Huddleston-Berry
Engineering & Testing, LLC

GEOTECHNICAL AND GEOLOGIC HAZARDS INVESTIGATION
1123 19 ROAD
FRUITA, COLORADO
PROJECT #00545-0065

VORTEX ENGINEERING
861 ROOD AVENUE
GRAND JUNCTION, COLORADO 81501

JANUARY 6, 2021

Huddleston-Berry Engineering and Testing, LLC
2789 Riverside Parkway
Grand Junction, Colorado 81501

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A geologic hazards and geotechnical investigation was conducted for a proposed subdivision at 1123 19 Road in Fruita, Colorado. The project location is shown on Figure 1 – Site Location Map. The purpose of the investigation was to evaluate the surface and subsurface conditions at the site with respect to geologic hazards, pavement design, and earthwork for the proposed development. This summary has been prepared to include the information required by civil engineers, structural engineers, and contractors involved in the project.

Subsurface Conditions (p. 2)

The subsurface investigation consisted of eight test pits, excavated on November 19, 2020. The locations of the test pits are shown on Figure 2 – Site Plan. The test pits generally encountered native silty sand soils. Groundwater was encountered in the subsurface at depths between 3.5 and 7.0 feet at the time of the investigation. The native soils are non-plastic and are anticipated to be slightly collapsible.

Geologic Hazards and Constraints (p. 3)

No geologic hazards were identified which would preclude development of this property. However, moisture sensitive soils and shallow groundwater were encountered during the subsurface investigation and these may impact the design and construction of foundations, pavements, etc.

Summary of Foundation Recommendations

- *Foundation Type* – Spread Footings or Monolithic (turndown) Structural Slabs. (p. 4)
- *Structural Fill* – 24-inches below foundations. The native soils are suitable for reuse as structural fill. Imported structural fill should consist of granular material approved by HBET. (p. 4)
- *Maximum Allowable Bearing Capacity* – 1,500 psf. (p. 5)
- *Subgrade Modulus* – 150 pci for native soils and 250 pci for imported granular materials. (p. 5)
- *Lateral Earth Pressure* – 45 pcf active. 65 pcf at-rest. (p. 5)

Summary of Pavement Recommendations (p. 6)

Internal Subdivision Roadways
EDLA = 20, Structural Number = 3.50

ALTERNATIVE	PAVEMENT SECTION (Inches)				
	Hot-Mix Asphalt Pavement	CDOT Class 6 Base Course	CDOT Class 3 Subbase Course	Rigid Pavement	TOTAL
A	3.0	16.0			19.0
B	4.0	13.0			17.0
C	3.0	6.0	14.0		23.0
Full Depth RP		6.0		6.0	12.0

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1.0 INTRODUCTION

As part of extensive development in Western Colorado, a new residential subdivision is proposed in Fruita. As part of the development process, Huddleston-Berry Engineering and Testing, LLC (HBET) was retained by Vortex Engineering to conduct a geologic hazards and geotechnical investigation at the site.

1.1 Scope

As discussed above, a geologic hazards and geotechnical investigation was conducted for a proposed subdivision at 1123 19 Road in Fruita, Colorado. The scope of the investigation included the following components:

- Conducting a subsurface investigation to evaluate the subsurface conditions at the site.
- Collecting soil samples and conducting laboratory testing to determine the engineering properties of the soils at the site.
- Providing preliminary recommendations for foundation type
- Providing recommendations for lateral earth pressure.
- Providing recommendations for pavements.
- Providing recommendations for drainage, grading, and general earthwork.
- Evaluating potential geologic hazards at the site.

The investigation and report were completed by a Colorado registered professional engineer in accordance with generally accepted geotechnical and geological engineering practices. This report has been prepared for the exclusive use of Vortex Engineering and the Owner.

1.2 Site Location and Description

The site encompasses approximately 15 acres at 1123 19 Road in Fruita, Colorado. The project location is shown on Figure 1 – Site Location Map.

At the time of the investigation, most of the site was open. However, an existing residence was present in the northeastern corner of the site. The site sloped slightly down to the south and vegetation consisted primarily of grasses and weeds with a few trees. The site was bordered to the north and west by residential/agricultural properties, to the east by 19 Road, and to the south by K Road.

1.3 Proposed Construction

The proposed subdivision is anticipated to include subdivision of the property into single-family residential lots. New utilities and internal subdivision roadways will also be included in the development.

2.0 GEOLOGIC SETTING

2.1 Soils

Soils data was obtained from the USDA Natural Resource Conservation Service Web Soil Survey. The data indicates that the soils at the site consist of Sagers silty clay loam, 0 to 2 percent slopes; Fruitland sandy clay loam, 0 to 2 percent slopes; and Turley clay loam, 0 to 2 percent slopes. Soil survey data is included in Appendix A.

Residential construction in the site soils is described as ranging from not limited to somewhat limited due to shrink-swell. Road construction in the site soils is indicated to be somewhat limited to very limited due to frost action, low strength, and/or shrink/swell. Excavation in the site soils is indicated to be somewhat limited due to dust and/or unstable excavation walls. The site soils are indicated to have a moderate potential for frost action, moderate risk of corrosion of uncoated steel, and low to moderate risk of corrosion of concrete.

2.2 Geology

According to the *Geologic Map of the Fruita Quadrangle, Mesa County, Colorado* (2009), the site is underlain by alluvial mudflow and fan valley fill deposits.

2.3 Groundwater

Groundwater was encountered in the subsurface at depths of between 3.5 and 7.0 feet at the time of the investigation.

3.0 FIELD INVESTIGATION

3.1 Subsurface Investigation

The subsurface investigation was conducted on November 19th, 2020 and consisted of eight test pits, excavated to depths between 5.0 and 7.0 feet below the existing ground surface. The locations of the test pits are shown on Figure 2 – Site Plan. Typed test pit logs are included in Appendix B. Samples of the subsurface soils were collected using hand drive samplers and bulk sampling methods at the locations shown on the logs.

As indicated on the logs, the subsurface conditions at the site were fairly consistent. The test pits encountered 1.0 foot of topsoil above brown, moist to wet, loose to medium dense silty sand soils to the bottoms of the excavations. As discussed previously, groundwater was encountered at depths ranging from 3.5 feet to 7.0 feet in the subsurface at the time of the investigation.

3.2 Field Reconnaissance

The field reconnaissance included walking the site during the subsurface investigation. In general, the site was very gently sloping. No evidence of active landslides, debris flows, rockfalls, etc. was observed.

4.0 LABORATORY TESTING

Selected soil samples collected from the test pits were tested in the Huddleston-Berry Engineering and Testing LLC geotechnical laboratory for grain-size analysis, Atterberg limits determination, natural moisture content and density determination, maximum dry density/optimum moisture (Proctor) determination, and California Bearing Ratio (CBR). The laboratory testing results are included in Appendix C.

