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SOIL, GEOLOGY, GEOLOGIC HAZARD, AND WASTEWATER STUDY, FLYING HORSE NORTH PUD SUBMITTAL EL PASO COUNTY, COLORADO

Prepared for

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Respectfully Submitted,

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SOIL, GEOLOGY, GEOLOGIC HAZARD,
AND WASTEWATER STUDY,
FLYING HORSE NORTH
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1.0 SUMMARY

Project Location

The project consists of Section 36, and portions of the N ½ of Sections 34 and 35, Township 11 South, Range 66 West and portions of Sections 30 and 31, Township 11 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 4 miles southeast of Monument, Colorado.

Project Description

Total acreage involved in the project is approximately 1,423 acres. The proposed site development consists of single-family rural residential lots with areas of open space, parks, and golf course. The development will utilize individual wells and on-site wastewater treatment systems.

Scope of Report

This report presents the results of our geologic evaluation, treatment of engineering geologic hazard study and wastewater study for individual on-site wastewater treatment systems.

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 seasonal and potentially seasonal shallow groundwater areas, drainage areas, areas of ponded water, floodplain, erosion, artificial fill, expansive soils, and areas of downslope creep. Based on the proposed development plan, it appears that these areas will have some impact 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 consists of Section 36, and portions of the N ½ of Sections 34 and 35, Township 11 South, Range 66 West, and portions of Sections 30 and 31, Township 11 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 4 miles southwest of Monument, Colorado, at the north end of Holmes Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from gently to moderately sloping generally to the northeast and southwest off a ridge line that bisects the site with some steeper slopes along drainages in the western portion of the site. The ridge line that bisects the site is associated with the Palmer Divide. The drainages on site flow in westerly and northerly directions through the property. No water was observed flowing in these the drainages at the time of this investigation, however, areas of ponded water were observed behind several earthern dams. 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 in the eastern portions of the site with areas of ponderosa pine tree coverage in the western portions of the site. Site photographs are included in Appendix A. The locations and directions of the photographs are indicated in Figure 3.

Total acreage involved in the proposed development is approximately 1,423 acres. Single-family rural residential lots are proposed with areas of open space, parks and a golf course. The total number of lots proposed is 283. Lot sizes are proposed at 2.5 acres or larger. The area will be serviced by individual wells and on-site wastewater treatment systems. The proposed Concept Plan by is presented in Figure 3.

The site was previously investigated as a part of a Soil, Geology, Geologic Hazard and Wastewater Study by Entech Engineering, Inc., dated February 26, 2015 (Reference 1). Information from this report was used in evaluating the site.

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 Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on November 21 and December 2, 2014. The site was revisited on January 22, 2016.

Fourteen (14) percolation tests were performed on the site to determine general suitability of the site for the use of on-site wastewater treatment systems. The locations of the percolation tests are indicated on the Percolation Test Location Map, Figure 3. The Test Boring Logs from the Profile Holes are presented in Appendix B. Results of this testing will be discussed later in this report.

Laboratory testing was also performed on some of the soils to classify and determine the soils engineering characteristics. Laboratory tests included moisture content testing, ASTM D-2216, grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell testing included both FHA Swell Tests and Swell/Consolidation Tests. 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 10 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 2). The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual, colluvial, man-made, and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. Some colluvial soils exist which are deposited by gravity and sheetwash. The alluvial soils were deposited by water in the drainages on site. Man-made soils exist as earthen dams and erosion 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 3), previously the Soil Conservation Service (Reference 4) has mapped six soil types on the site (Figure 4). In general, they vary from sandy loam to loam and sandy loam with subsoils of clay loam. The soils are described as follows:

Type	Description
14	Brussett loam, 1-3% slopes
26	Elbeth sandy loam, 8-15% slopes
41	Kettle gravelly loamy sand, 8-40% slopes
66	Peyton sandy loam, 1-5% slopes
67	Peyton sandy loam, 5-9% slopes
68	Peyton-Pring complex, 3-8% slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to have moderate to rapid permeabilities. Limitations on development include, limited ability to support a load, shrink swell potential, slopes and frost action 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 Black Forest and Monument Quadrangles Geology Maps showing the site is presented in Figure 5 (References 5 and 6). The Geology Map prepared for the site is presented in Figure 6. Three mappable units were identified on this site which are described as follows:

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

Qal **Recent Alluvium of Quaternary Age:** These are recent stream deposits associated with the drainages on-site. These materials generally consist of silty to clayey sands and may contain clay lenses. Highly organic soils may be encountered in some of these areas.

