

***WASTEWATER DISPOSAL REPORT***

*for*

***Atwell, LLC  
Mariah Trail Filing No. 1  
Subdivision***

***EPC Parcel #: 5100000511***

**April 2023**

**Prepared By:**



ATWELL, LLC  
MARIAH TRAIL FILING NO. 1  
SUBDIVISION  
EPC Parcel # 5100000511

WASTEWATER DISPOSAL REPORT

APRIL 2023

Prepared for:

Atwell, LLC  
12295 Oracle Boulevard, Suite 200  
Colorado Springs, CO 80921

Prepared by:

RESPEC  
5540 Tech Center Drive, Suite 100  
Colorado Springs, CO 80919

*Table of Contents*

**1.0 INTRODUCTION AND EXECUTIVE SUMMARY..... 2**

**2.0 PROJECTED LAND USES..... 2**

    2.1 Projected Land Uses ..... 2

**3.0 WASTEWATER REPORT..... 2**

    3.1 Wastewater Loads ..... 2

    3.2 On-Site Wastewater Treatment Systems (OWTS) ..... 3

**APPENDICES**

*Appendix A – Land Use Exhibit*

*Appendix B – OWTS Report*

**1.0 INTRODUCTION AND EXECUTIVE SUMMARY**

The purpose of this report is to address the specific wastewater loads for the proposed commercial property located at Parcel # 5100000511 in El Paso County, CO.

**EXECUTIVE SUMMARY: The proposed subdivision has adequate water rights, water quality, area, and soils to support the proposed residential lot on a 300-year basis.**

**2.0 PROJECTED LAND USES**

*2.1 Projected Land Uses*

This report pertains to the existing 35-acre parcel that is proposed to be divided into six (6) lots, with three lots described as 5.01 acres, one lot at 5.06 acres, one lot at 5.14 acres, and one lot at 8.19 acres. Please refer to the Land Use Exhibit in **Appendix A**.

**3.0 WASTEWATER REPORT**

*3.1 Wastewater Loads*

There are six (6) residential units proposed for the subdivided property. There are 0.625 AF/year of projected water demand for each residence on the 20-acre lot, 0.30 AF/year of which is projected for each household use. This equates to a total of 1.62 AF/year/subdivision total to be sent to septic annually. A breakdown of projected wastewater loads is summarized in Table 3-1. Average daily wastewater loads are expected to be 90% of average daily indoor use.

**Table 3-1: Summary of Expected Water Demands & Wastewater Loads**

Water						Wastewater
# of SFEs	Annual Indoor Use 0.30 (AF/YR/SFE)	Average Daily Indoor Use (GPD)	Irrigation 0.05 (AF/1,000 SF)	Domestic Watering 0.0125 (AF/Horse/Year)	Total Indoor, Watering, & Irrigation (AF)	ADF (@ 90% Indoor Use) (GPD)
6	<i>Note 1</i> 1.800	1607	<i>Note 2</i> 1.800	<i>Note 3</i> 0.150	3.75	1446
<b>Total</b>					<b>3.75</b>	<b>1446</b>

*Note 1: Per 2022CW3094 Section 8.3.*

*Note 2: Assuming 0.05 per 1000 ft<sup>2</sup> per 2022CW3094 Section 8.3 and 6000 ft<sup>2</sup> of lawn/garden/trees*

*Note 3: Per 2022CW3094 Section 8.3 for a total of 12 horses (2 horses per lot)*

### 3.2 *On-Site Wastewater Treatment Systems (OWTS)*

#### 3.2 *On-Site Wastewater Treatment System*

The proposed single-family homes will be served by individual on-site wastewater treatment systems. The site was evaluated soils and long-term acceptance rates (LTAR) with bores drilled on July 12, 2021, as well as the appropriateness of *on-site wastewater treatment systems* (OWTS). This evaluation was performed by Innovative Process Engineering Water and Waste Solutions's Ron LeBlanc, PE. Two (2) bores were excavated on the site to determine general suitability for the use of OWTS. All bores were drilled to eight feet and classified.

A visual and tactile examination was performed to classify and determine the soils engineering characteristics. Long term acceptance rates (LTAR) associated with the most restrictive soils observed in the profile pits was 0.60 gallons per day per square foot (BPD/sf) for the sandy loam (Soil Type SG-0). Groundwater was not encountered in Pit #1 or Pit #2. Bedrock was not encountered in either test pit.

Subsurface materials encountered in the profile pit excavations were classified using USDA Soil Structure Shape. Pit 1 was classified as USDA Structure SG-0 with all the soil from 6" to 8' containing sand with 22-34% rock. Pit 2 was classified as USDA Structure BK-2 (sandy loam) to 2' of depth. From 2'-8', Pit 2 soils were classified as SG-0 with all the soils containing sand and rock from 0-22% rock.

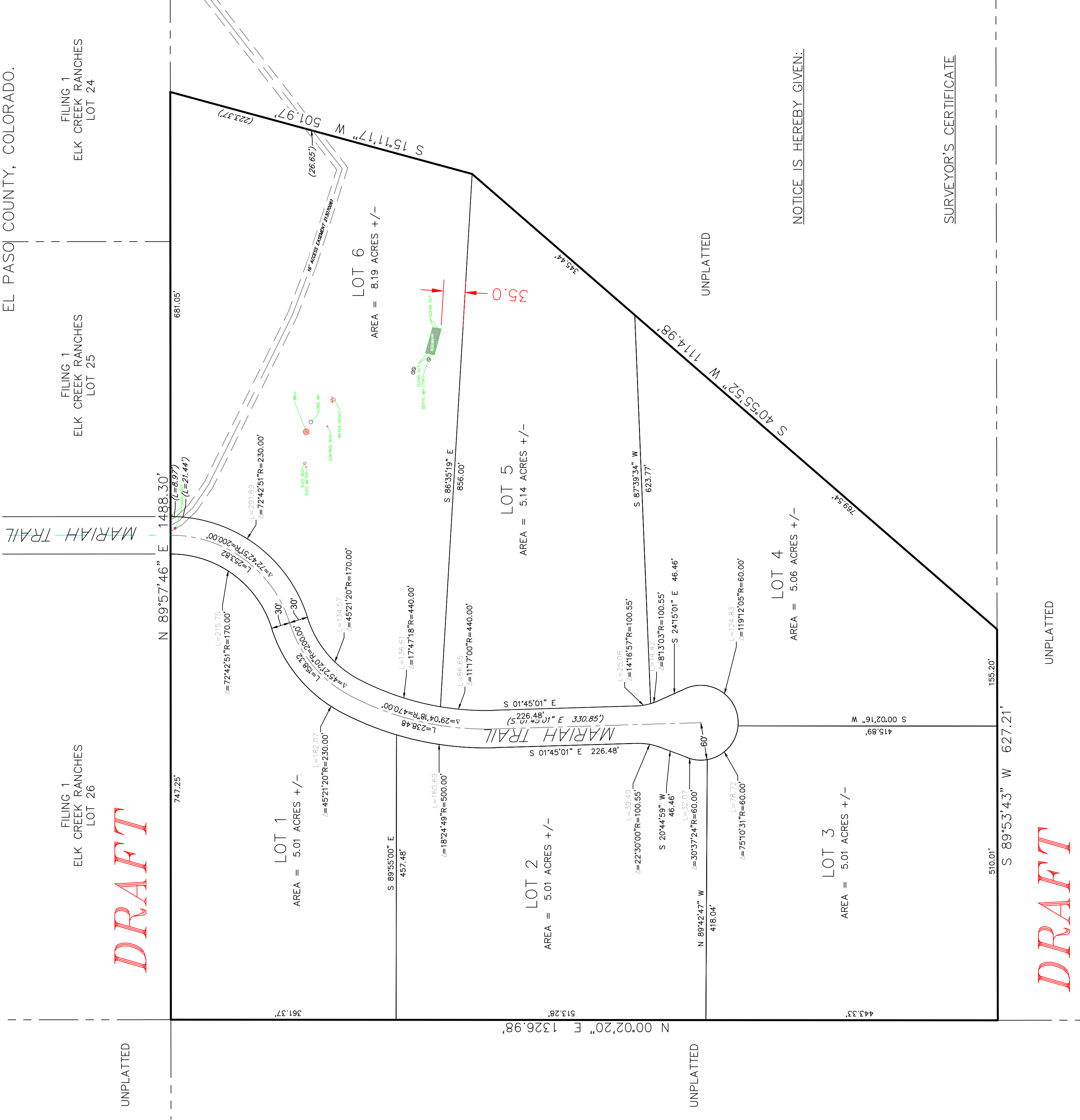
According to Innovative Process Engineering's report, the site is suitable for individual on-site wastewater treatment systems within its cited limitations. Based on the no groundwater or bedrock observed in either pit, an engineered system is not required.

The *Profile Pit Report for 19205 Mariah Trail, Colorado Springs, CO, El Paso County, Colorado* by Innovative Process Engineering Water and Waste Solutions dated July 12, 2021 is included in **Appendix B**.

# *Appendix A*

# MARIAH TRAIL FILING NO. 1

A PORTION OF THE NORTHWEST QUARTER OF SECTION 7,  
TOWNSHIP 11 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN,  
EL PASO COUNTY, COLORADO.



## KNOW ALL MEN BY THESE PRESENTS:

THAT THOMAS D KIRK JR. BEING THE OWNER OF THE FOLLOWING DESCRIBED PROPERTY TO WIT:  
A TRACT OF LAND BEING IN A PORTION OF THE NORTHWEST QUARTER OF SECTION 7, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPLE MERIDIAN, EL PASO COUNTY, COLORADO, DESCRIBE AS FOLLOWS:  
BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 7,  
THENCE N89°57'46"E, 1488.29 FEET ALONG THE NORTH LINE OF SAID NORTHWEST ¼;  
THENCE S15°11'17"W, 501.94 FEET;  
THENCE S89°53'43"W, 627.21 FEET TO A POINT ON THE WEST LINE OF SAID NORTHWEST ¼;  
THENCE N00°02'20"E, 1226.98 FEET ALONG THE WEST LINE OF SAID NORTHWEST ¼ TO THE NORTHWEST CORNER THEREOF; AND THE POINT OF BEGINNING.

## OWNERS' CERTIFICATE:

THE UNDERSIGNED BEING THE OWNER IN THE LAND DESCRIBED HEREIN, HAS LAID OUT, SUBDIVIDED AND PLATTED SAID LAND INTO LOTS, STREETS AND EASEMENTS AS SHOWN HEREON UNDER THE NAME AND SUBDIVISION OF MARIAH TRAIL FILING NO. 1, ALL PUBLIC IMPROVEMENTS SO PLATTED ARE HEREBY DEDICATED TO PUBLIC USE AND SAID OWNER DOES HEREBY COVENANT AND AGREE THAT THE PUBLIC IMPROVEMENTS WILL BE CONSTRUCTED TO EL PASO COUNTY STANDARDS AND THAT PROPER RECORDING OF THIS INSTRUMENT SHALL CONSTITUTE NOTICE TO THE PUBLIC. THE PUBLIC IMPROVEMENTS SO DEDICATED WILL BECOME MATTERS OF MAINTENANCE BY EL PASO COUNTY, COLORADO, UPON ACCEPTANCE BY RESOLUTION. ALL PUBLIC IMPROVEMENTS SO DEDICATED WILL BECOME MATTERS OF MAINTENANCE BY EL PASO COUNTY, COLORADO. THE UTILITY EASEMENTS SHOWN HEREON ARE HEREBY DEDICATED FOR PUBLIC UTILITIES AND COMMUNICATION SYSTEMS AND OTHER PURPOSES AS SHOWN HEREON. THE ENTITIES RESPONSIBLE FOR PROVIDING THE SERVICES FOR WHICH THE EASEMENTS ARE ESTABLISHED ARE HEREBY GRANTED THE PERPETUAL RIGHT OF INGRESS AND EGRESS FROM AND TO ADJACENT PROPERTIES FOR INSTALLATION, MAINTENANCE AND REPLACEMENT OF UTILITY LINES AND RELATED FACILITIES.

BY: THOMAS D KIRK, JR.

THOMAS D KIRK, JR.

## NOTARIAL:

STATE OF COLORADO) SS  
COUNTY OF EL PASO)

THE ABOVE AND AFORMENTIONED WAS ACKNOWLEDGED BEFORE ME THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 2023 A.D., BY THOMAS D KIRK, JR., OWNER

WITNESS MY HAND AND SEAL \_\_\_\_\_

MY COMMISSION EXPIRES \_\_\_\_\_

- BEARINGS ARE BASED ON THE NORTH LINE OF THE NORTHWEST ¼ OF SECTION 7, TOWNSHIP 11S, RANGE 65W, OF THE 6TH P.M., EL PASO COUNTY, COLORADO MONUMENTED AS SHOWN.
- WESTERLY LINE OF LOT 2, COLORADO SPRINGS AIRPORT FILING NO. 1, AS BEARING N00°15'49"E, AS MONUMENTED BY A #4 REBAR W/CAP MARKED "MPW L.S. 11997" AT THE WEST PC AND A FOUND 3-1/2 ALUM CAP AT THE SW CORNER OF SEC 36, T14S, R65W, 6TH P.M.
- THIS PROPERTY LIES WITHIN ZONE X, AREA OF MINIMAL FLOOD HAZARD, INFORMATION OBTAINED FROM FEMA FLOOD INSURANCE RATE MAP, COMMUNITY PANEL NO. 08041C03056 DATED 12/7/2018.
- SET #5 REBAR WITH A 2" ALUMINUM CAP STAMPED "POLARIS, PLS 27605", FLUSH WITH THE GROUND AT ALL EXTERIOR CORNERS, UNLESS OTHERWISE NOTED.
- LINEAL UNITS SHOWN HEREON ARE US SURVEY FEET.
- ANY PERSON WHO KNOWINGLY REMOVES, ALTERS OR DEFACTS ANY PUBLIC LAND SURVEY MONUMENT OR LAND BOUNDARY MONUMENT OR ACCESSORY COMMITS A CLASS TWO(2) MISDEMEANOR PURSUANT TO C.R.S. 18-4-508.
- FIELD WORK COMPLETED ON (DATE WILL BE ADDED AFTER FINAL APPROVAL).

## CLERK AND RECORDER'S CERTIFICATE

STATE OF COLORADO) SS  
COUNTY OF EL PASO) SS  
I HEREBY CERTIFY THIS INSTRUMENT WAS FILED FOR RECORD IN MY OFFICE AT \_\_\_\_\_ O'CLOCK \_\_\_\_\_ M., THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 2023 A.D., AND IS DULY RECORDED AT RECEPTION NUMBER \_\_\_\_\_ OF THE RECORDS OF EL PASO COUNTY.

STEVE SCHLEIKER, CLERK AND RECORDER  
BY: \_\_\_\_\_ DEPUTY

## NOTARIAL:

THE UNDERSIGNED, PROFESSIONAL LAND SURVEYOR, LICENSED IN THE STATE OF COLORADO, HEREBY CERTIFY THAT I AM THE AUTHOR OF THIS INSTRUMENT AND THAT I HAVE DRAWN UNDER HIS RESPONSIBLE CHARGE AND ACCURATELY SHOWS THE DESCRIBED TRACT OF LAND, AND SUBDIVISION THEREOF, AND THE REQUIREMENTS TO TITLE 38 OF THE COLORADO REVISED STATUTES, 1973, AS AMENDED, HAVE BEEN MET TO THE BEST OF HIS KNOWLEDGE AND BELIEF AND IS NOT A GUARANTY OR WARRANTY, EITHER EXPRESSED OR IMPLIED.

## DEDICATION:

RANDALL D. HENCY  
COLORADO REGISTERED PROFESSIONAL  
LAND SURVEYOR NO. 27605

DRAFT

DRAFT

DRAFT

DATE OF PREPARATION: 02/21/23 PCD FILE NO.

FINAL PLAT  
OWNER: THOMAS D KIRK JR  
19205 MARIAH TRAIL, CO.SPR. 80508  
POLARIS SURVEYING, INC.  
1903 Labroy Street, Suite 102  
10000 ARADO SPRINGS, CO 80919  
(719)448-0844 FAX (719)448-9225

DATE: 02/21/2023  
DRAWING NO: N/A  
SHEET: 1 of 1

ZONE	REV	DESCRIPTION	DATE	APPROVED
	1	CLIENT COMMENTS	03/14/23	
	2	CLIENT COMMENTS	03/17/23	

SCALE 1" = 100'

MARIAH TRAIL FILING NO. 1  
A PORTION OF THE NORTHWEST QUARTER OF SECTION 7,  
TOWNSHIP 11 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN,  
EL PASO COUNTY, COLORADO.

REGISTERED LAND SURVEYOR IN THE STATE OF COLORADO, NO. 27605 FOR AND ON BEHALF OF POLARIS SURVEYING, INC. NOTICE: THIS INSTRUMENT IS A FINAL INSTRUMENT AND IS NOT TO BE RECORDED OR FILED FOR RECORD WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE TAKEN MORE THAN THREE YEARS FROM THE DATE OF CERTIFICATION SHOWN HEREON.

# *Appendix B*





# Innovative Process Engineering

Water and Waste Solutions

## PROFILE PIT REPORT

for Septic System Evaluation

19205 Mariah Trail, Colorado Springs, CO

Client: Advanced Septic Systems

Location: El Paso County Colorado

Date: July 12, 2021

Project: 21203

Prepared by:

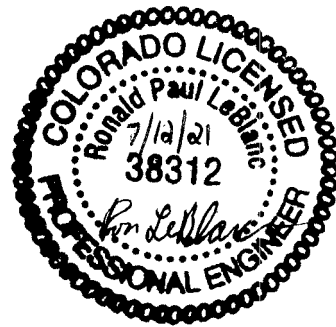
Ron LeBlanc, MS, PE

Innovative Process Engineering, PLLC

18490 Dunes Lake Lane

Monument, CO 80132

[ron@ipepllc.com](mailto:ron@ipepllc.com)



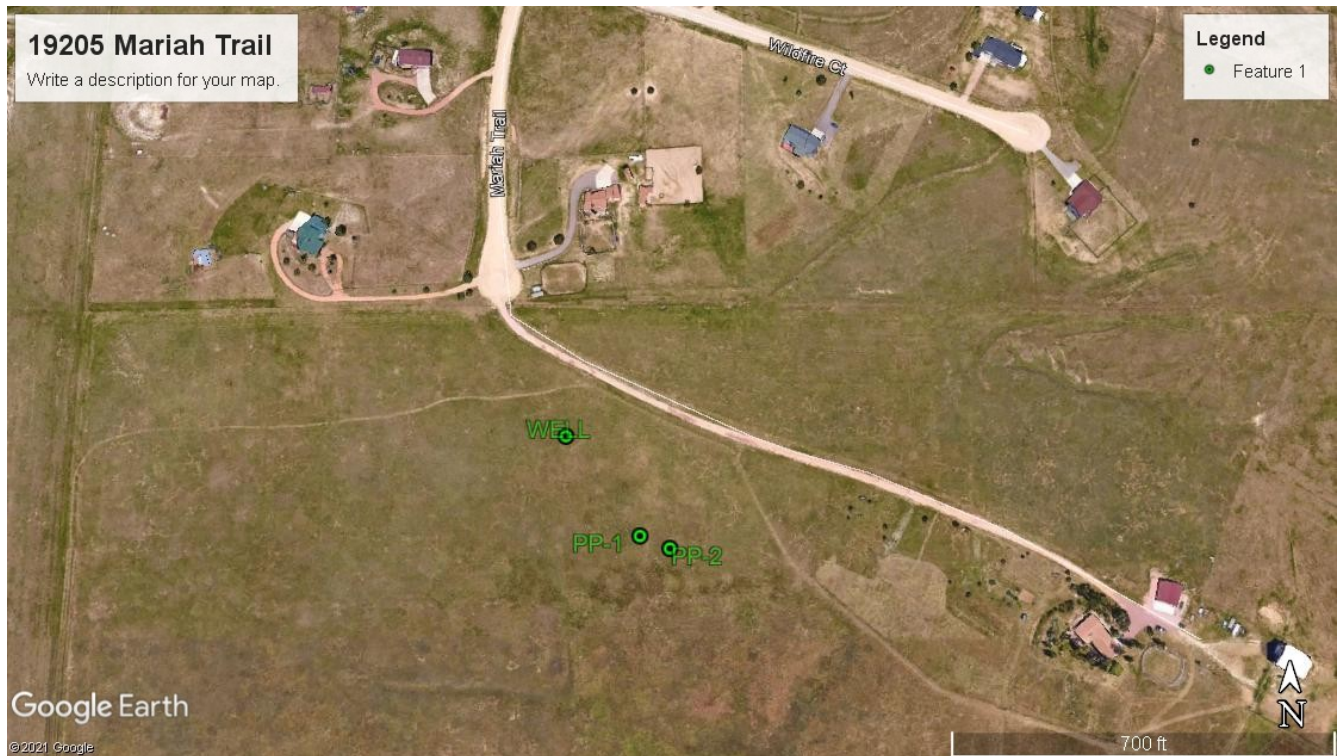
## Introduction:

