6/1/2023

GEOLOGIC HAZARD STUDY APPLICATION

Applicant: Challenger Communities Telephone: 719-653-0390

Address: 8605 Explorer Drive, Ste 250 Email: ESmith@ChallengerHomes.com

City/State/Zip: Colorado Springs, CO 80920

Site Location: 2060 Old Ranch Rd, 1455 Kettle Creek Rd ,10515 Kettle Creek Rd

The following documents have been included and considered as part of this study (checked off by individual(s) preparing the geologic study):

____ Rezoning

_X_ Development Plan

____ Land Use

____ Public Improvement construction drawings

____ Final Plat

ENGINEER'S STATEMENT

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of the City of Colorado Springs Unified Development Code Section, 7.4.5 Geological Hazards. I am qualified as:

X_____ Professional Geologist as defined by C.R.S. § 23-41-208: or,

_____ A professional Geotechnical Engineer licensed by the Colorado State Board of Licensure for Architects, Professional Engineers and Professional Land Surveyors.

Kelli Zigler

Submitted by: Kelli Zigler Date: November 5, 2025

This Geologic Hazard Study Is filed in accordance with the City of Colorado Springs Unified Development Code Section 7.4.5 Geological Hazards.

City Engineering: _____ **Date:** 11/5/2025

Hao Vo

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401

Matthew L. Morgan
State Geologist

November 5, 2025

Hao Vo, P.E.
Engineering Development Review
30 South Nevada Avenue, Suite 401
Colorado Springs, CO 80903

Location:
NE ¼ of NE ¼ of Sec 21 & NW of Sec 28
T12S, R66W of the 6th PM
38.9815°, -104.7886°

Subject: **Kettle Creek, Addition No. 1**
Colorado Springs, El Paso County, CO
City Number STM-REV25-0916; CGS Unique No. EP-26-0033

Dear Hao,

As requested in the City's October 15, 2025, email, the Colorado Geological Survey (CGS) has reviewed the referral. Challenger Communities proposes the annexation and subdivision of approximately 17.4 acres at 2060 Old Ranch Road / Kettle Creek Road into 122 single-family residential lots with private internal streets and a shared detention pond at the southeast corner. Two existing homes and outbuildings would be demolished. Zoning will change from RR-2.5/RR-5 (county) to a City of Colorado Springs PUD. Documents provided for review include the Kettle Creek Annexation DP – Overall Development Plan (N.E.S., Inc., DEPN-25-, October 10, 2025), Development Plan (Matrix, Project No. 24.1684.001, July 23, 2025), and the Preliminary Subsurface Soil Investigation and Geologic Hazard Study (RMG Engineers, Job No. 199648, August 5, 2025). CGS offers the following observations and recommendations.

The proposed development is still in an early review phase. Currently, grading and utility plans have not been submitted, so our review remains preliminary.

CGS generally agrees with RMG's interpretation of site geology, hazard identification, and constraints related to geologic conditions, along with the proposed mitigation measures. Key findings of the RMG report and CGS analysis include:

- Geologic conditions mainly consist of surface eolian sands above Dawson Formation claystone and sandstone.
- Groundwater was found 24 feet below the surface in boring TB-1 during drilling in late June 2025. Seasonal or perched groundwater probably occurs at the boundary between the eolian sand and bedrock, especially during wetter periods.
- Geologic hazards identified (expansive claystone, potentially compressible surficial soils, and perched groundwater) are common for the Colorado Springs area and are not deemed prohibitive.
- The RMG report suitably suggests further subsurface exploration and verification testing after completing the grading plan.

Given the current stage of the application, CGS agrees with the recommendations provided by RMG. Specifically:

1. Submission and review of detailed grading and drainage plans are required.
2. Additional subsurface investigations should be conducted once grading plans are finalized to address seasonal or perched groundwater and site-specific mitigation measures.

3. Foundation and infrastructure designs should follow standard local engineering practices to reduce identified geologic hazards.

CGS is available to provide additional comments after reviewing the detailed grading plans and the updated geotechnical evaluation.

CGS has no objection to approving the preliminary project proposal from a geologic hazard perspective, provided that RMG's report recommendations are strictly followed. If you have questions or need further review, please email me at jlovekin@mines.edu.

Sincerely,

Jonathan R. Lovekin, P.G.
Senior Engineering Geologist

Structural
Geotechnical

Materials Testing
Forensic

PRELIMINARY SUBSURFACE SOIL INVESTIGATION
AND
GEOLOGIC HAZARD STUDY

Proposed New Subdivision
Northeast Corner of Kettle Creek Road and Old Ranch Road
Colorado Springs, Colorado

PREPARED FOR:

Challenger Communities
8605 Explorer Drive, Suite 250
Colorado Springs, CO 80920

JOB NO. 199648

August 5, 2025

Respectfully Submitted,
RMG Engineers

Kelli Zigler

Kelli Zigler
Geotechnical Group Director

Reviewed by,
RMG Engineers

Tony Munger, P.E.
Sr. Geotechnical Proj Mgr | COO

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1.0 STUDY OVERVIEW

RMG – Rocky Mountain Group was retained to perform a Geologic Hazard Study of the site referenced above. The purpose of this study is to identify/characterize geologic conditions present on the site, and present our opinions of the potential effect of these conditions on the currently proposed development of the site.

1.1 Scope and Objective

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

The objectives of our study are to:

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

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

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

1.2 Previous Studies and Field Investigations

Reports of previous geotechnical engineering/geologic investigations specifically addressed to this site or the surrounding developments were reviewed and are referenced below:

- *Subsurface Soil Investigation, Cottages at Kettle Creek, Colorado Springs, Colorado,* prepared by RMG Engineers, Job No. 199362, last dated July 7, 2025
- *Soil and Geology Study, Powers Ranch Subdivision, Lot 2, Kettle Creek, El Paso County, Colorado*, prepared by RMG Engineers, Job No. 197770, last dated July 11, 2025.

- *Soils, Geology and Wastewater Study, Southeast corner of Old Ranch Rd and Otero Ave, Lots 1 and 2, Kettle Creek Estates, Filing No. 2, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 184689, last dated August 7, 2024.
- *Geologic Hazard Evaluation, Cottages at Kettle Creek, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 197353, dated November 22, 2024.
- *Geologic Hazard Evaluation, Hope Chapel of Colorado Springs, Old Ranch Road, Colorado Springs, Colorado,* Job No. 195670, dated February 14, 2024
- *Geologic Hazard Study, Currently addressed as: 2210 Old Ranch Rd, EPC Schedule No. 6228001007, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 182596, last dated June 6, 2022.
- *Preliminary Soils Investigation, currently addressed as: 2210 Old Ranch Road, EPC Schedule No. 6228001007, El Paso County, Colorado Springs, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 182596, dated July 8, 2021.
- *Subsurface Soil Investigation, Currently addressed as: 2295 Old Ranch Road, Lot 7, Spring Crest AMD Filing, El Paso County, Colorado Springs, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 185103, dated November 8, 2021.
- *Subsurface Soil Investigation, 10245 Otero Av, Lot 8, Spring Crest AMD Filing, El Paso County, Colorado Springs, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 184689, dated November 8, 2021.

1.3 Additional Documents

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

2.0 QUALIFICATIONS OF PREPARERS

This Geologic Hazard 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 24 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 is a licensed professional engineer with over 24 years of experience in the construction engineering (residential) field. Mr. Munger and holds a Bachelor of Science in Architectural Engineering from the University of Wyoming. Mr. Munger has supervised and performed numerous geological and geotechnical field investigation programs in Colorado and other states.

3.0 GENERAL SITE AND PROJECT DESCRIPTION

3.1 Site Location

The majority of the project lies in the northwest portion of Section 28 with the exception of the northern portion of the site, which lies in Section 21. The entire site lies within Township 12 South, Range 66 West of the 6th Principal Meridian, in City of Colorado Springs, El Paso County, Colorado. The site is generally located east of the intersection of Old Ranch Road and Kettle Creek Road.

The total calculated area of the three (3) included parcels, as recorded on the El Paso County (EPC) Assessors website, is approximately 17.43 acres. The proposed site development is to consist of rezoning and subdividing the parcels into 122 single-family dwelling units. The included parcels are as follows:

- **El Paso County Parcel Number 6228001006** – the site is currently addressed 2060 Old Ranch Road, is currently zone RR-2.5 – Residential Rural, contains a single-family residence, detached garage, outbuildings, and a well, and consists of 6.64 acres.
- **El Paso County Parcel Number 6228001010** – the site is currently addressed as 10455 Kettle Creek Road, is currently zoned RR-5 / RR-2.5 – Residential Rural, currently is undeveloped vacant land which consists of 5.32 acres.
- **El Paso County Parcel Number 6228001009** – the site is currently addressed as 10515 Kettle Creek Road, is currently zoned RR-2.5 / RR-5 – Residential Rural, contains a single-family residence, detached garage, outbuildings, and a well, and consists of 5.47 acres.

The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

3.2 Existing Land Use and Zoning

Currently the property contains two single-family residences with detached garages and multiple outbuildings. Each residence contains a well and currently are connected to the City of Colorado Springs for sewer service. It is our understanding the property is to be annexed into the City of Colorado Springs and the zoning is anticipated to be PUD – *"Planned Unit Development"*.

3.3 Proposed Development

It is our understanding the existing structures are to be demolished and all resulting debris removed prior to new construction. The wells will likely be abandoned. Based on the Concept Plan provided by N.E.S (not dated), the proposed construction is to consist of 122 single-family dwelling units.

Access it to be provided via the existing Kettle Creek Road extending north from Old Ranch Road, along the western boundary of the property. Shared access is also proposed with the adjacent Cottages at Kettle Creek development to the east.

The plan also includes a detention pond, located near the southeast corner of the property that is to be shared with the property to the east. The Concept Plan is presented in Figure 2.