Tkd **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 and sandy clays. Areas of colluvial soils may exist on some of the slopes on site. These materials are derived from the bedrock materials and have been re-deposited by the action of sheetwash and gravity.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Black Forest and Monument Quadrangles* distributed by the Colorado Geological Survey in 2003 (References 5 and 6), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 7), and the *Geologic Map of the Denver $1^0 \times 2^0$ Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 8). The Test Borings from the profile holes 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 of the percolation tests can be grouped into three general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 is a silty to clayey sand (SM, SC), encountered in twelve of the profile holes at depths ranging from the surface to 9 feet bgs and extending to depths ranging from one foot to the termination of the borings (15 feet). These soils were encountered at loose to dense states and at moist conditions. Samples tested had 18 to 37 percent passing the No. 200 Sieve. A swell pressure of 150 psf was measured in the FHA Swell Test, indicating low expansion potential.

Soil Type 2 consists of sandy to very sandy clay (CL). The clay was encountered in nine of the profile holes at depths ranging from the surface to 4 feet bgs and extending to depths ranging from one foot to the termination of the borings (15 feet). These soils were encountered at firm to very stiff consistencies and at moist conditions. Samples tested had 55 to 97 percent passing the No. 200 sieve. A swell of pressure of 1485 psf was measured on the clays in the FHA Swell Test. Swells of 0.3 to 2.7 percent were measured on the clays in the Swell/Consolidation Test. These swells are in the low to high expansion range.

Soil Type 3 consists of silty sandstone (SM). This material was encountered ten of the profile holes at depths ranging from one foot to 14 feet bgs and extending to the termination of the boring (15 feet). The sandstone was encountered at dense to very dense states and at moist conditions. The samples tested had 13 to 26 percent passing the No. 200 sieve. The silty sandstone typically exhibits low expansive potential. Expansive clayey sandstone and claystone are common in the area.

The Test Boring Logs from the Profile Holes are presented in Appendix B. Laboratory Test Results are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

5.5 Groundwater

Groundwater was not encountered in any of the profile holes which were drilled to 15 feet. Areas of seasonal and potentially seasonal shallow groundwater and ponded water have been mapped in the drainages on-site. A floodplain area is mapped in the extreme northerly portion of the 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 or clays. 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

As mentioned previously, 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 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 areas of man-made fill associated with earthen dams and erosion berms on-site.

Mitigation: The earthen dams lie within defined drainages and should be avoided as building sites. The erosion berms can either be avoided or penetrated by foundations. The fill on this site is considered uncontrolled for construction purposes. Any uncontrolled fill encountered beneath foundations will require removal and recompaction at a minimum of 95% of its maximum Modified Procter Dry Density, ASTM D-1557.

Areas of Erosion

These are areas that are undergoing erosion by water and sheetwash producing gullies and rill erosion.

Mitigation: Due to the nature of the soils on this site, virtually all the soils are subject to erosion by wind and water. Other minor areas of erosion were observed on site other than those mapped, particularly where some rill erosion has occurred. Areas of erosion can occur across the entire site, particularly if the soils are disturbed during construction. Vegetation reduces the potential for erosion. The areas identified where erosion is actually taking place may require check dams, regrading and revegetation using channel lining mats to anchor vegetation. Further recommendations for erosion control are discussed under Section 9.0 "Erosion Control" of this report. Recommendations pertaining to revegetation may require input from a qualified landscape architect and/or the Natural Resource Conservation Service (previously Soil Conservation Service).