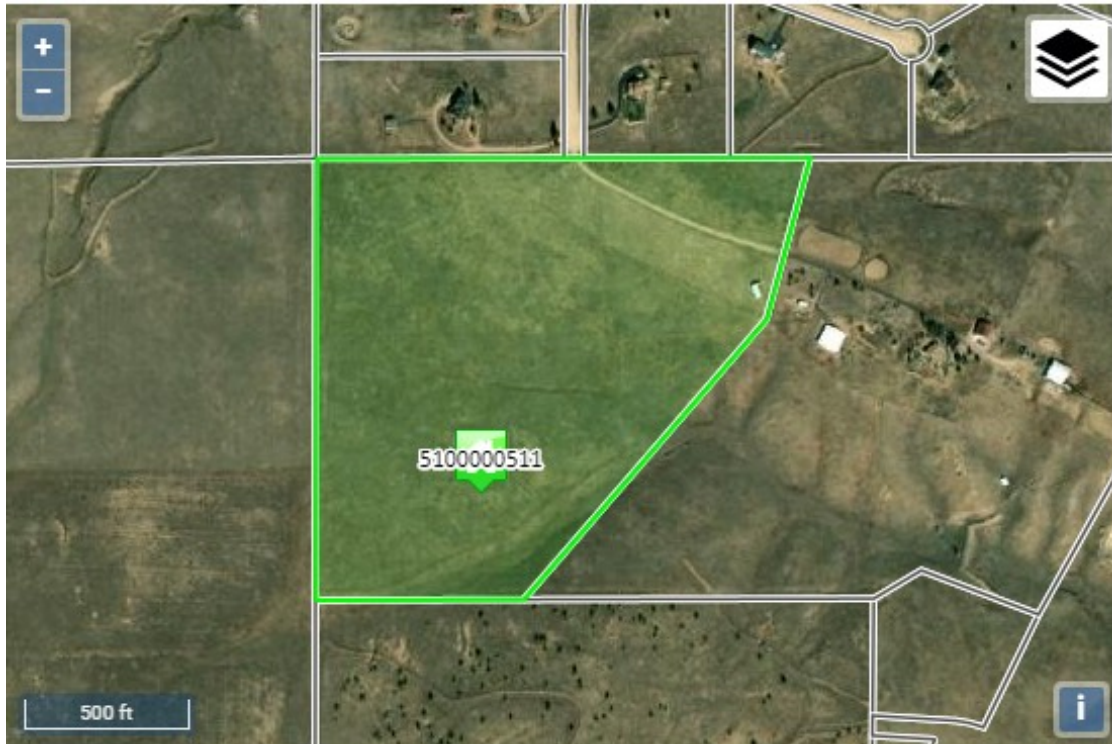
The property in El Paso County, Colorado is listed as A TR OF LAND BEING IN A PORTION OF LOT 1 SEC 7-11-65 DESC AS FOLS: BEG AT THE NW COR OF SD LOT 1, TH N89-57-46E 1488.29 FT, TH S15-11-17W 501.94 FT, TH S40-55-52W 1114.98 FT, TH S89-53-43W 627.21 FT, TH N00-02-20E 1326.99 FT TO POB. The address is 19205 Mariah Trail. The property is currently undeveloped. A new residence is planned.

This Profile Pit Examination was performed to evaluate soil conditions for a new Soil Treatment Area (STA) on the property. Two Profile Pits were dug to a depth of 8 feet with a Kubota excavator. A visual / tactile examination was performed.

## Site:

The property consists of 35 acres adjacent to Mariah Trail. The property is open and grassy. The area investigated slopes to the Southwest. The Profile Pit areas were mostly level and undisturbed.





	Profile Pit #1	Profile Pit #2
Groundwater	Not Encountered	Not Encountered
Bedrock	Not Encountered	Not Encountered
Redoximorphic Features	Not Encountered	Not Encountered
Well	> 100'	> 100'
Gulches	> 25'	> 25'
Water Body	> 150'	> 150'
Grade	5%	5%
GPS	39° 6'48.85"N, 104°42'56.95"W	39° 6'48.63"N, 104°42'56.25"W

**Elevations:**

Residence (future)	100
Profile Pit #1	96
Profile Pit #2	96

# SOIL PROFILE PIT LOG

BY: Ron LeBlanc, PE  
Client: Advanced Septic  
Address: 19205 Mariah Trail  
Date Sampled: 07/12/21  
Project: 21203

## PIT 1

DEPTH	USDA Texture	USDA Struct.	TYPE
0" – 6"	Organic	--	--
7" – 2'	Sand with 27% Rock	SG-0	1
2'1" – 4"	Sand with 30% Rock	SG-0	1
4'1" – 6'	Sand with 22% Rock	SG-0	1
6'1" – 8'	Sand with 34% Rock	SG-0	1

## NOTES

Limiting Condition? N  
Solution? N/A  
Redox Present? N  
Groundwater Present? N

## PIT 2

DEPTH	USDA Texture	USDA Struct.	TYPE
0" – 1'	Organic	--	--
7" – 2'	Sandy Loam 0% Rock	BK-2	2
2'1" – 4"	Sand with 22% Rock	SG-0	1
4'1" – 6'	Sand with 0% Rock	SG-0	1
6'1" – 8'	Sand with 0% Rock	SG-0	1

## NOTES

Limiting Condition? N  
Solution? N/A  
Redox Present? N  
Groundwater Present? N

## Results:

Based on a visual and tactile examination, the soils in PP-1 were acceptable to the 8' depth. Profile Pit-2 was the same. The soil matrix was sand and sandy loam.

**LTAR                    0.6**

## **Engineered System NOT Required**

## Site Protection:

The Soil Treatment Area should not be disturbed prior to system installation. Protect the area from construction activity by fencing or staking.

## Pre-Construction Inspection:

The County health department may choose to do an inspection of the property prior to issuance of a permit to construct a new OWTS.

## Limitations:

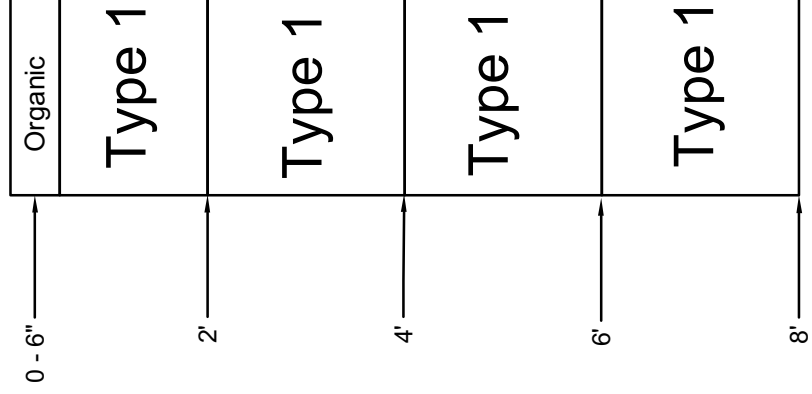
This report has been prepared exclusively for Owners and Representatives of 19205 Mariah Trail, Colorado Springs, CO. Use by any other persons or for any other site is not permitted without approval from this office. Additionally, this report assumes that the actual soil conditions do not deviate in any significant way from those described in this report. In the event that any variations or undesirable conditions are detected, please notify this office immediately.

Innovative Process Engineering, PLLC makes no warranty as to the findings or recommendations provided in this report except that they were prepared in accordance with the local and Colorado State Regulations.

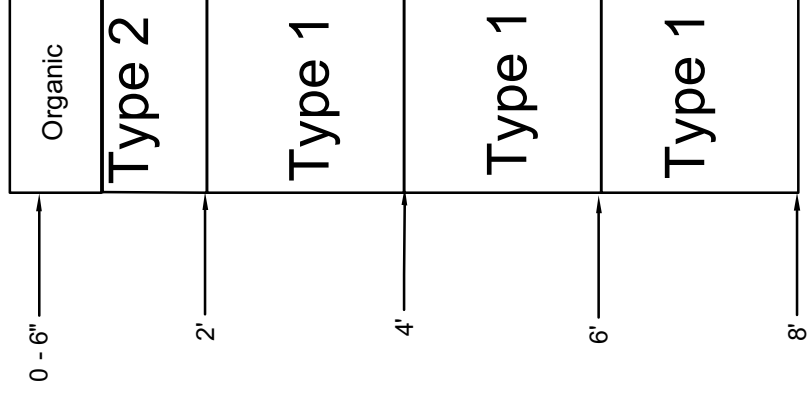
Setbacks are determined by the County Planning & Zoning Department, as well as OWTS Regulations. Innovative Process Engineering, PLLC attempted to locate any items in the vicinity of the exploratory profile examination holes that may affect minimum setbacks, however, there may be additional wells, gulches, streams, etc. not observed during the site visit. It is the owner's responsibility to make certain that all items that affect the minimum setbacks are properly maintained and represented to all parties, to whom it may concern.

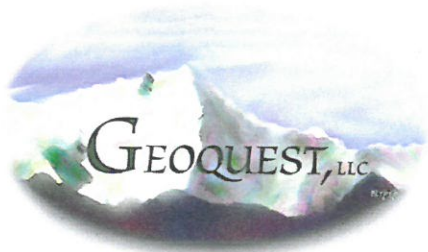
19205 Mariah Trail  
Project 21203

PP #1



PP #2





6825 Silver Ponds Heights #101  
Colorado Springs, CO 80908  
(719) 481-4560

Thomas Kirk  
19205 Mariah Trail  
Colorado Springs, Colorado 80908

RE: Soil Test Receipt, 19205 Mariah Trail, Geoquest #21-0989

To Whom It May Concern:

Thank you for choosing Geoquest, LLC to perform the Soils Report for the property at the above location.

The attached Soils Report provided by Geoquest, LLC, has been prepared in accordance with the standard of practice. This report does not address possible geologic hazards, environmental hazards, or drainage that exist on-site. There are specific requirements for the design and construction of the foundation of a structure at the location noted in the report. Some of these requirements are placed on the homeowner of the property and may be outside of the builders' control. **Accordingly, we are requiring both the builder and the homeowner to sign this letter indicating both parties have accepted a copy of the report, have read and understood the contents, and know they each have specific responsibilities. Failure to follow the recommendations and requirements of the report by any party can result in unsatisfactory performance of the foundation or building components. The Builder and Owner understand the risks, as noted in the Soils Report, and accept all risk, including movement of slabs.**

After the excavation has been completed an **Open Hole Observation is required** to be performed by the Soils Engineer. **After the Open Hole Observation is complete, the owner/builder should inform the Foundation Engineer of any changes to the soil conditions or allowable bearing. The Open Hole Observation is an additional cost.**

**Geoquest, LLC, will not provide any documentation for site inspections until we have received this letter with the required signatures.** If the property is being developed as a speculative investment and no homeowner has been contracted to purchase the property, you can indicate that under the homeowner signature line. Upon the sale of the property the builder understands that both this letter and a copy of the Soils Report shall be provided to the buyer, and a homeowner signed copy returned to Geoquest, LLC.

If you have any questions, feel free to contact us at (719) 481-4560.

Sincerely,

  
Charles E. Milligan, P.E.

Builder Representatives

Homeowner(s)

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_



6825 Silver Ponds Heights #101  
Colorado Springs, CO 80908  
(719) 481-4560

---

**SOILS REPORT**

**FOR**

**THOMAS KIRK**

**JOB #21-0989**

19205 Mariah Trail,  
El Paso County,  
Colorado

Sincerely,

  
Charles E. Milligan, P.E.





**TABLE OF CONTENTS**

INTRODUCTION ..... 1

CONCLUSIONS ..... 1

GENERAL..... 1

FIELD AND LABORATORY INVESTIGATION ..... 1

TOPOGRAPHY ..... 2

WEATHER ..... 2

DESIGN AND CONSTRUCTION CONSIDERATIONS ..... 2

RECOMMENDATION REMARKS..... 3

COLD TEMPERATURE CONSIDERATIONS..... 3

SURFACE DRAINAGE ..... 3

SUBSURFACE DRAINAGE ..... 4

REINFORCING ..... 4

FOOTING DESIGN ..... 4

CONSTRUCTION DETAILS..... 4

MINIMUM MATERIALS SPECIFICATIONS ..... 4

OPEN HOLE OBSERVATION (added cost)..... 4

COMPACTION TESTING (added cost) ..... 5

MODIFIED PROCTOR DENSITY TESTING (added cost) ..... 5

FINAL OBSERVATIONS (added cost) ..... 5

LIMITATIONS ..... 5

APPENDIX ..... 6

## INTRODUCTION

**The owners must be made aware of the contents of this report. If there are any questions or concerns regarding the information in this report, please contact Geoquest, LLC.** It is the responsibility of the contractor on this project to make subsequent owners aware of the contents of this report. This is to ensure that the recommendations and requirements of the report, especially regarding the surface drainage, are acknowledged and followed. This report is prepared for **Thomas Kirk, owner, 19205 Mariah Trail, El Paso County, Colorado.** This report is prepared with the understanding that a single-family residence is planned for this site. The site does not have existing structures.

## CONCLUSIONS

A satisfactory foundation for this structure is a properly designed shallow foundation system consisting of foundation components resting directly on undisturbed materials. Foundation components resting directly on undisturbed native materials shall be designed for a loading of not greater than **4,000 pounds per square foot. Any design by any engineer is subject to revision based on the results of the open hole observation.** The compressibility of this material is low. This bearing capacity is calculated with a safety factor of three. The type of foundation configuration used depends on the building loads applied. The depth of foundation elements shall be determined by the foundation engineer but should be at least as deep as the minimum depth required by the governing building authority. **The laboratory testing revealed that the on-site soil is silty sand and clayey sand (U.S.C.S. Classification Symbol SM, SC). The unit weight of equivalent fluid soil pressure of this material is 45 (SM) and 85 (SC) pounds per cubic foot. The native SC is not suitable and shall not be used as backfill material around the perimeter of the foundation.** The actual equivalent fluid soil pressure was not determined. The expected values are from ASCE 7-10, Table 3.2-1. **Foundation components should bear on soils of similar bearing capacity. Foundation components bearing on dissimilar soils should be avoided. The owners shall be made aware that movement will occur if surface or subsurface water is allowed to collect around the foundation wall.**

## GENERAL

The investigation was made to reveal important characteristics of the soils and of the site influencing the foundation design. Also evaluated during the investigation were subsurface conditions that affect the depth of the foundation and subsequent loading design, such as ground water levels, soil types, and other factors which affect the bearing capacity of the soils. Design loadings are based on soils characteristics and represent the maximum permissible loads for these conditions. The bearing capacity is calculated with a safety factor of three.

## FIELD AND LABORATORY INVESTIGATION

Two exploratory holes were drilled on August 17, 2021, at the locations shown on the enclosed site map. The location of these test holes was determined by Thomas Kirk. The test holes were drilled with a 4-inch diameter auger. At intervals anticipated to be the foundation depths, and as determined by the soils conditions, the drill tools were removed, and samples were taken by the use of a 2-inch split barrel sampler connected to a 140-pound drop-hammer. This hammer is dropped 30 inches to drive the penetration sampler into the soil **(ASTM D-1586)**. The depths and descriptions of the materials encountered in each test boring at which the samples were taken are shown on the enclosed log sheets. All samples were classified both in the field and in the laboratory to evaluate the physical and mechanical properties of the materials encountered.

## TOPOGRAPHY

The topography of this site is that of an incline sloping down towards the southwest at 5%.

## WEATHER

The weather at the time of the soil examination consisted of clear skies with hot temperatures.

## DESIGN AND CONSTRUCTION CONSIDERATIONS

Slabs-on-grade may move and crack. Vertical slab movement of up to one and a half inches should be expected for native soils with low expansion potential. In some cases, vertical movement may exceed this range. If movement and associated damage to basement floors and finishes cannot be tolerated, a structural floor system should be installed. If compaction is not performed, settlement may occur causing cracking of foundation walls and floors. Soil located beneath concrete walls shall be compacted to at least 95% Modified Proctor density (**ASTM D-1557**). Soil located beneath concrete slabs shall be compacted to at least 85% Modified Proctor density. Special care is to be taken to re-compact the material above utility lines to a minimum of 85% Modified Proctor density. During construction, conditions that could cause settlement shall be eliminated. Interior non-bearing partition walls shall be constructed such that they do not transmit floor slab movement to the roof or overlying floor. The gap or void (1.5 inch min.) installed in these non-bearing partitions may require re-construction over the life of the structure to re-establish the gap or void to allow for vertical slab movement. Stairwells, doorways, and sheeted walls should be designed for this movement.

The following are general recommendations of on-grade slabs:

1. Slabs shall be placed on well-compacted, non-expansive materials, and all soft spots shall be thoroughly excavated and replaced with non-expansive fill materials as stated above.
2. Slabs shall be separated from all foundation walls, load bearing members, and utility lines.
3. At intervals not to exceed 12 feet in each direction, provide control joints to reduce problems with shrinkage and curling as recommended by the American Concrete Institute (**ACI 360R-10**). Moisten the ground beneath the slab prior to the placement of concrete.
4. All concrete placed must be cured properly as recommended by the American Concrete Institute (**ACI 360R-10**). Separate load bearing members from slabs, as discussed above. Care must be exercised to prevent excess moisture from entering the soil under the structure, both during and after construction.
5. Due to the exposure of exterior concrete to variations in moisture fluctuations, heaving and cracking of exterior slabs-on-grade should be expected. Placement of at least 3 feet of non-expansive fill beneath the slabs can help to reduce the impact of differential movement and cracking but may not eliminate movement. Exterior concrete shall slope away from the structure a minimum of 2% grade.
6. The clayey sand (SC) has been analyzed for its expansion and/or consolidation potential. Basement slabs, garage slabs, and all concrete floor slabs, however, exert a very low dead-load pressure on the soil. Since this soil contains at least a small amount of swell potential, slabs will crack and heave or settle if excess water is allowed to penetrate the sub-grade. For example, column openings to pads below the placed slab, if exposed to precipitation during construction, will conduct water to the sub-grade, possibly causing it to expand. Also, if the slab is placed with concrete too wet, expansion may occur. We recommend 3,000 psi concrete placed at a maximum slump of 4 inches.

## RECOMMENDATION REMARKS

The recommendations provided in this report are based upon the observed soil parameters, anticipated foundation loads, and accepted engineering procedures. The recommendations are intended to minimize differential movement resulting from the heaving of expansive soil or from the settlement induced by the application of loads. **It must be recognized that the foundation will undergo some movement on all soil types.** In addition, concrete floor slabs will move vertically, therefore, adherence to those recommendations which isolate floor slabs from columns, walls, partitions or other structural components is extremely important if damage to the superstructure is to be minimized.

Any subsequent owners should be apprised of the soil conditions and advised to maintain good practice in the future with regard to surface and subsurface drainage and partition framing, drywall and finish work above floor slabs.

Geoquest, LLC does not assure that the contractor and/or homeowner will comply with the recommendations provided in this report. Geoquest, LLC provides recommendations only and does not supervise, direct or control the implementation of the recommendations.