3.4 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. Prior to 1969 the entire site was undeveloped. Prior to 1969 the two residences were constructed, one to the north (10515 Kettle Creek Road) and one to the south (2060 Old Ranch Rd). Since 1969, outbuildings were added to each residence, but little else on the site has changed to date.

4.0 SITE GEOLOGY AND DESCRIPTIONS

4.1 General Physiographic and Geologic Setting

Based upon review of the *Geologic Map of the Pikeview Quadrangle, El Paso County, Colorado*, our site reconnaissance, and the preliminary subsurface soil investigation included within, the surficial materials are generally comprised of eolian sands and clays that have been deposited by wind on level to gently sloping surfaces.

4.2 Geologic Mapping

The Engineering and Geology Map is presented in Figure 10. The geologic and engineering units mapped on the site are discussed in detail below.

GEOLOGIC UNITS

- *Af – Artificial fill (latest Holocene)* – fill resulting from construction of the existing single-family residences detached garages, outbuildings, and septic areas. This fill was not encountered in the test borings performed by RMG.
- *Qes – Eolian sand (Holocene to late Pleistocene)* – Fine-to coarse- grained silty sand deposited by wind and preserved on surfaces downwind (east) of Monument Creek. Sand is carried to monument Creek by alluvial processes and then blown east of the creek. Typically, it is crudely stratified and non-cohesive. The eolian sand was encountered across the site, in the test borings ranging in depths from the surface down to approximately 12 to 15 feet.
- *$Tkda_2$ – Daswon Formation (Paleocene and Upper Cretaceous)* – The entire site is underlain by the Dawson Formation which consists of light-gray to greenish-gray arkosic sandstone and olive-green to brownish-gray andesitic sandstone interbedded with sandy claystone. The residual and unweathered bedrock material were encountered in its native state and extended to the 20 to 35-foot termination depth of test borings. The Dawson formation within the Pikeview Quadrangle reportedly ranges in thickness from about 300 up to 1,000 feet in areas to the north.

ENGINEERING UNITS

- *2D* - Eolian deposits generally on flat to gentle slopes of upland areas.

4.3 Surficial Deposits

The surficial deposits across the majority of the property consisted of eolian (windblown) silty sand extending to between 6 and 9.5 feet below the surface. Contacts between surficial units may be gradual. It is anticipated the sandy soils are present across the entire site at varying depths and thicknesses. Residual sandy clay derived from the weathering of the underlying claystone within the Dawson Formation was encountered below the surficial sand in all three of the test borings performed by RMG.

4.4 Bedrock Units

The bedrock beneath the site is considered to be part of the Dawson formation (Upper Cretaceous), consisting of sandy claystone and sandstone. The thickness of the Dawson in the area of the site has been estimated to range around 300 feet thick but has been reported to range up to 1,000 feet in the northern portion of the quadrangle, in which this site lies.

The sandstone and claystone were encountered in all three test borings performed for the report referenced above. The bedrock was encountered at depths ranging from approximately 12 to 15 feet below the existing surface. Characteristics of the sandstone bedrock include:

- is generally medium to fine grained and moderately cemented,
- often higher strength and lower plasticity compared to the claystone, and
- may act as perched groundwater zone due to the interbedding with the lower permeability clays.

Characteristics of the claystone bedrock include:

- typically, moderately to highly plastic,
- low to moderate strength (compared to sandstone) in unconfined conditions,
- highly susceptible to moisture-induced volume changes (shrink-swell behaviors), particularly when exposed at or near the surface.
- may exhibit expansive soil behavior depending on the clay content

4.5 Landforms

The landforms within and surrounding the site can generally be described as gently sloping terrain with the upper portion of the slopes blanketed by eolian deposits.

4.6 Structural Features

Structural features such as joints, faults, shear zones, folds, schistocity, and foliation were not observed on the site or in the soil samples collected for laboratory testing. However, review of the *Geologic Map of the Pikeview Quadrangle* and *Map of Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado* indicates there are several geologic faults near the site. These faults are associated with the Ute Pass Fault and

Rampart Range Fault complexes. The Ute Pass Fault lies approximately 6 miles west of the site. According to the CGS, these faults are not considered to be recently active, though the last known activities of the fault complexes are unknown. However, they have been active during geologic times, and the site (and surrounding area) could be affected if one or more of these faults did rupture.

4.7 General Hydrogeology/Groundwater

Groundwater was encountered at 24 feet in TB-1 at the time of drilling on June 30, 2025. TB-2 was located near the center of the site. Seasonal variations in groundwater conditions and subsurface moisture conditions will occur due to variations in rainfall and other factors not readily apparent at this time. Excavations approaching bedrock may encounter groundwater conditions. Groundwater will also likely be influenced by site grading and installation of utilities. It is our understanding Challenger Homes is to construct stiffened slab or crawlspace foundations across the entire site. No basements are currently proposed at this time. Based on discussions with the Client, the overall (proposed) site grading is not known at this time.

4.8 Surface Drainage/Irrigation

Based on a review of the Pikeview Quadrangle, dated 2001 and our site reconnaissance, the presence of springs or potential springs were not observed at or adjacent to the site. According to the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0506G, effective December 7, 2018 and the online ArcGIS El Paso County Risk Map, the entire site lies outside both the 100-year and the 500-year floodplains of Kettle Creek. Kettle Creek is a defined drainageway that is located more than 225 feet to the east of the site, at the nearest point. The majority of the site is more than 500 feet from the creek.

4.9 Geophysical Investigations

Geophysical Investigations were not considered necessary for this investigation.

5.0 SUBSURFACE SOIL INVESTIGATION

5.1 Field and Laboratory Testing

The subsurface conditions below the subject site were investigated by RMG on June 30, 2025, as part of this study. The approximate locations of the RMG test borings are presented in the General Engineering and Geology Map, Figure 10.

The test borings were advanced with a power-driven, continuous-flight auger drill rig to depths of about 20 to 30 feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-1586 utilizing a 2-inch OD split-barrel sampler or in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figures 4 and 5.

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis, Atterberg Limits, and Denver Swell/Consolidation tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. A Summary of Laboratory Test Results is presented in Figure 6. Soil Classification Data are presented in Figure 7. Swell/Consolidation Test Results are presented in Figures 8 and 9.

6.0 POTENTIAL GEOLOGIC HAZARDS AND THEIR BEARING ON INTENDED LAND USE

This section involves the effects of the geologic features upon the proposed grading, construction, and land use, as well as the future effects (if any) of the proposed modifications upon the geological processes in the area. We have identified no geologic conditions that we believe will preclude the development, as currently proposed. The conditions identified herein can be mitigated with typical construction practices common to the Colorado Springs area. 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
- Erosion
- Floodplains
- Ground Subsidence
- Landslides
- Rockfall
- Ponding water
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainageways
- Springs and High Groundwater
- Corrosive Minerals

The Geologic Constraints that may affect this site are:

- Expansive soils and bedrock
- Potentially Compressible Soils
- History of landfill activity or undocumented/uncontrolled fill activity
- Seismic hazard
- Radon

6.1 Expansive Soils and Bedrock

Based on the test borings performed by RMG for this investigation, the sandy clay and claystone bedrock generally possess low to moderate swell potential. It is anticipated expansive clay soils or claystone bedrock will be encountered within some of the building excavations and utility

trenches. We have included conceptual mitigations below that are typical to this region of El Paso County, Colorado. However, the final mitigations for each lot are to be provided at the time of the site-specific subsurface soil investigation, once overlot grading is complete and utilities are installed.

Mitigation

Sporadic areas of expansive soils and bedrock are anticipated along with loose soils that will need to be recompacted. If expansive or loose soils are encountered beneath the foundations, mitigation may be required. "Mass" subexcavation is currently not proposed at this time. Depending on the proposed cut and fill depths and the type of foundation selected (stiffened slab or crawlspace), "mass" subexcavation may be considered to provide uniform soil and density across the site or to reduce the quantity of lot-specific overexcavations that are required at the time of home construction.

Overexcavation and replacement with non-expansive soils at a minimum of 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557) is a suitable mitigation. Floor slabs bearing directly on expansive material should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movement. Overexcavation is not anticipated for the majority of the lots, however if clay or claystone seams are encountered, overexcavation depths of 3 to 4 feet are anticipated. Moisture conditioning and recompacting the on-site clays would also be considered another form of mitigation for expansive soils. If moisture-conditioning and recompacting the on-site clays is selected, the builder must understand the use of these soils provides a higher risk of slab movement vs using non-expansive granular soils.

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.

6.2 Potentially Compressible Soils

The surficial alluvial soils may exhibit compressible characteristics. These soils were encountered across the entire site to depths ranging between 6 and 9.5 feet. The soils are moderately compacted in their native state and are of various grain sizes.

It is our opinion that the risks to the proposed structures at this site posed by compressible and/or hydrocompactive soils are generally low for lowly- to moderately-loaded structures. However, a site-specific subsurface soil investigation must be performed for each future building and should consider mitigations for compressible/hydrocompactive soils. We have included general mitigation concepts below that are typical to this region of El Paso County, Colorado.

Mitigation

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 compressible/loose soils is not considered to pose a risk to the proposed structures.

Removal and replacement will likely be required if loose soils are encountered and/or for some moderately- to heavily-loaded structures, if proposed. Subexcavation is currently not proposed by the contractor, but may be considered to mitigate loose soils through a "mass" removal and replacement to reduce the occurrence of lot-specific mitigations during construction. If subexcavation is preferred, we would recommend at a minimum of 2 feet below the bottom of all foundation components be removed, replaced, and recompacted prior to construction of the structures. Additional recommendations are included in **Section 12** of this report.

Additionally, the potential for settlement is directly related to saturation of the soils below foundation areas. It is critical that good surface and subsurface drainage be maintained throughout the life of the structures to reduce the potential for saturation of these soils.

