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SOILS AND GEOLOGY STUDY
THE COMMONS AT FALCON FIELD
PARCEL NOS. 43070-00-001 AND 430720-00-015
WOODMEN ROAD AND HIGHWAY 24
EL PASO COUNTY, COLORADO

Prepared for:

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Respectfully Submitted,

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1 SUMMARY

Project Location

The project lies in a portion of the N½ of Section 7, Township 13 South, Range 64 West, in El Paso County, Colorado. The site is south of Woodmen Road and Highway 24, ½ mile east of Falcon, Colorado.

Project Description

Total acreage involved in the project is approximately 57 acres. The proposed development is to consist of mixed use/commercial and residential development, with three full-spectrum detention ponds, and other associated site improvements. We also understand that the development will utilize a central water and sewer systems.

Scope of Report

The report presents the results of our geologic investigation and treatment of engineering geologic hazard study. This report presents the results of our geologic reconnaissance, a review of available maps, aerial photographs and our conclusions with respect to the impacts of the geologic conditions on development.

Land Use and Engineering Geology

This site was found to have constraints associated with shallow groundwater, surface waters, a spring, and a floodplain which will impose constraints on development and land use. Shallow groundwater will result in constraints with respect to depth of excavation. Other geologic conditions include hydrocompaction, expansive soils, unstable slopes and artificial fill. These conditions will be discussed in greater detail in Section 6.0 of this report.

It is our opinion that the proposed development can be completed if the groundwater and surface drainage are properly mitigated. All recommendations are subject to the limitations discussed in the report. All recommendations are subject to the limitations discussed in the report. The report was revised to address El Paso County and Colorado Geological Survey (CGS) review comments.

2 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the N½ of Section 7, Township 13 South, Range 64 West, in El Paso County, Colorado. The site is located south of Woodmen Road and Highway 24, ½ mile east of Falcon, Colorado. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The topography of the site is gently sloping over the majority of the site with some steep slopes along a drainage in the central portion of the site. A small mound is located in the southwest portion of the site. The drainages on-site trend in southerly to southeasterly directions. Water was observed flowing in the two drainages in the central and eastern portions of the site at the time of this investigation. Evidence of periodic shallow water was observed in other areas of the site as well. The boundaries of the site are shown on the USGS map, Figure 2. Previous land uses have been agricultural, as the area has been primarily used as grazing and pasture land. The site contains primarily field grasses and weeds over the entire site with trees around the existing house and outbuildings in the eastern portion of the site. Site photographs taken January 14, 2021, and June 30, 2023 are included in Appendix A. The approximate locations and directions of the photographs are indicated on the Site Plan/Test Boring Location Plan, Figure 3.

Total acreage involved in the proposed development is approximately 57 acres. It is our understanding that the proposed development is to consist of mixed use/commercial and residential development, with three full-spectrum detention ponds, and other associated site improvements. Eight commercial and one-hundred and sixty-nine residential lots are proposed. The Site Plan is presented in Figure 3. The area will be serviced by central water and sewer systems. Preliminary overall grading plan prepared by Drexel Barrell & Company indicates cuts for the proposed detention ponds, and fill across the majority of the eastern portion of the site.

3 SCOPE OF THE REPORT

The scope of the report will include 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.

4 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of bedrock features and significant surficial deposits. The Natural Resources Conservation Service (Reference 1), previously the Soil Conservation Service (Reference 2) survey, was reviewed to evaluate the site.

The positions of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved field reconnaissance, measurements and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identifies pertinent geologic conditions affecting development. The mapping was performed by personnel of Entech Engineering, Inc. (Entech) on January 14, 2021, and June 30, 2023.

Seven (7) test borings were drilled by Entech as a part of this investigation. The borings were drilled with a power-driven continuous flight auger drill rig to 20 feet. Samples were obtained during drilling using the Standard Penetration Test, ASTM D-1586, utilizing a 2-inch O.D. Split Barrel Sampler and a California Sampler. Results of the penetration tests are shown on the drilling logs to the right of the sampling point. The locations of the test borings are indicated on the Test Boring Location Plan, Figure 3. The drilling logs are included in Appendix B.

Six (6) piezometers were recently placed on the site by Entech to evaluation the extent of seasonal groundwater fluctuation across the site. The piezometers were placed in proposed detention ponds and other low-lying areas across the site. Locations of the piezometers are indicated on Figure 3. Initial groundwater readings were completed for the revisions of this report. Continued monitoring for remaining fall, winter, and spring seasons will be conducted by Entech.

Laboratory testing was performed to classify and determine the soils engineering characteristic. Laboratory tests included moisture content, ASTM D-2216, grain size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell tests included FHA Swell Testing and Swell/Consolidation Testing, ASTM D-4546. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

A Soil, Geology and Geologic Hazard Study was previously performed by Entech, February 23, 2004 (Reference 3). Information from this report was used in evaluating the site.

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 16 miles to the west is a major structural feature known as 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 southern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be gently dipping in a northeasterly direction (Reference 4). The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Cretaceous in age. The bedrock underlying the site itself is the Dawson Formation. Overlying this formation are unconsolidated deposits of alluvium, eolian, and man-made soils. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resources Conservation Service (Reference 1), previously the Soil Conservation Service (Reference 2) has mapped two soil types on the site (Figure 4). In general, the soil consists of loamy sand and sandy loam. Soils are described as follows:

Type	Description
8	Blakeland loamy sand, 1-9% slopes
19	Columbine gravelly sandy loam, 0-3% slopes

Complete descriptions of each soil type are presented in Appendix D (Reference 2). The soils have generally been described to have rapid to very rapid permeabilities. Soil Type 8 has been described by the Soil Conservation Service to provide good support for home sites. The potential for flooding is present in some areas on Soil Type 19. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. Most of the soils have been described to have slight to moderate erosion hazards with the hazard of soil blowing severe on Soil Type 8.

5.3 Site Stratigraphy

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

Qaf **Artificial Fill of Holocene Age:** These are man-made fill deposits associated with erosion berms and an earthen dam on-site.

Qal **Recent Alluvium of Holocene Age:** These are recent stream deposits associated with some of the drainages on-site.

Qp **Piney Creek Alluvium of Holocene Age:** This material is a water deposit alluvium, typically classified as a silty to well-graded sand, brown to dark brown in color and of moderate density. The Piney Creek Alluvium can sometimes be very highly stratified containing thin layers of very silty and clayey soil.

Qes **Eolian Sand of Quaternary Age:** These deposits are medium to fine grained soil deposited on the site by the action of the prevailing winds from the west and northwest. They typically occur as large dune deposits or narrow ridges. These soil types are typically tan to brown in color and tend to have a very uniform or well sorted gradation. These materials tend to have a relatively high permeability and low density.

The bedrock underlying the site is the Dawson Formation of Tertiary to Cretaceous Age. This formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. The bedrock encountered in the test borings consisted of silty sandstone and sandy claystone. The claystone is typically expansive. Bedrock was encountered at depths ranging from 16 to 19 feet in three of the test borings drilled on-site.

The soils listed above were mapped from site-specific mapping of the site, the *Geologic Map of the Falcon Quadrangle* by Morgan and White, 2012 (Reference 5), the *Geologic Map of the Pueblo 1x2 Quadrangle, South-Central Colorado*, distributed by the USGS in 1979 (Reference 6), and the *Reconnaissance Geologic Map of Colorado Springs and Vicinity, Colorado* by Scott and Wobus in 1973 (Reference 7). The test borings drilled on the site and the Soil, Geology, and Geologic Hazard Study previously performed by Entech Engineering, Inc. (Reference 3) were also used in evaluating the site.

5.4 Soil Conditions

Four soil and rock types were encountered in the test borings drilled on the site: Type 1: silty to slightly silty sand (SM, SM-SW), Type 2: sandy to very sandy clay (CL), Type 3: silty sandstone (SM), and Type 4: sandy to very sandy claystone (CL). Each material type was classified using the results of the laboratory testing and the Unified Soil Classification System (USCS). The bedrock encountered in the borings was classified as soil in that the upper bedrock zone could be penetrated using conventional soil drilling and sampling techniques.

Soil Type 1 was classified as a slightly silty to silty sand (SM-SW, SM). The sand was encountered in all of the test borings at depths ranging from the existing ground surface to 4 feet below the ground surface (bgs) and extending to depths ranging from 9 feet bgs to the termination of the borings (20 feet). Standard Penetration Testing on the sand resulted in N-values of 11 to 44 bpf, indicating medium dense to dense states. Water content and grain size testing resulted in water contents of 2 to 30 percent, with approximately 6 to 33 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing indicated non-plastic results. Sulfate testing resulted in 0.05 percent soluble sulfate by weight, indicating the sand exhibits a negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 classified as a sandy to very sandy clay (CL). The clay was encountered in four of the test borings at depths ranging from the existing ground surface to 16 feet bgs and extending to depths of 3 and 16 feet bgs to the termination of the borings (20 feet). Standard Penetration Testing on the clay resulted in values of 12 to 41 blows per foot (bpf), indicating firm to very stiff consistencies. Water content and grain size testing resulted in water contents of 11 to 29 percent, with approximately 58 to 68 percent of the soil size particles passing the No. 200 sieve. FHA Swell Testing resulted in an expansion pressure of 520 psf, indicating low expansion potential. Swell/Consolidation Testing resulted in a volume change of 0.5 percent, indicating low expansion potential.

Soil Type 3 was classified as silty sandstone bedrock (SM). The sandstone was encountered in Test Boring No. 1 at a depth of 16 feet bgs and extending to the termination of the boring (20 feet). Standard Penetration Testing on the sandstone resulted in an N-value greater than 50 bpf indicating very dense states. Water content and grain size testing resulted in a water content of 10 percent, with approximately 29 percent of the soil size particles passing the No. 200 sieve.

Soil Type 4 was classified as a sandy to very sandy, claystone bedrock (CL). The claystone was encountered in two of the test borings (Test Boring Nos. 4 and 6) at depths of 15 and 19 feet and extending to the termination of the borings (20 feet). Standard Penetration Testing on the claystone resulted in N-values greater than 50 bpf, indicating hard consistencies. Water content and grain size testing resulted in water contents of 13percent, with approximately 62 to 63 percent of the soil size particles passing the No. 200 Sieve. Atterberg limits testing resulted in liquid limits of 33 and 40, with corresponding plastic indexes of 11 and 18. Swell/Consolidation Testing of the claystone resulted in a volume change of 0.7 percent, indicating low expansion potential. Moderately to highly expansive claystone is common in the area. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating the claystone exhibits a negligible potential for below grade concrete degradation due to sulfate attack.

Test Boring logs are included in Appendix B. A Summary of the Laboratory Test Results for each of the soil and rock types is summarized in Table 1 and included in Appendix C.

5.5 Groundwater

Groundwater was previously encountered at depths ranging from 1.5 to 12.5 feet in all of the test borings subsequent to drilling. Shallow groundwater (1.5 to 3.5 feet) was encountered in Test Boring Nos. 3, 5, and 6. Groundwater was recently observed on the surface in the eastern portion of the site. Groundwater depths from the previous test borings are summarized in Table 2.

Additional groundwater investigation was conducted as part of the evaluation of the new plan to address El Paso County and CGS review comments. Six piezometers were placed across the site to evaluate the groundwater levels. The piezometers will be measured periodically to obtain seasonal groundwater fluctuations across the site. Initial readings in the piezometers indicated groundwater depths from the existing surface to 8.5 feet. The initial groundwater measurements area presented on Table 3, and locations of the piezometers are indicated on Figures 3 and 6.

Fluctuations in the groundwater conditions may occur due to conditions such as variations in rainfall, precipitation infiltration and development of nearby areas. Perched groundwater conditions may also be encountered where water flows through permeable sands overlying impermeable bedrock. Areas of seasonal and potentially seasonal shallow groundwater have been identified on the site. These areas will be discussed in the following sections.

6 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

Detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 6). This map shows the location of various geologic conditions of which the developers and planners should be cognizant during the planning, design and construction stages of the project. The constraints/hazards identified on this site include artificial fill, hydrocompaction, potentially expansive soils, seasonal and potentially seasonal shallow groundwater areas, areas of ponded water, springs, unstable slopes, and floodplains. These geologic conditions and the recommended mitigation techniques are as follows.

Expansive Soils – Constraint

Expansive soils were encountered in some of the test borings drilled on-site and as a part of the previous investigation (Reference 3). These areas are sporadic; therefore, none have been indicated on the map. Expansive clays and claystone, if encountered, can cause differential movement in the structure foundation.

Mitigation: Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. Drilled piers are another option that is used in areas where highly expansive soils are encountered. 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 can 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 on-site are gently sloping and do not exhibit any past or potential unstable slopes or landslides. Some of the steeper slopes along the drainage in the central portion of the site have been identified as unstable slopes. The mitigation recommendation for these areas is as follows:

Unstable Slopes – Hazard

Some of the steep slopes along the drainage in the central portion of the site have been identified as unstable. These are areas where cut banks along the drainage have eroded, and slope angles are generally 45 degrees to near vertical along the drainage.

Mitigation: According the preliminary overall grading plan prepared by Drexel Barrell & Company the drainage area with the unstable slopes (Lots 81 and 82) will be regraded and filled mitigating the unstable slopes hazard. Fill should be placed on native soils or bedrock and properly benched into the slopes. Dewatering of the area may be required during site grading prior to placing fill. The drainage is to be routed through a pipe or box culvert.

