Job No. 185466

August 8, 2022

El Paso County Planning & Community Development
2880 Internation Circle, Suite 110
Colorado Springs, CO 80910

Re: Response to:
Colorado Geological Survey Review Comments, dated June 6, 2022 and
El Paso County Planning and Community Development Comments, dated June 1, 2017.

Dear Planning & Community Development:

RMG - Rocky Mountain Group prepared the "*Soils and Geology Study*" (RMG Job No. 185466, amended August 8 2022) for the proposed minor subdivision to comprise three single-family residential lots on approximately 61.55 acres. The report was reviewed by personnel of the Colorado Geological Survey (CGS). The purpose of this letter is to provide our response to the CGS and El Paso County Planning & Community Development review comments. The responses and modifications noted herein have been incorporated into our amended report.

For clarity and ease of review we have "snipped" each of the CGS and El Paso County Planning & Community Development ccomments followed by our response.

Comments from Colorado Geological Survey

CGS Comment:

As noted on page 12 of the Soils and Geology Report (Rocky Mountain Group (RMG), stamped March 2, 2022), "Geologic hazards found to be present at this site include faults/seismicity and radioactivity/radon. Geologic constraints found to be present at this site include compressible soils, expansive soils, and artificial fill." RMG describes the site as containing potential expansive and compressible soils, although RMG did not include any laboratory testing. Additionally, RMG did not provide the test pit logs nor the total depth of the exploration. RMG states on page 5 that test pits were performed on September 22, 2021.

Without the field investigation results, CGS cannot come to the same conclusions and identification of geologic hazards and constraints as RMG. CGS recommends that the county require the soil and geology study to be expanded to evaluate the geologic constraints based on a site-specific investigation and data. This type of investigation typically includes test borings drilled to a sufficient depth (generally at least 20 feet) to determine groundwater and bedrock depths where both are likely to be shallow. The Engineering and Geology Map (figure 4) also

RMG Response:

- The Test Pits Logs, Figure 5 are included with the amended report.
- A *Subsurface Soil Investigation* report for proposed Lot 2 (included in this site) has been included in Appendix B of the amended report. The subsurface materials encountered in the subsurface soil investigation are anticipated to be generally representative of materials encountered across the site.

CGS Comment:

depths where both are likely to be shallow. The Engineering and Geology Map (figure 4) also designates areas within lot 3 as "potentially seasonally wet area." Mitigation measures for this hazard/constraint are not included in RMG's report. The expanded report should also include a discussion on groundwater conditions. If shallow groundwater is encountered or expected based on the subsurface conditions, the report should discuss the expected seasonal groundwater fluctuation expected at the site based on site-specific data and the feasibility of basements or other anticipated habitable below-grade space.

RMG Response:

Our amended report has been updated to include a discussion on groundwater conditions.

CGS Comment:

CGS agrees with RMG's recommendation (page 13) "The foundation systems for the proposed single-family residential structures and any retention/detention facilities should be designed and constructed based upon recommendations developed in a site-specific subsurface soil investigation." This recommendation should be noted in the plat.

RMG Response:

It is our understanding that the recommendation has been added to the plat.

El Paso County Comment:

Test pits described on Pg 6 need additional information per Engineering Criteria Manual Appendix C for Geologic Report guidelines Section C.2.2.6

See CGS review comments to be addressed on seasonal wet areas on Fig 4 and expected seasonal groundwater fluctuations etc. The drainage report depicts a proposed building site potentially directly in the area shown as season wet area.

RMG Response:

- The Test Pits locations are included on Figure 5 of the amended report. The Test Pit Logs, Figure 4 have also been included.

- The CGS comments have been addressed in our responses above and in the amended report.
- The Drainage Report is outside the scope of the Soils and Geology Study. The Owl Ridge Subdivision, Final Drainage Report, last dated March, 2022 prepared by SMH Consultants, Figure 4, shows the proposed building location for Lot 3, approximately 7,000 SF between the seasonally wet areas, as mapped by RMG. At this time, construction is not proposed on Lot 3. However, if construction is proposed in the future, a site specific subsurface soil investigation is recommended to verify the depth of groundwater. It is recommended that future structures be located outside any potentially seasonally wet areas.

El Paso County Comment:

Test Pits and Trenches. The test pit and trench information shall: • Describe the location and dimensions of all pits and trenches and date of investigation; • Indicate the location of all excavations on the topographic/geologic map and profiles; • Provide a large scale descriptive log with sufficient detail; and, • Show sample location if supplemental laboratory tests were conducted.

RMG Response:

- The Test Pits Logs are included on Figure 5 of the amended report.
- The test pit locations are indicated on the Engineering and Geology Map, Figure 5.

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

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Materials Testing
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SOILS AND GEOLOGY STUDY

Lots 1 and 2
Owl Ridge Subdivision
El Paso County, Colorado

PREPARED FOR:

SMH Consultants
411 S. Tejon Street, Suite 1
Colorado Springs, CO 80903

JOB NO. 185466

November 15, 2021
Last Revised: September 9, 2022

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

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APPENDIX B – *Subsurface Soil Investigation – Brown Road, Lot 2, Owl Ridge Subdivision, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 185466, dated August 8, 2022. (now designated as Lot 1, Owl Ridge Subdivision on the most recent plat)

1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in part of the north ½ of lot 2 of the SW ¼ of Section 7, Township 11 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located northwest of the intersection of Walker Road and Brown Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Existing Land Use

The site currently consists of one parcel (per the El Paso County Assessor's website). It is approximately 61.55 acres. The parcel included is:

- Schedule No. 5100000447, current land use is classified as meadow hay land

The current zoning is *"RR-5" – Residential Rural.* The parcel is currently partially developed in the southern portion of the site where the existing residence is located.

1.3 Project Description

The site consists of approximately 61.55 acres (noted as 61.949 acres on the referenced plat) and is partially developed. An existing two-story agricultural residence is located on the southwest corner of the property. Two one-story barns are located east of the residence. It is our understanding the existing 61.55 acres is to be subdivided into a total of two lots. As denoted on the Final Plat prepared by SMH Consultants, dated May 2022, Lot 1 is to consist of approximately 21.9 acres and Lot 2 is to consist of approximately 40 acres. Lot 2, is to retain the existing residence, well and septic. No additional residences are currently proposed on Lot 2. Based on conversations with the owner, a single family residence, well and septic is proposed for Lot 1. The remaining 35 acres, east of Lot 1 are not included in this subdivision. Lot 1 is to be accessed from Brown Road. The Proposed Lot Layout is presented in Figure 2.

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 21 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 21 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 on-site wastewater treatment system (OWTS) feasibility and present our opinions of the potential effect of these conditions on the proposed development within 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

- Visual and tactile characterization of representative site soil and rock samples
- Geologic research and analysis
- Site development concept plans and final plat prepared by SMH Consultants

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 partially developed. The site is generally located northwest of the intersection of Walker Road and Brown Road in El Paso County, Colorado and comprises approximately 61.55 acres. The site is zoned RR-5, Rural Residential. Adjacent properties to the north, west and east are also zoned RR-5, Rural Residential.

4.2 Topography

Based on our site reconnaissance on September 8, 2021 and USGS 2019 topographic map of the Black Forest Quadrangle, the site generally slopes down from west to east with an elevation difference of approximately 70 feet across the entire site. There appears to be multiple irrigation ditch features that traverse the site from west to east, these can be seen in Figure 5, Engineering and Geology Map. The water levels in the irrigation ditch areas are anticipated to vary dependent upon local precipitation events.

4.3 Vegetation

Site vegetation primarily consists of native grasses and other prairie-type vegetation. Deciduous trees are scattered sparsely across the site.

4.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site has remained partially developed land where the existing residence and barns are located since 1979. Prior to 1979 the parcel was undeveloped. The parcel has remained vacant agricultural land north of the residence.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

The subsurface conditions within the property were explored by observing four (4) test pits to approximately 8 feet on September 22, 2021. Additionally, two (2) exploratory borings were drilled on Lot 1 for the site-specific subsurface soil investigation within/near the location of the proposed single-

family residence on July 11, 2022. For clarity, at the time of the subsurface soil investigation, the area containing the existing house location was known as Lot 1 and the proposed new vacant lot was known as Lot 2. Subsequent to the issuance of the subsurface soil investigation, the plat was revised and the lot numbers were switched. The subsurface soil investigation has not been revised to reflect this change.

The test borings extended to depths of approximately 20 feet below the existing ground surface. The location of the test pits and test borings are presented on the Test Boring and Test Pit Location Plan, Figure 3.

5.1 Drilling

The subsurface materials encountered in the test borings generally consisted of sandy clay extending to approximately 9 feet below the existing surface. Underlying the surface materials, clayey sandstone extends to the 20-foot termination depths of the test borings. Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Test Boring Logs. The Test Boring Logs are included within the Subsurface Soil Investigation, presented in Appendix B.

5.2 Laboratory Testing

Soil laboratory testing was performed as part of the Subsurface Soil Investigation. The laboratory tests included moisture content, dry density, grain-size analyses, Atterberg Limit tests and one Denver/Consolidation test. A Summary of Laboratory Test Results, Soils Classification Data, Swell/Consolidation Test Results are presented in Appendix B.

5.3 Test Pit Excavations

Two test pits each were observed on Lot 1 and the northern portion of Lot 2 by RMG to explore the subsurface soils underlying the proposed on-site wastewater treatment systems. The number of test pits is in accordance with Regulations of the El Paso County Board of Health, Chapter 8, On-site Wastewater Treatment Systems (OWTS) as required by 8.5.D.3.a.

