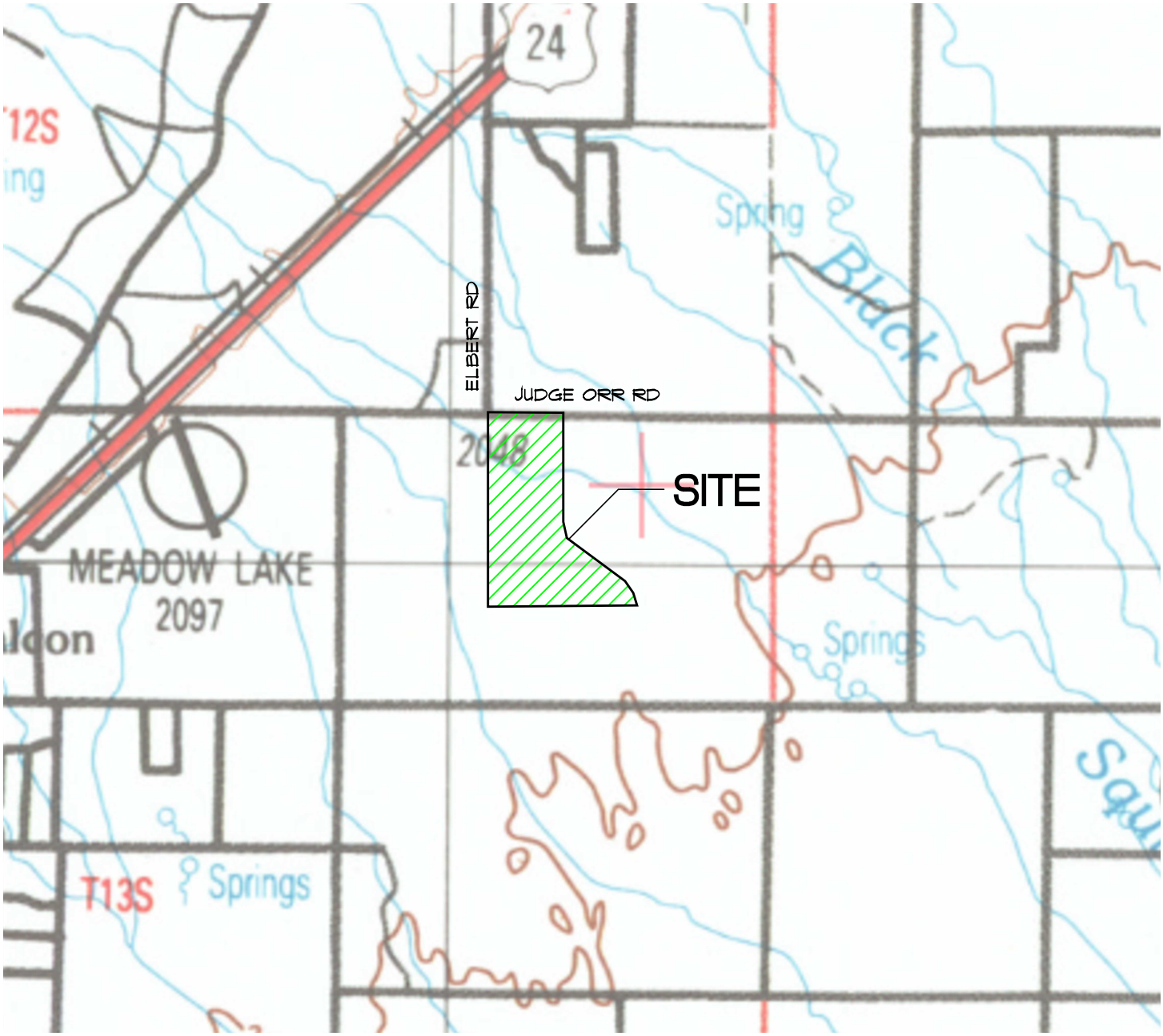
ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-28



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USGS TOPO MAP

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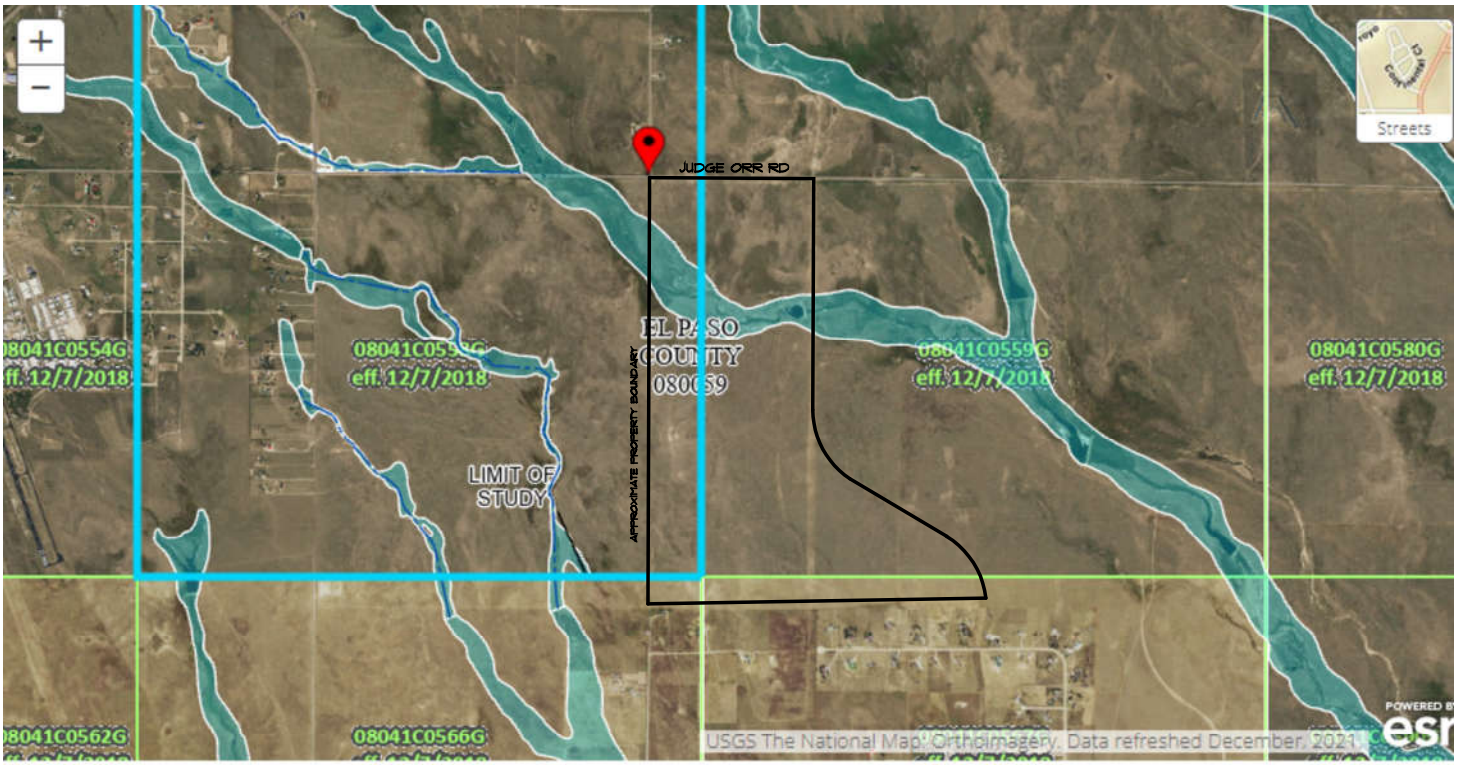
FIG No. 29

