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SOILS AND GEOLOGY STUDY
PYRAMID MOUNTAIN ROAD
PARCEL NO. 83230-00-026
EL PASO COUNTY, COLORADO

Prepared for:

Andy Mullet
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October 7, 2025
Revised April 1, 2026

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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Date: 04/01/26

Joseph C. Goode Jr., P.E
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Entech Job No. 251469
PBK/LLL/JCG

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1 SUMMARY

Project Location

The project is located in the SW¼ of Section 23, Township 13 South, Range 68 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately ¼ of a mile northeast of Cascade, Colorado. The location of the site is as shown in the Vicinity Map, Figure 1.

Project Description

A rural residential lot is proposed for the 16.94-acre parcel. The parcel is currently zoned PUD (Planned Unit Development), and the planned rezone will be RR-5 (Rural Residential). The proposed new lot will utilize Colorado Springs Utilities water and an onsite wastewater treatment system (OWTS).

Scope of Report

This report presents the results of our geologic evaluation and treatment of engineering geologic hazard study for the proposed subdivision.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development; however, geologic conditions in certain areas will impose some constraints on development and land use. These include downslope creep, potential seasonally shallow groundwater area, debris flow susceptible drainage, and the potential for elevated radon levels. These conditions are discussed in greater detail in this report.

In general, it is our opinion that the development can be achieved if the observed geologic conditions on site are either properly mitigated or avoided. All recommendations are subject to the limitations discussed in the report.

2 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The topography of the site is moderately to steeply sloping, generally to the south and southwest. The site boundaries are indicated in the USGS Map (Figure 2). Slopes in the potential building area are moderately sloping. A minor drainage was observed in the southern portion of the parcel, which was dry at the time of our site observations. The site primarily contains field grasses, weeds, mountain mahogany, scrub oak, and ponderosa pines. Site photographs taken August 25, 2025 are included in Appendix A.

A rural residential lot is proposed for the 16.94-acre parcel. The parcel is currently zoned PUD (Planned Unit Development), and the planned rezone will be RR-5 (Rural Residential). The proposed new lot will utilize Colorado Springs Utilities water and an onsite wastewater treatment system (OWTS). The proposed lot is shown in the Site and Exploration Plan (Figure 4). Grading/building plans were not available at the time of this investigation, but are expected to have minimal cut/fill associated with the grading of a gravel driveway.

3 SCOPE OF THE REPORT

The scope of the report includes a general geologic analysis utilizing published geologic data. Detailed site-specific mapping was conducted to obtain general information with respect to major geographic and geologic features, geologic descriptions, and their effects on the development of the property in accordance with the El Paso Land Development Code.

4 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The site was also evaluated using the Web Soil Survey from the Natural Resource Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS). The position of mappable units within the subject property is shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map, which identified pertinent geologic conditions affecting development. The field mapping was completed on August 25, 2025.

Three (3) test pits (designated TP-1 though TP-3) were excavated across the project site to determine the classification and engineering characteristics of the soils. The test pits were excavated to depths of 6 to 8 feet. TP-1 and TP-2 were located in potential owts locations, and TP-3 was excavated in the proposed building footprint.

The locations of the test pits are indicated on the Site and Exploration Plan (Figure 3). The Test Pit Logs are included in Appendix B, and Laboratory Test Results are included in Appendix C. The results of the testing will be discussed later in this report.

The site was included in previous investigations completed for the formerly proposed Pyramid Mountain Subdivision in a *Geology and Soils Study* completed by Kumar and Associates, Inc. (Reference 2), and a *Rockfall Analysis – Pyramid Mountain Subdivision* completed by Entech (Reference 3). Information from these reports were used in evaluating the site.

Laboratory testing was performed to classify and determine the engineering characteristics of the soils. Laboratory tests included moisture content testing (ASTM D2216) and grain-size analysis (ASTM D422). Results of the laboratory testing are included in Appendix C.

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

5.1 General Geology

The site lies in the eastern portion of the Southern Rocky Mountain Physiographic Province. A major structural feature known as the Rampart Range Fault lies approximately 2 miles to the east. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The rocks in the area of the site are igneous in nature and typically Proterozoic in age. The bedrock underlying the site consists of the Pikes Peak Granite. Overlying this formation are unconsolidated deposits of residual soils, sheetwash deposits, and alluvial fan deposits of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site and the alluvial materials deposited as alluvial fans and colluvial soils by the action of gravity and sheet wash along the mountain front. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 4), previously the Soil Conservation Service (Reference 5), has mapped two soil types on the site (Figure 4). In general, they are gravelly sandy loams. The soil is described as follows:

Exhibit 1: Soil Survey Description

Type	Description
46	Sphinx-Rock Outcrop Complex, 15% to 80% Slopes
48	Tecolote Very Gravelly Sandy Loam, 15% to 40% Slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described as having moderate to rapid permeabilities. Limitations on development include limited ability to support a load, slope instability, and frost action potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soils have been described to have moderate erosion hazards.

5.3 Site Stratigraphy

The Geologic Map of the Cascade Quadrangle, El Paso County, Colorado showing the site is presented in Figure 5 (Reference 6). The Geology/Engineering Geology Map prepared for the site is presented in Figure 6. Two mappable units were identified on this site that are described as follows:

Qfo **Old Alluvial Fan Deposits of Late to Middle Pleistocene Age:** These deposits are fine to very coarse-grained soils deposited as alluvial fans and colluvial soils by the action of gravity and sheet wash along the mountain front. It can be highly stratified grading from silty sands to gravelly soils and may contain some cobble-sized material.

Qc/Ypp **Colluvium of Quaternary Age overlying Pikes Peak Granite of Middle Proterozoic Age:** This unit is typically pink coarse-grained granite associated with the Pikes Peak Batholith. Overlying the granite are residual soils and sheetwash deposits.

The bedrock underlying the site is the Pikes Peak Granite of Middle Proterozoic Age. This formation typically consists of pink coarse-grained granite. Bedrock was not encountered in the test pits.

5.4 Soil Conditions

The soils encountered in the test pits which were excavated on the site can be grouped into 1 general soil type. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 classified as a gravelly silty sand to gravelly sand with silt (SW-SM). The loose to medium dense sand was encountered in the test pits at the existing surface extending to the terminations of the test pits (6 to 8 feet). The sand was encountered at moist conditions.

5.5 Groundwater

Groundwater was not encountered in the test pits dug to depths of 6 to 8 feet, and redoximorphic features were not observed. Groundwater is not expected to impact construction. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors including development of the site and surrounding areas.

For the sandy materials on site, it should be noted that some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock. Builders and planners should monitor potential occurrences of such subsurface water features during construction on-site and mitigate as necessary at the time of construction.

6 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

Detailed mapping has been performed on this site to produce a Geology/Engineering Geology Map (Figure 6). This map shows the location of various geologic conditions the developers should monitor during the planning, design, and construction stages of the project. No significant geologic hazards were identified on the site; however, the following constraints have been identified on the site: downslope creep and potentially unstable slopes. These constraints and recommended mitigation techniques are presented below:

<u>Areas of Artificial Fill – Constraint</u>
Artificial fill was not observed on the site.
<u>Mitigation:</u> Should fill be encountered during excavation, it will be considered uncontrolled. Any uncontrolled fill encountered under foundations or drainage structures will require removal and recompaction at a minimum of 95% of its Modified Procter (ASTM D1557) maximum dry density.

<u>Expansive Soils – Constraint</u>
The site is not mapped within an area of swell potential according to the Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado by Hart, 1974 (Reference 8). Expansive materials are not typically encountered within the area of the project site. If expansive materials are encountered during excavation, they will require mitigation. These occurrences should be identified and mitigated on an individual basis.

<u>Slope Stability and Landslide Susceptibility – Hazard</u>
The topography of the site is moderately to steeply sloping, generally to the south and southwest. Slopes in the potential building area are moderately sloping. Signs of failures or instability were

not observed during field mapping, however, signs of downslope creep were observed. It is recommended that any future grading or fill slopes be 3:1 or flatter.

Downslope Creep Areas – Constraint

The site has been identified with this hazard due to the moderate to steep slopes. In these areas we would anticipate lateral and vertical movement of the near surface soils in the downslope direction. These areas are acceptable as building sites with the following constraints on construction.

Mitigation: Building is possible in these areas if the following engineering and construction mitigation steps are taken: Downslope creep will increase lateral pressures against foundation walls on the uphill side of structures. The design of foundations in these areas should account for this additional pressure. A lateral pressure detail is shown in Figure 7. Where possible in areas of downslope creep, structures should be designed to be as compact and rigid as possible. This will help them better tolerate the vertical and lateral movements to which the foundation system may be subjected. Long, rambling, irregular structures should be avoided in these areas as they are associated with a much greater potential for damaging differential movement. Tie walls and buttresses are often used to stiffen the foundation system.

Rockfall – Hazard

No signs of past rockfall events or rockfall susceptible outcrops were observed on the parcel. The previous *Rockfall Analysis* completed by Entech did not identify any rockfall susceptible areas on the parcel. Areas of the previous study area identified with potential rockfall hazards are located north and west of the parcel. The previously completed *Rockfall Analysis* is included in Appendix E.

Drainage Floodplain Areas – Hazard

The site is not located within any floodplain zones according to FEMA Map No. 08041CO488G (Reference 9, Figure 8). The nearest floodplain is mapped to be approximately ¼ of a mile to the west of the site. It is mapped as a having a 0.2% to 1% annual change of flooding. Specific drainage studies and floodplain locations are beyond the scope of this report. A minor drainage swale is located in the southern portion of the site that has been identified as a potential seasonally shallow groundwater area.

Potentially Seasonally Shallow Groundwater Areas – Constraint

In these areas, we would anticipate periodic high subsurface moisture conditions and frost heave potential on a seasonal basis. The main drainage crossing the site has been identified as seasonally shallow groundwater. Areas of potentially seasonal shallow groundwater were identified along the minor drainage in the southern portion of the site. Additional, highly organic soils could be encountered in these areas. It is anticipated they will be avoided by proposed residence, however, the proposed driveway will cross the drainage. Any structures in or adjacent to these areas should follow the mitigation discussed below.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. Buildings should be a minimum of 3 feet above groundwater levels. Subsurface perimeter drains are recommended for any usable below-grade areas including crawlspaces. Typical perimeter drain detail is presented in Figures 10. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Structures should not block drainages. All organic material should be completely removed prior to any fill placement. Septic fields should not be placed in areas where there is the potential for shallow groundwater.

Debris Fans/Debris Flow Susceptibility – Hazard

Portions of the site are mapped as susceptible to debris flows according to the Debris Flow Susceptibility Map of El Paso County, Colorado, by McCoy, Morgan, and Berry (Reference 10) and is shown in Figure 9. These areas are associated with the minor drainage swale in the southern portion of the site. There is the potential for debris flows to initiate during heavy rainfall events in this area. The area identified with this hazard on this site will be avoided by the proposed residence, however, the proposed gravel driveway will cross this drainage. Culverts should account for the potential of hyper-concentrated sediment laden flows and be adequately sized by a qualified drainage engineer. Specific drainage studies are beyond the scope of this report.

Mitigation: Channel armoring consisting of riprap and/or other forms of erosion protection should be utilized in areas of concentrated flows to include permanent channel armoring to prevent accelerated erosion, creating unstable conditions. Riprap sizing should be based off potential flow velocities. The erosion protection must utilize proper fabric/grid grading to prevent piping and undermining. Erosion control measures and riprap sizing should be determined by a qualified professional.

Faults – Hazard

The closest fault is the Ute Pass Fault, located approximately ¼ of a mile west of the site. No faults are mapped in the site itself. Previously, Colorado was mapped entirely within Seismic Zone 1, a very low seismic risk. Additionally, the International Residential Code (IRC), 2003, currently places this area in Seismic Design Category B, also a low seismic risk. According to a report by the Colorado Geological Survey by Kirkman and Rogers, Bulletin 43 (1981) (Reference 11), this area should be designed for Zone 2 due to more recent data on the potential for movement in this area and any resultant earthquakes.

Radon – Hazard

Radon is a colorless, tasteless radioactive gas with a United States Environmental Protection Agency (EPA) specified action level of 4.0 picocuries per liter (pCi/L) of air. Radon gas has a very short half-life of 3.8 days. Radon levels for the area have been reported by the Colorado Geologic Survey in the Open File Report No. 91-4 (Reference 12). The average radon level for the 80909 zip code is 3.05 pCi/l. The following is a table of radon levels in this area:

Average Radon Levels for the 80909 Zip Code	
0 < 4 pCi/L	75.00%
4 < 10 pCi/L	25.00%
10 < 20 pCi/L	0.00%
> 20 pCi/L	0.00%

Mitigation:

The potential for high radon levels is present for the site. Build-up of radon gas can usually be mitigated by providing increased ventilation of basement and crawlspace and sealing joints. **Specific requirements for mitigation should be based on site specific testing.**

6.1 Relevance of Geologic Conditions to Land Use Planning

We understand that the development will be a single rural residential lot. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. Hazards on the site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper sand soils are typically at medium dense states. The medium dense soils should provide good support for foundations. Loose soils, if encountered at foundation depth, will require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation if recompaction of loose soils is required. Due to the slopes on the site, foundation stiffeners such as tie-beams, buttresses, or additional reinforcement may be required. Excavation is anticipated to be moderate with rubber-tired equipment for the site sand materials. Decomposed granite, if encountered at foundation grade, will be difficult to excavate and will likely require track-mounted equipment with ripper attachments. Expansive materials are not typically encountered within the area of the project site. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

In summary, development of the site can be achieved if the items mentioned above are mitigated. These items can be mitigated through proper design and construction or through avoidance. Investigation of the individual lots and building sites is recommended prior to construction.