Debris Fans – Hazard

Based on-site observations, debris fans were not observed in this area.

Groundwater and Floodplain Areas – Constraint

Areas of the site have been identified as seasonal and potentially seasonal shallow groundwater areas. Additionally, shallow groundwater was encountered in some of the borings (less than 5 feet) and is identified as areas of shallow groundwater. A spring is located in the northeastern portion of the property along Rio Lane. Water was observed flowing in this area at the time of our recent site observations, and along the drainage. The drainage in the central portion of the site west of the existing house and has been mapped as a floodplain zone according to the FEMA Map Nos. 08041CO553G and 08041CO561G, (Figure 7, Reference 8). The minor drainage in to the east of the house is not a mapped FEMA floodplain, however, it is a physiographic floodplain. These areas are indicated on the Geology/Engineering Geology Map Figure 6. The existing drainages will be routed through a pipe or box culvert. These areas are further discussed as follows:

Seasonal Shallow Groundwater – Constraint: In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and possible frost heave potential, depending on the soil conditions. These are areas where surface soils, topography or vegetation indicate the yearly presence of shallow groundwater. The site map shows areas with high groundwater conditions during our investigation.

Mitigation: In these locations, foundations subject to severe frost heave potential should penetrate sufficient depth so as to discourage the formation of ice lenses beneath foundations. At this location and elevation, a foundation depth for frost protection of 30 inches is recommended. In areas where high subsurface moisture conditions are anticipated periodically, a subsurface

Discuss proposed mitigation for the ponds as well. In Section 6.1 it is stated the ponds will be located in areas where groundwater will flow.

perimeter drain will be necessary to help prevent the intrusion of water into areas located below grade. A typical perimeter drain detail is presented in Figure 8. Unstable conditions should be expected where excavations approach the groundwater level. Stabilization using shot rock or geo-grids may be necessary. Underslab drains or capillary breaks or interceptor drains may be necessary to dewater the excavation. Drain details are presented in Figures 9 and 10. Basements or useable areas located below grade are not recommended in these areas. It may be desirable on some lots to build up the building area to raise the foundation further above the groundwater level. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. All soft or organic soils should be removed prior to any construction or filling. Further investigation will be necessary to determine the groundwater depth at each individual building site. Some areas of the site appear to be caused from springs and perched water. Dewatering will likely be necessary in some portions of the site.

Potentially Seasonal Shallow Groundwater – Constraint: In these areas, we would anticipate the potential for periodic high subsurface moisture conditions and frost heave potential. Areas of organic soils are also possible in areas mapped as potentially seasonal shallow groundwater but are not expected to be as extensive as areas mapped as seasonal shallow groundwater. These areas did not indicate the yearly presence of shallow groundwater in the surface soils and vegetation as the seasonal high groundwater areas did, however, based on topography, site conditions and groundwater measured in the test borings, these areas were mapped as having the potential for high groundwater during high moisture periods or years. The same mitigation recommendations for Seasonal High Groundwater areas apply to these Potentially Seasonal High Groundwater areas. Further investigation of each building site may be necessary to delineate the depth to groundwater.

Floodplain – Constraint: The drainage in the central portion of the site and has been mapped as a floodplain zone according to the FEMA Map Nos. 08041CO553G and 08041CO561G, (Figure 8, Reference 8). There is also and unmapped physiographic floodplain in the eastern portion of the site. Any construction considered in a floodplain area will require approval of the drainage plan. Lots immediately adjacent to the floodplain may experience higher groundwater levels during peak flows. Subsurface perimeter drains are recommended for structures adjacent to the floodplain to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Finished floor levels must be a minimum of one floor above the floodplain level. Exact floodplain locations by drainage studies are beyond the scope of this report.

Shallow Groundwater Areas: Areas identified with this hazard include those areas outside of drainage areas where shallow groundwater was encountered in the test borings. In these areas, the groundwater encountered may be associated with perched groundwater conditions. This is extremely common in the area, particularly where permeable sands associated with Eolian sand deposits exist over impermeable clayey sandstone or claystone. The potential for shallow groundwater also exists in areas identified as seasonal shallow groundwater and potentially seasonal shallow groundwater, as discussed previously. The same mitigation recommendations for seasonal shallow groundwater areas apply to these areas of known shallow groundwater. Overlot grading may influence the depth of groundwater and its effects on development. Specific recommendations should be made after grading plans are finalized.

Areas of Ponded Water: This is an area of ponded water associated with an earthen dam on site. The main portion of the dam has been breached on the east site, however, some water still ponds in a low area behind the dam. The pond and dam area exist in the area proposed as a detention pond and will be avoided by structures. Should construction or regrading of the pond site be considered, all organic matter and soft, wet soils should be completely removed before filling. Any drainage into these areas should be rerouted in a non-erosive manner off of the site where it does not create areas of ponded water around proposed structures.

Spring: This area lies within the floodplain area on the eastern portion of the site, therefore, recommendations for the floodplain should be followed for the spring area. Additionally, should development be considered in this area, interceptor drains will be necessary to capture water and transport them safely around structures. It is anticipated dewatering and drainage systems will be necessary for this site, particularly in the drainage area below the spring in the northeastern portion of the site.

It should be noted that shallow groundwater is anticipated across a large part of the site. Minimal excavation is recommended for the site. A minimum 30-inch depth is recommended for frost protection; however, deeper (basement) excavations are not recommended. Excavation depths can be reduced by building or filling the areas around the houses or buildings to provide frost protection. Unstable soil conditions will likely be encountered where groundwater is encountered in excavations. Some dewatering and soil stabilization of the excavation using shot rock or geofabric may be necessary. Builders should be cognizant of the potential for the occurrence of subsurface water during construction on-site. Installation of utilities will likely require trench stabilization.

Artificial Fill – Constraint

These are man-made fill deposits associated with an earthen dam and small erosion berms on site.

Mitigation: It is anticipated the erosion berms will be removed prior to construction. The earthen dam can be either regraded or avoided by development. Where uncontrolled fill is encountered beneath foundations, mitigation will be necessary. Mitigation typically involves removal and recompaction at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557. Any new fill added to the site should be placed on native or controlled fill soils, compacted as recommended above.

Hydrocompaction – Constraint

Areas in which hydrocompaction have been identified are acceptable as building sites. In areas identified for this hazard classification, however, we anticipate a potential for settlement movements upon saturation of these surficial soils. The low density, uniform grain sized, windblown sand deposits are particularly susceptible to this type of phenomenon. Additionally, loose or collapsible soils may be encountered on this site.

Mitigation: The potential for settlement movement is directly related to saturation of the soils below the foundation areas. Therefore, good surface and subsurface drainage is extremely critical in these areas in order to minimize the potential for saturation of these soils. The ground surface around all permanent structures should be positively sloped away from the structure to all points, and water must not be allowed to stand or pond anywhere on the site. We recommend that the ground surface within 10 feet of the structures be sloped away with a minimum gradient of five percent. If this is not possible on the upslope side of the structures, then a well-defined swale should be created to intercept the surface water and carry it quickly and safely around and away from the structures. Roof drains should be made to discharge well away from the structures and into areas of positive drainage. Where several structures are involved, the overall drainage design should be such that water directed away from one structure is not directed against an adjacent building. Planting and watering in the immediate vicinity of the structures, as well as general lawn irrigation, should be minimized.

Areas of loose or collapsible soils may also be encountered in these areas. Should loose or collapsible soils be encountered beneath foundations, removal and recompaction of the upper 2 to 3 feet with thorough moisture conditioning at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 will be necessary. Specific recommendations should be made after additional investigation of each building site.

Radon – Hazard

Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 9). Average Radon levels for the 80831-zip code is 4.5 pCi/l. The following is a table of radon levels in this area:

	80831
0 < 4 pCi/l	0.00%
4 < 10 pCi/l	100.00%
10 < 20 pCi/l	0.00%
> 20 pCi/l	0.00%

Mitigation:

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

6.1 Relevance of Geologic Conditions to Land Use Planning

The development will be mixed use/commercial with retail pad areas and detention ponds. The existing geologic and engineering geologic conditions will impose constraints on some development and construction. The most significant problems affecting development will be those associated with shallow groundwater and surface drainage on site. Basements or useable areas below grade are not recommended on the majority of the site. Additional investigation on each building site is recommended after grading plans are finalized and grading is completed. Soil stabilization will likely be required where groundwater is encountered in excavations and utility trenches. Building elevations should be kept as high as possible with the ground surface positively slopes away from the structure at all points. Dewatering of some of the building sites may be necessary.

The upper soils were encountered at medium dense states. Spread footing foundations are anticipated for the site. Areas of loose soils, if encountered, will require recompaction. Expansive layers may also be encountered in the soil and bedrock on this site. These areas are sporadic; therefore, no areas were indicated on the maps. Expansive soils, if encountered, will require special foundation design. These soils will not prohibit development.

Areas of seasonal shallow groundwater have been mapped in the drainage area in the central area of the site. This area will be regraded and the drainage will be routed through a pipe or box culvert. The potential exists for seasonally high subsurface moisture conditions across most of the site. Areas of perched groundwater areas on the site may require drainage systems in order to dewater the area. Filling the site as indicated on preliminary plans will further raise foundations above the groundwater level. A sanitary sewer underdrain should be considered to assist with controlling groundwater. All soft or organic soils should be removed prior to fill placement. Proposed floor levels should be a minimum of 3 feet above the highest anticipated groundwater levels.

Unstable soils may be encountered where excavations approach the groundwater level. Shallow groundwater areas may also affect utility installation. Geo-grids or shotrock may be necessary to stabilize excavations. Foundations should be kept as high as possible. Foundations in or adjacent to seasonal shallow groundwater areas may require drains to control seepage within the foundation zone. Typical drain details are presented in Figures 8 through 10. Basements or useable areas below grade are not recommended on the majority of the site. Additional investigation is recommended after grading and the storm sewer and other drainage improvements are installed to re-evaluate groundwater conditions. Proposed floor levels should be a minimum of 3 feet above the highest anticipated groundwater levels.

Six (6) piezometers were recently placed on the site by Entech to evaluate the extent of seasonal groundwater fluctuation across the site. The piezometers were placed in proposed detention ponds and other low-lying areas across the site. Locations of the piezometers are indicated on Figure 3. Initial groundwater readings were completed for the revisions of this report. Continued monitoring for the fall, winter, and spring seasons will be conducted by Entech. Initial reading indicated groundwater depths ranging from the surface to 8 feet, and are presented on Table 3.

Floodplain areas have been mapped in the central and eastern portions of the site, as indicated on the Geology/Engineering Geology Map and Floodplain Map, Figures 7. Areas in the eastern portions of the site will require approval of the Drainage Report that excludes them from the FEMA floodplain prior to construction. Finished floor elevations must be a minimum of one foot above the floodplain level. Specific floodplain locations and drainage studies are beyond the scope of this report.

According to the preliminary overall grading plan the unstable slopes along the central drainage will be filled and regraded mitigating the unstable slope hazard. The eastern portion of the site where standing water was observed will be filled. Fill should be placed on native soils or bedrock and properly benched into the slopes. Dewatering of the area may be required during site grading prior to placing fill. The drainage is to be routed through a pipe or box culvert. Piezometer Nos. 2 and 4 are located within proposed full-spectrum detention ponds. The highest groundwater elevations from our initial readings in these areas resulted in groundwater at 4.1 feet in Piezometer No. 2 (7/20/2023), and at 6.1 in Piezometer No. 4 (7/14/2023). Based on the current grading plans the proposed cuts in the ponds will extend into the current groundwater levels potentially limiting the capacity of the full-spectrum detention ponds.

Soil susceptible to erosion will also require consideration during development. Erosion problems are extremely common throughout the region and may be satisfactorily mitigated through proper engineering design and construction of drainage systems.

Areas of hydrocompaction have been identified on this site where there is the potential for settlement movements upon saturation of the surficial soils. Good surface and subsurface drainage is critical in these areas and the ground surface should be positively sloped away from structures at all points. Roof drains should be made to discharge well away from structures and planting and watering in the immediate vicinity of structures should be minimized.

In summary, the granular soils will provide suitable support for shallow foundations on site. Groundwater and surface drainage will affect construction on the site. Stabilization of soils will likely be required where groundwater is encountered in the excavations. Additional investigation is recommended after grading plans are finalized.

Discuss recommended mitigation for the ponds (like a clay or geomembrane liner or other methodology).

7 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 9), the area is mapped as upland deposits. According to the Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties distributed by the Colorado Geological Survey (Reference 10), areas of the site are mapped as A3 – Alluvial fan: sand resource. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 11), the area of the site has been mapped as "Good" for industrial minerals. Several quarries exist in the area of the site for sand and gravel. Considering the silty to clayey nature of much of these materials and abundance of similar materials through the region, 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 11), 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. The *El Paso County Aggregate Resource Map* (Reference 9) has mapped coal resources in the Falcon area, including the area of the site; however, the coal resources are estimated at 1,500 feet below the surface (Reference 9). At this depth, mining the coal would not be economical at this time. No metallic mineral resources have been mapped on the site (Reference 11).

The site has been mapped as "Fair" for oil and gas resources (Reference 11). No oil or gas fields have been discovered in the area of the site. A well was drilled southeast of the site to 1,662 feet deep in 1914. No oil or gas was reported and it was plugged. The sedimentary rocks in the area lacked the essential elements for oil or gas; therefore, it would not be considered a significant resource.