DATE 4-27-2023



PIN
- Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
- Selected FloodMap Boundary
- Digital Data Available
- No Digital Data Available
- Unmapped

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D
- Otherwise Protected Area
- Coastal Barrier Resource System Area

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth
- Regulatory Floodway Zone AE, AO, AH, VE, AR

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

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FEMA FLOOD MAP

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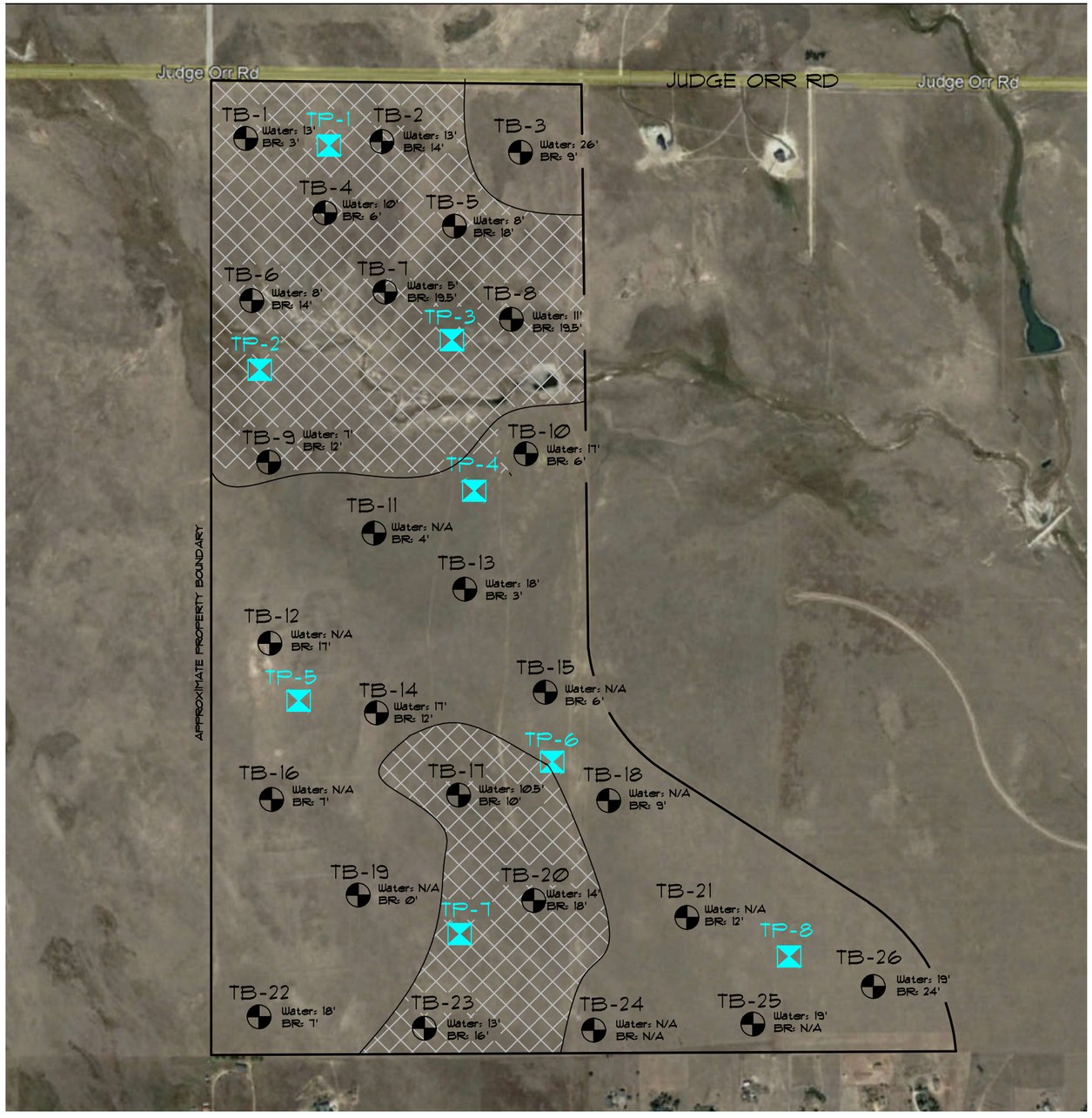
FIG No. 30

DATE 4-27-2023



DENOTES APPROXIMATE LOCATION OF TEST BORINGS

Water: Groundwater Depth on 2/28/23
BR: Bedrock depth at time of drilling

DENOTES APPROXIMATE LOCATION OF TEST PITS

AREAS WHERE GROUNDWATER IS LESS THAN 15 FEET FROM THE SURFACE. ADDITIONAL INVESTIGATIONS MAY BE PROPOSED TO DETERMINE BASEMENT FEASIBILITY.