**Failure to follow the recommendation provided by Geoquest, LLC and follow observation requirements may jeopardize the construction project and Geoquest, LLC shall be absolved from any and all responsibility for any damages arising from the failure to obtain proper site observation and follow recommendations.**

## COLD TEMPERATURE CONSIDERATIONS

1. Concrete shall not be placed upon wet or frozen soil.
2. Concrete shall be protected from freezing until it has been allowed to cure for at least 7 days after placement in forms.
3. Snow or other frozen water shall not be allowed in the forms during placement of concrete.
4. Concrete shall be cured in forms for at least 72 hours.
5. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.
6. The site shall be kept well drained at all times. Ponding of water should be avoided in the excavation area.

## SURFACE DRAINAGE

After construction of foundation walls, the backfill material shall be well compacted to 80% Modified Proctor density, to reduce future settlement. Any areas that settle after construction shall be filled to eliminate ponding of water adjacent to the foundation walls. **The finished grade shall have a positive slope away from the structure with an initial slope of 6 inch in the first 10 feet.** 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 of 5 feet from the foundation and sloped parallel with the wall at a 2% grade to intercept the surface water and carry it around and away from the structure. Homeowners shall maintain the surface grading and drainage installed by the builder to prevent water from being directed in the wrong direction. All downspouts shall have extensions that will remove runoff to the outside of the backfilled areas. Shrubs and plants requiring minimal watering shall be established in this area. Irrigated grass shall not be located within 5 feet of the foundation. Sprinklers shall not discharge water within 5 feet of the foundation. Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase the likelihood of floor slab and foundation movement.

All exterior grading and location of downspouts and their performance shall be inspected by Geoquest, LLC. **The native clayey sand (SC) material is not suitable and shall not be used as backfill material around the perimeter of the foundation.** If on-site soils are not suitable for the backfill, the backfill material shall consist of clean non-cohesive granular soils or road base material as described previously. Imported material is to be approved by Geoquest, LLC prior to placement. **We recommend imported granular backfill with a maximum unit weight of 45 pounds per cubic foot.** It is the responsibility of the contractor to schedule all inspections.

## SUBSURFACE DRAINAGE

Perimeter drains are required around all walls of the habitable or usable area portion of the structure that are below finished grade including all common wall(s) adjacent to the basement. Crawlspace, slab on grade, and walkout areas need not be drained unless specified at the time of the Open Hole Observation. Perimeter drains may be required during the open hole due to high moisture or grade that slopes toward the excavation. The final determination of the necessity for perimeter drains will be made at the time of the Open Hole Observation. An Exterior Drain Detail is provided in this report. Drains should daylight away from the structure or discharge to a sump pump. Even if drains are not required, areas below grade may experience moisture problems if unusual conditions are present in the future.

## REINFORCING

The concrete foundation walls shall be properly reinforced as per the specific design for this foundation by a **Colorado Registered Professional Engineer. Exact requirements are a function of the design of the structure. Questions concerning the specific design requirements shall be referred to the design engineer.**

## FOOTING DESIGN

The design for footings, pads, and/or piers for this structure is determined by applying the dead load and full live load to the foundation walls.

## CONSTRUCTION DETAILS

It is necessary with any soils investigation to assume that the materials from the test holes are representative of the materials in the area. On occasion variations in the subsurface materials do occur, therefore, should such variations become apparent during construction, the owner is advised to contact this office for a determination as to whether these variations will affect the design of the structure's foundation. If anomalies are observed during the excavation for the structure, this office should be contacted to determine whether the layers will adversely affect the design.

## MINIMUM MATERIALS SPECIFICATIONS

1. Minimum materials specifications of the concrete, reinforcing, etc., shall be determined by the Professional Foundation Design Engineer.
2. Compact beneath foundation walls a minimum of 95% Modified Proctor density to prevent settlement.
3. Compact all backfill material located around the perimeter of the foundation to a minimum of 80% Modified Proctor density.
4. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.
5. The site shall be kept well drained at all times.

## OPEN HOLE OBSERVATION (added cost)

**If anyone other than Geoquest, LLC, performs the Open Hole Observation, that person/company assumes liability for the soils, and any possible changes to the foundation design.**

The owner, or a representative of the construction company shall contact **Geoquest, LLC** a minimum of **24 hours** prior to excavating for the foundation. An Open Hole Observation must be performed on each individual structure prior to the placement of concrete, and preferably prior to the placement of forms in the excavated area. **The failure to request or obtain an Open Hole Observation prior to the placement of foundation components may result in this Soils Report being declared null and void.** This is to ensure that soft areas, anomalies, etc., are not present in the foundation region. At the time of the open hole observation the **foundation type recommendations, maximum allowable bearing capacity may be revised** according to soil conditions found at that time. If revisions are made to the Soils Report due to the soil conditions of the excavation, **the Foundation Design Engineer must be notified of all revisions.**

### COMPACTION TESTING (added cost)

Geoquest, LLC shall perform compaction testing on any replaced material. Soil shall be compacted in maximum 6-inch lifts. Testing shall be performed at intervals not to exceed 24 inches (or as required by the design engineer). Modified Proctor Density must be provided to Geoquest, LLC prior to compaction testing, see below.

The owner, or a representative of the construction, shall contact Geoquest, LLC a **minimum of 24 hours prior to the time the compaction test is requested. The failure to properly compact and/or obtain proper compaction testing may result in this Soils Report being declared null and void.**

### MODIFIED PROCTOR DENSITY TESTING (added cost)

**Modified Proctor Density test must be provided to Geoquest, LLC prior to compaction testing.** If a Proctor cannot be provided, a Modified Proctor Density test must be completed prior to compaction testing. Two 5-gallon valid samples of the soil to be used, must be provided for testing, at least 2 weeks prior to the placement and compaction of the material.

**The failure to provide this data may result in this Soils Report being declared null and void.**

### FINAL OBSERVATIONS (added cost)

The owner, or a representative of the construction company, shall contact Geoquest, LLC at the time final grading and landscaping procedures are completed. This is to ensure that sprinkler systems are not installed adjacent to the structure and that only shrubs or plants that require minimal watering are established in this area. All exterior grading as well as the location of downspouts and their performance shall be inspected by Geoquest, LLC. Any additional landscaping or grading changes performed by subsequent contractors and/or owners shall be inspected and approved. It is the responsible of the contractor and/or owner to schedule all these inspections at the appropriate times. **The failure to obtain this inspection may result in this Soils Report being declared null and void.**

### LIMITATIONS

This report is issued based on the understanding that the owner or his representative will bring the information, data, and recommendations contained in this report to the attention of the project engineer and architect, in order that they may be incorporated into the plans for the structure. It is also the owner's responsibility to ensure that all contractors and sub-contractors carry out these recommendations during the construction phase.

This report was prepared in accordance with generally accepted professional geotechnical/engineering methods. However, Geoquest, LLC makes no other warranty, express or implied, as to the findings, data, specifications, or professional advice rendered hereunder. **Due to circumstances outside of Geoquest, LLC's control, including improper construction, failure to follow recommendations, and unforeseen events, the Limits of Liability extend only to fees rendered for the professional services provided.**

This report is considered valid as of the present date. The owner acknowledges, however, that changes in the conditions of the property might occur with the passage of time, such as those caused by natural effects or man-made changes, both on this land and on abutting properties. Further, changes in acceptable tolerances or standards might arise as the result of new legislative actions, new engineering advances, or the broadening of geotechnical knowledge. Thus, certain developments beyond our control may invalidate this report, in whole or in part.

This report and its recommendations do not apply to any other site than the one described herein and are predicated on the assumption that the soil conditions do not deviate from those described. In the event that any variations or undesirable conditions should be detected during the construction phase or if the proposed construction varies from that planned as of this report date, the owner shall immediately notify Geoquest, LLC in order that supplemental recommendations can be provided, if so required.

This report excludes possible environmental issues, geologic hazards, flooding, or any other natural or man-made hazards that affect this site. These are outside the scope of work, for this report.

## APPENDIX



# DRILL LOGS

JOB #: 21-0989 TEST BORING NO.: TH-1 Date: 08/17/2021 By: jwg	DEPTH (in ft.)	SYMBOL	SAMPLES	BLOW COUNT	WATER %	SOIL TYPE
0" - 4" <u>TOPSOIL</u>	0-4	XXXX				
4" - 7' <u>SS (SM)</u> Fine-coarse grained Very high density Low moisture content Low-moderate clay content Low plasticity White color	4-7			35 3"	2.9	SM
7' - 14' <u>SS (SM)</u> Fine-coarse grained Very high density Low-moderate moisture content Moderate clay content Low plasticity White color	7-14			50 11"	7.7	SM

JOB #: 21-0989 TEST BORING NO.: TH-2 Date: 08/17/2021 By: jwg	DEPTH (in ft.)	SYMBOL	SAMPLES	BLOW COUNT	WATER %	SOIL TYPE
0" - 6" <u>TOPSOIL</u>	0-6	XXXX				
6" - 3' <u>Sand</u>	6-3					
3' - 8' <u>SS (SC)</u> Fine-coarse grained Very high density Low-moderate moisture content Moderate clay content Low plasticity White color	3-8			35 4"	6.5	SC
8' - 10' <u>WxSS (SM)</u> Fine-coarse grained High density Low-moderate moisture content Low-moderate clay content Low plasticity White color	8-10			46 12"	6.7	SM
10' - 14.5' <u>SS (SM)</u> Fine-coarse grained Very high density Low-moderate moisture content Low clay content Low plasticity White color	10-14.5			50 7"	6.5	SM

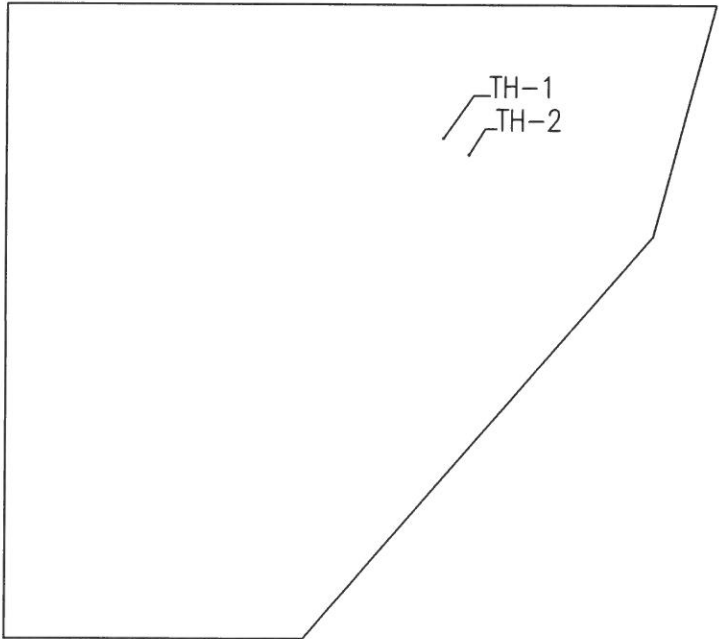


GEOQUEST LLC

**SITE MAP**

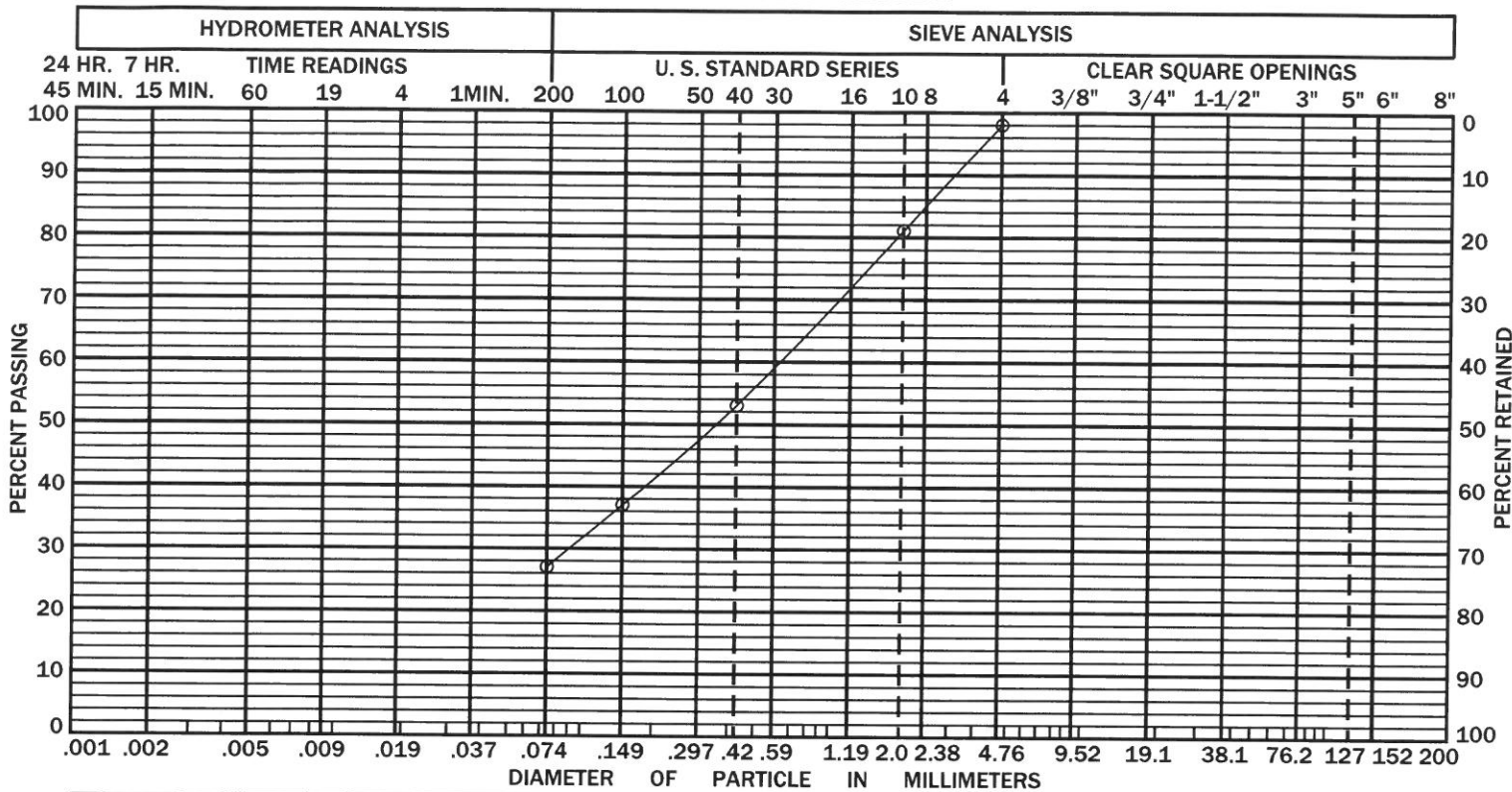
Lot #1  
19205 Mariah Trail  
El Paso County  
Colorado  
Job #21-0989  
By: jwg

Mariah Trail

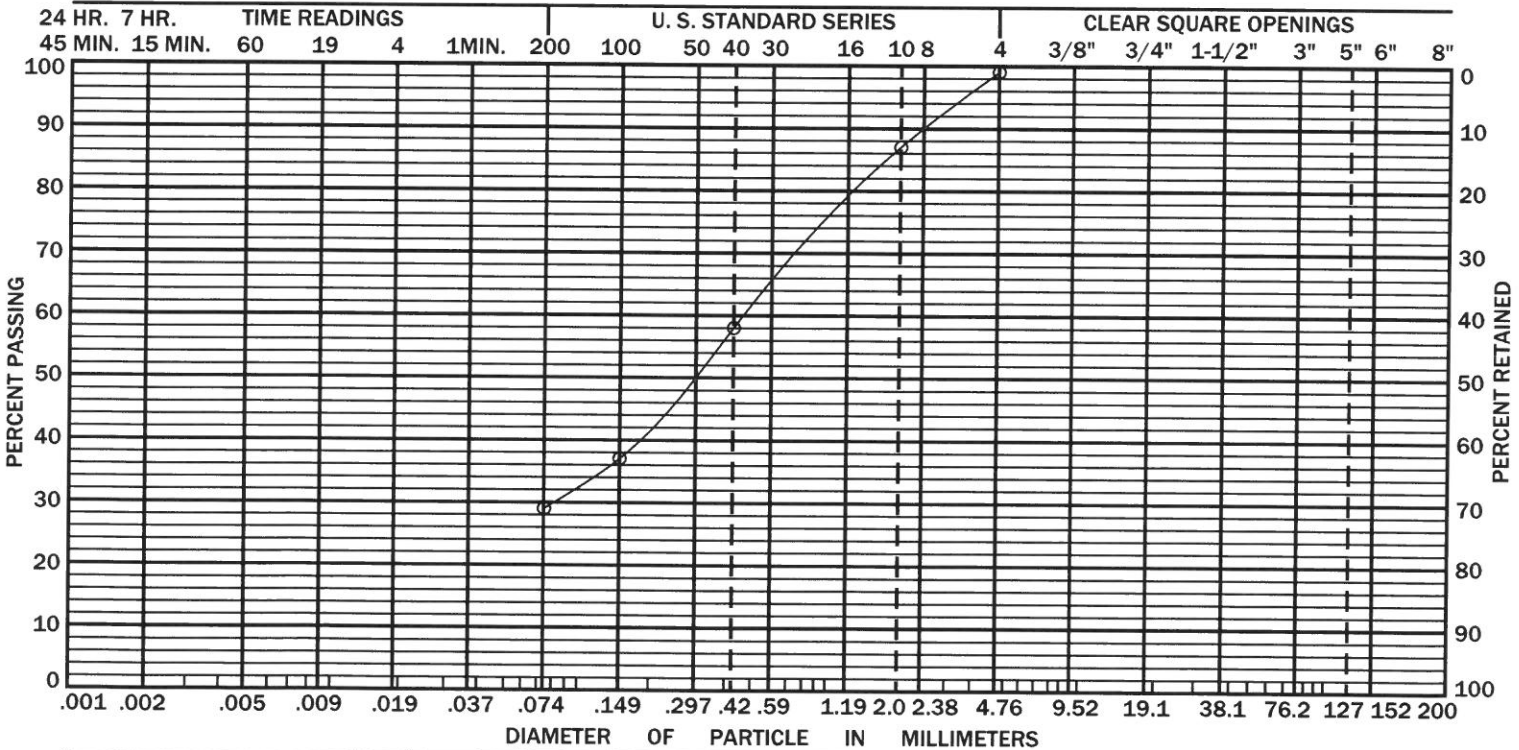


0 100 200 300 400  
GRAPHIC SCALE IN FEET  
SCALE: 1" = 400'

