

1/19/2019 (rev. 4/1/19)

# Wastewater Evaluation Report

**Proposed Grandwood Subdivision  
NE of Higby Road and Fairplay Drive  
El Paso County, Colorado  
VIVID Project No.: D18-2-175**



Only the client or it's designated representatives may use this document  
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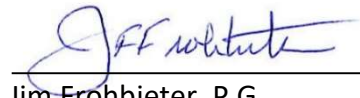
January 19, 2019 (revised April 1, 2019)

Report prepared for:

Bill Herebic  
Grandwood Enterprises, LLC  
270 Lodgepole Way  
Monument, Colorado 80132  
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**WASTEWATER EVALUATION REPORT**  
**Proposed Grandwood Subdivision**  
**NE of Higby Road and Fairplay Drive**  
**El Paso County, Colorado**  
**VIVID Project No. D18-2-175**

Prepared by:



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## 1.0 INTRODUCTION

### 1.1 General

This report presents the results of a wastewater evaluation report performed for the proposed Grandwood Subdivision to be constructed northeast of Higby Road and Fairplay Drive in El Paso County, Colorado. An attached Vicinity Map (Figure 1) shows the general location of the project. Our evaluation was performed for Grandwood Enterprises, LLC, and was authorized by Mr. Bill Herebic. **This report was revised from its original version dated January 19, 2019 which was a combined Geology & Soils and Wastewater report per Section 8.4.9 (B) (2) of the Land Development Code. This updated report includes only the Wastewater report conclusions (section 3.0) based on the County's request to provide separate Geology, Soils, and Wastewater reports.**

### 1.2 Project Description

The proposed project includes the development of a 151-acre parcel into a residential subdivision. 48 lots are planned, that will be approximately 2.5 acres in size. The property has no current improvements and is in a generally native condition. The development will include construction of access roadways and utilities. Residential lots will require individual water well and septic systems. 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 evaluate the site for general feasibility of the use of individual Onsite Wastewater Treatment Systems (OWTS) – a.k.a. septic systems. This report is part of the submittal of the Preliminary Development Plan for this proposed subdivision to El Paso County.

VIVID's scope of services included:

- A visual reconnaissance to observe surface and geologic conditions at the project site and locating the exploratory borings and test pit sites;
- Notification of the Utility Notification Center of Colorado (UNCC)/Colorado 811 to identify underground utility lines at the boring locations prior to our drilling;
- The drilling of seven exploratory borings (including percolation testing) and excavation of three test pits for tactile evaluation of the soils. This scope was previously discussed and approved by El Paso County Board of Health personnel who perform development reviews for the County for proposed OWTS facilities. These exploration were performed on 20 percent of the proposed lots at currently accessible locations across the proposed development area;
- Laboratory testing of selected samples obtained during the field exploration to evaluate relevant physical, geologic, and engineering properties of the soil; and
- 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, and an evaluation of the feasibility of the use of OWTS for this development.

## 2.0 FIELD EXPLORATION AND LABORATORY TESTING

### 2.1 Field Exploration

A field exploration performed on December 20, 2018 included the drilling of seven exploratory borings (including percolation testing), and excavation of three test pits for tactile evaluation of the soils at the locations presented on Figure 2 – Exploration Location Plan. This exploration and some of the basic information are presented in Table 1, below.

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

<b>Boring Designation</b>	<b>Approximate Boring Depth [feet, below ground surface]</b>	<b>Approximate Depth to Groundwater [feet, below ground surface]</b>	<b>Approximate Depth to Weathered Bedrock [feet, below ground surface]</b>	<b>Approximate Depth to Competent Bedrock [feet, below ground surface]</b>
<b>B-1</b>	25.0	23.0	None Encountered	None Encountered
<b>B-2</b>	14.5	None Encountered	4.0	12.0
<b>B-3</b>	25.0	19.0	None Encountered	None Encountered
<b>B-4</b>	20.0	17.0	-	12.0
<b>B-5</b>	14.5	None Encountered	8.0	None Encountered
<b>B-6</b>	25.0	19.0	25.0	None Encountered
<b>B-7</b>	20.0	14.0	14.0	None Encountered
<b>TP-1</b>	10.0	None Encountered	None Encountered	None Encountered
<b>TP-2</b>	10.0	None Encountered	None Encountered	None Encountered
<b>TP-3</b>	10.0	None Encountered	None Encountered	None Encountered

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, standard penetration (SPT) sampler, and by bulk methods. Penetration tests were obtained at the various sample depths as well.

Test pits were performed with a rubber-tire backhoe. Tactile observation/evaluation of the soils exposed was performed during excavation. Bulk samples of the soils were obtained for laboratory testing purposes.

Appendix A to this report includes logs of the borings and test pits 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
- Sieve Analysis of Fine and Coarse Aggregates
- Liquid Limit, Plastic Limit, and Plasticity Index
- Swell/Settlement

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.

## 2.3 General Geology

### 2.3.1 Site Description

The site is 151 acres and is currently covered with native grasses, trees, and shrubs. The parcel is a generally mild south and west sloping parcel with two shallow alluvial valleys separated by sandstone topographic highs. The site is bounded on the north, east and west by existing residential subdivisions. Higby Road borders the south.

### 2.3.2 Geologic Reconnaissance

A visual geologic reconnaissance of the site was performed by Mr. Jim Frohbieter, Professional Geologist, with J&K Geological Services. This reconnaissance was supported by the field drilling and test pit explorations, as well as geologic mapping and information from the following sources:

- CGS Geologic Map of the Monument Quadrangle, El Paso County, Colorado by Jon P. Thorson and Richard F. Madole, 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)
- Review of Available Geologic Hazard Studies in the surrounding area

Geologic maps are presented as Figures 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, and 4b. A USGS Topographic Map is attached as Figure 5.

## 3.0 ON-SITE WASTEWATER TREATMENT

### 3.1 Evaluation

The site was evaluated for use of On-Site Wastewater Treatment Systems (OWTS); a.k.a. Septic Systems. For the purpose of submitting the Preliminary Development Plan, and after review of requirements listed in the El Paso County Land Development Code, the El Paso County Public Health Regulations, and written and verbal communication with both departments, a combination of profile borings/percolation testing (7 total), and tactile test pits (3 total) were performed. These explorations were performed at currently accessible locations across the development, and are shown on Figure 2. Logs of the borings and test pits are presented in Appendix A. Laboratory test results are presented in Appendix B, and select lab data is presented on the logs in Appendix A. Percolation test results and Long Term Acceptance Rate (LTAR) values are presented at the bottom of the logs in Appendix A as well. Figure 7 presents a Septic Suitability Map showing the possible configurations of septic fields, residence, and water well locations for the evaluated lots.

### 3.2 NRCS Soil Survey Mapping

Mapping of the NRCS Soil Survey on this site is presented on Figure 4a with descriptions of the soil types presented on Figure 4b. The NRCS soil descriptions generally agree with the soils encountered in our investigation and the results of our laboratory soil testing.

### 3.3 Results of Evaluations

Soils encountered at the locations evaluated generally included Silty to Clayey SAND, to “cleaner” Well to Poorly-Graded SAND. These coincide with Sand, Loamy Sand, Sandy Loam, and Loam (Soil Types 1 and 2) per USDA Soil Type categories. These soils are generally considered to have favorable percolation rates for conventional septic system design and construction.

Percolation rates at our exploration locations ranged from approximately 5 to 23 minutes/inch. LTAR values based on tactile evaluations, and laboratory soil testing were estimated to range from 0.80 to 0.60 gallons/square foot/day.

Dawson Formation weathered to relatively un-weathered bedrock (mainly sandstone with minor clayey or claystone layers) was encountered in five of the ten explorations at approximate depths of 4, 8, 12, 14, and 24 feet below the existing ground surface. Groundwater was encountered in five of the ten explorations at approximate depths ranging from 14 to 23 feet below the existing ground surface. Table 1 presented in this report shows depth to bedrock and groundwater for each exploration in tabular format. This information is also presented on the individual exploration logs in Appendix A.