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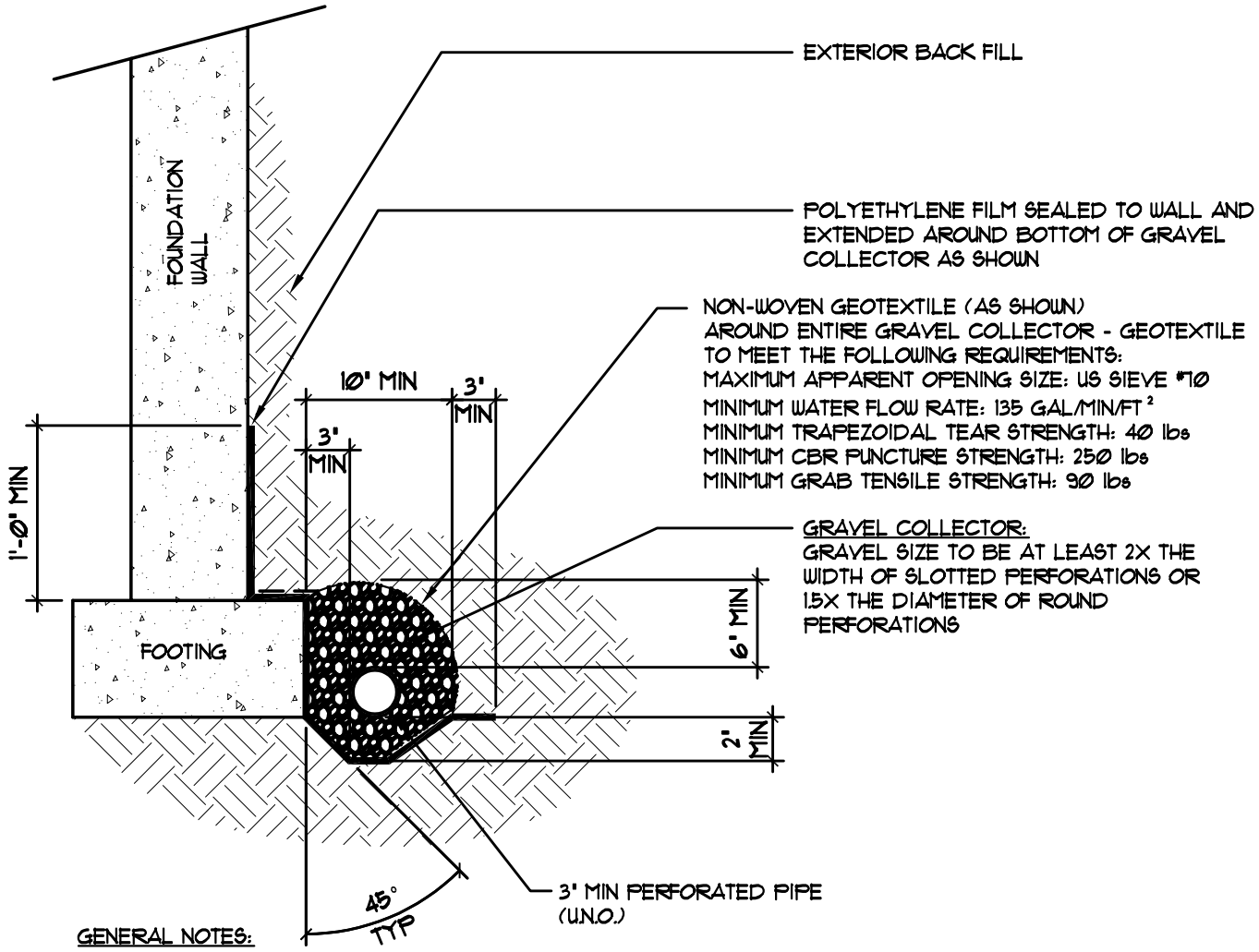
BASEMENT FEASIBILITY MAP

SHEET No.
FIG-31



GENERAL NOTES:

1. BOTTOM OF DRAIN PIPE SHALL BE AT OR BELOW BOTTOM OF FOOTING AT ALL LOCATIONS
2. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
3. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
4. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.
7. A VERTICAL SEGMENT OF PERFORATED DRAIN PIPE, CAPPED AT THE TOP, SHALL EXTEND TO FINISH GRADE WITHIN ALL WINDOW WELLS.

