CITY OF COLORADO SPRINGS

APPLICATION FORM FOR GEOLOGIC HAZARD REPORT

Applicant: S & R Construction c/o Dan Robertson Telephone 719-337-2224 Fax _

Address: 802 Cheyenne Blvd Zip Code 80905 e-mail dan@therobertsoncompany.com

Premises Involved: Development Plan/Subdivision Plat Name: 205 Yale Avenue, Colorado Springs, Colorado

Tax Schedule No(s). **74033-01-006**
(This can be obtained from the El Paso County Tax Assessor located at 27 E. Vermijo Avenue on the 2nd Floor; phone: 520-6600 or at their web site http://www.land.elpasoco.com)

GEOLOGIC HAZARD REPORT REQUIRED: (FIVE (5) PRELIMINARY COPIES)

An application review fee will be required to accompany these applications (make checks payable to City of Colorado Springs). The fee schedule is as follows:

Review of Geologic Hazard Reports	City Planning Fee: $300 plus any Colorado Geological Survey Review Cost Over $300
	City Engineering Fee: $284

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

Development Plan: _____

Landscape Plan (if applicable): _____

Grading Plan: _____

Drainage Report (necessary if debris and/or mud flow hazard is present): _____

ENGINEERS STATEMENT

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of Section 504 of the Geologic Hazards Ordinance of Colorado Springs. I am qualified as:

X _____ Professional Geologist as defined by CRS 34-1-201(3); or,

_____ Professional Engineer as defined by Board Policy Statement 50.2 - "Engineering in Natural Hazard Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. Board authority as defined by CRS 12-25-107(1).

Kelli Zigler

Submitted by: Kelli Zigler Date: September 15, 2020

This Geologic Hazard Study is filed in accordance with the Zoning Code of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____
City Engineer Date City Planning Director Date

Job No. 175767

December 14, 2020

S & R Construction, Inc
802 Cheyenne Blvd
Colorado Springs, CO 80905

Re: Response to CGS and Duane and Theresa Brands Comments
205 Yale Av
EPC Schedule No. 7403301006
Colorado Springs, Colorado

Dear Mr. Robertson:

RMG – Rocky Mountain Group (RMG) prepared the Geologic Hazard Study (RMG Job No. 175767, last dated December 14, 2020) for the proposed development, consisting of demolition of an existing detached garage and construction of a new two story single family residence with in Colorado Springs, Colorado. The report was reviewed by personnel of the Colorado Geological Survey (CGS). The CGS comments were included in the ***Red Rock and Yale Hillside Development Plan and Final Plat*** – *Second Round Comments*, (dated November 10, 2020) which was provided to us by Mr. Robertson. The letter is included at the end of this document. Tasha Brackin, a senior planner with the City of Colorado Springs, also requested that RMG address the comments from Duane and Theresa Brands, homeowners at 204 Red Rock Ave. The Brands' e-mail was provided to us by Mr. Robertson.

The purpose of this letter is to provide RMG's response to both CGS' and the Brands' comments. For clarity and ease of review we have "snipped" the relevant comments and pasted them below, each followed by our response to that comment.

CGS Comment:

RMG states rockfall will not preclude development (p.7) but have not provided any analysis or discussion of the potential for rockfall from the outcrop within the site. CGS recommends that prior to project approval a discussion and opinion be provided by the consultant that supports their conclusion that rockfall from the rock outcrop will not preclude development. To demonstrate this a discussion and evaluation of the outcrop will be necessary.

RMG Response:
Section 6.1 Rockfall was updated in the Geologic Hazard Study. The mitigation paragraph of this section has been revised as follows:

Mitigation

Blasting and ripping at the sandstone face are not currently proposed, and shall be prohibited. It is our understanding based on conversations with Mr. Robertson that demolition of the existing detached garage, concrete slab and asphalt paving is to incorporate reasonable measures to reduce the frequency and intensity of ground vibrations to a level that is not anticipated to adversely impact the sandstone "fin", including limiting the use of "heavy" construction equipment to a "skid-steer" style loader. We recommend that the equipment be further limited to a rubber-tired "skid-steer", which produces significantly lower ground vibration than the tracked version.

Per the "*Transit Noise and Vibration Impact Assessment Manual*" published by the Federal Transit Administration, vibration source levels (in PPV, or Peak Particle Velocity) from a small bulldozer at a distance of 25 feet (the average distance from the existing garage to the base of the sandstone "fin") is anticipated to be approximately 0.003 in/sec. A "skid-steer" loader is approximately half the weight of a small bulldozer and (particularly the rubber-tired version) would be anticipated to generate ground vibration levels of 1/2 to 1/3 of those from a small bulldozer. Also per the FTA, the threshold of human perception for vibration is 0.01 in/sec, which equates to approximately 6 to 10 times the vibrations anticipated to be generated by the proposed equipment. A survey of conclusions presented by the Federal Transit Administration, the National Park Service, the National Cooperative Highway Research Program, and multiple city, county, and state sources suggest that PPV levels of 0.08 in/sec to 0.2 in/sec are considered safe for sensitive historic structures and structures that are in a poor or deteriorated state of maintenance, which equates to approximately 50 to 200 times the vibrations anticipated to be generated by the proposed equipment.

Neither free-standing boulders nor freshly calved sandstone wedges were observed on or around the sandstone "fin". Based on the lack of free standing boulders, absence of any indications of recent rockfall, the general resistance of this and similar formations to weathering due to their strong cementation and thickly bedded grains, and the orientation of the majority of the fractures, it is our opinion that the sandstone "fin" is not considered an imminent rockfall hazard. Photos of the sandstone "fin" are included in Appendix C. Furthermore, as the anticipated ground vibrations from the proposed construction are anticipated to be at least 50 times lower than the levels generally considered "safe" for sensitive historic structures or structures in a poor or deteriorated state of maintenance (which we judge to be weaker than the subject sandstone "fin"). While this does not guarantee that a portion of the sandstone "fin" won't detach during the proposed construction (nor could such a guarantee be reasonably expected), it is our opinion that the risk of rockfall directly resulting from the vibrations caused by the proposed construction activities (as described above) is suitably low that rockfall hazard is not anticipated to preclude the proposed construction.

Brands comment

1. Mr. Robertson plans to demolish the existing garage. Back in the 1980's, the former owner built an addition (illegally with NO city permits). The northern wall of the addition sits within inches, if not directly on, our property line. When the addition was built, the former owner cut into the hillside and bedrock. Consequently, the northern and western walls of this garage are

serving as a retaining wall for the small hillside which is OUR property. If the garage is demolished, our hillside will collapse.

RMG Response

Mr. Robertson is proposing to leave the rear wall of the existing garage and existing retaining wall in place. These walls will continue to support the "hillside" to the west. We recommend that a portion of the northern wall be left in place as well, to provide support for the "hillside" to the north. Note, one or both of these walls may require modifications to reinforce the severed ends of these existing (unpermitted, and presumably non-engineered) walls.

Brands comment

It appears to us that this garage cannot easily be demolished without the workmen getting on our property. Garage debris will likely also fall onto our property. We will not permit access to our property for the purpose of destroying this structure.

RMG Response

Discussions with Mr. Robertson, who will be responsible for supervising the proposed demolition and construction of the single family residence, stated he is fully aware of the access limitations and is prepared to perform all operations only from the south (on the subject property).

Brands comment

2. Another MAJOR concern is the stability of the 35-40 foot sandstone "fin" that rises directly behind our house. There are numerous deep fractures and large "chunks" of this rock that appear ready to break away and come tumbling down on our property. People regularly stop in front of our house and ask us if we are afraid that these "chunks" are going to land on our house or garage. It is possible that a person could be under them should they come down.

RMG Response

See the first RMG Response above.

Brands comment

The geological hazard report's analysis is deficient. They did not come onto our property to effectively evaluate the rock's fractures and the stability of those pieces that are breaking away. They just said rockfall is not a problem. Based upon what exactly?

RMG Response

See the first RMG Response above.

Brands comment

In other words, movement of heavy equipment, demolition activities and excavation activities produce "micro-earthquakes". The geology report relied heavily on existing state geological reports and mapping. NONE of which can adequately address the current state of this particular "fin" and the potential for pieces breaking off and landing on our property--possibly causing major damage to our garage and house.

RMG Response

See the first RMG Response above.