8 EROSION CONTROL

The soil types observed on the site are mildly to moderately 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 reestablished, 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 re-vegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

9 ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed roadways and embankments. Groundwater should be expected to be encountered in deeper cuts and along drainages and low-lying areas. If excavations encroach on the groundwater level unstable soil conditions may be encountered. Excavation of saturated soils will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

Any areas to receive fill should have all topsoil, organic material or debris removed. Prior to fill placement Entech should observe the subgrade. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1. 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 ±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. Additional investigation will be required for pavement designs once roadway grading is completed and utilities are installed.

Please clarify that these embankment recommendations apply to the detention ponds also.

10 CLOSURE

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

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Individual investigations for building sites 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 Falcon Field, 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.

11 BIBLIOGRAPHY

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12. Keller, John W.; TerBest, Harry and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board*. Colorado Geological Survey. Open-File Report 03-07.

TABLE

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT FALCON FIELD, LLC
PROJECT WOODMEN & HIGHWAY 24
JOB NO. 202649

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 (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	2	5			6.1						SM-SW	SAND, SLIGHTLY SILTY
1	4	5			33.1	NV	NP	0.05			SM	SAND, SILTY
1	5	10			5.7						SM-SW	SAND, SLIGHTLY SILTY
1	7	5			14.1						SM	SAND, SILTY
2	1	2-3			68.4						CL	CLAY, SANDY
2	2	20	11.9	125.3	62.0					0.5	CL	CLAY, SANDY
2	3	2-3			58.0				520		CL	CLAY, VERY SANDY
3	1	20			28.9						SM	SANDSTONE, SILTY
4	4	20			61.7	40	18	<0.01			CL	CLAYSTONE, SANDY
4	6	20	14.9	117.4	63.0	33	11			0.7	CL	CLAYSTONE, SANDY

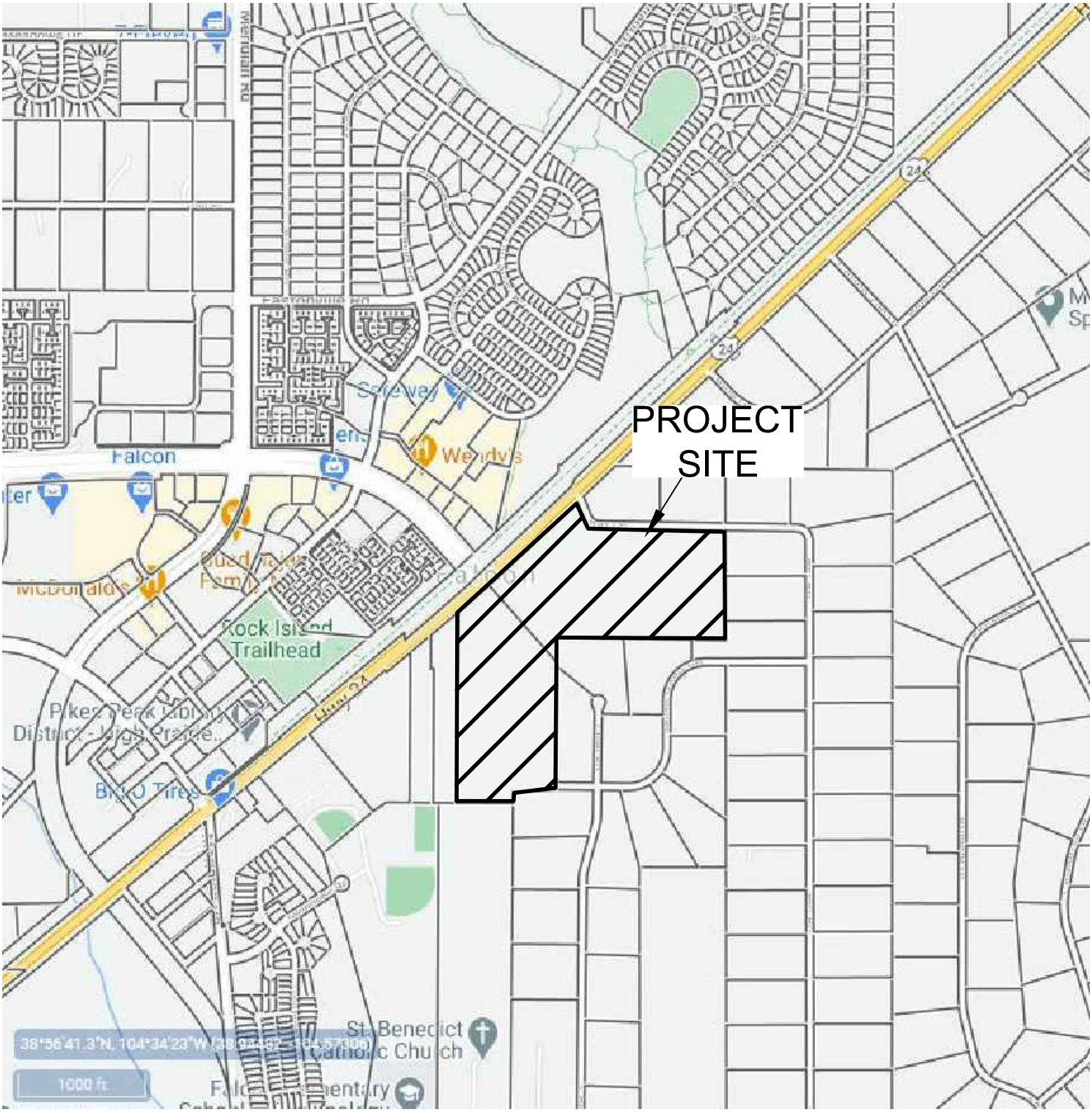
Table 2: Summary Test Boring Results

Test Boring No.	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	16	6.5
2	>20	6
3	>20	1.5
4	19	7
5	>20	3.5
6	15	3.5
7	>20	12.5

Table 3: Summary Piezometer Results

Piezometer No.	Depth to Groundwater (ft.)		
	6/30/2023	7/14/2023	7/20/2023
1	3.4	2.4	2.2
1e	Surface	Surface	Surface
1w	1	0.6	Dry
2	8.5	7.3	4.1
3	6	5	4.7
4		6.1	6.9

FIGURES



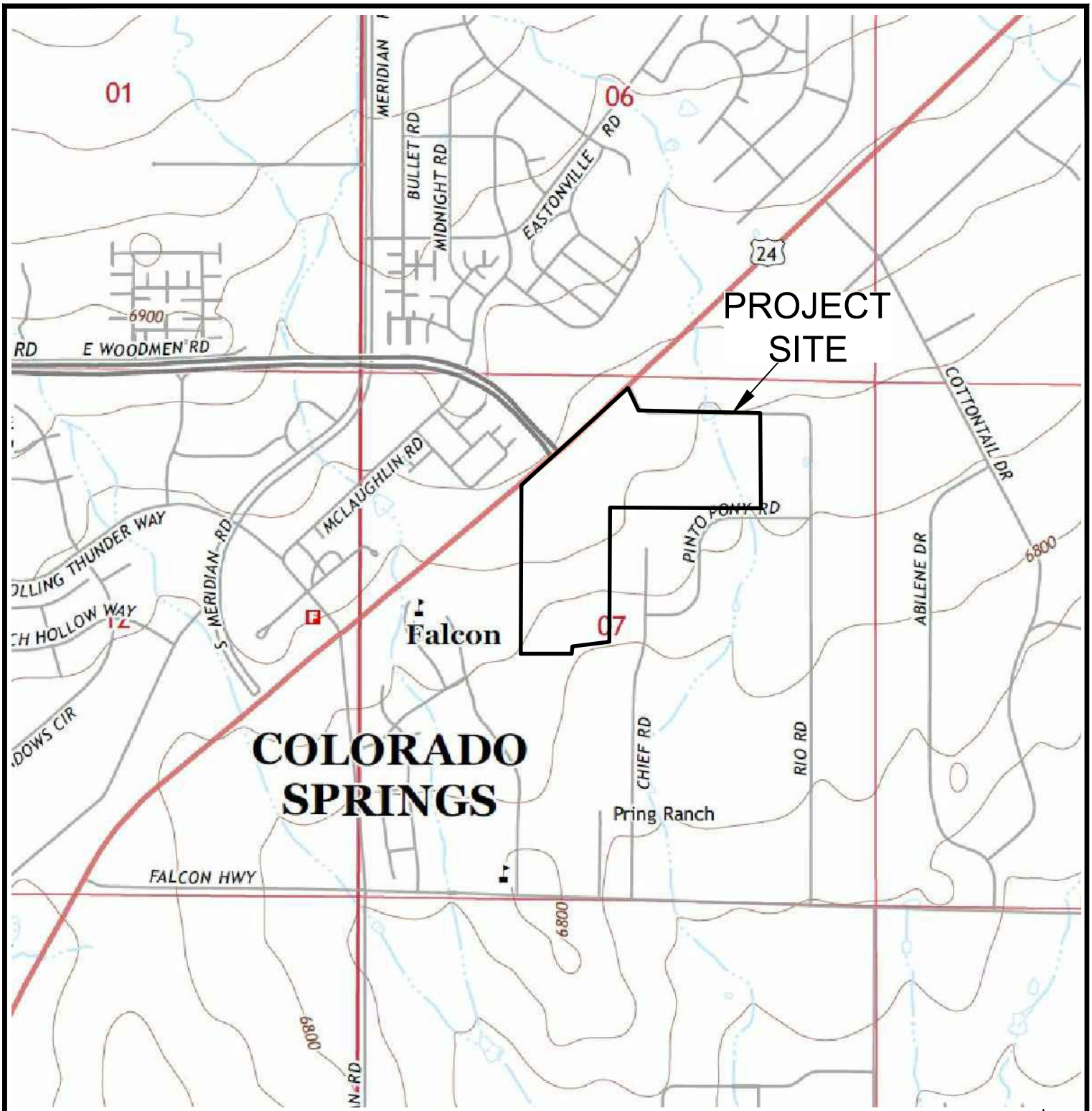
N

ENTECH ENGINEERING, INC.

VICINITY MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO.
202649

FIG. 1



N

ENTECH ENGINEERING, INC.

USGS TOPOGRAPHY MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO.
202649

FIG. 2

Please update the maps to reflect the current proposal. The map of the development is outdated.

SHEET 10 (GP03)

SHEET 9 (GP02)

SHEET 11 (GP04)

SHEET 12 (GP05)

FALCON RANCH ESTATES
LOT 18
12440 RIO LN

BLOCK 2
LOT 17
12520 RIO LN

LOT 16
12610 RIO LN

FALCON RANCH ESTATES
LOT 14
BURT & MELISSA CHAFFIN
4307003001
7420 RIO RD

BLOCK 1
LOT 13
TERRY HIGGINS TRUST
4307003002
7350 RIO RD

ARROWHEAD ESTATES
FILING NO.1
LOT 10
HEIDEMARIE POLLARD
4307003010
12610 PINTO PONY RD

ARROWHEAD ESTATES
FILING NO.1
LOT 13
FREDERRICK RUSSELL
4307003013
7020 CHIEF RD

ARROWHEAD ESTATES
FILING NO.1
LOT 11
MICAH & KRISTEN NORTH
4307003012
12570 PINTO PONY RD

ARROWHEAD ESTATES
FILING NO.1
LOT 14
CAROLYN SCHUTTS
4307003007
7020 CHIEF RD

RONDA EVANOIKA
4307200010
REC.NO.20100063939
12239 HWY 24

LOT 15

LOT 9

LOT 12

LOT 10

LOT 9

LOT 8

FALCON RANCH ESTATES
LOT 11

TB1 TB2 TB3 TB4 TB5 TB6 TB7

P1 P1e P1w P2 P3 P4 P5 P6 P7 P8 P9 P10 P11

FULL-SPECTRUM DETENTION BASIN

RIO LANE
GYRFALCON LANE
BUTEOS LANE
PINTO PONY
DIRICAWL DRIVE
TOWHEE LANE
TOWHEE CHUTE
GOLDFINCH PLACE
HOOPOE LANE
BARN OWL WAY
CHIEF ROAD
DOSHAWK WAY
CARACARA WAY
KESTREL PLACE
MERLIN WAY
GYRFALCON ROAD

TRACT A
TRACT B
TRACT C
TRACT D
TRACT G
TRACT H

SHEET 10 (GP03)
SHEET 9 (GP02)
SHEET 11 (GP04)
SHEET 12 (GP05)

KEY MAP
NTS

SCALE: 1"=150'
150 75 0 150 300

LEGEND

- PROPERTY LINE
- RIGHT OF WAY
- LOT LINE
- CENTERLINE ROAD
- EASEMENT
- EASEMENT (UTILITY)
- SETBACK
- POND
- SHEET MATCHLINE
- PROPOSED SLOPE GRADE -2.0%
- PROPOSED MAJOR CONROUR 6205
- PROPOSED MINOR CONTOUR 6203
- EXISTING MAJOR CONTOUR 6205
- EXISTING MINOR CONTOUR 6203
- LOT NUMBER 29
- EXISTING ADJOINING PROPERTY LINE
- EXISTING CENTERLINE ROAD
- EXISTING FENCE LINE
- EXISTING EDGE OF ASPHALT
- EXISTING SIGN

TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

P- APPROXIMATE PIEZOMETER LOCATION AND NUMBER

P2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

811 Know what's below. Call before you dig.
CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

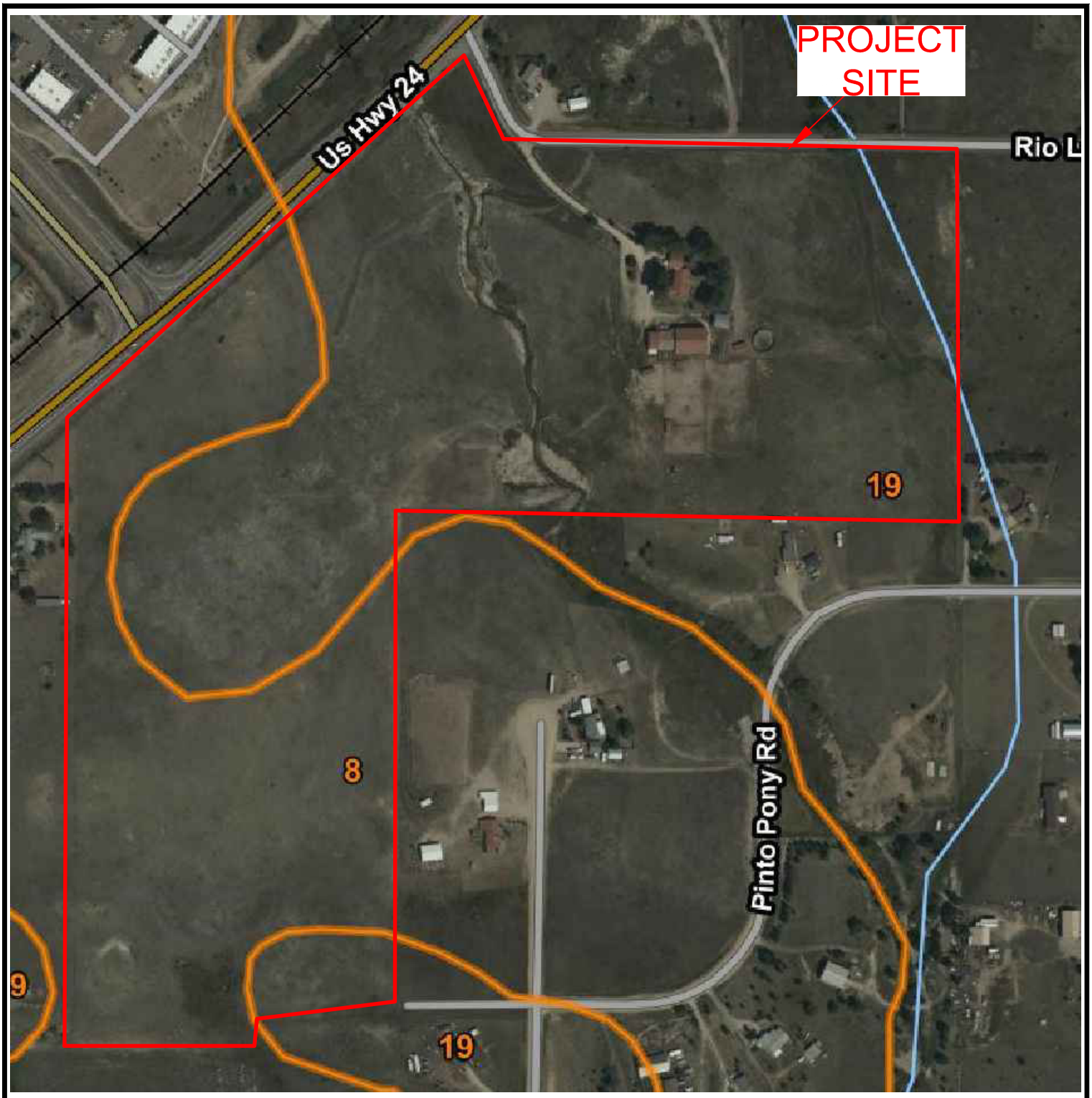
REVISION	BY

ENTECH ENGINEERING, INC.

SITE PLAN/TESTING LOCATION MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO. 202649

FIG. 3



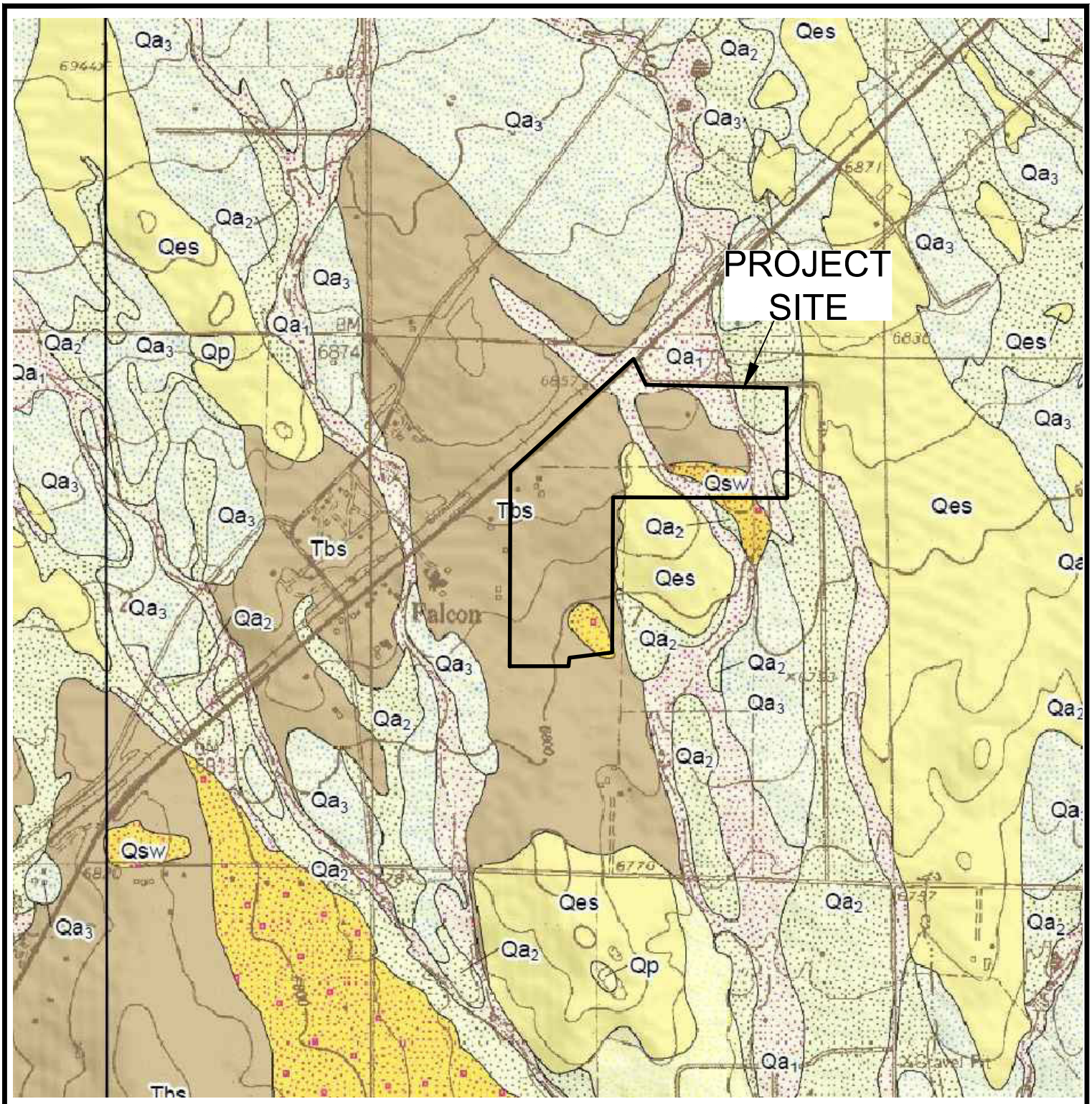
N

ENTECH ENGINEERING, INC.

SOIL SURVEY MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO.
202649

FIG. 4

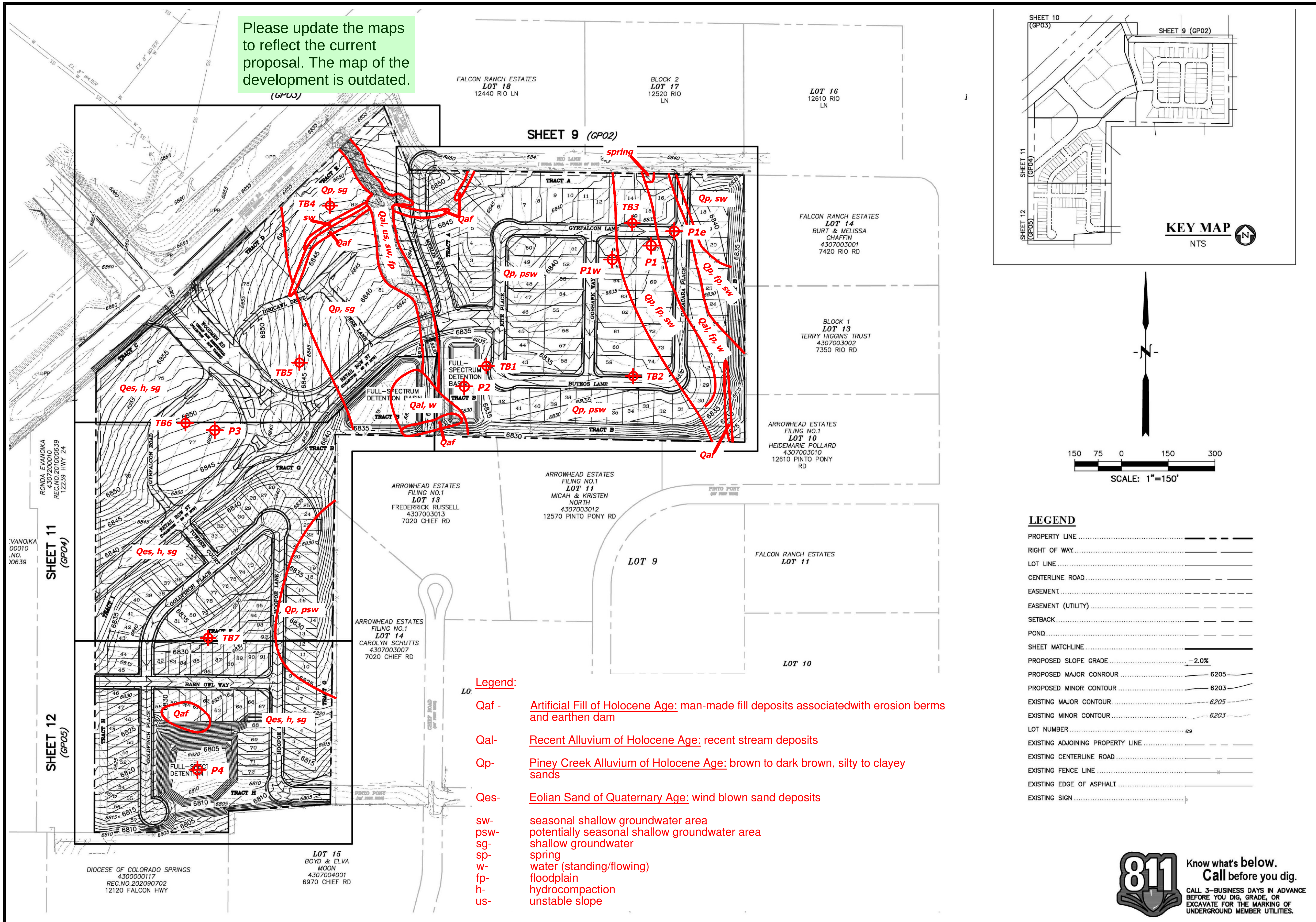


ENTECH ENGINEERING, INC.

FALCON QUADRANGLE GEOLOGIC MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO. 202649

FIG. 5



REVISION	BY

ENTECH ENGINEERING, INC.

GEOLOGY/ENGINEERING GEOLOGY MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO. 202649

FIG. 6

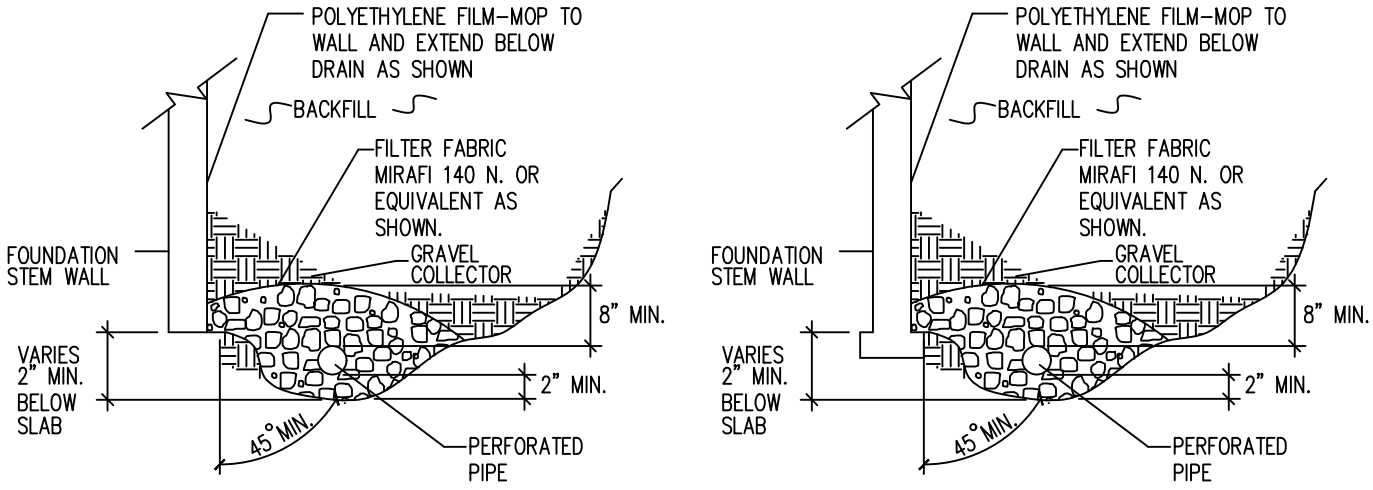
N

ENTECH ENGINEERING, INC.