A visual and tactile evaluation was performed by RMG for this investigation. The soils were evaluated to determine the soils types and structure. Bedrock was not encountered in the test pits. The soil descriptions of the test pit evaluation are presented on the Test Pit Logs. The approximate locations of the test pits are presented in the Engineering and Geology Map, Figure 5.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the central portion of the Great Plains Physiographic Province. A major structural feature known as the Rampart Range Fault is located approximately 12.5 miles west of the site. The Rampart Range Fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain 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 alluvium of Palmer Divide overlying the bedrock of the Upper part of the Dawson Formation.

6.1 Subsurface Soil Conditions

The subsurface soils encountered in the RMG test pit excavations were classified using the United States Department of Agriculture (USDA) and Unified Soil Classification System (USCS).

The classifications shown on the logs are based upon the engineer's 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

Bedrock (as defined by USDA Soil Structure and Grade) was not encountered in the test pit excavations performed for this investigation but was encountered in the test borings performed for the referenced subsurface soil investigation. In general, the bedrock (as defined by Colorado Geologic Survey) beneath the site is considered to be part of the Upper Dawson Formation – facies unit five which consists of very thick-bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate. Facies unit five also contains common beds of white to light-tan, fine- to medium-grained feldspathic, cross-bedded friable sandstone. The Dawson formation is thick-bedded to massive, generally light colored arkose, and pebbly. The sandstones are poorly sorted with high clay contents. The sandstone is generally permeable, well drained, and has good foundation characteristics. The Dawson sandstone is generally not considered a restrictive layer for OWTS.

6.3 U.S. Soil Conservation Service

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

- 15 – Brussett loam, 3 to 5 percent slopes. Properties of the loam include well drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms include hills.
- 67 – Peyton sandy loam, 5 to 9 percent slopes. Properties of the sandy loam include well drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and ponding is none, and landforms include hills.
- 69 – Peyton-Pring complex, 8 to 15 percent slopes. Properties of the complex include well drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soils Survey Map is presented in Figure 6.

6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, a geologic map was prepared which identifies the geologic conditions affecting the development. The geologic conditions affecting the development are presented in the Engineering and Geology Map, Figure 5.

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

- *TKda5 – Dawson formation, facies unit five (early to middle(?) Eocene)* – The unit is dominated by very thick-bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate. Facies unit five contains common beds of white to light-tan, fine- to medium-grained feldspathic, cross-bedded friable sandstone. The unit is estimated to be about 500 feet thick in the quadrangle; the top of the unit has been removed by erosion.
- *QTa – Alluvium of Palmer Divide (early? Pleistocene or Pliocene?)* – The deposits included in this oldest alluvial category include predominately sand deposits in the northwestern part of the quadrangle. The alluvium of Palmer Divide is up to 30 feet thick in the Black Forest quadrangle. The sandy deposits are composed generally of very pale-brown and pinkish-brown, fine to coarse sand interbedded with pinkish-gray to light brownish-gray pebble gravel. The sand is poorly sorted, medium to thin bedded, thinly laminated, and composed largely of quartz grains. The sandy pebble and cobble gravel is composed largely of subangular to subrounded fragments of white or light-gray quartz, light-pink to light-red and reddish-brown feldspar, a few fragments of pink to light-red to reddish-brown granite, and rare fragments of brownish-gray Wall Mountain Tuff.
- *psw* – Potentially Seasonally Wet Area – areas that may contain water during heavy moisture events (rain/snow storms). Currently, construction is not proposed in these areas. It is recommended that any future structures be located outside the potentially seasonally wet areas.
- *af* – Artificial fill Area – Apparent artificial fill placed between 1955 and 1960 for the creation of multiple irrigation ditches throughout the site.

6.5 Engineering Geology

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

- *1A* – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).
- *3B* – Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%)

6.6 Structural Features

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

6.7 Surficial (Unconsolidated) Deposits

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

6.8 Features of Special Significance

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

6.9 Groundwater – Seasonal and Permanent

The overall topography of the site generally slopes down from the west to east. It is anticipated the direction of surface water and groundwater generally flow in the same direction. Groundwater was not encountered in the test pits performed for this current study and is not anticipated to affect shallow foundations. Multiple irrigation ditch features (apparently man-made) traverse the site from west to east.

Groundwater was also not encountered in the test borings at the time of our field exploration. However, 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.

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.

The proposed foundations should penetrate sufficient depth to discourage the formation of frost/ice lenses beneath foundations. It is recommended that foundations extend to a depth of at least 2.5 feet below the finished grade for frost protection. A subsurface drain will be necessary to help prevent the intrusion of water into areas located below grade. A typical perimeter drain detail is presented in Figure 8. Additionally, although not anticipated for the proposed lots, an underslab drainage layer may also be recommended to help intercept groundwater before it enters the slab area should the groundwater levels rise. In general, if groundwater is encountered within 4 to 6 feet of the proposed slab elevation, an underslab drain should be anticipated. Careful attention should be paid to grade and discharge of the drain pipe. A typical underslab drain detail is presented in Figure 9.

If groundwater conditions are encountered at the time of foundation excavation result in either water flow into the excavation or destabilization of the foundation bearing soils, stabilization techniques should be implemented. Various stabilization methods can be employed and can be discussed at the time of construction. Final recommendations for mitigation are to be determined based on the conditions encountered at the time of the excavation observation.

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

6.10 Flooding and Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0305G and the online ArcGIS El Paso County Risk Map, the entire site lies outside of identified 100 or 500-year floodplains. The site lies in Zone X. 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. The FEMA Map is presented in Figure 7.

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 1* indicates the site is identified as Stream Terrace Deposits. The older stream deposits contain sand, gravel, silt and clay preserved on benches or broad flat to sloping areas adjacent to streams. Extraction of the sand, gravel, silt or clay more than likely would not be considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the southern part of the Denver Basin Coal Region. However, the area of the site has been mapped "Poor" for coal resources. The tract contains strata that may contain coal but no coal occurrences are within five miles. No metallic mineral resources have been mapped on the site. No oil and gas wells are drilled on this tract, or within two miles of it. The nearest historic coal mine sites are located around nine miles southwest of the tract in the Colorado Springs coal field. 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.

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

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

The following section presents the geologic conditions that have been identified on the property:

8.1 Expansive Soils

Based on the test pits performed by RMG for this investigation and the test borings performed for the site specific subsurface soil investigation referenced above, and our experience with similar materials in this area, the sandy clay generally possess low to moderate swell potential. The Dawson formation is known to have moderate to high swell potential in some locations. It is anticipated that expansive soil/bedrock may be encountered at depths anticipated to affect residential foundations. If these materials are encountered in the excavation for the proposed residence, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation

Foundation design and construction are typically adjusted for expansive soils. Mitigation of expansive soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated. Floor slabs bearing directly on expansive soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils can be successful in reducing slab movement.

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

8.2 Compressible Soils

Based on the test pits performed by RMG for this investigation and the test borings performed for the site specific subsurface soil investigation referenced above, and our experience with similar materials in this area, the sandy clay generally possesses low compressibility potential. If compressible materials are encountered in the excavation for the proposed residence, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

It is unknown at this time whether the proposed single-family residences will have crawlspaces, basements or a combination of both. Foundation design and construction are typically adjusted for compressible soils.

Mitigation

Mitigation of compressible soils and bedrock are typically accomplished by overexcavation and replacement with structural fill, subexcavation and replacement with on-site moisture-conditioned soils, and/or the installation of deep foundation systems. If soft or loose soils are encountered, mitigation of compressible soils can be accomplished by overexcavation and replacement with structural fill, subexcavation and replacement with on-site moisture-conditioned soils, and/or the use of a geogrid reinforced fill.

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

8.3 Seasonal Surface Water

The site currently contains two low-lying areas, located near the center of the northern portion of Lot 2. In reviewing aerial photos, some depict darker shades that could indicate surface runoff is being retained in these areas. We anticipate the potential for periodically high surface moisture conditions in these areas. The site is not mapped within floodplain zones according to the FEMA Map No. 08041C0305G.

Mitigation

Foundations are not proposed in the existing low-lying areas. According to the Owl Ridge Subdivision, Final Drainage Report, last dated March, 2022 prepared by SMH Consultants, Figure 4 shows the proposed building location for the northern portion of Lot 2, approximately 7,000 SF, between the seasonally wet areas. At this time, construction is currently not proposed on the northern portion of Lot 2. However, if future construction is proposed in that area, a site-specific subsurface soil investigation is recommended to verify the depth of groundwater. It is recommended any future structures be located outside any potentially seasonally wet areas. If future structures remain outside the mapped seasonally shallow surface water areas, as indicated on the Engineering and Geology Map, Figure 5, the seasonally wet areas are not considered to pose a risk to the future proposed structures.

8.4 Undocumented Fill

Multiple irrigation ditches appear to be traversing the property and it is assumed that man-placed artificial fill was used to create the ditches between 1955 and 1960. The locations of the irrigation ditches are presented in the Engineering and Geology Map, Figure 5.

Mitigation

If undocumented fill is located below the proposed residences, it will require removal and replacement with structural fill that has been selected, placed, and compacted in accordance with the recommendations presented in section **10.0 Structural Fill – General** of this report.