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

COLORADO REGISTERED
ANTHONY P. MUNGER
12/14/20
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

Architecture
Structural
Geotechnical

Materials Testing
Forensic
Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

GEOLOGIC HAZARD STUDY

205 Yale Avenue
EPC Schedule No. 7403301006
Colorado Springs, Colorado

PREPARED FOR:

S & R Construction, Inc
802 Cheyenne Blvd
Colorado Springs, CO 80905

JOB NO. 175767

September 15, 2020
Revised December 14, 2020

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
12/14/20
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

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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 development were reviewed and are referenced below:

1. *Subsurface Soil Investigation, 205 Yale Av, EPC Schedule No. 7403301006, Colorado Springs, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 175767, last dated May, 6, 2020.
2. *Limited Geologic Hazard Review, 205 Yale Av, EPC Schedule No. 7403301006, Colorado Springs, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 175767, last dated May, 22, 2020.

1.3 Additional Documents

Additional documents reviewed during the 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 with over 20 years of experience in the geological and geotechnical engineering field. Ms. Zigler holds a Bachelor of Science in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations in Colorado. Tony Munger is a licensed professional engineer with over 20 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.

3.0 GENERAL SITE AND PROJECT DESCRIPTION

3.1 Site Location

The project lies in the NE¼ of the SW¼ of Section 3, Township 14 South, Range 67 West of the 6th Principal Meridian, in City of Colorado Springs, El Paso County, Colorado. The site is generally located north of the intersection of N. 34th Street and W. Pike Peak Ave. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

3.2 Existing Land Use and Zoning

The site is currently developed. An existing single-story, single-family residence is located near the western portion of the property. A detached garage is located east of the residence. The site consists of approximately 17,100 square feet and is zoned "*R1-6 HS – Single Family Residential within the Hillside Overlay"* per the El Paso County Assessors Property Information. The site plan is presented with the Engineering and Geology Map in Figure 2.

3.3 Proposed Construction

It is our understanding that the lot is to be subdivided, and the existing residence on the western portion of the lot is to remain addressed as 205 Yale Avenue. The eastern portion of the site is to be provided with a new address (not determined yet), and the detached garage is to be demolished and all resulting debris removed to allow for construction of a new two-story single-family residence.

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 dating back to 1947. Both structures were reportedly constructed in approximately 1952. Overall, the photographs prior to 1952 depict the site as vacant and devoid of deciduous trees. It appears the site has remained relatively undisturbed since construction of the original structures.

4.0 SITE GEOLOGY AND DESCRIPTIONS

4.1 General Physiographic and Geologic Setting

Based upon review of the *Geologic Map of the Colorado Springs Quadrangle, El Paso County, Colorado*, geomorphically the area lies near the western edge of the Colorado Piedmont within the Great Plains Physiographic Province. Structurally the region is located east of the Rocky Mountain Front Range and the Rampart Range reverse fault. Along the fault, older Precambrian rocks to the west have been uplifted against younger sediments to the east. The Rampart Range fault lies approximately less than 0.25 miles from the site.

4.2 Geologic Mapping

The Engineering and Geology Map is presented in Figure 2. Three geologic units and one engineering unit were mapped on the site. These units are discussed in detail below.

GEOLOGIC UNITS

- *Af – Artificial fill (latest Holocene) –* potential fill resulting from the construction of the single family residence and detached garage. Uncontrolled fill that may be encountered in the vicinity of the existing garage. Fill was not encountered in the test boring performed by RMG.
- PlPf – Fountain Formation (Lower Permian and Pennsylvanian) coarse grained arkosic sandstone with pebble to boulder conglomerate beds. Siltstone beds are thinly interbedded within the conglomerate sandstone beds. The Fountain formation is generally red and white in color with the interbedded siltstone beds being maroon.
- PA – Preservation Area – construction shall not encroach within 10 feet of the sandstone "fin".

ENGINEERING UNITS

- 3A – Stable alluvium, colluvium and bedrock on moderate to steep slopes (12 to 24%). *Description from Robinson & Associates, 1977.*

4.3 Surficial Deposits

The surficial deposits across the property in the area of the proposed new single family residence have mostly eroded away. It is anticipated that natural, undisturbed surficial deposits (if encountered) will be fairly shallow.

4.4 Bedrock Units

The bedrock beneath the site is part of the Fountain Formation (Lower Permian and Pennsylvanian), consisting of silty sandstone. The Fountain Formation is estimated to be approximately 4,000 feet thick in the vicinity of this site.

4.5 Landforms

The site lies near an area of known and mapped thrust faults that define the west, southwest area of the Rampart Range. Within the Rampart Range is a series of five generally prominent northwest-trending reverse faults more than 40 miles in length known as the Ute Pass fault zone. A sedimentary sandstone "fin" resides on the site. This "fin" has been tilted vertically and faulted by the forces related to the uplift of the Rocky Mountains and Pikes Peak Massif.

4.6 Structural Features

Structural features such as joints, faults, shear zones, folds, schistocity, and foliation were not observed on the site. However, review of the *Geologic Map of the Colorado Springs 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 and Rampart Faults lie approximately 0.25 miles from 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 could be affected if one or more of these faults did rupture.

4.7 General Hydrogeology/Groundwater

Groundwater was reportedly not encountered in the test borings performed by RMG. Seasonal variations in groundwater conditions and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

4.8 Surface Drainage/Irrigation

Based on a review of the Colorado Springs Quadrangle 7.5-minute series dated 1961 and photo-revised in 1969, 1975, and 1995, 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. 08041C0737G, effective December 7, 2018 and the online ArcGIS El Paso County Risk Map, the site does not lie within any floodplains.

4.9 Geophysical Investigations

Geophysical Investigations were not considered necessary for this investigation.

5.0 SUBSURFACE SOIL INVESTIGATIONS

5.1 Field and Laboratory Testing

The subsurface conditions below the subject site was investigated by drilling two exploratory test boring on April 6, 2020. The approximate locations of the test borings are presented in the Engineering and Geology Map, Figure 2.

The test borings were advanced with a power-driven, continuous-flight auger to depths of approximately 20 feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. The Test Boring Logs are presented in Appendix B, Subsurface Soil Investigation.

The recovered samples obtained by RMG were tested in the laboratory. Moisture content, Grain-size analysis, and Atterberg Limits tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. The results of this testing are presented in Appendix B, Subsurface Soil Investigation.

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. Below is a list of the geologic conditions that we believe will not preclude the development, as currently proposed.

- Expansive soils and expansive bedrock
- Unstable or potentially unstable slopes
- Landslide areas or potential landslide areas
- Steeply dipping expansive bedrock
- Debris flow and debris fans
- Subsidence and abandoned mining activity
- Shallow water tables
- Groundwater springs or seeps
- Flood prone areas
- Collapsible soils
- History of landfill

The following conditions were identified at the site (discussed in additional detail below) can be mitigated with typical construction practices common to the Colorado Springs area.

- Rockfall
- Shallow very hard bedrock
- Faults/Seismicity
- Radon Gas
- Corrosive Minerals
- Undocumented/uncontrolled fill activity

6.1 Rockfall

Rockfall hazards are generally initiated by some climatic or biological event that causes a change in the forces acting on a rock. Such climatic events include: heavy rain storms, freeze-thaw processes, chemical degradation or weathering of the rock, root growth or leverage by roots moving in high winds, active construction environment and free falling rocks. Rockfall is also dependent on the climatic and biological events in relation to the source area geology (bedding thickness, bedding dip and dip direction, hardness, joint fracture orientation).

The steeply dipping sedimentary rock formation (sandstone "fin") is mapped within the Rockfall Hazard Susceptibility map, referenced in Appendix A. According to the Rockfall Hazard map; *the mapped areas represent the maximum extent of possible rockfall hazard based on a "worst-case scenario" for a probably volume of falling rock. This includes effects following wildfires, modest earthquakes, and extreme weathering."*

The mapped sandstone outcrop/formation is approximately 30 to 35 feet in height, is located 15 feet west of the existing detached garage and neighboring property, 204 Red Rock Ave. The sandstone outcrop is of the Fountain Formation and dips steeply to the east. Rocks of the Fountain Formation are considered to be of Late Pennsylvanian age, and are between 290 to 340 million years old. The Formation is characterized by its thickly bedded and often banded layers that include cross bedded dunes. The sandstone with in the formation was encountered at hard to very hard consistencies and exists due to its resilience to weathering. The majority of the joint fracture orientations of the sandstone "fin" are generally perpendicular to the dip. Generally active rockfall areas show evidence of recent falling and rock movement, such as displaced or damaged vegetation, fresh tracks of rocks rolling down slope, damage to fences and/or property.

