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**PRELIMINARY SOIL, GEOLOGY, AND
GEOLOGIC HAZARD STUDY
GRANDVIEW RESERVE
PARCEL NO. 42000-00-396
EASTONVILLE ROAD
EL PASO COUNTY, COLORADO**

Prepared for

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Respectfully Submitted,

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Entech Job No. 200693
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1.0 SUMMARY

Project Location

The project site lies in portions of Sections 21, 22, 27 and 28, Township 12 South, Range 64 West of the 6th Principal Meridian, in El Paso County, Colorado. The site is located approximately 4 miles northeast of Falcon, Colorado, northwest of Highway 24, east of Eastonville Road and west of Elbert Road.

Project Description

Total acreage involved in the project is 764.8 acres. The proposed site development consists of low density to high density residential housing, a church in the northwestern portion of the site, an elementary school, commercial lots, and detention ponds with parks and open space areas. The development will utilize municipal water and sewer.

Scope of Report

This report presents the results of our preliminary geologic evaluation and treatment of engineering geologic hazards for the proposed Grandview Reserve.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of artificial fill, potentially expansive soils, unstable slopes, floodplain, seasonal and potentially seasonal shallow groundwater, and areas of ponded water. Based on the proposed development plan, it appears that these areas will have some minor impacts on the development. These conditions will be discussed in greater detail in the report.

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

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in portions of Sections 21, 22, 27 and 28, Township 12 South, Range 64 West of the 6th Principal Meridian, of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 4 miles northeast of Falcon, Colorado, northwest of Highway 24, east of Eastonville Road and west of Elbert Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site consists of gentle areas to rolling hills that vary from gradually to moderately sloping generally to the southeast. Steep slopes are located along some of the drainages in the eastern portions of the site. The drainages on site flow in southeasterly directions through the site. Water was observed flowing in the drainage in the northeast portion of the site, however, no water was observed flowing in the other drainages. Water was observed ponded behind an earthen dam in the southeastern portion of the site at the time of this investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily field grasses and weeds. Site photographs, taken December 13, 2018, are included in Appendix A.

Total acreage involved in the proposed development is 764.8 acres. The proposed site development consists of low to high density residential housing, two institutional sites, commercial lots, and detention ponds with parks and open space areas. The development will utilize central sewer and water through local districts. The proposed Site Sketch Plan/Testing Location Map is presented in Figure 3.

3.0 SCOPE OF THE REPORT

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.
- The site will be evaluated for individual on-site wastewater treatment systems in accordance with El Paso Land Development Code.

4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Geology/Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on December 13, 2018.

Ten (10) test borings and eight (8) tactile test pits were performed on the site to determine soil and bedrock characteristics and general suitability of the site for the proposed development. The locations of the test borings and test pits are indicated on the Site Plan/Testing Location Map, Figure 3. The Test Boring and Test Pit Logs are presented in Appendix B. Results of this testing will be discussed later in this report.

Laboratory testing was also performed on select soil samples to classify and determine the soils engineering characteristics. Laboratory tests included grain-size analysis, ASTM D-422 and FHA Swell Testing. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 18 miles to the west is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northerly direction (Reference 1). The rocks in the area of the site are sedimentary in nature

and typically Tertiary to Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual soils, man-made, sheetwash deposits, eolian sands, and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. The alluvial soils were deposited by water in the drainages on the site and as stream terrace deposits and sheetwash deposits. Eolian sands are deposited by the action of prevailing winds. Man-made soils exist as earthen dams and berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has mapped three soil types on the site (Figure 4). In general, they vary from loam, loamy sands, and sandy loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
8	Blakeland Loamy Sands, 1-9% slopes
19	Columbine Gravelly Sandy Loam, 0 to 3% slopes
83	Stapleton Sandy Loam, 3 to 8% slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to typically have rapid permeabilities. The majority of the soils have been described as good for urban development. Limitations include the hazard of flooding on Soil Type No. 19 in some areas. Some areas of Soil Type 19 have mapped in the floodplain zones that are designated as open space. Roads may need to be designed to minimize frost-heave potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have moderate erosion hazards.

5.3 Site Stratigraphy

The Falcon Quadrangle Geology Map showing the site is presented in Figure 5 (Reference 4). The Geology Map prepared for the site is presented in Figure 6. Seven mappable units were identified on this site which are described as follows:

- Qaf Recent Artificial Fill of Holocene Age:** These are man-made fill deposits associated with earthen dams and berms on-site.
- Qal Recent Alluvium of Late Holocene Age:** These materials consist of water deposited sands located along some of the minor drainages across the site.
- Qp Piney Creek Alluvium (Alluvium One and Two) of Early Holocene Age:** These materials consist of low stream-terrace deposits above the current stream channel. The materials typically consist of silty to well graded sand.
- Qb Broadway Alluvium (Alluvium Three) of Late Pleistocene Age:** These materials consist of middle steam terrace deposits. The materials typically consist of silty to clayey gravelly sands.
- Qsw Sheetwash Deposits of Holocene to Late Pleistocene Age:** These materials consist of silty to clayey sands with some cobbles. The material was deposited by the action of sheetwash.
- Qes Eolian Sand of Pleistocene Age:** These materials consist of windblown sand deposits. The materials typically consist of light brown, well-sorted silty sands. The windblown sand deposits tend to have low density and low bearing characteristics.
- Qc/Tkd Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:** The Dawson Formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty to clayey sands, sandy clays and sandy silts.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Falcon Quadrangle* distributed by the Colorado Geological Survey in 2012 (Reference 4), and the *Geologic Map of the Denver 1^o x 2^o Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 5). The Test Pits were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the test borings and test pits can be grouped into four general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS). The test pit soils were also classified using the USDA Textural Soil Classification.

Soil Type 1 is well-graded, slightly silty to silty and clayey sand (SW, SM-SW, SM, SC, SC-SM-SW). This material was encountered in all of the test borings and in six of the test pits. The sand was encountered at the existing surface and extended to depths ranging from 1 to 9 feet in the test borings and 2 feet to the termination of the test pits (8 feet). These soils were encountered at medium dense to dense states and at dry to very moist conditions. Samples tested had 5 to 40 percent of the soil size particles passing the No. 200 Sieve. Atterberg Limits Testing resulted in a liquid limit of 17 and a plastic index of 5. FHA Swell Testing on samples of the sand resulted in expansion pressures of 110 and 130 psf, indicating low expansion potential.

Soil Type 2 is a sandy clay (CL). This material was encountered in two of the test borings and four of the test pits. The clays were encountered at depths ranging from the existing surface grade in the test pits and at 9 feet in the test borings and extended to depths up to 9 feet in the test pits and 14 feet in the test borings. The clays were encountered at very stiff consistencies and moist conditions. The samples tested had 74 to 85 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits Testing resulted in a liquid limit of 44 and a plastic index of 22. FHA Swell Testing resulted in an expansion pressure of 1020 psf, indicating moderate expansion potential.

Soil Type 3 is a silty to clayey sandstone and very clayey sandstone (SM, SC). This material was encountered nine of the test borings and in two of the test pits. The sandstone was encountered at depths ranging from 1 to 14 feet bgs and extended to depths ranging from 14 to 19 feet or to the termination of the borings and pits (6 to 20 feet). The sandstone was encountered at very dense states and moist to wet conditions. Samples tested had 13 to 42 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits Testing resulted in a liquid limit of 28 and a plastic index of 15.

Soil Type 4 is a sandy to very sandy claystone (CL). This material was encountered six of the test borings and Test Pit No. 6. The claystone was encountered at depths ranging from 9 to 19

feet in the test borings and 2 feet in the test pit and extended to depths ranging from 14 feet to the depths explored (5 to 20 feet). The claystone was encountered at hard consistencies and moist conditions. Samples tested had 59 to 72 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing resulted in a liquid limit of 35 and a plastic index of 21. FHA Swell Testing resulted in expansion pressures 950 and 1580 psf. Swell/Consolidation Testing resulted in a volume change of 0.7 percent. These results indicate the claystone exhibits low to high expansion potential.

The Test Boring and Test Pit Logs are presented in Appendix B. Laboratory Test Results are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1. Bedrock depths are summarized in Table 2.

5.5 Groundwater

Groundwater was encountered in seven of the test borings at depths ranging from 4.5 to 19 feet. Additionally, groundwater was encountered in Test Pit Nos. 2, 3 and 7 at 7.5, 8.5 and 6.5 feet respectively. Groundwater was not encountered in the remaining test borings or test pits which were drilled/excavated to depths ranging from 5 to 20 feet. Groundwater depths are summarized in Table 2. Areas of seasonal and potentially seasonal shallow groundwater have been mapped in the drainages on-site. These areas are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

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

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

Detailed mapping has been performed on this site to produce an Geology/Engineering Geology Map (Figure 6). This map shows the location of various geologic conditions of which the developers should be cognizant during the planning, design and construction stages of the project. These hazards and the recommended mitigation techniques are as follows:

Artificial Fill

These are man-made fill deposits associated with earthen dams and berms on-site.

Mitigation: Berms were observed along Eastonville Road that can be avoided or easily removed or penetrated by foundations. The earthen dams lie within areas designated as open space and will be avoided by development. Should any uncontrolled fill be encountered beneath foundations, removal and recompaction at 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 will be required.

Loose or Collapsible Soils

Loose soils were not encountered in the test borings; however, the windblown sand deposits are known to have layers of lower density. Any loose or collapsible soils encountered beneath foundations or floor slabs will require mitigation.

Mitigation: Any loose or collapsible soils encountered beneath foundations or floor slabs should be overexcavated 2 to 3 feet, moisture-conditioned and recompacted. The soils should be recompacted to 95 percent of the soils maximum Modified Proctor Dry Density ASTM D-1557 at ± 2 percent of optimum moisture content. The reconditioned soils on this site should be observed and tested to verify adequate compaction. Areas requiring recompaction should be determined during the excavation observation.