The laboratory testing results indicate that the native sand soils are non-plastic. Due to the granular nature of the soils, undisturbed samples of the soils were unable to be collected for swell/consolidation testing. However, based upon our experience with similar soils in the vicinity of the subject site, the native soils are anticipated to be slightly collapsible.

5.0 GEOLOGIC INTERPRETATION

5.1 Geologic Hazards

The primary geologic hazard identified on the site is the presence of moisture sensitive soils in the shallow subsurface.

5.2 Geologic Constraints

In general, the primary geologic constraint to construction at the site is the presence of moisture sensitive soils. However, shallow groundwater will also likely impact the construction.

5.3 Water Resources

No water supply wells were observed on the property. However, as discussed previously, shallow groundwater was encountered at this site. In general, with proper design and construction, the proposed construction is not anticipated to adversely impact surface water or groundwater.

5.4 Mineral Resources

Potential mineral resources in Western Colorado generally include sand, gravel, uranium ore, and commercial rock products such as flagstone. As discussed previously, sands were encountered across the site. However, economic valuation of the sands with regard to their suitability as a commercial quality resource was beyond the scope of this investigation.

6.0 CONCLUSIONS

Based upon the available data sources, field investigation, and nature of the proposed construction, HBET does not believe that there are any geologic conditions which should preclude subdivision of the site. However, foundations, pavements, and earthwork will have to consider the impacts of shallow groundwater and/or moisture sensitive soils at the site.

7.0 RECOMMENDATIONS

7.1 Foundations

As discussed previously, the subsurface conditions across the site were fairly consistent. Based upon the results of the subsurface investigation and nature of the proposed construction, shallow foundations are generally recommended. Spread footings and monolithic (turndown) structural slab foundations are both appropriate alternatives and can be designed and constructed in accordance with the *Mesa County Minimum House Foundation Standards*. However, as discussed previously, the native soils are slightly collapsible. Therefore, in order to provide a uniform bearing stratum and reduce the risk of excessive differential movements, it is recommended that the foundations be constructed above a minimum of 24-inches of structural fill.

The native sand soils, exclusive of topsoil, are suitable for reuse as structural fill. Imported structural fill should consist of a granular, non-expansive, ***non-free draining*** material approved by HBET.

For spread footing foundations, the footing areas may be trenched. However, for monolithic slab foundations, the structural fill should extend across the entire building pad area to a depth of 24-inches below the turndown edges. Structural fill should extend laterally beyond the edges of the foundation a distance equal to the thickness of structural fill.

Prior to placement of structural fill, it is recommended that the bottom of the foundation excavation be scarified to a depth of 6 to 9 inches, moisture conditioned, and compacted to a minimum of 95% of the standard Proctor maximum dry density, within ± 2% of the optimum moisture content as determined in accordance with ASTM D698. However, shallow groundwater was encountered at the site and this may make compaction of the subgrade difficult. It may be necessary to utilize geotextile and/or geogrid in conjunction with up to 30-inches of additional granular fill to stabilize the subgrade. HBET should be contacted to provide specific recommendations for subgrade stabilization based upon the actual conditions encountered during construction.

Structural fill should be moisture conditioned, placed in maximum 8-inch loose lifts, and compacted to a minimum of 95% of the standard Proctor maximum dry density for fine grained soils and modified Proctor maximum dry density for coarse grained soils, within ± 2% of the optimum moisture content as determined in accordance with ASTM D698 and D1557, respectively. Structural fill should be extended to within 0.1-feet of the bottom of the foundation. No more than 0.1-feet of gravel should be placed below the footings or turndown edge as a leveling course.

For structural fill consisting of the native soils or approved imported granular materials and foundation building pad preparation as recommended, a maximum allowable bearing capacity of 1,500 psf may be used. In addition, a modulus of 150 pci may be used for native soils as structural fill and a modulus of 200 pci may be used for approved imported structural fill materials. Foundations subject to frost should be at least 24-inches below the finished grade.

7.2 Corrosion of Concrete

As discussed previously, the USDA Soil Survey data suggests that the native soils have a low to moderate risk of corrosion of concrete. Therefore, at a minimum, Type I-II sulfate resistant cement is recommended for construction at this site.

7.3 Lateral Earth Pressures

Stemwalls or retaining walls should be designed to resist lateral earth pressures. For backfill consisting of the native soils or imported granular, non-free draining, non-expansive material, an active equivalent fluid unit weight of 45 pcf may be used in areas where no surcharge loads are present. An at-rest equivalent fluid unit weight of 65 pcf may be used for braced walls. Lateral earth pressures should be increased as necessary to reflect any surcharge loading behind the walls.

7.4 Drainage

Grading and drainage at the site are critical to the long-term performance of structure foundations and slabs-on-grade. Grading around the structures should be designed to carry precipitation and runoff away from the structures. It is recommended that the finished ground surface drop at least twelve inches within the first ten feet away from the structures. It is recommended that landscaping within five feet of the structures include primarily desert plants with low water requirements. In addition, it is recommended that automatic irrigation, including drip lines, within ten feet of foundations be minimized.

HBET recommends that surface downspout extensions be used which discharge 15 feet from the structures or beyond the backfill zone, whichever is greater. However, if subsurface downspout drains are utilized, they should be carefully constructed of solid-wall PVC and should daylight a minimum of 15-feet from the structures. In addition, an impermeable membrane is recommended below subsurface downspout drain lines. Dry wells should not be used.

7.5 Excavations

Excavations in the soils at the site may stand for short periods of time but should not be considered to be stable. Therefore, trenching and excavations should be sloped back, shored, or shielded for worker protection in accordance with applicable OSHA standards. The native soils at the site generally classify as Type C soil with regard to OSHA's *Construction Standards for Excavations*. For Type C soils, the maximum allowable slope in temporary cuts is 1.5H:1V.

7.6 Pavements

The proposed construction is anticipated to include internal subdivision roadways. From the subsurface investigation, the pavement subgrade materials at the site consist primarily of silty sand soils. The design California Bearing Ratio (CBR) of the native soils was determined in the laboratory to be approximately 3.0. This corresponds to a Resilient Modulus of approximately 4,500 psi. However, the native sand soils were indicated to be collapsible. Therefore, the recommended minimum Resilient Modulus of 3,000 psi was used for the pavement design.