Expansive Soils

The site is classified in an area of low to moderate swell potential according to *the Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* by Hart, 1974 (Reference 9). Expansive soils were encountered in some of the test borings drilled on–site. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These clays, if encountered beneath foundations, can cause differential movement in the structure foundation. These occurrences should be identified and dealt with 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% 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.

Seasonal Shallow Groundwater Area

In these areas, we would anticipate periodic high subsurface moisture conditions and frost heave potential on a seasonal basis. Additional, highly organic soils could be encountered in these areas. These areas lie within defined drainages and it is anticipated they will be avoided by development. Any structures in or adjacent to these areas should follow the mitigation discussed below.

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 7. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Structures should not block drainages. All organic material should be completely removed prior to any fill placement. Septic fields should not be located in areas where there is the potential for shallow groundwater. The majority of the site does not lie within any floodplain zones according to the FEMA Map Nos. 08041CO295F, 08041CO315F, and 08041CO325F dated March 17, 1997 (Figure 8, Reference 10). A minor area in the extreme northern portion of the site is mapped on a floodplain. This area is designated as open space and will be avoided by development. Exact locations of floodplain and specific drainage studies are beyond the scope of this report. Finished floor levels must be located a minimum of one foot above floodplain levels.

Potentially Seasonal Shallow Groundwater Area

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. The majority of these areas lie within defined drainages which can likely be avoided by the proposed development. The same mitigation recommendations for the seasonal shallow groundwater areas apply to the potentially seasonal shallow groundwater areas.

Areas of Ponded Water

These are areas of standing water behind earth dams on site. We would not expect development in these areas. Either the dams can be avoided by construction or the areas may be completely regraded. Should complete regrading of the 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.

Downslope Creep Areas

These areas are acceptable as building sites, however, in areas identified with this hazard classification, we would anticipate accelerated lateral and vertical movement of the near surface soils in the downslope direction.

Mitigation: The design of foundations in these areas should account for the additional pressure on the uphill side of the structure due to the creep potential. The lateral pressure distribution for sloping conditions in downslope creep area is presented in Figure 9. Tie-beams, buttresses and counterforts may be necessary in some areas. Where possible, in areas of downslope creep, structures should be designed to be as compact and rigid as possible. This will help them better tolerate the vertical and lateral movements to which the foundation system may be subjected with minimal damage. Long, rambling, irregular structures should be avoided, as they are associated with much greater potential for damaging differential movement. Additionally, structures should be designed to step up the slope. Deep cuts in these areas should be avoided. Any retaining walls proposed in these areas should also be properly designed for by a qualified professional engineer for the global slope stability. Proper control of drainage at both the surface and subsurface is important. Saturation of materials should be avoided that may create unstable conditions.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, we understand that the development will be rural residential. 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. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper residual soils are typically at loose to very dense states and firm to very stiff consistencies. The granular soils encountered in the upper soil profiles of the test borings should provide good support for foundations. Expansive soils were encountered on portions of the site that will require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils. Areas containing arkosic sandstone will have high allowable bearing conditions. Difficult excavation should be anticipated in areas of shallow bedrock. Expansive layers may also be encountered in the soil and bedrock on this site. Areas of expansive soils encountered on site are sporadic; therefore, none have been indicated on the maps. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.
Areas of seasonal and potentially seasonal high groundwater areas and ponded water were encountered on site. Due to the size of the lots and the proposed development, these areas can be avoided by construction. Septic systems are not recommended in these areas. Structures should not block drainages. Drains may be necessary for structures adjacent to these areas to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. The majority of the site does not lie within any floodplain zones according to the FEMA Map Nos. 08041CO295F, 08041CO315F and 08041CO325F, dated March 17, 1997 (Figure 8, Reference 10). A floodplain is mapped in the extreme northern portion of the site. This area is designated as open space and will be avoided by development. Exact locations of floodplain and specific drainage studies are beyond the scope of this report.