### 3.4 Conclusions

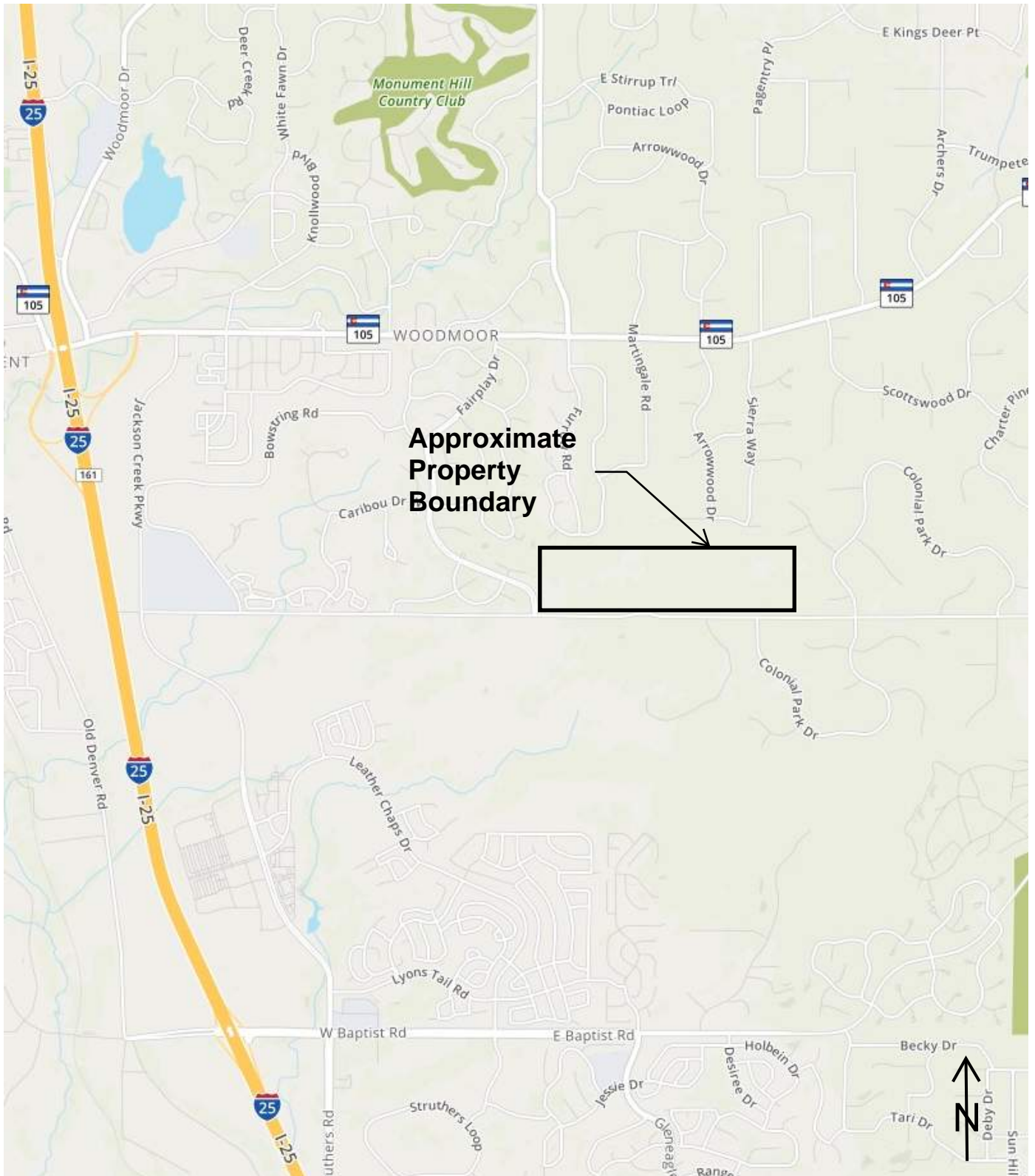
The locations evaluated as part of this study generally found soils and percolation rates that are favorable for conventional septic system construction. Geologic mapping as presented on Figures 3a and 3b indicate that shallower bedrock of the Dawson Formation (see areas of Tkd4 on Figure 3a) will be encountered at various locations that were outside accessible limits of this evaluation. These areas are anticipated to have higher occurrences of shallow bedrock and lower percolation rates that would require engineered systems.