Based upon the subgrade conditions and anticipated traffic loading, asphalt and concrete pavement section alternatives were developed in accordance with AASHTO design procedures. The following minimum pavement section alternatives are recommended:

Internal Subdivision Roadways
EDLA = 20, Structural Number = 3.50

ALTERNATIVE	PAVEMENT SECTION (Inches)				
	Hot-Mix Asphalt Pavement	CDOT Class 6 Base Course	CDOT Class 3 Subbase Course	Rigid Pavement	TOTAL
A	3.0	16.0			19.0
B	4.0	13.0			17.0
C	3.0	6.0	14.0		23.0
Full Depth RP		6.0		6.0	12.0

Prior to roadway construction, the roadway prism should be stripped of all topsoil, fill, or other unsuitable materials. It is recommended that the subgrade soils be scarified to a depth of 12-inches; moisture conditioned, and recompacted to a minimum of 95% of the standard Proctor maximum dry density, within ±2% of optimum moisture as determined by AASHTO T-99. However, shallow groundwater at the site may make compaction of the subgrade difficult. It may be necessary to utilize geotextile and/or geogrid in conjunction with up to 30-inches of additional granular fill to stabilize the subgrade. HBET should be contacted to provide specific recommendations for subgrade stabilization based upon the actual conditions encountered during construction.

Aggregate base course and subbase course should be placed in maximum 9-inch loose lifts, moisture conditioned, and compacted to a minimum of 95% and 93% of the maximum dry density, respectively, at -2% to +3% of optimum moisture content as determined by AASHTO T-180. In addition to density testing, base course should be proofrolled to verify subgrade stability.

It is recommended that Hot-Mix Asphaltic (HMA) pavement conform to CDOT grading SX or S specifications and consist of an approved 75 gyration Superpave method mix design. HMA pavement should be compacted to between 92% and 96% of the maximum theoretical density. An end point stress of 50 psi should be used. It is recommended that rigid pavements consist of CDOT Class P concrete or alternative approved by the Engineer. In addition, pavements should conform to local specifications.

The long-term performance of the pavements is dependent on positive drainage away from the pavements. Ditches, culverts, and inlet structures in the vicinity of paved areas must be maintained to prevent ponding of water on the pavement.

8.0 GENERAL

The recommendations included above are based upon the results of the subsurface investigation and on our local experience. These conclusions and recommendations are valid only for the proposed construction.

As discussed previously, the subsurface conditions at the site were fairly consistent. However, the precise nature and extent of any subsurface variability may not become evident until construction. As a result, it is recommended that HBET provide construction materials testing and engineering oversight during the entire construction process.

It is important to note that the recommendations herein are intended to reduce the risk of structural movement and/or damage, to varying degrees, associated with collapse of the native soils. However, HBET cannot predict long-term changes in subsurface moisture conditions and/or the precise magnitude or extent of volume change in the subsurface materials. Where significant increases in subsurface moisture occur due to poor grading, improper stormwater management, utility line failure, excess irrigation, or other cause, either during construction or the result of actions of the property owners, several inches of movement are possible. In addition, any failure to comply with the recommendations in this report releases Huddleston-Berry Engineering & Testing, LLC of any liability with regard to the performance of structures, flatwork, etc. at this site.

Huddleston-Berry Engineering and Testing, LLC is pleased to be of service to your project. Please contact us if you have any questions or comments regarding the contents of this report.