**GEOQUEST LLC**  
**GRADATION TEST RESULTS**

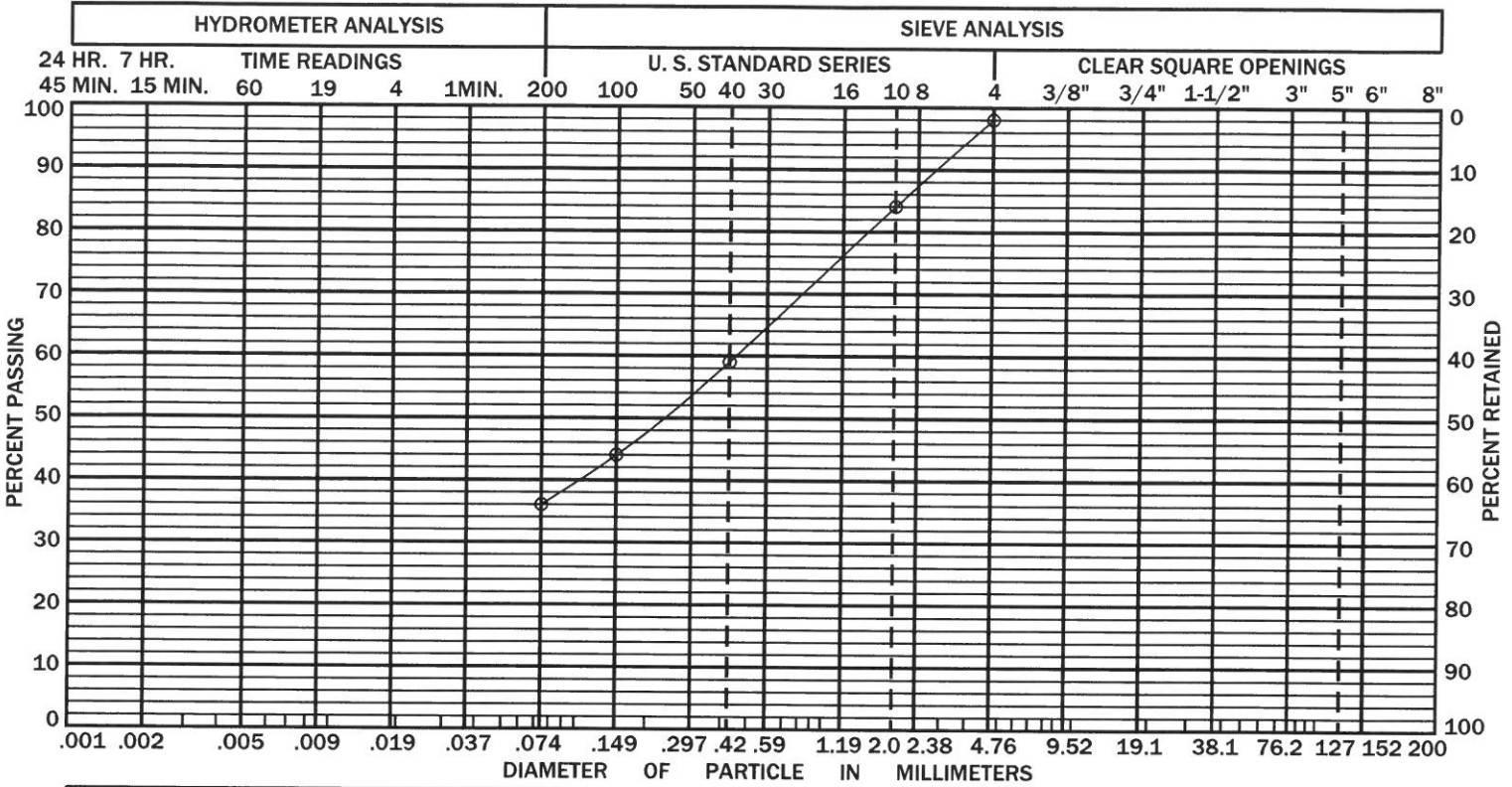


CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	
CLASSIFICATION <u>SM</u>	NOTES: <u>2.91 %</u> Moisture content					
GRAVEL <u>1.81 %</u>	Cu = <u>38.29</u>					
SAND <u>70.74 %</u>	Cc = <u>0.52</u>					
FINES <u>27.45 %</u>						
SAMPLE# <u>1</u> HOLE# <u>TH-1</u> DEPTH <u>4'</u> FEET						

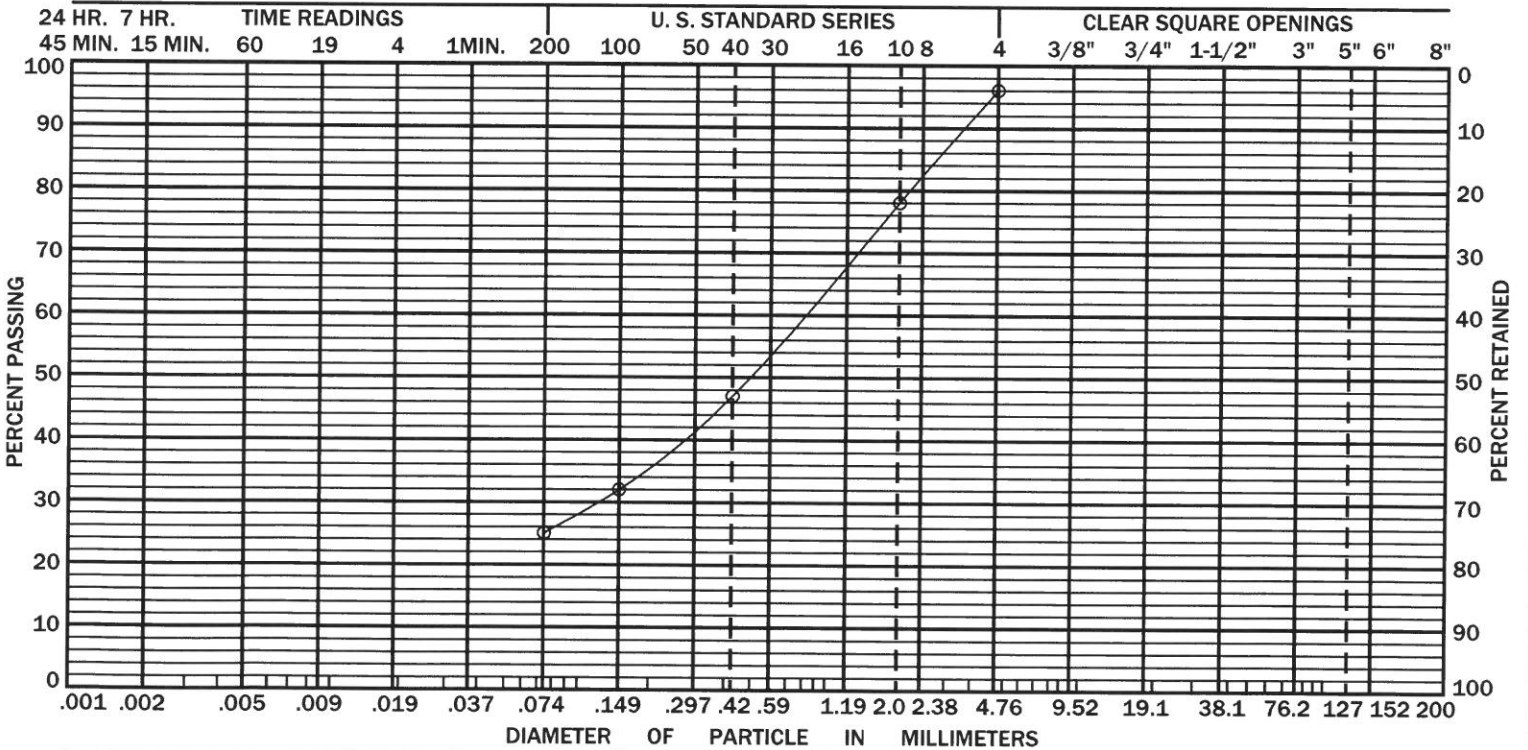


CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	
CLASSIFICATION <u>SM</u>	NOTES: <u>7.67 %</u> Moisture content					
GRAVEL <u>0.81 %</u>	Cu = <u>36.52</u>					
SAND <u>70.36 %</u>	Cc = <u>0.85</u>					
FINES <u>28.83 %</u>						
SAMPLE# <u>2</u> HOLE# <u>TH-1</u> DEPTH <u>9</u> FEET	Job: #21-0989 By: CHS 09/01/2021					

**GEOQUEST LLC**  
**GRADATION TEST RESULTS**



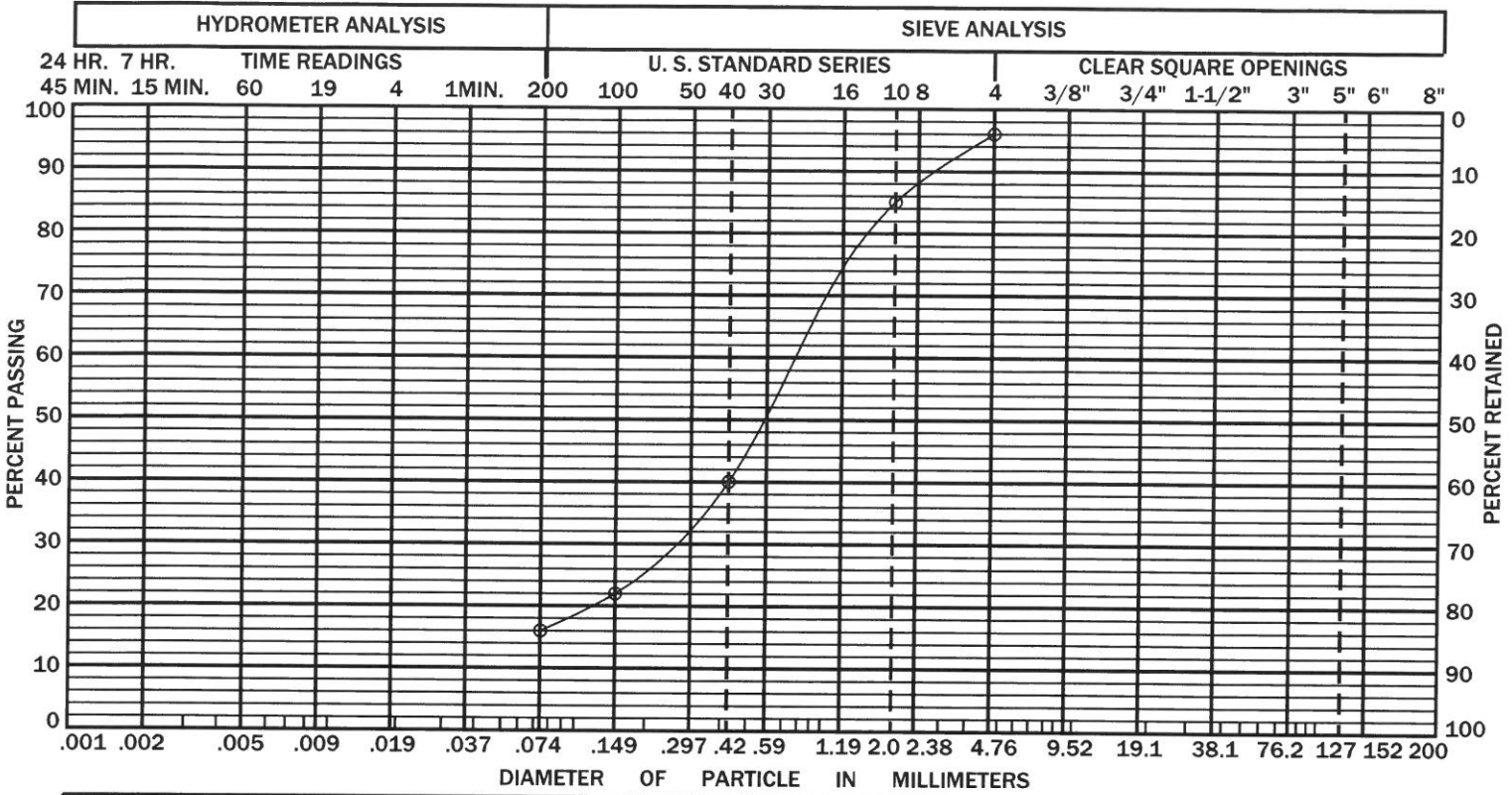
CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	
CLASSIFICATION <u>SC</u>	NOTES: <u>6.53 % Moisture content</u>					
GRAVEL <u>1.69 %</u>						
SAND <u>61.88 %</u>						
FINES <u>36.44 %</u>						
SAMPLE# <u>3</u> HOLE# <u>TH-2</u> DEPTH <u>4</u> FEET						



CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	
CLASSIFICATION <u>SM</u>	NOTES: <u>6.72 % Moisture content</u>					
GRAVEL <u>3.95 %</u>	<u>Cu = 74.96</u>					
SAND <u>70.86 %</u>	<u>Cc = 1.02</u>					
FINES <u>25.18 %</u>						
SAMPLE# <u>4</u> HOLE# <u>TH-2</u> DEPTH <u>9</u> FEET	Job: #21-0989 By: CHS 09/01/2021					

# GEOQUEST LLC

## GRADATION TEST RESULTS



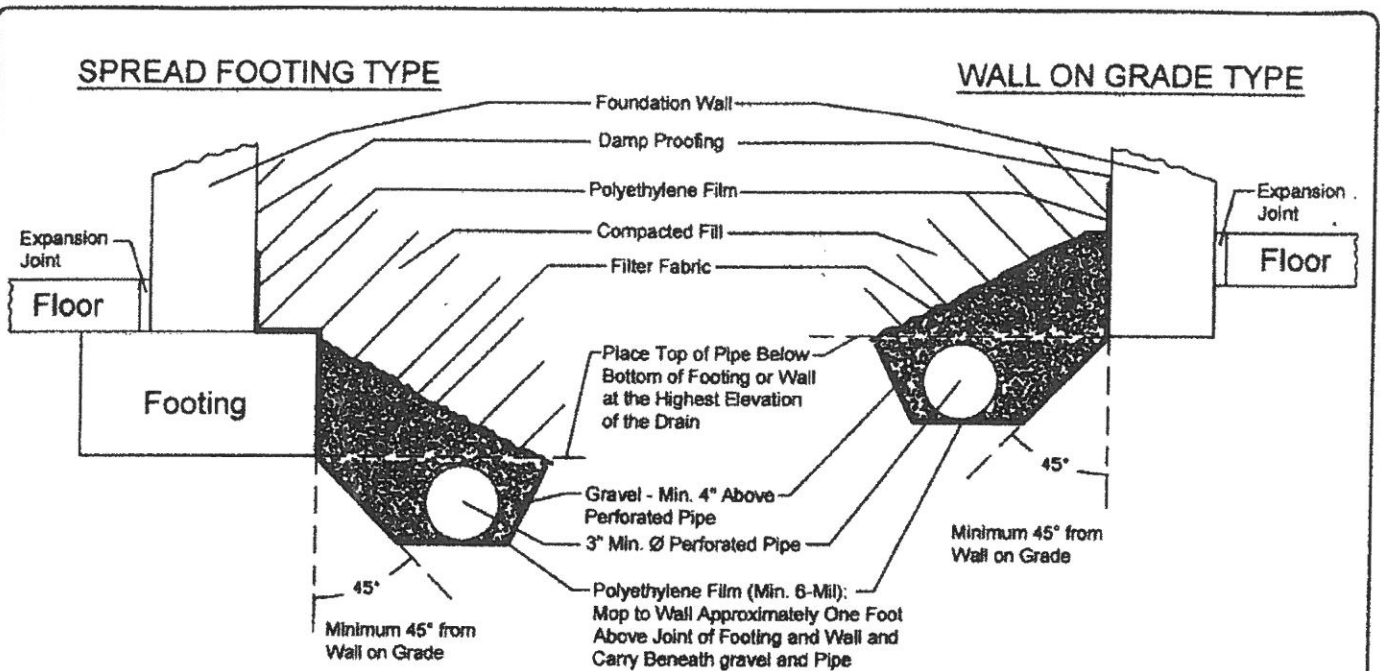
CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

CLASSIFICATION SM  
 GRAVEL 3.99 %  
 SAND 79.59 %  
 FINES 16.42 %  
 SAMPLE# 5 HOLE# TH-2 DEPTH 14 FEET

NOTES: 6.48 % Moisture content  
Cu = 34.96  
Cc = 2.05  
 Job: #21-0989 By: CHS 09/01/2021



## EXTERIOR DRAIN DETAIL



1. Gravel to be Not More Than 1-1/2" and Not Less Than 1/2" Diameter.
2. Perforated Pipe Diameter Varies With Expected Seepage. 3"Ø and 4"Ø are Most Common. ABS and PVC are Most Common Materials for Pipe. We approve the use of an "EZ Flow Drainage System" by Infiltrator. All specifications in this drain detail are still applicable.
3. Pipe to be Laid out in a Minimum Slope of 1" in 10'.
4. Gravity Outfall is Desired if Possible. Portion of Pipe in Area Not Drained Shall be Non-Perforated. Daylight Must be Maintained Clear of Debris in Order to Function Properly.
5. If Gravity Outfall is Not Possible, Provide a Sump With Operational Pump. Pump May Not Connect to Any Sanitary or Storm Sewer.
6. Soil Backfill Should be Compacted to at Least 80% of the Modified Proctor Density in the Upper Three Feet of Fill.
7. Filter Fabric to be Mirafi 140s or Approved Equivalent. Roofing Felt and Sheet Plastic are Not Acceptable.
8. Drain Pipe Shall be Laid Below Protected Area, as Shown in The Detail Above.
9. Mop Polyethylene Film to Wall Approximately One Foot Above Joint of Footing and Wall (Do Not Pull Plastic Tight) and Carry Beneath Gravel and Pipe.
10. The Polyethylene Film Shall be Continued to the Edge of the Excavation.

3/21/2023

# Geology and Soils Evaluation Report

**Proposed Mariah Trail Subdivision, Filing No. 1**

**El Paso County, Colorado**

**VIVID Project No.: D23-2-587**



Only the client or it's designated representatives may use this document  
and only for the specific project for which this report was prepared.

March 21, 2023

Report prepared for:

Daryn Strop  
Wayne Anthony Custom Homes  
[daryn@wacustomhomes.com](mailto:daryn@wacustomhomes.com)

Richie Lyon, PE  
Project Manager  
Atwell, LLC  
[rlyon@atwell-group.com](mailto:rlyon@atwell-group.com)

**GEOLOGY AND SOILS EVALUATION REPORT**  
**Proposed Mariah Trail Subdivision, Filing No. 1**  
**El Paso County, Colorado**  
**VIVID Project No. D23-2-587**

Prepared by:



---

William J. Barreire, PE  
Senior Geotechnical Engineer

**Reviewed by:**



---

Brysen T. Mustain, PG  
Professional Geologist

**VIVID Engineering Group, Inc.**  
1053 Elkton Drive  
Colorado Springs, CO 80907  
(719) 896-4356 phone



## Table of Contents

1.0	INTRODUCTION .....	1
1.1	GENERAL.....	1
1.2	PROJECT DESCRIPTION .....	1
1.3	PURPOSE AND SCOPE .....	1
2.0	FIELD EXPLORATION AND LABORATORY TESTING .....	2
2.1	FIELD EXPLORATION .....	2
2.2	LABORATORY TESTING .....	2
3.0	GEOLOGY AND SOILS.....	3
3.1	SITE DESCRIPTION.....	3
3.2	GEOLOGIC RECONNAISSANCE .....	3
3.3	SITE STRATIGRAPHY (FIGURES 3A AND 3B).....	3
3.4	ENGINEERING GEOLOGY AND MITIGATION OF GEOLOGIC HAZARDS .....	3
3.5	ECONOMIC MINERAL RESOURCES .....	5
4.0	LIMITATIONS.....	6

Figure 1:	VICINITY MAP
Figure 2:	FIELD EXPLORATION PLAN
Figure 3a:	REGIONAL GEOLOGY MAP
Figure 3b:	SITE-SPECIFIC GEOLOGY MAP
Figure 4a:	NRCS SOIL SURVEY MAP
Figure 4b:	NRCS SOIL SURVEY MAP (Soil Descriptions)
Figure 4c:	NRCS SOIL SURVEY MAP (Soil Descriptions)
Figure 4d:	NRCS SOIL SURVEY MAP (Soil Descriptions)
Figure 5:	TOPOGRAPHIC MAP
Figure 6:	FLOOD HAZARD MAP

Appendix A:	Logs of Explorations
Appendix B:	Laboratory Test Results





## 1.0 INTRODUCTION

### 1.1 GENERAL

This report presents the results of a geology and soils evaluation performed for the proposed Mariah Trail Subdivision, Filing No. 1, to be constructed south of the current terminus of Mariah Trail in El Paso County, Colorado. An attached Vicinity Map (Figure 1) shows the general location of the project. Our evaluation was performed for Wayne Anthony Custom Homes along with Atwell, LLC, and was authorized by Daryn Strop.

### 1.2 PROJECT DESCRIPTION

The proposed project includes the re-platting and development of a 35-acre parcel into a residential subdivision. Six lots are planned that will vary from approximately 5 to 7 acres in size. The property has no current improvements and is in a generally native condition. The development will include the extension of Mariah Trail (approximately 1000 feet) into the subdivision. A preliminary site layout is shown on Figure 2, attached to this report.