<u>Mitigation</u>

Blasting and ripping at the sandstone face are not currently proposed, and shall be prohibited. It is our understanding based on conversations with Mr. Robertson that demolition of the existing detached garage, concrete slab and asphalt paving is to incorporate reasonable measures to reduce the frequency and intensity of ground vibrations to a level that is not anticipated to adversely impact the sandstone "fin", including limiting the use of "heavy" construction equipment to a "skid-steer" style loader. We recommend that the equipment be further limited to a rubber-tired "skid-steer", which produces significantly lower ground vibration than the tracked version.

Per the "*Transit Noise and Vibration Impact Assessment Manual*" published by the Federal Transit Administration, vibration source levels (in PPV, or Peak Particle Velocity) from a small bulldozer at a distance of 25 feet (the average distance from the existing garage to the base of the sandstone "fin") is anticipated to be approximately 0.003 in/sec. A "skid-steer" loader is approximately half the weight of a small bulldozer and (particularly the rubber-tired version) would be anticipated to generate ground vibration levels of 1/2 to 1/3 of those from a small bulldozer. Also per the FTA, the threshold of human perception for vibration is 0.01 in/sec, which equates to approximately 6 to 10 times the vibrations anticipated to be generated by the proposed equipment. A survey of conclusions presented by the Federal Transit Administration, the National Park Service, the National Cooperative Highway Research Program, and multiple city, county, and state sources suggest that PPV levels of 0.08 in/sec to 0.2 in/sec are considered safe for sensitive historic structures and structures that are in a poor or deteriorated state of maintenance, which equates to approximately 50 to 200 times the vibrations anticipated to be generated by the proposed equipment.

Neither free-standing boulders nor freshly calved sandstone wedges were observed on or around the sandstone "fin". Based on the lack of free standing boulders, absence of any indications of recent rockfall, the general resistance of this and similar formations to weathering due to their strong cementation and thickly bedded grains, and the orientation of the majority of the fractures, it is our opinion that the sandstone "fin" is not considered an imminent rockfall hazard. Photos of the sandstone "fin" are included in Appendix C. Furthermore, as the anticipated ground vibrations from the proposed construction are anticipated to be at least 50 times lower than the levels generally considered "safe" for sensitive historic structures or structures in a poor or deteriorated state of maintenance (which we judge to be weaker than the subject sandstone "fin"). While this does not guarantee that a portion of the sandstone "fin" won't detach during the proposed construction (nor could such a guarantee be reasonably expected), it is our opinion that the risk of rockfall directly resulting from the vibrations caused by the proposed construction activities (as described above) is suitably low that rockfall hazard is not anticipated to preclude the proposed construction.

6.2 Shallow Very Hard Bedrock

The sandstone encountered in the test borings by RMG was found to be in a hard to very hard condition. It is anticipated that the upper 4 to 5 feet of sandstone can be excavated with typical construction equipment. A foundation atop a crawlspace foundation is proposed and excavation cuts are to be less than 40 inches. The deeper sandstone which exhibits characteristics of increased hardness and excavation difficulties appears to have sufficient separation.

Mitigation

Use of specialized heavy equipment to facilitate rock removal and breakup is not anticipated, but could be necessary if substantial sandstone is to be removed. RMG recommends **blasting should be prohibited on the site due to the close proximity of other structures and the rock outcroppings.**

6.3 Faults/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/ dating back to November 1, 1900 Colorado Springs has not experienced a recorded earthquake. The nearest recorded earthquake dates back to December 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes occurred between 1926 to 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3.

Rampart Range Fault is located less than 0.25 miles southeast of the site and according to the CGS, these faults are considered to be recently active and could affect the site (and surrounding areas) if they did rupture.

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.

6.4 Radon Gas

There is not believed to be unusually hazardous levels of radioactivity from naturally occurring sources at this site. However, the granular materials found in the area are often associated with the production of radon gas and concentrations may exceed those currently accepted by the EPA.

***"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

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.

6.5 Corrosive Minerals

Sandstone bedrock underlies the entire site. Sandstone bedrock is generally considered to contain corrosive minerals.

Mitigation

To help mitigate potential corrosion, buried ferrous metal piping, conduit, and similar construction materials should be coated, wrapped or otherwise protected to avoid or reduce contact with the on-site soils. For environments corrosive to concrete, sulfate-resistant cement and additives should be used.

6.6 Uncontrolled/Undocumented Fill Placement

Fill soils were not encountered in the *Subsurface Soil Investigation* report referenced above. However, a detached garage lies within the proposed construction area. It is anticipated fill soils may be encountered during construction of the proposed new single-family residence.

Mitigation

It is anticipated the majority of the unsuitable fill soils will be penetrated by the proposed excavation. However, if unsuitable fill soils remain below the proposed foundation components, they will require removal (overexcavation) and replacement with newly placed and 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 the fill, if encountered first).

6.7 Proposed Cuts and Fills

The lot is "benched" down to the south, southeast and slopes moderately across the center of the lot. The front and back of the lot are relatively moderate across the site center of the lot. The front and back of the lot are relatively flat with an elevation difference of up to 17 feet across the lot. A sandstone "fin" outcrops on Lot 1 and encroaches upon the northwest corner of the new proposed Lot 2. New long-term cuts and fills are not currently proposed for the site and/or the sandstone outcropping.

Mitigation

We anticipate that the deepest excavation cuts for slab-on-grade or crawlspace construction will be approximately 3 to 4 feet below the existing ground surface. A basement foundation is not proposed at this time. We believe the surficial soils will classify as Type B materials as defined by OSHA in 29CFR Part 1926, dated 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.

6.8 General Compatibility of Natural Features with Proposed Land Use

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 the property or surrounding properties.

Mitigation

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

7.0 CONCLUSIONS AND RECOMMENDATIONS

Geologic hazards that are anticipated to have significant bearing on the proposed construction on this site are:

- Shallow very hard bedrock
- Faults/Seismicity
- Radon Gas

- Corrosive Minerals
- Undocumented/uncontrolled fill activity

It is our opinion that these conditions, if encountered on this site, can be mitigated with typical construction practices common to the Colorado Springs area. Mitigation techniques proposed for these conditions are described herein.

Use of specialized heavy equipment to facilitate rock removal and breakup is not anticipated for the proposed shallow excavation cuts, but could be necessary if substantial sandstone is to be removed. RMG recommends **blasting should be prohibited on the site due to the close proximity of other structures and the rock outcroppings.**

The sandstone "fin" that exists on Lot 1 should be designated as a Preservation Area (PA). Construction should not be allowed to encroach within 10 feet of the sandstone outcrop.

Unstable slopes were not observed around or on the property. As noted above, the site slopes down to the south, southeast and has as fall of approximately 17 feet across the entire property. Slopes within the proposed building site are less than 3 percent. Grading operations and fill placement around the proposed structures and any proposed retaining walls shall not result in long-term fill slopes greater than 3:1(horizontal to vertical). It is recommended that cut slopes be no steeper than 3:1 (horizontal to vertical) for long-term cuts and 1:1 (horizontal to vertical) for temporary cuts.

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 southeast. Owners should maintain the surface grading and drainage recommended in the reports referenced above 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.

7.1 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 Subdivision Plat and Development plan:

This property is subject to the findings summary and conclusions of a Geologic Hazard Report prepared by RMG – Rocky Mountain Group, dated September 15, 2020, which identified the following specific geologic hazard on the property: shallow very hard bedrock, faults/seismicity, radon gas, corrosive minerals, and undocumented/uncontrolled fill activity. 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.