Respectfully Submitted:
Huddleston-Berry Engineering and Testing, LLC

Michael A. Berry, P.E.
Vice President of Engineering

FIGURES

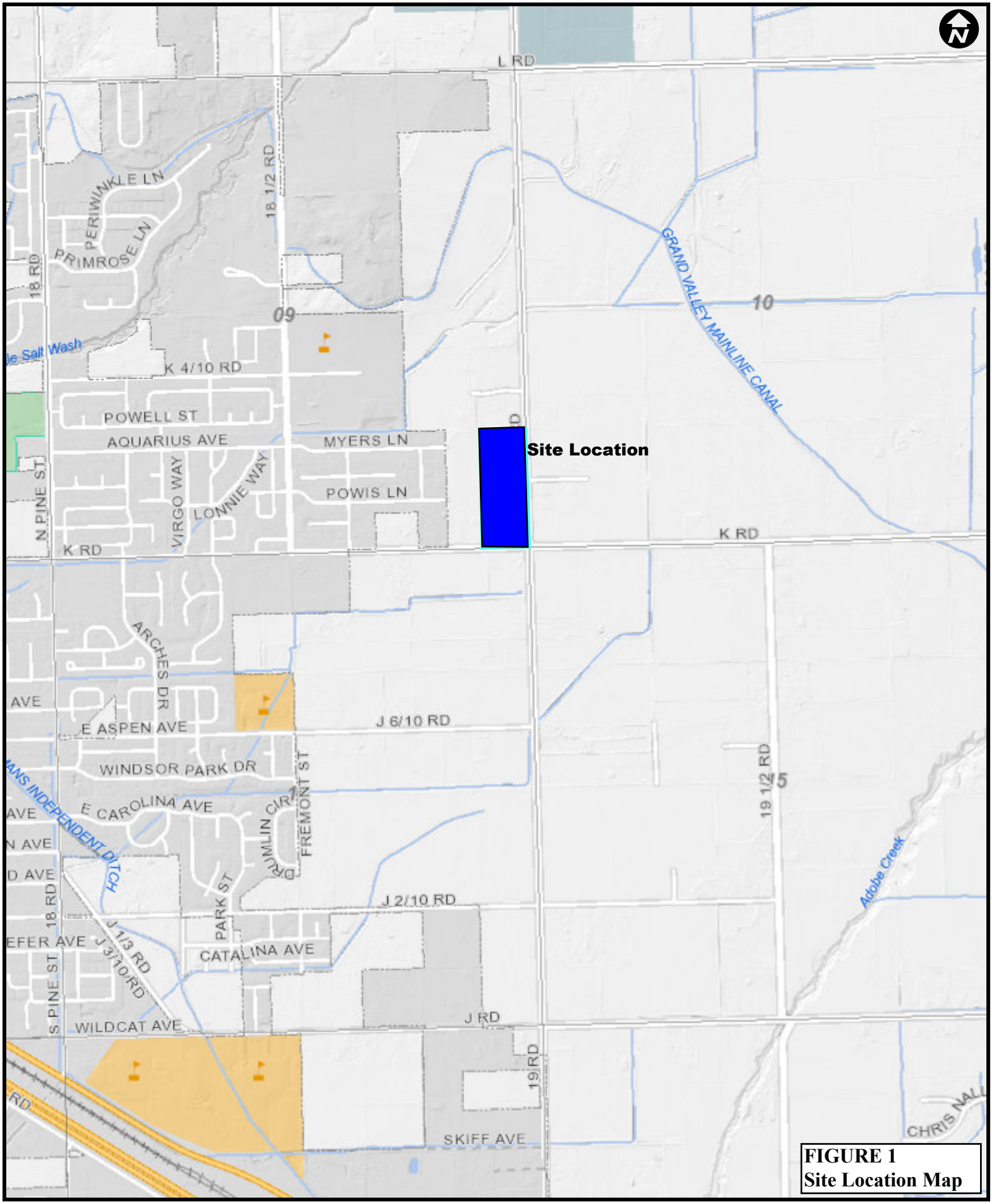


FIGURE 1
Site Location Map

Mesa County Map

0 0.125 0.25 0.5 mi
0 0.15 0.3 0.6 km

Print Date: December 28, 2020

Mesa County, Colorado
GIS/IT Department
gis.mesacounty.us

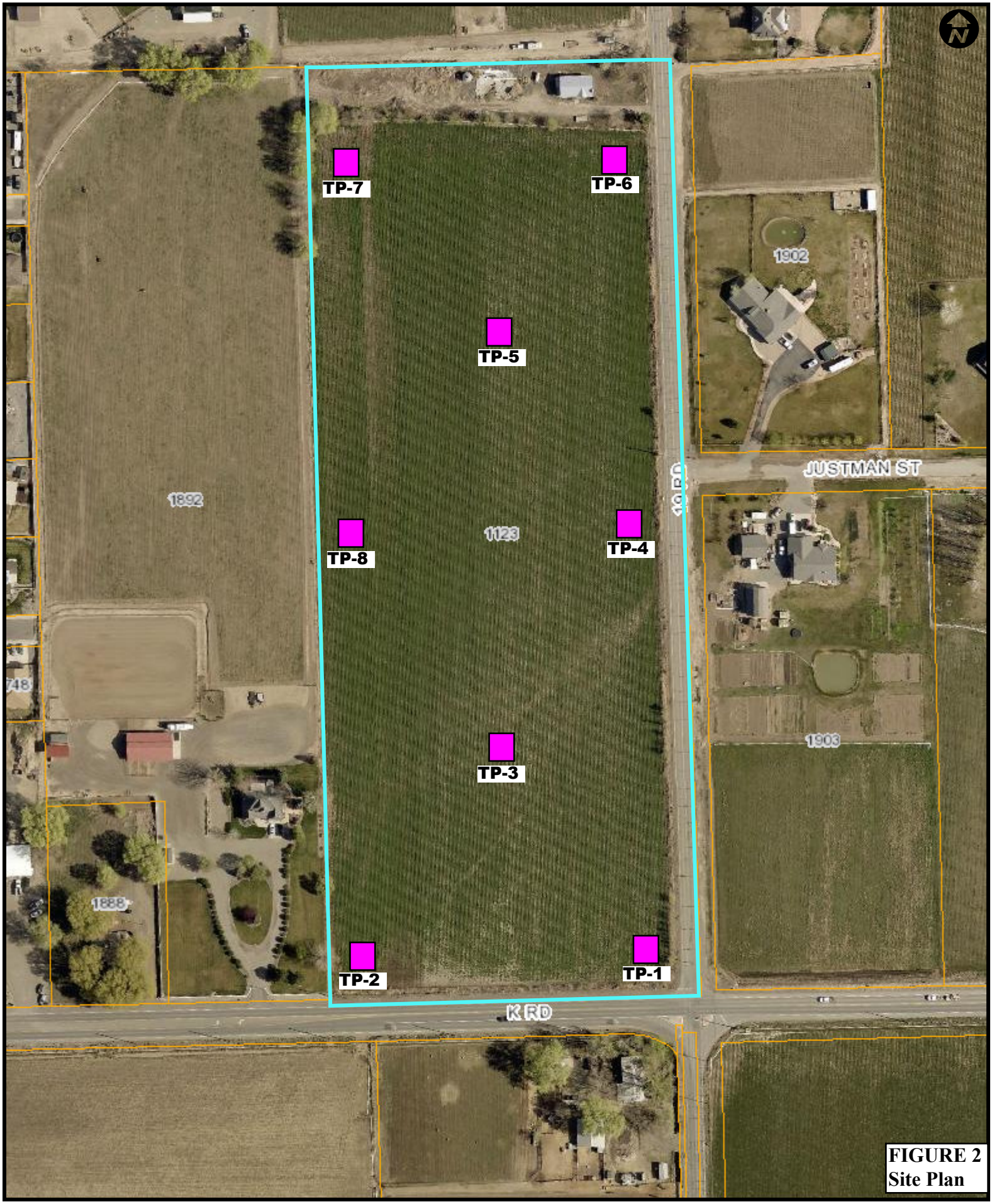


FIGURE 2
Site Plan

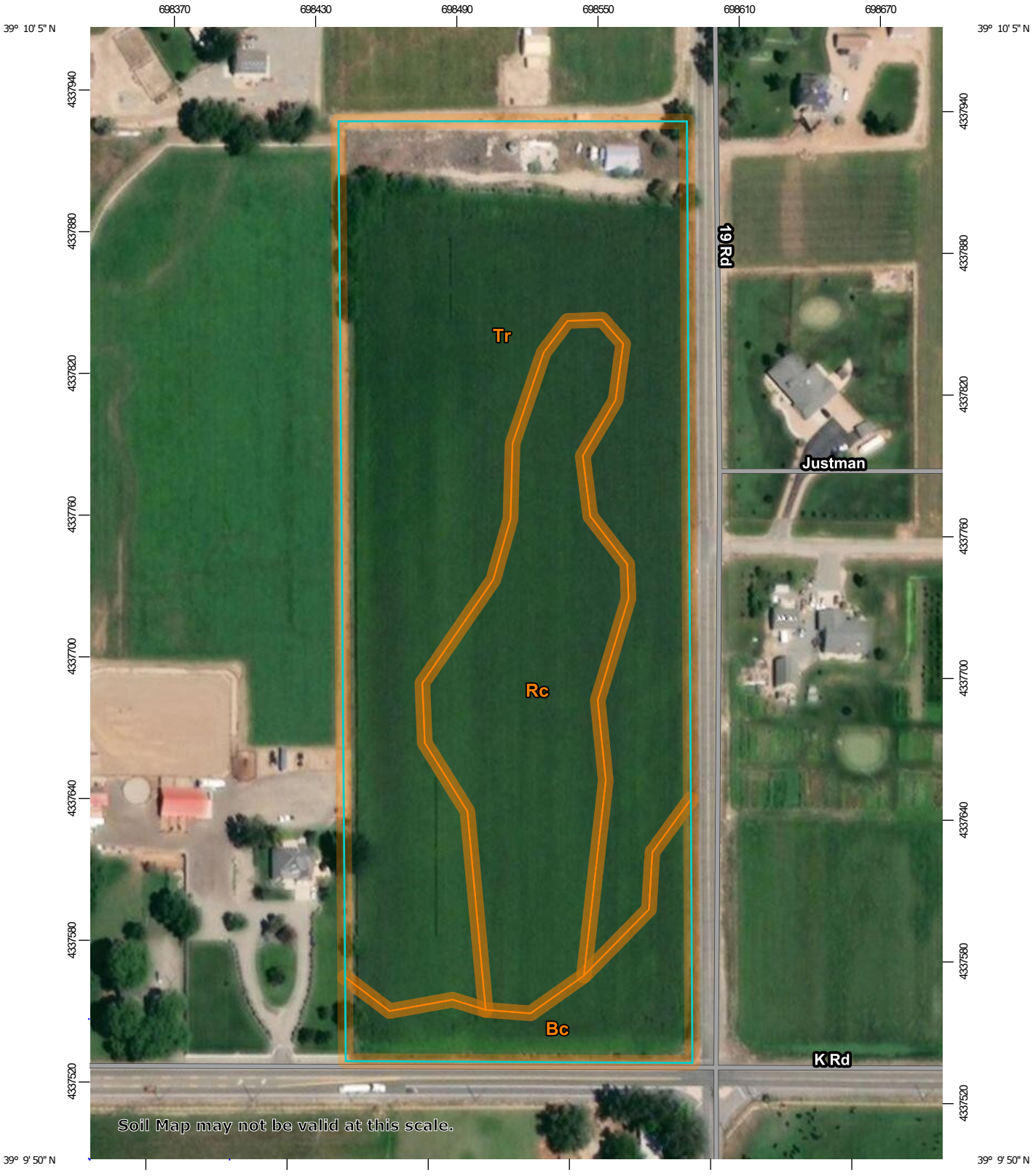
Mesa County Map

0 0.015 0.03 0.06 mi
0 0.0175 0.035 0.07 km

Print Date: November 11, 2020

Mesa County, Colorado
GIS/IT Department
gis.mesacounty.us

APPENDIX A
Soil Survey Data



Map Scale: 1:2,340 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 11, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 13, 2010—Aug 8, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bc	Sagers silty clay loam, 0 to 2 percent slopes	1.4	9.8%
Rc	Fruitland sandy clay loam, 0 to 2 percent slopes	3.7	25.1%
Tr	Turley clay loam, 0 to 2 percent slopes	9.5	65.1%
Totals for Area of Interest		**14.6**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Mesa County Area, Colorado

Bc—Sagers silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: k0bq
Elevation: 4,490 to 5,900 feet

Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sagers and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sagers

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Cretaceous source alluvium derived from sandstone and shale

Typical profile

Ap - 0 to 12 inches: silty clay loam
C - 12 to 25 inches: silty clay loam
Cy - 25 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 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 (0.21 to 0.71 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Available water capacity: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 7c
Hydrologic Soil Group: C
Ecological site: R034BY106UT - Desert Loam (Shadscale)
Hydric soil rating: No

Rc—Fruitland sandy clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: k0d0
Elevation: 4,490 to 4,890 feet

Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Fruitland and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fruitland

Setting

Landform: Fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Cretaceous source alluvium derived from sandstone and shale

Typical profile

Ap - 0 to 8 inches: sandy clay loam
C1 - 8 to 30 inches: gravelly sandy loam
C2 - 30 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.71 to 2.13 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7c
Hydrologic Soil Group: B
Ecological site: R034BY115UT - Desert Sandy Loam (Indian Ricegrass)
Hydric soil rating: No

Tr—Turley clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: k0d8
Elevation: 4,500 to 4,800 feet
Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 50 to 55 degrees F

Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Turley and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Turley

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Cretaceous slope alluvium derived from sandstone and shale

Typical profile

Ap - 0 to 10 inches: clay loam
C1 - 10 to 20 inches: fine sandy loam
C2 - 20 to 30 inches: clay loam
C3 - 30 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 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 (0.21 to 0.71 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 4 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 5e
Hydrologic Soil Group: C
Ecological site: R034BY106UT - Desert Loam (Shadscale)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 11, Jun 8, 2020