Expansive Soils

Clays and claystone were encountered in some of the test borings and test pits excavated on-site that are potentially expansive. Expansive claystone is commonly encountered within the Dawson Formation. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These expansive soils, if encountered beneath foundations, can cause

differential movement in the structure foundation. These occurrences should be identified and mitigated on an individual basis.

Mitigation: Should expansive soils be encountered beneath the foundation, mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Slope Stability and Landslide Hazard

The majority of the slopes in the building areas on site are gently to moderately sloping and do not exhibit any past or potential unstable slopes or landslides. However, the steeply sloping areas along the drainage in the eastern portion of the site have been identified as unstable slopes. These areas are identified on the Geology/Engineering Geology Map, Figure 6. The recommendations for these areas are as follows:

- Unstable Slope Area

The area identified with this hazard is located in the northeastern portion of the site along a portion of a minor drainage where cut banks have created unstable slopes. Considerable care must be exercised in these areas not to create a condition which would tend to activate instability.

Mitigation: Building should be avoided in these areas. These areas are located in open space and will be avoided. Any structures or signs in these areas should be set back a minimum of 30 feet from the crest of these slopes. It appears there is sufficient room on the lots to avoid this hazard. Proper control of drainage at both the surface above the slope and the subsurface is extremely important. Areas of ponded water at the surface should be avoided. Utility trenches, basement excavations and other subsurface features should not be permitted to

become water traps which may promote saturation of the subsurface materials. Drainage should not be permitted over the potentially unstable slope but directed in a non-erosive manner away from the slope. Irrigation above these slopes should be kept to a minimum to prevent saturation of the subsurface soils. The use of xeriscape landscaping utilizing native plantings is recommended to reduce the need for irrigation.

Floodplain and Drainage Areas

Portions of the site associated with some of the drainages are mapped within a floodplain zones according to the FEMA Map No. 08041CO556G, dated December 7, 2018 (Figure 7, Reference 6). The floodplain areas have been designated as open space and/or can be avoided by construction. An area of ponded water exists in the floodplain that is designated as open space and will be avoided by development. Additionally, areas of seasonal and potentially seasonal shallow groundwater were observed across the site. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. These areas lie within the low-lying areas and minor drainages across the site. Water was observed in the drainage in the northeastern portion of the site, but was not observed in any of the other minor drainages at the time of our site investigation, however, water was observed ponded behind an earthen dam in the southeastern portion of the site. These areas can likely be avoided or properly mitigated by development. The floodplain should be avoided by construction unless site-specific floodplain determination and drainage studies are performed. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following precautions should be followed.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Some of the minor drainage swales can be avoided or regraded. The main drainage that bisects the site is designated as open space and will be avoided. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Finished floors must be located at least one foot above floodplain levels. Specific drainage studies and exact floodplain locations are beyond the scope of this report.

6.1 Relevance of Geologic Conditions to Land Use Planning

The proposed development consists of low density to high density residential housing, two institutional sites, commercial lots, and detention ponds with parks and open space areas. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the drainages on site that can be avoided or properly mitigated during construction on each lot. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices or avoidance.

The upper materials in the area are typically at medium dense to dense states. Areas of loose soils may be encountered that may require recompaction. The medium dense to dense granular soils encountered in the upper soil profiles of the test pits should provide good support for foundations. Loose soils, if encountered beneath foundations or slabs, will require removal of the upper 2 to 3 feet of material and recompaction. Any uncontrolled fill encountered beneath foundations will require complete removal and recompaction. Expansive soils, although sporadic, were encountered. Expansive clayey sandstone, claystone and associated clayey residual soils are common in the Dawson Formation, and may require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils or loose soils. Areas of artificial fill, if encountered beneath foundations will require penetration or recompaction. Areas containing arkosic sandstone will have high allowable bearing conditions. Expansive layers may also be encountered in the soil and bedrock on this site. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

Unstable slopes exist along portions of the drainage in the eastern portion of the site where the drainage has eroded cut banks. A 30-foot building setback is recommended from the crest of the unstable slopes. Additional reinforcement may be necessary in the foundation to account for additional pressures due to sloping conditions. Tie-beams and/or buttresses may be necessary, depending on site conditions and grading plans.

Areas of seasonal shallow groundwater and potentially seasonal shallow groundwater were encountered on site. Additionally, portions of the site have been mapped in floodplain zones. The floodplain areas are in the designated open space area and can be avoided by development. Water was observed ponded behind an earthen dam in the eastern portion of the site during our site investigation. This area lies in an area designated as open space and will be avoided by development. Due to the size of the lots and the proposed development, the majority of the areas mapped as seasonal or potentially seasonal shallow groundwater can be avoided by construction on the lots. Regrading can also mitigate some minor drainages on some of the lots. Structures should not block drainages. Any site grading should be done in such a manner as to not create areas of ponded water around structures. Finished floor levels must be a minimum of one foot above the floodplain level. Specific floodplain locations and drainage studies are beyond the scope of this report.

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

7.0 EMBANKMENT CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed embankment. Groundwater may be encountered in cuts for the proposed detention ponds across the site. If excavations encroach on the groundwater level unstable soil conditions may be encountered.

Any areas to receive fill should have all topsoil, organic material or debris removed. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1 or flatter on the upstream faces or 2.5:1 or flatter on the downstream face. The subgrade should be scarified and moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557, prior to placing new fill. Areas receiving fill may require stabilization with rock or fabric if shallow groundwater conditions are encountered.

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of its maximum Modified Proctor Dry Density, ASTM D-1557. These materials should be placed at a moisture content conducive to compaction, usually 0 to $\pm 2\%$ of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any import materials prior to placing or hauling them to the site.

8.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 7), the area is mapped with upland deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 8), areas of the site are mapped with upland deposits: probable aggregate resource (U4). According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 9), the area of the site has been mapped with some areas as "Good" and some as "Little or No Potential" for industrial minerals depending on geologic deposits. Considering the abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 9), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as "Poor" for coal resources. No active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site (Reference 9).

The site has been mapped as "Fair" for oil and gas resources (Reference 9). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be

commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

9.0 EROSION CONTROL

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

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

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

the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

10.0 CLOSURE

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

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Individual investigations for building sites and septic systems will be required prior to construction. Construction and design personnel should be made familiar with the contents of this report. Reporting such discrepancies to Entech Engineering, Inc. soon after they are discovered would be greatly appreciated and could possibly help avoid construction and development problems.

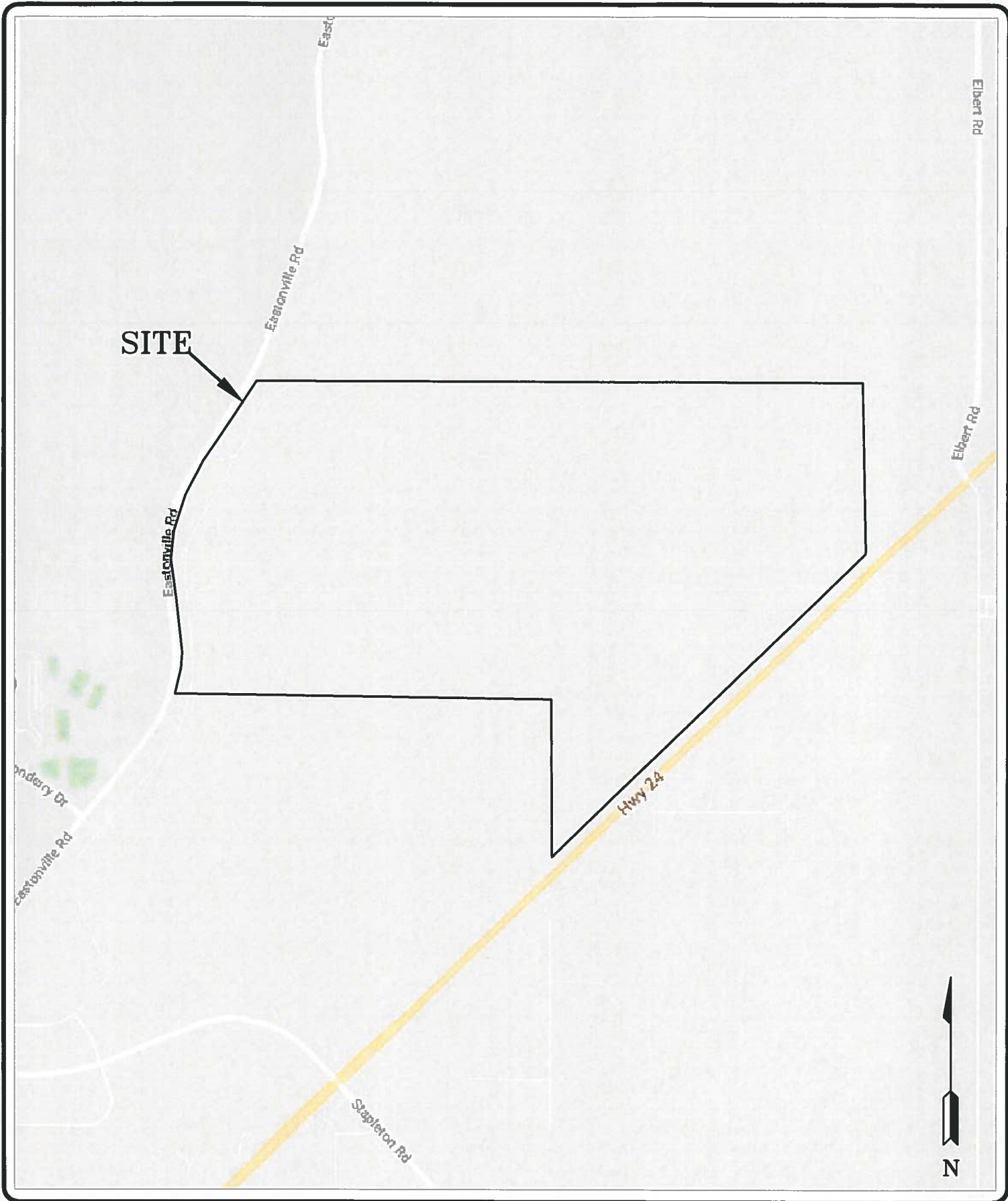
This report has been prepared for 4 Site Investments, LLC for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