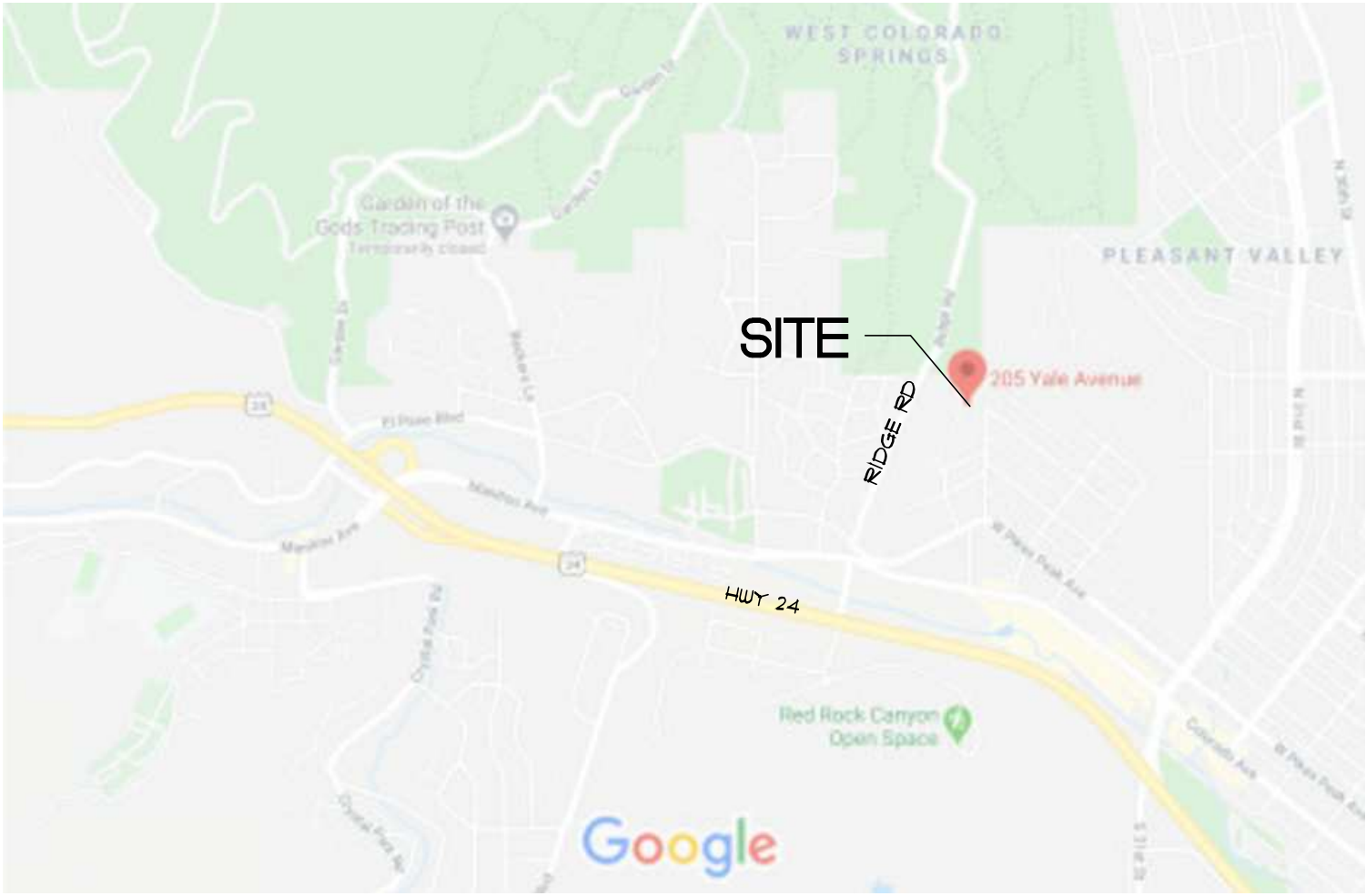
8.0 CLOSING

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 **S & R Construction, Inc.** 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 project.

FIGURES



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ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs,CO 80918
(719) 548-0600
Central Office:
Englewood, CO 80112
(303) 688-9475
Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071

SITE VICINITY MAP

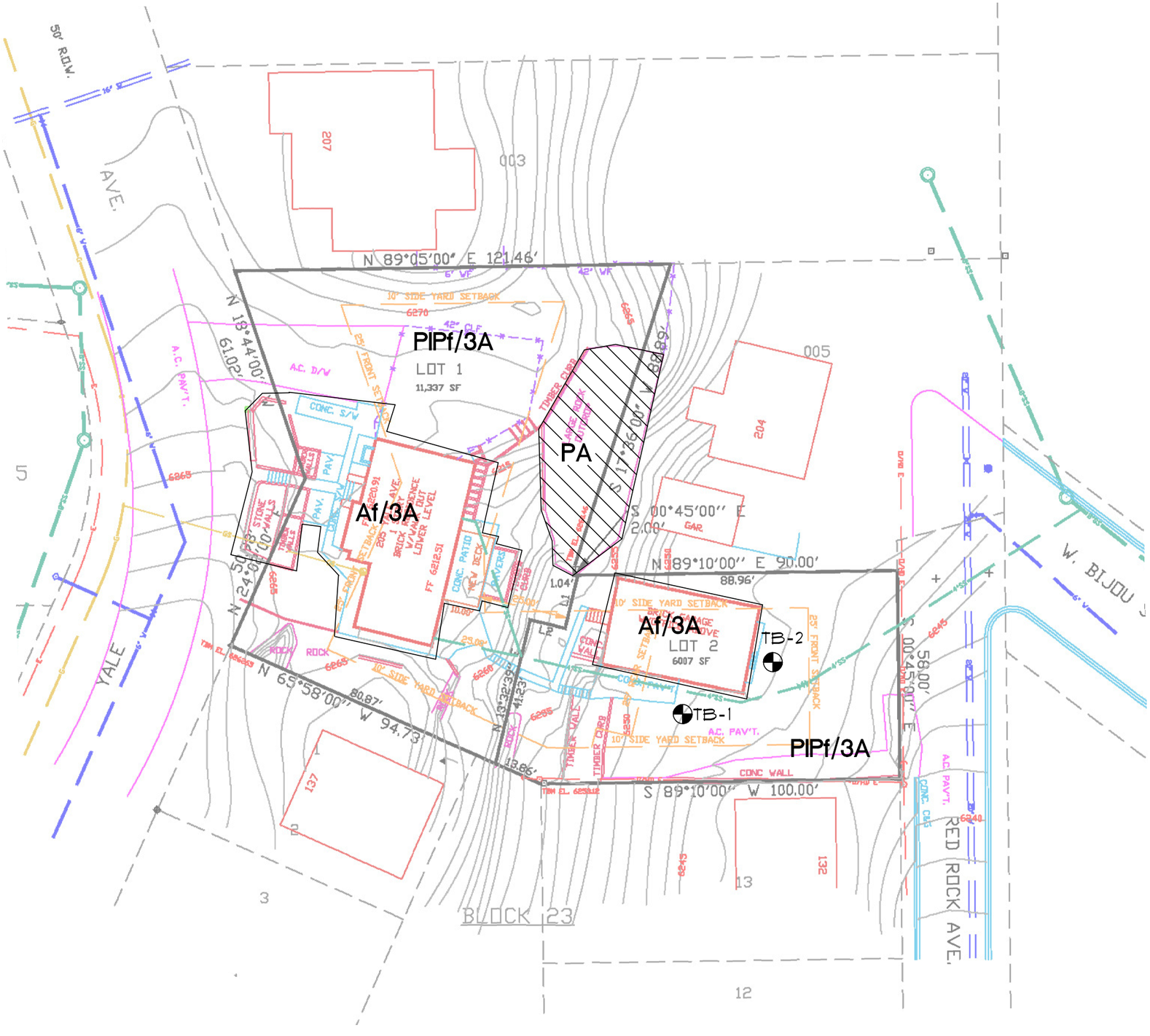
205 YALE AVENUE
EPC SCHEDULE NO. 7403301006
COLORADO SPRINGS, CO
S & R CONSTRUCTION

JOB No. 175767

FIG No. 1

DATE 9-15-2020

GEOLOGIC HAZARD STUDY



Geologic

Af - fill resulting from the removal of the existing garage.

P|Pf - Fountain Formation

PA - Preservation Area

Engineering

3A - Stable alluvium, colluvium and bedrock on moderate to steep slopes (12 to 24%). Description from Robinson & Associates, 1977

⊕ Denotes approximate location of test borings performed for the Subsurface Soil Investigation, completed by RMG - Rocky Mountain Group, Job No. 175767, last dated May 6, 2020

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BASE MAP PROVIDED BY: MARR LAND SURVEYING

JOB No.