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

8.5 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 0.185g 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.

8.6 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 80908 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 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 8.0 of this report) found to be present at this site include faults/seismicity and radioactivity/radon. Geologic constraints (as described in section 8.0 of this report) found to be present at this site include compressible soils, expansive soils, potentially seasonally wet areas, and undocumented fill. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

10.0 STRUCTURAL FILL - GENERAL

Areas to receive structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

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

Structural fill shall consist of granular, non-expansive material. It should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557. The materials should be compacted by mechanical means.

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

11.0 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 pits, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction.

A lot-specific subsurface soil investigation has been completed for Lot 1. If new construction is proposed on Lot 2 in the future, a lot-specific subsurface soil investigation will be required (prior to construction) to determine recommendations for design and construction of the proposed structures.

12.0 CONCLUSIONS

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

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be considered. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. A typical perimeter drain detail is presented in Figure 8. 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 silty clay will classify as Type A materials and the sandy loam and clay loam will classify as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that

temporary excavations made in Type A and B materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and 1:1 (horizontal to vertical), respectively, unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

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 the property to 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.

13.0 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 **SMH Consultants** 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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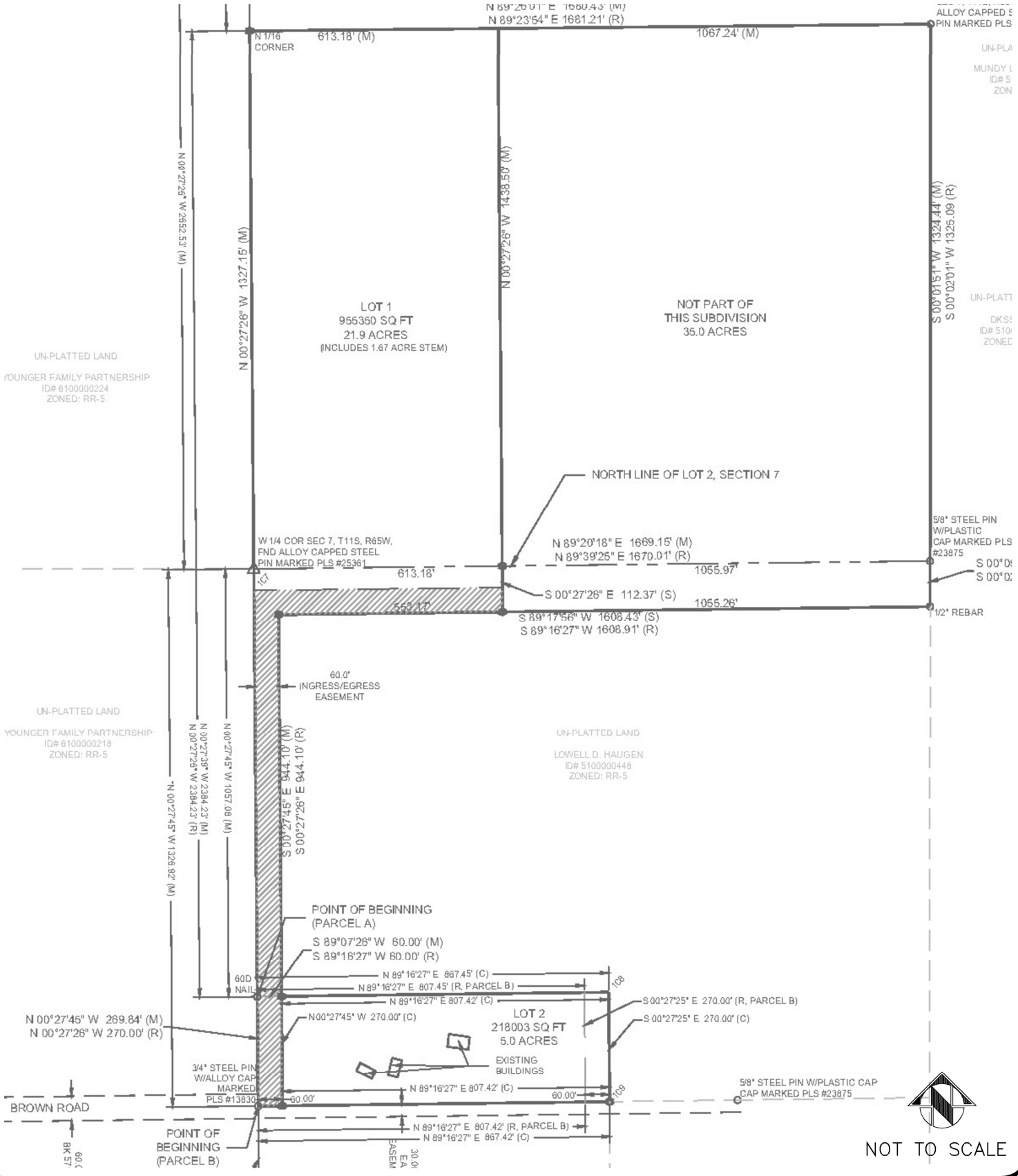
SITE VICINITY MAP

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

JOB No. 185466

FIG No. 1

DATE 7-20-2022
REV 9-9-2022



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PROPOSED LOT LAYOUT

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
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FIG No. 2

DATE 7-20-2022
REV 9-9-2022

DENOTES APPROXIMATE LOCATION OF TEST PITS

DENOTES APPROXIMATE LOCATION OF TEST BORINGS FOR THE SITE SPECIFIC SUBSURFACE SOIL INVESTIGATION

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TEST BORING AND TEST PIT LOCATION MAP

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
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JOB No. 185466

FIG No. 3

DATE 7-20-2022
REV 9-9-2022

TEST PIT TP-1

DATE OBSERVED: 09/22/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SILTY CLAY (STRONG)	2ft 4ft 6ft 8ft		4

TEST PIT TP-2

DATE OBSERVED: 09/22/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 5.0 FT SANDY CLAY (STRONG)	2ft 4ft		4
5.0 - 8.0 FT SANDY LOAM (MODERATE)	6ft 8ft		2 4

SOIL DESCRIPTIONS

SANDY CLAY

SANDY LOAM

SILTY CLAY

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TEST PIT LOGS

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

JOB No. 185466

FIG No. 4

DATE 7-20-2022

TEST PIT TP-3

DATE OBSERVED: 09/22/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT CLAY LOAM (MODERATE)	2ft 4ft 6ft 8ft		R-1

TEST PIT TP-4

DATE OBSERVED: 09/22/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SILTY CLAY (STRONG)	2ft 4ft 6ft 8ft		4

SOIL DESCRIPTIONS

CLAY LOAM

SILTY CLAY

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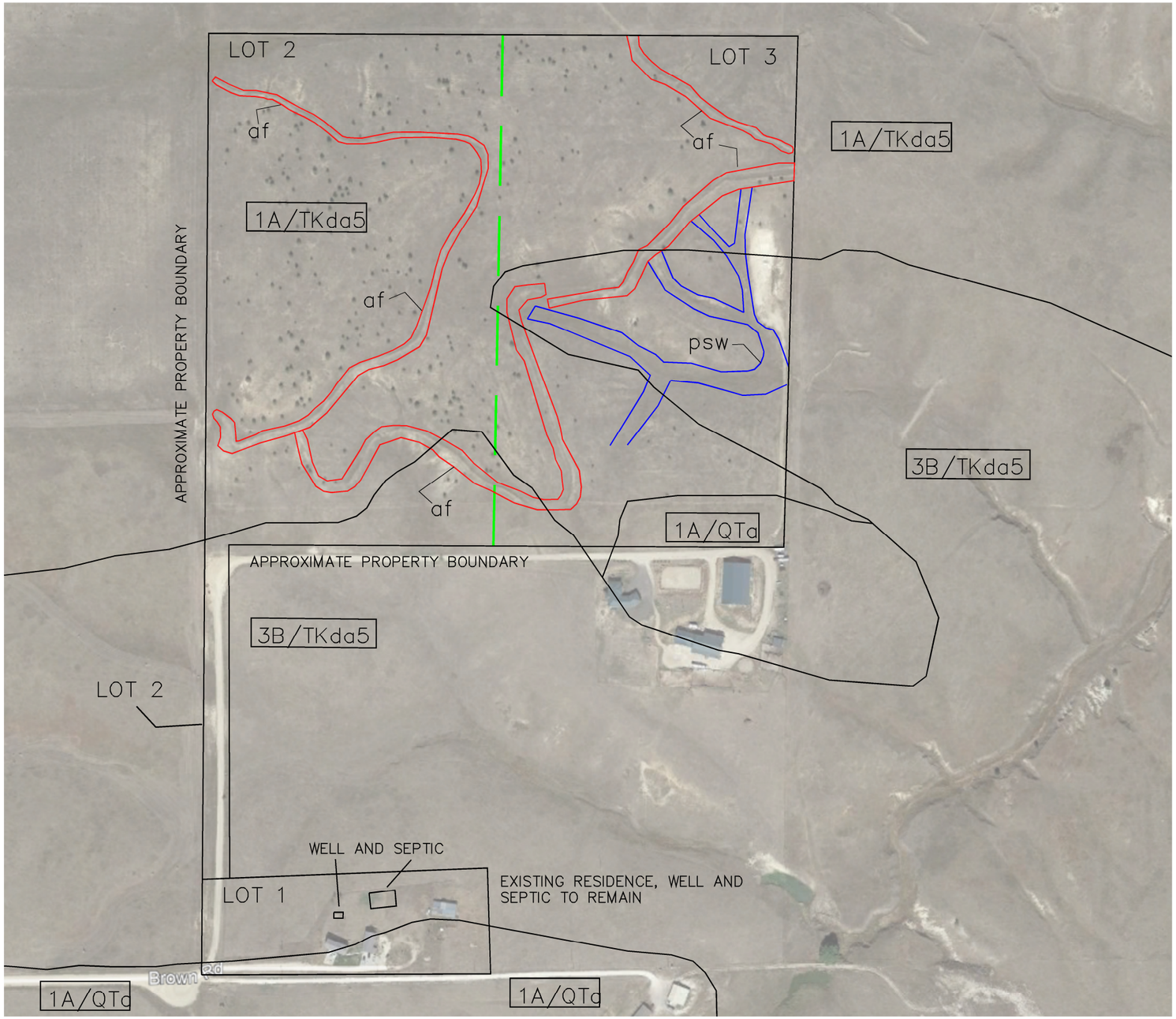
TEST PIT LOGS