## 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.





Not to Scale. Base image obtained from www.mapquest.com, 2019



Project No: D18-2-175

Date: 1/15/19

Drawn by: WJB

Reviewed by: BTM

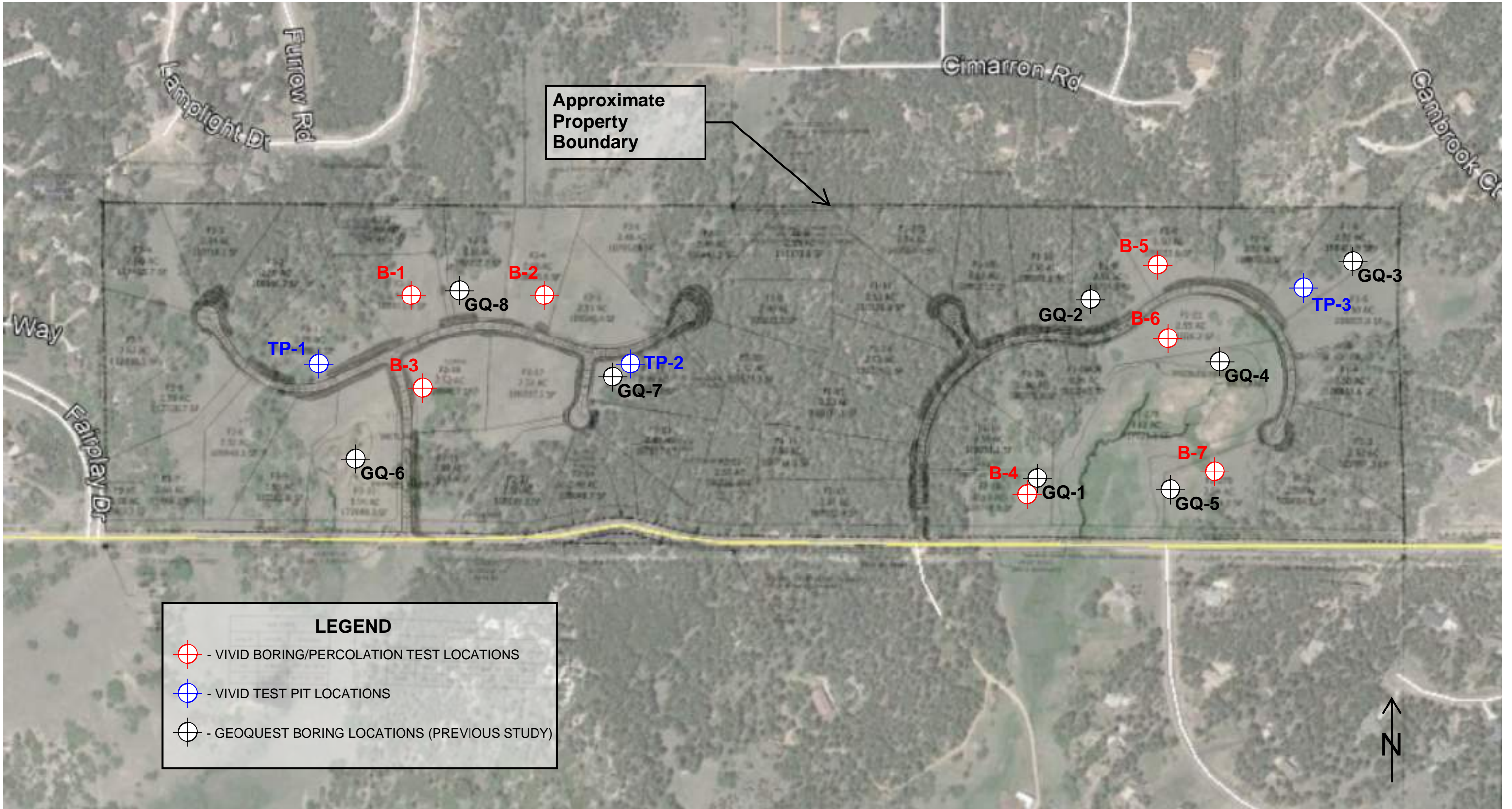
## VICINITY MAP

Grandwood Subdivision  
El Paso County, Colorado


Figure

1

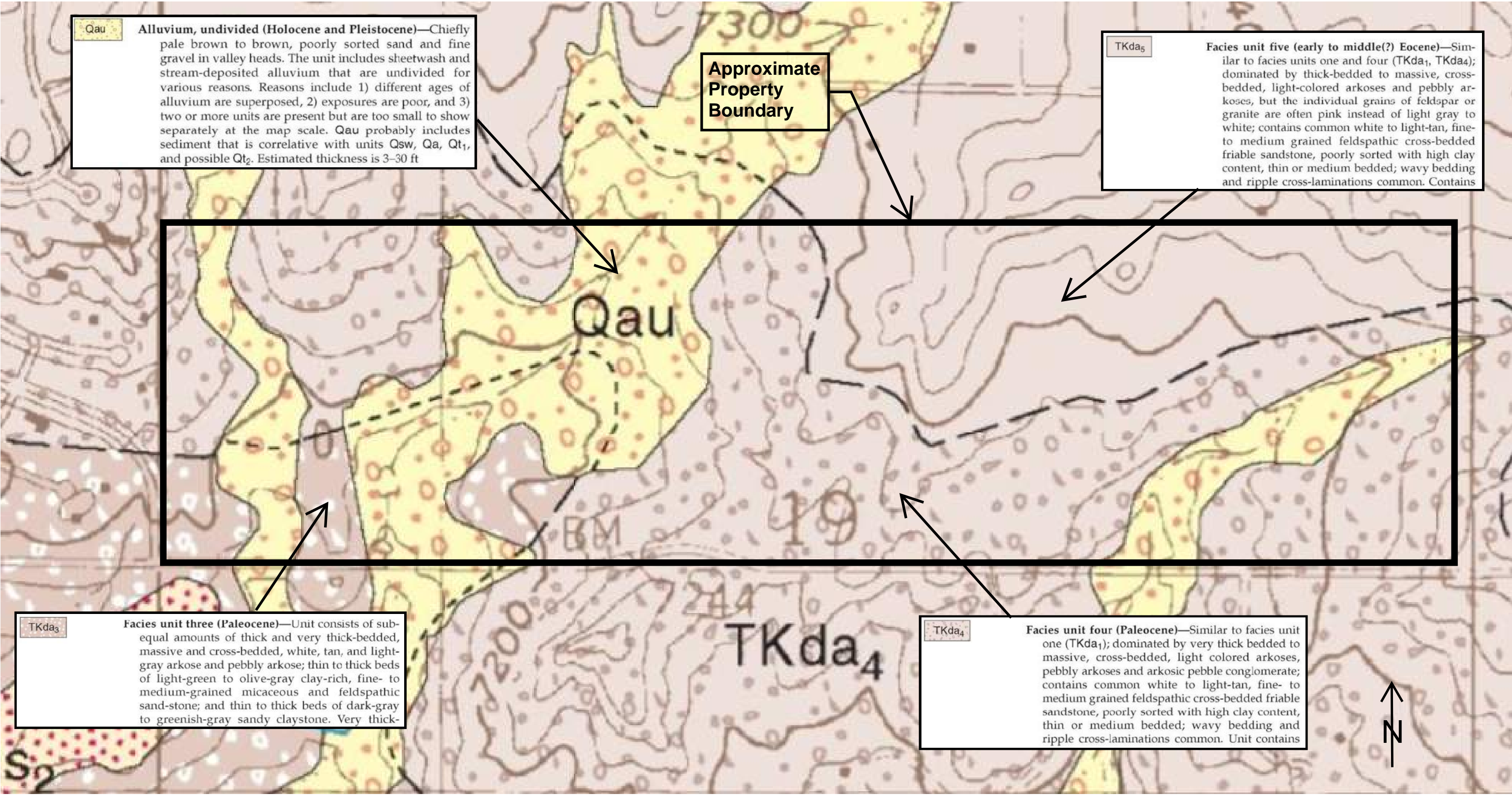




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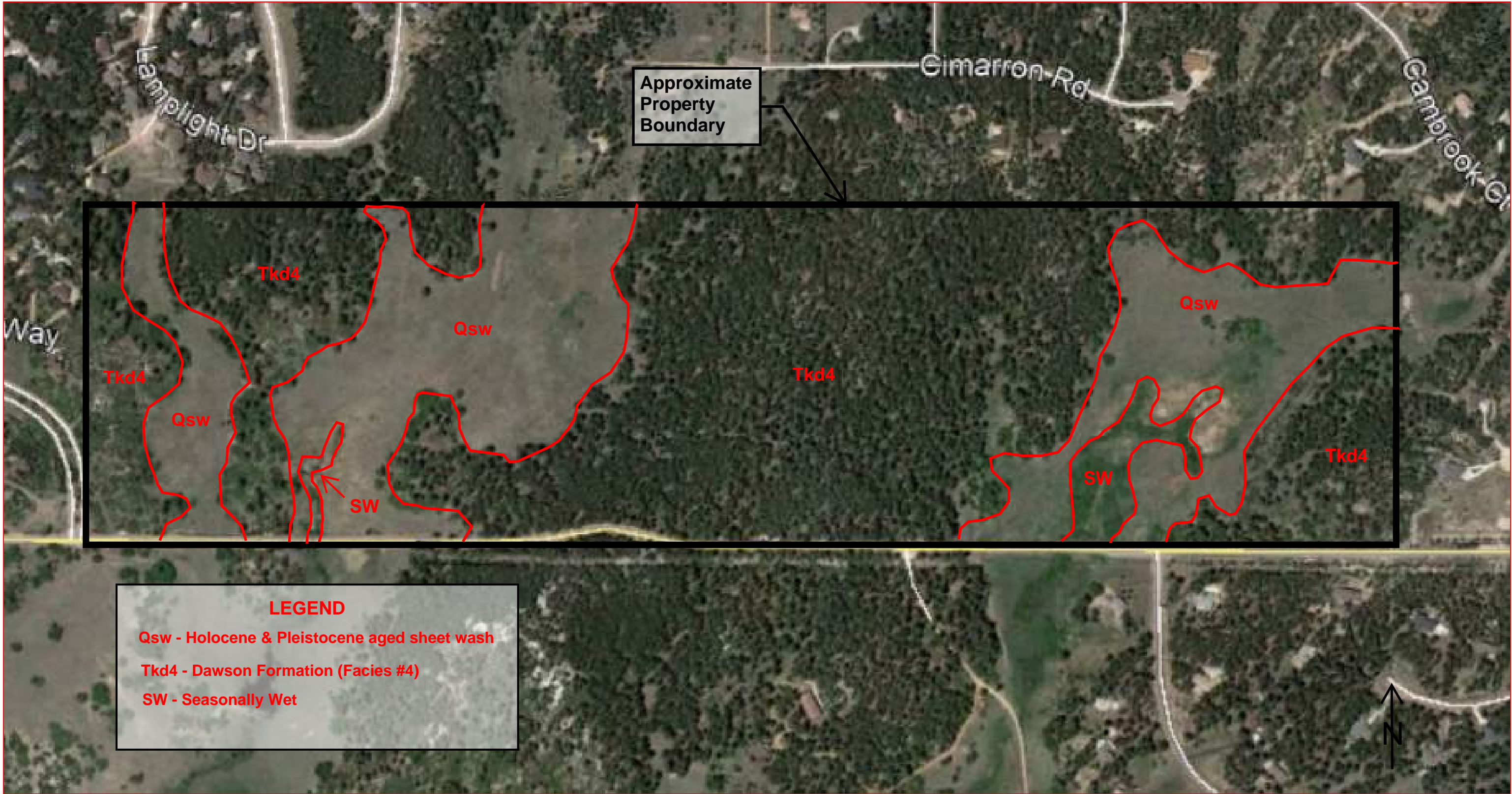
 <div> VIVID Engineering Group, Inc.  1053 Elkton Drive  Colorado Springs, Colorado 80907  719.896.4356 </div>	Project No: D18-2-175	<div>EXPLORATION LOCATION PLAN</div> <div>Grandwood Subdivision El Paso County, Colorado</div>	<div>Figure</div> <div>2</div>
	Date: 1/15/19		
	Drawn by: WJB		
	Reviewed by: BTM		






Not to Scale. Base image from [https://ngmdb.usgs.gov/Prodesc/proddesc\\_76327.htm](https://ngmdb.usgs.gov/Prodesc/proddesc_76327.htm) (Geologic Map of the Monument Quadrangle, El Paso County, Colorado, 2003)

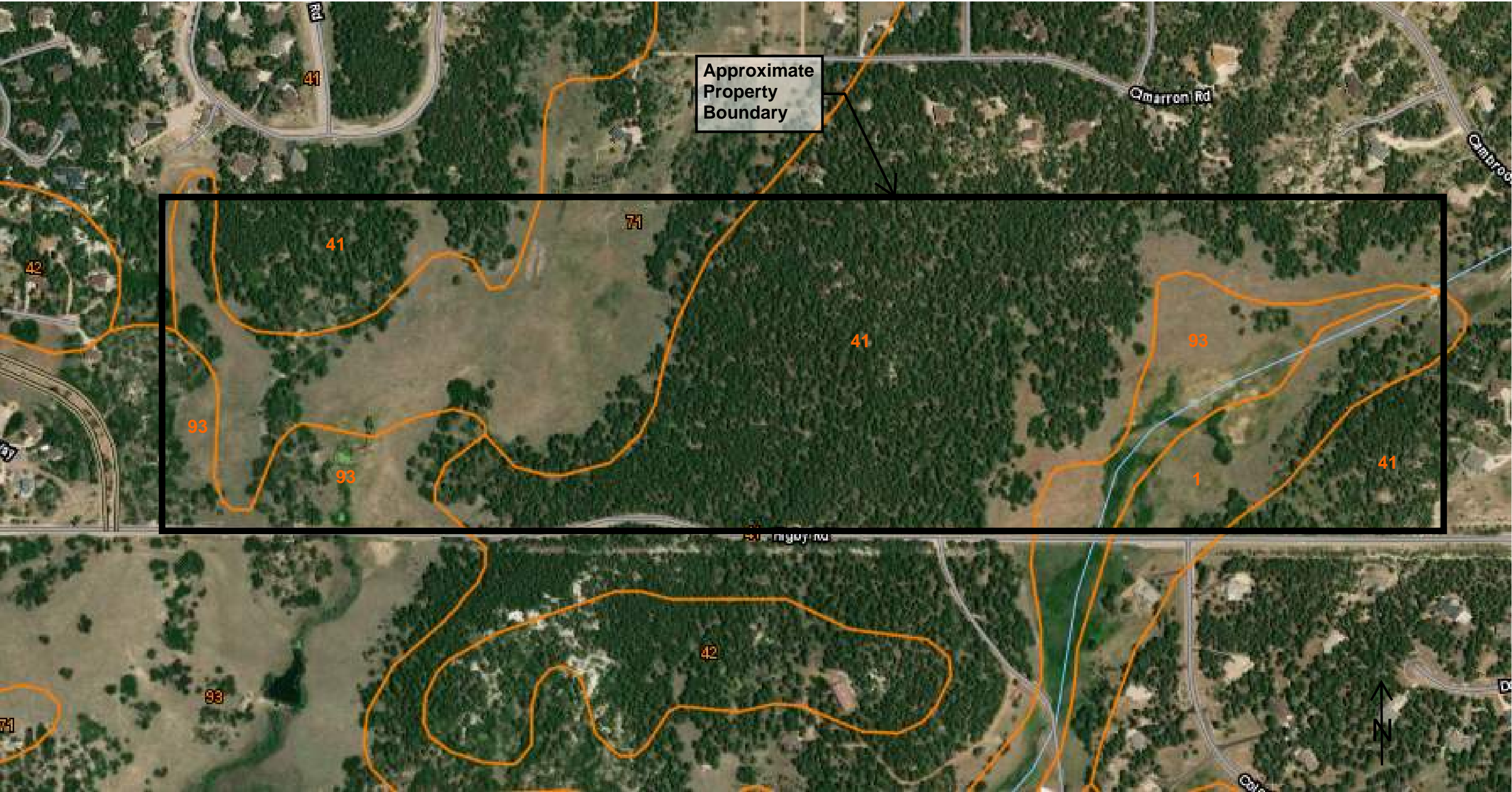
 <div>VIVID Engineering Group, Inc. 1053 Elkton Drive Colorado Springs, Colorado 80907 719.896.4356</div>	Project No: D18-2-175	REGIONAL GEOLOGY MAP	Figure <b>3a</b>
	Date: 1/15/19		
	Drawn by: WJB	Grandwood Subdivision El Paso County, Colorado	
	Reviewed by: BTM		