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ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs, CO 80918
(719) 548-0600
Central Office:
Englewood, CO 80112
(303) 688-9475
Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071
Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

205 YALE AVENUE
EPC SCHEDULE NO. 7403301006
COLORADO SPRINGS, CO
S & R CONSTRUCTION

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	9-15-2020

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-2

Appendix A

Additional Documents Reviewed

1. *Red Rock and Yale Hillside Development Plan and Final Plat – Second Review Comments, File # AR DP 20-00500 and AR FP 20-00501,* Planning & Community Development Department, Land Use Review Division, letter dated November 10, 2020.
2. Email from Duane and Theresa Brands, 204 Red Rock to Tasha Brackin, Kerri Schoot and Peter Wysocki dated November 5, 2020.
3. *Presumed Existing Site Plan, 205 Yale Avenue, Part Blocks 22 and 23, Chautaqua Assoc. Resub, Colorado Springs, Colorado,* prepared by Oliver E. Watts, last surveyed by DEW, ESW 4-21.20.
4. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0737G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
5. *Geologic Map of the Colorado Springs Quadrangle, El Paso County, Colorado*, Open-File Map 0-02, by Madole, R.F. and Thorson, J.P., 2003.
6. *Map of Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado*, by John W. Himmelreich, Jr. and David C. Noe, Colorado Geologic Survey, Map Series 32, Plate 1 of 1, 1999.
7. *Master Plan for Mineral Extraction*, El Paso County, February 8, 1996.
8. *Colorado Springs Subsidence Investigation, State of Colorado Mined Land Reclamation*, Dames and Moore, 1985.
9. *Colorado Springs Quadrangle, Environmental and Engineering Geologic Map for Land Use*, Charles S. Robinson & Associates, Inc., Golden, Colorado 1977.
10. *Colorado Springs Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, Charles S. Robinson & Associates, Inc., Golden, Colorado 1977.
11. *Rockfall Hazard Susceptibility in Colorado Springs, El Paso County, Colorado,* OF-06-03, by Wait, T.C. and Jonathan L. White, Colorado Geological Survey, Department of Natural Resources, 2006.

Appendix B

Subsurface Soil Investigation, 205 Yale Av, EPC Schedule No. 7403301006, Colorado Springs, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 175767, last dated May, 6, 2020.

SUBSURFACE SOIL INVESTIGATION

205 Yale Av
EPC Schedule No. 7403301006
Colorado Springs, Colorado

PREPARED FOR:

S & R Construction, Inc
802 Cheyenne Blvd
Colorado Springs, CO 80905

JOB NO. 175767

May 6, 2020

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
5/6/20
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

Scope of Investigation

An existing residence currently resides on the western portion of the site, and a detached garage currently resides on the eastern portion of the site. It is our understanding that the lot is to be subdivided, and the existing residence on the western portion of the lot is to remain addressed as 205 Yale Avenue. The eastern portion of the site is to be provided with a new address (not determined yet), and the detached garage is to be demolished and all resulting debris removed to allow for construction of a new two story single-family-residence.

RMG – Rocky Mountain Group drilled two test borings for the proposed two story residence east of the above-referenced address on April 30, 2020. 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 3 inches of asphalt. The test borings were performed in the existing driveway to the detached garage. Underlying the asphalt, native silty sandstone extends to the 24- and 19-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. 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.

Geotechnical Considerations

Fill was not encountered in the test borings. However, fill soils from the original construction may be encountered. Unless appropriate documentation can be provided, it will be assumed that this fill was not moisture conditioned and compacted in a manner consistent with the **Structural Fill** recommendations contained within this report. If such fill is encountered, it is not considered suitable for support of shallow foundations. It is recommended that the new foundation be extended down through the fill (if encountered) to bear on the native sand soils below.

Special Considerations

The sandstone bedrock at this site is hard to very hard and may require the use of specialized heavy-duty equipment facilitate rock break-up and removal.

Foundation Recommendations

A spread footing foundation supported on the on-site sandstone or 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 two inches is considered possible for soils/bedrock of low expansion potential. 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 walls should be designed to resist lateral earth pressures. For granular, non-expansive backfill materials, we recommend an equivalent fluid pressure of 40 pcf be used for design. Expansive soils or bedrock should not be used as backfill against foundation walls.

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. This includes crawlspace areas but not the walkout trench, if applicable. A typical drain detail is presented in Figure 7.

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

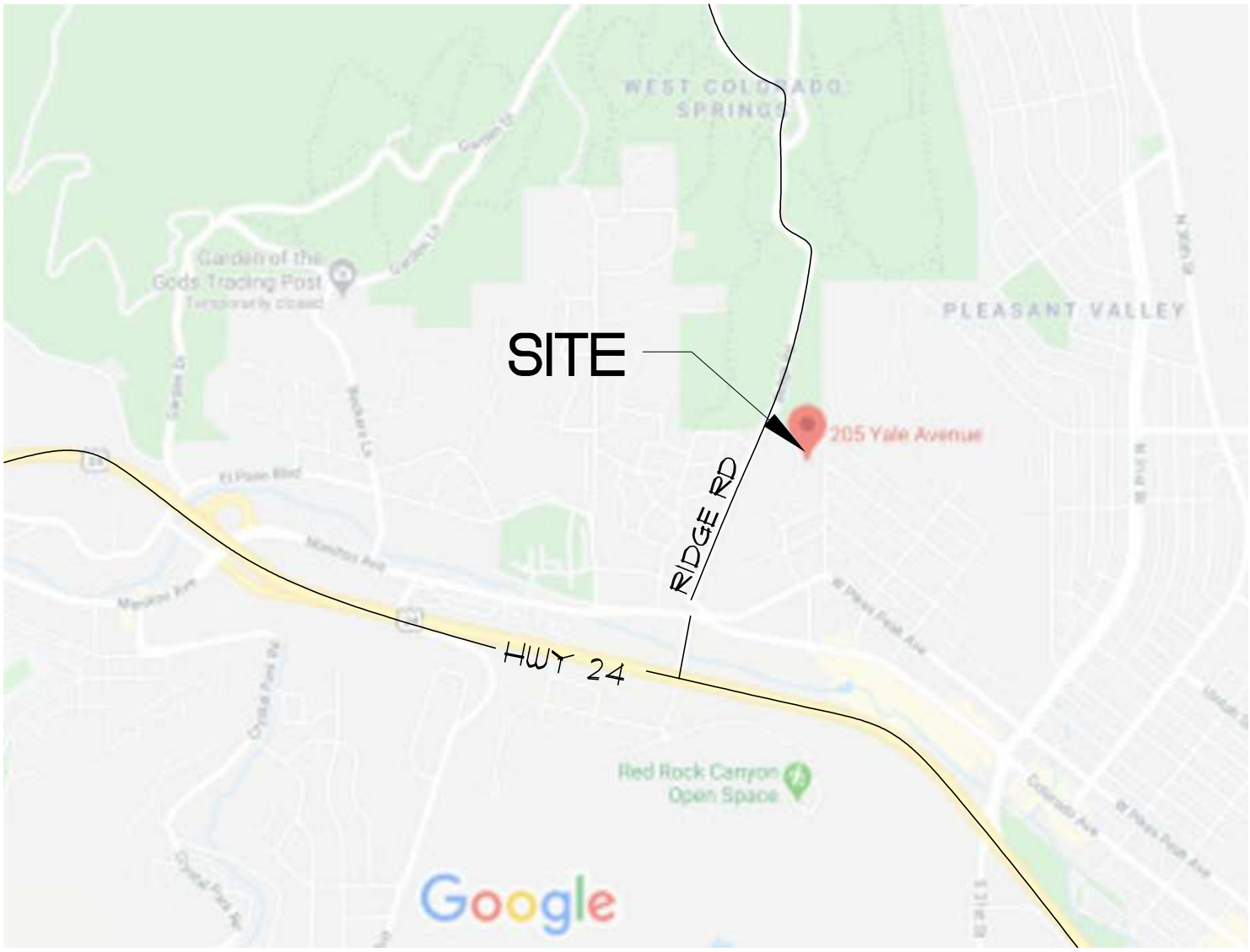
This report may be partial fulfillment of Colorado Senate Bill 13 (1984), C.R.S. 6-6.5-101, *The Soil and Hazard Analysis of Residential Construction*, if the purchaser receives this report at least fourteen days prior to closing.