6.3 History of Landfill or Uncontrolled/Undocumented Fill Placement

The site does not have a known history of landfill activity. Fill soils were not encountered in the test borings performed for this study. However, existing structures are present on the southern and northern ends of the property. Fill soils will likely be encountered in the vicinity of the existing structures. It is our understanding the structures are to be removed prior to overlot grading.

Mitigation

If any man-placed fill is encountered during development and/or construction, it is considered unsuitable for support of foundations. These soils (e.g. berms, exterior backfill from existing structure) should be removed (overexcavated) and replaced with compacted structural fill prior to placement of any new fill or structures. The on-site sands generally can be used as structural fill if all organics have been removed. The zone of overexcavation shall extend to the bottom of the unsuitable fill zone and shall extend at least that same distance beyond the building perimeter (or lateral extent of any fill, if encountered first). Provided that these recommendations are implemented, the presence of this fill is not considered to pose a risk to the proposed new structures.

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

6.4 Seismic Hazard

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. 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 in the vicinity of the Ute Pass Fault, but 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 are more likely to affect structures at this site, and will likely only affect slope stability to a minimal degree.

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.

The following recommended Seismic Design Parameters are based upon Seismic Site Class D, and a 2 percent probability of exceedance in 50 years. The Seismic Design Category is "B".

Period (sec)	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S_s	0.206	F_a	1.6	S_{ms}	0.329	S_{ds}	0.219
1.0	S_1	0.058	F_v	2.4	S_{m1}	0.139	S_{d1}	0.093

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

6.5 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. The US EPA has set an action level of 4 pCi/L. At or above this level of radon, the EPA recommends you take corrective measures to reduce your exposure to radon gas".*

Most of Colorado is generally considered to have the potential for high indoor levels of radon gas, based on the geology, soils, construction type and aerial radiation measurements that have been gathered from indoor testing by the Colorado Department of Public Health and Environment (CDPHE), Radon Outreach Program and Colorado Environmental Public Health Tracking the information provided at https://www.colorado.gov/pacific/cdphe/colorado-radon-zones.

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. 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.

6.6 Proposed Cuts and Fills

The majority of the site is generally flat, with approximately 30 to 33 feet of fall across the entire site from the north to south. The anticipated fall across each building site is anticipated to have 1 to 2 feet of fall if overlot grading is minimal. Slopes within the proposed building site are to be shallower than 5 percent. It is our understanding that the extent of cuts and/or fills has not yet been determined, but it is anticipated that limited cuts and fills will be performed for the site.

Mitigation

We anticipate that the deepest excavation cuts for slab on grade and/or crawlspace construction will be approximately 3 to 4 feet below the proposed ground surface, not including overexcavation depths (if required). We believe the surficial soils will classify as Type C materials as defined by OSHA in 29CFR Part 1926, dated January 2, 1990. OSHA requires temporary slopes made in Type C materials be laid back at ratios no steeper than 1.5:1 (horizontal to vertical) unless the excavation is shored or braced. Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur.

6.7 General Compatibility of Natural Features with Proposed Land Use

Natural features impacting the proposed development and their associated mitigation recommendations are presented in the relevant sections above.

Provided that the recommendations within this report and the referenced reports are adhered to, the proposed construction is not anticipated to adversely impact the natural features on surrounding properties.

Mitigation

Prior to placement of overlot fill or removal and recompaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned to facilitate compaction, and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

If unsuitable fill soils are encountered at the time of construction for the single-family residences, they should be removed (overexcavated) and replaced with compacted structural fill. The zone of overexcavation shall extend to the bottom of the unsuitable fill zone and shall extend at least that same distance beyond the building perimeter (or lateral extent of any fill, if encountered first). Provided that this recommendation is implemented, the presence of this fill is not considered to pose a risk to proposed structures.

We anticipate that the deepest excavation cuts for slab on grade and crawlspace construction will be approximately 3 to 4 feet (not including subexcavation if utilized) below the existing ground surface. Basements are currently not proposed. We believe the clay and claystone will classify as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type B materials be laid back at ratios no steeper than 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).

It is our opinion that no additional mitigation measures (aside from those already described in the sections above) are required.

7.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 6 of this report) were not found to be present at this site. Geologic constraints (also as described in section 6 of this report) such as: expansive soils and bedrock, faults, seismicity, and radon were found on the site. Where avoidance is not readily achievable, it is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and contraction practices.

8.0 EARTHWORK

8.1 Granular Structural Fill

Granular Structural Fill shall consist of granular, non-expansive material. If materials are to be imported for use as structural fill, they should be approved by RMG prior to delivery to the site. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement.

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, moisture conditioned, and compacted as indicated in the table below. After preparation of the subgrade, structural fill placement can commence. Granular Structural Fill should be placed in loose lifts not exceeding 12 inches, and shall be moisture-conditioned and compacted as indicated in the table below.

8.2 Moisture-Conditioned Structural Fill

Only approved materials as described above may be used for Moisture-Conditioned Structural Fill. If materials are to be imported for use as structural fill, they should be approved by RMG prior to delivery to the site. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement.

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, moisture conditioned, and compacted as indicated in the table below. After preparation of the subgrade, structural fill placement can commence. Moisture-Conditioned Structural Fill shall consist of a moisture-conditioned, on-site (expansive) fill material. The fill material shall be processed 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 between 1% and 4% 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, but shall be moisture-conditioned to between 1% and 4% above optimum moisture content.

- Moisture-Conditioned Structural Fill should be placed in maximum 6" compacted lifts. These materials shall be moisture-conditioned and compacted as indicated in the table below.

Material not meeting the above requirements shall be reprocessed.

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 clay and claystone materials 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 sub-excavation 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 1.5 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 sub-excavation 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 sub-excavation 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.

8.3 All Structural Fill

Note, the foundation shall be supported entirely atop one type of structural fill. Materials to be used for structural fill are to be moisture-conditioned and compacted as follows:

Soil Type	Moisture-Conditioning	Compaction
Native Subgrade	As required to facilitate compaction (generally within 2% of Optimum Moisture Content)	95% of Standard Proctor or 92% of Modified Proctor
Granular Structural Fill	As required to facilitate compaction (generally within 2% of Optimum Moisture Content)	
Moisture-Conditioned (Expansive) Structural Fill	Between 1% and 4% above Optimum Moisture Content	

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.

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.

Earthwork operations should be observed and compaction of structural fill materials should be tested by the project's geotechnical consultant (additional fees apply for observations and testing of fill). It is the **responsibility of the builder or contractor to schedule with this office** to conduct compaction tests, retrieve or accept delivery of a fill sample, or certify the fill material. Early testing is recommended to demonstrate that placement and compaction methods are achieving the required compaction for the entire depth of fill. Without a strict quality assurance program, the fill may not be of sufficient quality to achieved required performance.

8.4 Proposed Grading, Cuts, and Masses of Fill

Preliminary grading plans were not provided or reviewed by RMG at the time the report was issued. It is assumed (based on the test borings for this investigation) that the excavations will encounter silty to clayey sand (man-placed and native) and sandy clay. The on-site sand soils mixed with the sandy clay can generally be used as site grading fill or structural fill.

Prior to placement of overlot fill or removal and recompaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned as noted above, and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

8.5 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.

9.0 BURIED UTILITIES

Based upon the conditions encountered in the test borings, we anticipate that the soils encountered in individual utility trench excavations will consist mostly of native or moisture-conditioned on-site soils comprised of a combination of soils ranging from silty to clayey sand, sandy clay, and claystone bedrock. It is anticipated the silty to clayey sand will be encountered at loose to medium dense densities. The sandy clay will likely be encountered at stiff to very stiff densities and claystone at medium hard to very hard relative densities. Bedrock conditions are anticipated within the utility trenches.

We believe the silty to clayey sand will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type C materials be laid back at ratios no steeper than 1.5:1 (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.

We believe the clay and claystone will classify as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type B materials be laid back at ratios no steeper than 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.

10.0 PRELIMINARY PAVEMENT RECOMMENDATIONS

The discussion presented below is based on the subsurface conditions encountered in the test borings, laboratory test results and the project characteristics previously described. If the subsurface conditions are different from those described in this report or the project characteristics change, RMG should be retained to review our recommendations and modify them, if necessary. The preliminary sections presented below should be verified by a subsurface soil investigation and pavement design prior to construction.

10.1 Subgrade Preparation

The upper two feet of material encountered in the pavement boring location consisted of a combination of sand with various amounts of silt and clay. This soil is generally considered “fair” as subgrade material. However, without knowing the proposed cut and fill depths, the pavement support materials may include a mixture of the on-site soils.

The on-site sand soils encountered in the Test Borings are suitable as subgrade material. All subgrade material placed below pavements should be moisture conditioned and compacted in accordance with the recommendations presented herein.

Clay soils typically are generally considered unsuitable for pavement support because they lack long-term stability and strength, and are prone to swelling and heaving upon wetting. We anticipate that clay soils and claystone bedrock, where encountered within 2 feet of the proposed pavement,

may require removal to a depth of at least **16-24 inches** below the bottom of the ABC layer. This requirement is to be verified with a pavement design prior to construction. The exposed soil should be proofrolled with a heavy pneumatic-tired vehicle to a firm and unyielding condition. After proofrolling, backfill with **16-24 inches** of compacted granular non-expansive soil installed in 8-inch loose lifts, moisture conditioned to **within 2 percent** of optimum moisture, and compacted to **95%** of Modified Proctor value as determined by ASTM D-1557. The backfill soil may consist of crushed concrete, decomposed granite, well-graded sand and gravel, CDOT classified road base, or other similar material.

Prior to placement of the pavement section, the final subgrade should be scarified to a depth of 12 inches, adjusted to within 2 percent of the optimum moisture content and recompacted. The subgrade should then be proof-rolled with a heavy, pneumatic tired vehicle. Areas that deform under wheel loads should be removed and replaced. Base course atop subgrade should be compacted to at least 95 percent of the maximum Modified Proctor density (ASTM D1557). Note, areas with silt and/or clay soils present immediately below the proposed pavement may require overexcavation and replacement with on-site sand soils, prior to placement of the ABC and HMA sections.