7 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 14), the site is mapped within a deposit of decomposed granite. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 15), the area of the site is not mapped within an area of potential aggregate deposits. 3 active aggregate mines within the decomposed granite are mapped within 3 miles of the site. Given the abundance of decomposed granite in the area of the site, the site is considered to have low potential for economic mineral resources.

8 EROSION CONTROL

The soil types observed on the site are mildly susceptible to wind erosion and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed and vegetation re-established, the potential for wind erosion should be considerably reduced.

Regarding water erosion, loosely compacted soils will be the most susceptible to water erosion; residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on site, allowable velocities for unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of synthetic channel lining materials on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities as well as provide small traps for containing sediment. The determination of the amount, location, and placement of ditch linings, check dams, and special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

9 ROADWAY, EMBANKMENT, and STORMWATER CONSTRUCTION RECOMMENDATIONS

The site soils are suitable for the proposed private drives and embankments. Groundwater is not anticipated to affect roadway construction. Additional investigation of these areas is recommended as plans are completed. If excavations encroach on the groundwater level, unstable soil conditions may be encountered. Excavation of saturated soils will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

Any areas to receive fill should have all topsoil, organic material, or debris removed. Prior to fill placement, Entech should observe the subgrade. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1 or flatter. The subgrade should be scarified and moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density prior to placing new fill. Areas receiving fill may require stabilization with rock or fabric if shallow groundwater conditions are encountered.

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of the Modified Proctor (ASTM D1557) maximum dry density. These materials should be placed at a moisture content conducive to compaction, usually 0 to +/-2% of the Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any imported materials prior to placing or hauling them to the site. Additional investigation will be required for pavement designs once roadway grading is completed and utilities are installed.

10 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The majority of these conditions can be mitigated through proper engineering design and construction practices. The proposed development and use are consistent with anticipated geologic and engineering geologic conditions.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Construction and design personnel should be made familiar with the contents of this report. Additional investigation is recommended for the building site prior to construction as plans (grading and development) are generated.

This report has been prepared for Andy Mullet for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty, expressed or implied, is made.

We trust that this report has provided you with all the information that you require. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

11 REFERENCES

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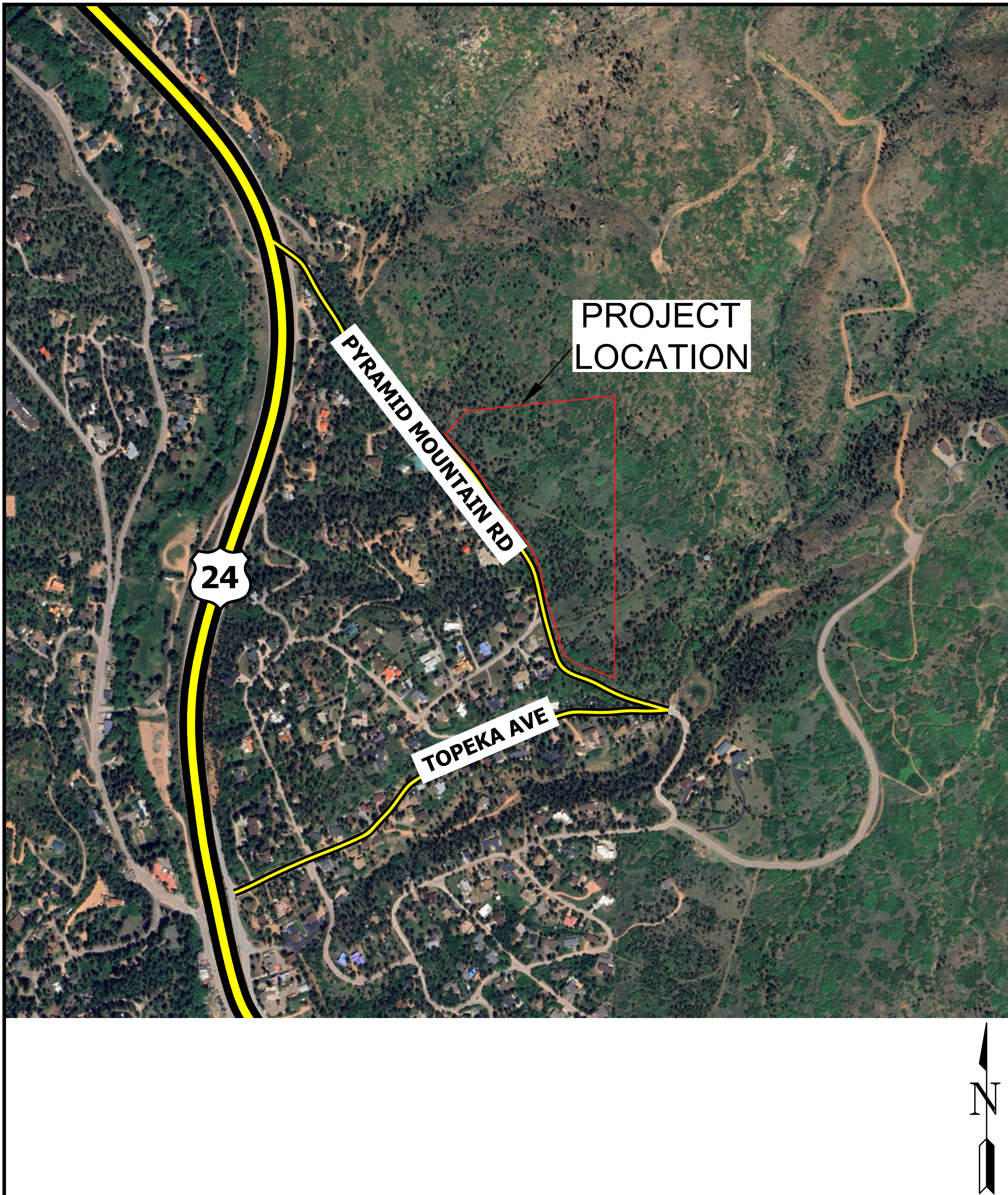
FIGURES



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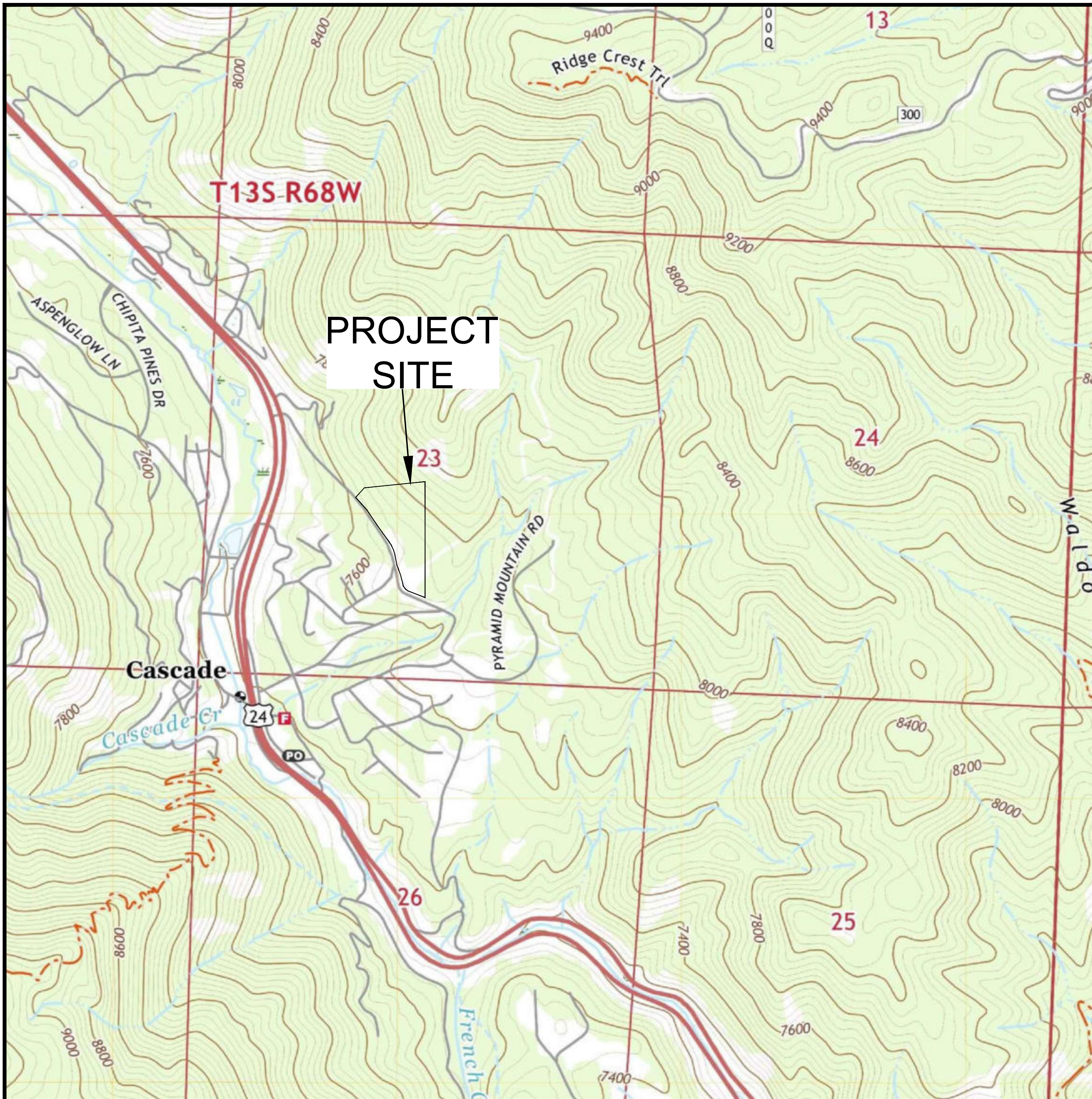
VICINITY MAP

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO. 251469

FIG. 1

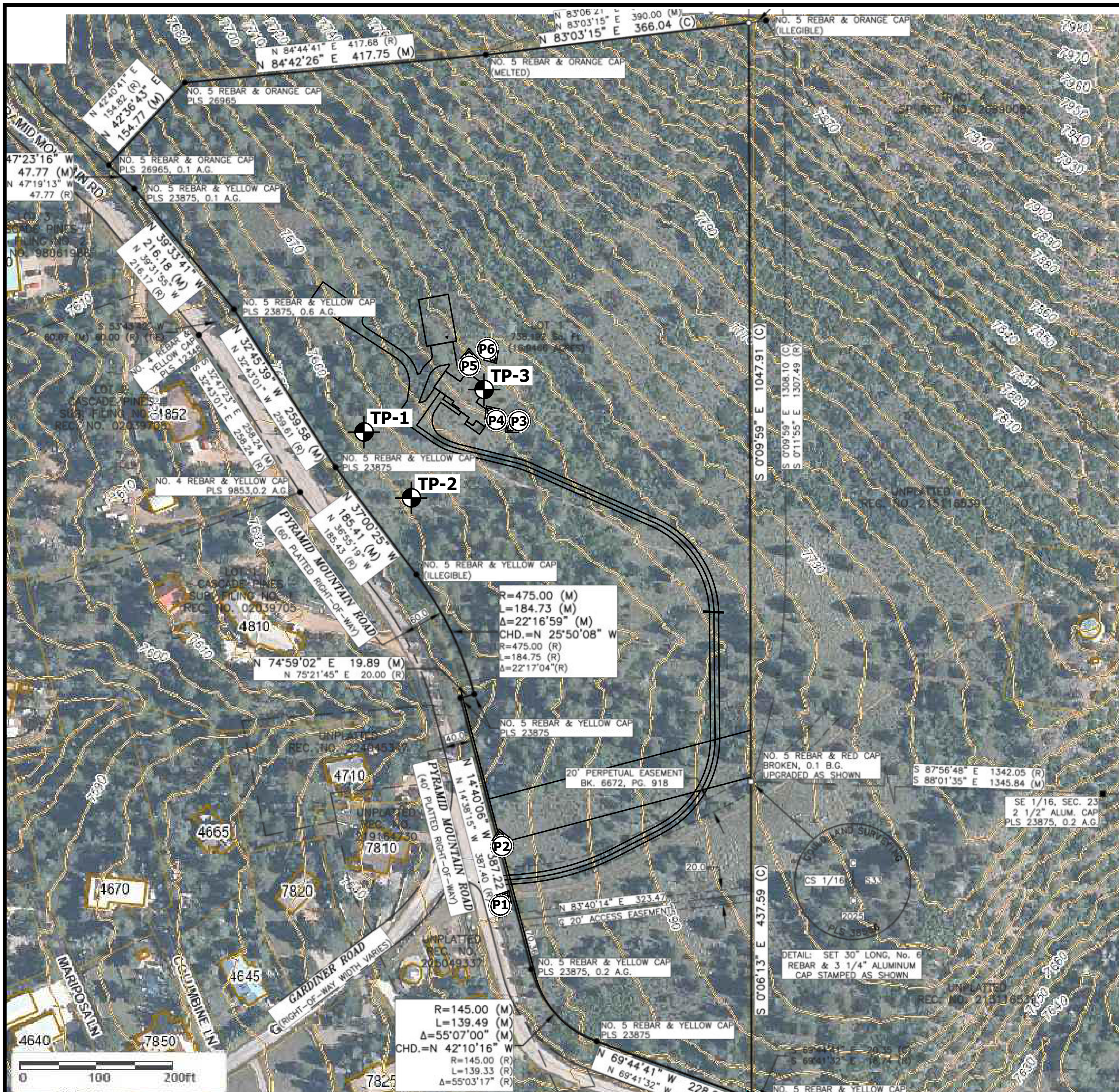


USGS TOPOGRAPHY MAP

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO. 251469

FIG. 2



- APPROXIMATE TEST BORING LOCATION AND NUMBER

(P2) - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

ENTECH ENGINEERING, INC.