FEMA FLOODPLAIN MAP
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO.
202649

FIG. 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.

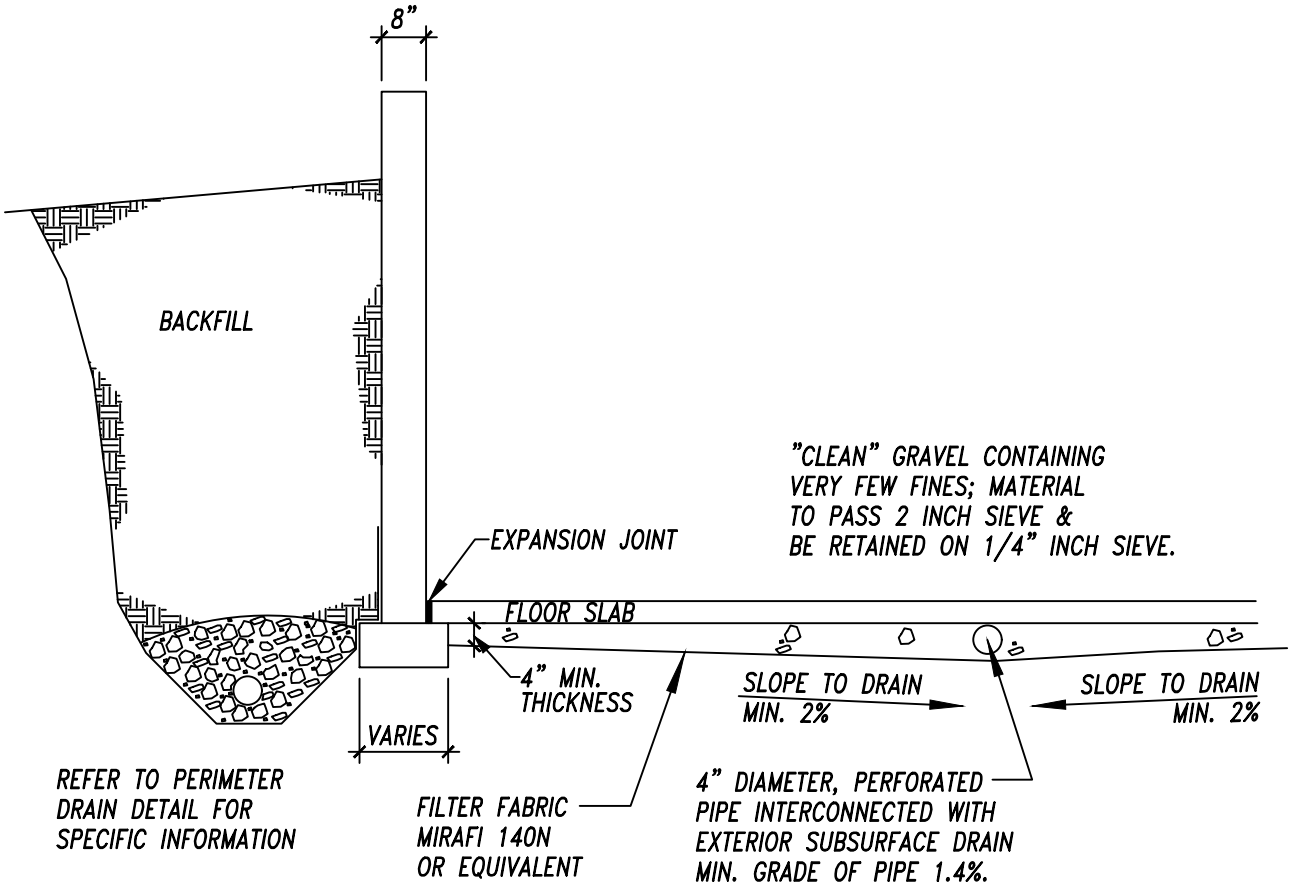
–DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

ENTECH ENGINEERING, INC.

PERIMETER DRAIN DETAIL
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO. 202649

FIG. 8



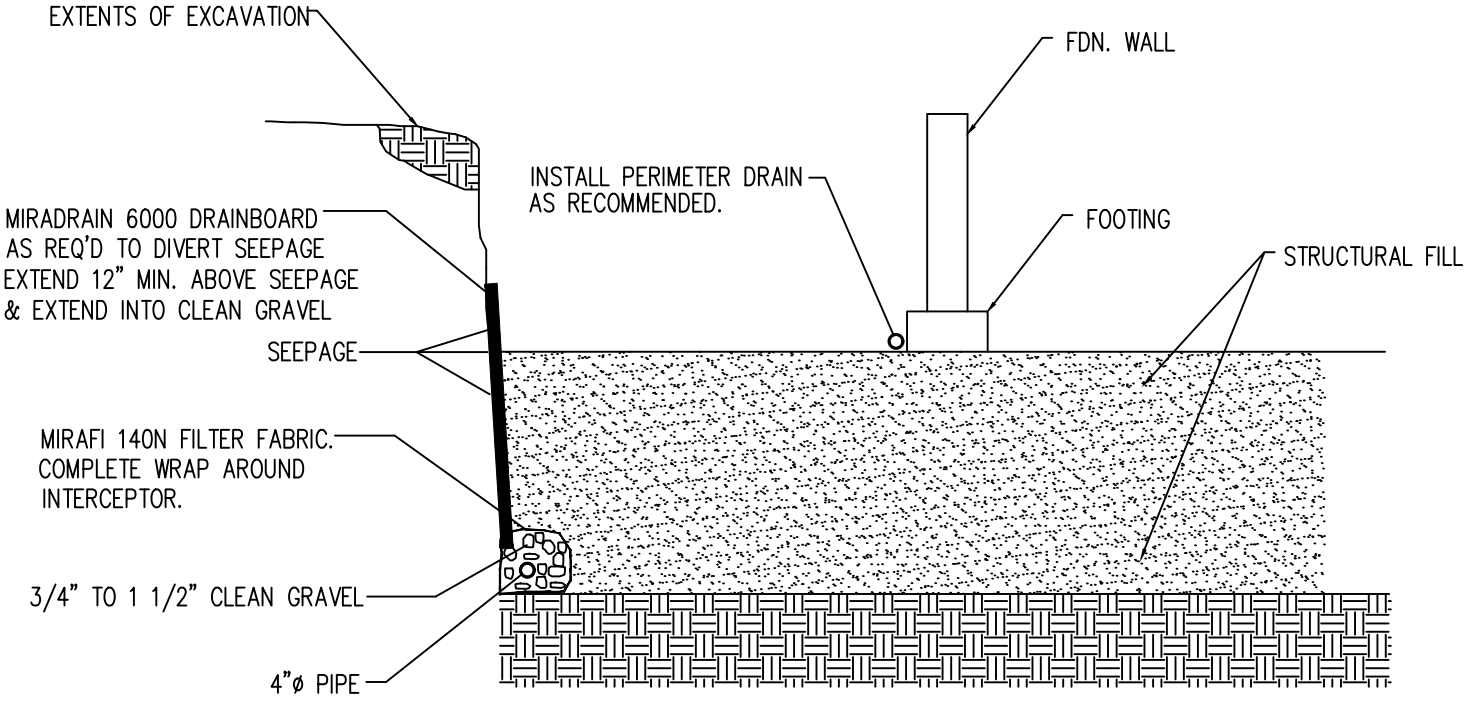
ENTECH ENGINEERING, INC.

TYP. UNDERSLAB DRAINAGE LAYER (CAPILLARY BREAK)

THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO.
202649

FIG. 9



NOTE:
EXTEND INTERCEPTOR DRAIN TO UNDERDRAIN OR TO SUMP.
BENCH DRAIN INTO NATIVE SOILS 12 INCHES MINIMUM.

INTERCEPTOR DRAIN DETAIL

N.T.S.

ENTECH ENGINEERING, INC.

INTERCEPTOR DRAIN DETAIL
THE COMMONS AT FALCON FIELD
EL PASO COUNTY, COLORADO
FALCON FIELD, LLC

JOB NO.
202649

FIG. 10

APPENDIX A: Photographs

1

Looking west from the northeastern corner of the site.

January 14, 2021

2

Looking south from then northeastern corner of the site.

January 14, 2021

Job No. 202649

3

Looking northwest along drainage in the northern portion of the site.

January 14, 2021

4

Looking west from the northern portion of the site.

January 14, 2021

Job No. 202649

5

Looking northeast towards spring in the northern portion of the site.

January 14, 2021

6

Looking southeast along drainage in the central portion of the site.

January 14, 2021

Job No. 202649

7

Looking south across drainage in the north-central portion of the site.

January 14, 2021

8

Looking west from the central portion of site.

January 14, 2021

Job No. 202649

9

Looking north from the physiographic floodplain in the eastern portion of the site.

June 30, 2023

10

Looking south from the physiographic floodplain in the eastern portion of the site.

June 30, 2023

Job No. 202649

11

Looking south across drainage in the central portion of the site.

June 30, 2023

12

Looking south from the south-central portion of site.

June 30, 2023

Job No. 202649

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 12/10/2020
Job # 202649

REMARKS

WATER @ 6.5', 12/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			16	10.8	2	CLAY, SANDY, TAN, STIFF, MOIST
5			11	7.6	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN TO BROWN, MEDIUM DENSE TO DENSE, MOIST TO WET
10			31	11.4	1	
15			12	16.7	2	CLAY, SANDY, GRAY BROWN, FIRM, WET
20			50/9"	9.8	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, WET

TEST BORING NO. 2
DATE DRILLED 12/10/2020
CLIENT FALCON FIELD, LLC
LOCATION WOODMEN & HIGHWAY 24

REMARKS

WATER @ 6', 12/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			22	4.9	1	SAND, SILTY TO SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN TO GRAY BROWN, MEDIUM DENSE, DRY TO WET
5			18	1.7	1	
10			20	12.5	1	
15			26	12.0	1	
20			41	11.3	2	CLAY, SANDY, GRAY BROWN, VERY STIFF, VERY MOIST

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO.: 202649
FIG NO.: B-1

TEST BORING NO. 3
DATE DRILLED 12/14/2020
Job # 202649

REMARKS

WATER @ 1.5', 12/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			15	25.6	2	CLAY, VERY SANDY, BROWN, STIFF, WET
5			12	27.8	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN TO BROWN, MEDIUM DENSE, WET
10			17	20.1	1	
						CLAY, SANDY, GRAY BROWN, STIFF, VERY MOIST
15			22	14.1	2	
						SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, WET
20			*	24.7	1	

TEST BORING NO. 4
DATE DRILLED 12/14/2020
CLIENT FALCON FIELD, LLC
LOCATION WOODMEN & HIGHWAY 24

REMARKS

WATER @ 7', 12/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			28	5.7	1	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST TO VERY MOIST
5			12	19.3	1	
10			17	28.6	2	CLAY, SANDY, GRAY BROWN, STIFF, WET
15			25	24.0	2	
20			50/4"	13.4	4	CLAYSTONE, VERY SANDY, GRAY BROWN, HARD, MOIST

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO.: 202649
FIG NO.: B-2

TEST BORING NO. 5
DATE DRILLED 12/14/2020
Job # 202649

REMARKS

WATER @ 3.5', 12/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			19	3.4	1
5			15	25.6	1
10			18	30.2	1
15			23	22.7	1
20			27	27.5	1

SAND, SILTY TO SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN TO GRAY BROWN, MEDIUM DENSE, MOIST TO WET

TEST BORING NO. 6
DATE DRILLED 12/14/2020
CLIENT FALCON FIELD, LLC
LOCATION WOODMEN & HIGHWAY 24

REMARKS

WATER @ 3.5', 12/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			18	6.3	1
5			15	19.0	1
10			18	23.2	1
15			44	15.3	1
20			50/6"	12.5	4

SAND, SILTY, FINE TO COARSE GRAINED, TAN TO BROWN, MEDIUM DENSE TO DENSE, MOIST TO WET

CLAYSTONE, SANDY, GRAY BROWN, HARD, WET

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE	CHECKED:	DATE
			12/24/20

JOB NO. 202649
FIG NO. B-3

TEST BORING NO. 7
DATE DRILLED 12/14/2020
Job # 202649

TEST BORING NO.
DATE DRILLED
CLIENT FALCON FIELD, LLC
LOCATION WOODMEN & HIGHWAY 24

REMARKS

WATER @ 12.5', 12/15/20

REMARKS

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			22	2.1	1	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST TO WET
5			19	2.8	1	
10			18	4.3	1	
15			19	22.8	1	
20			23	22.8	1	