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

JOB No. 185466

FIG No. 4

DATE 7-20-2022



NOT TO SCALE

Geologic

- TKda5 – Dawson Formation, facies unit three (early to middle Eocene) – Unit is estimated to be about 500 feet thick
- QTa – Alluvium of Palmer Divide (early Pleistocene or Pliocene) – Unit is up to 30 feet thick
- af – Artificial Fill Area – Artificial fill placed between 1955 and 1960 for the creation of irrigation ditchesthroughout the property
- psw – Potentially Seasonally Wet Area

Engineering

- 1A – stable alluvium, colluvium and bedrock on flat to gentle slopes (0–5%)
- 3B – expansive and potentially expansive soil and bedrock on flat to moderate slopes (0–12%)

DENOTES BOUNDARY BETWEEN LOTS 2 AND 3

DENOTES ARTIFICIAL FILL AREA

DENOTES POTENTIALLY SEASONALLY WET AREA

JOB No. 185466

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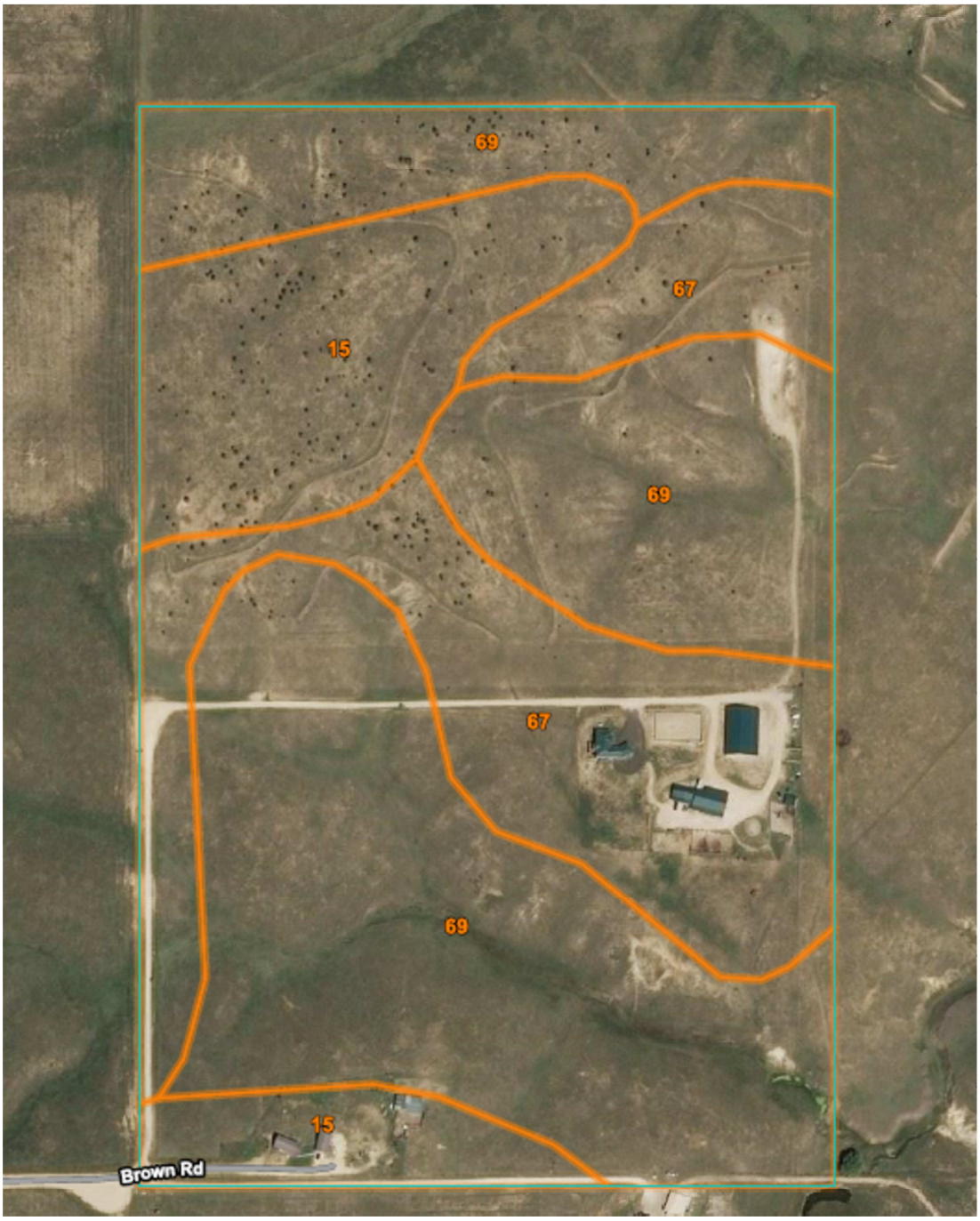
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

ENGINEER:	TPM
DRAWN BY:	KCR
CHECKED BY:	TPM
ISSUED:	2–21–2022

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-5



15 – BRUSSETT LOAM, 3 TO 5 PERCENT SLOPES

67 – PEYTON SANDY LOAM, 5 TO 9 PERCENT SLOPES

69 – PEYTON–PRING COMPLEX, 8 TO 15 PERCENT SLOPES

NOT TO SCALE

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USDA SOIL SURVEY MAP

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

JOB No. 185466

FIG No. 6

DATE 7-20-2022
REV 9-9-2022

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 — Cross Sections with 1% Annual Chance
- 17.5 — 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

NOT TO SCALE

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FEMA MAP

LOTS 1-2, OWL RIDGE SUBDIVISION
BROWN ROAD
EL PASO COUNTY, COLORADO
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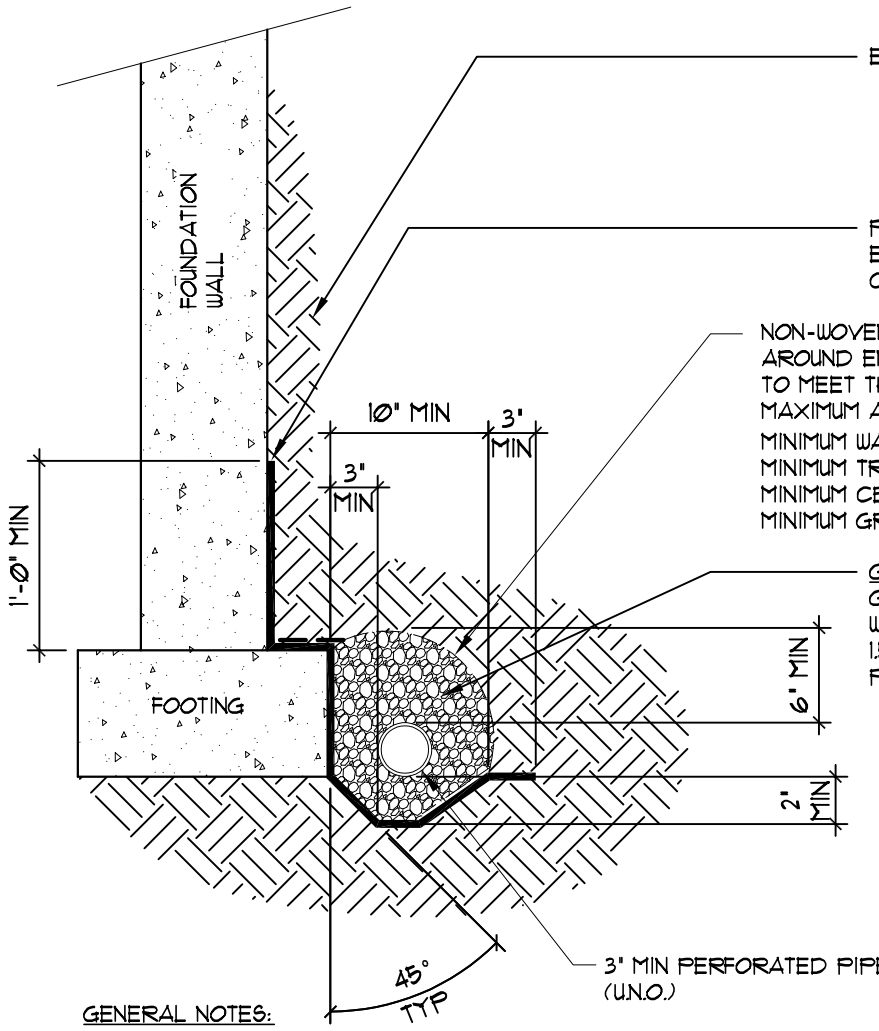
JOB No. 185466