Areas of fill were observed on site associated with dams and erosion control berms. It is anticipated the dams could be avoided by development. The erosion berms can be avoided or penetrated by foundations. Any uncontrolled fill encountered beneath foundations should be removed and recompacted at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

Areas of erosion and gullying may require the construction of check dams and revegetation if construction encroaches on these areas. General recommendations for erosion control are discussed under Section 9.0 "Erosion Control".

Areas of downslope creep areas have been identified on this site. In areas of downslope creep, structures should be designed to be as compact and rigid as possible. Foundations may require tie-beams or additional reinforcement in these areas. Foundations should be designed to step up the slopes to avoid deep cuts. Deep cuts should be avoided on all steeper sloping areas of the site. Any retaining walls proposed should be designed for the global slope stability by a qualified professional engineer. This includes cuts made for terracing in backyards. Proper control of drainage at both the surface and subsurface is important. Saturation of materials should be avoided that may create unstable conditions.

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. Additional field investigation is recommended as each filing is developed. Investigation on each lot is also recommended prior to construction.

7.0 ON-SITE WASTEWATER TREATMENT

The site was evaluated for individual on-site wastewater treatment systems in accordance with El Paso Land Development Code. Fourteen (14) percolation tests were performed on the property. Percolation tests may not be located in the exact areas of proposed systems. The approximate locations of the percolation tests are indicated on Figure 3 and on the Geology Map, Figure 6 and the Septic Suitability Map Figure 10. A table showing the results of the percolation tests is presented in Table 2. The specific test results are presented in Appendix E of this report.

The Natural Resource Conservation Service (Reference 3), previously the Soil Conservation Service (Reference 4) has been mapped with 5 soil descriptions. The Soil Survey Map (Reference 3) is presented in Figure 4, and the Soil Survey Descriptions are presented in Appendix D. The soils are described as having moderate to rapid percolation rates.

The individual percolation test results ranged from 34 minutes per inch to 240 minutes per inch. Two of the percolation rates are suitable for conventional individual sewage treatment systems. However, one of these tests had shallow bedrock that would require a designed system. Most of the percolation rates are slower than 60 minutes per inch which will require designed systems.

Standard penetration testing, ASTM D-1586, was performed in each profile hole to evaluate the density of the soil and the presence of bedrock. Bedrock was encountered in 10 of the profile holes at depths ranging from one to 14 feet. Bedrock was not encountered of the other profile holes which were drilled to 15 feet. Shallow bedrock was encountered in two of the profile holes. Designed systems are required in areas of shallow bedrock.

Absorption fields must be maintained a minimum of 4 feet above groundwater. Groundwater was not encountered in any of the profile holes which were drilled to depths of 15 feet. Should any be encountered within 6 feet of the surface, shallow leaching fields would be recommended. In areas where groundwater is less than 4 feet, designed systems will be required.

The percolation rates in two of the locations are suitable for conventional systems. However, one of these tests had shallow bedrock which would require a designed system. Twelve tests had rates of slower than 60 minutes per inch. El Paso County guidelines require designed systems for percolation rates that exceed 60 minutes per inch. Bedrock was encountered in two of the profile holes at depths that would affect conventional systems. Other areas of the site may also contain shallow bedrock. Where bedrock is encountered shallower than 6 feet, designed systems may be required. A Septic Suitability Map is presented in Figure 10. A possible house location, two potential on site wastewater treatment systems (OWS) and a possible well location for each lot are indicated on Figure 11. Septic systems are not recommended in drainage areas where the potential exits for shallow groundwater. In areas where suitable percolation rates cannot be found, shallow groundwater exists or shallow

bedrock exists, designed systems will be required. It is anticipated designed systems will be required on much of the site.

In summary, it is our opinion the site is suitable for individual on-site wastewater treatment systems (OWS) and that contamination of surface and subsurface water resources should not occur provided the OWS sites are evaluated and installed according to El Paso County and State Guidelines and properly maintained. Individual percolation testing is required on each lot prior to construction. Septic systems must be located a minimum of 100 feet from any well, including those on adjacent properties. Absorption fields also be located a minimum of 50 feet from any drainages, floodplains or ponded areas and 25 feet from dry gulches.