SITE AND EXPLORATION MAP

PYRAMID MOUNTAIN ROAD
ANDY MULLET

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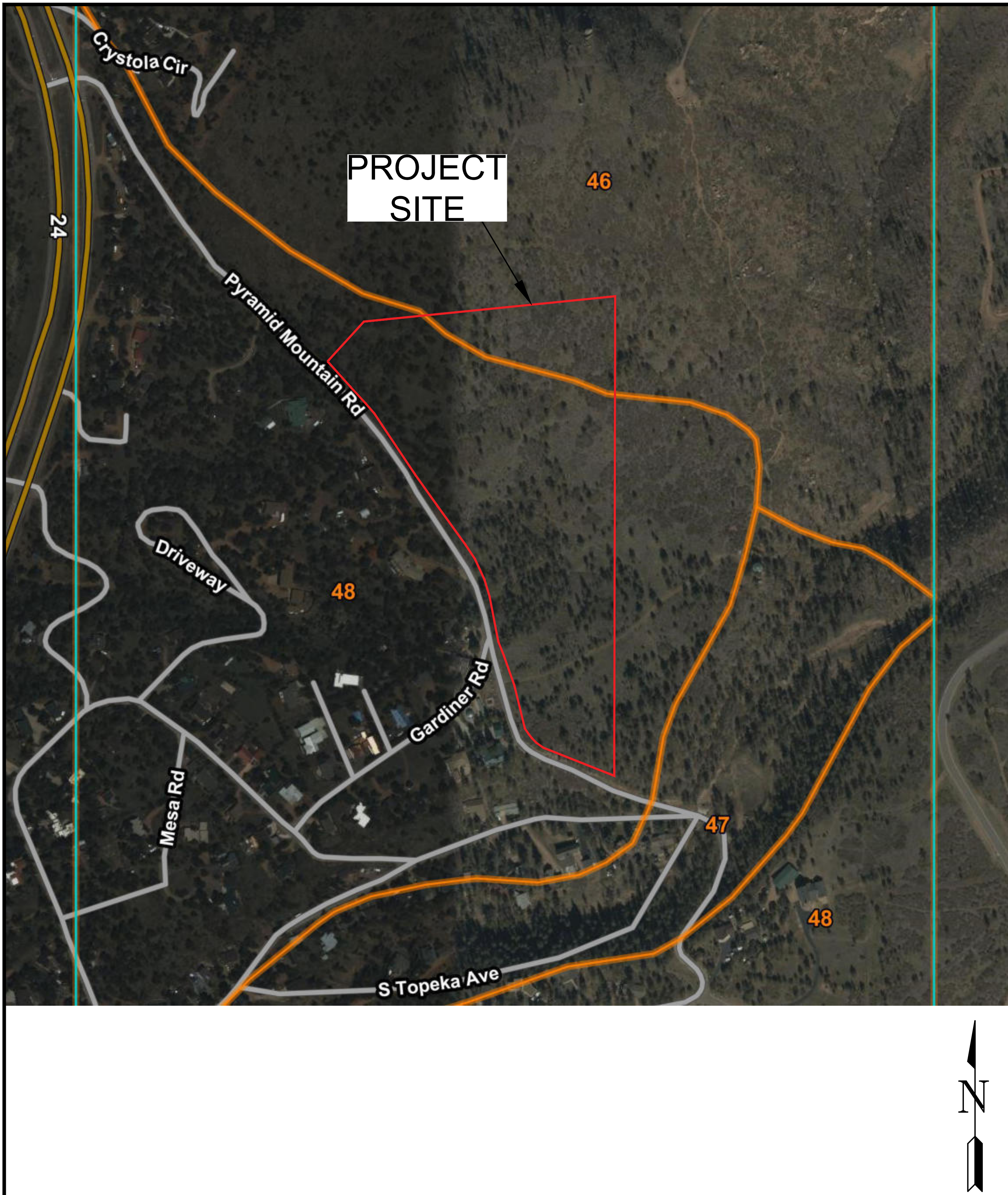
FIG. 3



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SOIL SURVEY MAP

PYRAMID MOUNTAIN ROAD
ANDY MULLET

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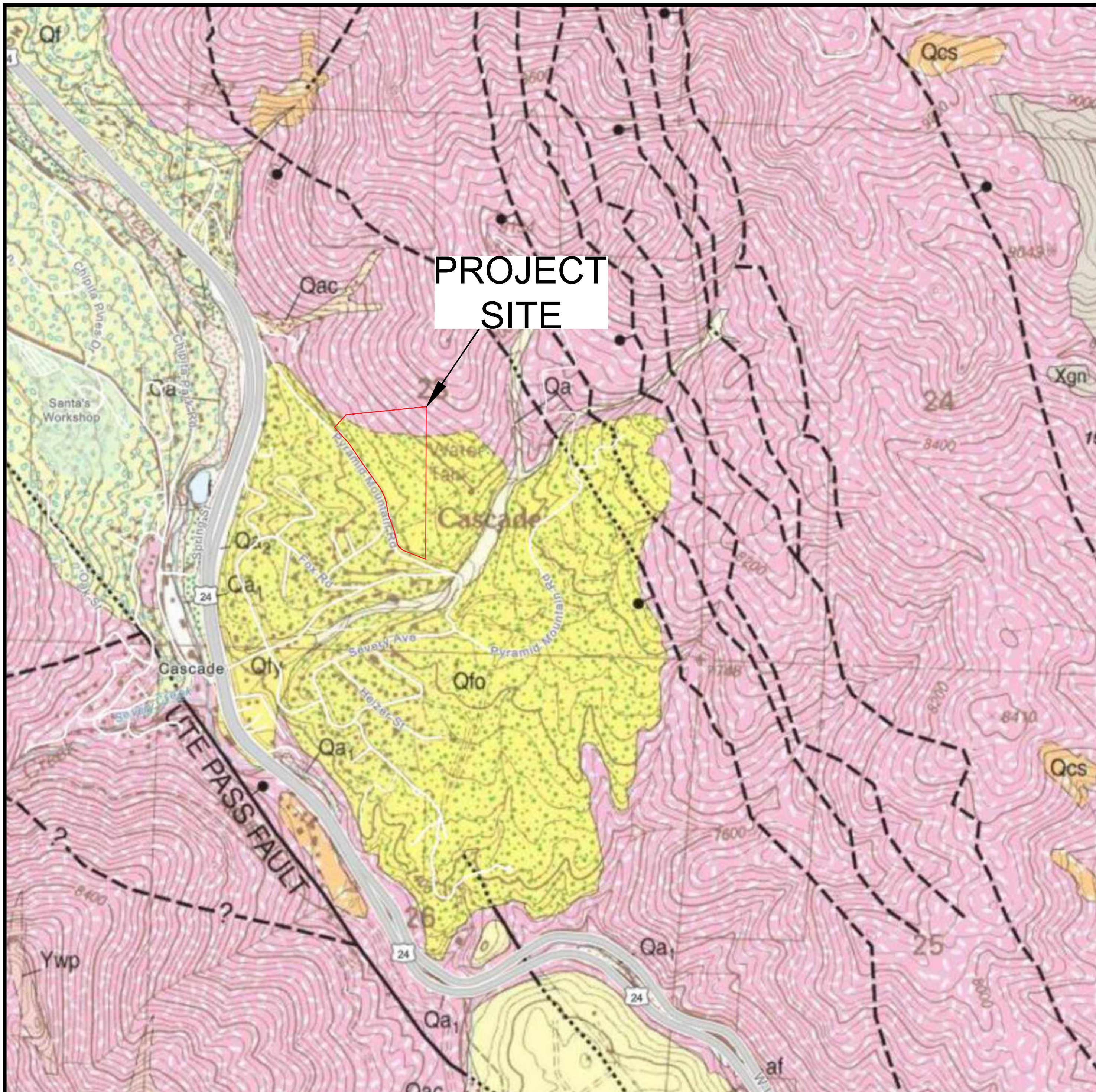
FIG. 4



GEOLOGIC MAP OF THE CASCADE QUADRANGLE

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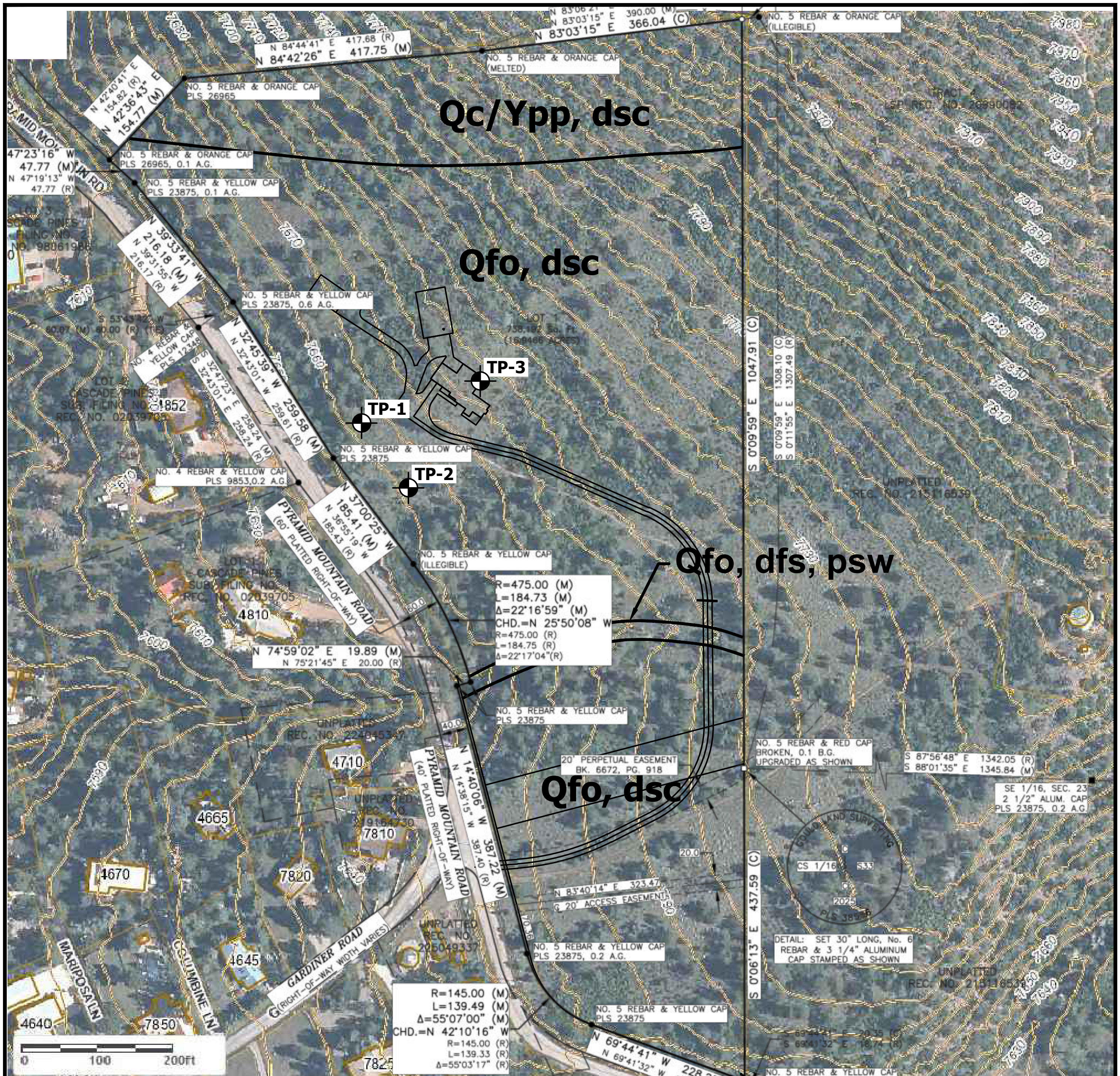
FIG. 5