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5					
10					
15					
20					

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

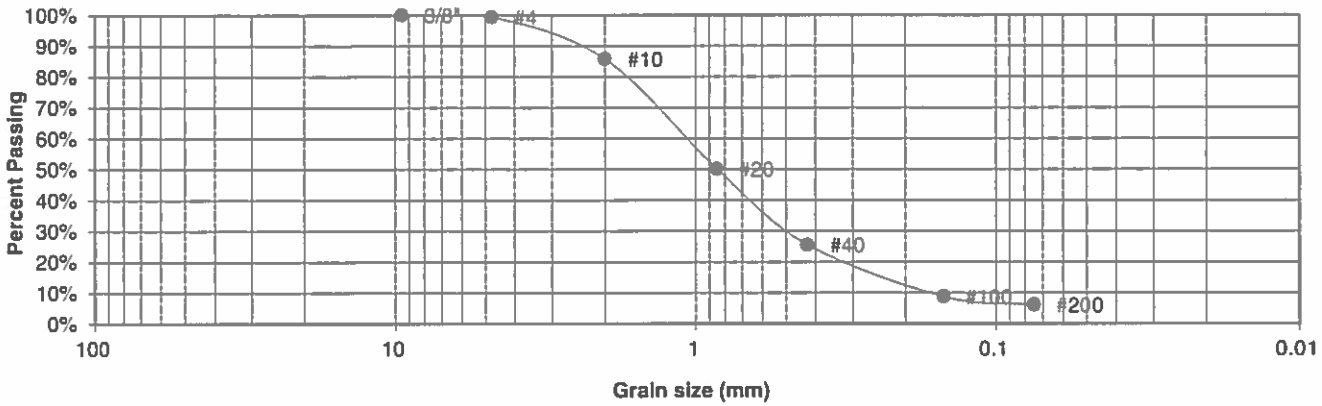
DRAWN:	DATE:	CHECKED:	DATE: 12/24/20

JOB NO. 202649
FIG NO. B-4

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM-SW	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	1	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	2	JOB NO.	202649
DEPTH (FT)	5	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	85.8%
20	50.1%
40	25.5%
100	8.8%
200	6.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

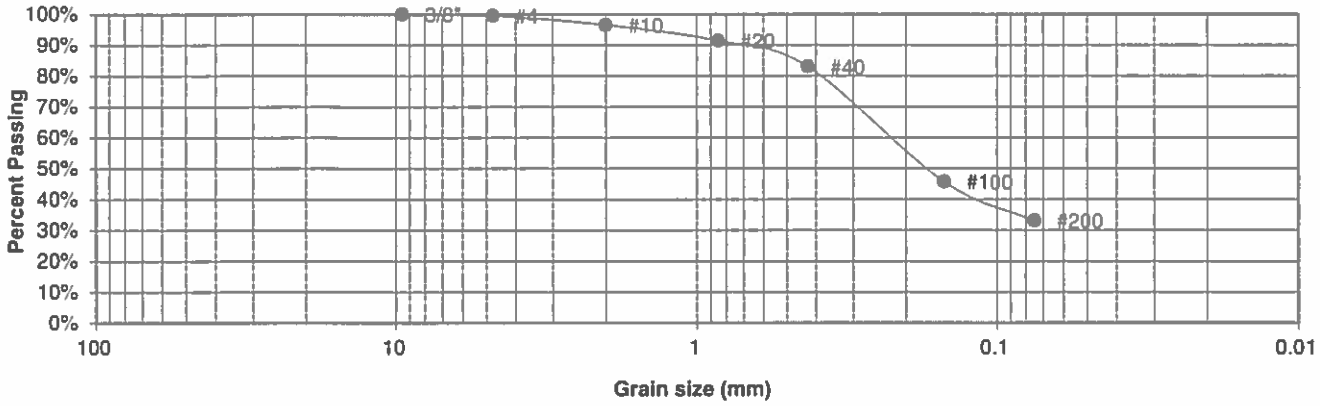
DRAWN:	DATE:	CHECKED:	DATE:
		h	12/24/20

JOB NO: 202649

FIG NO: C-1

UNIFIED CLASSIFICATION	SM	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	1	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	4	JOB NO.	202649
DEPTH (FT)	5	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.5%
10	96.5%
20	91.4%
40	82.9%
100	45.7%
200	33.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

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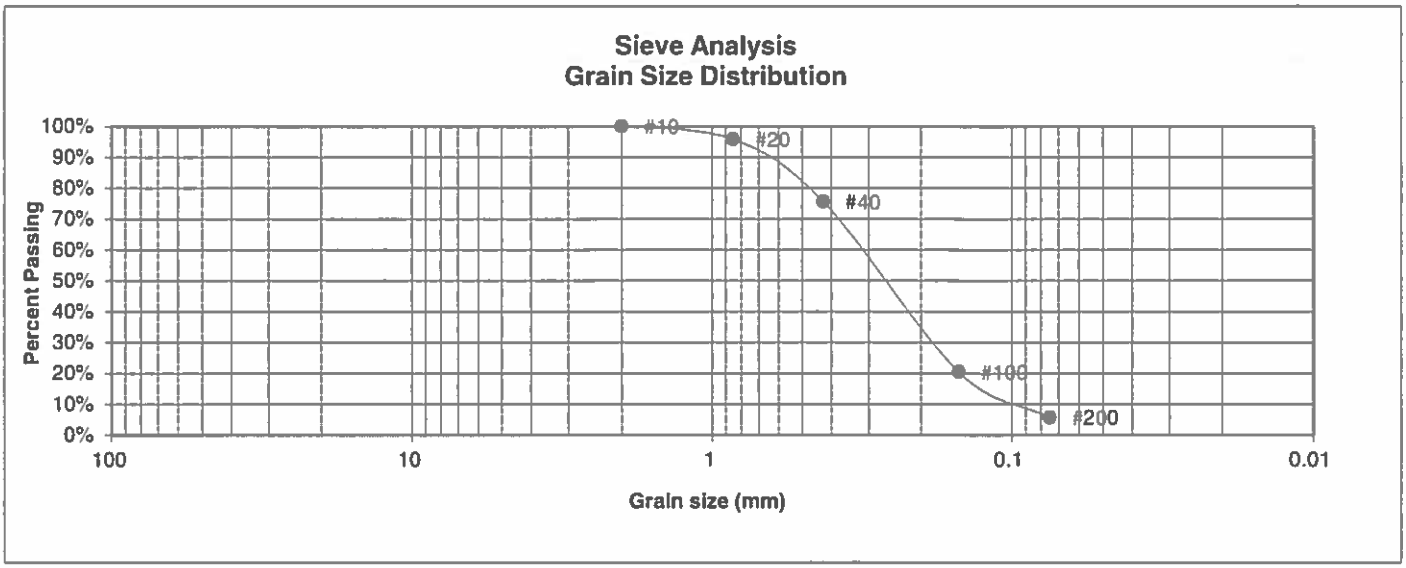
			12/24/20

JOB NO.: 202649

FIG NO.: C-2

UNIFIED CLASSIFICATION	SM-SW	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	1	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	5	JOB NO.	202649
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	95.9%
40	75.6%
100	20.5%
200	5.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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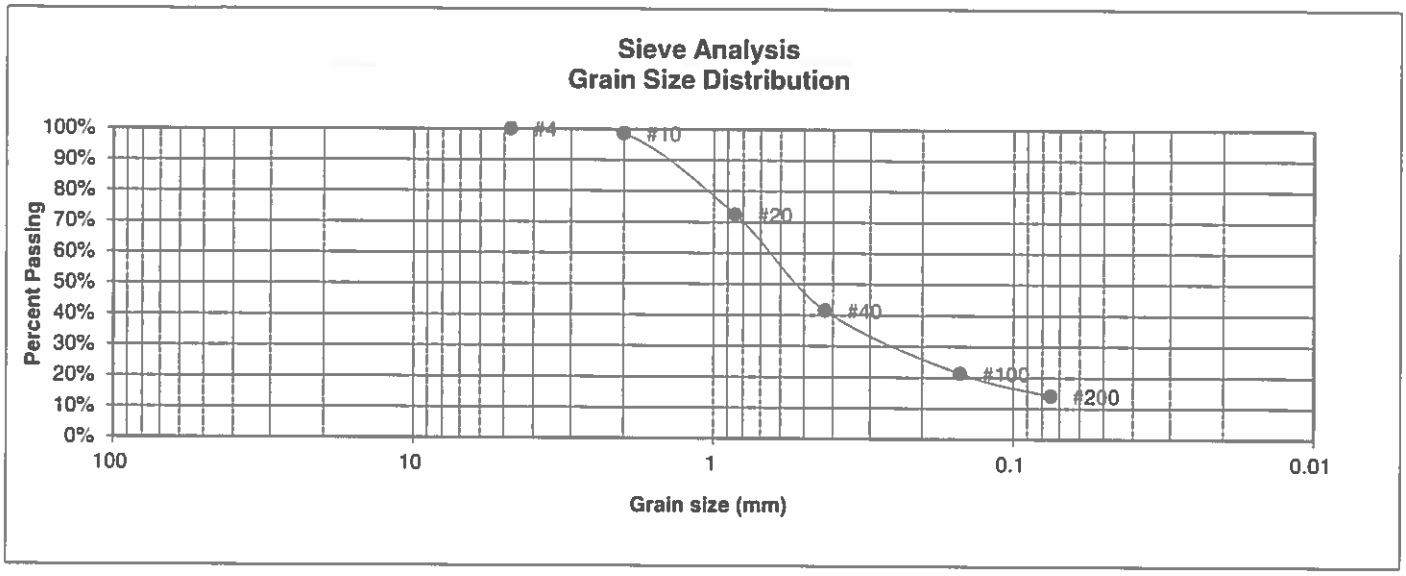
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/29/20

JOB NO.: 202649

FIG NO.: C-3

UNIFIED CLASSIFICATION	SM	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	1	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	7	JOB NO.	202649
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.6%
20	72.4%
40	41.5%
100	21.3%
200	14.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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505 ELKTON DRIVE
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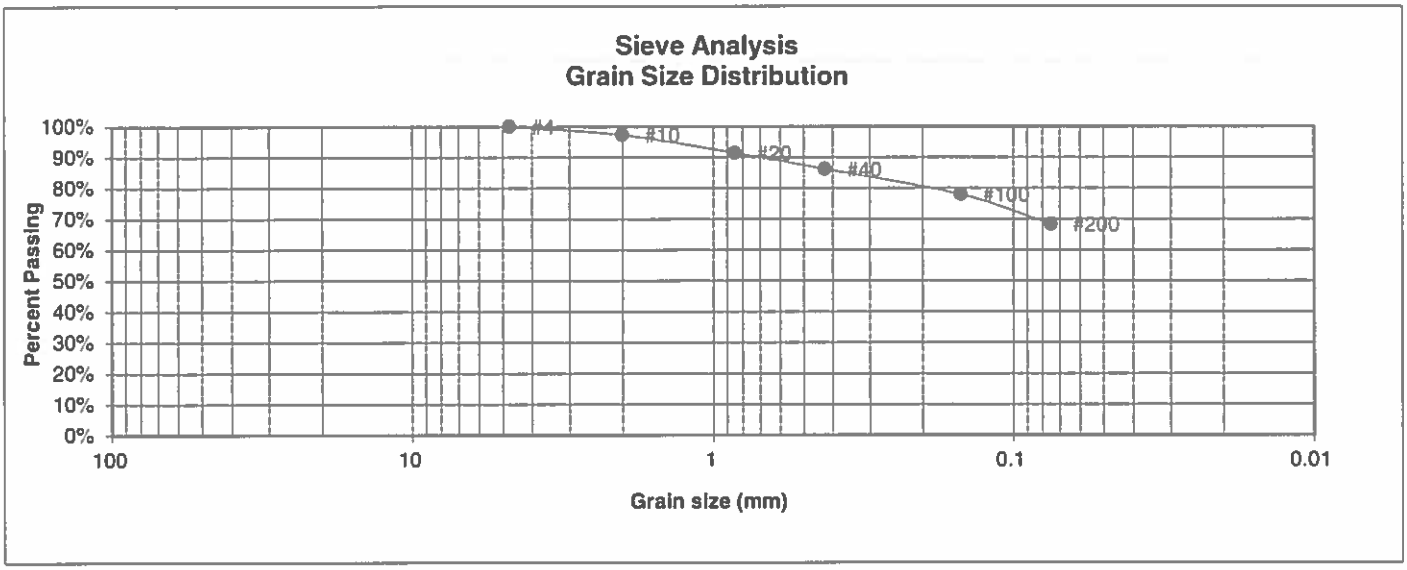
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		h	12/24/20