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

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FIGURES



ENTECH
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VICINITY MAP
 GRANDVIEW RESERVE
 EASTONVILLE ROAD
 EL PASO COUNTY, CO.
 FOR: 4 SITE INVESTMETNS, LLC

DRAWN:
 LLL

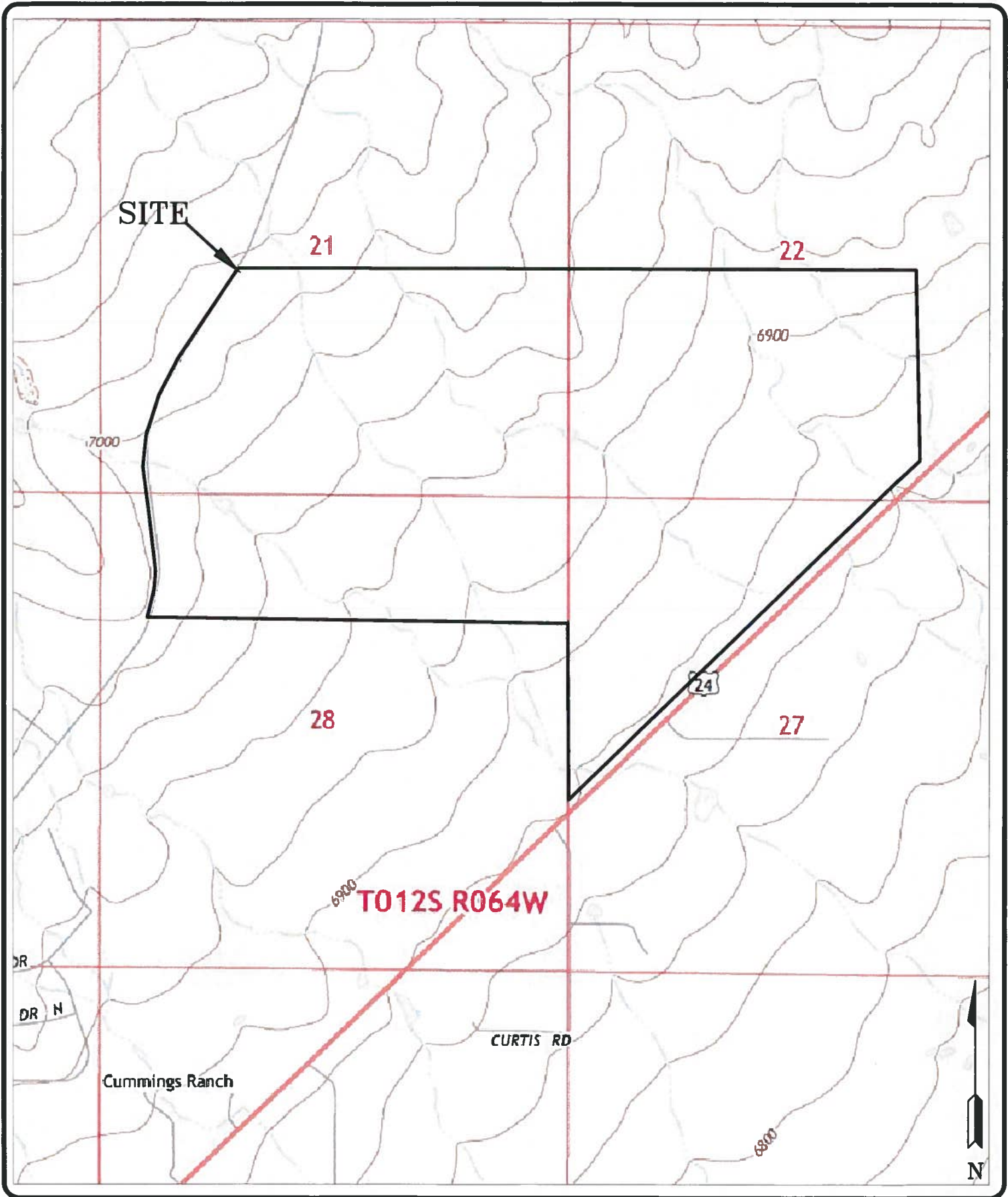
DATE:
 4/1/20

CHECKED:

DATE:

JOB NO.:
 200693

FIG NO.:
 1



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

USGS MAP
 GRANDVIEW RESERVE
 EASTONVILLE ROAD
 EL PASO COUNTY, CO.
 FOR: 4 SITE INVESTMETNS, LLC

DRAWN:
 LLL

DATE:
 4/1/20

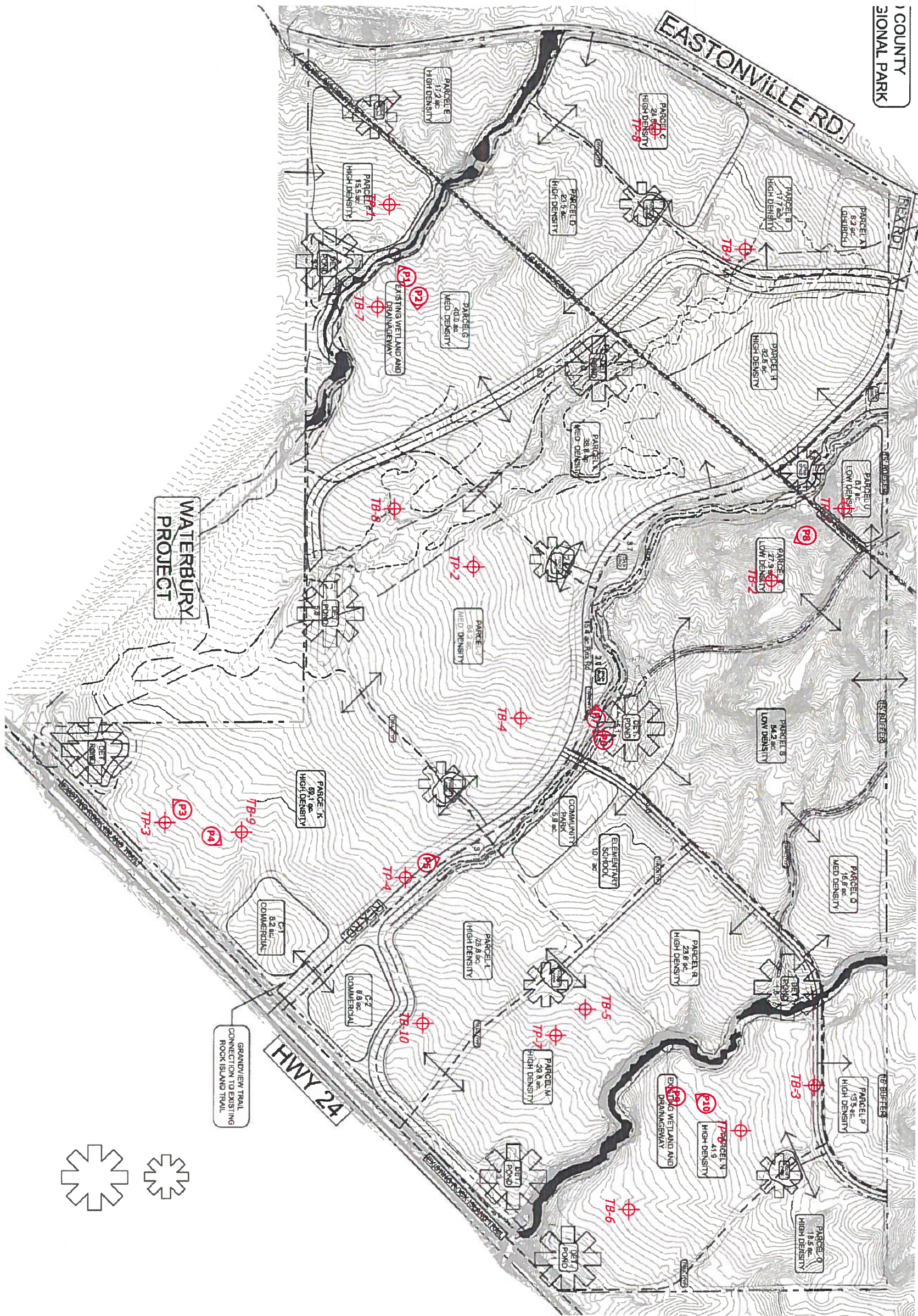
CHECKED:

DATE:

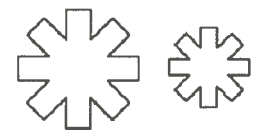
JOB NO.:
 200693

FIG NO.:
 2

EL PASO COUNTY
SIGNAL PARK




- ⊕ TB - approximate test boring location
- ⊕ TP - approximate test pit location
- ⊕ - approximate location and direction of photograph