10.2 Preliminary Pavement Thickness

The final pavement thicknesses shall be determined by a pavement design investigation performed once the utilities are installed and the roadways are rough-graded. Preliminary estimates of pavement sections for the paved areas are 4 inches of Hot-Mix Asphalt (HMA) over 6 to 8 inches of Aggregate Base Course (ABC).

As an alternative to a composite HMA/ABC section, a 5- to 6-inch section of Portland Cement Concrete Pavement (PCCP) may be used. Rigid concrete pavements may be constructed directly on proof-rolled non-expansive granular subgrade, the top one foot of which has been compacted to a minimum of 95% of maximum dry density as determined by ASTM D1557.

These recommendations are for preliminary planning purposes only. A subsurface soil investigation and pavement design should be performed once overlot grading and utility installation are completed to determine the final pavement sections.

10.3 Pavement Materials

Pavement materials should be selected, prepared, and placed in accordance with the above referenced document and the *Pikes Peak Region Asphalt Paving Specifications*. Tests should be performed in accordance with the applicable procedures presented in the specifications.

10.4 Surface Drainage

Surface drainage is important for the satisfactory performance of pavement. Wetting of the subgrade soils or base course will cause a loss of strength which can result in pavement distress. Surface drainage should provide for efficient removal of storm-water runoff. As a general rule, parking area surfaces should have a minimum slope of 2 percent (approximately ¼ inch per foot).

Water should not be allowed to pond on the pavement or along the edges of the pavement, and areas adjacent to the pavement should be designed to provide positive drainage away from the paved surface.

11.0 ANTICIPATED FOUNDATION SYSTEMS AND DRAINS

11.1 Foundation Systems

Based on the information presented previously, conventional shallow foundation systems are anticipated to be suitable for the proposed residential structures. It is our understanding a combination of stiffened slab-on-grade and crawlspace foundations are proposed for the lots. Typical foundation cuts are anticipated to be approximately 3 to 4 feet below the final ground surface for slab on grad and crawlspace foundations, not including subexcavation, where performed.

Depending on the proposed cuts and fills, expansive soils and/or bedrock may be encountered in some of the excavations at foundation and floor slab bearing levels. Removal and replacement with structural fill is anticipated. This can be accomplished through "mass" subexcavation and replacement with moisture-conditioned expansive soils/bedrock during land development operations, lot-specific overexcavation and replacement with structural fill during construction, or a combination of the two. However, it should be noted that the use of subexcavated and moisture-conditioned expansive soils as fill below foundations may result in a condition that is not suitable for all shallow foundations.

It must be understood that the subexcavation and replacement process does not guarantee that the swell potential will be reduced to acceptable levels. It is possible that the expansive material will retain swell potential in excess of the allowable value presented herein, even after processing and moisture-conditioning. In such a case, the material will need to be removed, reconditioned, and replaced until the swell potential is reduced to the stated value.

If (at the time of the lot-specific subsurface soil investigation and/or the open excavation observation) the soil is found to possess swell potential in excess of acceptable levels for the foundation system and design parameters proposed for construction at that time, overexcavation and replacement of some or all of the previously placed fill material may be required.

It is also possible that material that was properly conditioned, placed, and compacted during the subexcavation process will require removal (overexcavation) and replacement at the time of construction. The swell potential of the moisture-conditioned structural fill is dependent on many factors, including (but not limited to) density/degree of compaction, moisture content (particularly changes that occur in the moisture content from the time of placement to the time of actual foundation construction), etc. Additionally, various construction processes which can adversely affect the performance of moisture-conditioned structural fill are completed at times before and after our observations, as well as between the time of land development and when the lot-specific foundation is constructed.

While the subexcavation and replacement process is generally considered suitable for use with shallow foundation types, it may result in design parameters that are not consistent with the future builder(s)' pre-existing foundation designs. In such a case, the builder would either need to obtain a foundation designed for parameters consistent with the subsurface soil conditions present at that time, or perform additional mitigation (in most cases, this consists of overexcavation and replacement with material suitable to provide the design parameters utilized in that pre-existing foundation design).

The final foundation design parameters are to be determined based on lot-specific subsurface soil investigations performed at the time of construction. However, for a structure supported atop moisture-conditioned structural fill, the maximum allowable bearing pressures are anticipated to be in the range of 1,500 to 2,000 psf with minimum dead loads in the range of 800 to 1,500 psf. For a structure supported atop granular, non-expansive structural fill, the maximum allowable bearing pressures are anticipated to range from 2,000 to 2,400 psf with no minimum dead load requirement.

The foundation designs 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.

11.2 Foundation Drains

A subsurface perimeter drain is recommended around portions of the structures which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas. Subsurface perimeter drains are not required for stiffened slab-on-grade foundations.

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

12.0 SUBEXCAVATION AND REPLACEMENT

The proposed lots within the proposed development contain a variety of soils near the surface that are anticipated to effect the performance of foundations and floor slabs. Subexcavation of the expansive soils and/or loose soils may be required on a lot-by-lot basis or mitigated on a "mass" basis during overlot grading operations. "Mass" subexcavation and replacement with moisture-conditioned structural fill is considered an acceptable alternative to the typical lot-by-lot overexcavations.

It is our understanding that "mass" subexcavation below the lots/roadways during the development phase and replacement with moisture conditioned and recompacted on-site material is being considered as an alternative to overexcavation and replacement at the time of construction. The subexcavation enhances the performance of the foundations, roadways, and flatwork during the early earthwork for the subdivision vs on a lot by lot basis later.

Where subexcavation is to be performed, vegetation, organic and deleterious material shall be cleared and disposed of in accordance with applicable requirements prior to performing excavation and/or filling operations.

The subexcavation below the proposed buildings should extend to minimum depths of 2 to 4 feet below the bottom of all proposed foundations components (4 feet where clay soils are within 4 feet of proposed foundations or roadways, or 2 feet where clay soils are not present within that distance), and at least those same distances (laterally) beyond the proposed "buildable" area on each lot. The exposed subgrade soil and the proposed replacement fill should be prepared, moisture-conditioned, and compacted as noted in **Section 8** of this report.

13.0 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, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction. We recommend that a *lot-specific* subsurface soil investigation be performed for the proposed structures. The extent of any fill soils encountered during the lot-specific investigation(s) should be evaluated for suitability to support the proposed structures prior to construction.

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

14.0 RECOMMENDATIONS

Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure and the slope to the north. Owners should maintain the surface grading and drainage recommended in a site-specific subsurface soil investigation that will need to be completed prior to construction of the structures, 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.

The recommendations in this and the referenced reports 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.

It is important for the potential owner of this lot to read and understand this report, as well as the previous reports referenced above) carefully to familiarize themselves with the landslide hazards associated with residential construction in this subdivision. This report only addresses the geologic constraints contained within the boundaries of the lot referenced above.

15.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified (expansive soils and bedrock, faults, seismicity, and radon) are not considered unusual 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 local construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be implemented. 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.

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

Foundation selection and design should consider the potential for subsurface expansive soil-related movements. Mitigation techniques commonly used in the El Paso County area include overexcavation and replacement with structural fill, sub-excavation and replacement with on-site moisture-conditioned soils, and/or the installation of deep foundation systems all of which are considered common construction practices for this area.

We believe the clay and claystone will classify as Type B as defined by OSHA in 29CFR Part 1926, date January 2, 1990. OSHA requires temporary slopes made in Type B materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) unless the excavation is shored or braced. Flatter slopes will likely be necessary should groundwater conditions occur.

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.

15.1 Geologic Hazard Disclosure Statement

It is required by the City of Colorado Springs Engineering Criteria Manual (Chapter 3 Section 3.7) that the following disclosure statement be placed on each site plan:

This property is subject to the findings summary and conclusions of a Geologic Hazard Study prepared by RMG – Rocky Mountain Group, amended August 5 2025, which identified the following specific geologic constraints on the property: expansive soils/bedrock, potentially compressible soils, artificial fill/uncontrolled fill, seismicity and radon. A copy of said report has been placed within the subdivision file of the City of Colorado Springs Planning and Development Team. Contact the Planning and Development Team, 30 South Nevada Avenue, Suite 105, Colorado Springs, CO, if you would like to review said report.

16.0 CLOSING

This report has been prepared for the exclusive purpose of providing geologic hazards information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

This report has been prepared for the exclusive use by **Challenger Communities** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical and geological engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers 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

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

APPENDIX A - ADDITONAL REFERENCED DOCUMENTS

1. *Geology and Soils Report with Wastewater Study, Lot 10, Lot K, Lot L, Springs Crest Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 162650, last dated January 7, 2019.
2. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0506G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018. *FEMA Flood Map Service Center:* https://msc.fema.gov/portal/search?AddressQuery=2295%20old%20ranch%20road%2C%20colorado%20springs%2C%20colorado#searchresultsanchor
3. *Geologic Map of the Pikeview 7.5 Minute Quadrangle, El Paso Couny, Colorado*, By Jon P. Thorson, Christopher J. Carroll, and Matthew L. Morgan, Geological Survey Open-File Map 01-3.
4. *Pike View Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
5. *Pike View Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Reconnaissance Geologic Map of Colorado Springs and Vicinity, Colorado,* Department of the Interior United State Geologic Survey, prepared by Glenn R. Scott and Reinhord A. Wobus, Miscellaneous Field Studies, Map MF-482, Sheets 1 and 2, 1973.
7. *Colorado Springs Landslide Susceptibility, Colorado Geological Survey:* https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=5e7484a637c4432e84f4f16d0af306d3
8. *Colorado Landslide Inventory, Colorado Geological Survey:* https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=9dd73db7fbc34139abe51599396e2648.
9. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
10. *City of Colorado Springs, Subdivision Document Viewer:* http://www.springsgov.com/SubDivView/default.asp?cmdGoBack=New+Search....
11. *El Paso County Assessor, El Paso County, Colorado:* https://property.spatialest.com/co/elpaso/#/property/6228005030 and
12. *Colorado Geological Survey, USGS Geologic Map Viewer*: http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
13. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1960, 1969, 1999, 2005, 2009, 2011, 2013, 2015, 2017, 2019, and 2021..
14. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Images dated 1950, 1951, 1956, 1657, 1963, 1966, 1970, 1974, 1977, 1994, 2001, 2013 and 2023.
15. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2015, 2017, and 2018-2024.