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Dwellings and Small Commercial Buildings

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Dwellings and Small Commercial Buildings–Mesa County Area, Colorado							
Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Bc—Sagers silty clay loam, 0 to 2 percent slopes							
Sagers	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.03	Shrink-swell	0.03	Shrink-swell	0.03
Rc—Fruitland sandy clay loam, 0 to 2 percent slopes							
Fruitland	90	Not limited		Not limited		Not limited	

Dwellings and Small Commercial Buildings–Mesa County Area, Colorado							
Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Tr—Turley clay loam, 0 to 2 percent slopes							
Turley	90	Not limited		Not limited		Not limited	

Data Source Information

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 11, Jun 8, 2020

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Roads and Streets, Shallow Excavations, and Lawns and Landscaping

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Roads and Streets, Shallow Excavations, and Lawns and Landscaping–Mesa County Area, Colorado							
Map symbol and soil name	Pct. of map unit	Lawns and landscaping		Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Bc—Sagers silty clay loam, 0 to 2 percent slopes							
Sagers	90	Somewhat limited		Very limited		Somewhat limited	
		Dusty	0.50	Low strength	1.00	Dusty	0.50
				Frost action	0.50	Unstable excavation walls	0.01
				Shrink-swell	0.03		

Roads and Streets, Shallow Excavations, and Lawns and Landscaping–Mesa County Area, Colorado							
Map symbol and soil name	Pct. of map unit	Lawns and landscaping		Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Rc—Fruitland sandy clay loam, 0 to 2 percent slopes							
Fruitland	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.05	Frost action	0.50	Dusty	0.05
						Unstable excavation walls	0.01
Tr—Turley clay loam, 0 to 2 percent slopes							
Turley	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.19	Low strength	0.56	Dusty	0.19
				Frost action	0.50	Unstable excavation walls	0.01

Data Source Information

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 11, Jun 8, 2020

Soil Features

This table gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage, or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (Ksat), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Report—Soil Features

Soil Features–Mesa County Area, Colorado									
Map symbol and soil name	Restrictive Layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		Low-RV-High	*Range*		*Low-High*	*Low-High*			
		In	*In*		*In*	*In*			
Bc—Sagers silty clay loam, 0 to 2 percent slopes									
Sagers		—	—		0	0	Moderate	Moderate	Moderate
Rc—Fruitland sandy clay loam, 0 to 2 percent slopes									
Fruitland		—	—		0	0	Moderate	Moderate	Low
Tr—Turley clay loam, 0 to 2 percent slopes									
Turley		—	—		0	0	Moderate	Moderate	Low

Data Source Information

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 11, Jun 8, 2020

APPENDIX B
Typed Test Pit Logs

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-1

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 5.5 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 5.5 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (SM), brown, moist to wet, loose to medium dense										
2.5		**Lab Classified GB1	GB 1					21	NP	NP	NP	47
5.0		Bottom of test pit at 6.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-2