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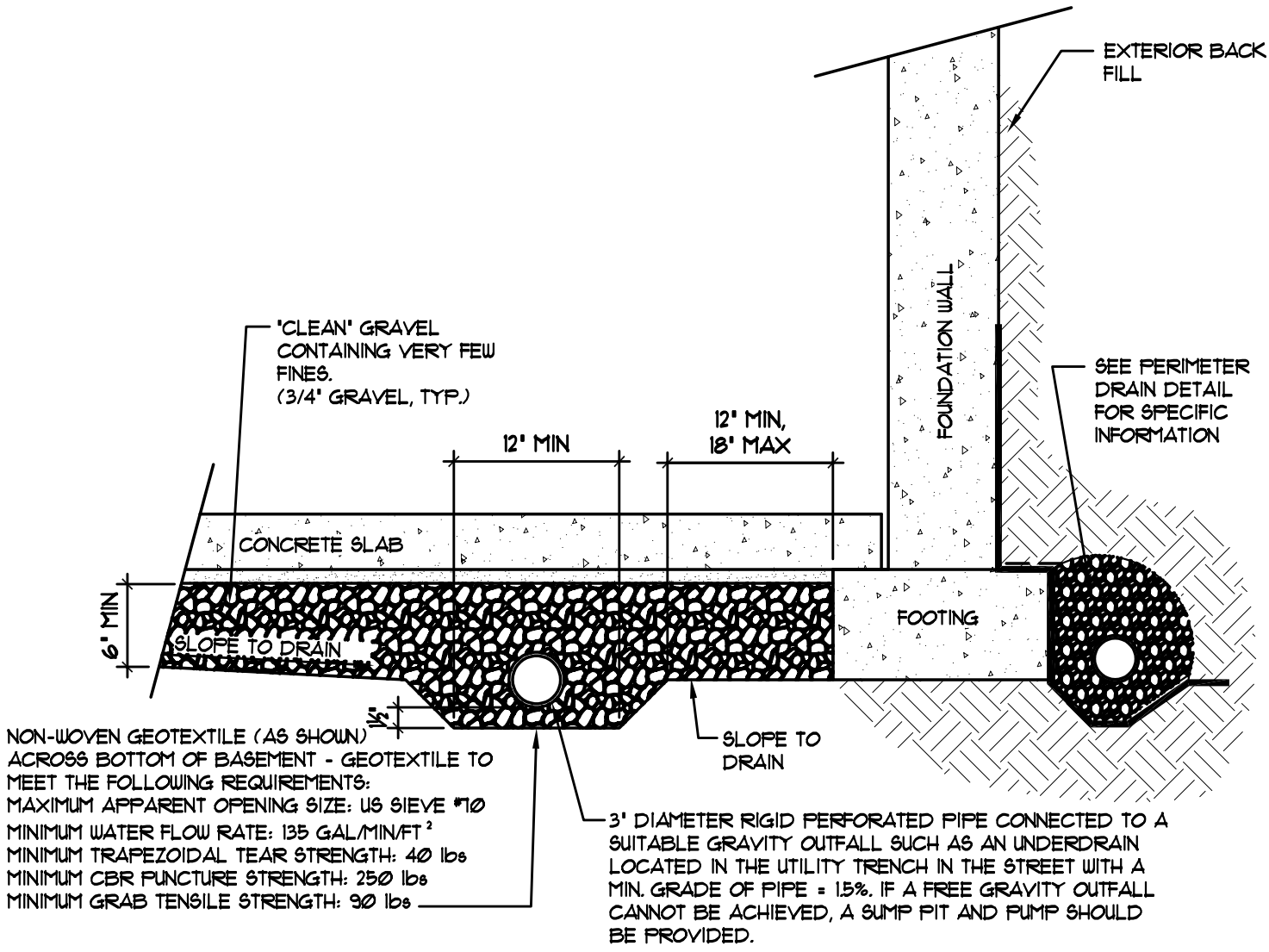
PERIMETER DRAIN

FIG No. 32



GENERAL NOTES:

1. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
2. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
3. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
4. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
5. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.

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UNDERSLAB DRAIN

FIG No. 33

APPENDIX A
Additional Reference Documents

1. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0556G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
2. *Geologic Map of the Falcon Quadrangle, El Paso County, Colorado*, Morgan, M.L. and White, J.L, 2012, Colorado Geological Survey Open-File Report OF-12-05.
3. *Falcon Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
4. *Falcon Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
5. Colorado's Decision Support Systems, CWCB, DWR, Well Permits,
6. *El Paso County, Master Plan for Mineral Extraction,* dated February 8, 1996.
7. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board,* prepared by Colorado Geological Survey, dated February 19, 2003, Open-file Report OF-03-07.
8. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
   https://property.spatialest.com/co/elpaso/#/property/4300000534
   Schedule No. 4300000534, 4300000537, and 4300000538.
9. *Colorado Geological Survey, USGS Geologic Map Viewer*:
   http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
10. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1955, 1960, 1983, 1984, 1985, 1999, 2005, 2009, 2011, 2013, 2015, 2017, and 2019.
11. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs, Black Forest Quadrangle dated 1898, 1909, 1948, 1969, 1981 and 1989.
12. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.

APPENDIX B

Site Photos – February 2, 2023

Center of property, looking east

Northern portion of property, looking east

Northern portion of property, looking west

Western portion of property

Center of the property, looking west

Center of the property, looking east

Utility easement, looking east

Utility easement, looking west

Southern portion of the property, looking northeast

Southern portion of the property

APPENDIX C

Wastewater Study

Job No. 190388

April 27, 2023

William Guman & Associates, Ltd
731 North Weber Street, Ste 10
Colorado Springs, CO 80903

Re: Wastewater Study
Judge Orr Rd
Esteban Subdivision
El Paso County, Colorado

Dear Mr. Guman:

As requested, personnel of RMG – Rocky Mountain Group has performed a preliminary investigation and site reconnaissance at the above referenced address. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

The site currently consists of three parcels (per the El Paso County Assessor's website) for a combined 496.25 acres. It is our understanding the parcels included in this study are:

- Schedule No. 4300000534, currently labeled as Judge Orr Road, zoned A-35, consists of approximately 27.11 acres, and land use is classified as agricultural grazing land;
- Schedule No. 4300000537, currently labeled as 02-13-64, zoned A-35, consists of approximately 136.98 acres and land use is classified as agricultural grazing land;
- Schedule No. 4300000538, currently labeled as 02-13-64, zoned A-35, consists of approximately 332.16 acres and land use is classified as agricultural grazing land.

The parcels listed above are to be combined then subdivided into single-family residential lots. The new lots are to be zoned as RR-2.5 and/or RR-5, with minimum lot sizes of 2.5 to 5 acres.

It is anticipated the proposed lots are to be accessed from a new road extending south from Judge Orr Road. At this time, it is uncertain as how the lots south of the drainageway are to be accessed. One potential access could be an elevated roadway with a bridge across the drainageway. The lots are to utilize individual wells and on-site treatment systems. The Proposed Property Boundary is presented in Figure 2.

This letter is to provide information for the on-site wastewater report per the On-Site Wastewater Treatment Systems (OWTS) Regulations of the El Paso County Board of Health pursuant to Chapter 8.