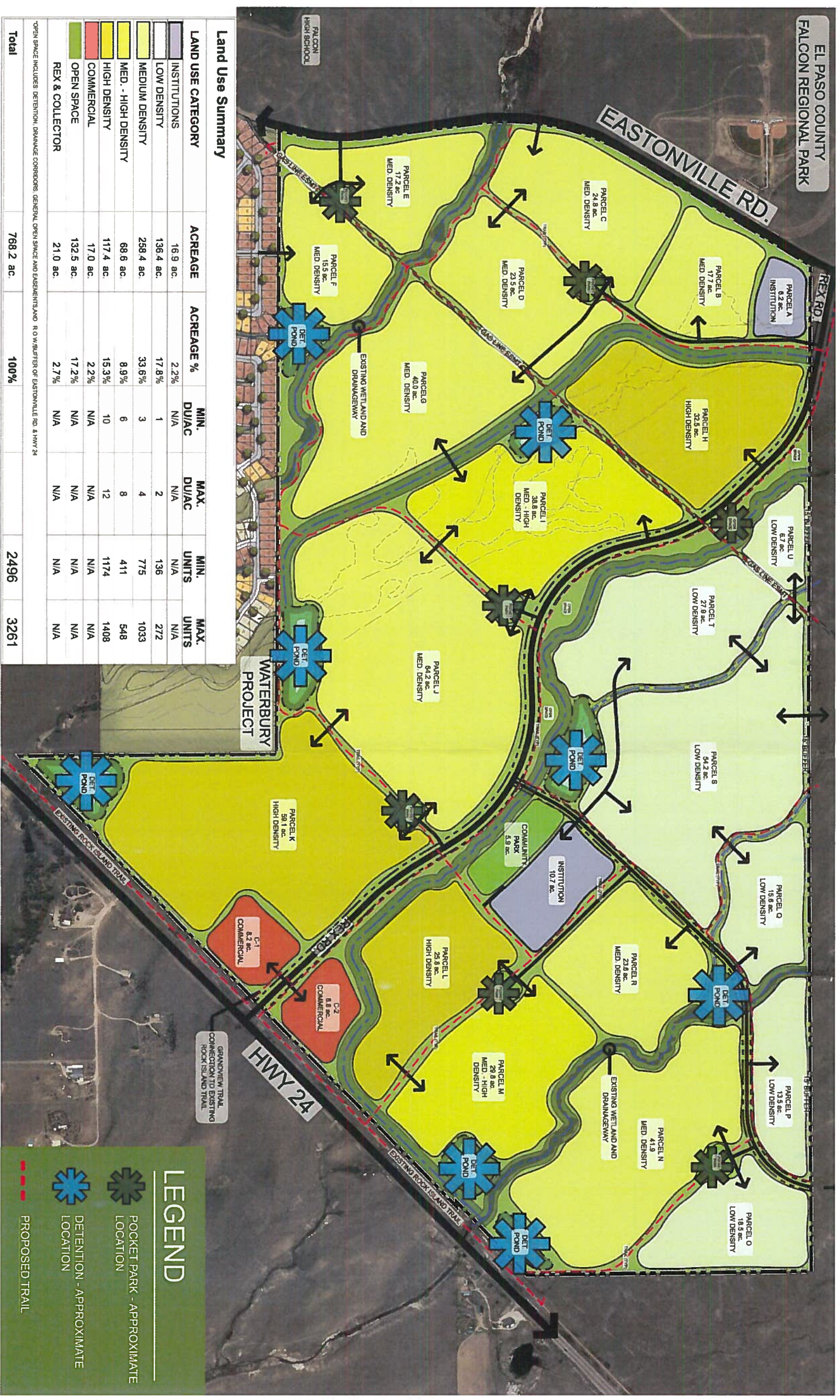
DRAWN	LLM/MLC
CHECKED	
DATE	4/1/20
SCALE	AS SHOWN
JOB NO.	2006993
FIGURE NO.	3

SITE PLAN/TESTING LOCATION MAP
GRANDVIEW RESERVE
EASTONVILLE ROAD
EL PASO COUNTY, CO.
FOR: 4 SITE INVESTMETNS, LLC



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

REVISION BY	DATE



Land Use Summary

LAND USE CATEGORY	ACREAGE	ACREAGE %	MIN. DU/AC	MAX. DU/AC	MIN. UNITS	MAX. UNITS
INSTITUTIONS	16.9 ac.	2.2%	N/A	N/A	N/A	N/A
LOW DENSITY	136.4 ac.	17.8%	1	2	136	272
MEDIUM DENSITY	258.4 ac.	33.6%	3	4	775	1033
MED. - HIGH DENSITY	68.8 ac.	8.9%	6	8	411	548
HIGH DENSITY	117.4 ac.	15.3%	10	12	1174	1408
COMMERCIAL	17.0 ac.	2.2%	N/A	N/A	N/A	N/A
OPEN SPACE	132.5 ac.	17.2%	N/A	N/A	N/A	N/A
REX & COLLECTOR	21.0 ac.	2.7%	N/A	N/A	N/A	N/A
Total	768.2 ac.	100%			2496	3261

*OPEN SPACE INCLUDES DETENTION, DRAINAGE CORRIDORS, GENERAL OPEN SPACE AND EXISTING LAND. R.O.W./BUFFER OF EASTONVILLE RD. & HWY 24



SKETCH PLAN - DRAFT 4-09-20
GRANDVIEW RESERVE
 FALCON, CO



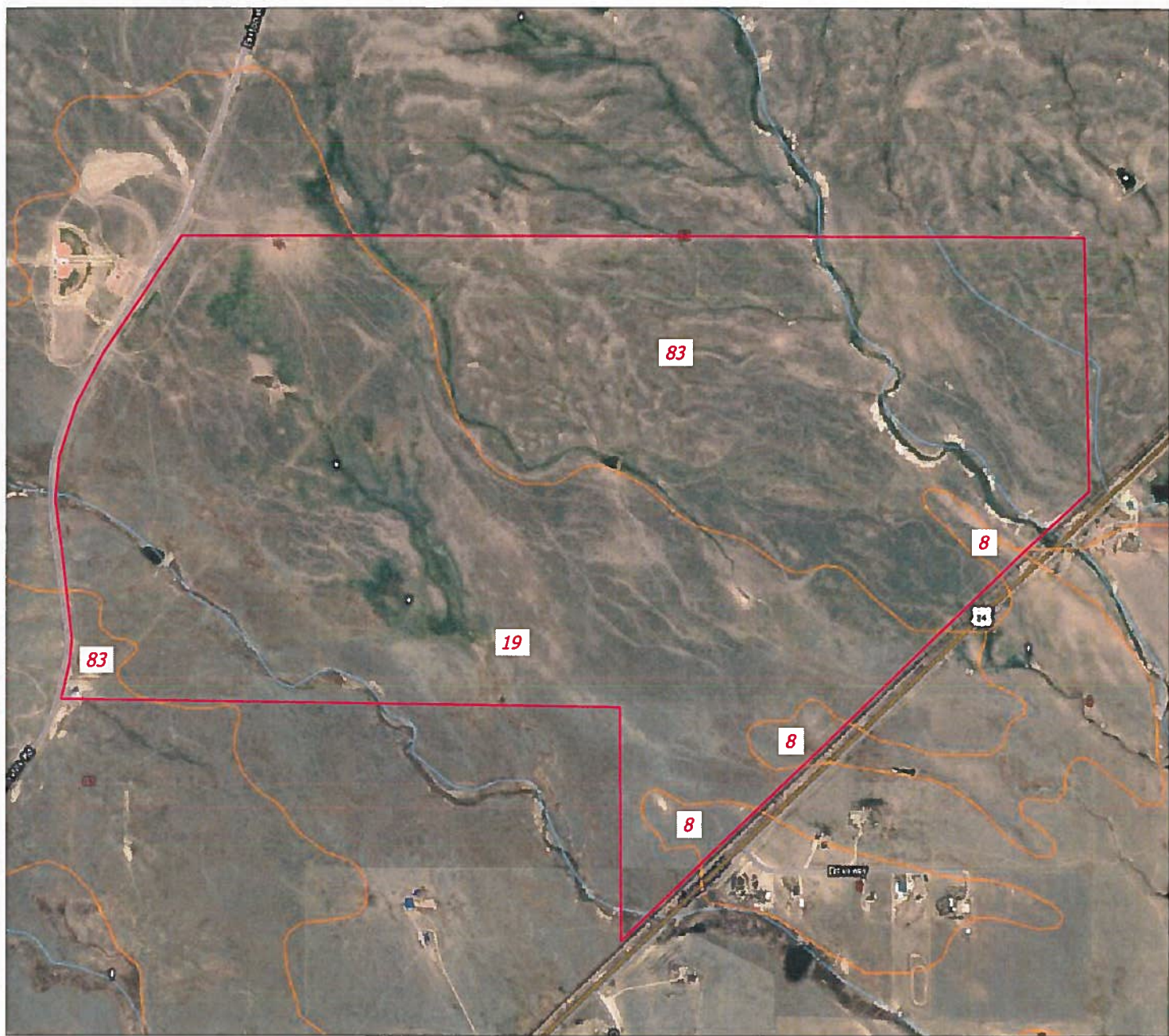
SKETCH PLAN - DRAFT 4-09-20
GRANDVIEW RESERVE
 FALCON, CO

REVISION	BY

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

SKETCH PLAN
 GRANDVIEW RESERVE
 EASTONVILLE ROAD
 EL PASO COUNTY, CO.
 FOR: 4 SITE INVESTMETNS, LLC

DATE	SCALE	BY	CHECKED
4/1/20	AS SHOWN	AS SHOWN	AS SHOWN
2009/5/3	AS SHOWN	AS SHOWN	AS SHOWN
3A			



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 COLORADO SPRINGS, CO. 80907 (719) 531-5599