FIGURES

NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects
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

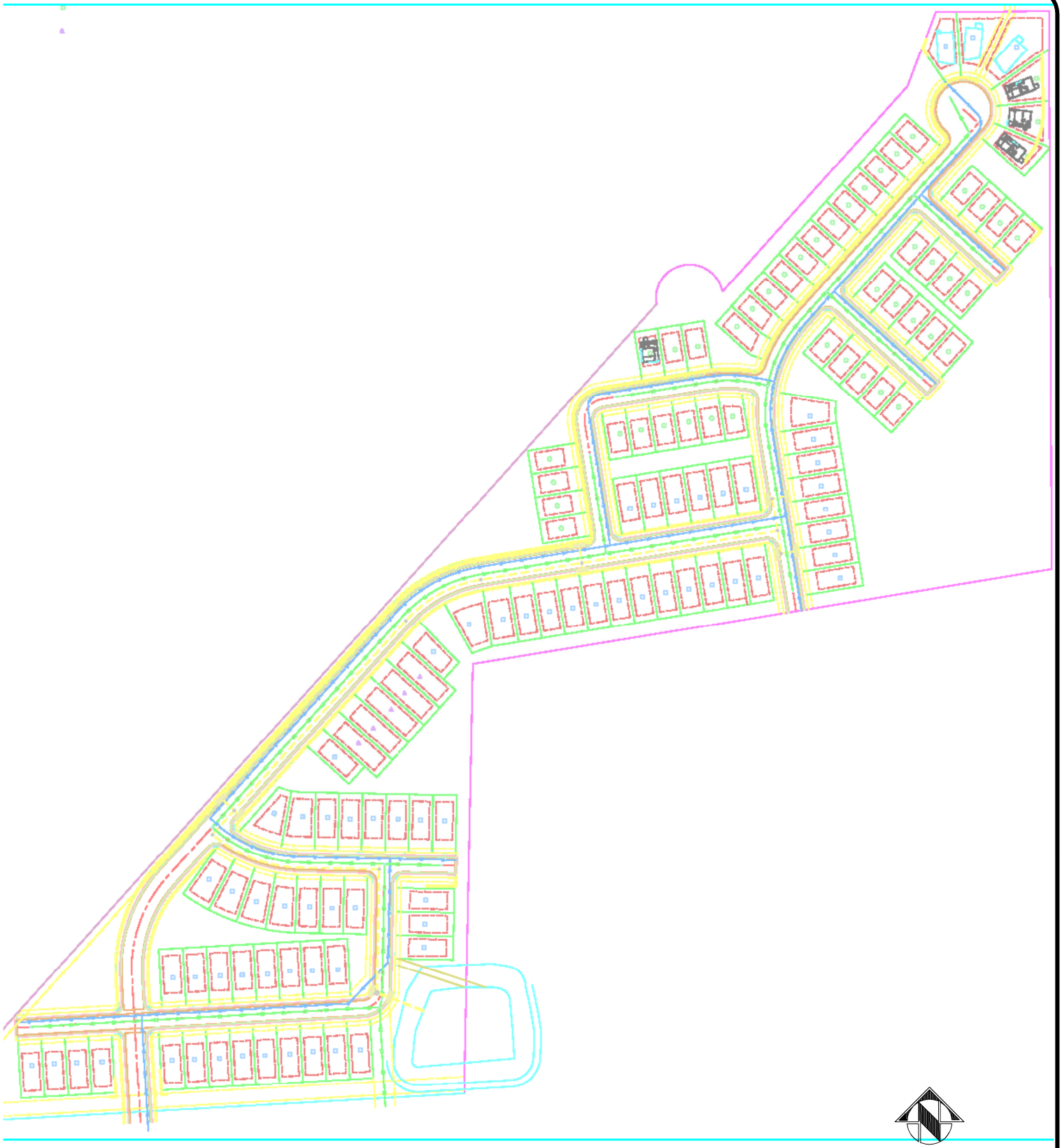
SITE VICINITY MAP

PROPOSED SUBDIVISION
EL PASO COUNTY, CO
CHALLENGER COMMUNITIES

JOB No. 199648

FIG No. 1

DATE 8/5/2025



NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects

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CONCEPT PLAN

PROPOSED SUBDIVISION
EL PASO COUNTY, CO
CHALLENGER COMMUNITIES

JOB No. 199648

FIG No. 2

DATE 8/5/2025

SOILS DESCRIPTION


CLAYEY SAND


CLAYSTONE


SANDY CLAY


SILTY SAND

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
5085 LIST DRIVE, SUITE 200
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 (%)

ROCKY MOUNTAIN GROUP

Structural Forensics

RMG

Geotechnical Materials Testing

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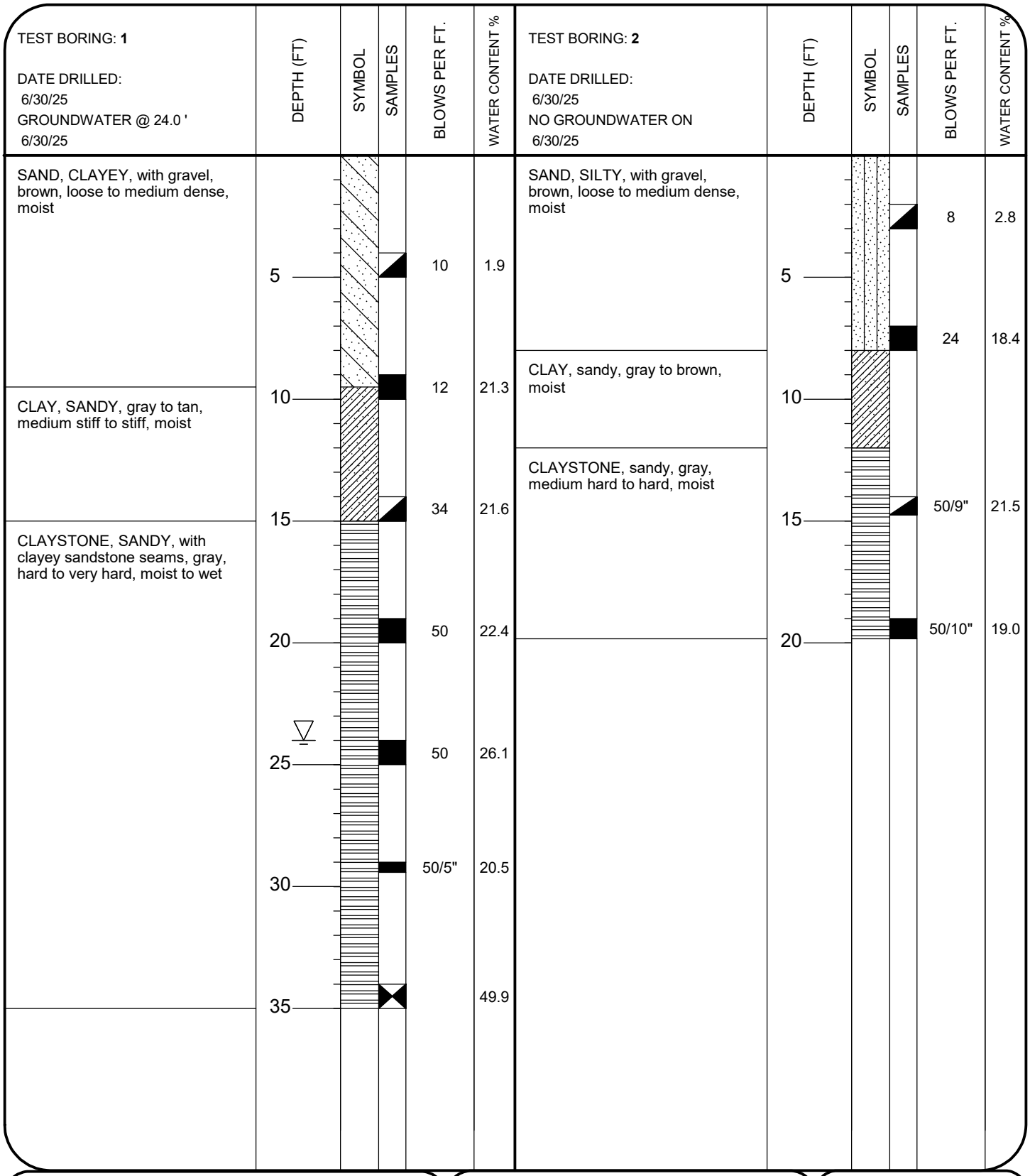
5085 List Drive, Suite 200
Colorado Spings, CO 80918
(719) 548-0600
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 199648

FIGURE No. 3

DATE Aug/05/2025



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TEST BORING LOG

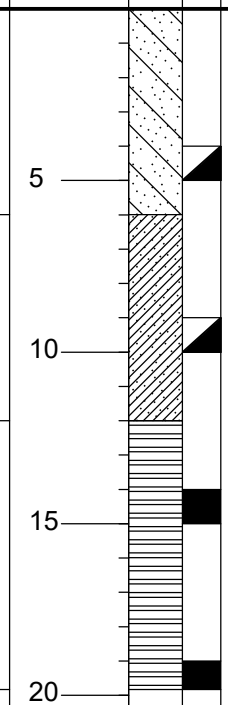
JOB No. 199648

FIGURE No. 4

DATE Aug/05/2025

TEST BORING: **3**

DATE DRILLED:
6/30/25
NO GROUNDWATER ON
6/30/25



DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5		16	16.5
10		42	26.3
15		37	21.7
20		50/10"	24.0