The following are also excluded from the scope of this report including (but not limited to) foundation recommendations, site grading/surface drainage recommendations, subsurface drainage recommendations, geologic, natural and environmental hazards such as landslides, unstable slopes,

seismicity, snow avalanches, water flooding, corrosive soils, erosion, radon, wild fire protection, hazardous waste and natural resources.

Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site and area were available for our review and are listed below:

1. *Soil and Geology Study, Esteban Subdivision, 3 parcels totaling 496.2 acres, El Paso County, Colorado,* RMG – Rocky Mountain Group, Job No. 190388, dated April 27, 2023.
2. *Soil and Geology Study, Judge Orr Rd, 6 parcels totaling 398.91 acres, El Paso County, Colorado,* RMG – Rocky Mountain Group, Job No. 190392, dated April 27, 2023.
3. *Wastewater Study, Judge Orr Rd, 6 parcels totaling 398.91 acres, El Paso County, Colorado,* RMG – Rocky Mountain Group, Job No. 190392, dated April 27, 2023.

The findings, conclusions and recommendations contained in this report was considered during the preparation of this report.

SITE CONDITIONS

Personnel of RMG performed a reconnaissance visit on February 24, 2023. The purpose of the reconnaissance visit was to evaluate the site surface characteristics including landscape position, topography, vegetation, natural and cultural features, and current and historic land uses. Eight test pits to depths of 6 to 8 feet deep were performed across the property during our reconnaissance visit. A Test Pit Location Plan is presented in Figure 3.

The site surface characteristics were observed to consist of low lying grasses and weeds across the entire site. No deciduous trees are located on the property.

The following conditions were observed with regard to the 496.25-acre parcel:

- One well currently **does** exist on the site;
- No runoff or irrigation features anticipated to cause deleterious effects to treatment systems on the site were observed;
- A drainageways exists on the property and lies within a designated floodway or floodplain;
- Slopes greater than 20 percent **do** exist on the site; and
- Significant man-made cuts **do** exist on the site.

Treatment Areas

Treatment areas at a minimum must achieve the following:

- The treatment areas must be 4 feet above groundwater or bedrock as defined by the Definitions 8.3.4 of the Regulations of the El Paso County Board of Health, Chapter 8, *OWTS Regulations*, effective July 7, 2018;
- Prior to construction of an OWTS, an OWTS design prepared per *the Regulations of the El Paso County Board of Health, Chapter 8,* will need to be completed. A scaled site plan and engineered design will also be required prior to obtaining an OWTS permit;

- The treatment areas must comply with any physical setback requirements of Table 7-1 of the El Paso County Department of Health and Environment (EPCHDE);
- Treatment areas are to be located a minimum 100 feet from any well (existing or proposed), including those located on adjacent properties per Table 7-2 per the EPCHDE;
- Treatment areas must also be located a minimum 50 feet from any spring, lake, water course, irrigation ditch, stream or wetlands;
- The treatment areas are to be located a minimum 10 feet from property lines, dry gulches, cut banks and fill areas (from the crest);
- The new lots shall be laid out to ensure that the proposed OWTS does not fall within any restricted areas, (e.g. utility easements, right of ways).

Contamination of surface and subsurface water resources should not occur if the treatment areas are evaluated and installed according to El Paso County Health Department and State Guidelines in conjunction with proper maintenance.

DOCUMENT REVIEW

RMG has not reviewed a site plan. The soil conditions anticipated to be encountered during construction of the proposed OWTS for the lots included a review of documented Natural Resource Conservation Service - NRCS data provided by websoilsurvey.nrcs.usda.gov. The Soil Survey Descriptions are presented below. A review of FEMA Map No. 08041C0559G, effective December 7, 2018 indicates that some of the proposed lots could be located within an identified floodplain. OWTS's are not recommended in these areas.

SOIL EVALUATION

Personnel of RMG performed a soil evaluation to include eight 6 to 8-foot deep test pits, on February 24, 2023 (Test Pit TP-1 through TP-8), utilizing the visual and tactile method for the evaluation of the site soils. The test pits were excavated in areas that appeared most likely to be used for residential construction. The Test Pit Logs are presented in Figures 4 through 7.

The USDA/NRCS soil survey identifies the site soils as:

- 8 – Blakeland loamy sand, 1 to 9 percent slopes. The Blakeland loamy sand was mapped by the USDA and is located throughout most of the property. The Blakeland loamy sand encompasses the majority of the property. The properties of the Blakeland loamy sand include somewhat excessively drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be low and frequency of flooding or ponding is none. Landforms are flats and hills;
- 19 – Columbine gravelly sandy loam, 0 to 3 percent slopes. The Columbine gravelly sandy loam was mapped by the USDA and is only located in the southwest corner of the property. Properties of the Columbine gravelly sandy loam include well drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be well drained and frequency of flooding or ponding is none. Landforms are fans and hills;
- 29 – Fluvaquentic Haplaquolls, 0 to 2 percent slopes. The Fluvaquentic Haplaquolls was mapped by the USDA and traverses from the western end of the property to the eastern end in the northern portion of the property. Properties of the Fluvaquentic Haplaquolls include poorly drained soil with a depth to water table of 0 to 24 inches. Runoff is anticipated to be very high and frequency of

flooding is frequent. Frequency of ponding is none. Landforms are flood plains and swales. The hydrologic soil group of the unit is D;

- 95 – Truckton loamy sand, 1 to 9 percent slopes. The Truckton loamy sand was mapped by the USDA and is located in the middle of the southern end of the property. Properties of the Truckton loamy sand include well drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be low and frequency of flooding or ponding is none. Landforms are interfluves and fan remnants;
- 96 – Truckton sandy loam, 0 to 3 percent slopes. The Truckton sandy loam was mapped by the USDA and is located in the eastern portion along the southern end of the property. Properties of the Truckton sandy loam include well drained soil with a depth to water table of over 80 inches. Runoff is anticipated to be very low and frequency of flooding or ponding is none. Landforms are interfluves and fan remnants.

The USDA Soil Survey Map is presented in Figure 8.