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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ARCHITECTS RMG ENGINEERS
ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs,CO 80918
(719) 548-0600
Central Office:
Englewood, CO 80112
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Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071

SITE VICINITY MAP

205 YALE AVENUE
COLORADO SPRINGS, CO
S ¢ R CONSTRUCTION

JOB No. 175767

FIG No. 1

DATE 5-6-2020

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DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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Englewood, CO 80112
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TEST BORING LOCATION PLAN

205 YALE AVENUE
COLORADO SPRINGS, CO
S ¢ R CONSTRUCTION

GEOLOGIC HAZARD STUDY

JOB No. 175767

FIG No. 2

DATE 5-6-2020

SOILS DESCRIPTION

ASPHALT

SANDSTONE

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

SYMBOLS AND NOTES

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

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

FREE WATER TABLE

DEPTH AT WHICH BORING CAVED

BULK — DISTURBED BULK SAMPLE

AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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Structural
Forensics

ARCHITECTS RMG ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

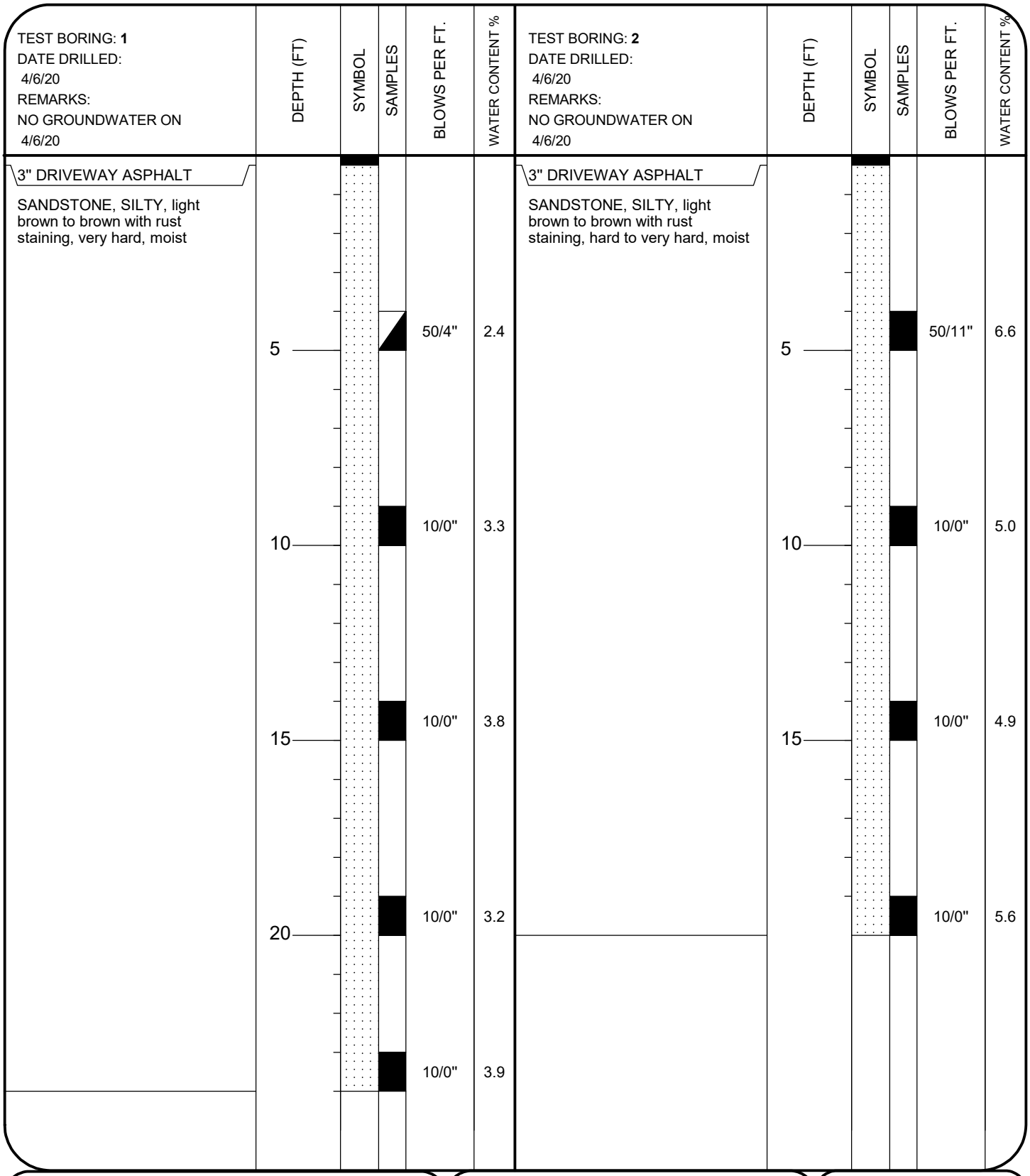
Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 175767

FIGURE No. 3

DATE May/06/2020



ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS RMG ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
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TEST BORING LOGS

JOB No. 175767

FIGURE No. 4

DATE May/06/2020

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load (psf)	% Swell/ Collapse	USCS Classification
1	4.0	2.4		NP	NP	1.6	13.6			SM
1	9.0	3.3								
1	14.0	3.8								
1	19.0	3.2								
1	24.0	3.9								
2	4.0	6.6								
2	9.0	5.0		NP	NP	2.6	21.6			SM
2	14.0	4.9								
2	19.0	5.6								

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS RMG ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
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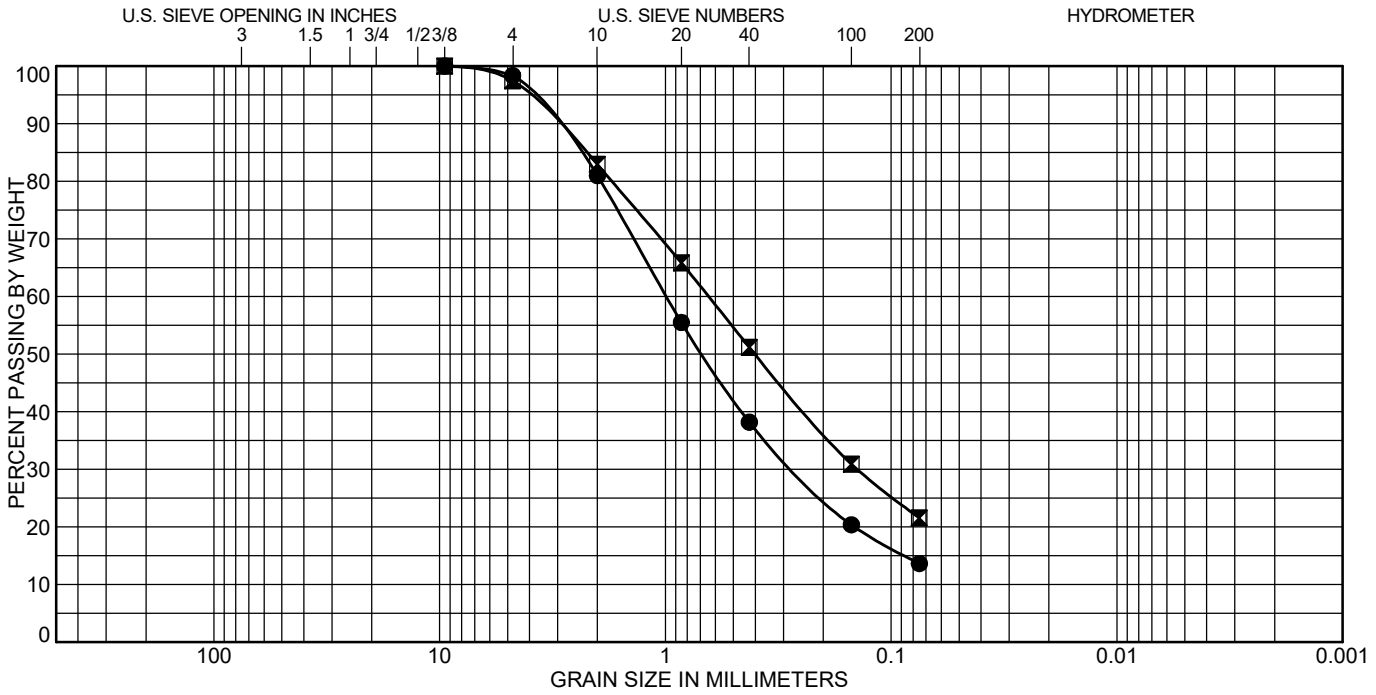
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 175767
FIGURE No. 5
PAGE 1 OF 1
DATE May/06/2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	1	4.0	**SILTY SAND(SM)**	**NP**	**NP**	**NP**
⊠	2	9.0	**SILTY SAND(SM)**	**NP**	**NP**	**NP**