SAND, clayey, with gravel, brown, medium dense, moist

CLAY, sandy, tan, very stiff, moist

CLAYSTONE, sandy, tan, with rust staining, medium hard to hard, moist

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TEST BORING LOG

JOB No. 199648

FIGURE No. 5

DATE Aug/05/2025

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	1.9		NP	NP	9.3	8.0			SW-SM
1	9.0	21.3								
1	14.0	21.6	108.4					1,000	1.4	
1	19.0	22.4				3.7	37.4			
1	24.0	26.1								
1	29.0	20.5								
1	34.0	49.9								
2	2.0	2.8								
2	7.0	18.4		NP	NP	0.0	57.8			ML
2	14.0	21.5	102.2					1,000	2.5	
2	19.0	19.0								
3	4.0	16.5								
3	9.0	26.3	100.2	73	38	0.0	26.5	1,000	0.6	SM
3	14.0	21.7								
3	19.0	24.0								

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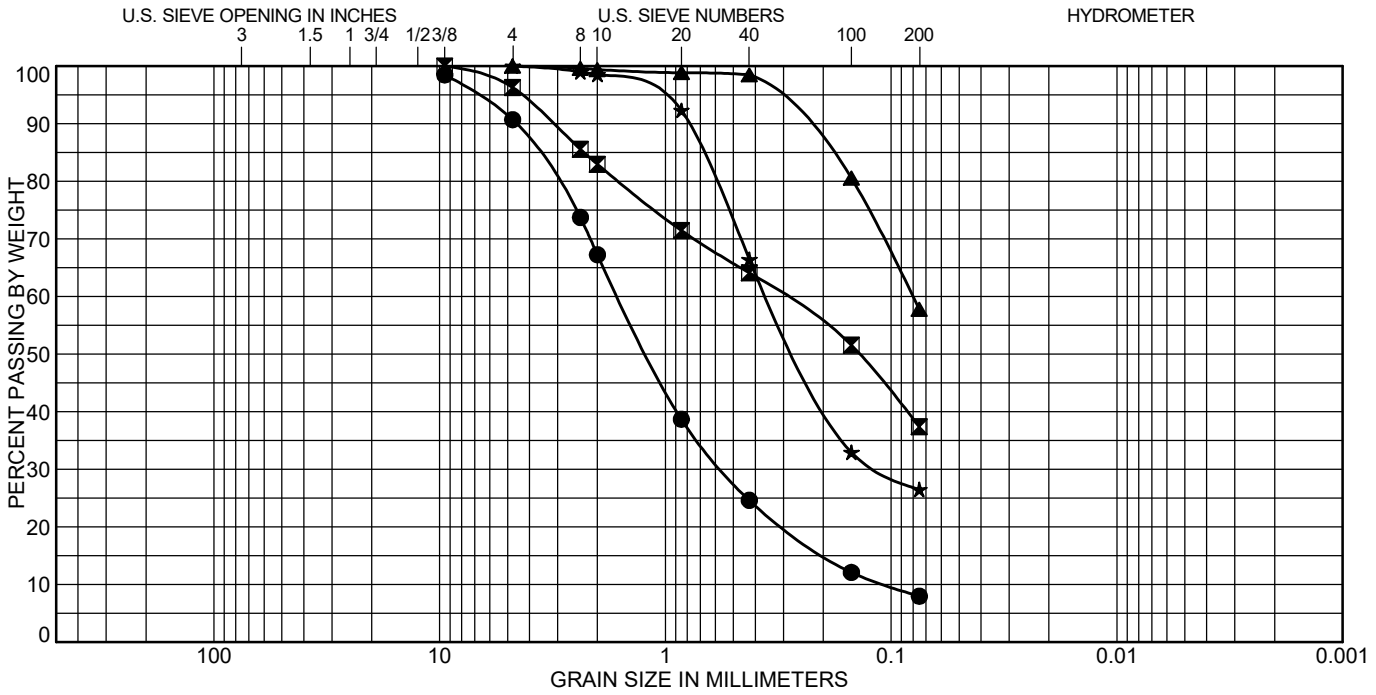
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 199648
FIGURE No. 6
PAGE 1 OF 1
DATE Aug/05/2025



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	4.0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP
⊠	1	19.0				
▲	2	7.0	SANDY SILT(ML)	NP	NP	NP
★	3	9.0	SILTY SAND(SM)	73	35	38

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0	7.8	82.7	8.0	
⊠	1	19.0	3.7	58.9	37.4	
▲	2	7.0	0.0	42.2	57.8	
★	3	9.0	0.0	73.5	26.5	

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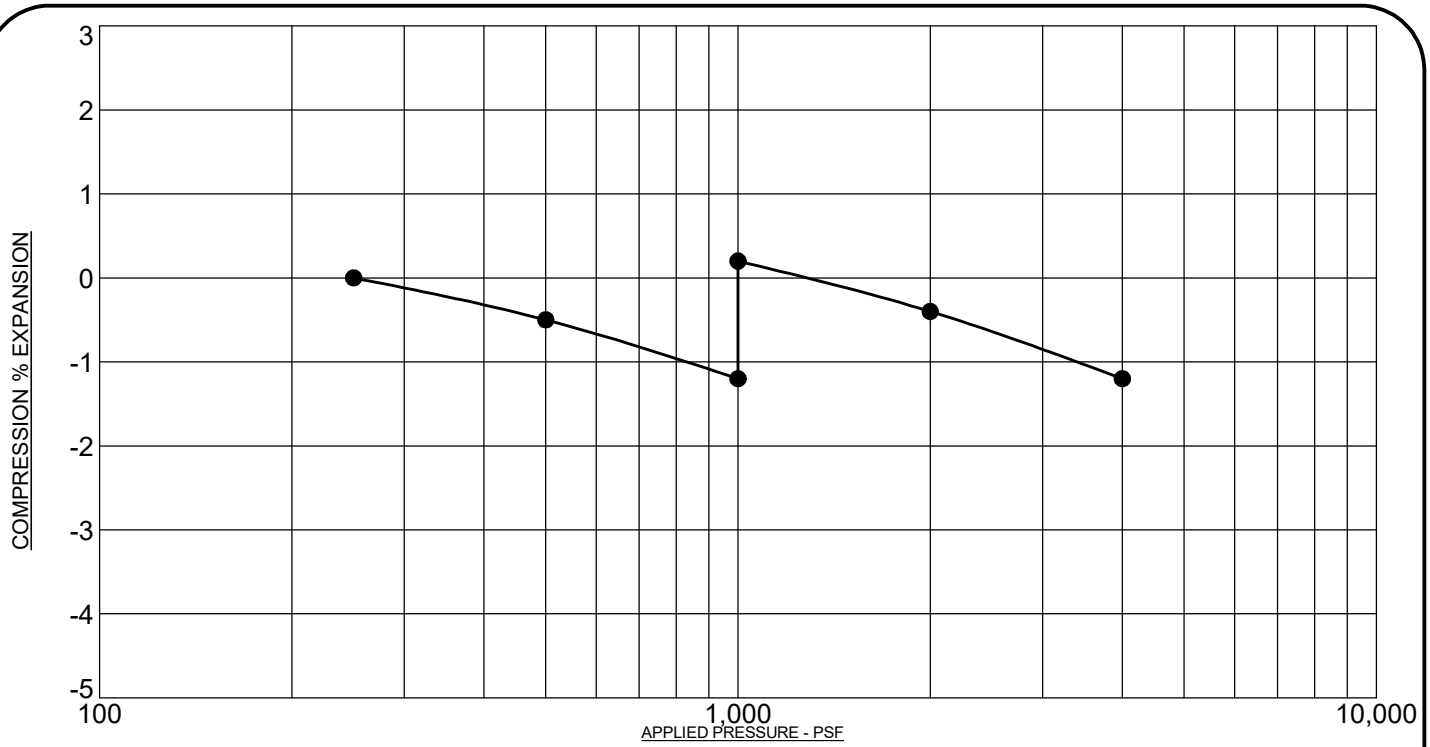
SOIL CLASSIFICATION DATA