SOIL SURVEY MAP
 GRANDVIEW RESERVE
 EASTONVILLE ROAD
 EL PASO COUNTY, CO.
 FOR: 4 SITE INVESTMETNS, LLC

DRAWN:
 LLL

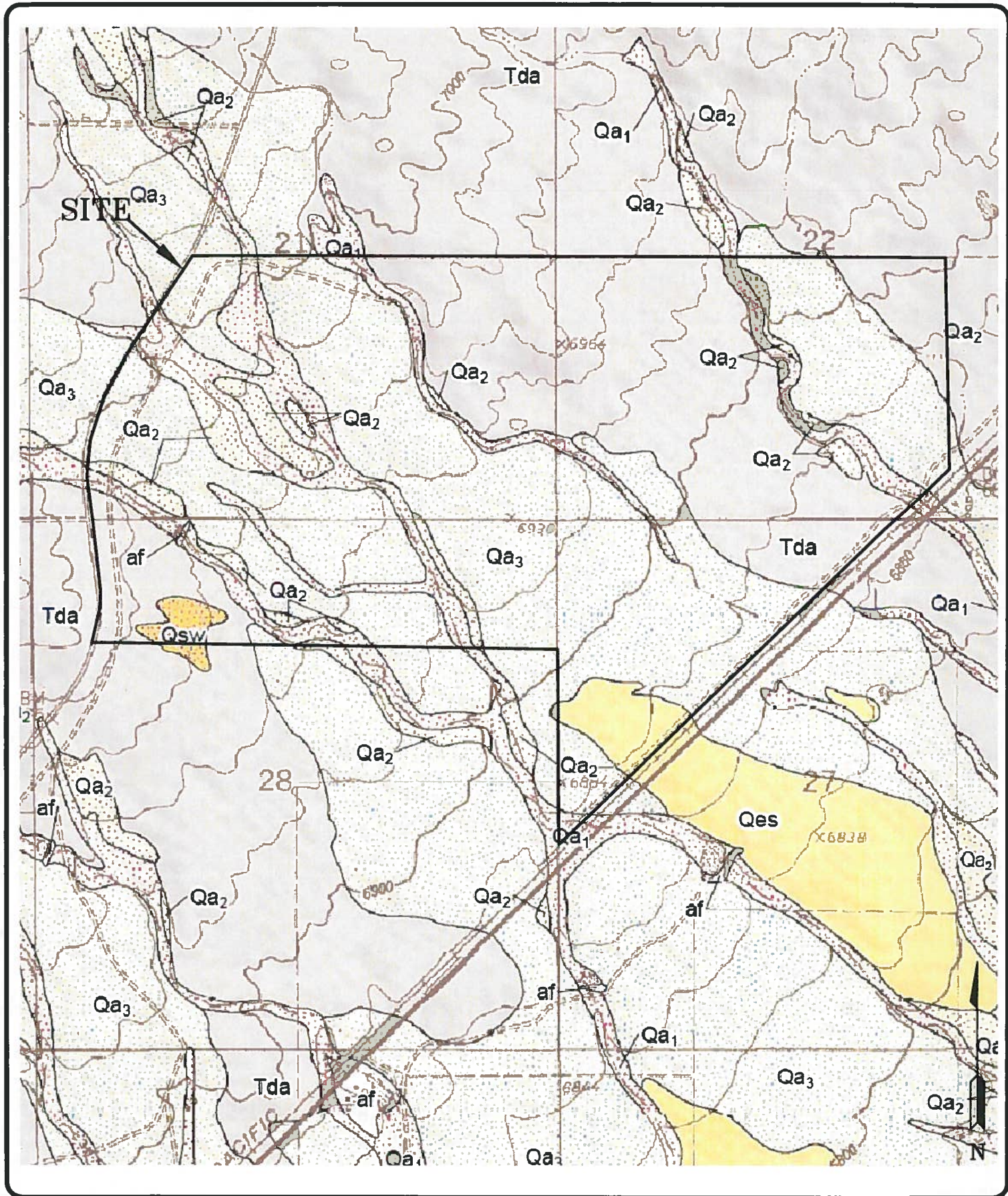
DATE:
 4/1/20

CHECKED:

DATE:

JOB NO.:
 200693

FIG NO.:
 4



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 COLORADO SPRINGS, CO. 80907 (719) 531-3599

FALCON QUADRANGLE GEOLOGIC MAP
GRANDVIEW RESERVE
EASTONVILLE ROAD
EL PASO COUNTY, CO.
FOR: 4 SITE INVESTMETNS, LLC

DRAWN:
 LLL

DATE:
 4/1/20

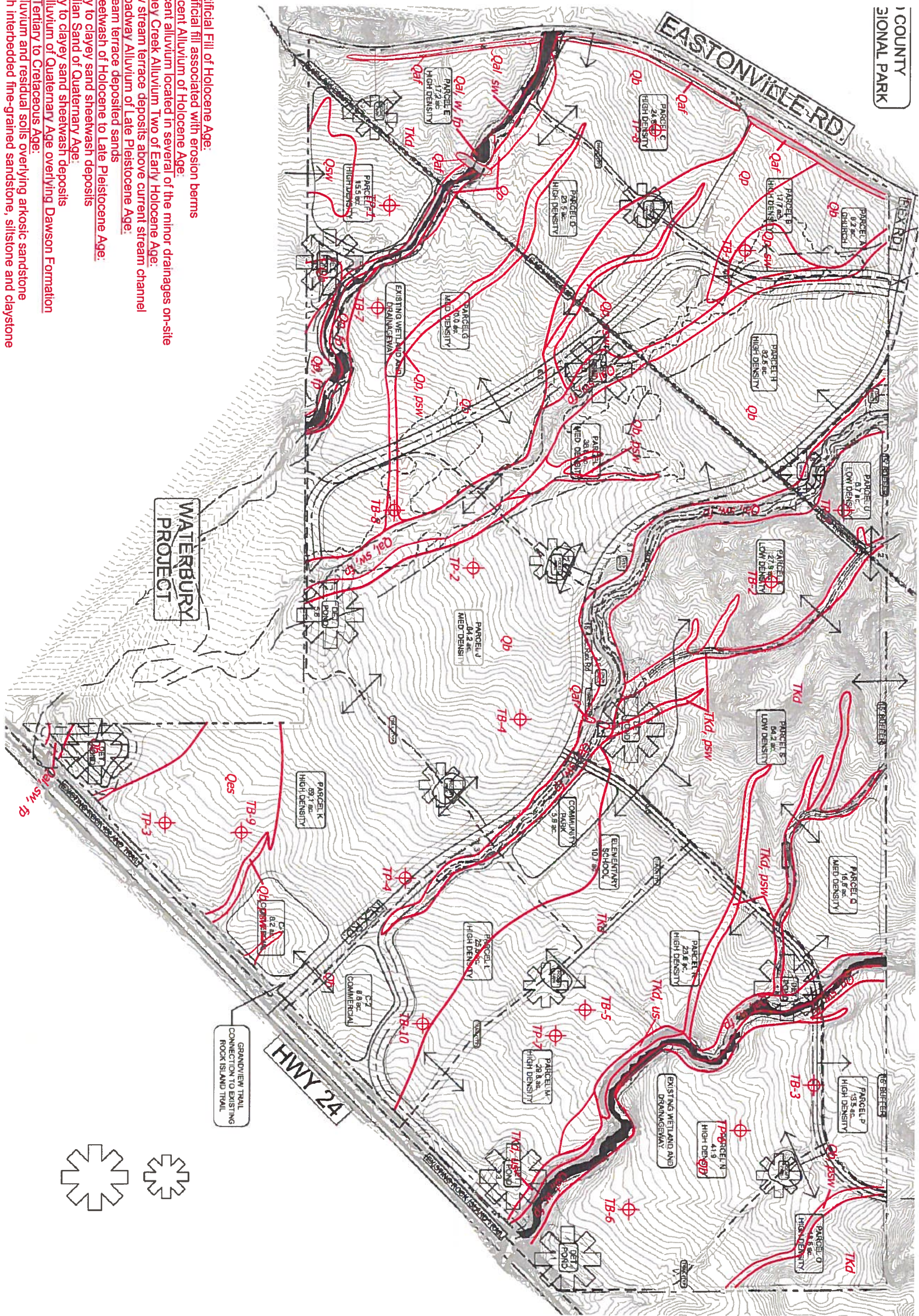
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DATE:

JOB NO.:
 200693

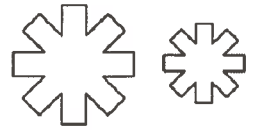
FIG NO.:
 5

EL PASO COUNTY
SIGNAL PARK



WATERBURY PROJECT

- LEGEND:**
- Qaf - Artificial Fill of Holocene Age: artificial fill associated with erosion berms
 - Qal - Recent Alluvium of Holocene Age: recent alluvium located in several of the minor drainages on-site
 - Qp - Piney Creek Alluvium Two of Early Holocene Age: low stream terrace deposits above current stream channel
 - Qb - Broadway Alluvium of Late Pleistocene Age: stream terrace deposited sands
 - Qsw - Sheetwash of Holocene to Late Pleistocene Age: silty to clayey sand sheetwash deposits
 - Qes - Eolian Sand of Quaternary Age: silty to clayey sand sheetwash deposits
 - Qc/TKda - Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age: colluvium and residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone
 - fp - floodplain
 - us - unstable slope
 - psw - potentially seasonal shallow groundwater area
 - sw - seasonal shallow groundwater area
 - w - flowing water
 - - approximate test boring and pit locations



DATE	4/1/20
SCALE	AS SHOWN
JOB NO.	2000693
FIGURE NO.	6

GEOLOGY/ENGINEERING GEOLOGY MAP
GRANDVIEW RESERVE
EASTONVILLE ROAD
EL PASO COUNTY, CO.
FOR: 4 SITE INVESTMENTS, LLC

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

REVISION BY	

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the mean-surface elevation of the 1% annual chance flood.

ZONE A
No Base Flood Elevations determined.

ZONE AE
Base Flood Elevations determined.

ZONE AH
Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO
Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, vehicles also determined.