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 11), portions of the area are mapped as stream terrace and floodplain deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 12), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 13), the area of the site has been mapped as "Little or No Potential" for industrial minerals. It is possible sand materials on site could be an aggregate resource. However, considering the silty to clayey nature of much of these materials and 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 13), 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 13).

The site has been mapped as "Fair" for oil and gas resources (Reference 13). 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 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 Flying Horse North 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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TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT FLYING HORSE DEVELOPMENT
PROJECT FLYING HORSE NORTH
JOB NO. 141588

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	1	2-3			23.9						SM	SAND, SILTY
1	11	2-3			17.6	NV	NP	<0.01			SM	SAND, SILTY
1	14	2-3			30.8						SM	SAND, SILTY
1	5	2-3			22.3	22	3				SM	SAND, SILTY
1	9	10			19.8				152		SM	SAND, SILTY
1	12	10			36.5			0.01			SM	SAND, SILTY
2	8	10	10.8	111.7	55.5	36	12			0.3	CL	CLAY, VERY SANDY
2	2	5			61.4						CL	CLAY, VERY SANDY
2	3	2-3	11.1	116.2	84.8	32	13			0.7	CL	CLAY, SANDY
2	4	5			74.5				1485		CL	CLAY, SANDY
2	6	2-3	10.7	112.3	96.5	39	17			0.6	CL	CLAY, SANDY
2	10	5	14.3	113.6	62.5					2.7	CL	CLAY, SANDY
3	13	5			20.0						SM	SANDSTONE, SILTY
3	1	15			24.0						SM	SANDSTONE, SILTY
3	3	10			23.8	NV	NP				SM	SANDSTONE, SILTY
3	6	15			12.7						SM	SANDSTONE,S ILTY
3	7	10			26.3						SM	SANDSTONE, SILTY

Table 2: Summary of Percolation Test Results

Percolation Test No.	Percolation Rate (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	6.3	9/11*	>15
2	240	>15	>15
3	67	9/>15*	>15
4	80	>15	>15
5	240	3/>15*	>15
6	187	8/10*	>15
7	240	11/>15*	>15
8	240	>15	>15
9	134	14	>15
10	111	>15	>15
11	40	9/11*	>15
12	67	11	>15
13	34	1	>15
14	76	11	>15