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0	1.6	84.7	13.6	
⊠	2	9.0	2.6	75.9	21.6	

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS RMG ENGINEERS

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Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
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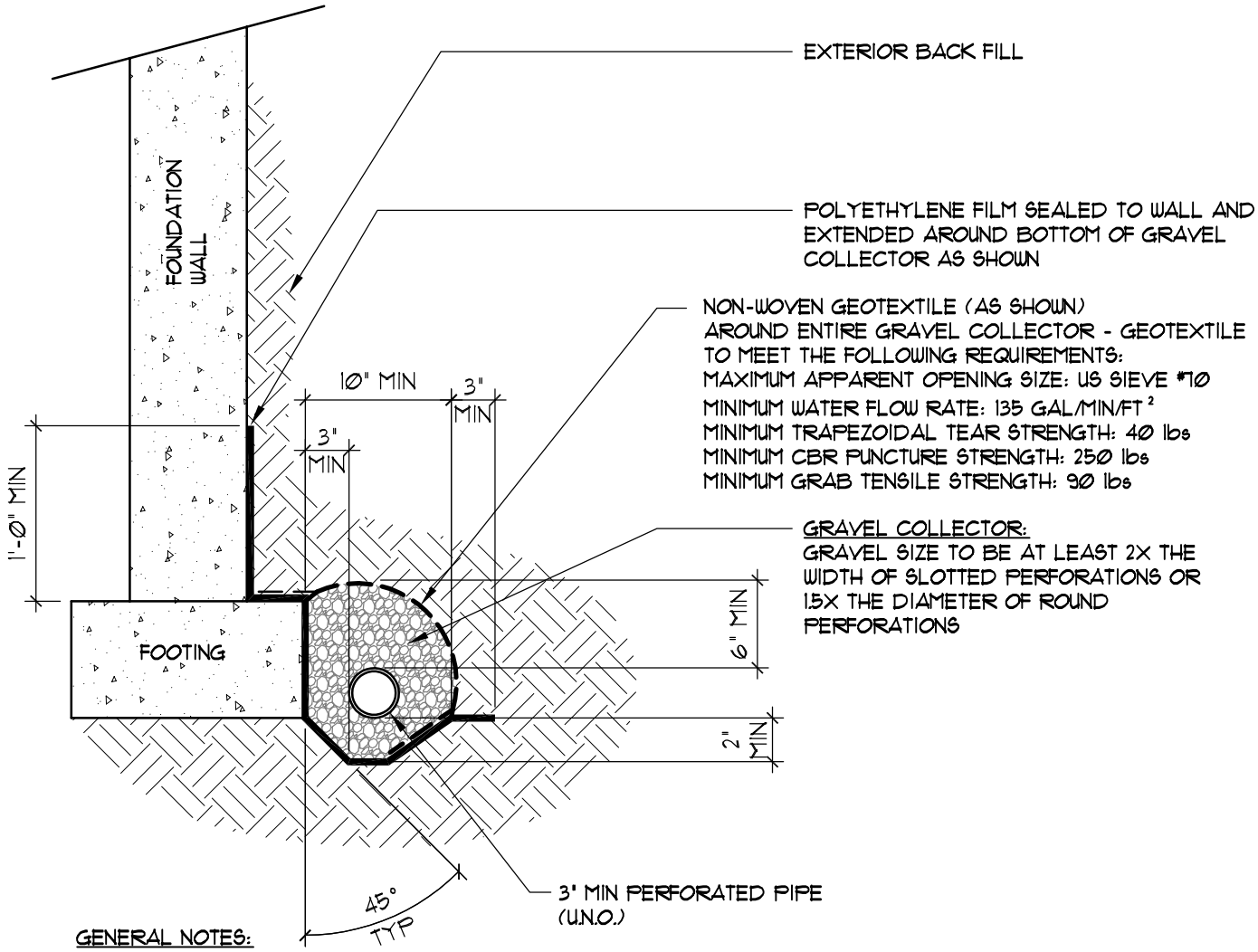
SOIL CLASSIFICATION DATA

JOB No. 175767

FIGURE No. 6

DATE May/06/2020



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.

ARCHITECTS RMG ENGINEERS
ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs,CO
80918
(719) 548-0600
Central Office:
Englewood, CO 80112
(303) 688-9475
Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071

PERIMETER DRAIN

FIG No. 7

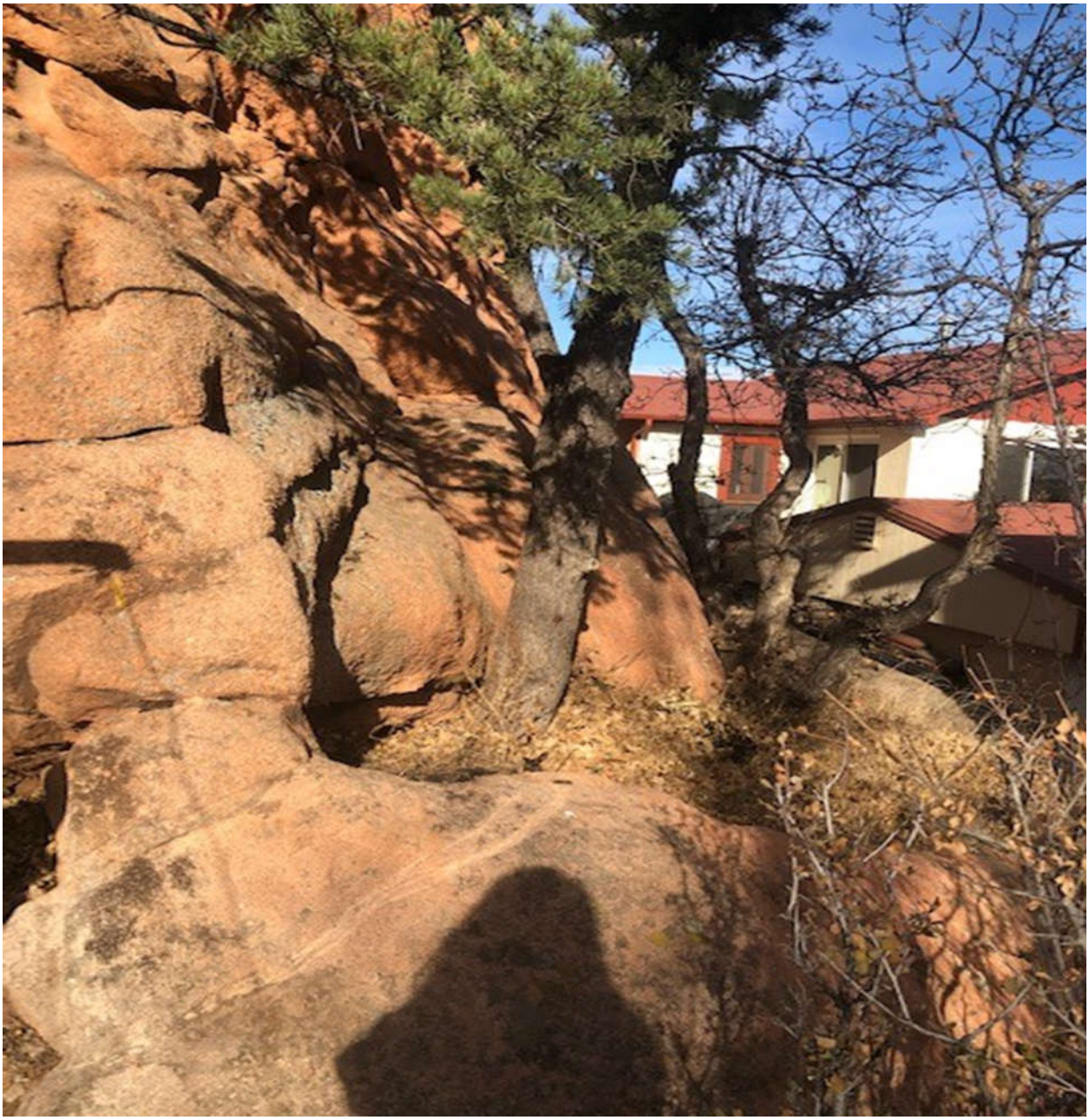
APPENDIX C - Site Photos

Left of photo, detached garage. Right of photo, 204 Red Rock Ave.