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 6.0 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 6.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (sm), brown, moist to wet, loose to medium dense										
2.5												
5.0												
		Bottom of test pit at 6.5 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-3

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 3.5 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 3.5 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (SM), brown, moist to wet, loose to medium dense										
		**Lab Classified GB1	GB 1					20	NP	NP	NP	40
2.5												
5.0		Bottom of test pit at 5.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-4

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 6.0 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 6.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (sm), brown, moist to wet, loose to medium dense										
2.5												
5.0												
		Bottom of test pit at 6.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-5

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 7.0 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 7.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (sm), brown, moist to wet, loose to medium dense										
2.5												
5.0												
		Bottom of test pit at 7.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-6

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 6.0 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 6.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (sm), brown, moist to wet, loose to medium dense										
2.5												
5.0												
		Bottom of test pit at 6.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-7

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 6.0 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 6.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (sm), brown, moist to wet, loose to medium dense										
2.5												
5.0												
		Bottom of test pit at 6.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
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Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-8

CLIENT Vortex Engineering
PROJECT NAME 1123 19 Road
PROJECT NUMBER 00545-0065
PROJECT LOCATION Fruita, CO
DATE STARTED 11/19/20 **COMPLETED** 11/19/20
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 6.0 ft
LOGGED BY SD **CHECKED BY** MAB
AT END OF EXCAVATION 6.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Silty SAND with Organics (TOPSOIL)										
		Silty SAND (sm), brown, moist to wet, loose to medium dense										
2.5												
5.0												
		Bottom of test pit at 6.0 feet.										