Not to Scale. Base image dated 06/09/2017 and obtained from Google Earth, 2019.  
Site-specific Geology Mapping by Jim Frohbieter, Professional Geologist

 <div>VIVID Engineering Group, Inc. 1053 Elkton Drive Colorado Springs, Colorado 80907 719.896.4356</div>	Project No: D18-2-175	SITE-SPECIFIC GEOLOGY MAP		Figure <b>3b</b>
	Date: 1/15/19			
	Drawn by: WJB	Grandwood Subdivision El Paso County, Colorado		
	Reviewed by: BTM			





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



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Date: 1/15/19

Drawn by: WJB

Reviewed by: BTM

NRCS SOIL SURVEY MAP

Grandwood Subdivision  
El Paso County, Colorado

Figure

4a

**El Paso County Area, Colorado**  
**1—Alamosa loam, 1 to 3 percent slopes**  
**Map Unit Setting**  
*National map unit symbol:* 3670  
*Elevation:* 7,200 to 7,700 feet  
*Farmland classification:* Prime farmland if irrigated and reclaimed of excess salts and sodium

**Map Unit Composition**  
*Alamosa and similar soils:* 85 percent

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

**Description of Alamosa Setting**  
*Landform:* Flood plains, fans  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

**Typical profile**  
*A - 0 to 6 inches:* loam  
*Bt - 6 to 14 inches:* clay loam  
*Btk - 14 to 33 inches:* clay loam  
*Cg1 - 33 to 53 inches:* sandy clay loam  
*Cg2 - 53 to 60 inches:* sandy loam

**Properties and qualities**  
*Slope:* 1 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)  
*Depth to water table:* About 12 to 18 inches  
*Frequency of flooding:* Frequent  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 5 percent  
*Salinity, maximum in profile:* Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)  
*Available water storage in profile:* High (about 10.2 inches)

**Interpretive groups**  
*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 5w  
*Hydrologic Soil Group:* D  
*Ecological site:* Mountain Meadow (R048AY241CO)  
*Hydric soil rating:* Yes

**Minor Components**  
**Other soils**  
*Percent of map unit:*  
*Hydric soil rating:* No

**El Paso County Area, Colorado**  
**41—Kettle gravelly loamy sand, 8 to 40 percent slopes**  
**Map Unit Setting**  
*National map unit symbol:* 368h  
*Elevation:* 7,000 to 7,700 feet  
*Farmland classification:* Not prime farmland

**Map Unit Composition**  
*Kettle and similar soils:* 85 percent

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

**Description of Kettle Setting**  
*Landform:* Hills  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Sandy alluvium derived from arkose

**Typical profile**  
*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

**Properties and qualities**  
*Slope:* 8 to 40 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Somewhat excessively drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* (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 storage in profile:* Low (about 3.4 inches)

**Interpretive groups**  
*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7e  
*Hydrologic Soil Group:* B  
*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**  
**71—Pring coarse sandy loam, 3 to 8 percent slopes**  
**Map Unit Setting**  
*National map unit symbol:* 369k  
*Elevation:* 6,800 to 7,600 feet  
*Farmland classification:* Not prime farmland

**Map Unit Composition**  
*Pring and similar soils:* 85 percent

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

**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:* 3 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural 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 storage in profile:* Low (about 6.0 inches)

**Interpretive groups**  
*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* B  
*Ecological site:* Loamy Park (R048AY222CO)  
*Hydric soil rating:* No

**Minor Components**  
**Pleasant**  
*Percent of map unit:*  
*Landform:* Depressions  
*Hydric soil rating:* Yes

**Other soils**  
*Percent of map unit:*  
*Hydric soil rating:* No

**El Paso County Area, Colorado**  
**93—Tomah-Crowfoot complex, 8 to 15 percent slopes**  
**Map Unit Setting**  
*National map unit symbol:* 36bb  
*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  
*C - 48 to 60 inches:* coarse sand

**Properties and qualities**  
*Slope:* 8 to 15 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural 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 storage in profile:* Very low (about 2.0 inches)

**Interpretive groups**  
*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 6e  
*Hydrologic Soil Group:* B  
*Ecological site:* Sandy Divide (R049BY216CO)  
*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:* 8 to 15 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural 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 storage in profile:* Low (about 4.7 inches)

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



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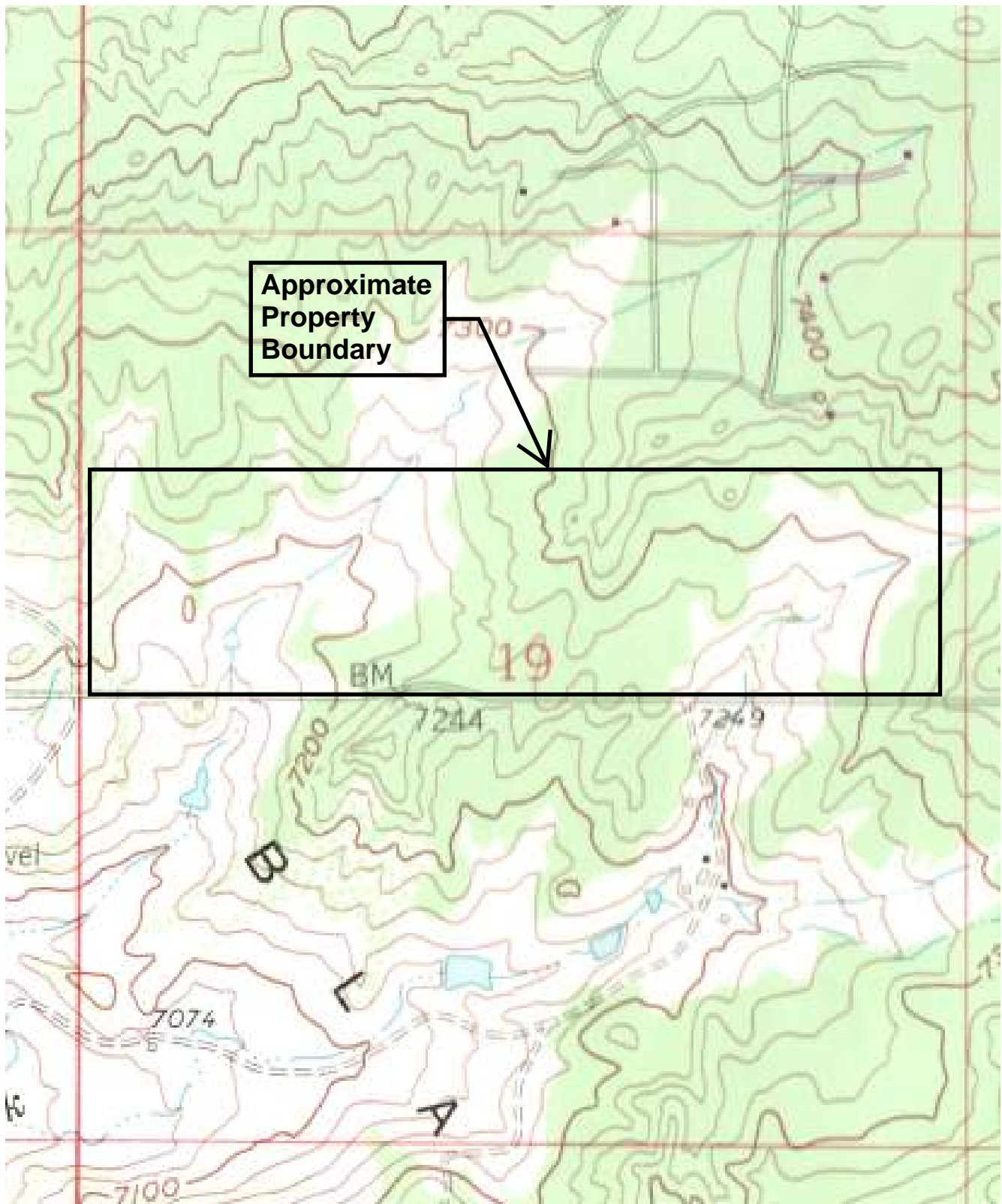
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Drawn by: WJB
Reviewed by: BTM