Sandstone “fin” formation west of 204 Red Rock Ave.

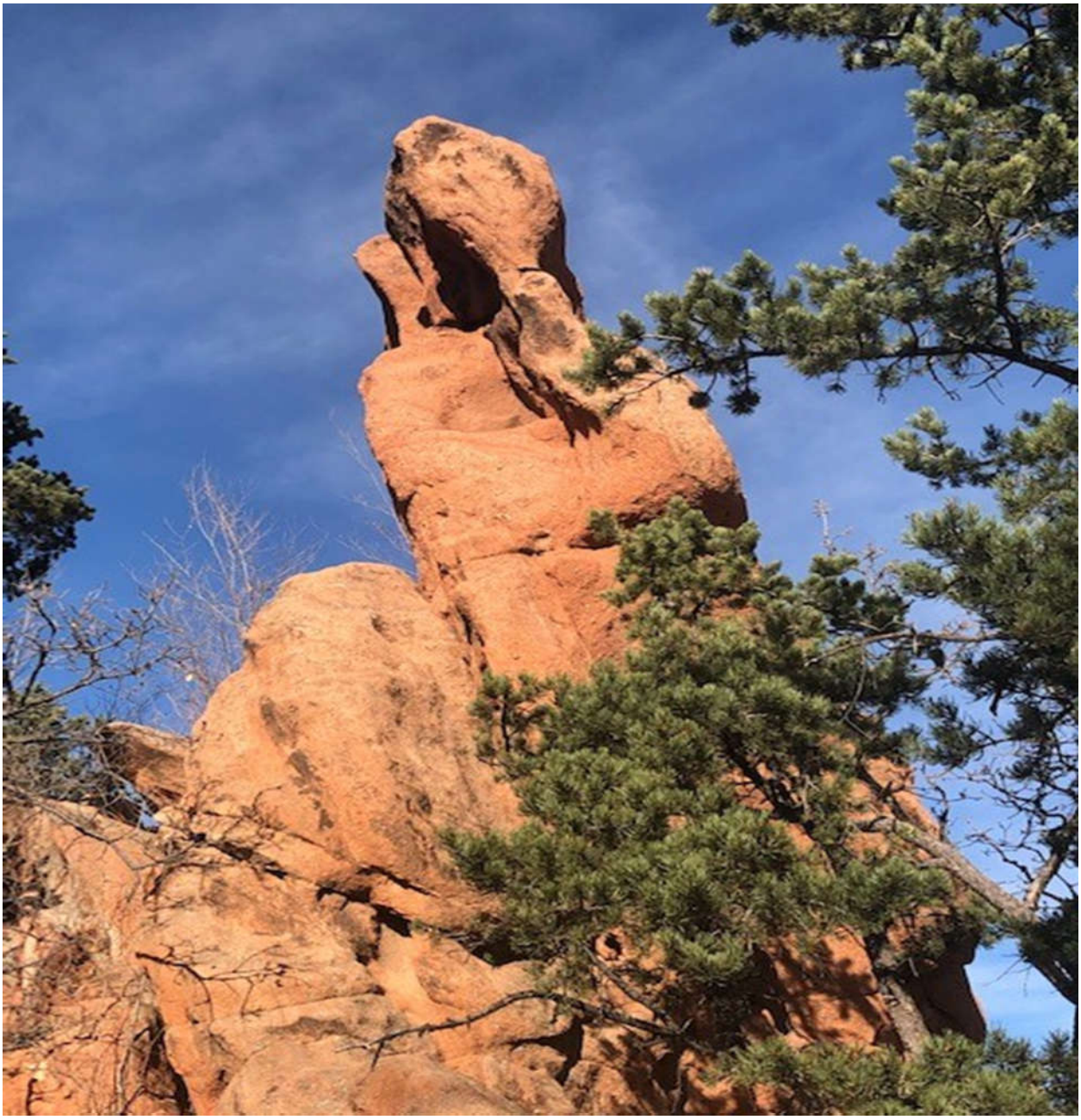
GEOLOGIC HAZARD STUDY

West of detached garage, looking north



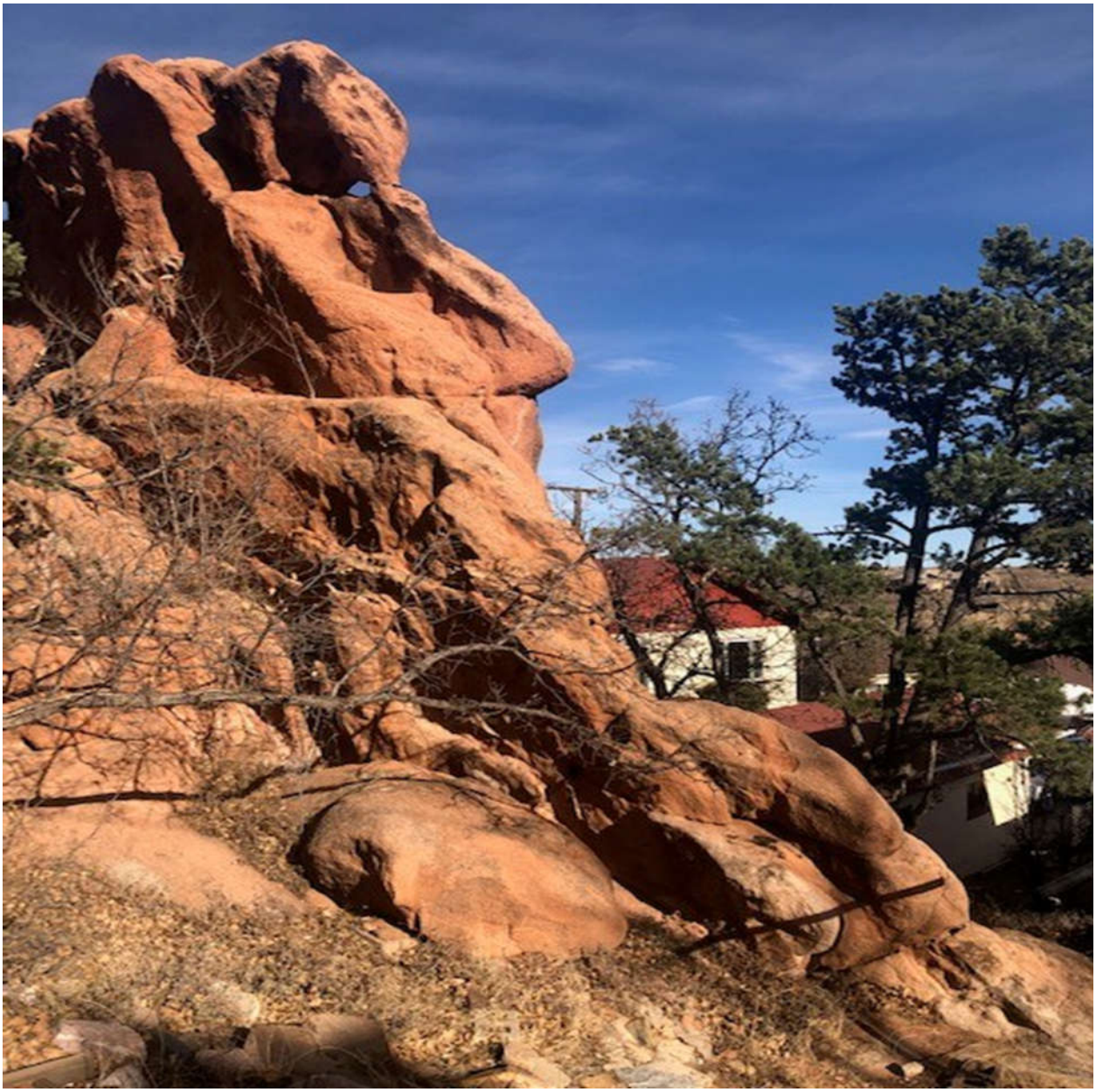
Pine tree that is to be preserved within the proposed preservation area

West of detached garage, looking north



Steeply dipping sandstone formation

Retaining wall, west of detached garage to remain



Looking northeast, towards 204 Red Rock Ave.

Looking east towards sandstone formation