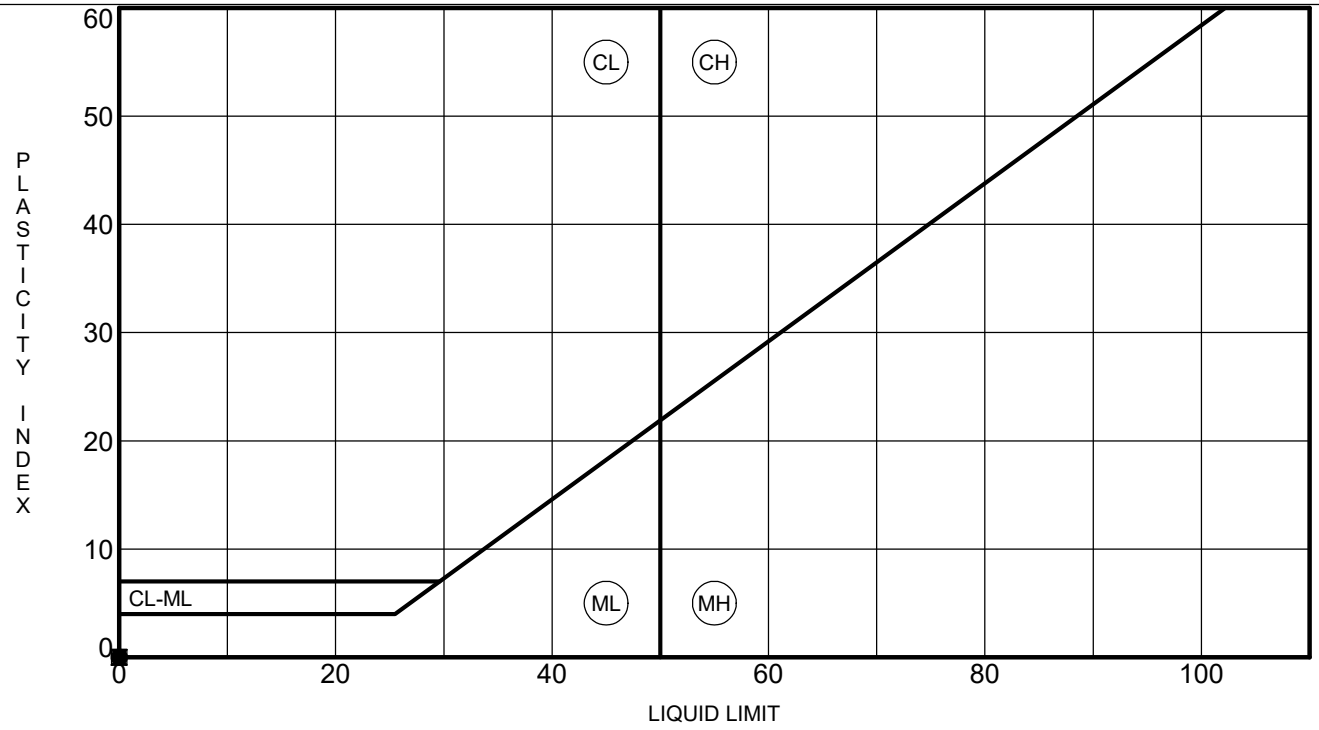
APPENDIX C
Laboratory Testing Results

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

ATTERBERG LIMITS' RESULTS

CLIENT Vortex Engineering **PROJECT NAME** 1123 19 Road

PROJECT NUMBER 00545-0065 **PROJECT LOCATION** Fruita, CO



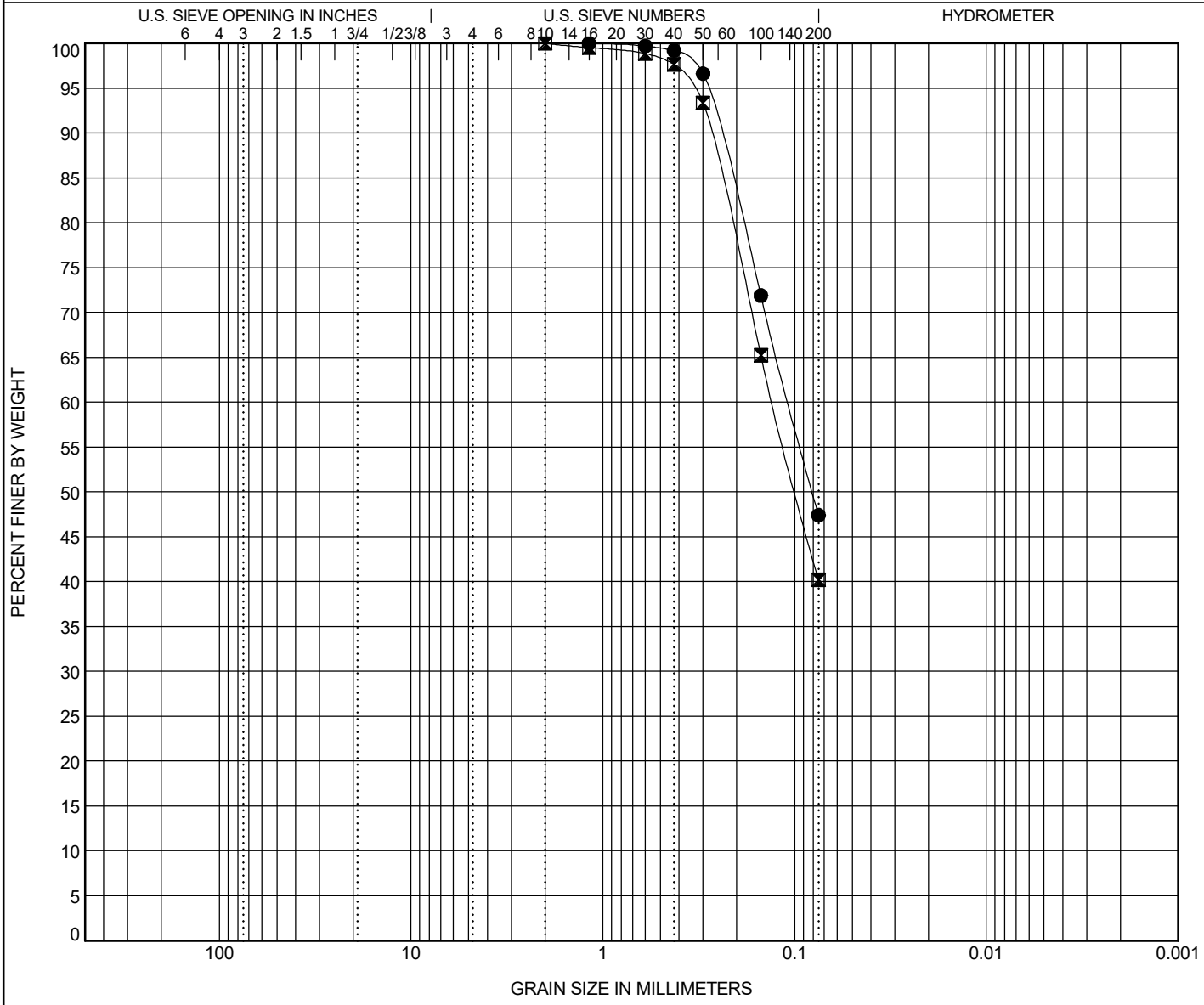
	Specimen Identification		LL	PL	PI	#200	Classification
●	**TP-1, GB1**	**11/19/2020**	**NP**	**NP**	**NP**	**47**	**SILTY SAND(SM)**
⧓	**TP-3, GB1**	**11/19/2020**	**NP**	**NP**	**NP**	**40**	**SILTY SAND(SM)**

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

GRAIN SIZE DISTRIBUTION

CLIENT Vortex Engineering **PROJECT NAME** 1123 19 Road

PROJECT NUMBER 00545-0065 **PROJECT LOCATION** Fruita, CO



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**TP-1, GB1 11/20**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊠	**TP-3, GB1 11/20**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-1, GB1 11/20**	**1.18**	**0.107**			**0.0**	**52.6**	**47.4**	
⊠	**TP-3, GB1 11/20**	**2**	**0.13**			**0.0**	**59.8**	**40.2**	

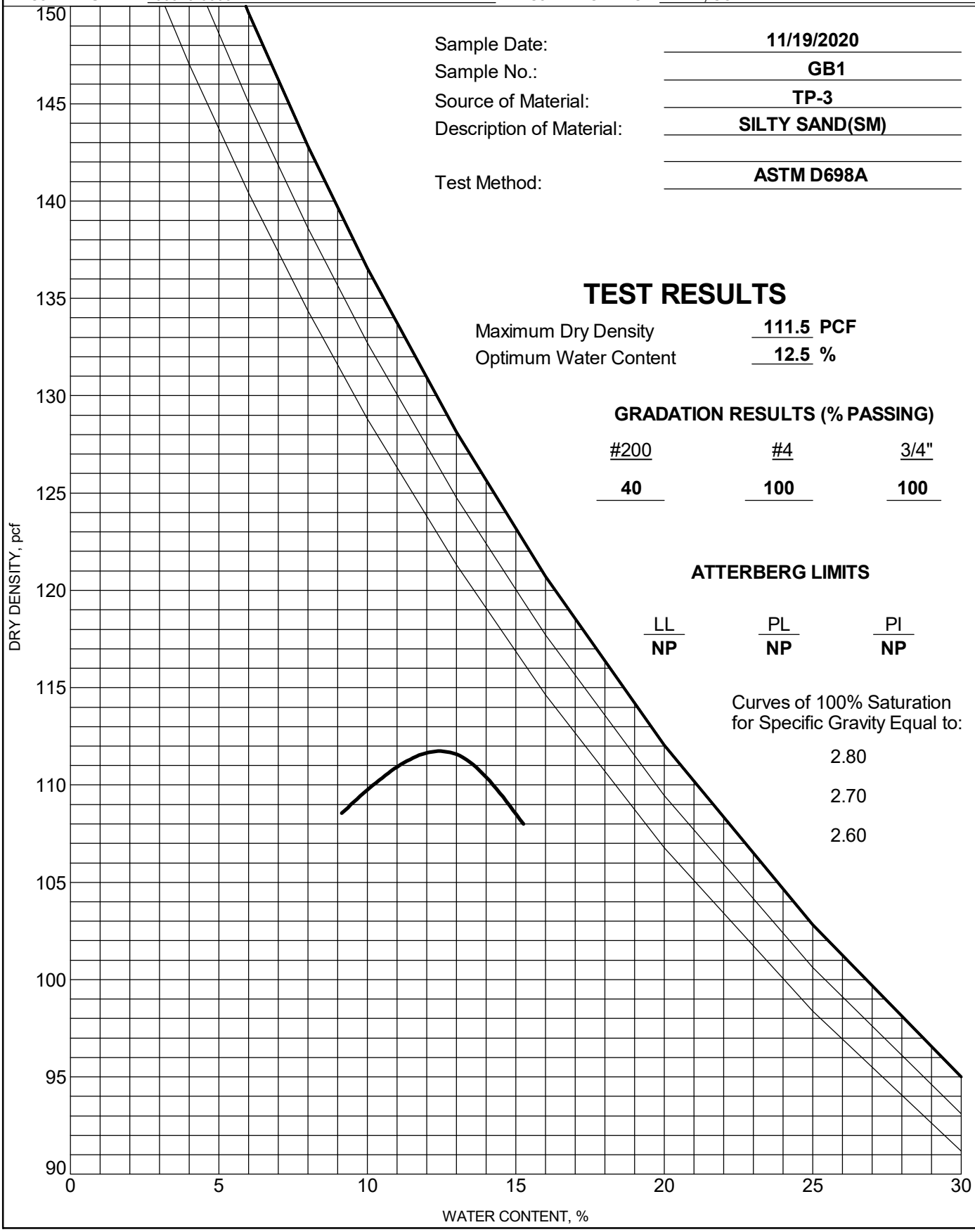
GRAIN SIZE 00545-0065 1123 19 RD.GPJ GINT US LAB.GDT 12/28/20