NRCS SOIL SURVEY MAP (Soil Descriptions)

Grandwood Subdivision  
El Paso County, Colorado

Figure

4b



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



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Reviewed by: BTM

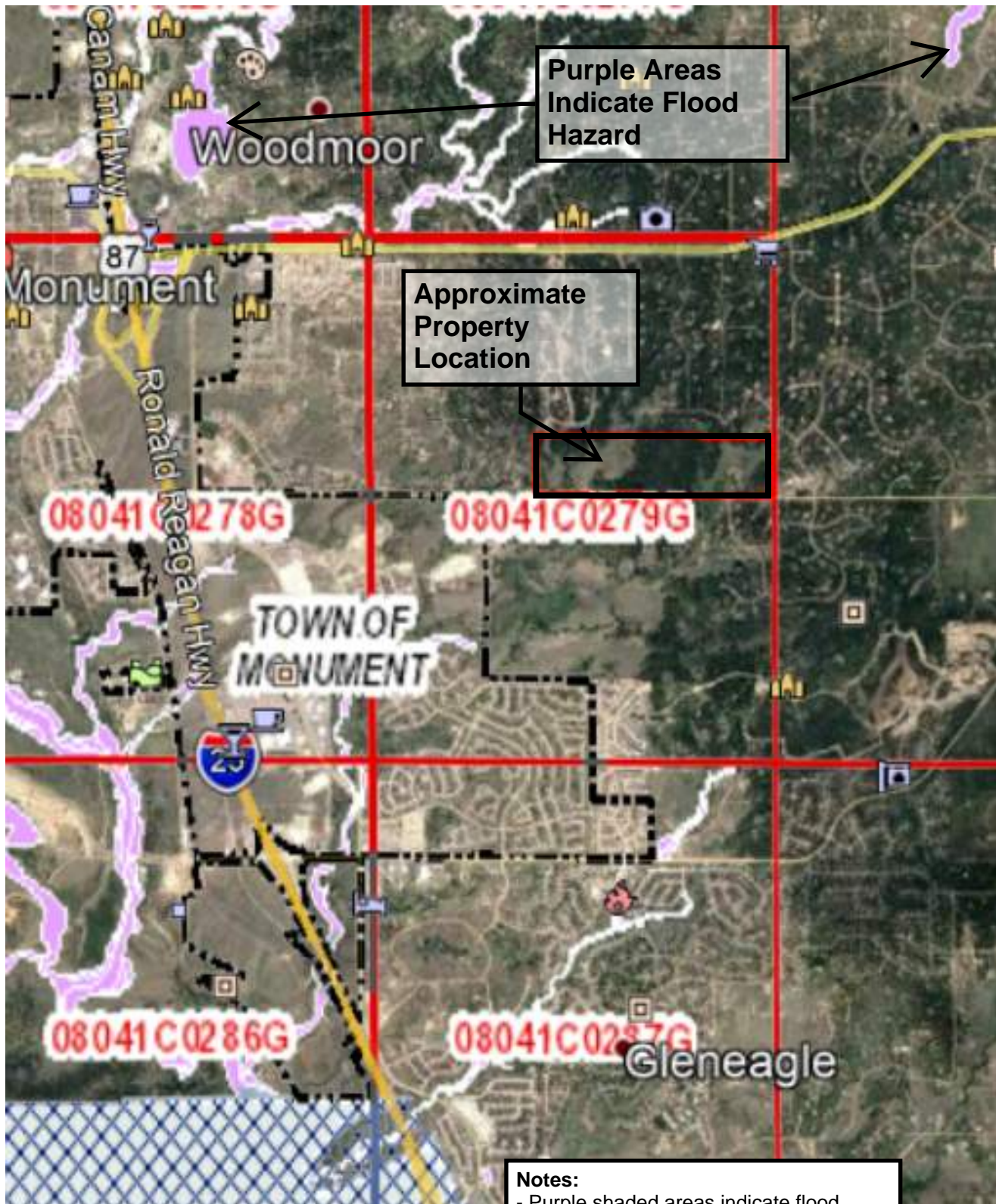
## TOPOGRAPHIC MAP

Grandwood Subdivision  
El Paso County, Colorado

Figure

5





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

**Notes:**

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



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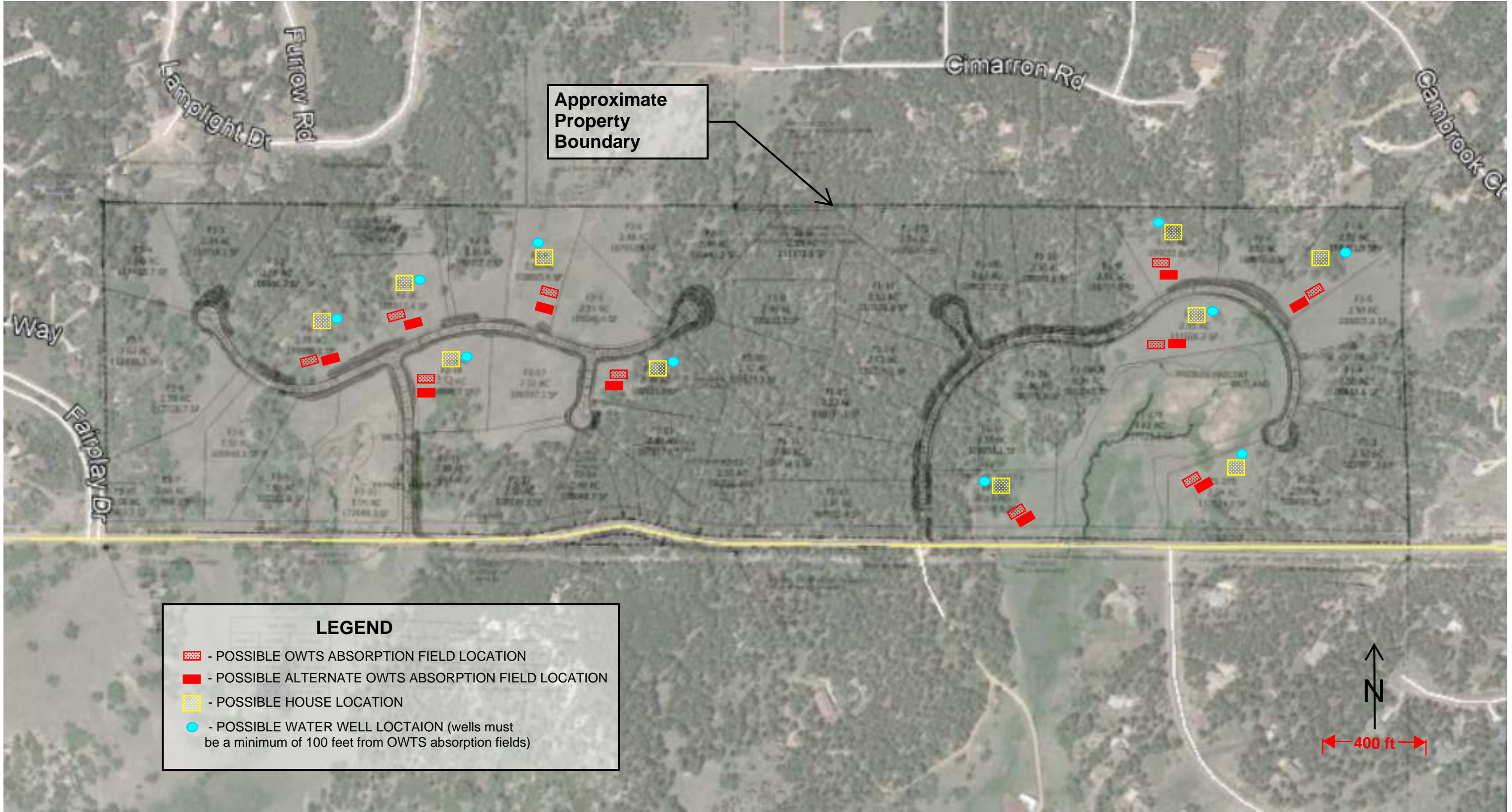
**FLOOD HAZARD MAP**

Grandwood Subdivision  
 El Paso County, Colorado

Figure

**6**





Not to Scale. Base image dated 06/09/2017 and obtained from Google Earth, 2019.



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Engineering Group

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SEPTIC SUITABILITY MAP

Grandwood Subdivision  
El Paso County, Colorado

Figure

7

## Appendix A

### Logs of Explorations



VIVID Engineering Group, Inc.  
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Fax: 719-896-4357

# BORING NUMBER B-1

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
DRILLING CONTRACTOR	Old Dirt Drilling	GROUND ELEVATION	
DRILLING METHOD	CME-45 Truck	HOLE SIZE	4 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		▽ AT TIME OF DRILLING	23.00 ft
		AT END OF DRILLING	---
		AFTER DRILLING	---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 1/17/19 15:03 - F:\VIVID PROJECTS\18-2-175 GRANDWOOD SUBDIVISION - DRAFTING\18-2-175.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	✖ SPT	4-5			
5	✖ SPT	7-5			
					Silty to Clayey SAND, tan, dry to wet (below about 23 feet), loose to medium dense, fine to coarse-grained. USDA Soil Type: 2, Structure Shape: GR, Structure Grade: 2
10	✖ SPT	3-5	MC = 8.2% LL = NP PL = NP Fines = 14.0%		
15	✖ SPT	5-5			
20	✖ SPT	4-4			
25	✖ SPT	5-5	MC = 17.3% LL = NP PL = NP		
					Bottom of borehole at 25.0 feet.