* Weathered bedrock/Formational bedrock

FIGURES

N

DANCING WOLF SUB

SETTLERS RANCH

TRI

TRI

HIGH FOREST RANCH

EAGLE CREST ESTATES

SITE

BLA

BLA

COUNTRY VIEW ESTATES

PALMER DIVIDE SUB

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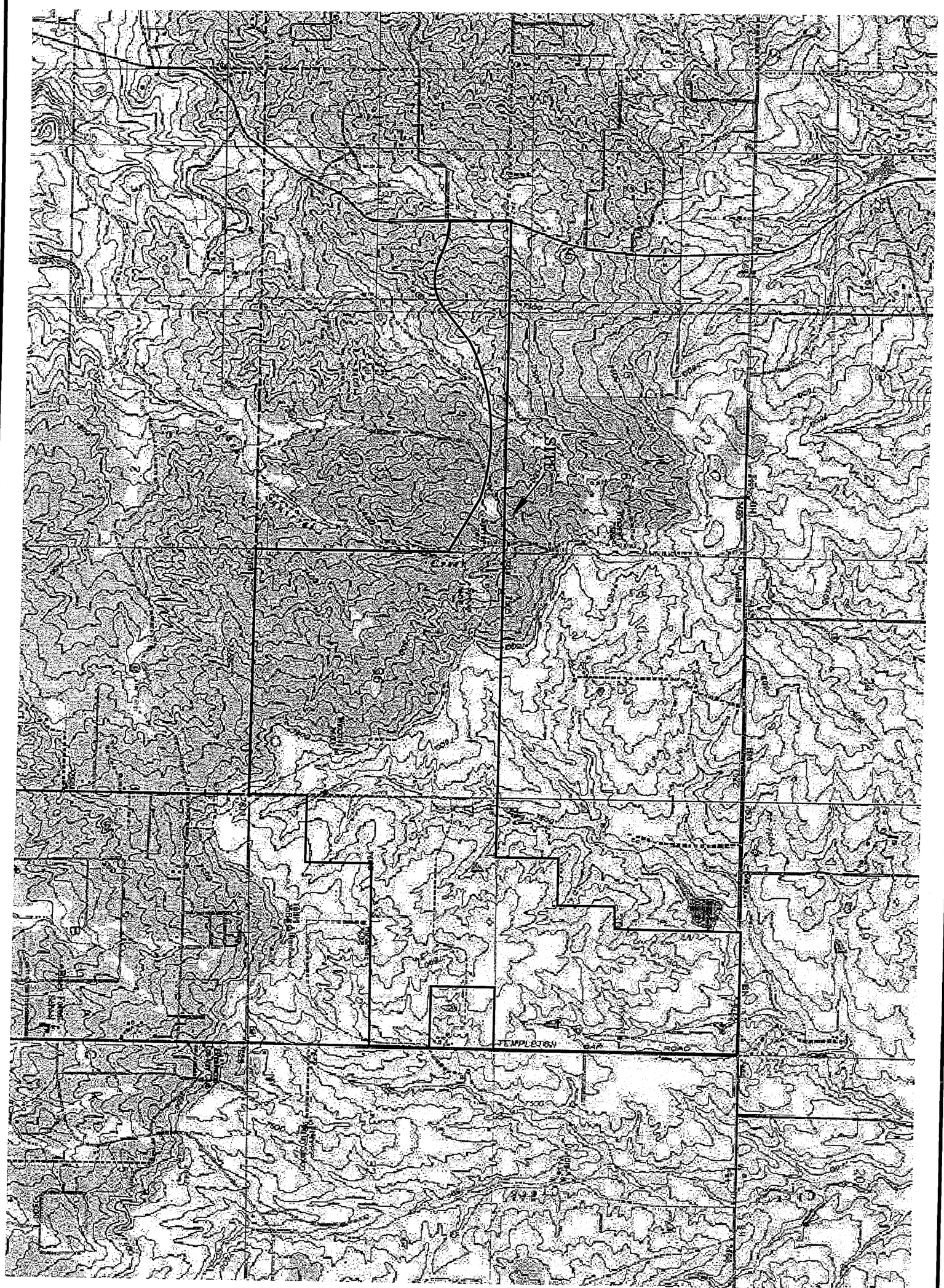
COLORADO SPRINGS, CO. 80907

Vicinity Map
Flying Horse North
El Paso County, CO.

DRAWN	KAH
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	160118
FIGURE No.	1



DRAWN	KAH
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	1018
PROJECT NO.	

2

USGS Map
Flying Horse North
El Paso County, CO.

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Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