Legend

Qfo- **Old Alluvial fan deposits of middle to Late Pleistocene Age**
older water deposited sands and gravel

Qc/Ypp- **Colluvium of Quaternary Age overlying Pikes Peak Granite of Precambrian Age:**
sheetwash and residual soil deposits overlying intrusive igneous red to brown granite

dsc - downslope creep
dfs - debris flow susceptible area
psw - potential seasonally shallow groundwater area

- APPROXIMATE TEST BORING LOCATION AND NUMBER

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GEOLOGY/ENGINEERING GEOLOGY MAP
PYRAMID MOUNTAIN ROAD
ANDY MULLET

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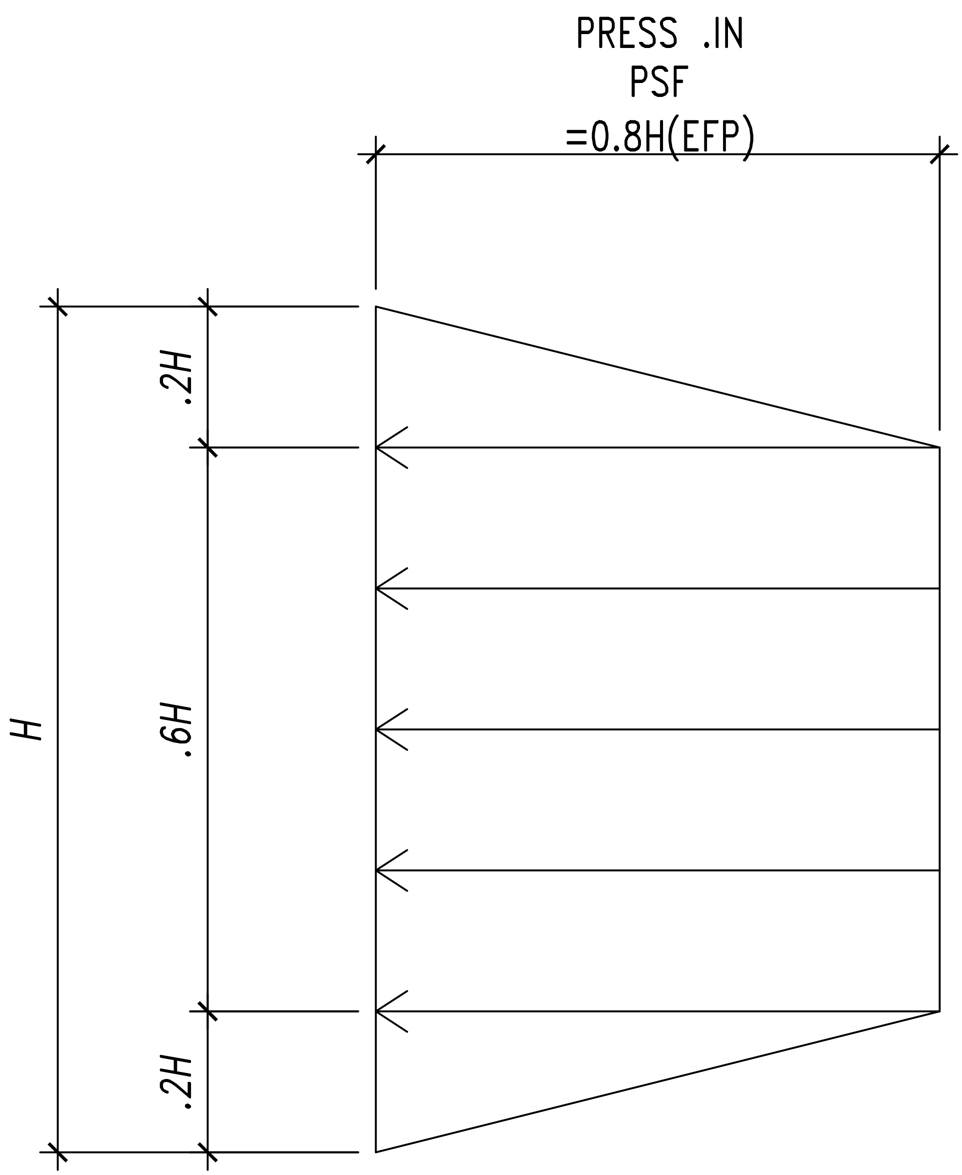
FIG. 6



PRESSURE DISTRIBUTION

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LATERAL PRESSURE DIAGRAM

PYRAMID MOUNTAIN ROAD
ANDY MULLET

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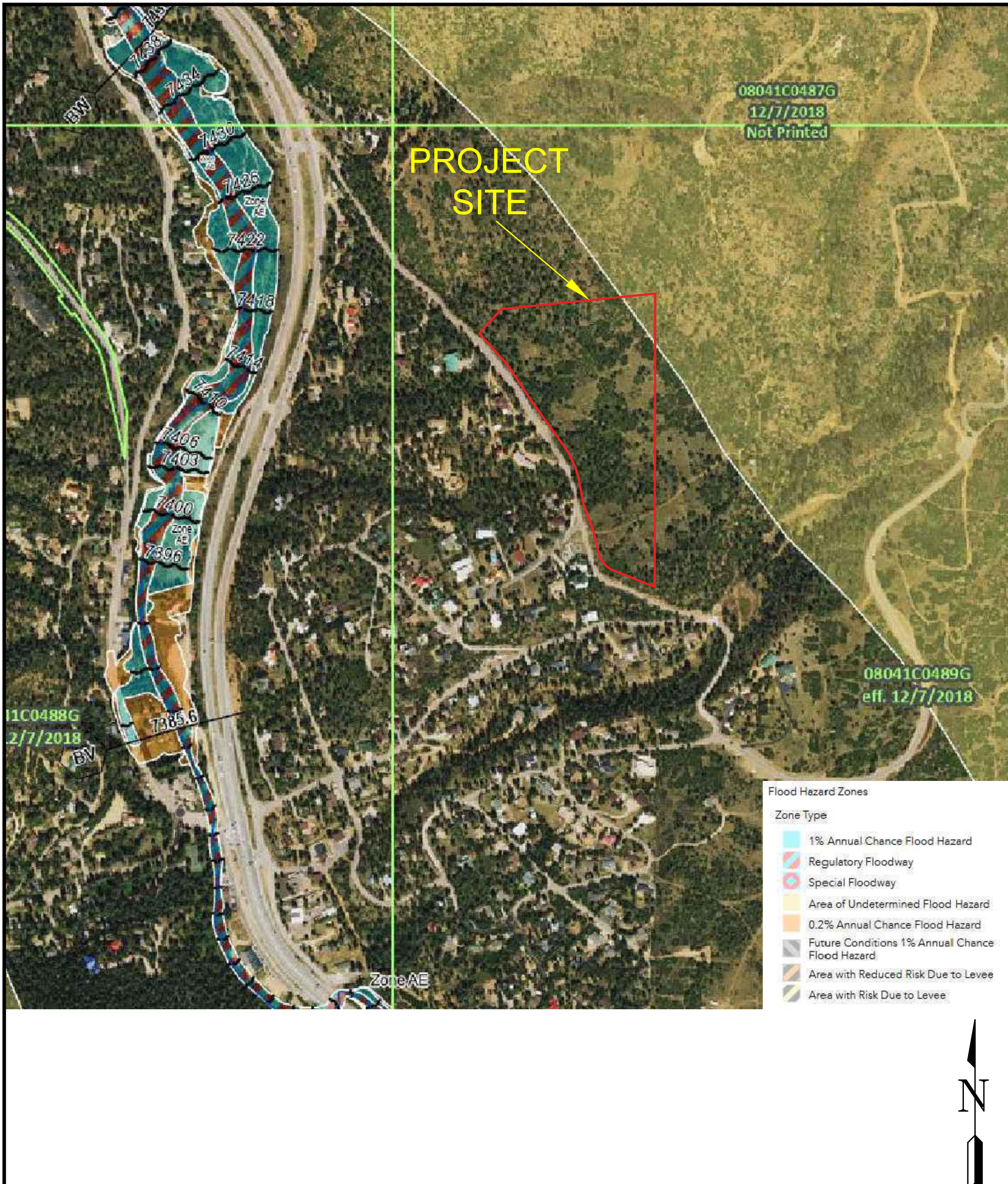
FIG. 7



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FEMA FLOODPLAIN MAP

PYRAMID MOUNTAIN ROAD
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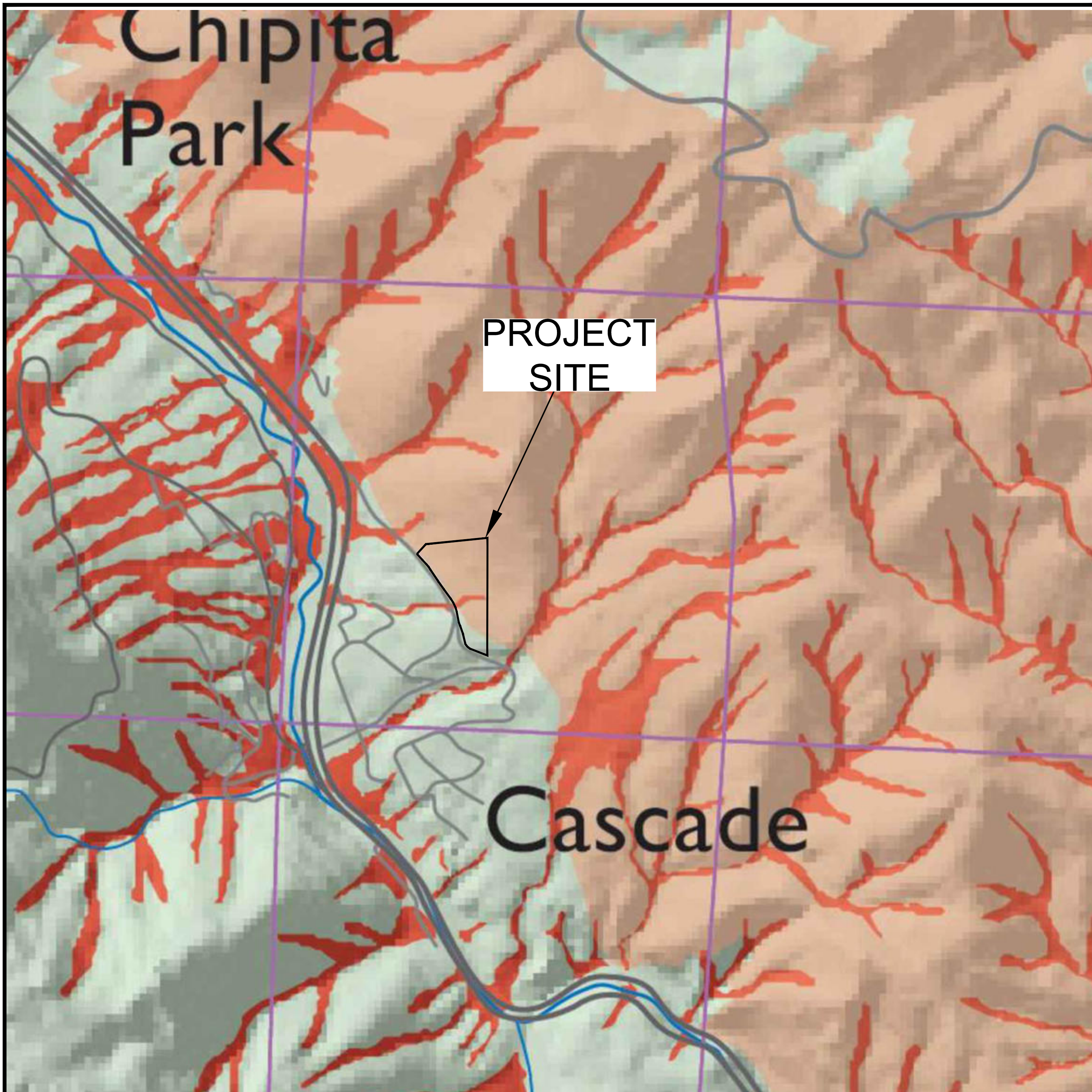
FIG. 8



DEBRIS FLOW SUSCEPTIBILITY MAP

PYRAMID MOUNTAIN ROAD
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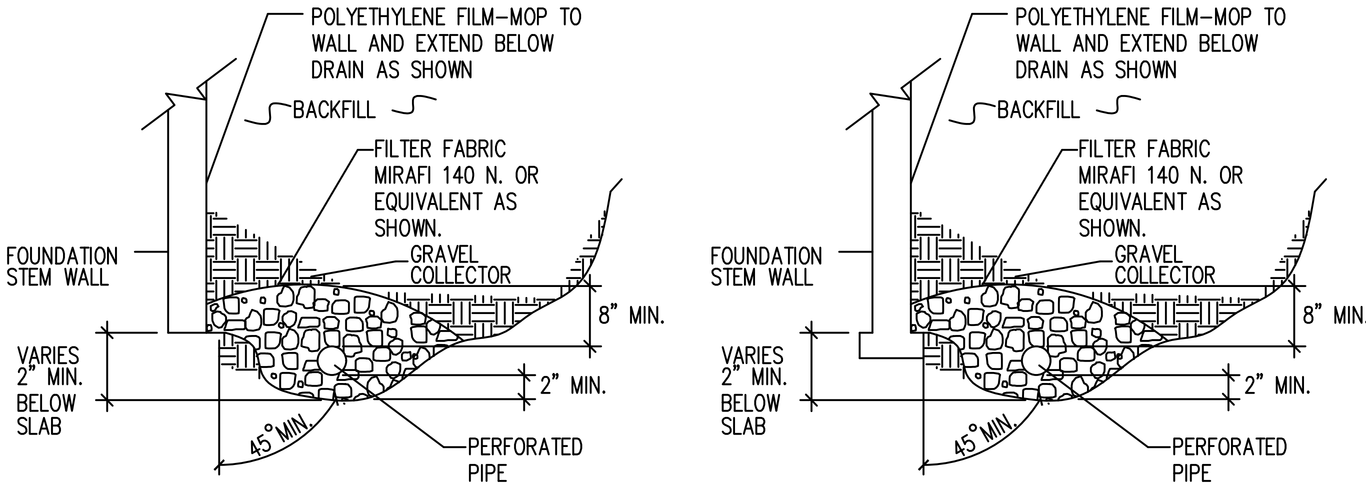
FIG. 9



NOTES:

-GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS-85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

-PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4-INCH DIAMETER IS MOST OFTEN USED.

-ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON-PERFORATED PIPE.

-FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

-MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

-DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

ENTECH ENGINEERING, INC.

PERIMETER DRAIN DETAIL

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO. 251469

FIG. 10

APPENDIX A: Site Photographs

1

Looking north from the southern portion of the site.

August 25, 2025

2

Looking northeast from the western portion of the site.

August 25, 2025

3

Looking northeast from the southwestern portion of the site.

August 25, 2025

4

Looking east from the southwestern portion of the site.

August 25, 2025

5

Looking northeast from the southwestern portion of the site.

August 25, 2025

6

Looking east from the southwestern portion of the site.

August 25, 2025

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APPENDIX B: Test Boring and Test Pit Logs

TEST PIT 1
DATE EXCAVATED 8/25/2025

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
topsoil, brown, moist						
	1					
gravelly silty sand, fine to coarse grained, red-brown,	2			gr	m	2 R-1
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

TEST PIT 2
DATE EXCAVATED 8/25/2025

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
topsoil, brown, moist						
gravelly silty sand, fine to coarse grained, red-brown,	1			sg	w	2 R-1
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l
structureless - sl

ENTECH ENGINEERING, INC.

TEST PIT LOGS

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO.
251469

FIG. B-1

TEST PIT 1

DATE EXCAVATED 8/25/2025

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
topsoil, brown, moist						
gravelly silty sand, fine to coarse grained, red-brown,	1–8			gr	m	2 R-1

Depth scale (ft): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

TEST PIT 2

DATE EXCAVATED 8/25/2025

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
topsoil, brown, moist						
gravelly silty sand, fine to coarse grained, red-brown,	1–8			sg	w	2 R-1

Depth scale (ft): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

<u>Soil Structure Shape</u>

granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

<u>Soil Structure Grade</u>

weak - w
moderate - m
strong - s
loose - l
structureless - sl

ENTECH ENGINEERING, INC.

TEST PIT LOGS

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO. 251469

FIG. B-1

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APPENDIX C: Laboratory Test Results

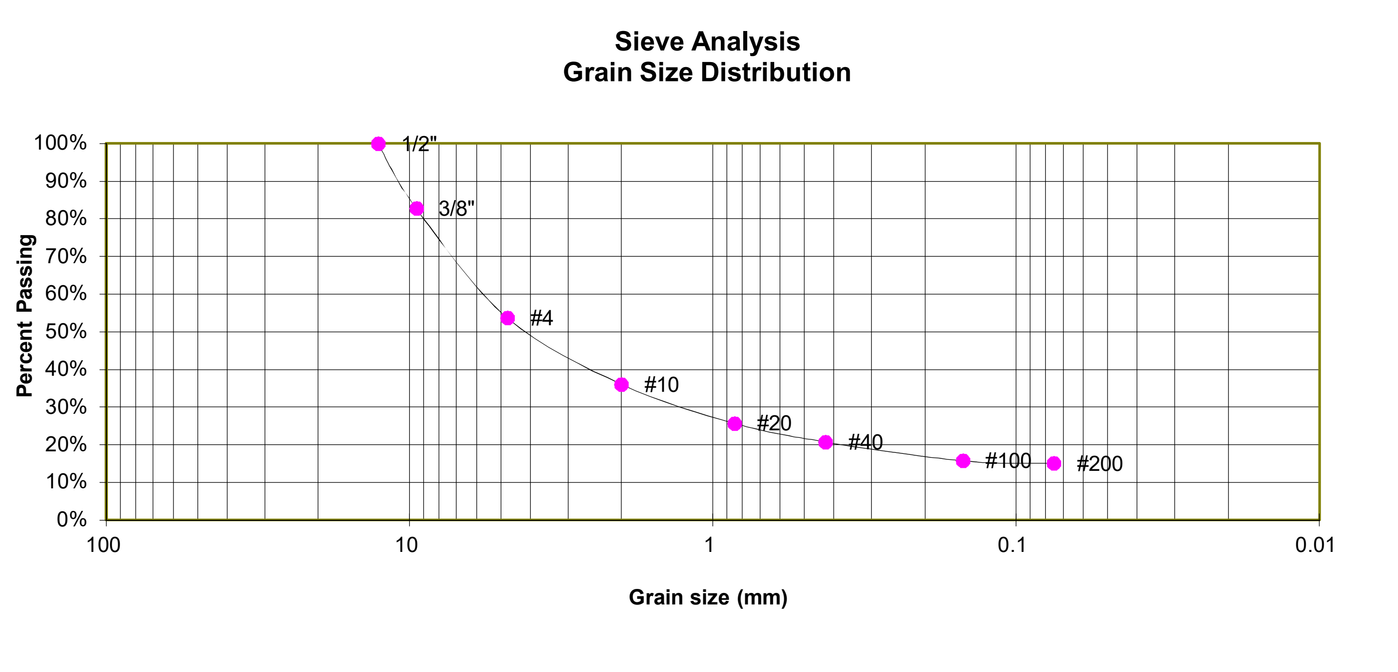
TABLE C-1

SUMMARY OF LABORATORY TEST RESULTS

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	PASSING NO. 200 SIEVE (%)	SULFATE (WT %)	USCS	SOIL DESCRIPTION
1	TP-1	6	15.1		SM	SAND, GRAVELLY, SILTY
1	TP-2	2-3	9.2		SW-SM	SAND, GRAVELLY, WITH SILT
1	TP-3	2-3	7.6	0.00	SW-SM	SAND, GRAVELLY, WITH SILT
1	TP-3	5	11.1		SP-SM	SAND, GRAVELLY, WITH SILT

Project: Pyramid Mountain Road
Client: Andy Mullet
Job No: 251469

TEST BORING	TP-1	SOIL DESCRIPTION	SAND, GRAVELLY, SILTY
DEPTH (FT)	6	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	82.7%
4	53.6%
10	36.0%
20	25.7%
40	20.7%
100	15.7%
200	15.1%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

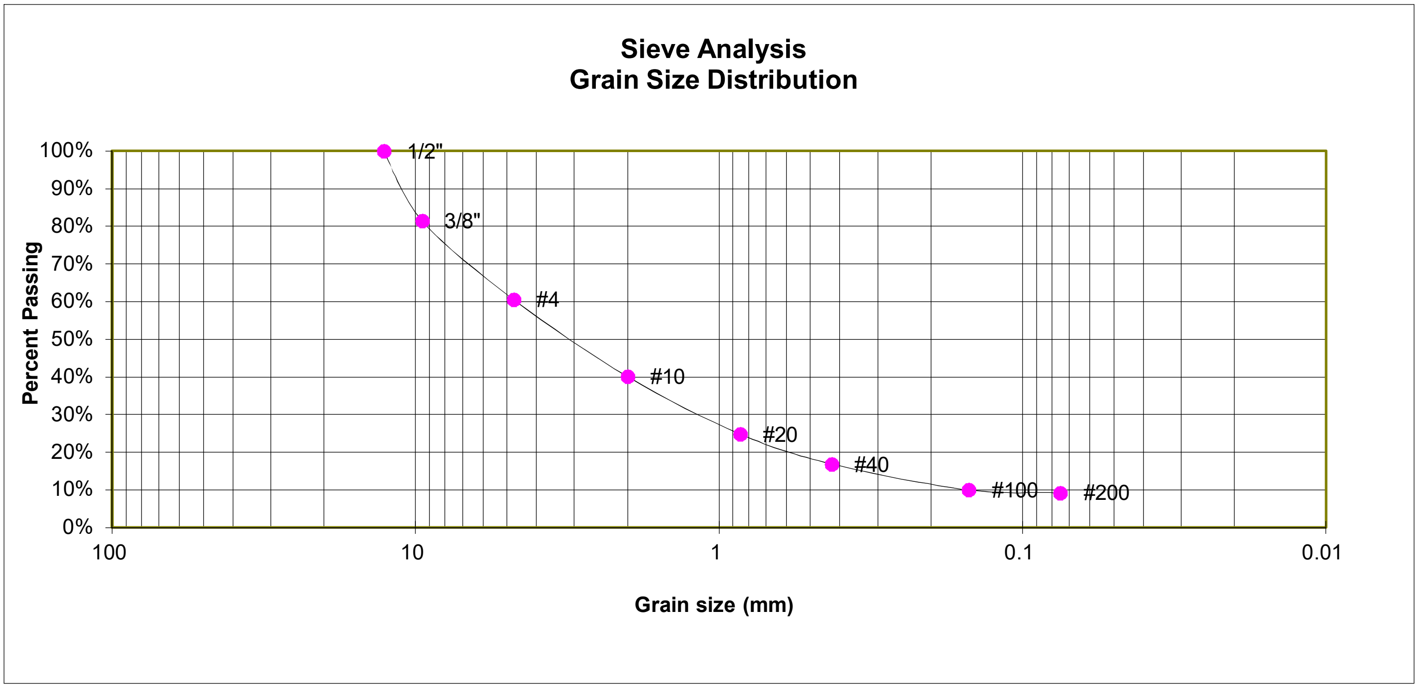
LABORATORY TEST RESULTS

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO.
251469

FIG. C-1

TEST BORING	TP-2	SOIL DESCRIPTION	SAND, GRAVELLY, WITH SILT
DEPTH (FT)	2-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	81.4%
4	60.6%
10	40.1%
20	24.9%
40	16.9%
100	10.0%
200	9.2%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

ENTECH ENGINEERING, INC.

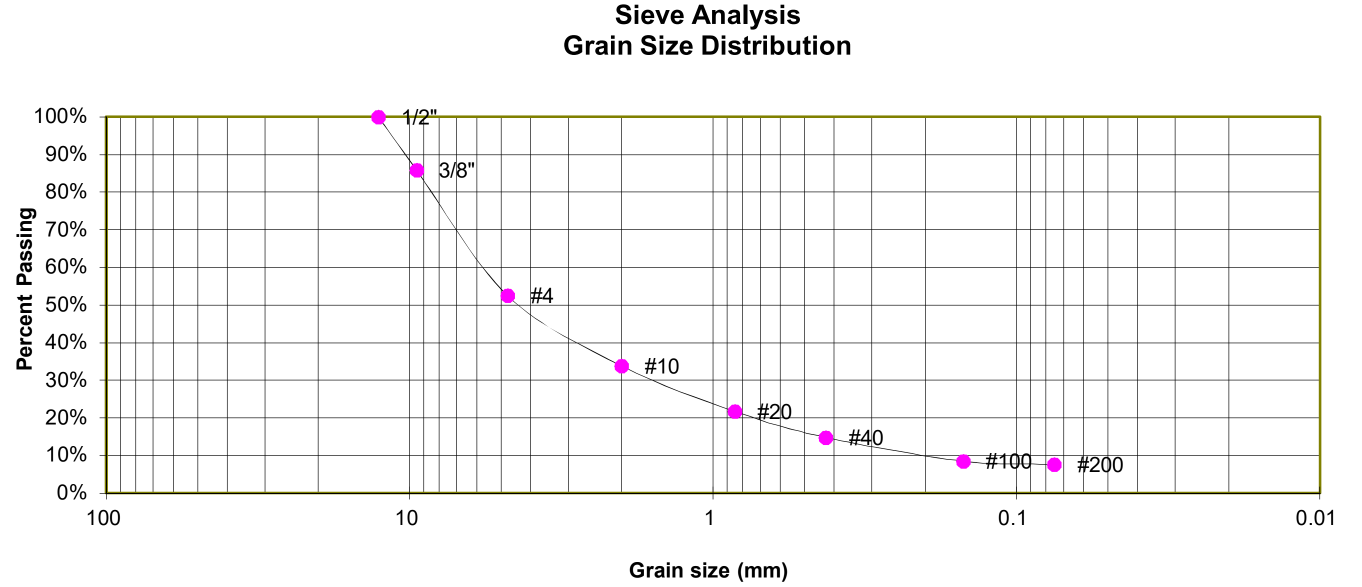
LABORATORY TEST RESULTS

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO.
251469

FIG. C-2

TEST BORING	TP-3	SOIL DESCRIPTION	SAND, GRAVELLY, WITH SILT
DEPTH (FT)	2-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	85.9%
4	52.5%
10	33.8%
20	21.8%
40	14.8%
100	8.5%
200	7.6%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

ENTECH ENGINEERING, INC.