FIG No. 7

DATE 7-20-2022
REV 9-9-2022



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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Geotechnical

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Forensics
Civil / Planning

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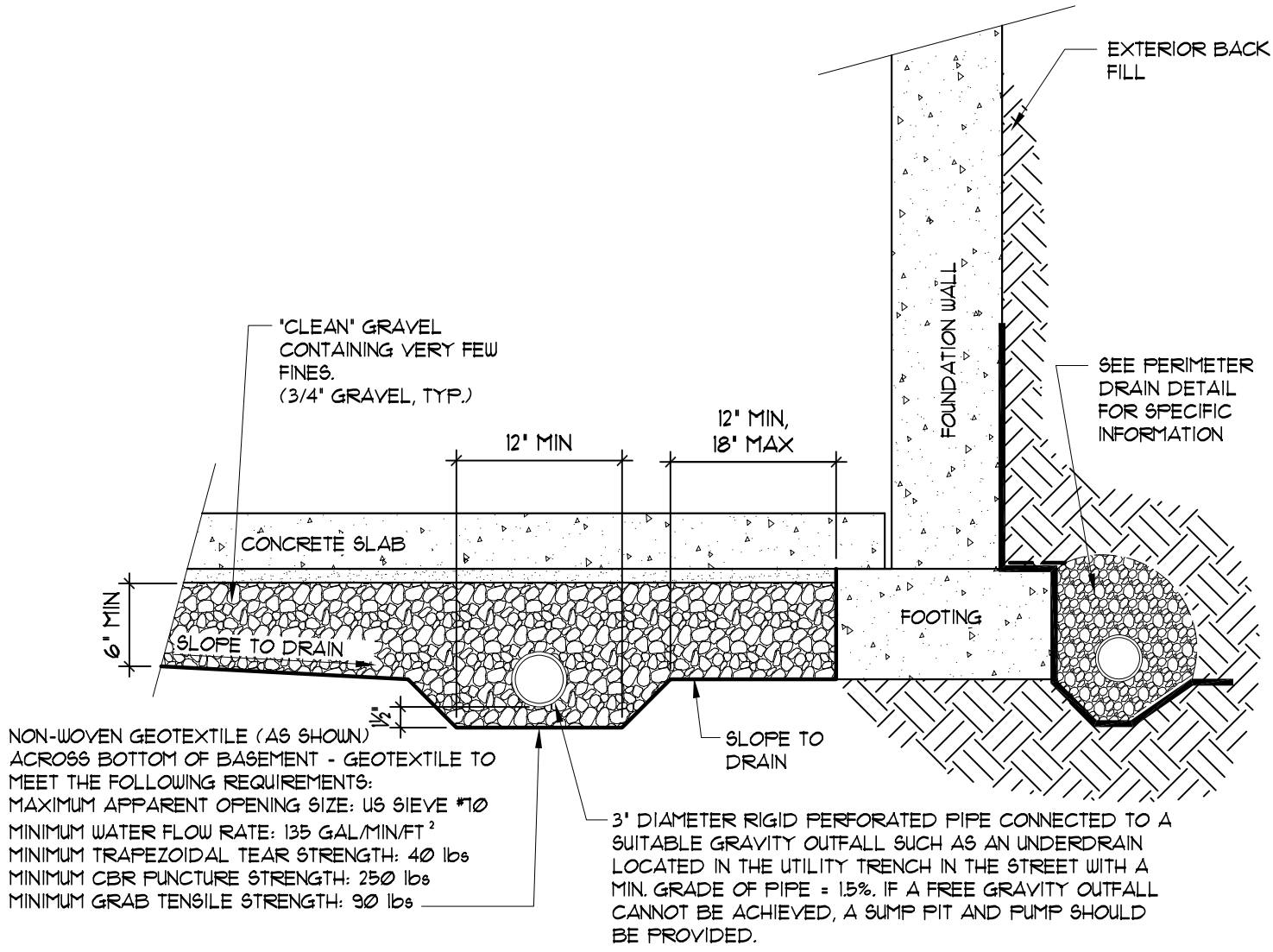
Southern Colorado, Denver Metro, Northern Colorado

PERIMETER DRAIN

FIG No. 8



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. 9

APPENDIX A
Additional Reference Documents

1. *Owl Ridge Subdivision, Final Plat, County of El Paso, State of Colorado,* prepared by SMH Consultants, dated May 2022.
2. *Owl Ridge Subdivision, Final Drainage Report, Colorado Springs, El Paso County, Colorado*, prepared by SMH Consultants, dated March 2022.
3. *Land Survey Plat Map, 18885 Brown Road, Lots 1-3, Owl Ridge Subdivision, El Paso County, Colorado*, prepared by SMH Consultants, Job No. 2010CS4031, dated November 19, 2020.
4. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0305G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
5. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*, Madole, R.F., 2003, Colorado Geological Survey Open-File Report OF03-06.
6. *Cherry Valley and Black Forest Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
7. *Black Forest Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
8. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
9. El Paso County Assessor Website
   https://property.spatialest.com/co/elpaso/#/property/5100000447
   Schedule No. 5100000447
10. *Colorado Geological Survey, USGS Geologic Map Viewer*:
    http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
11. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, and 2017.
12. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs, Black Forest Quadrangle dated 1898, 1909, 1948, 1969, 1981 and 1989.
13. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.

APPENDIX B

Subsurface Soil Investigation – Brown Road, Lot 2 (aka Lot 1), Owl Ridge Subdivision, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 185466, dated August 8, 2022

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Forensic
Civil/Planning

SUBSURFACE SOIL INVESTIGATION

Brown Road
Lot 2, Owl Ridge Subdivision
Paso County, Colorado

PREPARED FOR:

SMH Consultants
411 S. Tejon Street
Suite 1
Colorado Springs, CO 80903

JOB NO. 185466

August 8, 2022

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
8/8/22
39818
PROFESSIONAL ENGINEER

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

Scope of Investigation

RMG – Rocky Mountain Group drilled two test borings for the proposed single family residence at the above-referenced address on July 11, 2022. It is our understanding the parcel is to be subdivided into 3 lots. Once the subdivision is approved, each new lot is to be assigned a new address. This soils investigation was completed for the proposed construction on Lot 2, which currently has not been assigned a new address. A Site Vicinity Map and Test Boring Location Plan are presented in Figures 1 and 2, respectively. Our findings, conclusions and recommendations are provided in this report.

This report presents geotechnical engineering recommendations for design and construction of residential foundations. The following is excluded from the scope of this report including but not limited to 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.

Subsurface Materials

The subsurface materials encountered in the test borings generally consisted of sandy clay extending to approximately 9 feet below the existing surface. Underlying the surface materials, clayey sandstone extends to to the 20-foot termination depths of the test borings. Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Test Boring Logs.

Groundwater was not encountered in the test borings at the time of drilling or when checked one day subsequent to drilling. 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.

An Explanation of the Test Boring Logs, the Test Boring Logs, and a Summary of Laboratory Test Results are presented in Figures 3 through 5. Soil Classification Data is presented in Figure 6. Swell/Consolidation Test Results are presented in Figure 7.

Overexcavation and Replacement

The sandy clay is considered to possess low to moderate swell potential and is not suitable for support of shallow foundations. If sandy clay is determined to be within 3 feet of the bottom of foundation components or floor slabs, it will require removal (overexcavation) and replacement with non-expansive, granular structural fill to a depth which results in at least 3 feet of compacted structural fill below foundation components and floor slabs. The zone of overexcavation and replacement should extend a minimum of 3 feet beyond the building perimeter, including beyond the perimeter of counterforts and "T" wall footings. The structural fill should be observed and tested during placement as indicated under the **Structural Fill** section of this report, to ensure proper compaction.

Foundation Recommendations

A spread footing foundation supported on sandstone or on compacted structural fill is suitable for the proposed residential structures. We have anticipated the deepest excavation cuts for basement level construction will be approximately 6 to 8 feet below the existing ground surface.

If the bottom of the excavation consists entirely of sandstone, a maximum allowable bearing pressure of 3,000 psf with no minimum dead load requirement may be used for design. However, the structure shall not be supported atop soils/bedrock of significantly different bearing capacities. If any portion of the structure is to be supported atop the on-site sand soils or on structural fill, the remaining portions of the excavation shall have the top 12 inches of exposed sandstone bedrock removed and replaced with structural fill.

For a structure supported atop sand soils and/or structural fill, a maximum allowable bearing pressure of 2,000 psf with no minimum dead load requirement may be used for design.

The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection.

Open Excavation Observation

During construction, foundation excavations should be observed by RMG prior to placing structural fill, forms, or concrete to verify the foundation bearing conditions for each structure. Based on the conditions observed in the foundation excavation, the recommendations made at the time of construction may vary from those contained herein. In the case of differences, the Open Excavation Observation report shall be considered to be the governing document. The recommendations presented herein are intended only as preliminary guidelines to be used for interpreting the subsurface soil conditions exposed in the excavation and determining the final recommendations for foundation construction.

Soil Test Borings

The soil/rock classifications shown on the logs are based upon the engineer's classification of samples. Lines shown on the logs represent the approximate boundary between subsurface materials, and the actual transition may be gradual and vary across the site.