ZONE AR
Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently determined. Zone AR indicates that the flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99
Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V
Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE
Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X
Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X
Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D
Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 (E.L. 987)
Base Flood Elevation line and value; elevation in feet; Base Flood Elevation value where uniform within zone; elevation in feet

Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A A
Cross section line

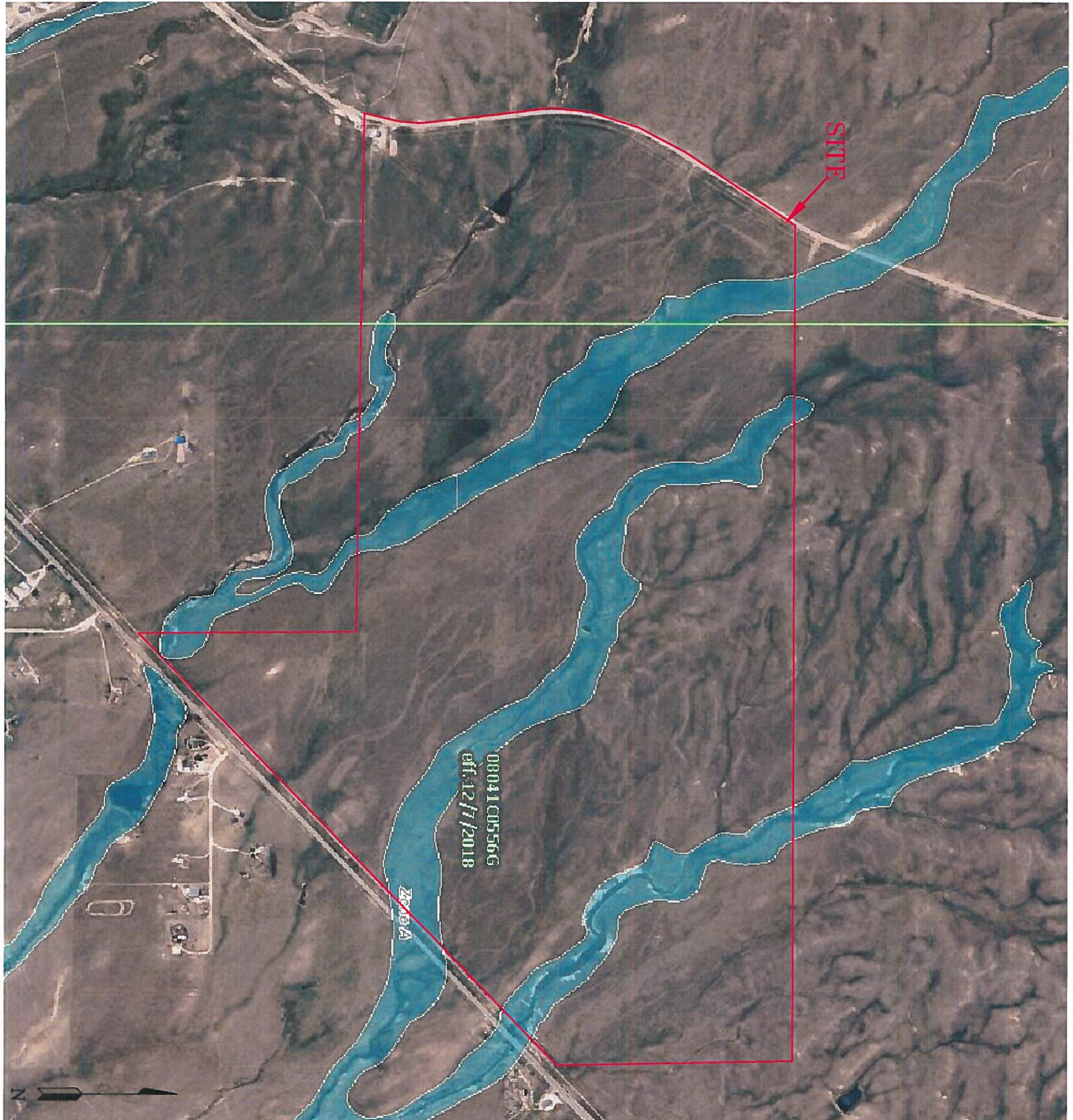
29 29
Transect line

97° 07' 30.00"
32° 22' 30.00"
47gsmN
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
2000-meter Universal Transverse Mercator grid ticks, zone 13

6000000 FT
5000-foot grid ticks: Colorado State Plane coordinate system, central zone (GPRZONE 0502), Lambert Conformal Conic Projection
Bench mark (see explanation in Notes to Users section of this Fifth panel)
DX5510 X
River Mile

M1.5
MAP REPOSITORIES
Refer to Map Repositories tab on Map Index
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.
For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

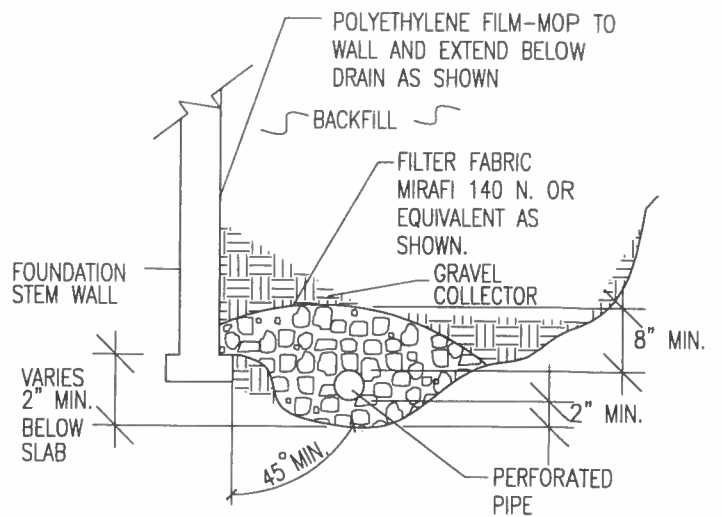
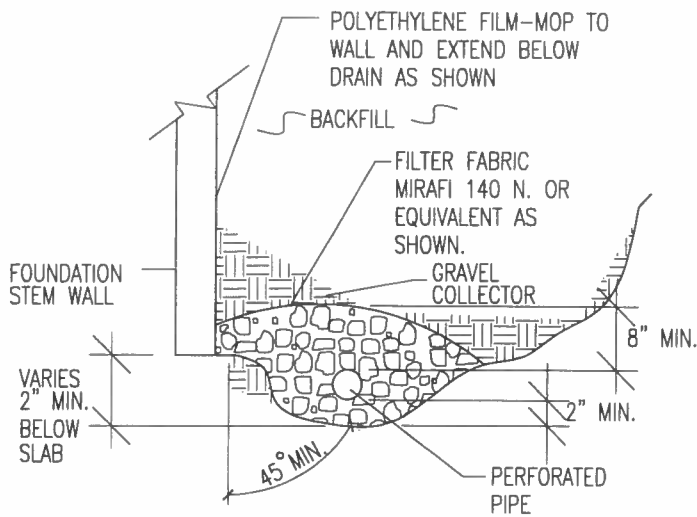


REVISION	BY

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FLOODPLAIN MAP
GRANDVIEW RESERVE
EASTONVILLE ROAD
EL PASO COUNTY, CO.
FOR: 4 SITE INVESTMETNS, LLC

DATE	BY	SCALE
4/1/20	AS SHOWN	AS SHOWN
200983	200983	200983
7	7	7



NOTES:

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

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

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

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

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

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



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

PERIMETER DRAIN DETAIL

DRAWN:

DATE:

DESIGNED:

CHECKED:

D S

LLL

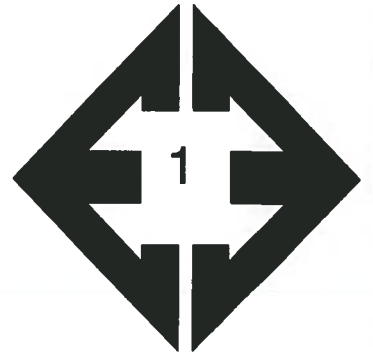
JOB NO.:

200693

FIG NO.:

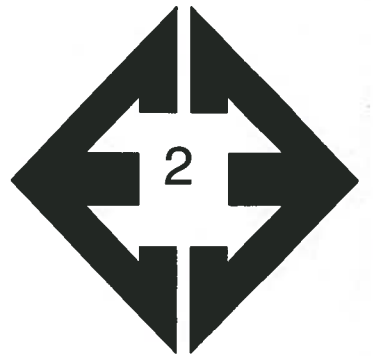
8

APPENDIX A: Site Photographs



Looking west from the southwestern portion of the site.

December 13, 2018



Looking northeast from the southwestern portion of the site.

December 13, 2018



**Looking southwest
from the southeastern
portion of the site.**

December 13, 2018



**Looking northeast
from the southeastern
portion of the site.**

December 13, 2018



**Looking northwest
along drainage in
eastern portion of the
site.**

December 13, 2018



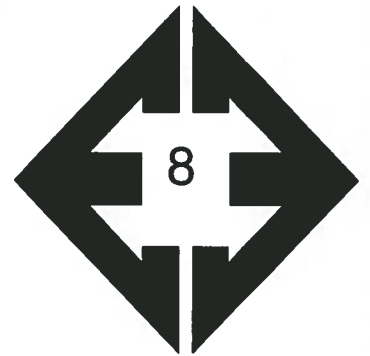
**Looking southwest
along man-made dam
in the central portion
of the site.**

December 13, 2018



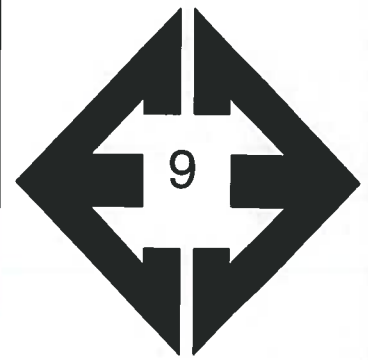
Looking west from the central portion of the site.

December 13, 2018



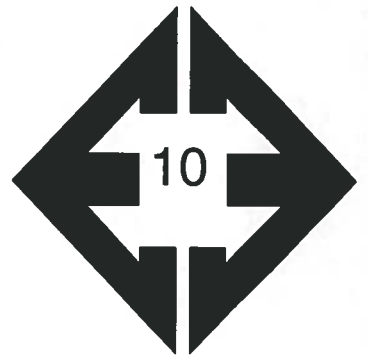
Looking southeast from the northwestern portion of the site.

December 13, 2018



Looking west from the northeastern portion of the site.

December 13, 2018



Looking northeast from the northeastern portion of the site.