JOB No. 199648

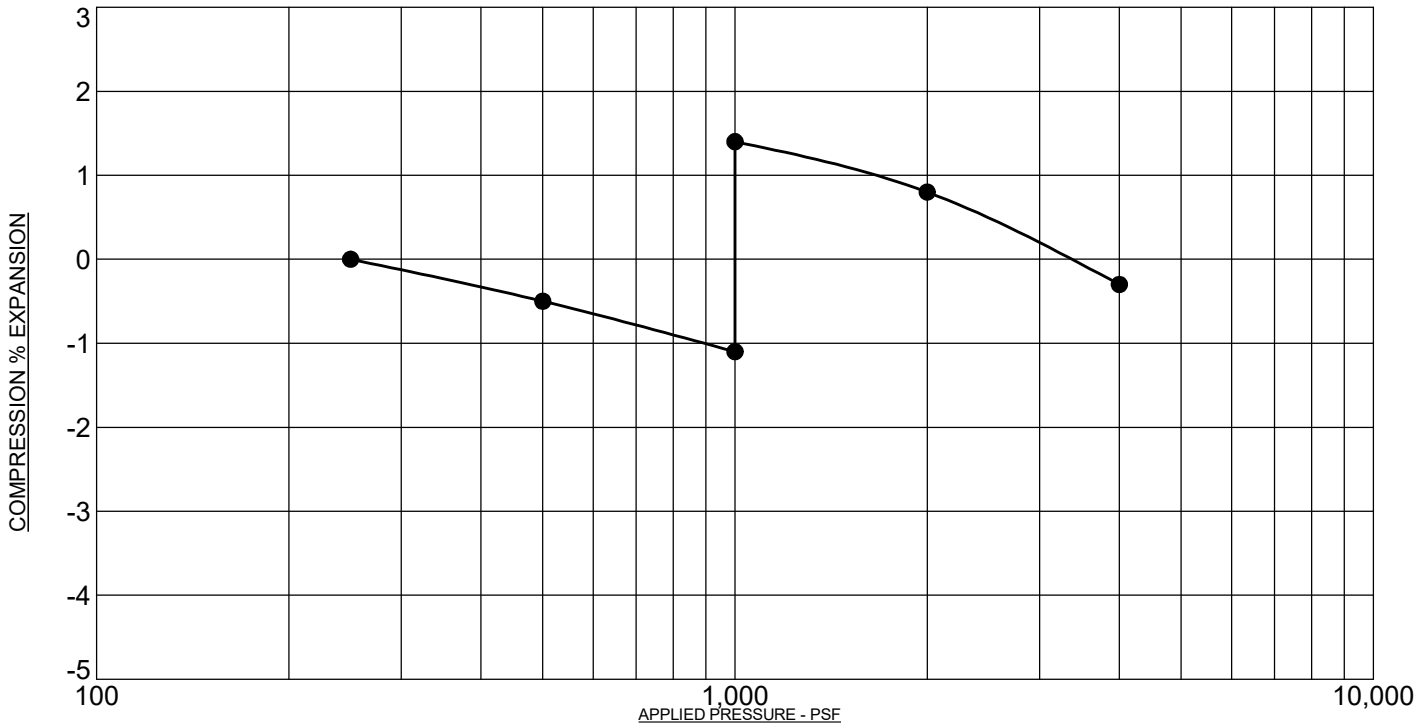
FIGURE No. 7

DATE Aug/05/2025



PROJECT: **Kettle Creek Rd, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **SANDSTONE, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **108.4 PCF**
NATURAL MOISTURE CONTENT: **27.0%**
PERCENT SWELL/COMPRESSION: **1.4**



PROJECT: **Kettle Creek Rd, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **2 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **102.2 PCF**
NATURAL MOISTURE CONTENT: **21.5%**
PERCENT SWELL/COMPRESSION: **2.5**

ROCKY MOUNTAIN GROUP

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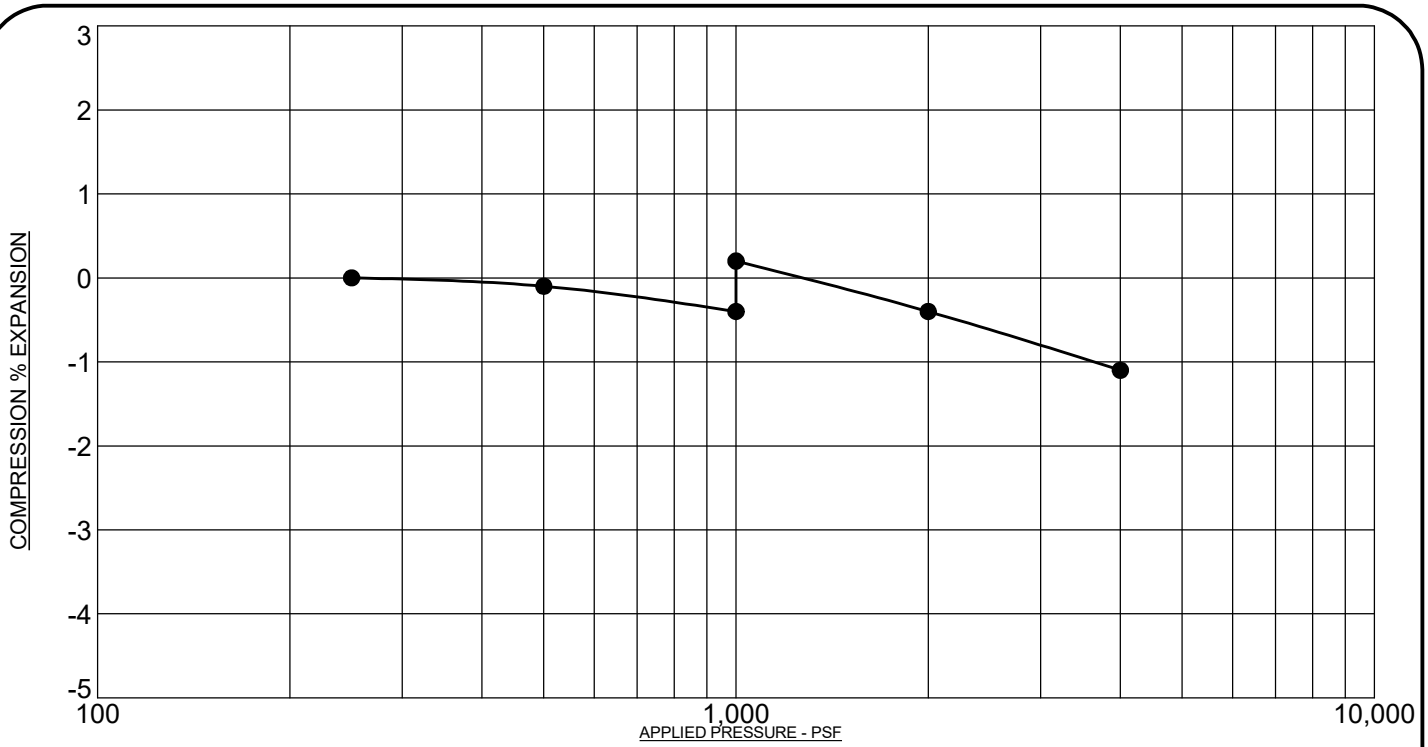
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 199648

FIGURE No. 8

DATE Aug/05/2025



PROJECT: **Kettle Creek Rd, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **3 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **100.2 PCF**
NATURAL MOISTURE CONTENT: **26.3%**
PERCENT SWELL/COMPRESSION: **0.6**

ROCKY MOUNTAIN GROUP

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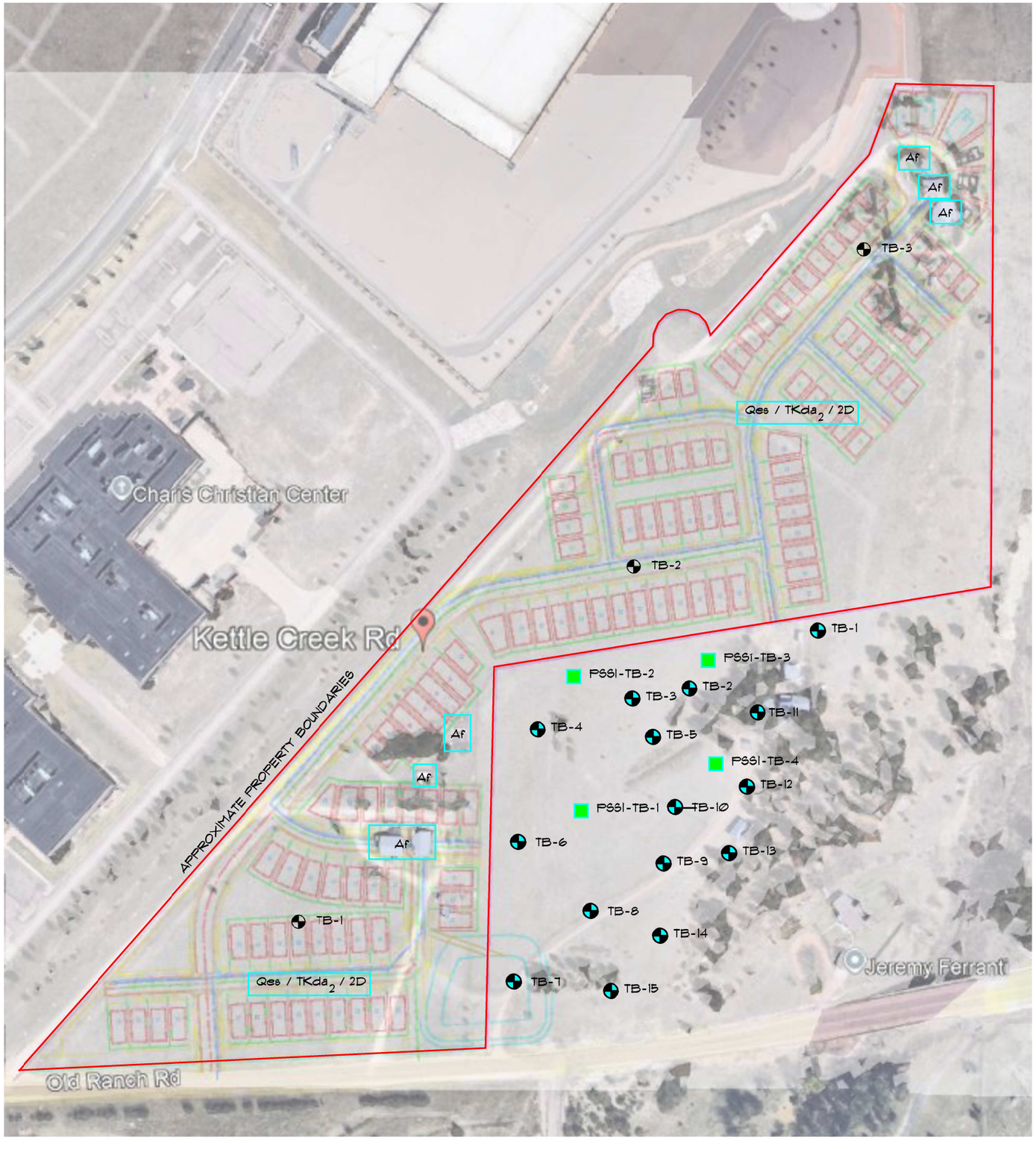
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 199648

FIGURE No. 9

DATE Aug/05/2025



LEGEND

GEOLOGIC UNITS

- *Af - Artificial fill (latest Holocene)* - fill resulting from construction of the existing single-family residences detached garages, outbuildings, and septic areas. This fill was not encountered in the test borings performed by RMG.