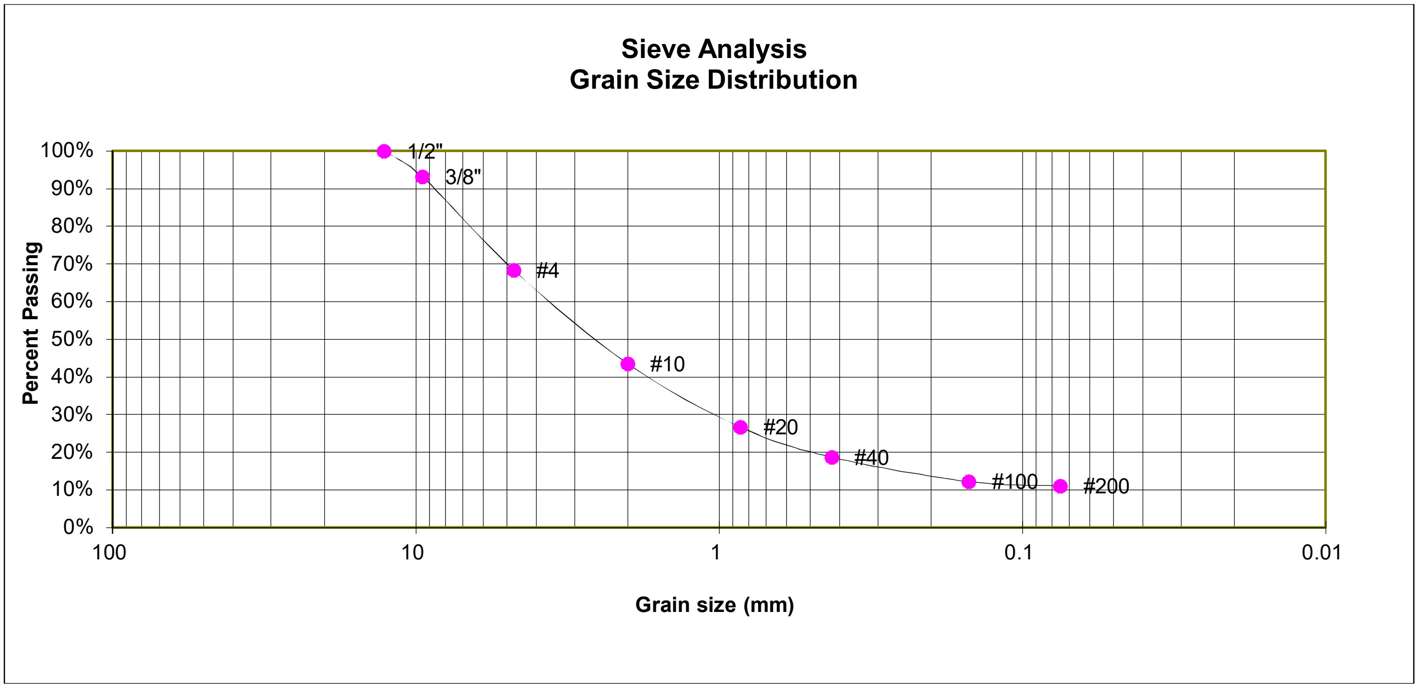
LABORATORY TEST RESULTS

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO.
251469

FIG. C-3

TEST BORING	TP-3	SOIL DESCRIPTION	SAND, GRAVELLY, WITH SILT
DEPTH (FT)	5	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	93.1%
4	68.3%
10	43.5%
20	26.7%
40	18.7%
100	12.2%
200	11.1%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SP-SM

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

PYRAMID MOUNTAIN ROAD
ANDY MULLET

JOB NO.
251469

FIG. C-4

APPENDIX D: USDA Soil Survey Descriptions

Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties

46—Sphinx-Rock outcrop complex, 15 to 80 percent slopes

Map Unit Setting

National map unit symbol: jpjy
Elevation: 6,500 to 9,200 feet
Mean annual precipitation: 15 to 24 inches
Mean annual air temperature: 43 to 48 degrees F
Frost-free period: 70 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Sphinx and similar soils: 60 percent
Rock outcrop: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sphinx

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Weathered from granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 5 inches: gravelly coarse sandy loam
AC - 5 to 13 inches: very gravelly loamy coarse sand
Cr - 13 to 61 inches: weathered bedrock

Properties and qualities

Slope: 15 to 70 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D
Ecological site: R048AY240CO - Shallow Pine
Other vegetative classification: Ponderosa pine/kinnikinnick (PIPO/ARUV) (C1140)
Hydric soil rating: No

Description of Rock Outcrop

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Sphinx, dark surface

Percent of map unit: 10 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Other vegetative classification: Ponderosa pine/kinnikinnick (PIPO/ARUV) (C1140)
Hydric soil rating: No

Garber

Percent of map unit: 5 percent
Landform: Mountain slopes, drainageways
Landform position (three-dimensional): Mountainbase
Down-slope shape: Convex, linear, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Data Source Information

Soil Survey Area: Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties
Survey Area Data: Version 11, Aug 29, 2024

Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties

48—Tecolote very gravelly sandy loam, 15 to 40 percent slopes, very stony

Map Unit Setting

National map unit symbol: jpk0
Elevation: 7,500 to 9,000 feet
Mean annual precipitation: 20 to 25 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 65 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Tecolote, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tecolote, Very Stony

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainbase, lower third of mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Cobbly or stony colluvium over weathered granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
E - 3 to 21 inches: very cobbly sandy loam
B/E - 21 to 31 inches: very cobbly sandy clay loam
Bt - 31 to 46 inches: very cobbly sandy clay loam
Cr - 46 to 61 inches: bedrock

Properties and qualities

Slope: 15 to 40 percent
Surface area covered with cobbles, stones or boulders: 3.0 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F048AY924CO - Douglas Fir/Gambel Oak
Other vegetative classification: Douglas-fir/Gambel oak (PSME/QUGA) (C1214)
Hydric soil rating: No

Minor Components

Tecolote, mollic

Percent of map unit: 5 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainbase, lower third of mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Other vegetative classification: Douglas-fir/Gambel oak (PSME/QUGA) (C1214)
Hydric soil rating: No

Tecolote, very deep

Percent of map unit: 5 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainbase, lower third of mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Other vegetative classification: Douglas-fir/Gambel oak (PSME/QUGA) (C1214)
Hydric soil rating: No

Tecolote, non-skeletal

Percent of map unit: 5 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainbase, lower third of mountainflank
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Other vegetative classification: Douglas-fir/Gambel oak (PSME/QUGA) (C1214)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties
Survey Area Data: Version 11, Aug 29, 2024

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ENGINEERING, INC.

APPENDIX E: Entech Engineering, Inc., Rockfall Analysis – Pyramid Mountain Subdivision, El Paso County, Colorado

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

June 29, 2006

Cascade Resort Communities
4455 Fountain Avenue
Cascade, Colorado 80809

Attn: P. J. Anderson

Re: Rockfall Analysis
Pyramid Mountain Subdivision
Cascade, El Paso County, Colorado

Dear Mr. Anderson:

As requested, personnel of Entech Engineering, Inc. have performed a rockfall analysis to determine the impacts and possible mitigation to rockfall hazards on the site. The site is located east of Pyramid Mountain Road in Cascade, Colorado. The location of the site is indicated on the Vicinity Map, Figure 1.

The topography of the site is gently to steeply sloping with exposed granite outcrops on the upper slopes on portions of the site and north and east of the site. Single-family residential development is proposed in the gentle to moderate slopes of the property. A drainage area bisects the site and flows in a southerly direction. The topography of the site is indicated on Figures 1 and 2. The proposed development is presented in Figure 2.

A Geology and Soils Study was performed by Kumar Associates, Inc., dated January 4, 2006.[1] Preliminary rockfall mapping was performed as a part of Kumar's Study. Information from this report was used in evaluating the site.

The site was visited by personnel of Entech Engineering, Inc. to map the rockfall hazard and to evaluate the soil, vegetation and other site conditions for modeling the site in the rockfall analysis. The rockfall analysis was performed using the Colorado Rockfall Simulation Program, Version 4.0.[2] Results of this analysis will be discussed later.

Areas on the steeper hillsides have been identified as having rockfall hazards. In these areas, granite cliffs and boulders are exposed and produce boulder and cobble size talus. The hazard affects areas lying topographically below this area. On all the lots affected by rockfall where structures are proposed in the rockfall hazard zone, mitigation for rockfall hazard will be required. The rockfall zones have been divided into three separate zones based on the severity of the hazard. Areas lying typographically below the RF-3 zone would be considered reasonably safe from rockfall. Existing rockfall zones are shown on the Rockfall Map, Figure 2. Grading will affect the location of these zones.

RFS-1: Rockfall source area
This zone delineates the major rockfall source areas or the granite cliffs themselves, and the area immediately below them. This area carries the highest risk of damaging rockfall, but also is an area which is not likely to be considered

1 Kumar and Associates, Inc., January 4, 2006. *Geology and Soils Study, Proposed Pyramid Mountain Subdivision, Cascade, El Paso County, Colorado.* Project No. 042-129.

2 Jones, C.L. Higgins, J.D. and Andrew, R. D. 2000. *Colorado Rockfall Simulation Program, Version 4.0.* Colorado Department of Transportation, Colorado Geological Survey. MI-66.

for development for many reasons. Some of the rock fragments located within this zone should be stabilized or knocked down to more stable areas, lessening the hazard in areas below this zone.
Mitigation: Stabilization of the area can include removal of loose blocks of rock, often referred to as scaling. Other techniques include stabilization of loose blocks mechanically and may involve pinning the loose rocks to the face of the cliff to prevent dislodgment. This may be accomplished with Portland cement grout, gunite or a combination of mechanical rock bolts and/or cable lashing.

RFR-2: Rockfall runout zone, high velocity
This area delineates the runout zone immediately beneath the rockfall source areas. This area is typically strewn with rock fragments in a state of marginal instability. The detached rock fragments already present in this zone may also serve as a source of rockfall to the slopes below. Permanent structures in this zone could be anticipated to be subject to impact from boulders having moderate to high velocity. Construction in this area is not recommended.
Mitigation: Mitigation within the RFR-2 hazard zone will greatly reduce the potential for rockfall within the building areas below. Mitigation techniques include those discussed for the RFS-1 zone. Another option is the use of structures in this zone designed to stop rocks before they reach the proposed building areas. These structures could include walls or fences that are specifically designed by a qualified professional engineer or geologist to absorb the impact of moving boulders or debris and stop them. Drainage should be directed around the structures to avoid areas of ponding water or sediment buildup. These types of structures do require periodic maintenance to prevent debris from building up behind the catchment structure and reducing its effectiveness. A Rockfall Analysis was conducted using CRSP Computer Software in order to determine the rockfall characteristics and the effectiveness of catchment structures on this site. Results of this analysis are discussed later in this report.

RFR-3: Rockfall runout zone, low velocity
This zone represents the runout zone at the toe area of the steeply sloping portions of the site. Any rock fragments reaching this zone are very rapidly losing their momentum, and therefore, the rockfall danger in this zone is significantly less than in the other zones described. Permanent structures located in or immediately adjacent to this zone could be subject to impact from rock fragments having a moderate to low velocity, depending upon their position within the zone.
Mitigation: Construction in Zone RFR-3 or immediately below this zone could be performed with the following conditions. Stabilization in the RFS-1 and RFR-2

should be performed as discussed previously. This could involve the construction of catchment structures to stop dislodged rocks before they reach the RFR-3 zone or stabilization of rocks in place using Portland cement grout, rock bolts or cable lashing. Preliminary analysis has been performed for catchment structures and is discussed in the following section. In addition, the structures in Zone RFR-3 should have concrete foundation walls on the upslope side that extend a minimum of 4 feet above grade, and no windows should be located in this portion of the concrete wall. Earthen berms sloping away from the structure foundations for a distance of at least 15 feet may also be used to significantly reduce the danger of damage from rockfall impact. Grades of 10 to 15 percent are recommended. It is anticipated that the rockfall mitigation will incorporate several of the above systems. Areas for each specific mitigation should be determined as the site work is performed and development and building plans are completed.