### 1.3 PURPOSE AND SCOPE

The purpose of this evaluation was to investigate the site geology and potential geologic hazards for the proposed development. This report is part of the submittal of the Preliminary Development Plan for this proposed subdivision to El Paso County.

Our scope of services included the following:

- ✓ Review of available mapping to evaluate the local geology, topography, flood risk potential, and other geologic features and hazards.
- ✓ Obtain permission to enter the private property for fieldwork activities.
- ✓ Perform a visual site reconnaissance to observe existing site conditions, field locate soil borings, and establish safety procedures as applicable.
- ✓ Notify the Colorado One-call Center (Colorado 811) to locate utilities.
- ✓ The drilling of three exploratory borings along the proposed Mariah Trail extension and one boring at the location of a possible drainage feature.
- ✓ Laboratory testing of selected samples obtained during the field exploration to evaluate relevant physical, geologic, and engineering properties of the soil.
- ✓ Preparation of this report, which includes a description of the proposed project, a description of the surface and subsurface site conditions found during our investigation, geologic and geotechnical research and mapping for evaluation of challenges or hazards that may impact the development.

## 2.0 FIELD EXPLORATION AND LABORATORY TESTING

### 2.1 FIELD EXPLORATION

A field exploration performed on March 3, 2023 included the drilling of three exploratory borings along the approximate alignment of the proposed Mariah Trail extension and one boring at the approximate location of a potential site drainage feature. The locations of the borings are presented on Figure 2 – Field Exploration Plan. A summary of the subsurface exploration is presented in Table 1, below.

**Table 1**  
**Summary of Subsurface Exploration**

Boring Designation	Approximate Boring Depth [feet, below ground surface]	Approximate Depth to Groundwater [feet, below ground surface]	Approximate Depth to Weathered Bedrock [feet, below ground surface]
<b>B-1</b>	10	None Encountered	4
<b>B-2</b>	10	None Encountered	None Encountered
<b>B-3</b>	10	None Encountered	2.5
<b>B-4</b>	10	None Encountered	7.5

Borings were performed with a truck-mounted CME-45 drill rig equipped with 4-inch outside diameter, continuous-flight, solid-stem auger. Samples were taken with a 2.5-inch O.D./2.0-inch I.D., California-type sampler, and by bulk methods. Penetration tests were obtained at the various sample depths as well.

Appendix A to this report includes logs of the borings describing the subsurface conditions. The lines defining boundaries between soil and rock types on the logs are based upon drill behavior and interpolation between samples and are therefore approximate. Transition between soil and rock types may be abrupt or may be gradual.

### 2.2 LABORATORY TESTING

Laboratory tests were performed on selected soil samples to estimate their relative engineering properties. Tests were performed in general accordance with the following methods of ASTM or other recognized standards-setting bodies, and local practice:

- Description and Identification of Soils (Visual-Manual Procedure)
- Classification of Soils for Engineering Purposes
- Moisture Content and Unit Weight
- Sieve Analysis of Fine and Coarse Aggregates
- Liquid Limit, Plastic Limit, and Plasticity Index
- Swell/Settlement
- R-value

Results of the laboratory tests are included in Appendix B of this report. Selected test results are also shown on the boring logs in Appendix A.



## 3.0 GEOLOGY AND SOILS

### 3.1 SITE DESCRIPTION

The site is a vacant 35 acres and is currently covered with native grasses and shrubs. The parcel is a generally mild south and east sloping parcel with one shallow alluvial valley. Sparse residential properties surround the parcel.

### 3.2 GEOLOGIC RECONNAISSANCE

A visual geologic reconnaissance of the site was performed by Mr. William Barreire, Professional Engineer (Geotechnical), with VIVID Engineering Group, Inc. This reconnaissance was supported by the field drilling and laboratory testing, as well as geologic mapping and information from the following sources:

- CGS Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado, by Jon P. Thorson, 2003
- Soil Survey of El Paso County Area, Colorado Soil Conservation Service, USDA, 1979
- El Paso County, Colorado: Potential Geologic Hazards and Surficial Deposits, Environmental and Engineering Maps and Tables for Land Use (Colorado Springs Quadrangle 1961), Charles S. Robinson and Associates, Inc. Cochran, D.M. (1977)

Portions of geologic mapping are presented as Figure 3a-Regional Geology Map and Figure 3b-Site Specific Geology Map, attached to this report. An NRCS Soil Survey Map and associated Soil Descriptions are presented as Figures 4a, 4b, 4c, and 4d. A USGS Topographic Map is attached as Figure 5.

### 3.3 SITE STRATIGRAPHY (FIGURES 3A AND 3B)

Based on information available, two geologic units are identified on the site which may be described as follows:

#### **QTa**

Alluvium of Palmer

Divide:

The alluvial sheet washed deposits encountered on and adjacent to the site are generally associated with the early Pleistocene or Pliocene Ages. The material is typically pale brown. This unit consists of poorly sorted sand, medium to thin bedded, laminated, and composed largely of quartz grains. Sand and pebble gravel are interbedded with cobble and boulder gravel which consist of Pikes Peak Granite.

#### **TKd5**

Dawson Formation

(Facies #5):

The Upper Dawson Formation (TKd5) is associated with the early to middle Eocene Age, and is one of five facies of this unit in this area of El Paso County. This unit is typically made up of very thick to massive, cross-bedded, light gray colored arkoses. These sandstones are generally pink to light gray in color, with high clay contents.

### 3.4 ENGINEERING GEOLOGY AND MITIGATION OF GEOLOGIC HAZARDS

No geologic hazards were found that would preclude the proposed development as planned. The following presents a list of geologic hazards, their applicability to this site, and the typical mitigation techniques.

#### **Expansive/Settlement Prone Soil**

Expansive soil was encountered on this site based on Denver Swell testing under light loads (for pavement design purposes) when subject to wetting. The underlying Dawson Formation bedrock can also possess zones of expansive material. Expansive soils can be mitigated through typical engineering approaches including removal



of expansive layers, over-excavation and treatment or replacement, or use of deep foundations. Expansion potential and proper mitigation must be evaluated during final geotechnical investigations for specific structures.

Settlement prone soils and bedrock were not encountered during this investigation and are not anticipated to be a significant or widespread hazard for this development.

### **Erodible Soils**

Soils with a sandy matrix, such as that encountered underlying the site, are susceptible to erosion when exposed. These concerns are normally addressed in an erosion control plan during construction and a long-term seeding/landscape plan that is typical for this type of development.

### **Corrosive Soils**

The site may be underlain by soil or bedrock materials that may contain corrosive minerals. Corrosive minerals can have detrimental effects on concrete and buried metals if not identified prior to design and properly mitigated. The potential for corrosive minerals is addressed in a site-specific geotechnical investigation report.

### **Mine Subsidence**

This project is outside of areas of known mining and mine subsidence.

### **Slope Stability**

The Dawson Formation and moderate to gentle slopes on this site are not considered to be prone to slope instability and there are no published geologic maps that indicate these issues exist on this site.

### **Flooding Potential**

As shown on Figure 6, the project site is outside of mapped flood plain areas. Based on the mapping and our site observations flooding is not considered to be a hazard for this development.

### **Seismicity**

The major structural feature of this region is the Rampart Range Fault System which is located approximately 11 miles west of the site along the Front Range. There is evidence of movement during the past 2 million years along this fault zone. The Rampart Range Fault is considered to be active by the Colorado Geologic Survey. This area, as is the case with most of central Colorado, is subject to a degree of risk due to seismic activity. The Colorado Geologic Survey considers the El Paso County area to be in Seismic Risk Zone 2A. Pikes Peak Regional Building Department has adopted the International Building Code. Refer to the currently approved building codes for current design and construction practices.

### **Radiation**

The primary radiation hazard associated with soil and bedrock commonly found in the El Paso County area is Radon gas. The higher concentrations of radon gas normally occur in residential structures that have been sealed to prevent exchange of outside air. Buildup of Radon gas can usually be mitigated by providing frequent exchange of air within the structure and by sealing joints and cracks that are located adjacent to the subsoil. Radon can be evaluated and mitigated utilizing common local construction practices if radon is found to exist during site specific geotechnical investigations.



## **Groundwater**

Groundwater was not encountered in our soil borings; however, our borings were terminated at a depth of 10 feet below the existing ground surface due to their planned use for pavement design and general drainage/permeability information.

Although groundwater was not encountered during this investigation, groundwater and smaller seeps are not uncommon as perched water above the bedrock, or in more permeable lenses within the Dawson Formation. If this condition is encountered during site-specific geotechnical investigations for individual lots, it should be mitigated with cut-off or foundation drains that are common local design and construction techniques.

## **Preliminary Residence Foundation Concepts**

As indicated above, expansive soil was encountered on this site based on swell-settlement (aka Denver Swell ) testing under light loads (for pavement design purposes) when subject to wetting. The underlying Dawson Formation bedrock can also possess zones of expansive material. Expansive soils and bedrock can be mitigated through typical engineering approaches including removal of expansive layers, over-excavation and treatment or replacement, or use of deep foundations. Expansion potential and proper mitigation must be evaluated during final geotechnical investigations for specific structures.

Typically, shallow foundations and slab-on-grade floors can be utilized on similar soil and bedrock conditions with proper mitigation and acceptance of some risk of movement structure and slab movement. Where expansive soils or bedrock is encountered, over-excavation of the expansive materials followed by moisture treatment and reuse/re-compaction of this material or replacement of the over-excavated material with non-expansive soils can be performed. The depth of over-excavation is dependent on the magnitude of the expansion but is generally anticipated to be between approximately 3 and 6 feet in this type of geology, with some potential variation. Maximum allowable bearing capacity for the on-site soils or moisture treated materials will likely be on the order of 2,000 to 3,000 pounds per square foot. Maximum allowable bearing capacity for footing bearing in the Dawson Formation material can range from 3,000 to 5,000 psf. Voided footings to concentrate structure deadload can also be utilized to resist heave of expansive soils.

If expansion characteristics are more severe, or to further reduce risk of foundation and floor movement, deep drilled shaft foundations extending into bedrock and structural floor systems (with a crawl space) can be used to effectively isolate the foundation and slabs from the effects of the underlying expansive materials.

## **Conclusion**

It is our opinion that the project site exhibits no geologic hazards that pose a significant risk to the proposed project or adjacent properties that cannot be mitigated through proper land usage planning, foundation design, engineering design, and/or construction practice. Recommendations regarding mitigation of the identified potential hazards are to be addressed in the future, site-specific geotechnical investigation reports, or through the use of current building design codes.

## **3.5 ECONOMIC MINERAL RESOURCES**

According to the *El Paso County Aggregate Resource Evaluation Map*, the project site is not mapped with any viable aggregate deposits. The site is mapped as “poor” for coal resources and “fair” for oil, according to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso, State Mineral Lands*.

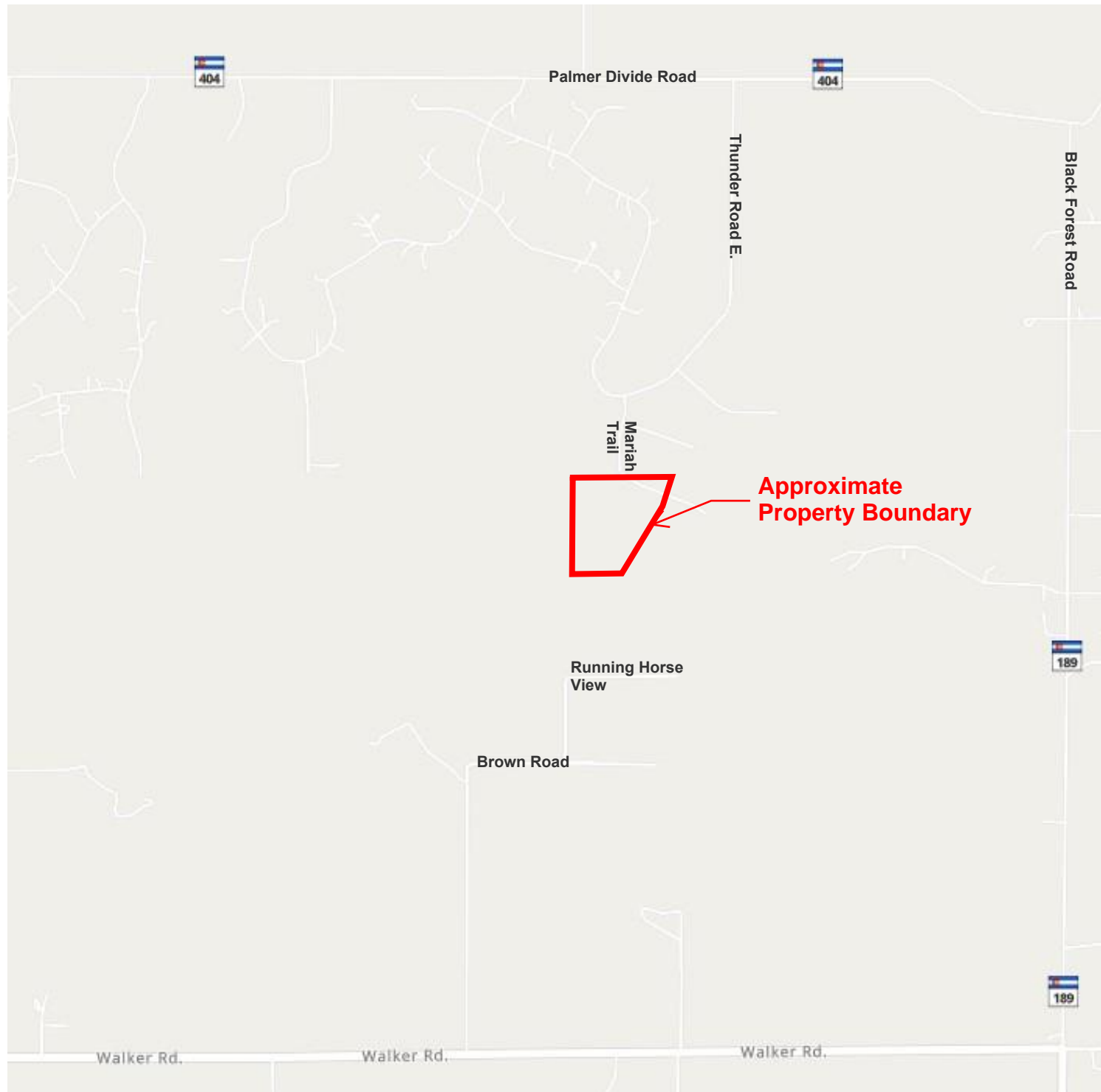


## 4.0 LIMITATIONS


This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of VIVID's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. VIVID makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report.

## Figures



Not to Scale. Base image obtained from www.mapquest.com, 2023

	Project No: D23-2-587	<b>VICINITY MAP</b>	Figure <b>1</b>
	Date: 1/31/23		
	Drawn by: JA	Mariah Trail Subdivision, Filing No. 1 El Paso County, Colorado	
	Reviewed by: WJB		





**MARIAH TRAIL FILING NO. 1**  
 A PORTION OF THE NORTHWEST QUARTER OF SECTION 7,  
 T14N R10E W1E, RANGE 65 WEST, THE 6th PRINCIPAL MERIDIAN,  
 EL PASO COUNTY, COLORADO.

Mariah Trail

Not to Scale

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Vivid makes no representations or warranties, express or implied, as to the accuracy, completeness, timeliness or right to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

**REFERENCE:**

Base image obtained from  
 Polaris Surveying, dated  
 2/21/23.