Note:

Average Percolation Rate = 18 min./in.

LTAR = 0.60 gal./s.f./day





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## BORING NUMBER B-2

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
DRILLING CONTRACTOR	Old Dirt Drilling	GROUND ELEVATION	
DRILLING METHOD	CME-45 Truck	HOLE SIZE	4 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
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					
					8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	▲ SPT	9-8			Silty to Clayey SAND, tan to light brown, dry, loose to medium dense, fine to coarse-grained. USDA Soil Type: 2, Structure Shape: GR, Structure Grade: 2
5	▲ SPT	7-15			4.0
					<b>Dawson Formation</b> Weathered SANDSTONE with clayey zones, tan to light gray, dry to slightly moist, medium dense to very dense. USDA Soil Type: 3A, Structure Shape: 0, Structure Grade: 1
10	▲ SPT	35-15/2"	MC = 10.6% LL = 43 PL = 26 Fines = 22.0%		
					12.0
					<b>Dawson Formation</b> CLAYSTONE, sandy, light gray, slightly moist, hard. USDA Soil Type: 4A, Structure Shape: 0, Structure Grade: 1
	▲ MC	50	MC= 17.0%		14.5

Comp. = 0.7%  
Under 1ksf surcharge pressure

Bottom of borehole at 14.5 feet.

### Note:

Average Percolation Rate = 23 min./in.  
LTAR = 0.60 gal./s.f./day

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 1/17/19 15:03 - F:\VIVID PROJECTS\ID18-2-175 GRANDWOOD SUBDIVISION - DRAFTING\ID18-2-175.GPJ



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# BORING NUMBER B-3

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
DRILLING CONTRACTOR	Old Dirt Drilling	GROUND ELEVATION	
DRILLING METHOD	CME-45 Truck	HOLE SIZE	4 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		▽ AT TIME OF DRILLING	19.00 ft
		AT END OF DRILLING	---
		AFTER DRILLING	---

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DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	✖ SPT	9-8			Well Graded to Silty to Slightly Clayey SAND, dark brown to tan and pink, dry to wet (below about 19 feet), medium dense to loose. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
5	✖ SPT	4-4	MC = 2.1% LL = NP PL = NP Fines = 11.4%		
10	✖ SPT	5-4			
15	✖ SPT	5-5	MC = 4.4% LL = NP PL = NP Fines = 7.8%		
20	✖ SPT	3-3			
25	✖ SPT	5-5			

Bottom of borehole at 25.0 feet.

## Note:

Average Percolation Rate = 5 min./in.  
LTAR = 0.80 gal./s.f./day



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# BORING NUMBER B-4

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
DRILLING CONTRACTOR	Old Dirt Drilling	GROUND ELEVATION	
DRILLING METHOD	CME-45 Truck	HOLE SIZE	4 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		▽ AT TIME OF DRILLING	17.00 ft
		AT END OF DRILLING	---
		AFTER DRILLING	---

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DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	✖ SPT	5-5	MC = 2.8% LL = NP PL = NP Fines = 19.0%		1.0 - Poorly Graded to Silty/Slightly Clayey SAND, brown to tan to pinkish-tan, dry, loose to medium dense, fine to coarse-grained. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
5	✖ SPT	5-6			
10	✖ SPT	2-3			
15	✖ SPT	35-15/1"	MC = 11.7% LL = NP PL = NP Fines = 15.0%		12.0 - <b>Dawson Formation</b> SANDSTONE with clayey zones, tan to light gray, dry to slightly moist, very dense to hard, fine to coarse-grained, poorly cemented. USDA Soil Type: 3A, Structure Shape: 0, Structure Grade: 1
	✖ SPT	25-25/2"			▽ 19.7

Bottom of borehole at 19.7 feet.

## Note:

Average Percolation Rate = 5 min./in.

LTAR = 0.80 gal./s.f./day



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# BORING NUMBER B-5

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
DRILLING CONTRACTOR	Old Dirt Drilling	GROUND ELEVATION	
DRILLING METHOD	CME-45 Truck	HOLE SIZE	4 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		AT TIME OF DRILLING	---
		AT END OF DRILLING	---
		AFTER DRILLING	---

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DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				1.0 8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	▲ SPT	2-3		Poorly Graded to Silty/Slightly Clayey SAND, brown to tan, slightly moist, loose. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
5	▲ SPT	3-2		
				8.0
10	▲ SPT	31-19/3"		<b>Dawson Formation</b> Weathered SANDSTONE, clean to slightly clayey, tan to pink, dry to slightly moist, dense to hard. USDA Soil Type: 3A, Structure Shape: 0, Structure Grade: 1
	▲ SPT	50		14.5

Bottom of borehole at 14.5 feet.

## Note:

Average Percolation Rate = 5 min./in.

LTAR = 0.80 gal./s.f./day



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# BORING NUMBER B-6

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
DRILLING CONTRACTOR	Old Dirt Drilling	GROUND ELEVATION	
DRILLING METHOD	CME-45 Truck	HOLE SIZE	4 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		▽ AT TIME OF DRILLING	19.00 ft
		AT END OF DRILLING	---
		AFTER DRILLING	---

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DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	✖ SPT	3-3			
5	✖ SPT	3-2			
					Well Graded to Silty/Slightly Clayey SAND, tan to pinkish-tan, dry to wet (below about 19 feet), loose. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
10	✖ SPT	2-2	MC = 10.1% LL = 25 PL = 19 Fines = 21.0%		
15					
	✖ SPT	3-4			
20	✖ SPT	1-2			
25	✖ SPT	4-35			

## Dawson Formation

Weathered SANDSTONE, clean to slightly clayey, tan, moist, very dense  
Bottom of borehole at 25.0 feet.

### Note:

Average Percolation Rate = 7 min./in.  
LTAR = 0.80 gal./s.f./day





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# BORING NUMBER B-7

PAGE 1 OF 1

<b>CLIENT</b> <u>Herebic Homes</u>	<b>PROJECT NAME</b> <u>Grandwood Subdivision</u>
<b>PROJECT NUMBER</b> <u>D18-2-175</u>	<b>PROJECT LOCATION</b> <u>Higby Road, Monument, Colorado</u>
<b>DATE STARTED</b> <u>12/20/18</u> <b>COMPLETED</b> <u>12/20/18</u>	<b>GROUND ELEVATION</b> _____ <b>HOLE SIZE</b> <u>4 inches</u>
<b>DRILLING CONTRACTOR</b> <u>Old Dirt Drilling</u>	<b>GROUND WATER LEVELS:</b>
<b>DRILLING METHOD</b> <u>CME-45 Truck</u>	<u>▽</u> <b>AT TIME OF DRILLING</b> <u>14.00 ft</u>
<b>LOGGED BY</b> <u>J. Frohbieter</u> <b>CHECKED BY</b> <u>W. Barreire</u>	<b>AT END OF DRILLING</b> <u>---</u>
<b>NOTES</b> _____	<b>AFTER DRILLING</b> <u>---</u>

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DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
	✖ SPT	4-6			1.0 8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
5	✖ SPT	6-5	MC = 6.4% LL = NP PL = NP Fines = 30.0%		Silty to Slightly Clayey SAND, tan with some iron-oxide staining, dry to slightly moist, loose to medium dense, fine-grained to about 6 feet then coarse-grained. USDA Soil Type: 2, Structure Shape: GR, Structure Grade: 2
10	✖ SPT	6-6			
15	✖ SPT	6-25	MC = 22.1% LL = 33 PL = 24 Fines = 54.0%		14.0 ▽ <b>Dawson Formation</b> Weathered SANDSTONE to CLAYSTONE, tan to gray, moist to very moist, very dense to hard, poorly cemented, fine to coarse-grained
	✖ SPT	30-20/2"			19.7

Bottom of borehole at 19.7 feet.

**Note:**

Average Percolation Rate = 6 min./in.  
LTAR = 0.60 gal./s.f./day



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# TEST PIT NUMBER TP-1

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
EXCAVATION CONTRACTOR	Bush Excavating	GROUND ELEVATION	
EXCAVATION METHOD	Rubber-Tire Backhoe	TEST PIT SIZE	60 X 120 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		AT TIME OF EXCAVATION	---
		AT END OF EXCAVATION	---
		AFTER EXCAVATION	---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	GB			8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	GB	MC = 2.9% LL = NP PL = NP Fines = 16.5%		Poorly Graded SAND with silt, brown, dry, loose to medium dense, coarse-grained. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
5	GB			Silty to Clayey SAND, brown, dry to moist, medium dense, fine to coarse-grained. USDA Soil Type: 2, Structure Shape: GR, Structure Grade: 2
10	GB			
Bottom of test pit at 10.0 feet.				