- *Qes - Eolian sand (Holocene to late Pleistocene)* - Fine-to coarse-grained silty sand deposited by wind and preserved on surfaces downwind (east) of Monument Creek. The eolian sand was encountered across the site, in the test borings ranging in depths from the surface down to approximately 6 to 9.5 feet.

- *$Tkda_2$ - Dawson Formation (Paleocene and Upper Cretaceous)* - The entire site is underlain by the Dawson Formation. The residual and unweathered bedrock material were encountered in its native state and extended to the 20 to 35-foot termination depth of test borings. The Dawson formation within the Pikeview Quadrangle reportedly ranges in thickness from about 300 up to 1,000 feet in areas to the north.

ENGINEERING UNITS

- *2D* - Eolian deposits generally on flat to gentle slopes of upland areas.

DENOTES APPROXIMATE LOCATION OF TEST BORINGS PERFORMED FOR THIS INVESTIGATION

DENOTES APPROXIMATE LOCATION OF TEST BORINGS PERFORMED FOR COTTAGES AT KETTLE CREEK, RMG JOB NO. 199362, DATED JUNE 23, 2025

DENOTES APPROXIMATE LOCATION OF TEST BORINGS PERFORMED FOR THE PRELIMINARY SOILS INVESTIGATOIN, RMG JOB NO. 182596, DATED JULY 8, 2021

NOT TO SCALE

JOB No. 199648

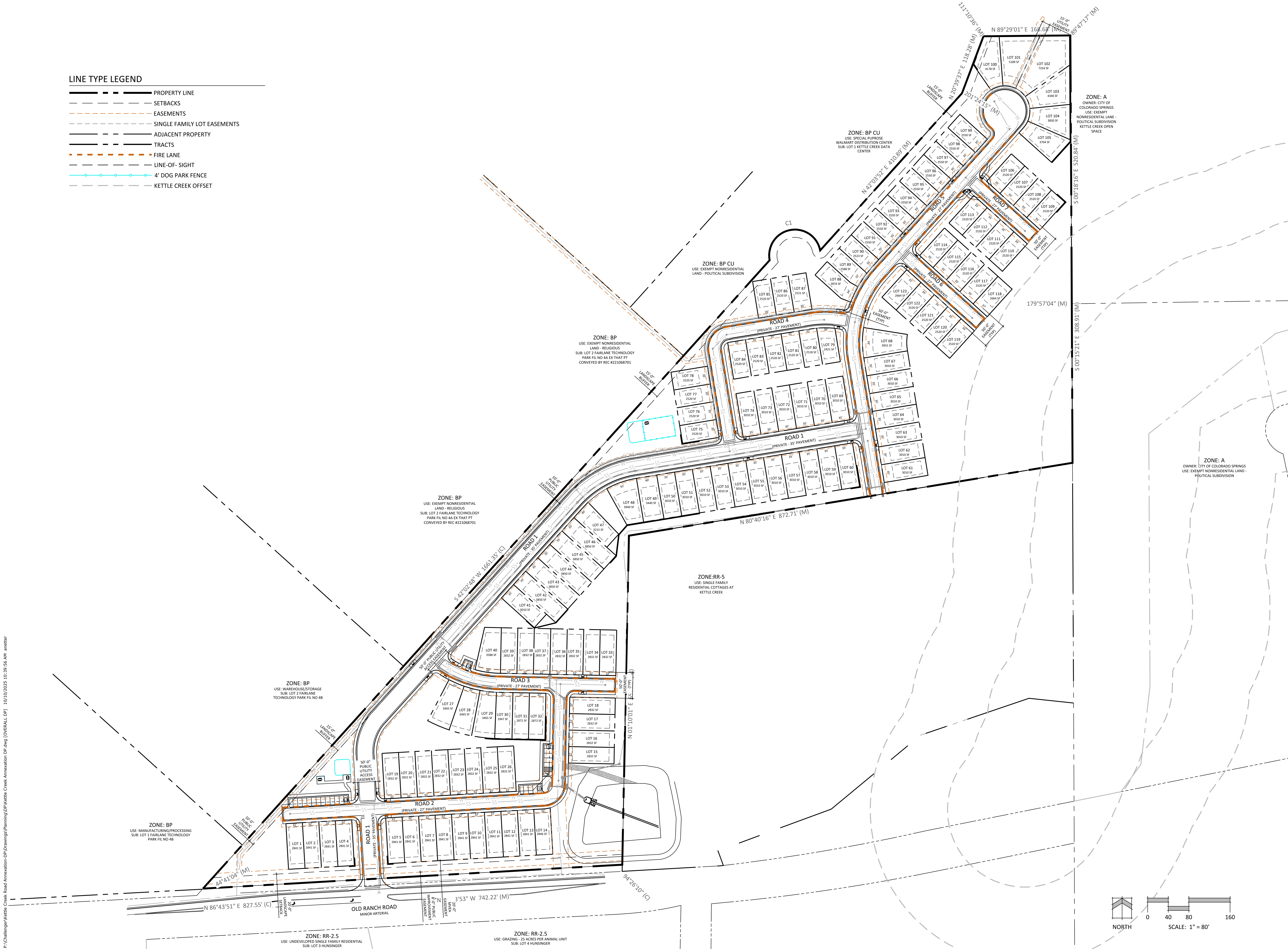
RMG
Materials Testing
Forensics
Civil / Planning
Architecture
Structural
Geotechnical
Engineers / Architects
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

PROPOSED SUBDIVSION
EL PASO COUNTY, CO
CHALLENGER COMMUNITIES

ENGINEER:	TM
DRAWN BY:	KZ
CHECKED BY:	TM
ISSUED:	8-5-2025

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-10


LINE TYPE LEGEND
PROPERTY LINE
SETBACKS
EASEMENTS
SINGLE FAMILY LOT EASEMENTS
ADJACENT PROPERTY
TRACTS
FIRE LANE
LINE-OF- SIGHT
4' DOG PARK FENCE
KETTLE CREEK OFFSET
ZONE: BP CU
USE: SPECIAL PURPOSE
WALMART DISTRIBUTION CENTER
SUB: LOT 1 KETTLE CREEK DATA CENTER
ZONE: A
OWNER: CITY OF COLORADO SPRINGS
USE: EXEMPT NONRESIDENTIAL LANE - POLITICAL SUBDIVISION
KETTLE CREEK OPEN SPACE
ZONE: BP CU
USE: EXEMPT NONRESIDENTIAL LAND - POLITICAL SUBDIVISION
ZONE: BP
USE: EXEMPT NONRESIDENTIAL LAND - RELIGIOUS
SUB: LOT 2 FAIRLANE TECHNOLOGY PARK FIL NO 4A EX THAT PT CONVEYED BY REC #221068701
ZONE:RR-5
USE: SINGLE FAMILY RESIDENTIAL COTTAGES AT KETTLE CREEK
ZONE: A
OWNER: CITY OF COLORADO SPRINGS
USE: EXEMPT NONRESIDENTIAL LAND - POLITICAL SUBDIVISION
ZONE: BP
USE: WAREHOUSE/STORAGE
SUB: LOT 2 FAIRLANE TECHNOLOGY PARK FIL NO 4B
ZONE: BP
USE: MANUFACTURING/PROCESSING
SUB: LOT 1 FAIRLANE TECHNOLOGY PARK FIL NO 4B
ZONE: RR-2.5
USE: UNDEVELOPED SINGLE FAMILY RESIDENTIAL
SUB: LOT 3 HUNSINGER
ZONE: RR-2.5
USE: GRAZING - 25 ACRES PER ANIMAL UNIT
SUB: LOT 4 HUNSINGER
OLD RANCH ROAD
MINOR ARTERIAL
ROAD 1 (PRIVATE - 35' PAVEMENT)
ROAD 2 (PRIVATE - 27' PAVEMENT)
ROAD 3 (PRIVATE - 27' PAVEMENT)
ROAD 4 (PRIVATE - 27' PAVEMENT)
N 89°29'01" E 168.68' (M)
S 00°18'16" E 520.84' (M)
S 00°15'21" E 308.91' (M)
179°57'04" (M)
N 80°40'16" E 872.71' (M)
N 01°10'01" E
S 42°02'48" W 1661.35' (C)
N 42°03'52" E 410.89' (M)
N 20°39'37" E 118.28' (M)
N 86°43'51" E 827.55' (C)
44°41'04" (M)
94°26'10" (C)
NORTH
0 40 80 160
SCALE: 1" = 80'

N.E.S. Inc.
619 N. Cascade Avenue, Suite 200
Colorado Springs, CO 80903

Tel. 719.471.0073
Fax 719.471.0267

www.nescolorado.com

PLANNER / LANDSCAPE ARCHITECT

IN ASSOCIATION WITH

KETTLE CREEK FILING NO. 1

PLANNED DEVELOPMENT ZONE DEVELOPMENT PLAN

2060 OLD RANCH ROAD,
1455 KETTLE CREEK RD,
10515 KETTLE CREEK RD

PROJECT INFO

DATE: 10-07-25
PROJECT MGR: K. JOHNSON
PREPARED BY: A. ROMAN

STAMP

ISSUE INFO

DATE:	BY:	DESCRIPTION:

ISSUE / REVISION

SHEET DESCRIPTION

OVERALL SITE PLAN

SHEET NUMBER/TITLE

DP1

1 OF 1

PLAN FILE #

DEPN-25-

P:\Challenger\Kettle Creek Road Annexation\Drawings\Planning\DP\Kettle Creek Annexation DP.dwg [OVERALL DP] 10/10/2025 10:39:56 AM anetter