December 13, 2018

**APPENDIX B: Test Boring and Test Pit Logs, and Summary of
Laboratory Testing Results, Entech Job No. 181951**

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT 4 SITE INVESTMENTS, LLC
 PROJECT GRANDVIEW RESERVE
 JOB NO. 181851

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/CONSOL (%)	USDA SOIL TYPE	UNIFIED CLASS.	SOIL DESCRIPTION
1	TP-2	2-3			5.8						2A	SM-SW	SAND, SLIGHTLY SILTY
1	TP-3	2-3			6.5						2A	SM-SW	SAND, SLIGHTLY SILTY
1	TP-3	8-9			18.4						3A	SC	SAND, CLAYEY
1	TP-4	5-6			4.9						1	SW	SAND
1	TP-7	5-6			17.5						2A	SM	SAND, SILTY
1	3	2-3			23.3							SM	SAND, SILTY
1	6	5			20.9							SM	SAND, SILTY
1	1	5			12.1				130			SM	SAND, SILTY
1	4	2-3			7.1							SM-SW	SAND, SLIGHTLY SILTY
1	5	5			9.9	17	5	0.02				SC-SM-SW	SAND, SLIGHTLY SILTY, CLAYEY
1	8	5			19.2							SM	SAND, SILTY
1	9	5			39.8				110			SM	SAND, VERY SILTY
2	TP-8	5-6			84.8				1020		4A	CL	CLAY, SANDY
2	10	10			73.6	44	22	<0.01				CL	CLAY, SANDY
3	TP-1	4-5			16.2						4A	SM	SANDSTONE, SILTY
3	TP-5	4-5			42.3						4A	SC	SANDSTONE, VERY CLAYEY
3	3	10			15.2							SM	SANDSTONE, SILTY
3	6	20			35.8							SC	SANDSTONE, CLAYEY
3	2	2-3			14.0	28	15	<0.01				SC	SANDSTONE, CLAYEY
3	4	15			12.9							SM	SANDSTONE, CLAYEY
3	7	2-3			14.4							SM	SANDSTONE, SILTY
4	3	15	12.8	112.7						0.7%		CL	CLAYSTONE, SILTY
4	TP-6	2-3			61.6				950		4A	CL	CLAYSTONE, SANDY
4	9	15			71.9				1580			CL	CLAYSTONE, SANDY
4	1	10			59.0							CL	CLAYSTONE, VERY SANDY
4	2	10			62.3	35	21	0.00				CL	CLAYSTONE, SANDY

Table 2: Summary of Depths to Bedrock and Groundwater

Test No.	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
TB-1	9	6
TB-2	1	12.5
TB-3	8	>20
TB-4	9	11.5
TB-5	9	13
TB-6	8	>20
TB-7	1	8
TB-8	14	4.5
TB-9	9	>15
TB-10	14	19
TP-1	4	>6
TP-2	>8	7.5
TP-3	>9	8.5
TP-4	>8	>8
TP-5	4	>6
TP-6	2	>5
TP-7	>8	6.5
TP-8	>8	>8

Table 3: Summary Tactile Test Pit Results

Test Pit No.	USDA Soil Type	LTAR Value	Depth to Bedrock (ft.)	Depth to Seasonally Occurring Groundwater (ft.)
1	4A*	0.15*	4*	N/A
2	2A	0.60	N/A	7.5
3	2A	0.60	N/A	8.5
4	2A	0.60	N/A	N/A
5	4A*	0.15*	4*	N/A
6	4A*	0.15*	2*	N/A
7	4A*	0.15*	N/A	6.5
8	4A*	0.15*	N/A	N/A

*- Conditions that will require an engineered OWTS

APPENDIX B: Test Boring and Test Pit Logs

TEST BORING NO. 1
 DATE DRILLED 11/28/2018
 Job # 181951

TEST BORING NO. 2
 DATE DRILLED 11/28/2018
 CLIENT 4 SITE INVESTMENTS, LLC
 LOCATION GRANDVIEW RESERVE

REMARKS

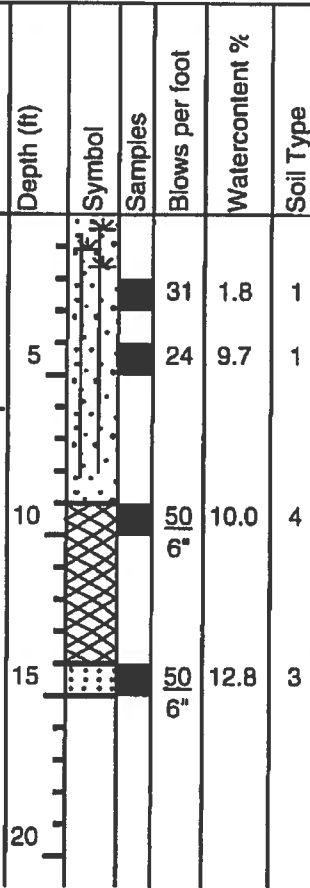
38° 59' 16" N,
 104° 33' 49" W

WATER @ 6', 11/30/18

2' TOPSOIL, SAND, SILTY FINE TO
 COARSE GRAINED, BROWN TO
 TAN, DENSE TO MEDIUM DENSE,
 DRY TO VERY MOIST
 MEDIUM DENSE, DRY TO MOIST

CLAYSTONE, VERY SANDY, BLUE
 GRAY, HARD, MOIST

SANDSTONE, CLAYEY, FINE TO
 COARSE GRAINED, GRAY, VERY
 DENSE, WET



REMARKS

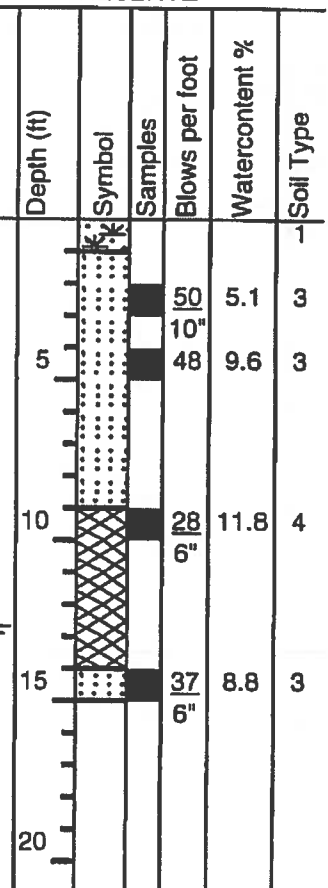
38° 59' 19" N,
 104° 33' 22" W

WATER @ 12.5', 11/30/18

1' TOPSOIL, SAND, SILTY, BROWN
 SANDSTONE, CLAYEY, FINE
 TO COARSE GRAINED, TAN, VERY
 DENSE TO DENSE, MOIST

CLAYSTONE, SANDY, GRAY
 BROWN, HARD, MOIST

SANDSTONE, SILTY, FINE TO
 COARSE GRAINED, BROWN,
 VERY DENSE, MOIST



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 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN: _____ DATE: _____ CHECKED: *[Signature]* DATE: 11/15/19

JOB NO. 181951

FIG NO. B-1

TEST BORING NO. 3
 DATE DRILLED 11/28/2018
 Job # 181951

TEST BORING NO. 4
 DATE DRILLED 11/28/2018
 CLIENT 4 SITE INVESTMENTS, LLC
 LOCATION GRANDVIEW RESERVE

REMARKS

DRY TO 20', 12/18/18

SAND, SILTY TO CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

VERY MOIST LENSES

SANDSTONE, SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST

CLAYSTONE, SANDY, BROWN TO GRAY BROWN, HARD, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Symbol]		25	4.7	1
5-10	[Symbol]		21	11.8	1
10-15	[Symbol]	50 6"	50 6"	8.8	3
15-20	[Symbol]	50 5"	50 5"	13.8	4
20-25	[Symbol]	50 5"	50 5"	12.3	4

REMARKS

38° 59' 04" N,
 104° 33' 09" W

WATER @ 11.5', 11/30/18

1' TOPSOIL, SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, DRY TO MOIST

SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST

CLAYSTONE, SANDY, BLUE GRAY, HARD, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Symbol]		23	2.2	1
5-10	[Symbol]		20	3.4	1
10-15	[Symbol]	50 6"	50 6"	10.5	3
15-20	[Symbol]	30 3"	30 3"	8.3	3
20-25	[Symbol]	40 7"	40 7"	12.3	4



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE 11/15/19

JOB NO:
 181951

FIG NO:
 B- 2

TEST BORING NO. 5
 DATE DRILLED 11/28/2018
 Job # 181951

TEST BORING NO. 6
 DATE DRILLED 11/28/2018
 CLIENT 4 SITE INVESTMENTS, LLC
 LOCATION GRANDVIEW RESERVE

REMARKS

38° 59' 05" N,
 104° 32' 44" W

WATER @ 13', 11/30/18

1" TOPSOIL, SAND, SLIGHTLY
 SILTY, SLIGHTLY CLAYEY, FINE
 TO COARSE GRAINED, GRAY
 BROWN, MEDIUM DENSE, MOIST

CLAY LENSES

SANDSTONE, SILTY, FINE TO
 COARSE GRAINED, GRAY BROWN,
 VERY DENSE, VERY MOIST

CLAYSTONE, SANDY, GRAY,
 HARD, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	(Dotted pattern)		25	12.7	1
5-10	(Dotted pattern)		20	7.9	1
10-15	(Dotted pattern)		50	12.3	3
15-20	(Dotted pattern)		50 11"	13.2	4

REMARKS

DRY TO 20', 12/18/18

6" TOPSOIL, SAND, SILTY, FINE
 TO COARSE GRAINED, BROWN,
 DENSE, DRY TO MOIST

SANDSTONE, CLAYEY, FINE TO
 MEDIUM GRAINED, BROWN,
 VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	(Dotted pattern)		34	0.7	1
5-10	(Dotted pattern)		31	3.9	1
10-15	(Dotted pattern)		50 7"	13.7	3
15-20	(Dotted pattern)		50 7"	10.9	3
20-25	(Dotted pattern)		50 3"	12.4	3