Interior Floor Slabs

Vertical slab movement on the order of one to three inches is considered possible for soils/bedrock of low expansion potential and for structural fill after recommended removal (overexcavation) of expansive soils/bedrock. In some cases, vertical movement may exceed this range. If movement and associated damage to floors and finishes cannot be tolerated, a structural floor system should be used.

Floor slabs should be separated from structural components to allow for vertical movement. Control and construction joints should be placed in accordance with the latest guidelines and standards published by the American Concrete Institute (ACI) and applicable local Building Code requirements.

Recommendations for exterior concrete slabs, such as patios, driveways, and sidewalks, are not included in this report.

Interior Partitions

Interior non-bearing partitions and attached furnishings (e.g., cabinets, shower stalls, etc.) on concrete slabs should be constructed with a void so that they do not transmit floor slab movement to the roof or overlying floor. A void of at least 1-1/2 inches is recommended beneath non-bearing partitions. The void may require reconstruction over the life of the structure to re-establish the void due to vertical slab movement.

Lateral Earth Pressure Parameters

Foundation and basement walls should be designed to resist lateral pressures. For non-expansive backfill materials, we recommend an equivalent fluid pressure of 40 pcf for design. For on-site moisture-conditioned expansive backfill materials, we recommend an equivalent fluid pressure of 50 pcf for design.

The above lateral earth pressure applies to level, drained backfill conditions. Equivalent Fluid Pressures for sloping/undrained conditions should be determined on an individual basis.

Surface Grading and Drainage

The ground surface should be sloped from the building with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. 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. Owners should maintain the surface grading and drainage recommended in this report to help prevent water from being directed toward and/or ponding near the foundations.

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

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

The recommendations listed in this report are intended to address normal surface drainage conditions, assuming the presence of groundcover (established vegetation, paved surfaces, and/or structures) throughout the regions upslope from this structure. However, groundcover may not be present due to a variety of factors (ongoing construction/development, wildfires, etc.). During periods when groundcover is not present in the "upslope" regions, higher than normal surface drainage conditions may occur, resulting in perched water tables, excess runoff, flash floods, etc. In these cases, the surface drainage recommendations presented herein (even if properly maintained) may not mitigate all groundwater problems or moisture intrusion into the structure. We recommend that the site plan be prepared with consideration of increased runoff during periods when groundcover is not present on the upslope areas.

Perimeter Drain

A subsurface perimeter drain is recommended around portions of the structure which will have habitable or storage space located below the finished ground surface, including around crawlspace areas but not the walkout trench, if applicable. A typical drain detail is presented in Figure 8.

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

Overexcavation Drain

If an overexcavation is performed and granular, non-expansive backfill is used for the replacement soils, a subsurface drain may also be recommended around the perimeter of the excavation. This drain is to be placed at the bottom of the overexcavated portion of the excavation (in this case 3 feet below footing grade) prior to backfilling. A typical drain detail is presented in Figure 9.

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

Concrete

Type I/II cement is recommended for concrete in contact with the subsurface materials. Calcium chloride should be used with caution for soils with high sulfate contents. The concrete should not be placed on frozen ground. If placed during periods of cold temperatures, the concrete should be kept from freezing. This may require covering the concrete with insulated blankets and heating. Concrete work should be completed in accordance with the latest applicable guidelines and standards published by ACI.

Exterior Backfill

Backfill 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 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.

Structural Fill

Areas to receive structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

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

Structural fill shall consist of granular, non-expansive material, and it should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557. The materials should be compacted by mechanical means.

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

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

Foundation Configuration Remarks

The configuration of the foundation system is critical to its performance. The position of foundation windows, jogs, steps and the relative elevation of adjacent and opposite walls can affect foundation performance. The nature of residential foundation construction does not allow for control of these conditions by the Foundation Design Engineer. Improper placement of the above can result in differential and lateral foundation movement not anticipated by the Geotechnical Engineer. The Foundation Design Engineer should be contacted regarding the foundation configuration.

General Remarks

The recommendations provided in this report are based upon the subsurface conditions encountered in the test borings, anticipated foundation loads, and accepted engineering procedures. The recommendations are intended to reduce differential movement. *It must be recognized that the foundation will undergo some movement on all soil types*. Concrete floor slabs will likely move vertically. The recommendations for isolating floor slabs from columns, walls, partitions or other structural components should be implemented to mitigate potential damage to the structure. Subsequent owners should be provided a copy of this report. The recommendations are based on accepted local engineering practice and are intended for individuals familiar with local construction practices and standards.

RMG does not assure the existence of and/or the compliance with the above recommendations. This is the responsibility of the client referenced on the first page. RMG provided recommendations only and does not supervise, direct or control the implementation of the recommendations.

Senate Bill 13

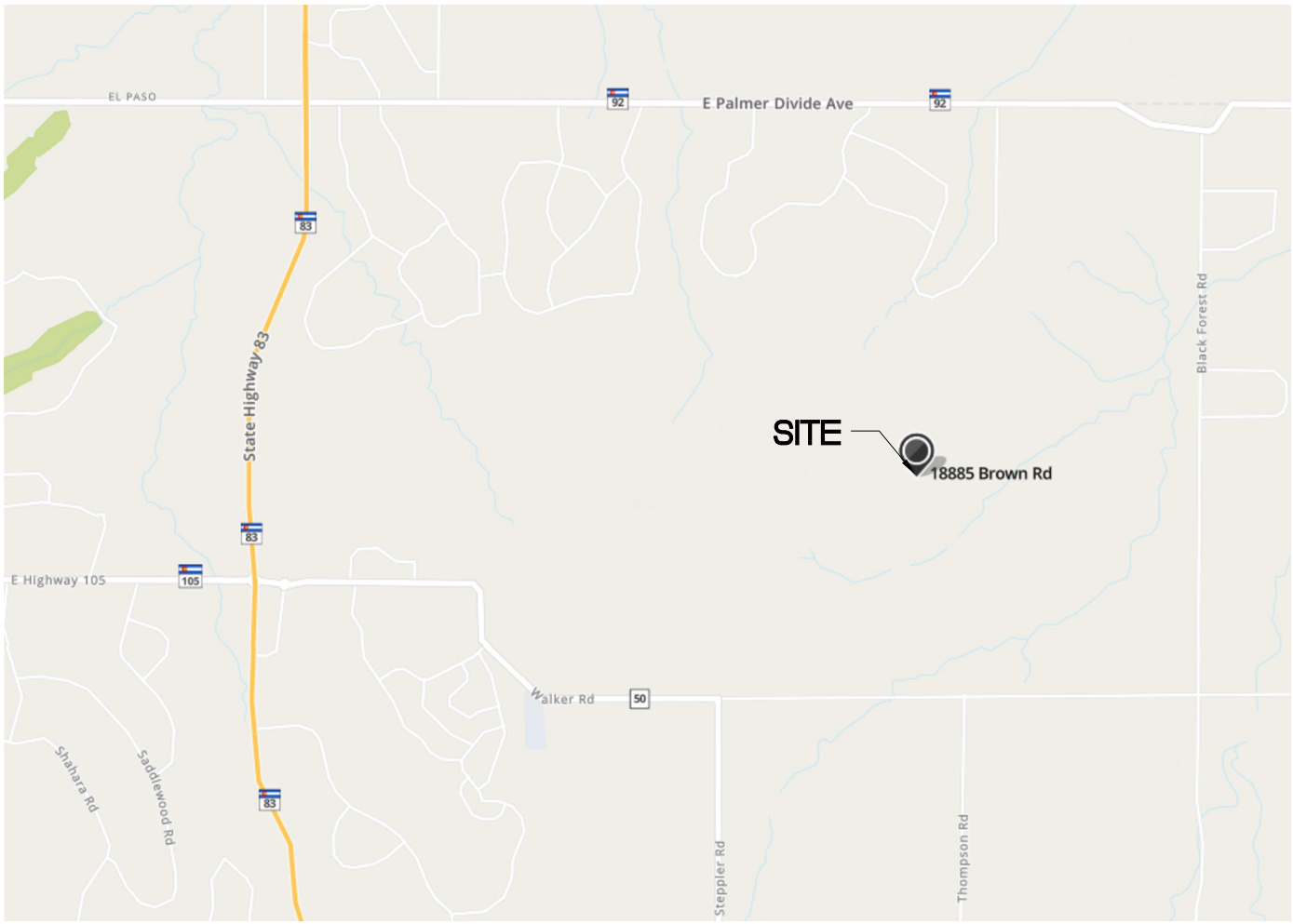
This report may be partial fulfillment of Colorado Senate Bill 13 (1984), C.R.S. 6-6.5-101, *The Soil and Hazard Analysis of Residential Construction*, if the purchaser receives this report at least fourteen days prior to closing.

The purpose of Senate Bill 13 is to inform the purchaser of the presence of expansive soil or hazards on the site. Geologic and environmental hazards are outside the scope of services of this report. Expansive soil and bedrock may result in movement of foundation components and floor slabs. The recommendations presented in this report are intended to reduce, not eliminate, these movements.

The owner and builder should review and become familiar with Special Publications 43 issued by the Colorado Geologic Survey.

This report and the recommendations contained therein are only valid if all parts of Senate Bill 13 are satisfied.