An OWTS is proposed for each lot and should conform to the recommendations of a future OWTS site evaluation, performed in accordance with the applicable health department codes prior to construction. This report may require additional test pits in the vicinity of the proposed treatment field. A minimum separation of 4 feet shall be maintained from groundwater and bedrock to the infiltrative surface.

Redoximorphic features indicating the fluctuation of groundwater or higher ground water levels were not observed in the test pits. However, groundwater was also encountered in the majority of the test borings performed for the Soil and Geology Study reports, referenced above, at depths ranging from 5 to 28 feet below the existing ground surface.

CONCLUSIONS

In summary, it is our opinion the site is suitable for individual on-site wastewater treatment systems within the cited limitations. There are no foreseeable or stated construction related issues or land use changes proposed at this time.

Soil and groundwater conditions at the site are generally suitable for individual treatment systems. It should be noted that the LTAR values stated above are for the test pit locations performed for this report only. The LTAR values may change throughout the site. If an LTAR value of less than 0.35 (soil types 3A to 5) or greater than 0.80 (soil type 0) are encountered at the time of the site specific OWTS evaluation an "engineered system" will be required.

Additionally, based on the depth of the limiting layers (bedrock and groundwater) encountered at depths ranging from the surface to 5 feet, respectively, below the existing ground surface, the maximum depth of the OWTS components may be further limited or mound systems (above surface) may be required.

LIMITATIONS

The information provided in this report is based upon the subsurface conditions observed in the profile pit excavations and accepted engineering procedures. The subsurface conditions encountered in the excavation for the treatment area may vary from those encountered in the test pit excavations.

Therefore, depth to limiting or restrictive conditions, bedrock, and groundwater may be different from the results reported in this letter. However, due to the depth of bedrock and groundwater encountered in the test borings completed for the Soils and Geology Study, referenced above, the majority of OWTS are anticipated to be "engineered'.

An OWTS site evaluation will need to be performed in accordance with the applicable health department codes prior to construction.

I hope this provides the information you have requested. Should you have questions, please feel free to contact our office.

Cordially,

RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,

RMG – Rocky Mountain Group

Tony Munger, P.E.
Sr. Geotechnical Project Manager

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SITE VICINITY MAP

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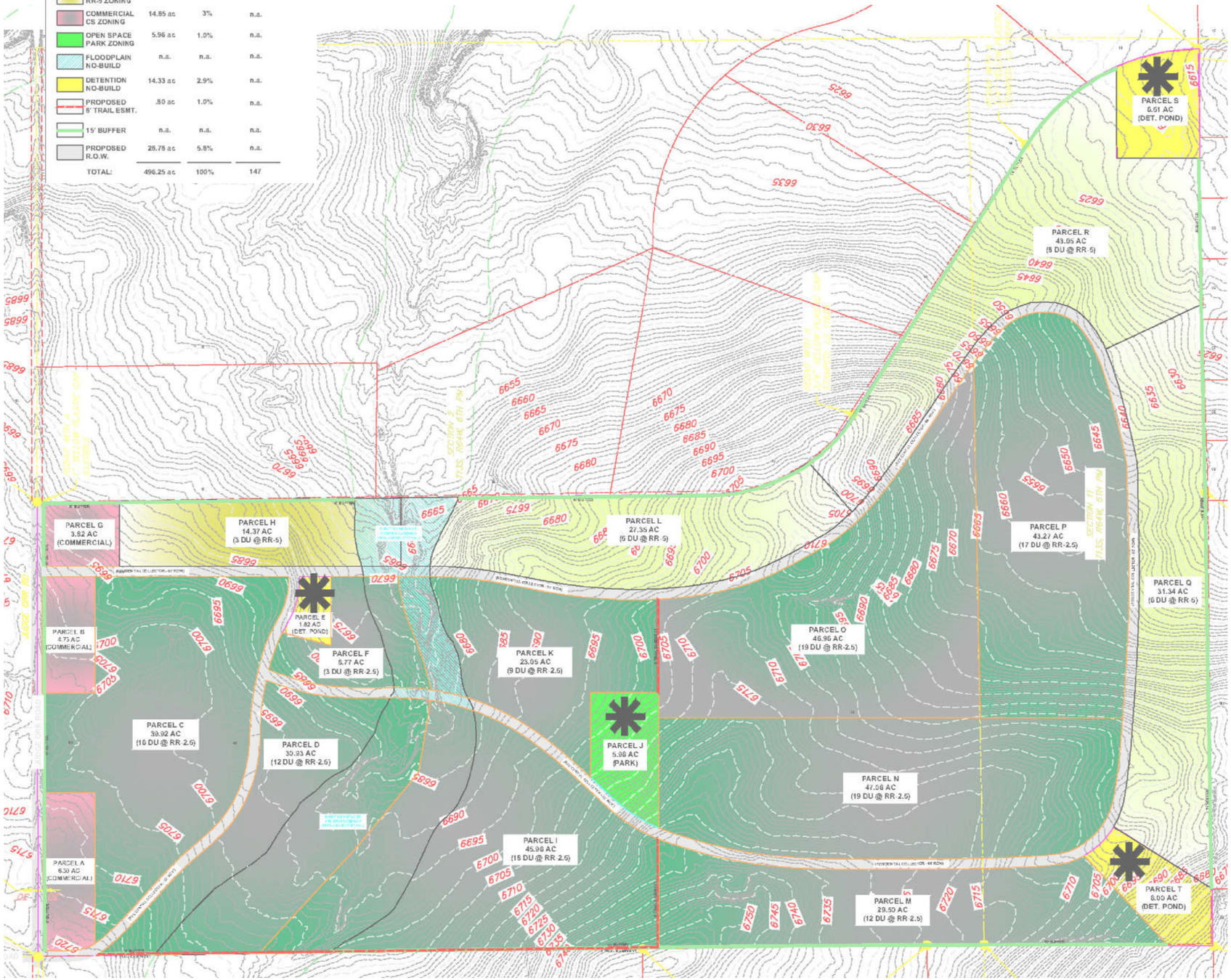
FIG No. 1

DATE 4-27-2023

LAND USE SUMMARY TABLE:

LAND USE CATEGORY	ACREAGE	% OF SITE	MAXIMUM UNITS
LOW DENSITY RR-2.5 ZONING	315.42 ac	63.3%	125
LOW DENSITY RR-5 ZONING	116.11 ac	23%	22
COMMERCIAL CS ZONING	14.85 ac	3%	n.a.
OPEN SPACE PARK ZONING	5.96 ac	1.0%	n.a.
FLOODPLAIN NO-BUILD	n.a.	n.a.	n.a.
DETENTION NO-BUILD	14.33 ac	2.9%	n.a.
PROPOSED 8' TRAIL ESMT.	.50 ac	1.0%	n.a.
15' BUFFER	n.a.	n.a.	n.a.
PROPOSED R.O.W.	28.78 ac	5.8%	n.a.
TOTAL:	496.25 ac	100%	147



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BASE MAP PROVIDED BY
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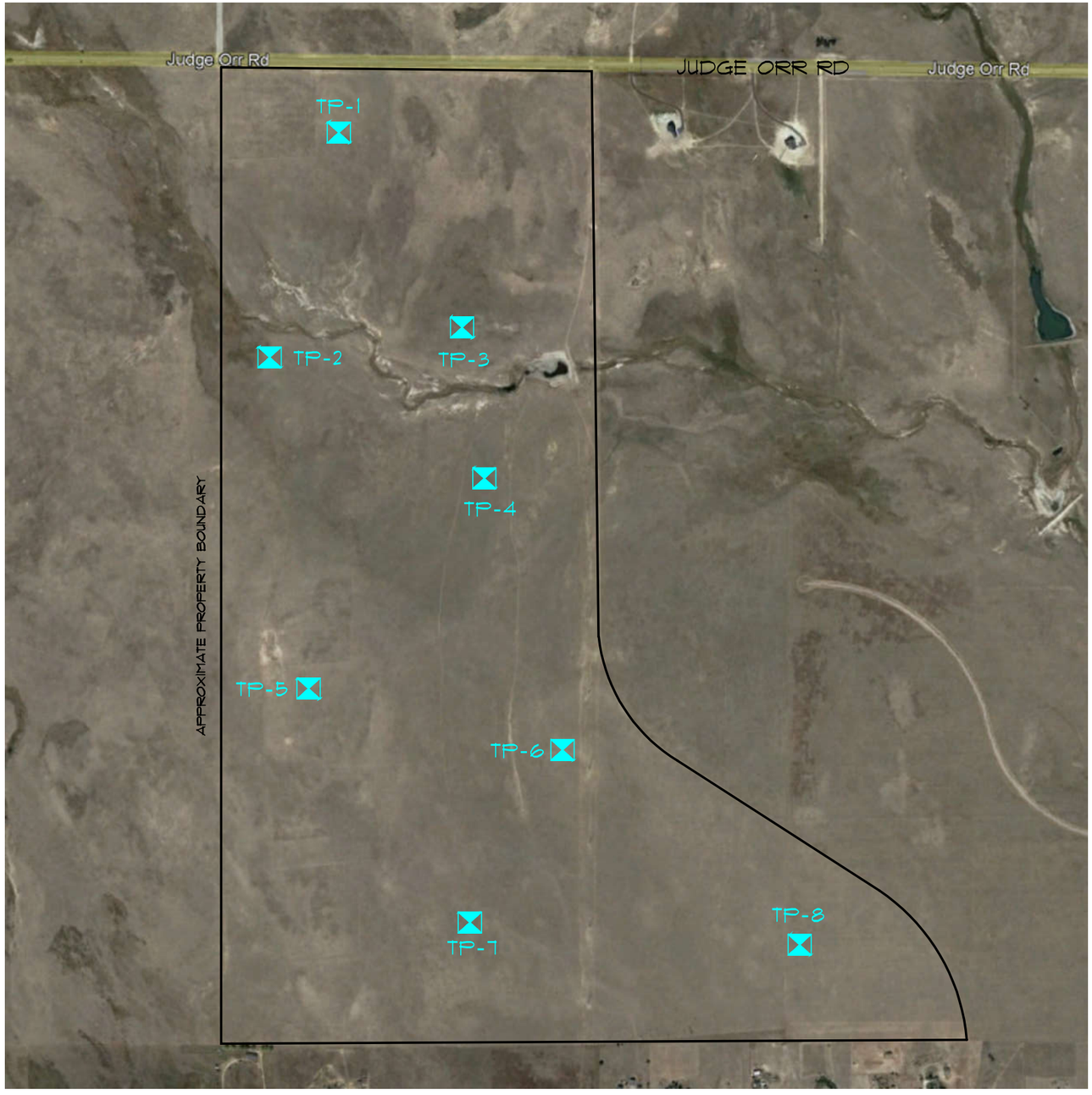
PROPOSED SITE BOUNDARIES

SHEET No.
FIG-2



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DENOTES APPROXIMATE LOCATION OF TEST PITS

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TEST PIT
LAYOUT PLAN

SHEET No.
FIG-3

TEST PIT TP-1

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SAND (SINGLE GRAIN, STRUCTURELESS)	2ft 4ft 6ft		1
NO GROUNDWATER NO LIMITING LAYER	8ft		

TEST PIT TP-2

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SAND (SINGLE GRAIN, STRUCTURELESS)	2ft 4ft 6ft		1
NO GROUNDWATER NO LIMITING LAYER	8ft		

SOIL DESCRIPTIONS

SAND

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TEST PIT LOGS

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FIG No. 4

DATE 4-27-2023

TEST PIT TP-3

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 1.0 FT SAND (SINGLE-GRAIN, STRUCTURELESS)	2ft		1
1.0 - 3.5 FT SANDY CLAY (BLOCKY, GRANULAR, MODERATE)	4ft		4
3.5 - 8.0 FT SANDY CLAY LOAM (GRANULAR, STRONG)	6ft		3
GROUNDWATER AT 6 FEET LIMITING LAYER	8ft		