**LEGEND**

B-1 Approximate  
 Boring Location



**VIVID Engineering Group, Inc.**  
 1053 Elkton Drive  
 Colorado Springs, CO 80907  
 719-896-4356

Project No. D23-2-587

Date: March 21, 2023

Drawn by: BTM

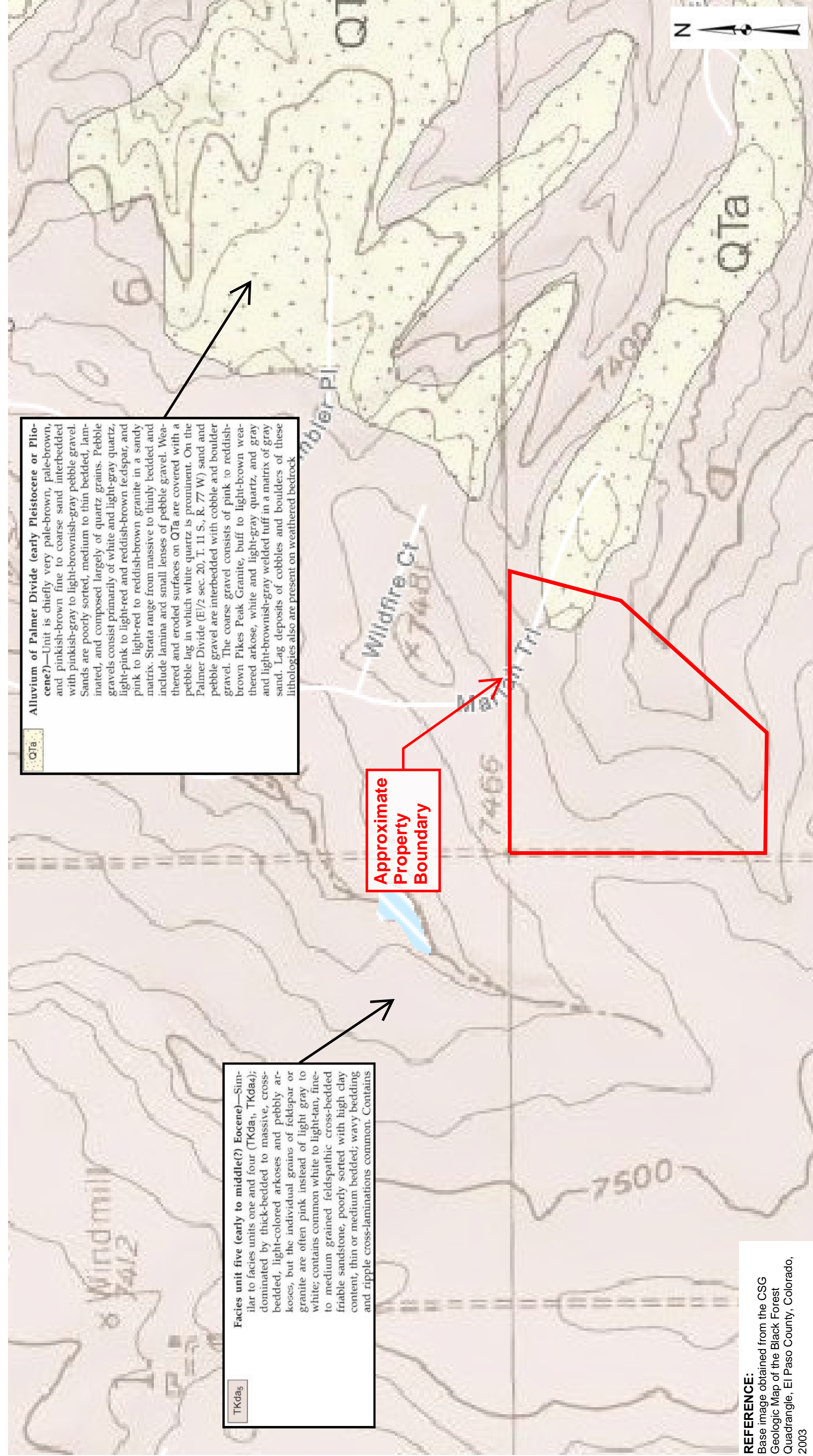
Reviewed by: WJB

**FIELD EXPLORATION PLAN**

Mariah Trail Subdivision, Filing No. 1  
 El Paso County, Colorado

Figure

2




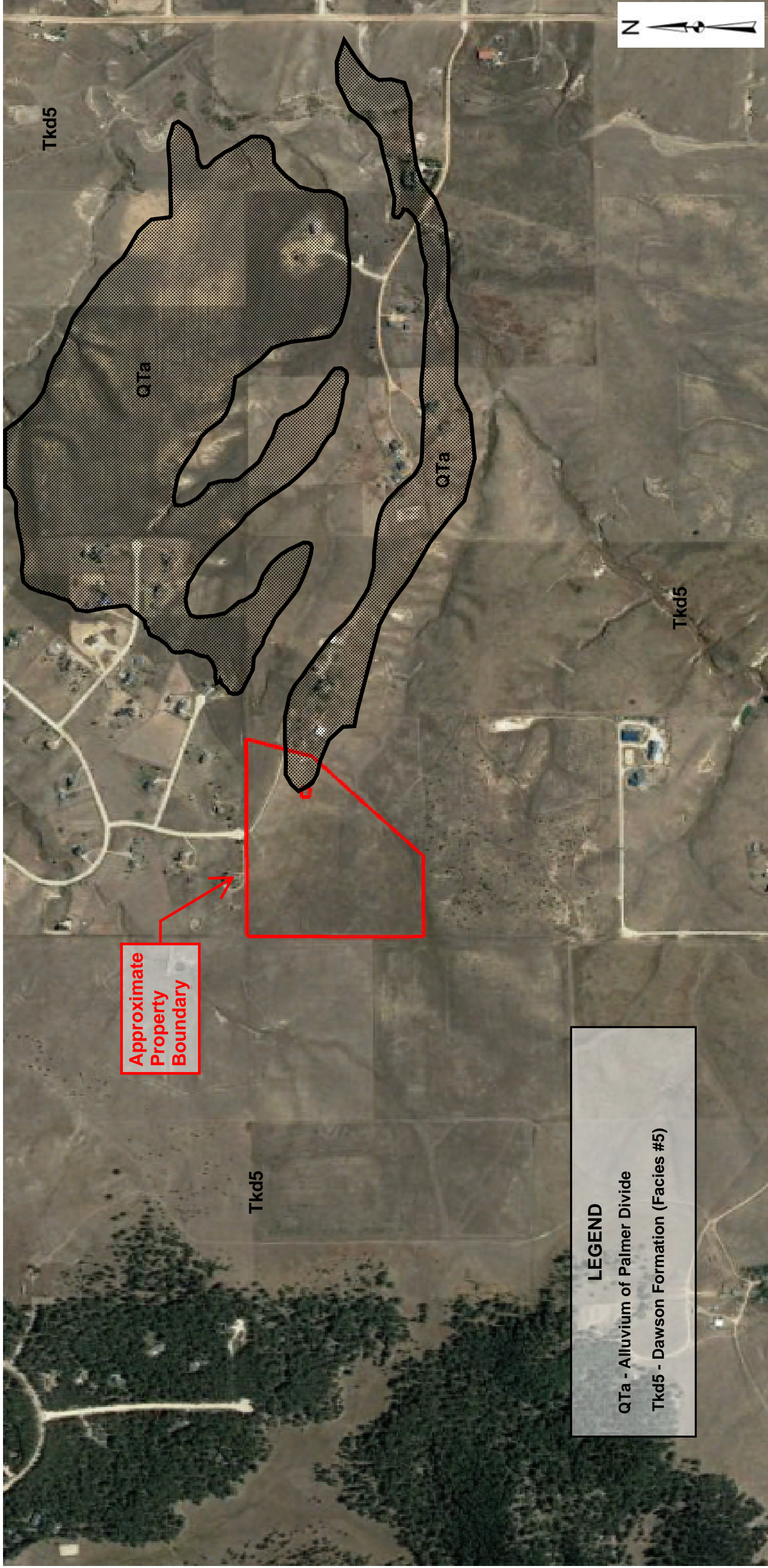
**Alluvium of Palmer Divide (early Pleistocene or Pliocene?)**—Unit is chiefly very pale-brown, pale-brown, and pinkish-brown fine to coarse sand interbedded with pinkish-gray to light-brownish-gray pebbly gravel. Sands are poorly sorted, medium to thin bedded, laminated, and composed largely of quartz grains. Pebble gravels consist primarily of white and light-gray quartz, light-pink to light-red and reddish-brown feldspar, and pink to light-red to reddish-brown granite in a sandy matrix. Strata range from massive to thinly bedded and include lamina and small lenses of pebbly gravel. Weathered and eroded surfaces on Q1a are covered with a pebble lag in which white quartz is prominent. On the Palmer Divide (E/2 sec. 20, T. 11 S., R. 77 W) sand and pebble gravel are interbedded with cobble and boulder brown Pikes Peak Granite, buff to light-brown weathered arkose, white and light-gray quartz, and gray and light-brownish-gray welded tuff in a matrix of gray sand. Lag deposits of cobbles and boulders of these lithologies also are present on weathered bedrock

**Facies unit five (early to middle(?) Eocene)**—Similar to facies units one and four (TKda1, TKda4); dominated by thick-bedded to massive, cross-bedded, light-colored arkoses and pebbly arkoses, but the individual grains of feldspar or granite are often pink instead of light gray to white; contains common white to light-tan, fine to medium grained feldspathic cross-bedded friable sandstone, poorly sorted with high clay content, thin or medium bedded; wavy bedding and ripple cross-laminations common. Contains

**REFERENCE:**  
Base image obtained from the CSG Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado, 2003

**Approximate Property Boundary**

	<b>VIVID Engineering Group, Inc.</b> 1053 Elkton Drive Colorado Springs, Colorado 80907 719.896.4356		Project No: D23-2-587
	Date: 1/31/23 Drawn by: JA Reviewed by: WJB		REGIONAL GEOLOGY MAP
Mariah Trail Subdivision, Filing No. 1 El Paso County, Colorado		Figure <b>3a</b>	



Not to Scale. Base image dated 10/6/2019 and obtained from Google Earth, 2023.



VIVID Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 719.896.4356

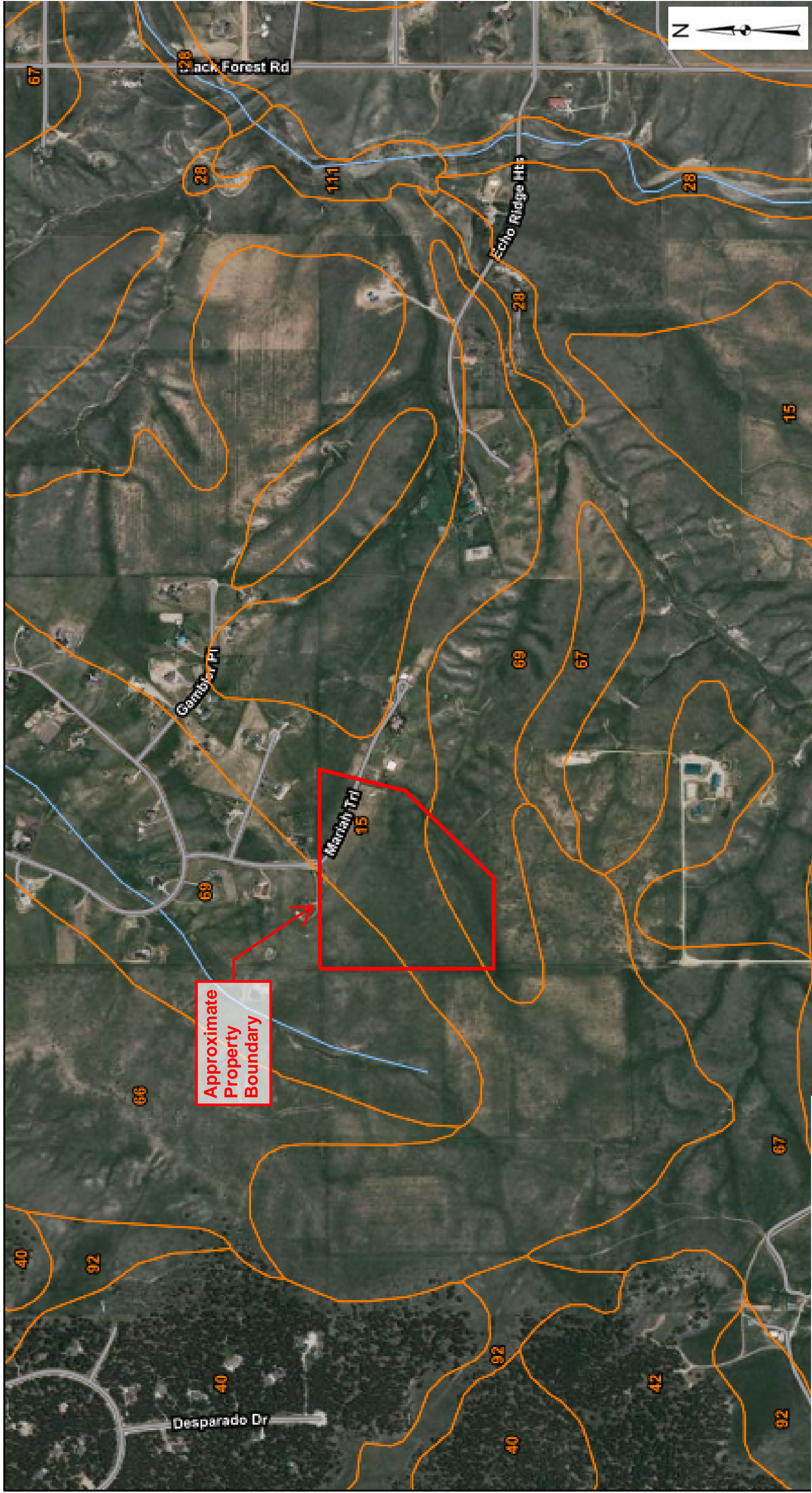
Project No: D23-2-587  
 Date: 1/31/23  
 Drawn by: JA  
 Reviewed by: WJB

**SITE-SPECIFIC GEOLOGY MAP**

Mariah Trail Subdivision, Filing No. 1  
 El Paso County, Colorado

Figure

**3b**



Not to Scale. Base image from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>



VIVID Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 719.896.4356

Project No: D23-2-587  
 Date: 1/31/23  
 Drawn by: JA  
 Reviewed by: WJB

**NRCS SOIL SURVEY MAP**

Mariah Trail Subdivision, Filing No. 1  
 El Paso County, Colorado

Figure

**4a**

<p><b>El Paso County Area, Colorado</b> 15—Brussett loam, 3 to 5 percent slopes</p> <p><b>Map Unit Setting</b> National map unit symbol: 367k Elevation: 7,200 to 7,500 feet Mean annual precipitation: 115 to 125 days Frost-free period: 115 to 125 days Farmland classification: Prime farmland if irrigated</p> <p><b>Map Unit Composition</b> Brussett and similar soils: 85 percent</p> <p>Estimates are based on observations, descriptions, and transects of the mapunit.</p> <p><b>Description of Brussett</b> <b>Setting</b> Landform: Hills Landform position (three-dimensional): Side slope Down-slope shape: Linear Across-slope shape: Linear Parent material: Eolian deposits</p> <p><b>Typical profile</b> A - 0 to 8 inches: loam BA - 8 to 12 inches: loam Bt - 12 to 26 inches: clay loam Bk - 26 to 60 inches: silt loam</p> <p><b>Properties and qualities</b> Slope: 3 to 5 percent Depth to restrictive feature: More than 80 inches Drainage class: Well drained Runoff class: Low Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr) Depth to water table: More than 80 inches Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum content: 5 percent Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm) Available water supply, 0 to 60 inches: High (about 9.1 inches)</p> <p><b>Interpretive groups</b> Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 4e Hydrologic Soil Group: B Ecological site: R048AY222CO - Loamy Park Hydric soil rating: No</p> <p><b>Minor Components</b></p> <p><b>Other soils</b> Percent of map unit: No Hydric soil rating: No</p>	<p><b>El Paso County Area, Colorado</b> 28—Ellicott loamy coarse sand, 0 to 5 percent slopes</p> <p><b>Map Unit Setting</b> National map unit symbol: 3680 Elevation: 5,500 to 6,500 feet Mean annual precipitation: 13 to 15 inches Mean annual air temperature: 47 to 50 degrees F Frost-free period: 125 to 145 days Farmland classification: Not prime farmland</p> <p><b>Map Unit Composition</b> Ellicott and similar soils: 97 percent Minor components: 3 percent</p> <p>Estimates are based on observations, descriptions, and transects of the mapunit.</p> <p><b>Description of Ellicott</b> <b>Setting</b> Landform: Hills Landform position (three-dimensional): Side slope Down-slope shape: Linear Across-slope shape: Linear Parent material: Sandy alluvium</p> <p><b>Typical profile</b> A - 0 to 4 inches: loamy coarse sand C - 4 to 60 inches: stratified coarse sand to sandy loam</p> <p><b>Properties and qualities</b> Slope: 0 to 5 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat excessively drained Runoff class: Very low Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr) Depth to water table: More than 80 inches Frequency of flooding: None, Frequent Frequency of ponding: None Available water supply, 0 to 60 inches: Low (about 4.1 inches)</p> <p><b>Interpretive groups</b> Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 7w Hydrologic Soil Group: A Ecological site: R069XY031CO - Sandy Bottomland Other vegetative classification: SANDY BOTTOMLAND (069AY031CO) Hydric soil rating: No</p> <p><b>Minor Components</b></p> <p><b>Fluvaquentic haplaquoll</b> Percent of map unit: 1 percent Landform: Swales Hydric soil rating: Yes</p> <p><b>Other soils</b> Percent of map unit: 1 percent Hydric soil rating: No</p> <p><b>Pleasant</b> Percent of map unit: 1 percent Landform: Depressions Hydric soil rating: Yes</p>	<p><b>El Paso County Area, Colorado</b> 40—Kettle gravelly loamy sand, 3 to 8 percent slopes</p> <p><b>Map Unit Setting</b> National map unit symbol: 368g Elevation: 7,000 to 7,700 feet Farmland classification: Not prime farmland</p> <p><b>Map Unit Composition</b> Kettle and similar soils: 85 percent</p> <p>Estimates are based on observations, descriptions, and transects of the mapunit.</p> <p><b>Description of Kettle</b> <b>Setting</b> Landform: Hills Landform position (three-dimensional): Side slope Down-slope shape: Linear Across-slope shape: Linear Parent material: Sandy alluvium derived from arkose</p> <p><b>Typical profile</b> E - 0 to 16 inches: gravelly loamy sand Bt - 16 to 40 inches: gravelly sandy loam C - 40 to 60 inches: extremely gravelly loamy sand</p> <p><b>Properties and qualities</b> Slope: 3 to 8 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat excessively drained Runoff class: Low Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr) Depth to water table: More than 80 inches Frequency of flooding: None Frequency of ponding: None Available water supply, 0 to 60 inches: Low (about 3.4 inches)</p> <p><b>Interpretive groups</b> Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 4e Hydrologic Soil Group: B Ecological site: F048AY908CO - Mixed Conifer Hydric soil rating: No</p> <p><b>Minor Components</b></p> <p><b>Other soils</b> Percent of map unit: No Hydric soil rating: No</p> <p><b>Pleasant</b> Percent of map unit: No Landform: Depressions Hydric soil rating: Yes</p>	<p><b>El Paso County Area, Colorado</b> 42—Kettle-Rock outcrop complex</p> <p><b>Map Unit Setting</b> National map unit symbol: 368j Elevation: 6,800 to 7,700 feet Frost-free period: 110 to 130 days Farmland classification: Not prime farmland</p> <p><b>Map Unit Composition</b> Kettle and similar soils: 60 percent Rock outcrop: 20 percent</p> <p>Estimates are based on observations, descriptions, and transects of the mapunit.</p> <p><b>Description of Kettle</b> <b>Setting</b> Landform: Hills Landform position (three-dimensional): Side slope Down-slope shape: Linear Across-slope shape: Linear Parent material: Sandy alluvium derived from arkose</p> <p><b>Typical profile</b> E - 0 to 16 inches: gravelly loamy sand Bt - 16 to 40 inches: gravelly sandy loam C - 40 to 60 inches: extremely gravelly loamy sand</p> <p><b>Properties and qualities</b> Slope: 8 to 40 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat excessively drained Runoff class: Medium Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr) Depth to water table: More than 80 inches Frequency of flooding: None Frequency of ponding: None Available water supply, 0 to 60 inches: Low (about 3.4 inches)</p> <p><b>Interpretive groups</b> Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 7e Hydrologic Soil Group: B Ecological site: F048AY908CO - Mixed Conifer Hydric soil rating: No</p> <p><b>Description of Rock Outcrop</b> <b>Typical profile</b> R - 0 to 60 inches: unweathered bedrock</p> <p><b>Properties and qualities</b> Slope: 8 to 60 percent Depth to restrictive feature: 0 inches to lithic bedrock Available water supply, 0 to 60 inches: Very low (about 0.0 inches)</p> <p><b>Interpretive groups</b> Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 8s Hydrologic Soil Group: D Hydric soil rating: No</p> <p><b>Minor Components</b></p> <p><b>Other soils</b> Percent of map unit: No Hydric soil rating: No</p>
<p>Not to Scale. Base image from <a href="https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx">https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx</a></p>			
 <p>VIVID Engineering Group, Inc. 1053 Elkton Drive Colorado Springs, Colorado 80907 719.896.4356</p>	<p>Project No: D23-2-587 Date: 1/31/23 Drawn by: JA Reviewed by: WJB</p>	<p>NRCS SOIL SURVEY MAP (Soil Descriptions)</p> <p>Mariah Trail Subdivision, Filing No. 1 El Paso County, Colorado</p>	<p>Figure <b>4b</b></p>

**El Paso County Area, Colorado**

66—Peyton sandy loam, 1 to 5 percent slopes

**Map Unit Setting**

National map unit symbol: 369c  
 Elevation: 6,800 to 7,600 feet  
 Farmland classification: Prime farmland if irrigated and the product of 1 (soil erodibility) x C (climate factor) does not exceed 60

**Map Unit Composition**

Peyton and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

**Description of Peyton****Setting**

Landform: Flats, hills  
 Landform position (three-dimensional): Side slope, talf  
 Down-slope shape: Linear  
 Across-slope shape: Linear  
 Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

**Typical profile**

A - 0 to 12 inches: sandy loam  
 Bt - 12 to 25 inches: sandy clay loam  
 BC - 25 to 35 inches: sandy loam  
 C - 35 to 60 inches: sandy loam

**Properties and qualities**

Slope: 1 to 5 percent  
 Depth to restrictive feature: More than 80 inches  
 Drainage class: Well drained  
 Runoff class: Low  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)  
 Depth to water table: More than 80 inches  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

**Interpretive groups**

Land capability classification (irrigated): None specified  
 Land capability classification (nonirrigated): 4c  
 Hydrologic Soil Group: B  
 Ecological site: R049XY216CO - Sandy Divide  
 Hydric soil rating: No

**Minor Components****Other soils**

Percent of map unit:  
 Hydric soil rating: No

**Pleasant**

Percent of map unit:  
 Landform: Depressions

**El Paso County Area, Colorado**

67—Peyton sandy loam, 5 to 9 percent slopes

**Map Unit Setting**

National map unit symbol: 369d  
 Elevation: 6,800 to 7,600 feet  
 Mean annual air temperature: 43 to 45 degrees F  
 Frost-free period: 115 to 125 days  
 Farmland classification: Not prime farmland

**Map Unit Composition**

Peyton and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

**Description of Peyton****Setting**

Landform: Hills  
 Landform position (three-dimensional): Side slope  
 Down-slope shape: Linear  
 Across-slope shape: Linear  
 Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

**Typical profile**

A - 0 to 12 inches: sandy loam  
 Bt - 12 to 25 inches: sandy clay loam  
 BC - 25 to 35 inches: sandy loam  
 C - 35 to 60 inches: sandy loam

**Properties and qualities**

Slope: 5 to 9 percent  
 Depth to restrictive feature: More than 80 inches  
 Drainage class: Well drained  
 Runoff class: Medium  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)  
 Depth to water table: More than 80 inches  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

**Interpretive groups**

Land capability classification (irrigated): None specified  
 Land capability classification (nonirrigated): 4e  
 Hydrologic Soil Group: B  
 Ecological site: R049XY216CO - Sandy Divide  
 Hydric soil rating: No