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

MOISTURE-DENSITY RELATIONSHIP

CLIENT Vortex Engineering **PROJECT NAME** 1123 19 Road

PROJECT NUMBER 00545-0065 **PROJECT LOCATION** Fruita, CO



Sample Date: **11/19/2020**

Sample No.: **GB1**

Source of Material: **TP-3**

Description of Material: **SILTY SAND(SM)**

Test Method: **ASTM D698A**

TEST RESULTS

Maximum Dry Density **111.5** PCF

Optimum Water Content **12.5** %

GRADATION RESULTS (% PASSING)

#200	#4	3/4"
40	100	100

ATTERBERG LIMITS

LL	PL	PI
NP	NP	NP

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

COMPACTION 00545-0065 1123 19 RD.GPJ GINT US LAB.GDT 12/28/20

Huddleston-Berry
Engineering & Testing, LLC

CALIFORNIA BEARING RATIO
ASTM D1883

Project No.:	00545-0065		**Authorized By:**	Client	**Date:** 11/19/20
Project Name:	1123 19 Road		**Sampled By:**	SD	**Date:** 11/19/20
Client Name:	Vortex Engineering		**Submitted By:**	SD	**Date:** 11/19/20
Sample Number:	20-0889	**Location:** TP-3, GB1	**Reviewed By:**	MAB	**Date:** 12/28/20

Compaction Method: ASTM D698, Method A

Maximum Dry Density (pcf): 111.5

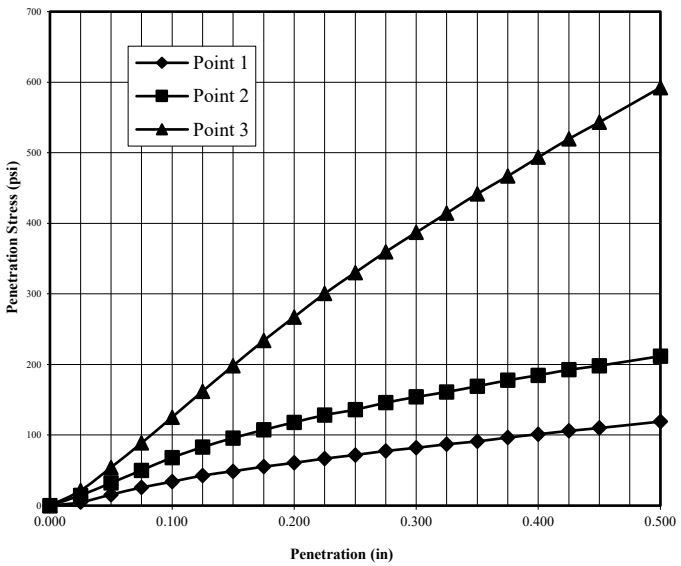
Opt. Moisture Content (%): 12.5

Sample Condition: Soaked

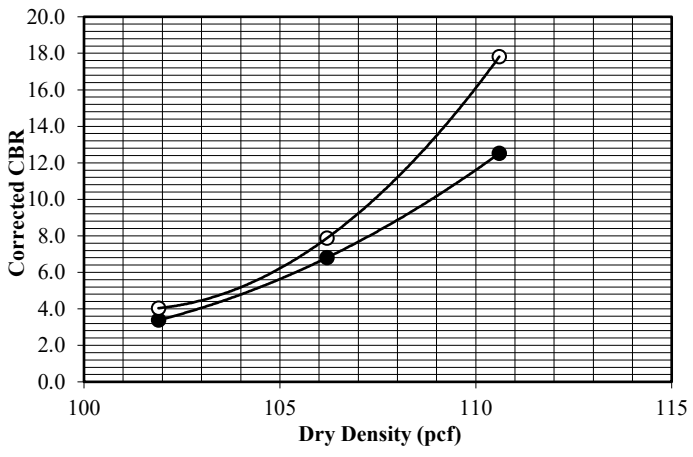
Remarks:

Sample Data		Point 1	Point 2	Point 3
Blows per Compacted Lift:		15	25	56
Surcharge Weight (lbs):		10.0	10.0	10.0
Dry Density Before Soak (pcf):		101.9	106.2	110.6
Dry Density After Soak (pcf):		101.9	106.2	110.6
Moisture Content (%)	Bottom Pre-Test	11.8	11.9	11.3
	Top Pre-Test	11.2	11.5	11.6
	Top 1" After Test	18.8	18.0	15.4
	Average After Soak:	20.2	18.3	15.8
Percent Swell After Soak:		0.0	0.0	0.0

Load Pentration Curve(s)



Dry Density vs CBR



Penetration Data								
Point 1			Point 2			Point 3		
Dist. (in)	Load (lbs)	Stress (psi)	Dist. (in)	Load (lbs)	Stress (psi)	Dist. (in)	Load (lbs)	Stress (psi)
0.000	0	0	0.000	0	0	0.000	0	0
0.025	14	5	0.025	43	15	0.025	63	21
0.050	46	16	0.050	95	32	0.050	160	54
0.075	76	26	0.075	148	50	0.075	262	89
0.100	100	34	0.100	201	68	0.100	370	125
0.125	126	43	0.125	245	83	0.125	479	162
0.150	144	49	0.150	283	96	0.150	586	198
0.175	163	55	0.175	317	107	0.175	691	234
0.200	179	61	0.200	349	118	0.200	790	267
0.225	197	67	0.225	379	128	0.225	888	300
0.250	212	72	0.250	402	136	0.250	976	330
0.275	229	77	0.275	431	146	0.275	1063	360
0.300	242	82	0.300	455	154	0.300	1144	387
0.325	257	87	0.325	476	161	0.325	1225	414
0.350	269	91	0.350	500	169	0.350	1306	442
0.375	285	96	0.375	525	178	0.375	1380	467
0.400	299	101	0.400	546	185	0.400	1459	494
0.425	313	106	0.425	569	192	0.425	1536	520
0.450	325	110	0.450	586	198	0.450	1606	543
0.500	352	119	0.500	626	212	0.500	1751	592

Corrected CBR @ 0.1"		
3.4	6.8	12.5
Corrected CBR @ 0.2"		
4.0	7.9	17.8

Penetration Distance Correction (in)		
0.000	0.000	0.000

Figure: _____