## Note:

Average Percolation Rate = N/A

LTAR = 0.60 gal./s.f./day



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## TEST PIT NUMBER TP-2

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
EXCAVATION CONTRACTOR	Bush Excavating	GROUND ELEVATION	
EXCAVATION METHOD	Rubber-Tire Backhoe	TEST PIT SIZE	60 X 120 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
		GROUND WATER LEVELS:	
		AT TIME OF EXCAVATION	---
		AT END OF EXCAVATION	---
		AFTER EXCAVATION	---

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 1/17/19 15:03 - F:\VIVID PROJECTS\18-2-175 GRANDWOOD SUBDIVISION - DRAFTING\18-2-175.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
	GB		1.0	Well Graded SAND with silt and clay, light brown, dry to slightly moist, loose to medium dense, fine to coarse-grained. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
			3.0	Well Graded SAND with silt and clay, tan, slightly moist, loose to medium dense. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
5	GB	MC = 5.7% LL = NP PL = NP Fines = 8.6%	6.5	Clayey SAND, brown, slightly moist, medium dense. USDA Soil Type: 2, Structure Shape: GR, Structure Grade: 2
	GB		10.0	

Bottom of test pit at 10.0 feet.

Note:

Average Percolation Rate = N/A  
LTAR = 0.60 gal./s.f./day



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# TEST PIT NUMBER TP-3

PAGE 1 OF 1

CLIENT	Herebic Homes	PROJECT NAME	Grandwood Subdivision
PROJECT NUMBER	D18-2-175	PROJECT LOCATION	Higby Road, Monument, Colorado
DATE STARTED	12/20/18	COMPLETED	12/20/18
EXCAVATION CONTRACTOR	Bush Excavating	GROUND ELEVATION	
EXCAVATION METHOD	Rubber-Tire Backhoe	TEST PIT SIZE	60 X 120 inches
LOGGED BY	J. Frohbieter	CHECKED BY	W. Barreire
NOTES			
GROUND WATER LEVELS:			
AT TIME OF EXCAVATION		---	
AT END OF EXCAVATION		---	
AFTER EXCAVATION		---	

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
				8"-12" Topsoil - SAND, slightly clayey with organics, dark brown, dry, loose
			1.0	
			2.0	Poorly Graded SAND with clay, light brown, dry to slightly moist, loose to medium dense, fine to coarse-grained. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
			4.0	Poorly Graded SAND with silt and clay, light brown, dry to slightly moist, loose to medium dense, fine to coarse-grained. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
5				
				Poorly Graded SAND with clay, tan, dry to slightly moist, loose to medium dense, fine to coarse-grained. USDA Soil Type: 1, Structure Shape: N/A, Structure Grade: 0
10			10.0	

Bottom of test pit at 10.0 feet.

## Note:

Average Percolation Rate = N/A  
LTAR = 0.80 gal./s.f./day



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## KEY TO SYMBOLS

CLIENT Herebic Homes

PROJECT NAME Grandwood Subdivision

PROJECT NUMBER D18-2-175

PROJECT LOCATION Higby Road, Monument, Colorado

### LITHOLOGIC SYMBOLS (Unified Soil Classification System)



CLAYSTONE



SANDSTONE



SC: USCS Clayey Sand



SC-SM: USCS Clayey Sand



SM: USCS Silty Sand



SP-SC: USCS Poorly-graded Sand with Clay



SP-SM: USCS Poorly-graded Sand with Silt



SW-SM: USCS Well-graded Sand with Silt



TOPSOIL



WEATHERED SANDSTONE

### SAMPLER SYMBOLS



Grab Sample



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



Standard Penetration Test (SPT)

### ABBREVIATIONS

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

▽ Water Level at Time  
Drilling, or as Shown

## Appendix B

### Laboratory Test Results



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## SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT Herebic Homes

PROJECT NAME Grandwood Subdivision

PROJECT NUMBER D18-2-175

PROJECT LOCATION Higby Road, Monument, Colorado

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)		
B-1	9.0	NP	NP	NP	19	14	SM	8.2			
B-1	24.0	NP	NP	NP				17.3			
B-2	9.0	43	26	17	9.5	22	SC	10.6			
B-3	4.0	NP	NP	NP	19	11	SW-SM	2.1			
B-3	14.0	NP	NP	NP	25	8	SW-SM	4.4			
B-4	2.0	NP	NP	NP	12.5	19	SM	2.8			
B-4	14.0	NP	NP	NP	9.5	15	SM	11.7			
B-6	9.0	25	19	6	19	21	SC-SM	10.1			
B-7	4.0	NP	NP	NP	12.5	30	SM	6.4			
B-7	14.0	33	24	9	9.5	54	ML	22.1			
TP-1	2.0	NP	NP	NP	25	17	SM	2.9			
TP-2	3.0	NP	NP	NP	12.5	9	SW-SM	5.7			
TP-3	4.0	NP	NP	NP	25	12	SP-SM	4.5			



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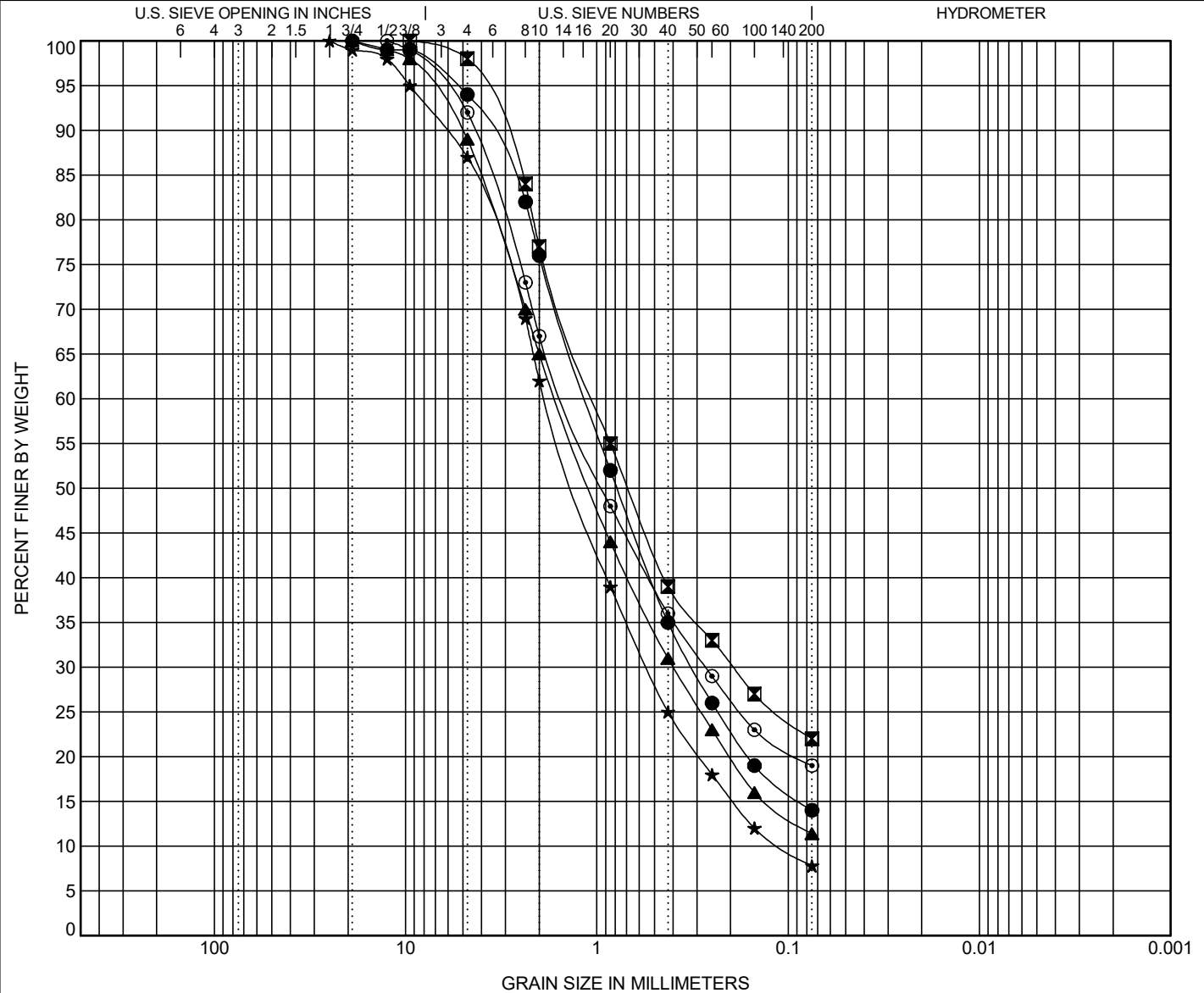
# GRAIN SIZE DISTRIBUTION