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



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SITE VICINITY MAP

BROWN ROAD
LOT 2, OWL RIDGE SUBDIVSION
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

JOB No. 185466

FIG No. 1

DATE 8-8-2022

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⊕ DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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TEST BORING LOCATION PLAN

BROWN ROAD
LOT 2, OWL RIDGE SUBDIVSION
EL PASO COUNTY, COLORADO
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FIG No. 2

DATE 8-8-2022

SOILS DESCRIPTION


SANDSTONE


SANDY CLAY

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
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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

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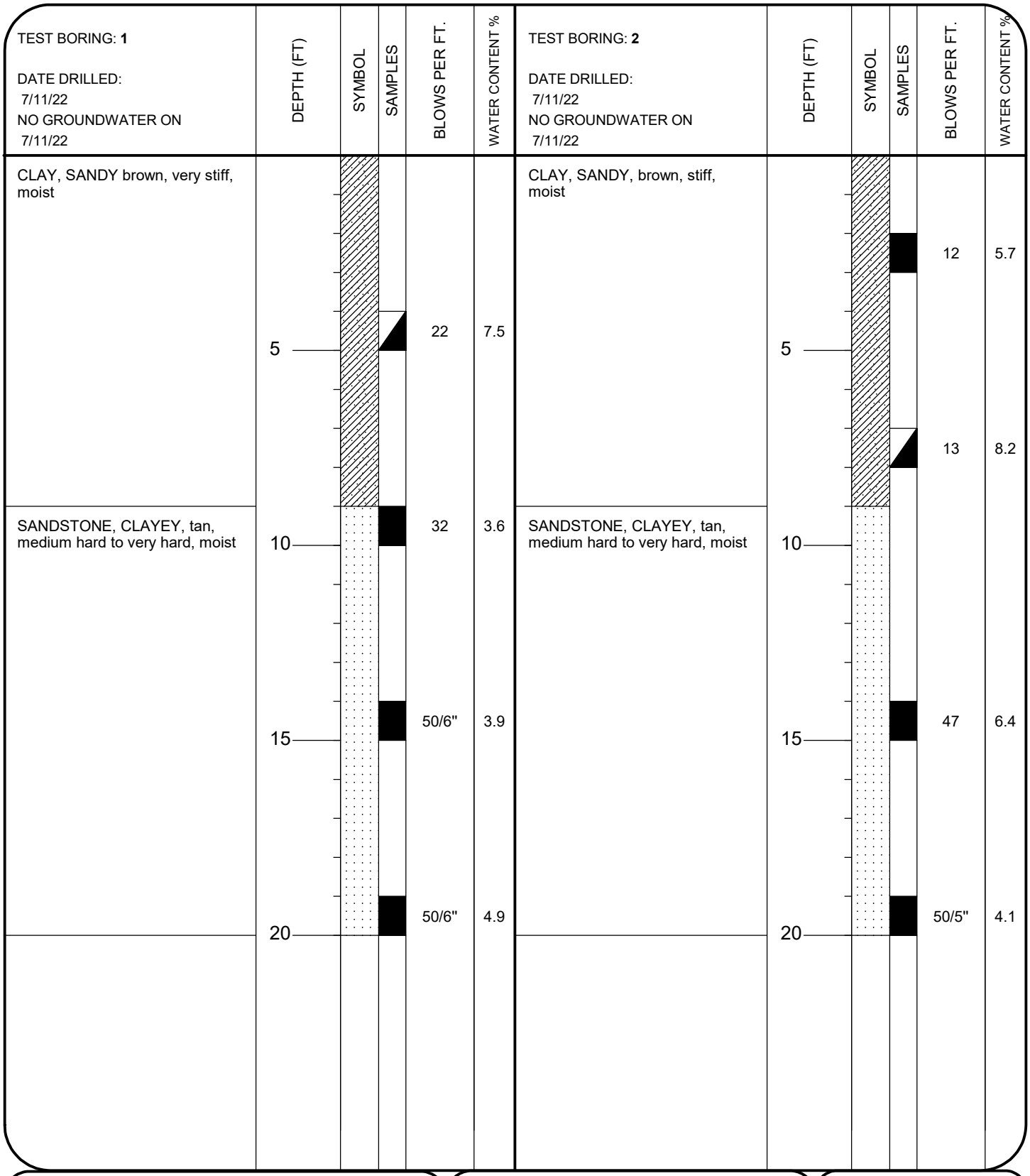
FIGURE No. 3

DATE Aug/08/2022



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TEST BORING LOG

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FIGURE No. 4

DATE Aug/08/2022

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	7.5	99.0	31	20	0.0	77.9		- 0.1	CL
1	9.0	3.6								
1	14.0	3.9								
1	19.0	4.9								
2	2.0	5.7								
2	7.0	8.2		31	20	0.0	83.1			CL
2	14.0	6.4								
2	19.0	4.1								

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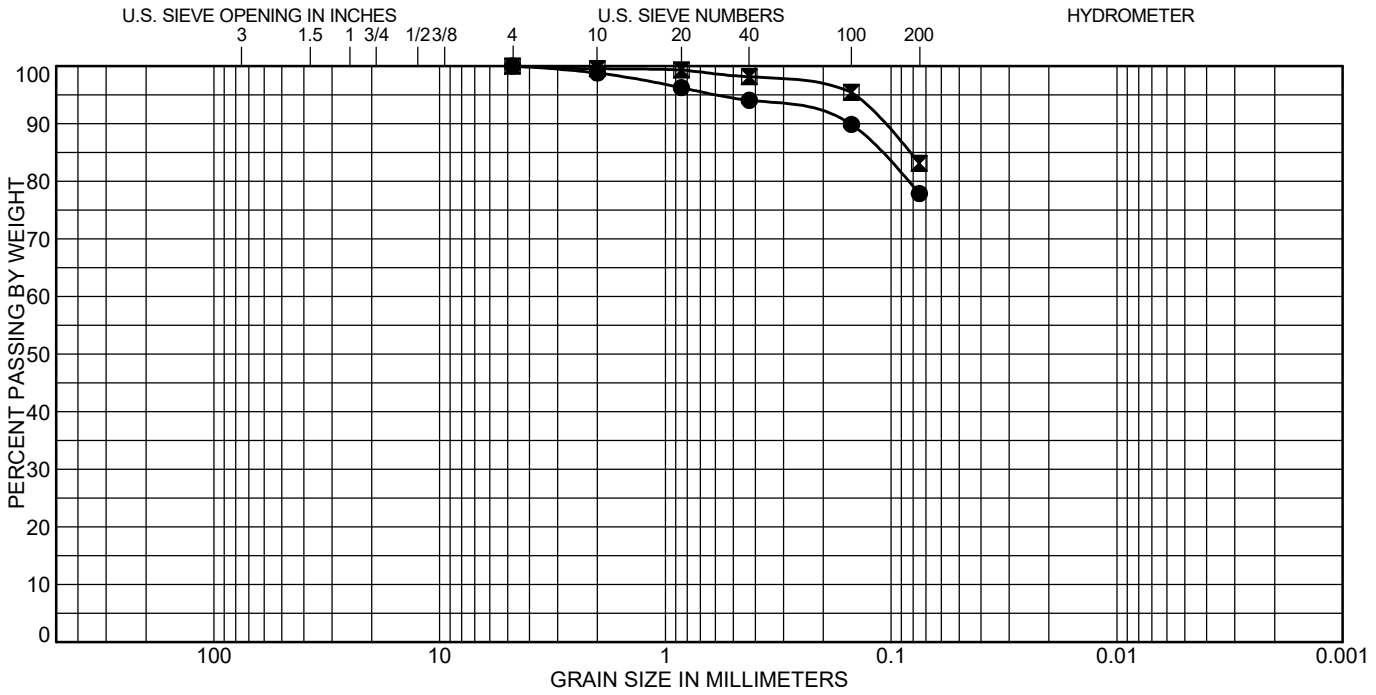
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 185466
FIGURE No. 5
PAGE 1 OF 1
DATE Aug/08/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	4.0	**LEAN CLAY with SAND(CL)**	31	11	20
⊠	2	7.0	**LEAN CLAY with SAND(CL)**	31	11	20

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0	0.0	22.1	77.9	
⊠	2	7.0	0.0	16.9	83.1	