JOB NO: 202649

FIG NO: C-4

UNIFIED CLASSIFICATION	CL	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	2	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	1	JOB NO.	202649
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.3%
20	91.4%
40	86.2%
100	78.0%
200	68.4%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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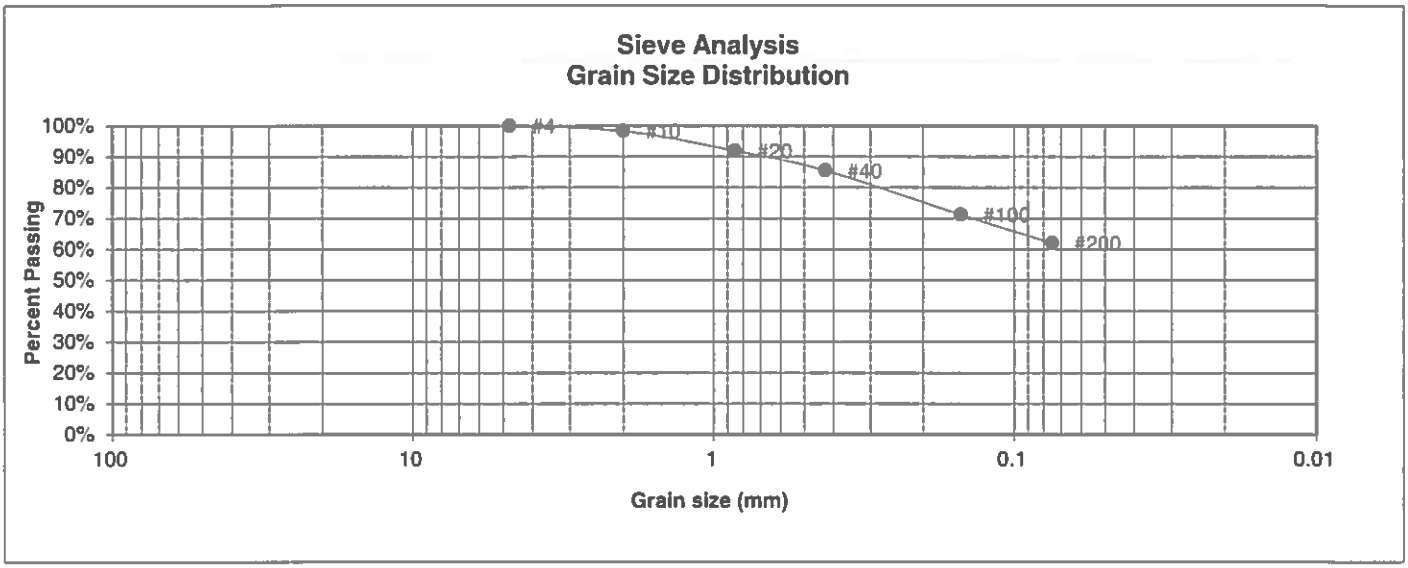
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO.: 202649

FIG NO.: C-5

UNIFIED CLASSIFICATION	CL	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	2	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	2	JOB NO.	202649
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.3%
20	91.9%
40	85.5%
100	71.2%
200	62.0%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

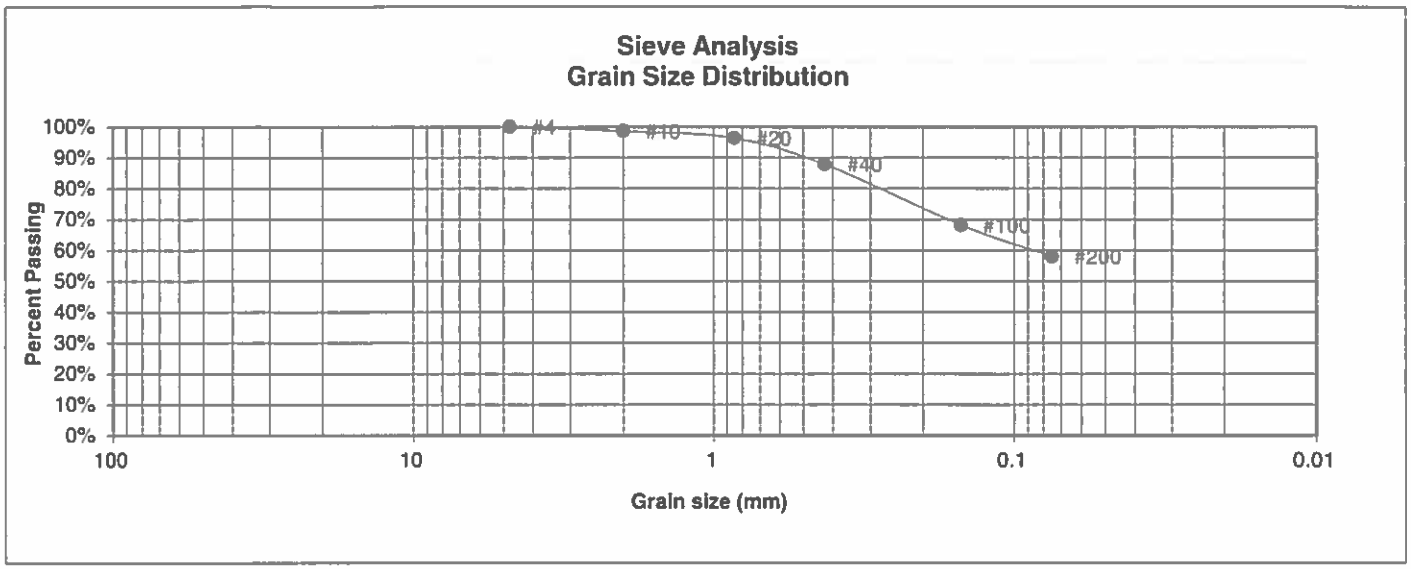
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO: 202649

FIG NO: C-6

UNIFIED CLASSIFICATION	CL	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	2	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	3	JOB NO.	202649
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.6%
20	96.4%
40	87.8%
100	68.2%
200	58.0%

Atterberg Limits	
Plastic Limit	
Liquid Limit	
Plastic Index	
Swell	
Moisture at start	13.8%
Moisture at finish	21.2%
Moisture increase	7.4%
Initial dry density (pcf)	100
Swell (psf)	520

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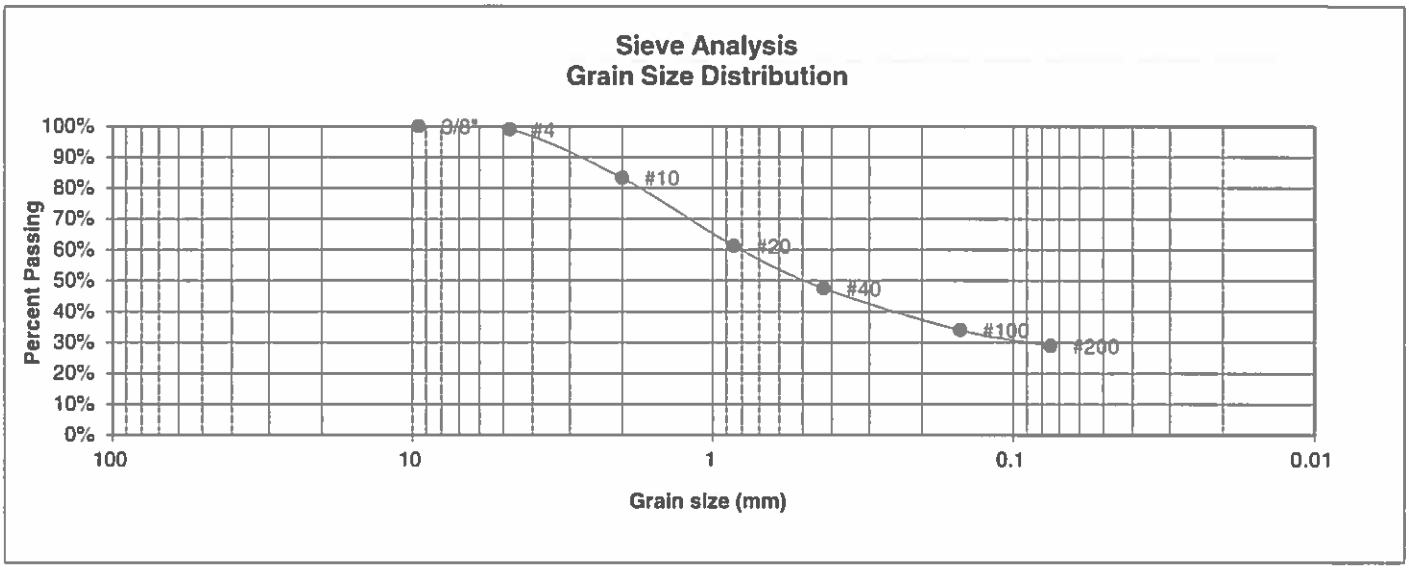
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO: 202649

FIG NO: C-7

UNIFIED CLASSIFICATION	SM	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	3	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	1	JOB NO.	202649
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	83.3%
20	61.2%
40	47.5%
100	34.0%
200	28.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

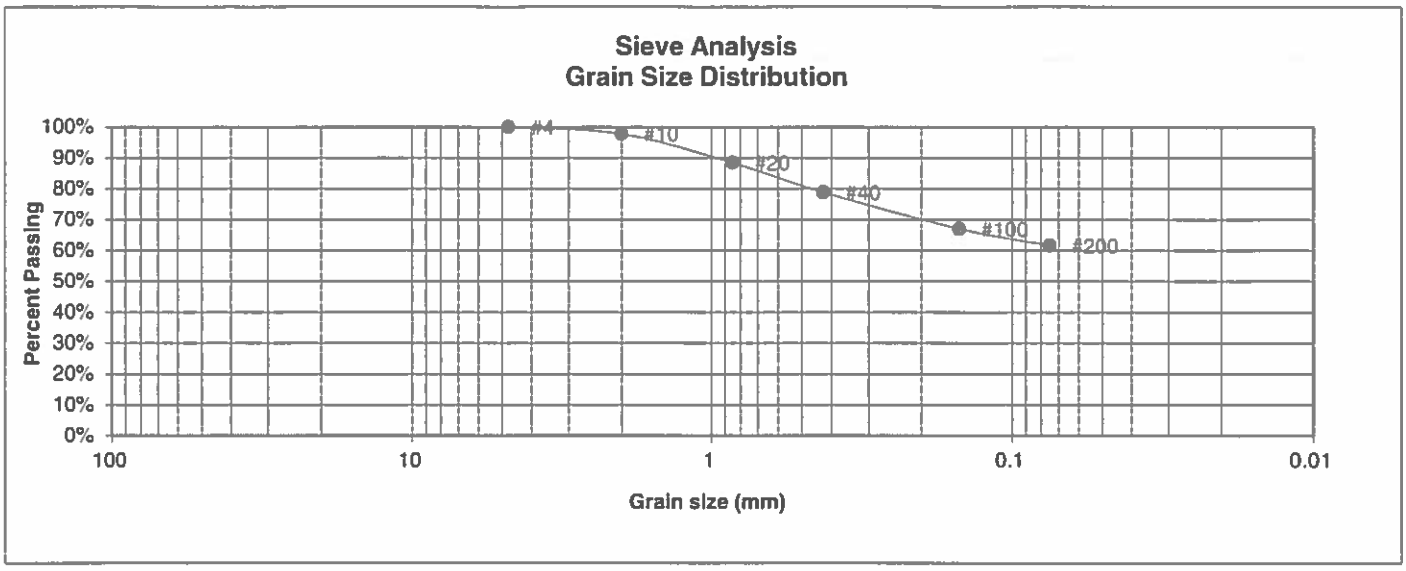
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO.: 202649

FIG NO.: C-8

UNIFIED CLASSIFICATION	CL	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	4	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	4	JOB NO.	202649
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.8%
20	88.5%
40	78.8%
100	67.0%
200	61.7%

Atterberg Limits	
Plastic Limit	22
Liquid Limit	40
Plastic Index	18

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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COLORADO SPRINGS, COLORADO 80907

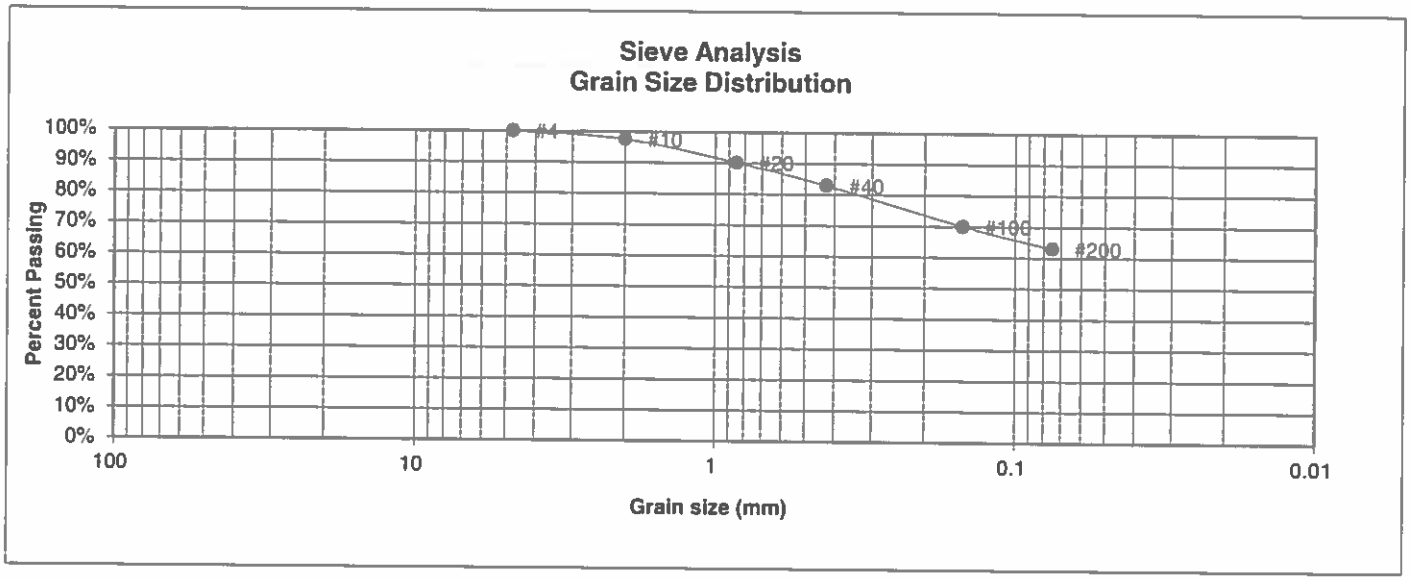
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO: 202649