CLIENT Herebic Homes

PROJECT NAME Grandwood Subdivision

PROJECT NUMBER D18-2-175

PROJECT LOCATION Higby Road, Monument, Colorado







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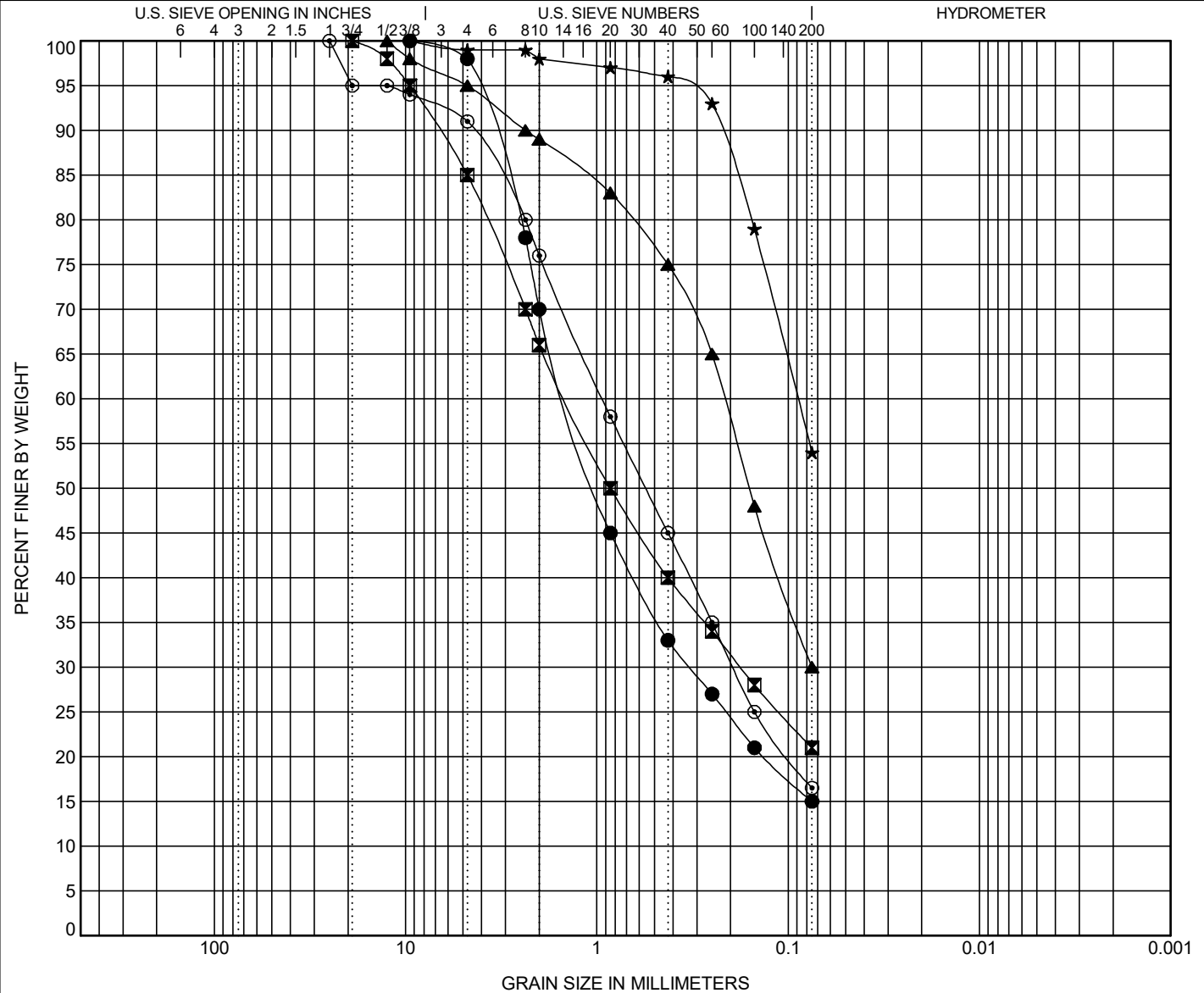
# GRAIN SIZE DISTRIBUTION

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PROJECT NAME Grandwood Subdivision

PROJECT NUMBER D18-2-175

PROJECT LOCATION Higby Road, Monument, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-4	14.0	SILTY SAND(SM)					NP	NP	NP		
✕ B-6	9.0	SILTY, CLAYEY SAND with GRAVEL(SC-SM)					25	19	6		
▲ B-7	4.0	SILTY SAND(SM)					NP	NP	NP		
★ B-7	14.0	SANDY SILT(ML)					33	24	9		
○ TP-1	2.0	SILTY SAND(SM)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-4	14.0	9.5	1.42	0.326		2.0	83.0	15.0			
✕ B-6	9.0	19	1.451	0.178		15.0	64.0	21.0			
▲ B-7	4.0	12.5	0.215	0.075		5.0	65.0	30.0			
★ B-7	14.0	9.5	0.089			1.0	45.0	54.0			
○ TP-1	2.0	25	0.935	0.194		9.0	74.5	16.5			

GRAIN SIZE - GINT STD US LAB.GDT - 1/17/19 09:32 - F:\VIVID PROJECTS\D18-2-175 GRANDWOOD SUBDIVISION\6 - DRAFTING\D18-2-175.GPJ



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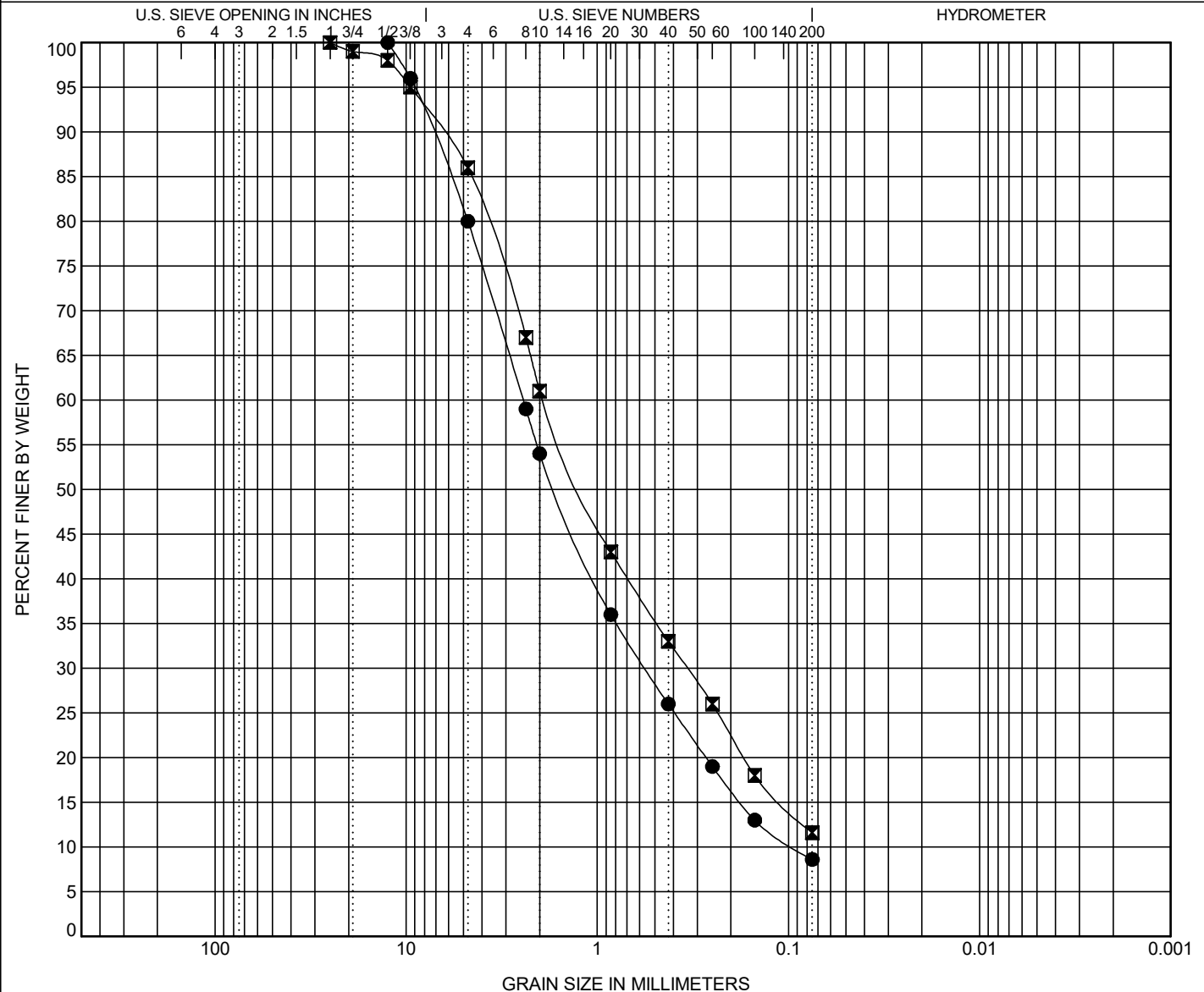
# GRAIN SIZE DISTRIBUTION

CLIENT Herebic Homes

PROJECT NAME Grandwood Subdivision

PROJECT NUMBER D18-2-175

PROJECT LOCATION Higby Road, Monument, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● TP-2	3.0	WELL-GRADED SAND with SILT and GRAVEL(SW-SM)					NP	NP	NP	1.38	26.09
☒ TP-3	4.0	POORLY GRADED SAND with SILT(SP-SM)					NP	NP	NP	0.95	30.24
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● TP-2	3.0	12.5	2.44	0.561	0.094	20.0	71.4	8.6			
☒ TP-3	4.0	25	1.907	0.339		14.0	74.4	11.6			

GRAIN SIZE - GINT STD US LAB.GDT - 1/17/19 09:32 - F:\VIVID PROJECTS\D18-2-175 GRANDWOOD SUBDIVISION6 - DRAFTING\D18-2-175.GPJ