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SOIL CLASSIFICATION DATA

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FIGURE No. 6

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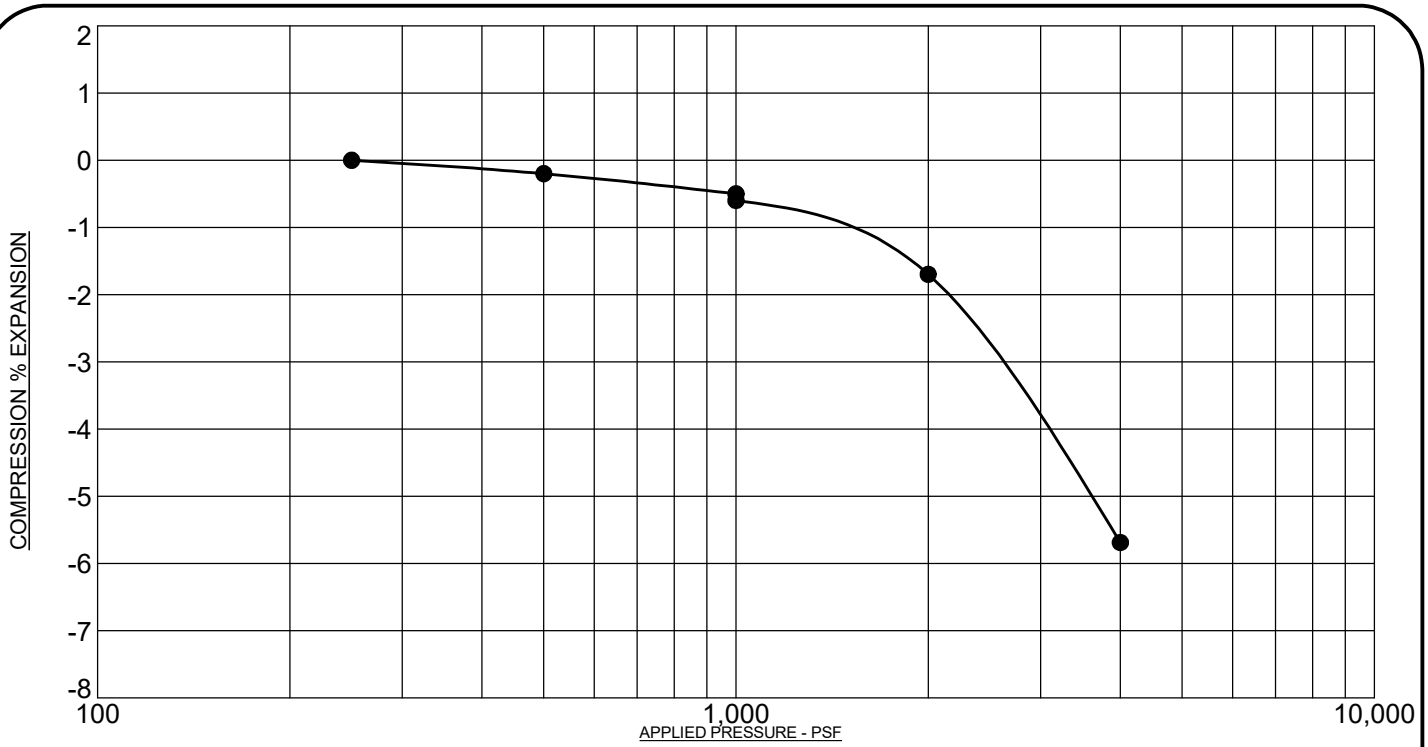

PROJECT: **18885 Brown Road, El Paso County, Colorado**
SAMPLE DESCRIPTION: **SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **99.0 PCF**
NATURAL MOISTURE CONTENT: **7.5%**
PERCENT SWELL/COMPRESSION: **- 0.1**

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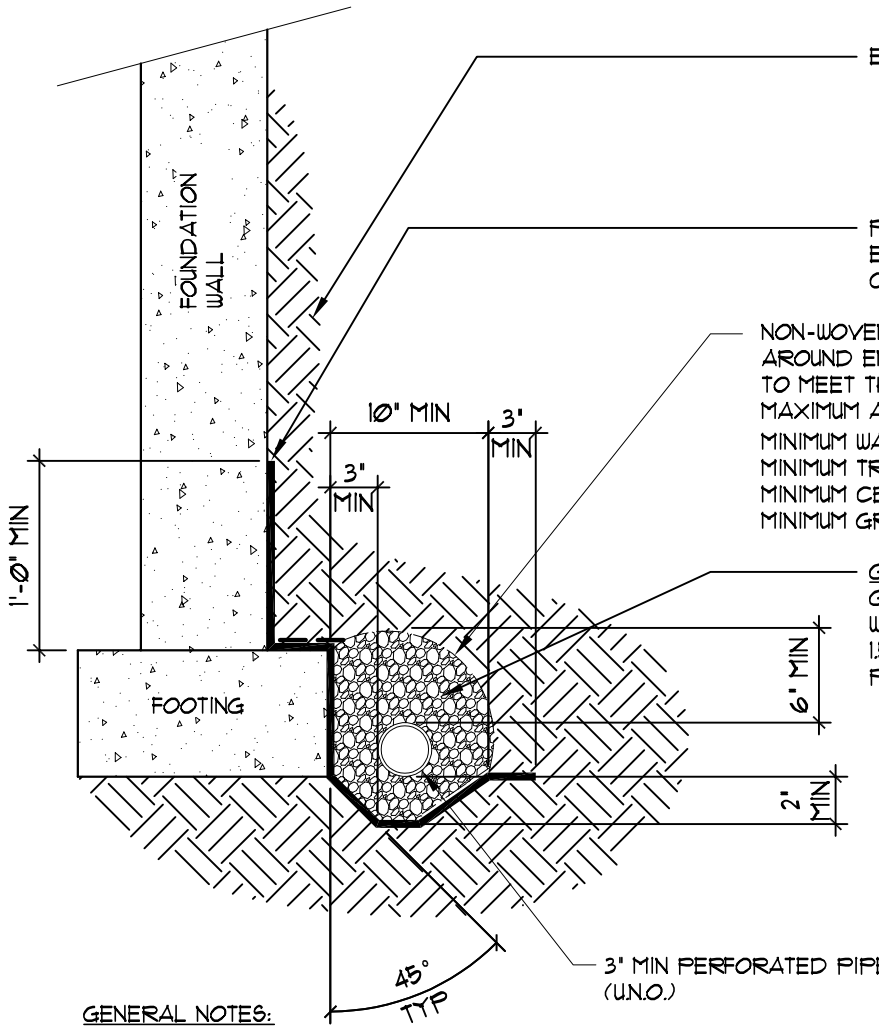
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 185466

FIGURE No. 7

DATE Aug/08/2022



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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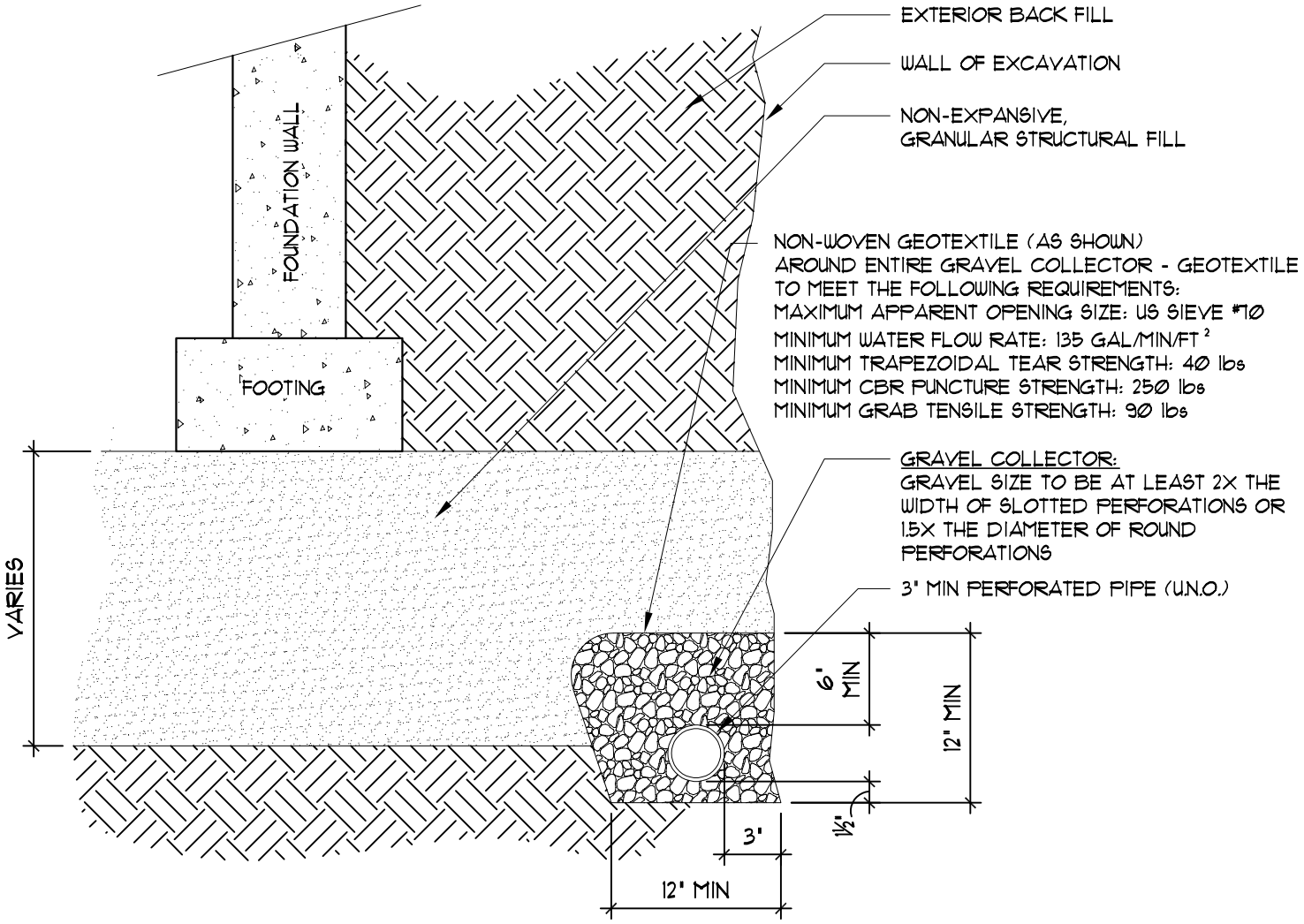
PERIMETER DRAIN

FIG No. 8



GENERAL NOTES:

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

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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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OVEREXCAVATION DRAIN

FIG No. 9