**Minor Components****Other soils**

Percent of map unit:  
 Hydric soil rating: No

**Pleasant**

Percent of map unit:  
 Landform: Depressions  
 Hydric soil rating: Yes

**El Paso County Area, Colorado**

69—Peyton-Pring complex, 8 to 15 percent slopes

**Map Unit Setting**

National map unit symbol: 369g  
 Elevation: 6,800 to 7,600 feet  
 Farmland classification: Not prime farmland

**Map Unit Composition**

Peyton and similar soils: 40 percent

Pring and similar soils: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

**Description of Peyton****Setting**

Landform: Hills  
 Landform position (three-dimensional): Side slope  
 Down-slope shape: Linear  
 Across-slope shape: Linear  
 Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

**Typical profile**

A - 0 to 12 inches: sandy loam  
 Bt - 12 to 25 inches: sandy clay loam  
 BC - 25 to 35 inches: sandy clay loam  
 C - 35 to 60 inches: sandy loam

**Properties and qualities**

Slope: 8 to 9 percent  
 Depth to restrictive feature: More than 80 inches  
 Drainage class: Well drained  
 Runoff class: Medium  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)  
 Depth to water table: More than 80 inches  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

**Interpretive groups**

Land capability classification (irrigated): None specified  
 Land capability classification (nonirrigated): 4e  
 Hydrologic Soil Group: B  
 Ecological site: R049XY216CO - Sandy Divide  
 Hydric soil rating: No

**Description of Pring****Setting**

Landform: Hills  
 Landform position (three-dimensional): Side slope  
 Down-slope shape: Linear  
 Across-slope shape: Linear  
 Parent material: Arkosic alluvium derived from sedimentary rock

**Typical profile**

A - 0 to 14 inches: coarse sandy loam  
 C - 14 to 60 inches: gravelly sandy loam

**Properties and qualities**

Slope: 8 to 15 percent  
 Depth to restrictive feature: More than 80 inches  
 Drainage class: Well drained  
 Runoff class: Low  
 Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)  
 Depth to water table: More than 80 inches  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Not to Scale. Base image from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>



VIVID Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 719.896.4356

Project No: D23-2-587

Date: 1/31/23

Drawn by: JA

Reviewed by: WJB

### NRCS SOIL SURVEY MAP (Soil Descriptions)

Mariah Trail Subdivision, Filing No. 1  
 El Paso County, Colorado

Figure

**4c**

**El Paso County Area, Colorado**  
**111—Water**

**Map Unit Composition**

Water: 100 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**El Paso County Area, Colorado**  
**92—Tomah—Crowfoot loamy sands, 3 to 8 percent slopes**

**Map Unit Setting**

National map unit symbol: 36b9

Elevation: 7,300 to 7,600 feet

Farmland classification: Not prime farmland

**Map Unit Composition**

Tomah and similar soils: 50 percent

Crowfoot and similar soils: 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Tomah**

**Setting**

Landform: Alluvial fans, hills

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

**Typical profile**

A - 0 to 10 inches: loamy sand

E - 10 to 22 inches: coarse sand

Bt - 22 to 48 inches: stratified coarse sand to sandy clay loam

C - 48 to 60 inches: coarse sand

**Properties and qualities**

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.6 inches)

**Interpretive groups**

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: R049XY216CO - Sandy Divide

Hydric soil rating: No

**Description of Crowfoot**

**Setting**

Landform: Hills, alluvial fans

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium

**Typical profile**

A - 0 to 12 inches: loamy sand

E - 12 to 23 inches: sand

Bt - 23 to 36 inches: sandy clay loam

C - 36 to 60 inches: coarse sand

**Properties and qualities**

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Not to Scale. Base image from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>



VIVID Engineering Group, Inc.  
1053 Elkton Drive  
Colorado Springs, Colorado 80907  
719.896.4356

Project No: D23-2-587

Date: 1/31/23

Drawn by: JA

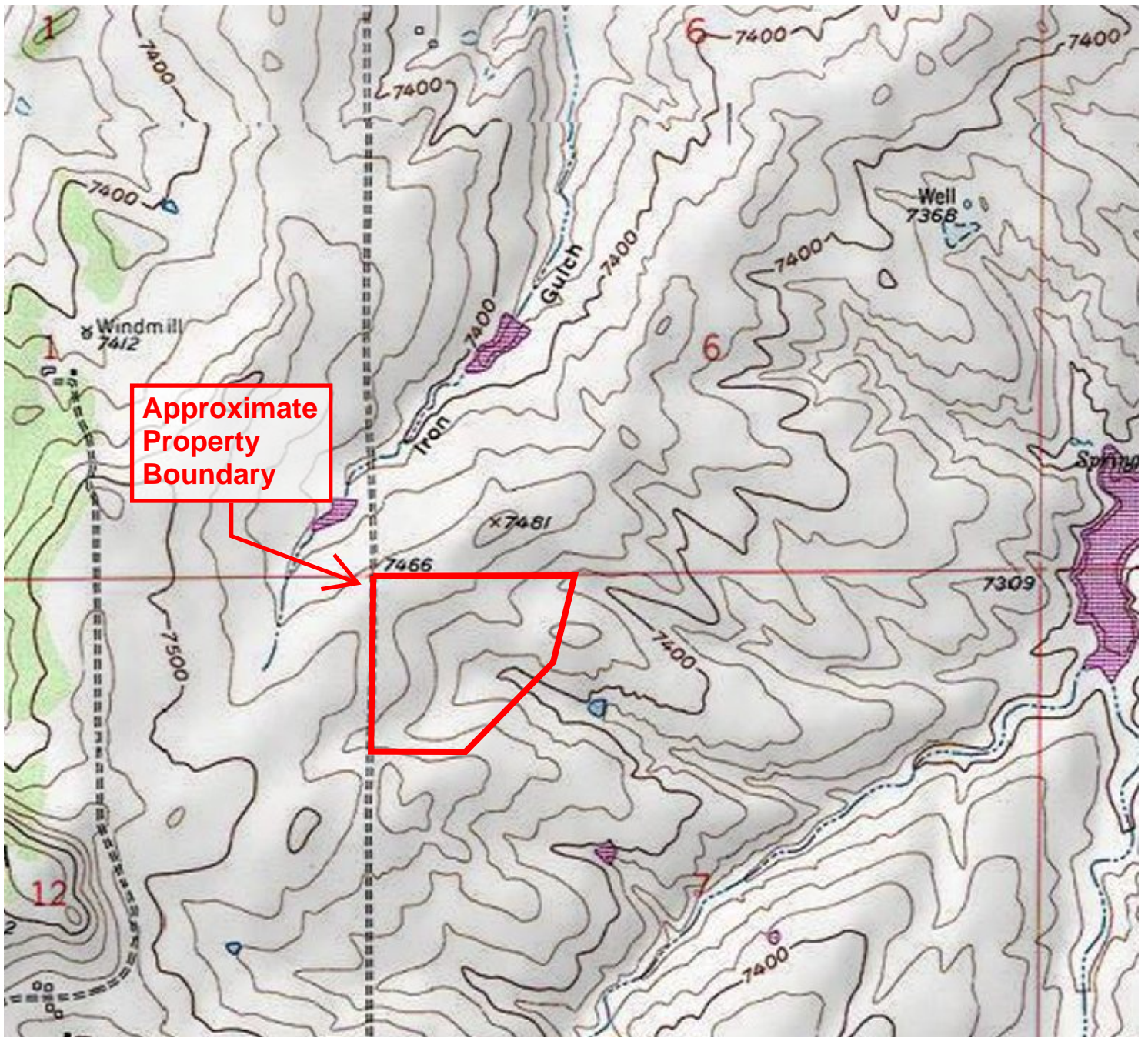
Reviewed by: WJB

**NRCS SOIL SURVEY MAP (Soil Descriptions)**


Mariah Trail Subdivision, Filing No. 1  
El Paso County, Colorado

Figure

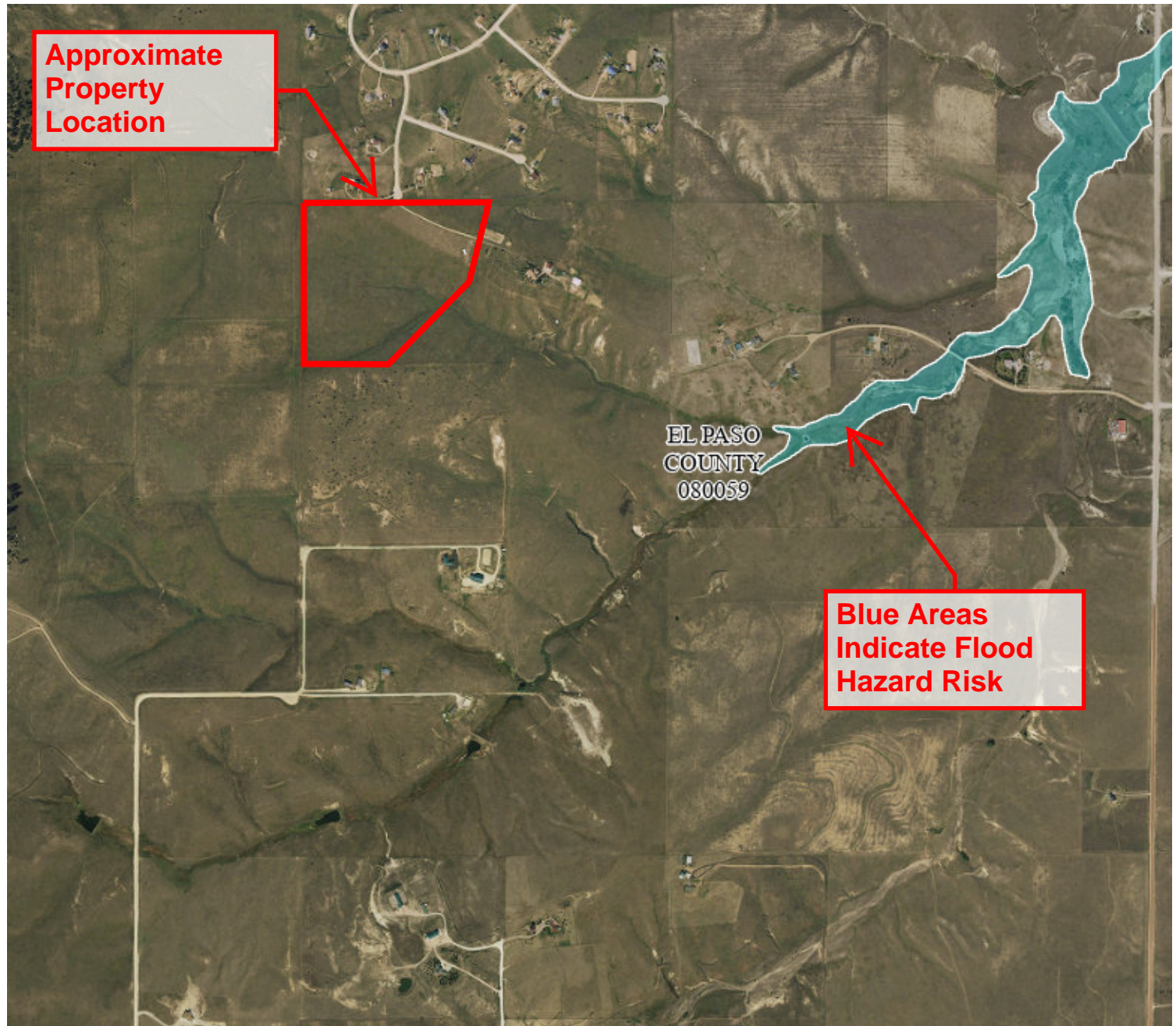
**4d**



Not to Scale. Base image obtained from USGS 7.5 Minute Quadrangle, 1961

	Project No: D23-2-587	<b>TOPOGRAPHIC MAP</b>	Figure  <b>5</b>
	Date: 1/31/23		
	Drawn by: JA	Mariah Trail Subdivision, Filing No. 1 El Paso County, Colorado	
	Reviewed by: WJB		





**Approximate  
Property  
Location**

EL PASO  
COUNTY  
080059

**Blue Areas  
Indicate Flood  
Hazard Risk**

Not to Scale. Base image obtained from  
[https://dsat.services.femadata.com/arcgis/rest/services/FEMA\\_R8/RiskMAP\\_EIPasoCounty\\_Colorado/MapServer/legend](https://dsat.services.femadata.com/arcgis/rest/services/FEMA_R8/RiskMAP_EIPasoCounty_Colorado/MapServer/legend), 2019

**Notes:**

- Blue shaded areas indicate flood hazard risk
- Site has no mapped flood hazards



Project No: D23-2-587

Date: 1/31/23

Drawn by: JA

Reviewed by: WJB

**FLOOD HAZARD MAP**

Mariah Trail Subdivision, Filing No. 1  
 El Paso County, Colorado

Figure

**6**

**Appendix A**  
**Logs of Exploratory Borings**



Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

# KEY TO SYMBOLS

**CLIENT** Wayne Anthony Custom Homes

**PROJECT NAME** Mariah Trail Subdivision, Filing No. 1

**PROJECT NUMBER** D23-2-587

**PROJECT LOCATION** South Terminus of Mariah Trail

## LITHOLOGIC SYMBOLS (Unified Soil Classification System)



CL-ML: USCS Low Plasticity Silty Clay



SC: USCS Clayey Sand



SC-SM: USCS Clayey Sand



SM: USCS Silty Sand



WEATHERED SANDSTONE

## SAMPLER SYMBOLS



Grab Sample



2" I.D. Modified California Sampler (MC)

## ABBREVIATIONS

- LL - LIQUID LIMIT (%)
- PI - PLASTIC INDEX (%)
- MC - MOISTURE CONTENT (%)
- DD - DRY DENSITY (PCF)
- NP - NON PLASTIC
- FINES- PERCENT PASSING NO. 200 SIEVE

KEY TO SYMBOLS - GINT STD US LAB.GDT - 3/21/23 13:20 - C:\USERS\BRYSEN MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS\_2023\ID23-2-587\_MARIAH TRAIL SUBDIVISION6 - DRAFTING\ID23-2-587.GPJ



Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

# BORING NUMBER B-1

GENERAL BH / TP / WELL - MODIFIED - GINT STD US LAB GDT - 3/21/23 13:19 - C:\USERS\BRYSEN MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS - 2023\ID23-2-587 - MARIAH TRAIL SUBDIVISION6 - DRAFTING\ID23-2-587.GPJ

**CLIENT** Wayne Anthony Custom Homes  
**PROJECT NUMBER** D23-2-587  
**DATE STARTED** 3/3/23 **COMPLETED** 3/3/23  
**DRILLING CONTRACTOR** Custom Auger Drilling (CME-45)  
**DRILLING METHOD** 4" Solid Stem Auger  
**LOGGED BY** J. Adams **CHECKED BY** W. Barreire  
**NOTES** \_\_\_\_\_

**PROJECT NAME** Mariah Trail Subdivision, Filing No. 1  
**PROJECT LOCATION** South Terminus of Mariah Trail  
**GROUND ELEVATION** \_\_\_\_\_ **HOLE SIZE** 4 inches  
**GROUND WATER LEVELS:**  
**AT TIME OF DRILLING** ---  
**AT END OF DRILLING** ---  
**AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
1.5	GB				Clayey SAND, brown, slightly moist, medium dense to dense
2.5	MC	15-22	MC = 8.7% DD = 118.9 pcf Swell = 4.9% when wetted under 200 psf load		
3.5	GB				<hr style="border-top: 1px dashed black;"/> <b>Dawson Formation</b> Weathered SANDSTONE, poorly cemented, light brown, slightly moist, moderately hard
4.5	MC	17-32			
5.0					
7.5					
9.5	MC	20-20			
10.0					

Bottom of borehole at 10.0 feet.



Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

# BORING NUMBER B-2

GENERAL BH / TP / WELL - MODIFIED - GINT STD US LAB GDT - 3/21/23 13:19 - C:\USERS\BRYSEN MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS - 2023\ID23-2-587 - MARIAH TRAIL SUBDIVISION6 - DRAFTING\ID23-2-587.GPJ

**CLIENT** Wayne Anthony Custom Homes

**PROJECT NUMBER** D23-2-587

**DATE STARTED** 3/3/23      **COMPLETED** 3/3/23

**DRILLING CONTRACTOR** Custom Auger Drilling (CME-45)

**DRILLING METHOD** 4" Solid Stem Auger

**LOGGED BY** J. Adams      **CHECKED BY** W. Barreire

**NOTES** \_\_\_\_\_

**PROJECT NAME** Mariah Trail Subdivision, Filing No. 1

**PROJECT LOCATION** South Terminus of Mariah Trail

**GROUND ELEVATION** \_\_\_\_\_      **HOLE SIZE** 4 inches

**GROUND WATER LEVELS:**

**AT TIME OF DRILLING** ---

**AT END OF DRILLING** ---

**AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
1.5	GB				Silty to Clayey SAND, light brown, slightly moist, medium dense
2.5	MC	10-15	MC = 4.6% DD = 108.7 pcf Swell = 1.1% when wetted under 200 psf load		
4.0	GB				
5.0	MC	10-16	MC = 3.5% DD = 106.5 pcf LL = NP PL = NP Fines = 32.0%		
10.0	MC	16-20			

Bottom of borehole at 10.0 feet.



Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

# BORING NUMBER B-3

PAGE 1 OF 1

**CLIENT** Wayne Anthony Custom Homes  
**PROJECT NUMBER** D23-2-587  
**DATE STARTED** 3/3/23 **COMPLETED** 3/3/23  
**DRILLING CONTRACTOR** Custom Auger Drilling (CME-45)  
**DRILLING METHOD** 4" Solid Stem Auger  
**LOGGED BY** J. Adams **CHECKED BY** W. Barreire  
**NOTES** \_\_\_\_\_

**PROJECT NAME** Mariah Trail Subdivision, Filing No. 1  
**PROJECT LOCATION** South Terminus of Mariah Trail  
**GROUND ELEVATION** \_\_\_\_\_ **HOLE SIZE** 4 inches  
**GROUND WATER LEVELS:**  
**AT TIME OF DRILLING** ---  
**AT END OF DRILLING** ---  
**AFTER DRILLING** ---

GENERAL BH / TP / WELL - MODIFIED - GINT STD US LAB GDT - 3/21/23 13:19 - C:\USERS\BRYSEN MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS\_2023\ID23-2-587\_MARIAH TRAIL SUBDIVISION6 - DRAFTING\ID23-2-587.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
2.5	GB				Silty, Clayey SAND, light brown, slightly moist, medium dense to dense
2.5	MC	32-40	MC = 2.9% DD = 131.9 pcf LL = 23 PL = 16 Fines = 23.0%		<b>Dawson Formation</b> Weathered SANDSTONE, poorly cemented, light brown, slightly moist, moderately hard
5.0	GB				
5.0	MC	24-29			
7.5					
10.0	MC	15-24			

Bottom of borehole at 10.0 feet.



Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

# BORING NUMBER B-4

PAGE 1 OF 1

GENERAL BH / TP / WELL - MODIFIED - GINT STD US LAB GDT - 3/21/23 13:19 - C:\USERS\BRYSEN MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS - 2023\023-2-587 - MARIAH TRAIL SUBDIVISION6 - DRAFTING\023-2-587.GPJ

**CLIENT** Wayne Anthony Custom Homes

**PROJECT NUMBER** D23-2-587

**DATE STARTED** 3/3/23      **COMPLETED** 3/3/23

**DRILLING CONTRACTOR** Custom Auger Drilling (CME-45)

**DRILLING METHOD** 4" Solid Stem Auger

**LOGGED BY** J. Adams      **CHECKED BY** W. Barreire

**NOTES** \_\_\_\_\_

**PROJECT NAME** Mariah Trail Subdivision, Filing No. 1

**PROJECT LOCATION** South Terminus of Mariah Trail

**GROUND ELEVATION** \_\_\_\_\_      **HOLE SIZE** 4 inches

**GROUND WATER LEVELS:**

**AT TIME OF DRILLING** ---

**AT END OF DRILLING** ---

**AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
0.0 - 2.5	GB				Silty SAND, light brown, slightly moist, medium dense
2.5	MC	7-7	MC = 4.7% DD = 98.7 pcf LL = 20 PL = 17 Fines = 40.0%		
2.5 - 4.0	GB				
4.0 - 5.0	MC	9-12	MC = 5.6% DD = 106.3 pcf LL = 24 PL = 19 Fines = 50.0%		Sandy, Silty CLAY, light brown, moist, very stiff
5.0 - 7.5					
7.5					
7.5 - 10.0					<b>Dawson Formation</b> Weathered SANDSTONE, poorly cemented, light brown, slightly moist, medium hard to hard
10.0	MC	25-40			
10.0					Bottom of borehole at 10.0 feet.