Rockfall Analysis

Two rockfall sections were simulated to determine rockfall characteristics and preliminary catchment structure requirements. Colorado Rockfall Simulation Program 4.0 (CRSP) was used for the analysis. These sections are located as shown on the Rockfall Map, Figure 2. Results of the analysis are included in the Appendix.

A field investigation was conducted to evaluate the size of rocks, slope, soil, and vegetation characteristics to determine the values for coefficients used in the analysis. The data input table and slope profile is included in the Appendix. Several sized rocks were used in the analysis including 2 to 10 foot-diameter rocks. There are larger rocks observed in the RFS-1 and upper portions of the RFR-2 zone, however, the majority of these larger rocks tended to stop within the RFR-2 zone, not reaching the RFR-3 zone where the catchment structure was analyzed.

The simulations were initially run for each section with three analysis points set at a potential catchment structure location, possible building location, and at a distance from the toe of the slope to determine rockfall characteristics and requirements for a catchment structure designed to stop all rocks. This would require a 9-foot high catchment structure. The catchment structure was analyzed at the boundary of the high velocity zone (RFR-2) and the low velocity zone (RFR-3). The location of the catchment structure will alter design requirements. Additionally, stabilization of larger rocks can also alter the design of the catchment structure. The rockfall runout zone as determined from the simulation is the lower boundary of the RFR-3 runout zone, indicated on Figure 2.

Another option to a catchment structure is to stabilize all rocks in place. Some of the rocks may be located on adjacent properties. Stabilization may involve buttresses using Portland cement grout or cable lashing to tie larger boulder in place. Due to the presence of the Ute Pass Fault on the site, Stabilization designs should incorporate seismic requirements for the area. Rocks ranging from 3 to 9 feet that are determined to be potentially unstable should be stabilized for structures proposed in the RFR-3 zone. Rocks larger than 9 feet did not reach the RFR-3 zone in the analysis. One-foot rocks also did not reach the RFR-3 zone. The 2-foot rocks are rapidly loosing their momentum as they reach the RFR-3 zone. One option to mitigate hazards from the 2-foot rocks is to stabilize the 2-foot rocks above the RFR-3 zone. Another option is to use larger, steeper berms behind the foundations to more effectively stop the rocks. Grades of 15 to 20 percent may be recommended in addition to the 4-foot above ground foundation walls, depending upon where the structure is located within the zone. Structures located adjacent to the RFR-2/RFR-3 boundary will require larger berms unless the 2-foot rocks are stabilized.

Rockfall Source Area A (as indicated on Figure 2) contains many rocks and catchment structures may be more feasible in this area to mitigate the rockfall hazard to Lots 23 through 25. Additionally, there is sufficient room in the RFR-3 zone where rocks are slowing down and the catchment structure may require less stringent design, depending upon its location within the zone. Rockfall from source areas on the northwestern portion of the site is stopped in the drainage at the rear of Lots 21 through 24. Rockfall Source Areas B, C and D contain fewer rocks and it may be more feasible to stabilize the rocks in place in these areas in lieu of the catchment structure option. Source Areas B through D affect Lots 28 through 39. Structures on these lots will require the foundation walls above grade and berms on the upslope side of the foundations in addition to the source rock stabilization. The drainage at the rear of Lots 29 and 30 controls rockfall characteristics between Rockfall Source Areas A and B-D.

Should a catchment structure be considered, it should be designed by a qualified professional engineer or geologist. Drainage should be directed around the structure to avoid areas of ponded water. Different locations of the catchment structure will alter design requirements. Specific catchment structure design requirements should be determined after specific rockfall mitigation plans are finalized. Catchment structure designs and specific rockfall mitigation plans are beyond the scope of this report.

It should be noted that site grading will influence rockfall characteristics. This analysis was modeled on existing site conditions. Cutting and steepening slopes will increase rock velocity and increase the area of the runout zone. Additionally, removal of vegetation and changes in soil surfaces will also affect velocity and runout area. Any site disturbance above a catchment structure will require additional analysis.

In summary, it is our opinion rockfall hazards have impact on portions of the site. In some areas, particularly in the east-central portions of the site, it may be more feasible to stabilize the loose rocks in place where there are fewer rocks that pose a hazard. Areas affected by rockfall hazards from the northeast may benefit from a catchment structure where many rocks could impact development. Building should be avoided in the rockfall source (rfs1) and high velocity runout zone (rfr2).

Any mitigation initializing buttresses/grout bases, cables or catchment structures should be designed by a qualified professional engineer or geologist using seismic requirements for one area.

We trust this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Kristen A. Andrew-Hoeser, P. G.
Engineering Geologist

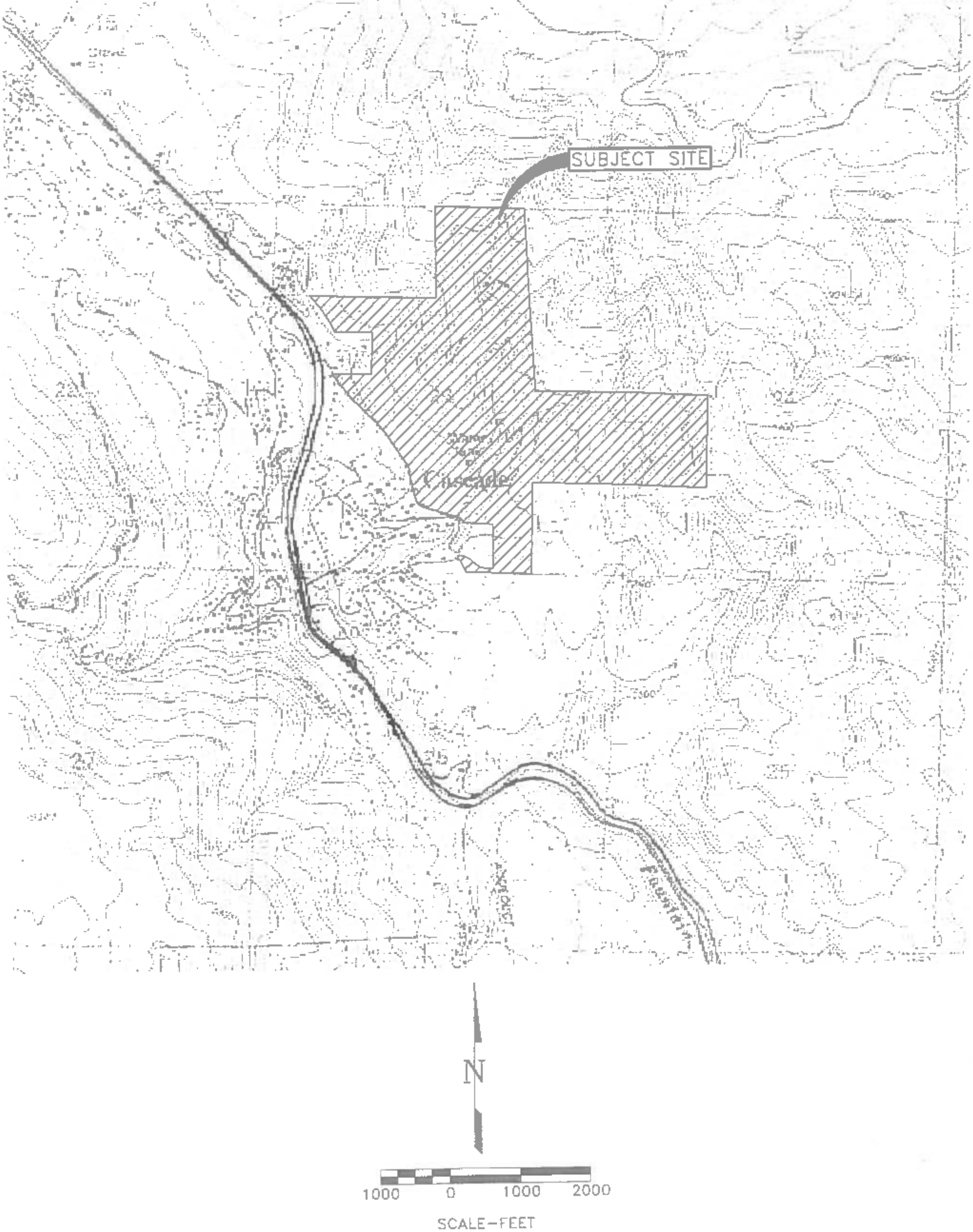
Reviewed by:

Joseph C. Goode, Jr., P.E.
President

KAH/rs

Encl.

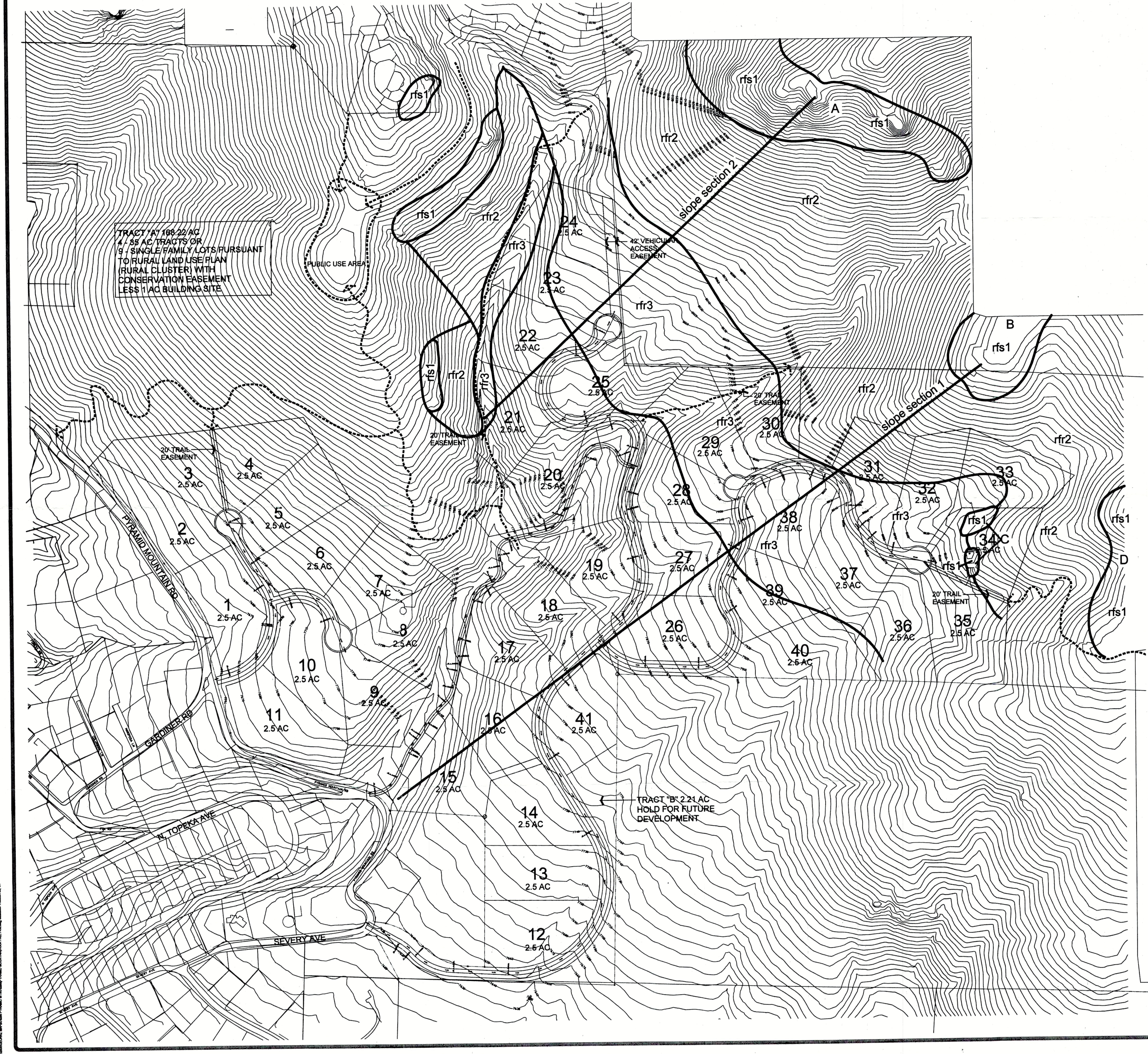
Entech Job No. 76286
2MSW/ltr/2006/76286ra



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

VICINITY MAP
PYRAMID MOUNTAIN
EL PASO COUNTY, CO.
FOR: P.J. ANDERSON

DRAWN:	DATE:	CHECKED:	DATE:	JOB NO.:	FIG NO.:
RJO	28JUN06			76286	1



N

100' 0 100' 200'

SCALE: 1" = 100'

LEGEND

rfs1 - rockfall source area

rfr2 - rockfall runout zone, high velocity

rfr3 - rockfall runout zone, low velocity

REVISION	BY:

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

ROCKFALL MAP
PYRAMID MOUNTAIN
EL PASO COUNTY, CO.
FOR: P.J. ANDERSON

DRAWN BY: R.J. OLSON
DESIGNED BY:
CHECKED BY:
DATE: 28 JUN 06
SCALE: 1" : 200'
JOB NO.: 76286
FIGURE NO.:
2

Appendix: Rockfall Analysis

CRSP Input File - C:\Program Files\Crsp\76286-1.dat

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 7
Analysis Point X-Coordinate 1: 520
Analysis Point X-Coordinate 2: 850
Analysis Point X-Coordinate 3: 1210
Initial Y-Top Starting Zone Coordinate: 8375
Initial Y-Base Starting Zone Coordinate: 8370
Remarks: Section 1

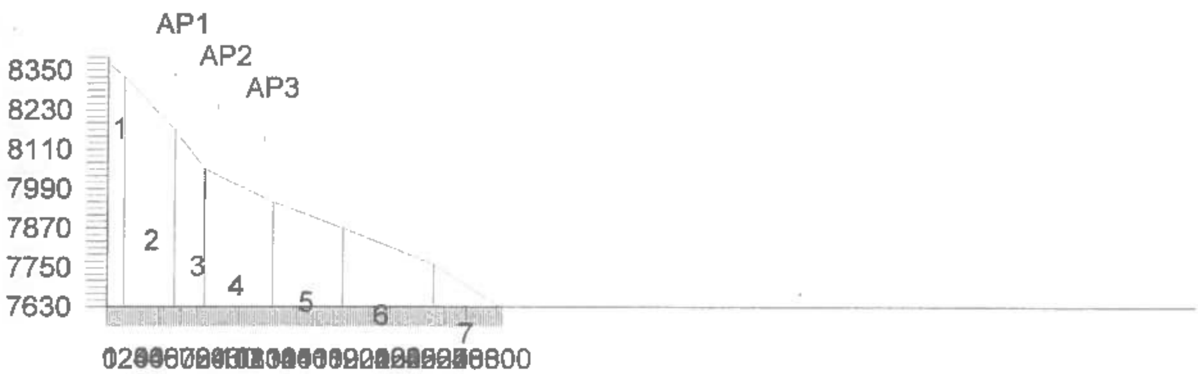
Cell Data

Cell No.	Surface R.	Tangent C.	Normal C.	Begin X	Begin Y	End X	End Y
1	1	.8	.25	0	8370	130	8330
2	.5	.7	.25	130	8330	520	8170
3	.5	.7	.25	520	8170	750	8050
4	.5	.6	.2	750	8050	1280	7950
5	.5	.6	.2	1280	7950	1820	7870
6	.4	.65	.15	1820	7870	2520	7760
7	.5	.65	.2	2520	7760	3020	7630

C:\Program Files\Crsp\76286-1.dat   Total Rocks Rolled: 100

Spherical Rock: 10-ft dia., 86394-lb

Scale: Each division = 20 feet



CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 1

Analysis Point 1: X = 520, Y = 8170

Spherical Rock: 3-ft dia., 2333-lb

NO ROCKS PAST ANALYSIS POINT 1

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 1

Analysis Point 1: X = 520, Y = 8170

Spherical Rock: 4-ft dia., 5529-lb

Total Rocks Passing Analysis Point: 4

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 49.59	Maximum: 1.74	Maximum: 275664
Average: 45.53	Average: 1.11	Average: 238469
Minimum: 41.83	G. Mean: .96	Std. Dev.: 0
Std. Dev.: 0	Std. Dev.: 1	

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 2

Analysis Point 2: X = 850, Y = 8031

Spherical Rock: 4-ft dia., 5529-lb

Total Rocks Passing Analysis Point: 4

Velocity (ft/sec)

Maximum: 44.33
Average: 39.97
Minimum: 35.88
Std. Dev.: 0

Bounce Height (ft)

Maximum: 1.25
Average: .44
G. Mean: .08
Std. Dev.: 1

Kinetic Energy (ft-lb)

Maximum: 235033
Average: 192274
Std. Dev.: 0

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 3

Analysis Point 3: X = 1210, Y = 7963

Spherical Rock: 4-ft dia., 5529-lb

NO ROCKS PAST ANALYSIS POINT 3

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 1

Analysis Point 1: X = 520, Y = 8170

Spherical Rock: 6-ft dia., 18661-lb

Total Rocks Passing Analysis Point: 71

Velocity (ft/sec)

Maximum: 53.07
Average: 48.08
Minimum: 40.72
Std. Dev.: 2.37

Bounce Height (ft)

Maximum: 1.65
Average: .58
G. Mean: .16
Std. Dev.: 13.01

Kinetic Energy (ft-lb)

Maximum: 1078884
Average: 912220
Std. Dev.: 81966

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 2

Analysis Point 2: X = 850, Y = 8031

Spherical Rock: 6-ft dia., 18661-lb

Total Rocks Passing Analysis Point: 71

Velocity (ft/sec)

Maximum: 51.69
Average: 45.49
Minimum: 38.75
Std. Dev.: 2.76

Bounce Height (ft)

Maximum: 1.58
Average: .45
G. Mean: .21
Std. Dev.: 6.09

Kinetic Energy (ft-lb)

Maximum: 1048451
Average: 830499
Std. Dev.: 96058

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 3

Analysis Point 3: X = 1210, Y = 7963

Spherical Rock: 6-ft dia., 18661-lb

NO ROCKS PAST ANALYSIS POINT 3

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 1

Analysis Point 1: X = 520, Y = 8170

Spherical Rock: 8-ft dia., 44234-lb

Total Rocks Passing Analysis Point: 50

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 49.42	Maximum: .84	Maximum: 2331640
Average: 40.43	Average: .25	Average: 1558176
Minimum: 30.35	G. Mean: .06	Std. Dev.: 379284
Std. Dev.: 4.97	Std. Dev.: 13.32	

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 2

Analysis Point 2: X = 850, Y = 8031

Spherical Rock: 8-ft dia., 44234-lb

Total Rocks Passing Analysis Point: 50

Velocity (ft/sec)

Maximum: 48.08
Average: 36.34
Minimum: 11.95
Std. Dev.: 7.02

Bounce Height (ft)

Maximum: .75
Average: .16
G. Mean: .06
Std. Dev.: 6.97

Kinetic Energy (ft-lb)

Maximum: 2169334
Average: 1301792
Std. Dev.: 439998

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 3

Analysis Point 3: X = 1210, Y = 7963

Spherical Rock: 8-ft dia., 44234-lb

NO ROCKS PAST ANALYSIS POINT 3

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 1

Analysis Point 1: X = 520, Y = 8170

Spherical Rock: 9-ft dia., 62981-lb

Total Rocks Passing Analysis Point: 10

Velocity (ft/sec)

Maximum: 47.01
Average: 37.55
Minimum: 15.37
Std. Dev.: 9.43

Bounce Height (ft)

Maximum: .82
Average: .16
G. Mean: .02
Std. Dev.: 17.58

Kinetic Energy (ft-lb)

Maximum: 2946718
Average: 1983997
Std. Dev.: 783059

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 2

Analysis Point 2: X = 850, Y = 8031

Spherical Rock: 9-ft dia., 62981-lb

Total Rocks Passing Analysis Point: 7

Velocity (ft/sec)

Maximum: 45.45
Average: 35.57
Minimum: 28.82
Std. Dev.: 5.68

Bounce Height (ft)

Maximum: .14
Average: .01
G. Mean: .01
Std. Dev.: 12.09

Kinetic Energy (ft-lb)

Maximum: 2824725
Average: 1756641
Std. Dev.: 584992

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 3

Analysis Point 3: X = 1210, Y = 7963

Spherical Rock: 9-ft dia., 62981-lb

NO ROCKS PAST ANALYSIS POINT 3

Remarks: Section 1

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-1.dat

Analysis Point 1

Analysis Point 1: X = 520, Y = 8170

Spherical Rock: 10-ft dia., 86394-lb

NO ROCKS PAST ANALYSIS POINT 1

Remarks: Section 1

CRSP Input File - C:\Program Files\Crsp\76286-2.dat

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 6
Analysis Point X-Coordinate 1: 1200
Analysis Point X-Coordinate 2: 1340
Analysis Point X-Coordinate 3: 1400
Initial Y-Top Starting Zone Coordinate: 8535
Initial Y-Base Starting Zone Coordinate: 8530
Remarks: Section 2

Cell Data

Cell No.	Surface R.	Tangent C.	Normal C.	Begin X	Begin Y	End X	End Y
1	.5	.85	.25	0	8530	230	8370
2	.5	.7	.25	230	8370	600	8170
3	.5	.65	.2	600	8170	850	8080
4	.5	.6	.2	850	8080	1220	7995
5	.5	.6	.2	1220	7995	1650	7930
6	.5	.65	.2	1650	7930	1900	7820

C:\Program Files\Crsp\76286-2.dat   Total Rocks Rolled: 100

Spherical Rock: 3-ft dia., 2333-lb

Scale: Each division = 20 feet

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 2-ft dia., 691-lb

NO ROCKS PAST ANALYSIS POINT 1

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 3-ft dia., 2333-lb

Total Rocks Passing Analysis Point: 15

Velocity (ft/sec)

Maximum: 19.38
Average: 9.72
Minimum: 3.93
Std. Dev.: 4.66

Bounce Height (ft)

Maximum: .29
Average: .07
G. Mean: .02
Std. Dev.: 10.05

Kinetic Energy (ft-lb)

Maximum: 17818
Average: 5662
Std. Dev.: 5073

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 2

Analysis Point 2: X = 1340, Y = 7977

Spherical Rock: 3-ft dia., 2333-lb

NO ROCKS PAST ANALYSIS POINT 2

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 4-ft dia., 5529-lb

Total Rocks Passing Analysis Point: 98

Velocity (ft/sec)

Maximum: 30.07
Average: 18.89
Minimum: 5.8
Std. Dev.: 4.99

Bounce Height (ft)

Maximum: .82
Average: .17
G. Mean: .06
Std. Dev.: 8.18

Kinetic Energy (ft-lb)

Maximum: 102020
Average: 44609
Std. Dev.: 21659

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 2

Analysis Point 2: X = 1340, Y = 7977

Spherical Rock: 4-ft dia., 5529-lb

NO ROCKS PAST ANALYSIS POINT 2

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 6-ft dia., 18661-lb

Total Rocks Passing Analysis Point: 95

Velocity (ft/sec)

Maximum: 36.82
Average: 26.29
Minimum: 7.9
Std. Dev.: 5.23

Bounce Height (ft)

Maximum: .67
Average: .14
G. Mean: .05
Std. Dev.: 8.13

Kinetic Energy (ft-lb)

Maximum: 522112
Average: 286493
Std. Dev.: 101109

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 2

Analysis Point 2: X = 1340, Y = 7977

Spherical Rock: 6-ft dia., 18661-lb

Total Rocks Passing Analysis Point: 1

Velocity (ft/sec)

Maximum: 9.95
Average: 9.95
Minimum: 9.95
Std. Dev.: 0

Bounce Height (ft)

Maximum: .07
Average: .07
G. Mean: .07
Std. Dev.: 1

Kinetic Energy (ft-lb)

Maximum: 39942
Average: 39942
Std. Dev.: 0

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 3

Analysis Point 3: X = 1400, Y = 7968

Spherical Rock: 6-ft dia., 18661-lb

NO ROCKS PAST ANALYSIS POINT 3

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 8-ft dia., 44234-lb

Total Rocks Passing Analysis Point: 13

Velocity (ft/sec)

Maximum: 31.05
Average: 21.93
Minimum: 13.41
Std. Dev.: 5.49

Bounce Height (ft)

Maximum: .16
Average: .03
G. Mean: .01
Std. Dev.: 7.16

Kinetic Energy (ft-lb)

Maximum: 917019
Average: 481611
Std. Dev.: 230670

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 9-ft dia., 62981-lb

Total Rocks Passing Analysis Point: 2

Velocity (ft/sec)

Maximum: 27.71
Average: 25.33
Minimum: 22.96
Std. Dev.: 0

Bounce Height (ft)

Maximum: .03
Average: .02
G. Mean: .02
Std. Dev.: 1

Kinetic Energy (ft-lb)

Maximum: 1038364
Average: 878920
Std. Dev.: 0

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 1

Analysis Point 1: X = 1200, Y = 8000

Spherical Rock: 10-ft dia., 86394-lb

NO ROCKS PAST ANALYSIS POINT 1

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 2

Analysis Point 2: X = 1340, Y = 7977

Spherical Rock: 8-ft dia., 44234-lb

NO ROCKS PAST ANALYSIS POINT 2

Remarks: Section 2

CRSP Analysis Point Data - C:\Program Files\Crsp\76286-2.dat

Analysis Point 2

Analysis Point 2: X = 1340, Y = 7977

Spherical Rock: 9-ft dia., 62981-lb

NO ROCKS PAST ANALYSIS POINT 2

Remarks: Section 2