FIG NO: C-9

UNIFIED CLASSIFICATION	CL	CLIENT	FALCON FIELD, LLC
SOIL TYPE #	4	PROJECT	WOODMEN & HIGHWAY 24
TEST BORING #	6	JOB NO.	202649
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.6%
20	90.1%
40	82.9%
100	70.1%
200	63.0%

Atterberg Limits

Plastic Limit	22
Liquid Limit	33
Plastic Index	11

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		h	12/24/20

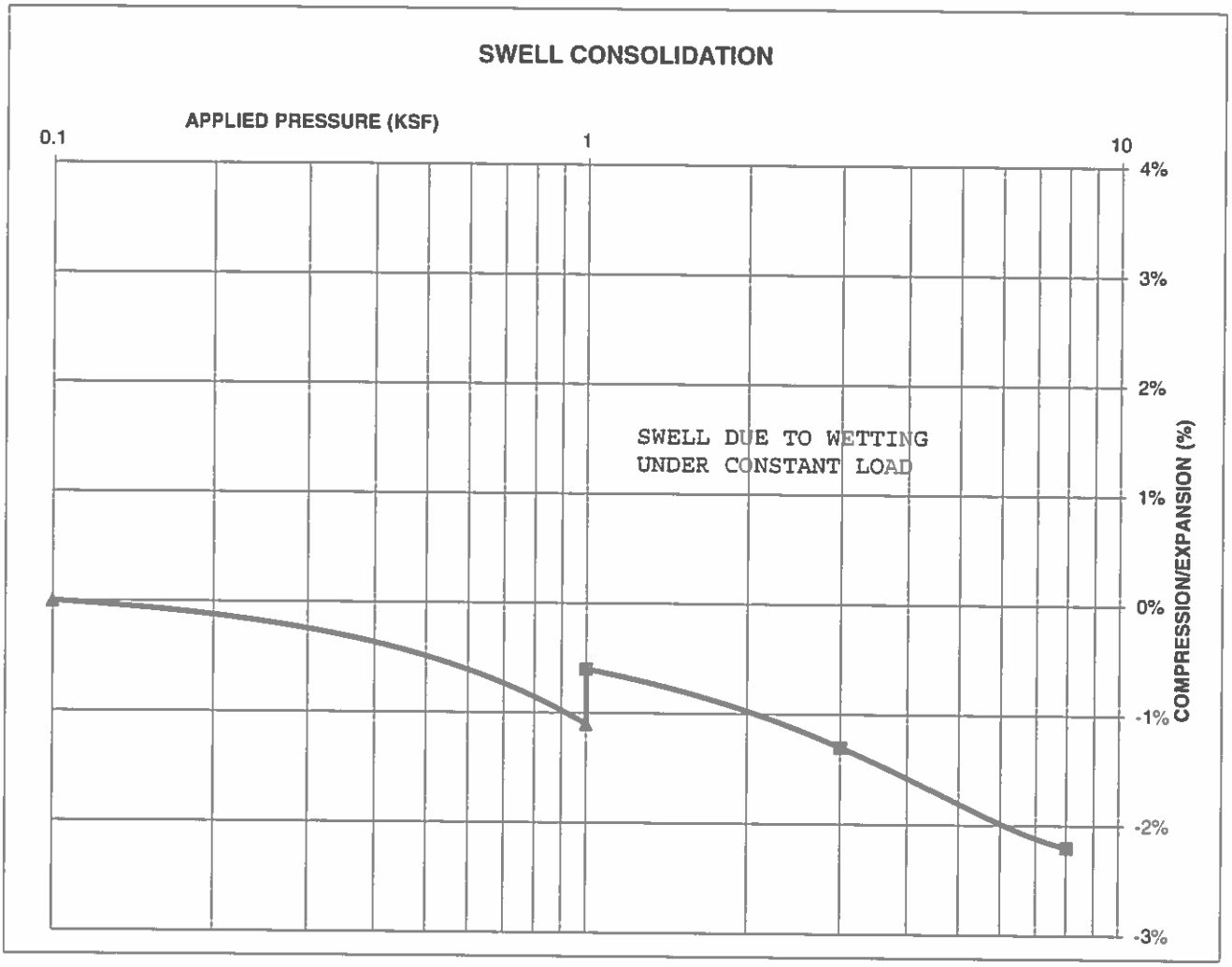
JOB NO. 202649

FIG NO. C-10

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	20
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			125
NATURAL MOISTURE CONTENT			11.9%
SWELL/CONSOLIDATION (%)			0.5%

JOB NO. 202649
CLIENT FALCON FIELD, LLC
PROJECT WOODMEN & HIGHWAY 24



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COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

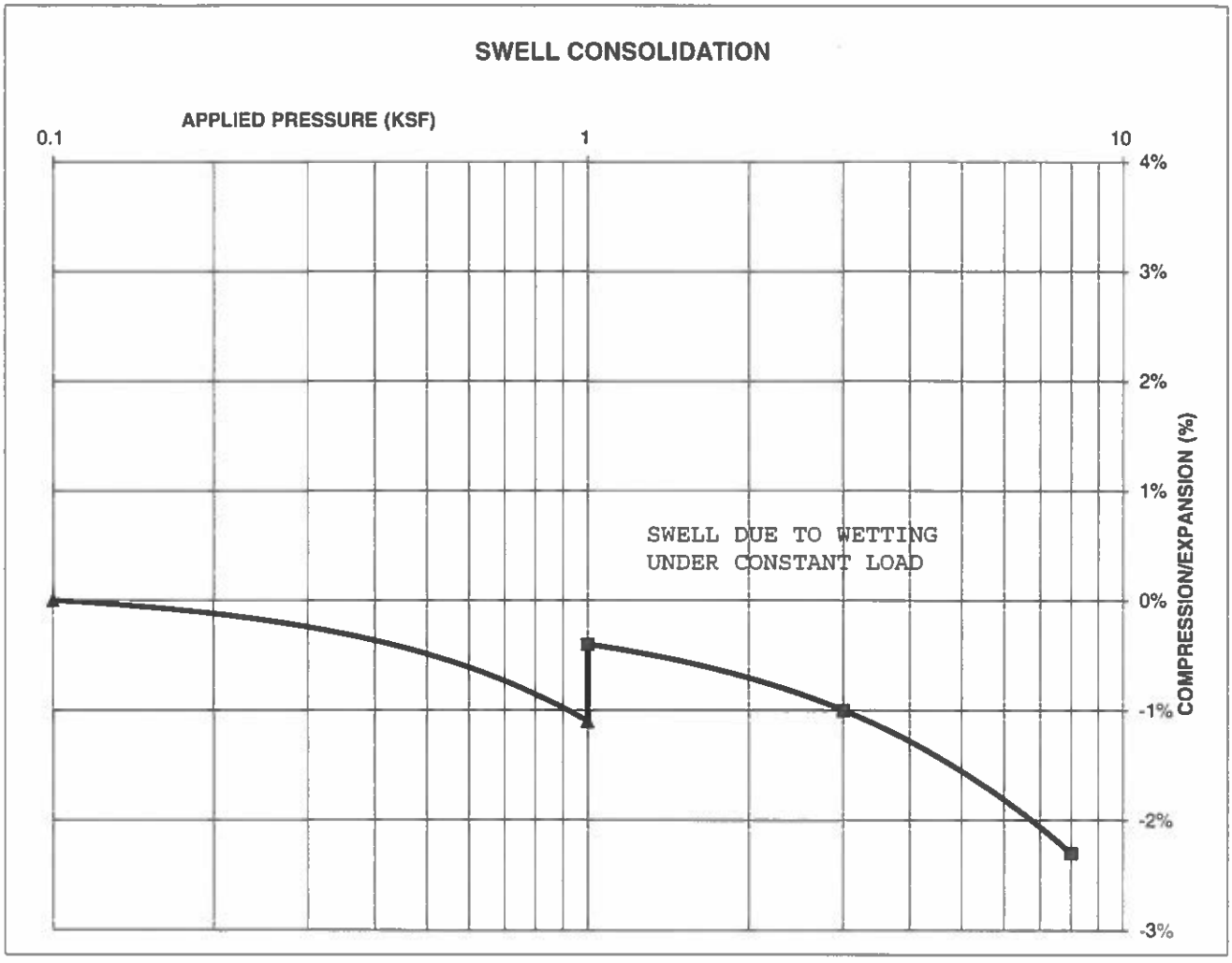
DRAWN:	DATE:	CHECKED:	DATE:
			12/24/20

JOB NO.: 202649
FIG NO.: C-11

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	20
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			117
NATURAL MOISTURE CONTENT			14.9%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 202649
CLIENT FALCON FIELD, LLC
PROJECT WOODMEN & HIGHWAY 24



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 12/24/20

JOB NO.: 202649
FIG NO.: C-12

CLIENT	FALCON FIELD, LLC	JOB NO.	202649
PROJECT	WOODMEN & HIGHWAY 24	DATE	12/17/2020
LOCATION	WOODMEN & HIGHWAY 24	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-4	5	1	SM	0.05
TB-4	20	4	CL	<0.01
TB-6	20	4	CL	0.00

QC BLANK PASS

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LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE
			12/24/20

JOB NO.: 202649

FIG NO.: C-13

APPENDIX D: 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
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 content: 5 percent
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

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

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

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: Fans, flood plains, fan terraces
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
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 capacity: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB215CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 1 percent

Landform: Depressions
Hydric soil rating: Yes

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

Fluvaquentic haplaquolls
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

APPENDIX F: Colorado Geological Survey, Review Comments dated April 14, 2023

…Colorado Geological Survey 4/14/2023 8:17:32 AM	At the time of our March 3, 2021 review of this development (SP211), 20 commercial mixed-use lots were planned. However, based on the updated preliminary plan (Drexel, Barrell & Co., March 16, 2023), eight regional commercial and 169 single-family residential lots are now planned. Entech Engineering states on page 2 of their soil, geology and geologic hazard study (January 20, 2021), “The proposed development is to consist of mixed use/commercial development with retail pads and detention pond tracts.” CGS recommends that Entech be provided with the updated preliminary plans and that their report be revised as appropriate. As noted on page 9 of Entech’s Soil, Geology and Geologic Hazard Study (Entech Engineering, Inc., January 20, 2021), the hazards identified on this site include artificial fill, hydrocompaction, potentially expansive soils, seasonal and potentially seasonal shallow groundwater areas, areas of ponded water, springs, unstable slopes, and floodplains. As noted on page 17 of Entech’s report and the Floodplain Map (figure 7), “Floodplain areas have been mapped in the eastern portions of the site.” Entech also observed groundwater in all the borings at depths ranging from 1.5 to 12.5 feet. Entech states (page 16), “Basements or useable areas below grade are not recommended on the majority of the site.” CGS agrees with Entech that the shallow groundwater conditions preclude the construction of basement levels for this development. A statement indicating “No Basements” should be shown on the preliminary plans and final plat. Seasonal groundwater monitoring has not been conducted at this site as recommended by the Engineering Criteria Manual (ECM), and the extent of seasonal fluctuation is unknown. Without monitoring, potential impacts from groundwater are indeterminate. Since groundwater levels are as shallow as 1.5 feet, CGS recommends the county require groundwater monitoring/observation to verify that proposed floor levels are at least three feet, preferably five feet above maximum anticipated groundwater levels, and maintained year-round. To be effective, however, this monitoring should include observations through fall, winter, and spring rather than merely during site-specific building investigations. It is outside the scope of CGS review to determine whether the 3-ft minimum separation distance exists. CGS agrees with Entech (page 16) that “Filling the site would further raise foundations above the groundwater level.” As noted on page 10 of Entech’s report, “areas of steep slopes along the drainage in the central portion of the site have been identified as unstable,” and “the majority of the drainage is to be located in a drainage tract” (Lots 80 and 81 as indicated on the Preliminary Plan). Entech states (page 10), “A setback of 20 feet from the crest of these slopes is recommended unless stabilized,” and “stabilization could involve regrading to slope angles no steeper than 3:1 or the use of engineer-designed retaining walls, tiebacks, or buttresses.” If stabilization of the slopes is performed, CGS recommends the county requires a slope stability analysis to be completed, submitted, and reviewed for the lots adjacent to the drainage. The required setback should be indicated on the project plans. In summary, CGS recommends:	4/14/2023 8:17:32 AM

• Entech is provided the revised preliminary plan and updates their January 20, 2021 report as appropriate.
• A note be added to the plans stating basement construction is not allowed for this development.
• The county requires groundwater monitoring/observation to verify that proposed floor levels are at least three feet, preferably five feet above maximum anticipated groundwater levels, and maintained year-round.
• The county requires a slope stability analysis to be completed, submitted, and reviewed for lots adjacent to the drainage (Lots 81 and 82) if stabilization of the slopes is performed as a means of mitigation.
• Entech's recommendations are incorporated into the project planning and design.

Submitted 4/14/2023 by Amy Crandall, Engineering Geologist, Colorado Geological Survey