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 11/15/19

JOB NO:
 181951

FIG NO:
 B-3

TEST BORING NO. 7
 DATE DRILLED 11/28/2018
 Job # 181951

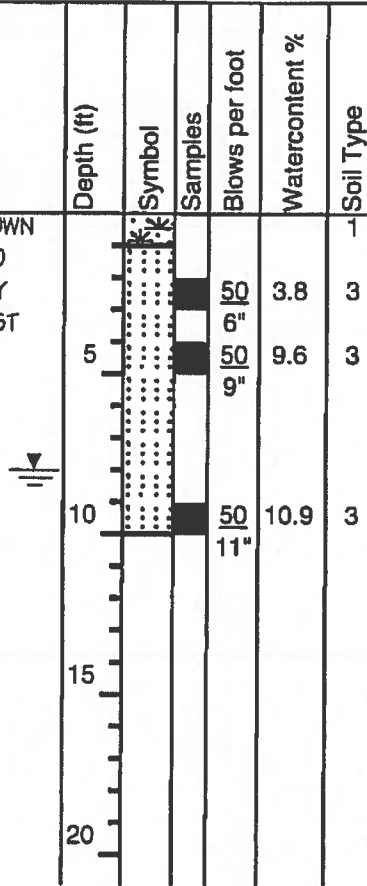
TEST BORING NO. 8
 DATE DRILLED 11/28/2018
 CLIENT 4 SITE INVESTMENTS, LLC
 LOCATION GRANDVIEW RESERVE

REMARKS

38° 58' 52" N,
 104° 33' 44" W

WATER @ 8', 11/30/18

1' TOPSOIL, SAND, SILTY, BROWN
 SANDSTONE, SILTY, FINE TO
 COARSE GRAINED, TAN, VERY
 DENSE, MOIST TO VERY MOIST



REMARKS

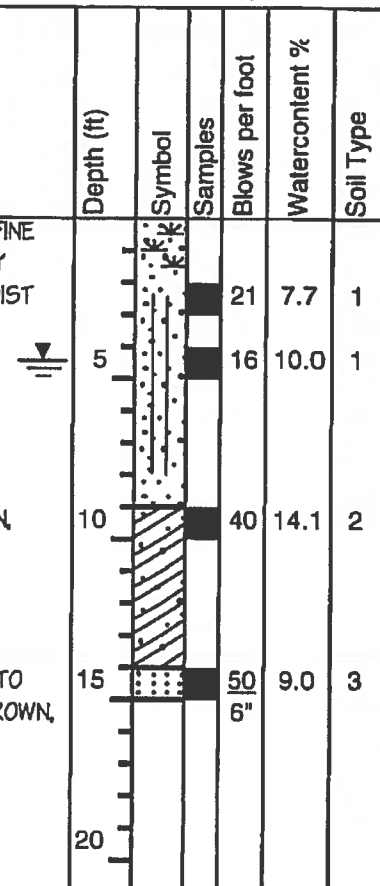
38° 58' 48" N,
 104° 33' 25" W

WATER @ 4.5', 11/30/18

1.5' TOPSOIL, SAND, SILTY, FINE
 TO COARSE GRAINED, GRAY
 BROWN, MEDIUM DENSE, MOIST
 TO VERY MOIST

CLAY, SANDY, GRAY BROWN,
 VERY STIFF, MOIST

SANDSTONE, CLAYEY, FINE TO
 COARSE GRAINED, GRAY BROWN,
 VERY DENSE, MOIST



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TEST BORING LOG

DRAWN

DATE

CHECKED

DATE

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 181951

FIG NO.
 B- 4

TEST BORING NO. 9
 DATE DRILLED 11/28/2018
 Job # 181951

TEST BORING NO. 10
 DATE DRILLED 11/28/2018
 CLIENT 4 SITE INVESTMENTS, LLC
 LOCATION GRANDVIEW RESERVE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
38° 58' 44" N, 104° 32' 59" W							38° 59' 05" N, 104° 32' 44" W						
DRY TO 15.5', 11/30/18							WATER @ 19', 11/30/18						
1' TOPSOIL, SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	0-1	Symbol 1	1	25	3.9	1	1' TOPSOIL, SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, DRY TO MOIST	0-1	Symbol 1	1	17	1.4	1
SAND, VERY SILTY, FINE GRAINED, GRAY BROWN, MEDIUM DENSE, VERY MOIST	1-5	Symbol 2	4	16	18.9	1		1-5	Symbol 2	4	18	3.7	1
CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST	5-10	Symbol 3	5	30 6"	12.1	4	CLAY, SANDY, DARK BROWN, VERY STIFF, MOIST	5-10	Symbol 3	5	30	19.9	2
	10-15	Symbol 4	5	50 10"	15.7	4	SANDSTONE, CLAYEY, FINE TO MEDIUM GRAINED, BLUE GRAY, VERY DENSE, MOIST	10-15	Symbol 4	5	32 6"	9.7	3
	15-20	Symbol 5	5					15-20	Symbol 5	5	37 4"	10.4	3



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TEST BORING LOG

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JOB NO. 181951
 FIG NO. B-5

TEST PIT NO. 1
 DATE EXCAVATED 12/13/2018
 Job # 181951

TEST PIT NO. 2
 DATE EXCAVATED 12/13/2018
 CLIENT 4 Site Investments, LLC
 LOCATION Grandview Reserve

REMARKS

Dry to 6', 12/13/18
 topsoil sandy loam, brown
 sandy loam, fine to coarse
 grained, tan
 weathered to formational
 silty sandstone, tan

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
1	[Symbol]		gr	w	2A
2	[Symbol]				
3	[Symbol]				
4	[Symbol]		ma		4A
5	[Symbol]				
6	[Symbol]				
7	[Symbol]				
8	[Symbol]				
9	[Symbol]				
10	[Symbol]				

REMARKS

Water at 7.5', 12/13/18
 topsoil sandy loam, brown
 gravelly sandy loam, fine to
 coarse grained, tan
 gravelly sand, fine to coarse
 grained, tan to gray
 *groundwater at 7.5'



Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
1	[Symbol]		gr	w	2A
2	[Symbol]				
3	[Symbol]				
4	[Symbol]				
5	[Symbol]		sg		1
6	[Symbol]				
7	[Symbol]				
8	[Symbol]				
9	[Symbol]				
10	[Symbol]				

Soil Structure Shape

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

Soil Structure Grade

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



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JOB NO:
 181951
 FIG NO:
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TEST PIT NO. 3
 DATE EXCAVATED 12/13/2018
 Job # 181951

TEST PIT NO. 4
 DATE EXCAVATED 12/13/2018
 CLIENT 4 Site Investments, LLC
 LOCATION Grandview Reserve

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Water at 8.5', 12/13/18							Dry to 8', 12/13/18						
topsoil sandy loam, brown	1	[Symbol]		gr	w	2A	topsoil sandy loam, brown	1	[Symbol]		gr	w	2A
gravelly sandy loam, fine to coarse grained, tan	2	[Symbol]					gravelly sandy loam, fine to coarse grained, tan	2	[Symbol]				
	3	[Symbol]						3	[Symbol]				
	4	[Symbol]					gravelly sand, fine to coarse grained, tan	4	[Symbol]		sg		1
gravelly sand, fine to coarse grained, tan	5	[Symbol]		sg		1		5	[Symbol]				
	6	[Symbol]						6	[Symbol]				
	7	[Symbol]						7	[Symbol]				
gravelly sandy clay loam, fine to coarse grained, fgray	8	[Symbol]		ma		3A		8	[Symbol]				
*groundwater at 8.5'	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

Soil Structure Shape

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

Soil Structure Grade

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



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JOB NO:
 181951

FIG NO:
 B-7

TEST PIT NO. 5
 DATE EXCAVATED 12/13/2018
 Job # 181951

TEST PIT NO. 6
 DATE EXCAVATED 12/13/2018
 CLIENT 4 Site Investments, LLC
 LOCATION Grandview Reserve

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Dry to 6', 12/13/18							Dry to 5', 12/13/18						
topsoil sandy clay loam, brown	1	[Symbol]		gr	w	3A	topsoil sandy loam, brown	1	[Symbol]		gr	w	2A
sandy clay loam, light brown	2	[Symbol]					sandy loam, fine to coarse grained, tan weathered to formational very sandy claystone, tan	2	[Symbol]		ma		4A
	3	[Symbol]						3	[Symbol]				
weathered to formational very clayey sandstone, light brown	4	[Symbol]		ma		4A		4	[Symbol]				
	5	[Symbol]						5	[Symbol]				
	6	[Symbol]						6	[Symbol]				
	7	[Symbol]						7	[Symbol]				
	8	[Symbol]						8	[Symbol]				
	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

Soil Structure Shape

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

Soil Structure Grade

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



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TEST PIT LOG

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JOB NO.: 181951
 FIG NO.: B-8

TEST PIT NO. 7
 DATE EXCAVATED 12/13/2018
 Job # 181951

TEST PIT NO. 8
 DATE EXCAVATED 12/13/2018
 CLIENT 4 Site Investments, LLC
 LOCATION Grandview Reserve

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Water at 6.5', 12/13/18							Dry to 8', 12/13/18						
topsoil sandy loam, brown	1			gr	w	2A	topsoil sandy clay loam, brown	1			gr	m	3
gravelly sandy loam, fine to coarse grained, tan	2						sandy clay loam, light brown	2					
	3							3					
	4							4					
	5						very sandy clay, light brown	5			gr	w	4A
sandy clay, gray	6			ma		4A		6					
*groundwater at 6.5'	7							7					
	8							8					
	9							9					
	10							10					

Soil Structure Shape

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

Soil Structure Grade

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



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FIG NO.: B-9

APPENDIX C: Soil Survey Descriptions

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 17, Sep 13, 2019

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

El Paso County Area, Colorado

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

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

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

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 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 17, Sep 13, 2019