## **Appendix B**

### **Geotechnical Laboratory Test Results**





Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

# SUMMARY OF LABORATORY RESULTS

**CLIENT** Wayne Anthony Custom Homes

**PROJECT NAME** Mariah Trail Subdivision, Filing No. 1

**PROJECT NUMBER** D23-2-587

**PROJECT LOCATION** South Terminus of Mariah Trail

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)		
B-1	2.0							8.7	118.9		
B-2	2.0							4.6	108.7		
B-2	4.0	NP	NP	NP	2	32	SM	3.5	106.5		
B-3	2.0	23	16	7	9.5	23	SC-SM	2.9	131.9		
B-4	2.0	20	17	3	9.5	40	SM	4.7	98.7		
B-4	4.0	24	19	5	9.5	50	CL-ML	5.6	106.3		

LAB SUMMARY - GINT STD US LAB.GDT - 3/21/23 13:21 - C:\USERS\BRYSEN\MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS\_2023\ID23-2-587\_MARIAH TRAIL SUBDIVISION6 - DRAFTING\ID23-2-587.GPJ





Vivid Engineering Group, Inc.  
 1053 Elkton Drive  
 Colorado Springs, Colorado 80907  
 Telephone: 719-896-4356  
 Fax: 719-896-4357

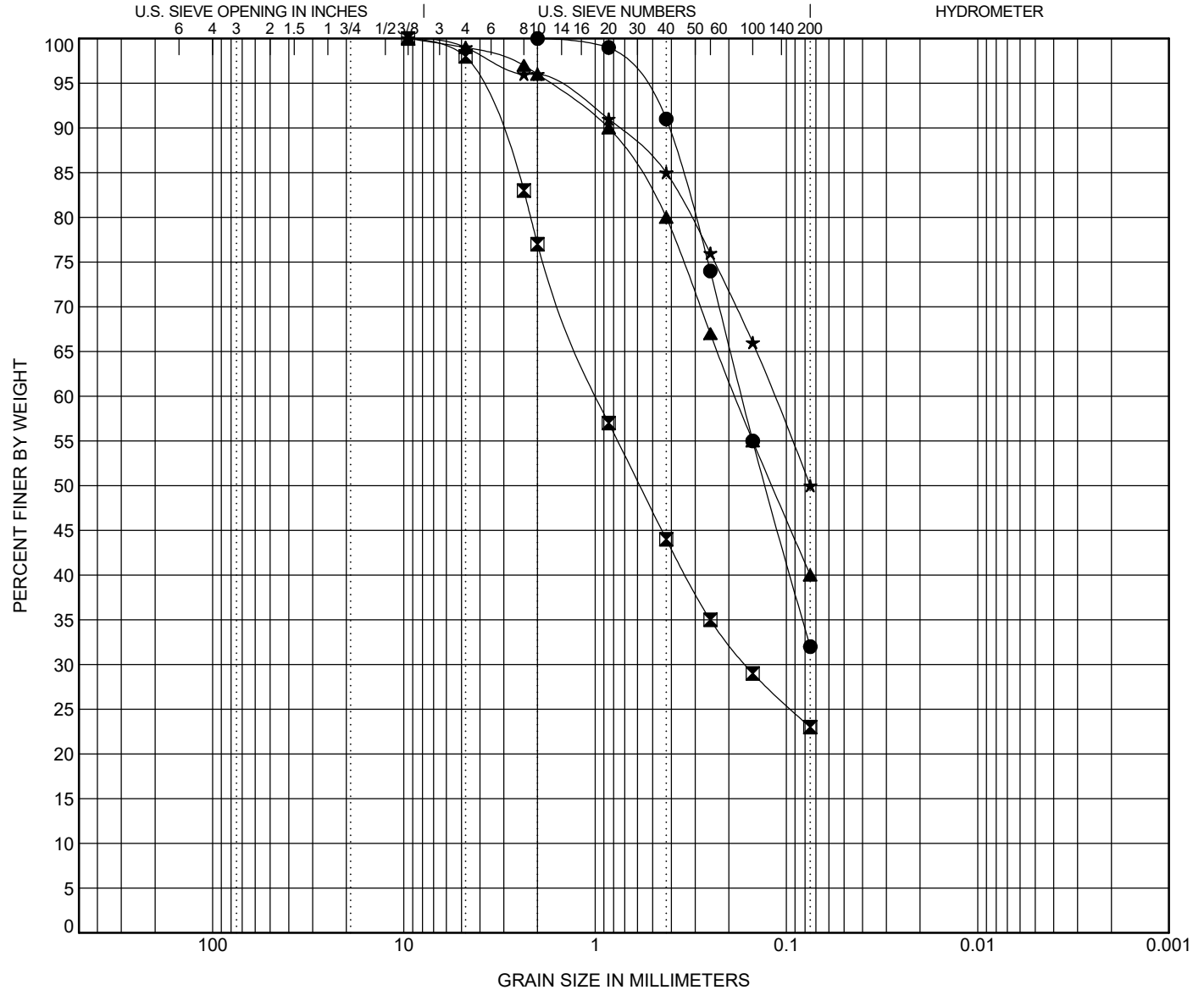
# GRAIN SIZE DISTRIBUTION

CLIENT Wayne Anthony Custom Homes

PROJECT NAME Mariah Trail Subdivision, Filing No. 1

PROJECT NUMBER D23-2-587

PROJECT LOCATION South Terminus of Mariah Trail



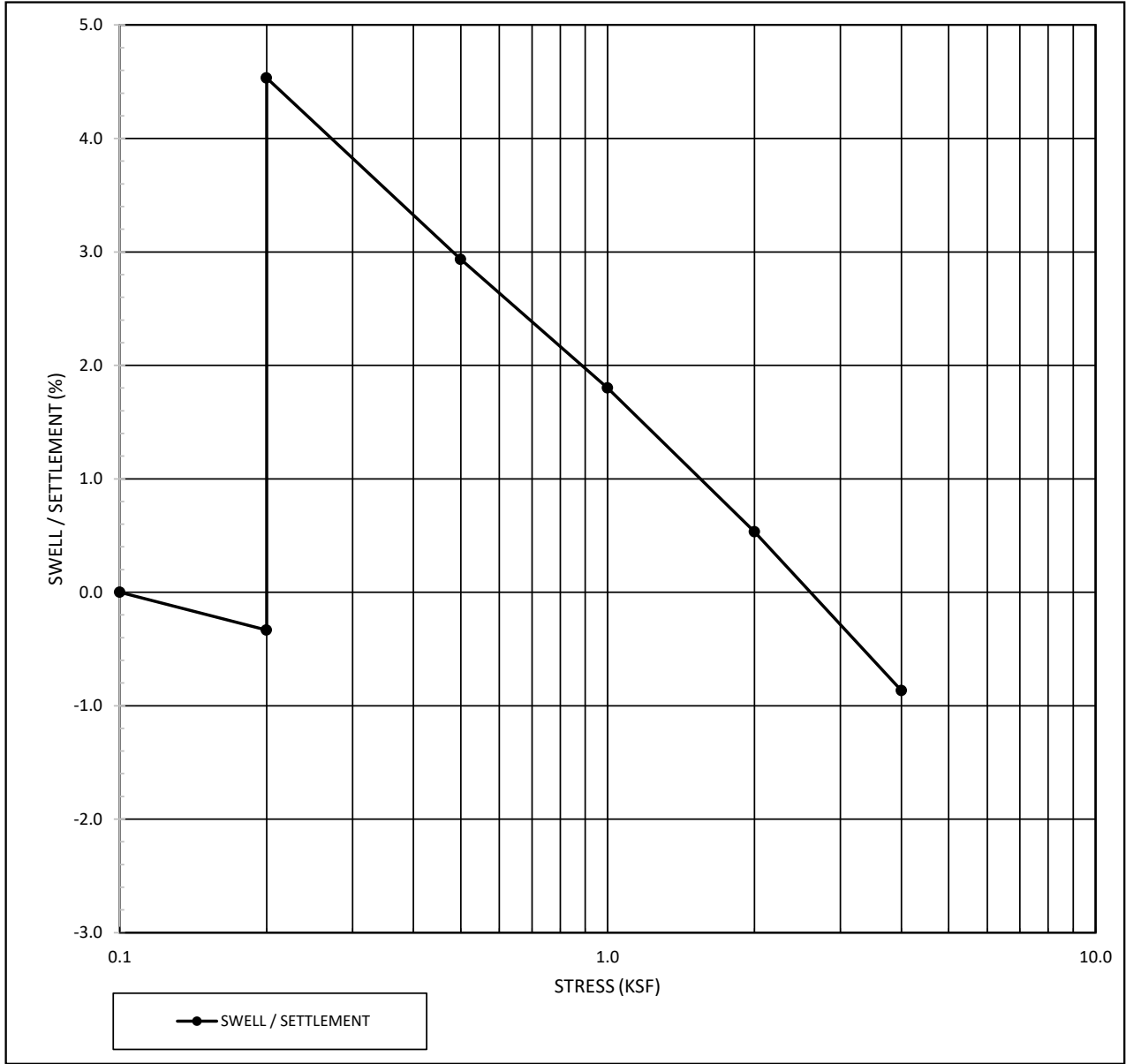
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
● B-2	4.0	SILTY SAND(SM)	NP	NP	NP		
☒ B-3	2.0	SILTY, CLAYEY SAND(SC-SM)	23	16	7		
▲ B-4	2.0	SILTY SAND(SM)	20	17	3		
★ B-4	4.0	SANDY SILTY CLAY(CL-ML)	24	19	5		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-2	4.0	2	0.172			0.0	68.0	32.0	
☒ B-3	2.0	9.5	0.966	0.163		2.0	75.0	23.0	
▲ B-4	2.0	9.5	0.186			1.0	59.0	40.0	
★ B-4	4.0	9.5	0.116			1.0	49.0	50.0	

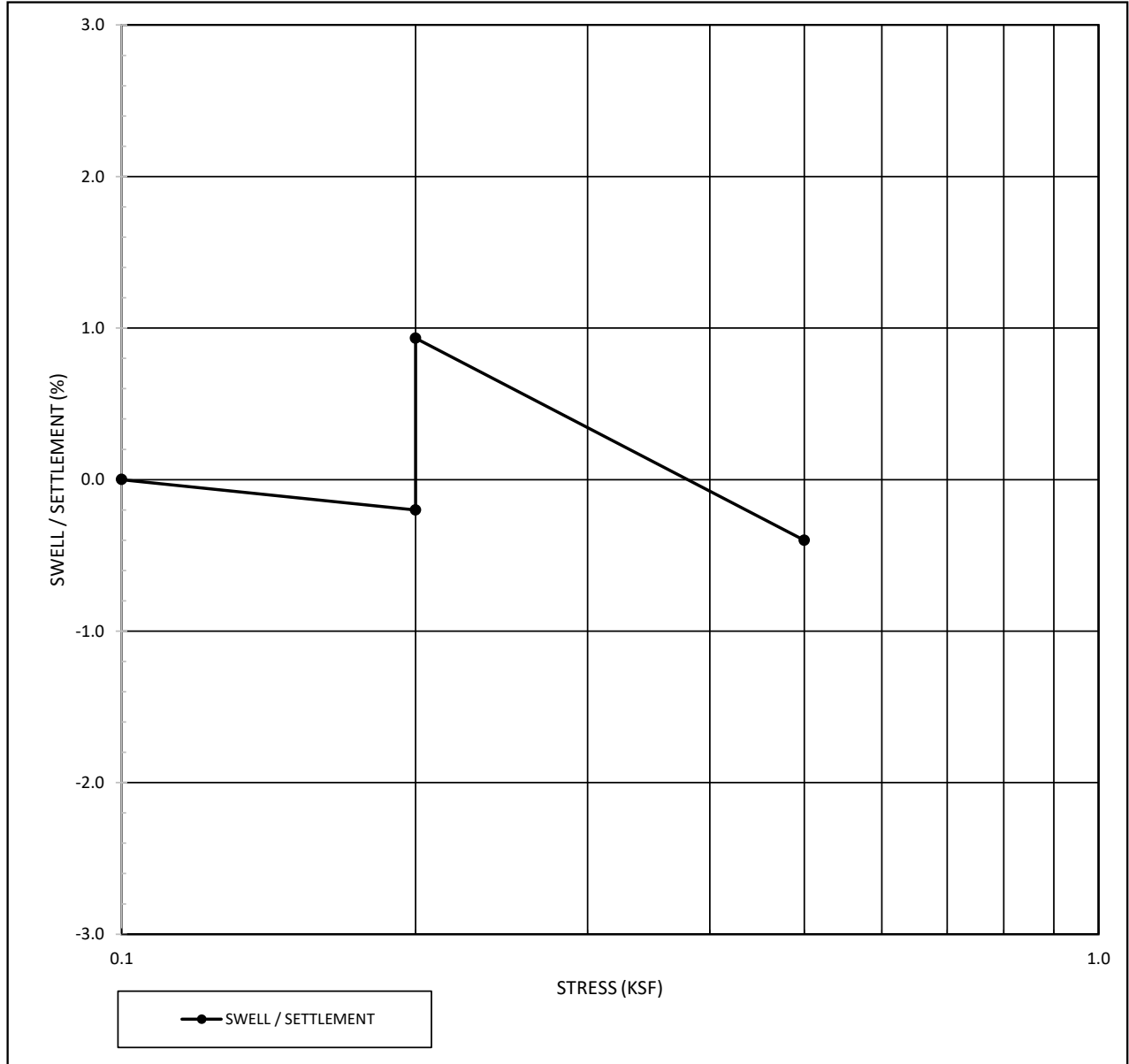
GRAIN SIZE - GINT STD US LAB.GDT - 3/21/23 13:21 - C:\USERS\BRYSEN MUSTAIN\VID ENGINEERING GROUP\GEO - DOCUMENTS\PROJECTS\_2023\ID23-2-587\_MARIAH TRAIL SUBDIVISION6 - DRAFTING\ID23-2-587.GPJ

Project Name:	Mariah Trail Subdivision, Filing No. 1	Date	3/3/2023
Project No.:	D23-2-587		
Boring ID.:	B-1	Sample Depth (ft)	2
Sample Description:	Clayey SAND, brown, slightly moist		
		Swell @ Wetting Weight:	4.9 %



<b>Initial Condition</b>	
Moisture Content %	8.7
Dry Density (pcf)	118.9
<b>Post-Swell Condition</b>	
Moisture Content %	17.7

Project Name:	Mariah Trail Subdivision, Filing No. 1	Date	3/3/2023
Project No.:	D23-2-587		
Boring ID.:	B-2	Sample Depth (ft)	2
Sample Description:	Clayey SAND, light brown, slightly moist		
		Swell @ Wetting Weight:	1.1 %



<b>Initial Condition</b>	
Moisture Content %	4.6
Dry Density (pcf)	108.7
<b>Post-Swell Condition</b>	
Moisture Content %	18.1

3885 Forest Street  
Denver, CO 80207

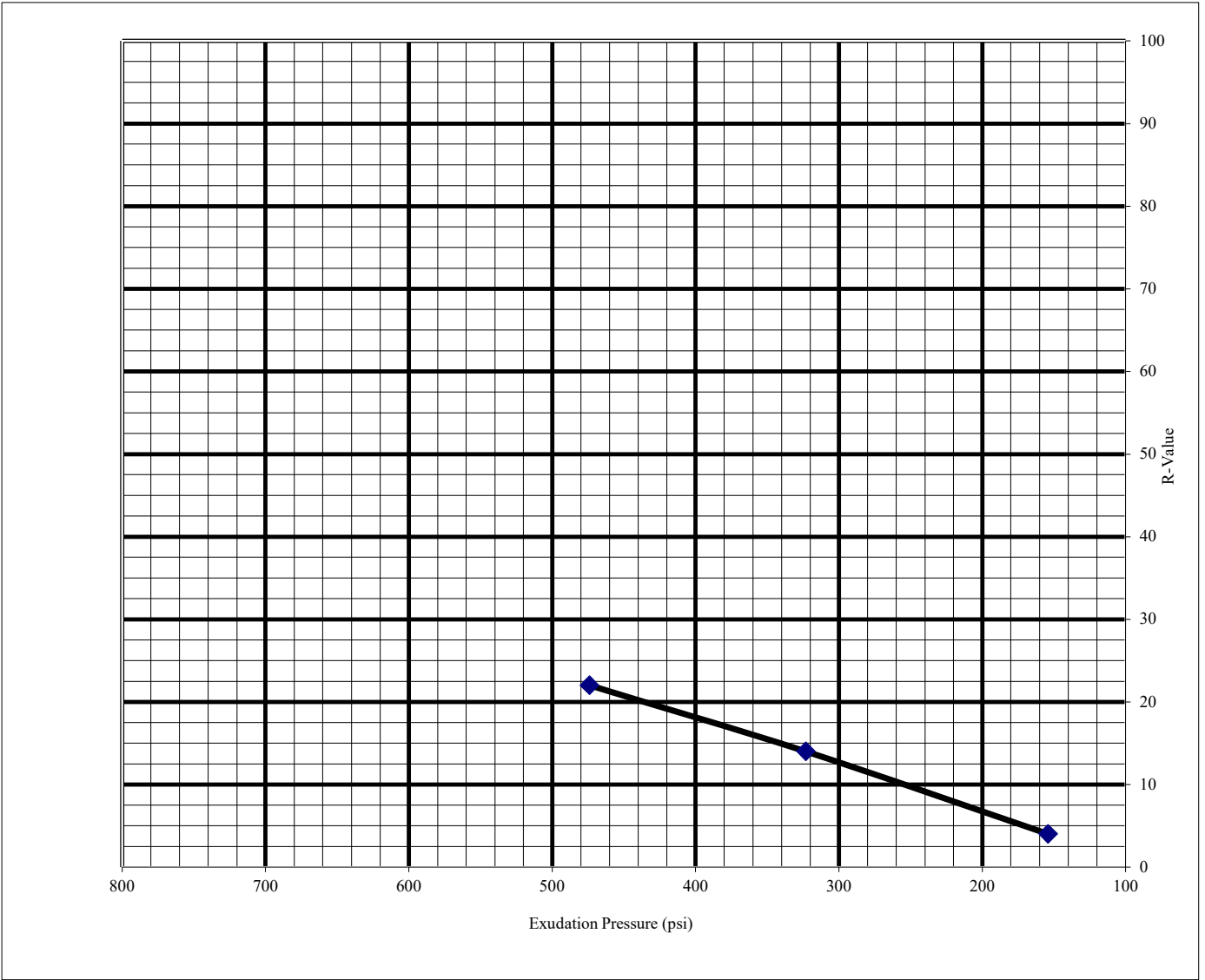
Vivid Engineering Group  
R-Value Test Report



Project Number D23-2-587  
Sample Id: N/A  
Location: B-1 to B-3 Combined  
Date Sampled: 3/3/2023

Project Name: Mariah Trail Subdivision, Filing No. 1  
Depth (ft): 0-4'  
Classification: N/A  
Date Tested: 3/9/2023

R-Value at 300 psi exudation pressure = 12



Test No.	Compact. Press. (psi)	Density (pcf)	Moist. (%)	Horizont. Pressure (psi)' @ 160 psi	Sample Height (in).	Exud. Pressure (psi)	R Value	R Value Correct.
1	180	123.0	8.9	110	2.49	474	22	22
2	160	117.0	10.5	129	2.63	323	12	14
3	120	111.8	12.9	148	2.62	154	4	4

Sampled by: WJB

Tested by: AX

Checked by: CV