TEST PIT TP-4

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 5.5 FT CLAY (BLOCKY, MODERATE)	2ft 4ft		4
5.5 - 8.0 FT SANDY CLAY (BLOCKY, GRANULAR, STRONG)	6ft		4
NO GROUNDWATER NO LIMITING LAYER	8ft		

SOIL DESCRIPTIONS

SAND

SANDY CLAY

SANDY CLAY LOAM

CLAY

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TEST PIT LOGS

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FIG No. 5

DATE 4-27-2023

TEST PIT TP-5

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SAND (SINGLE GRAIN, STRUCTURELESS)	2ft 4ft 6ft		1
NO GROUNDWATER NO LIMITING LAYER	8ft		

TEST PIT TP-6

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 3.0 FT CLAY LOAM (SINGLE GRAIN, STUCTURELESS)	2ft		3
3.0 - 8.0 FT CLAY (BLOCKY, MODERATE)	4ft 6ft		4
NO GROUNDWATER NO LIMITING LAYER	8ft		

SOIL DESCRIPTIONS

SAND

CLAY LOAM

CLAY

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TEST PIT LOGS

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FIG No. 6

DATE 4-27-2023

TEST PIT TP-7

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SAND (SINGLE GRAIN, STRUCTURELESS)	2ft 4ft 6ft		1
NO GROUNDWATER NO LIMITING LAYER	8ft		

TEST PIT TP-8

DATE OBSERVED: 2/24/23

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 2.5 FT SANDY LOAM (GRANULAR, STRONG)	2ft		2
2.5 - 8.0 FT SANDY CLAY (BLOCKY, MODERATE)	4ft 6ft		4
NO GROUNDWATER NO LIMITING LAYER	8ft		

SOIL DESCRIPTIONS

SAND

SANDY CLAY

SANDY LOAM

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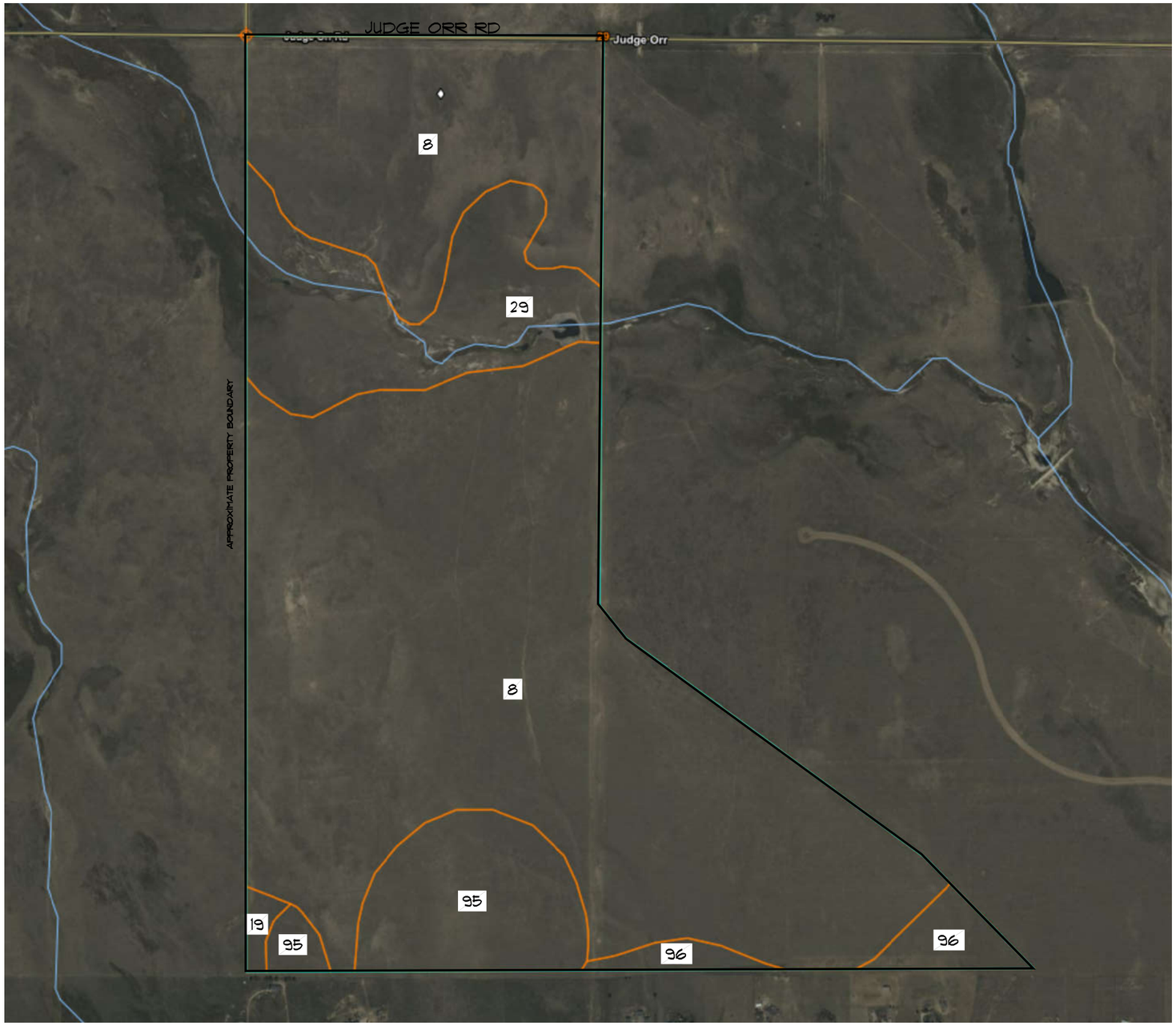
FIG No. 7

DATE 4-27-2023



8 - Blakeland Loamy Sand, 1 to 9 percent slopes

19 - Columbine Gravelly Sandy Loam, 0 to 3 percent slopes

29 - Fluvaquentic Haplaquolls, 0 percent slopes

95 - Truckton Loamy Sand, 1 to 9 percent slopes

96 - Truckton Sandy Loam, 0 to 3 percent slopes

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USDA SOIL SURVEY MAP

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FIG-8