(P3) APPROXIMATE LOCATION AND DIRECTION OF PHOTOGRAPH

N

HODGEN ROAD

THOMPSON RD

KY WAY

FARRAR RD

SIESTA GROVE

EAGLE CREST ESTATES

DESIGN IN PROGRESS

HIGH FOREST RANCH

WINDING TRAIL RD

HIDDEN ROCK RD

HIGH FOREST RD

OPEN SKY WAY

SHAMROCK PRESERVE

MILLHAVEN PL

TRAIL CONNECTION

BLACK FOREST ROAD

PH1 PH2 PH3 PH4 PH5 PH6 PH7 PH8 PH9 PH10 PH11 PH12 PH13 PH14

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P20 P21 P22 P23 P24 P25 P26

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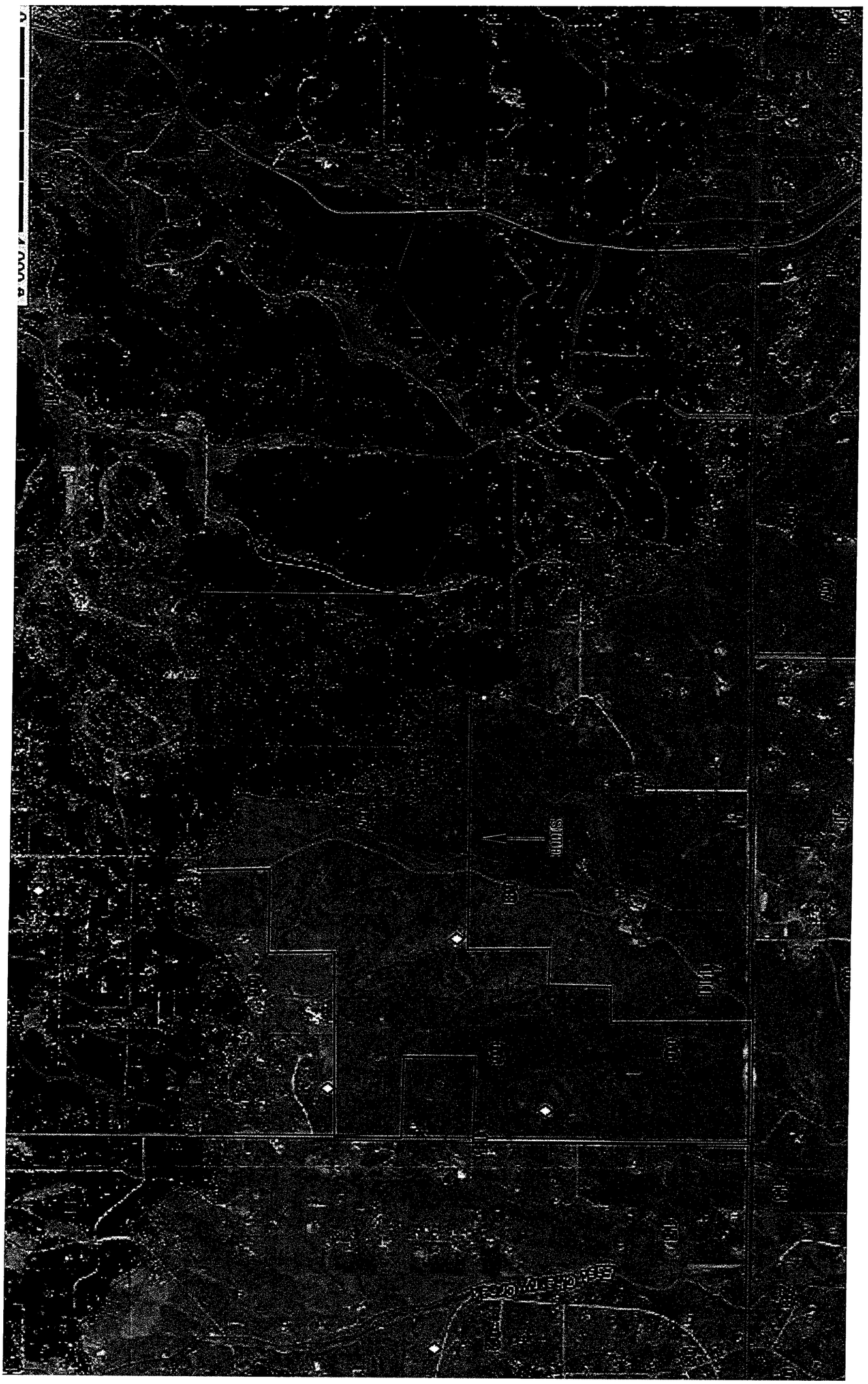
DEVELOPMENT PLAN/
PERCOLATION TEST LOCATION MAP
FLYING HORSE NORTH
EL PASO COUNTY, CO.

DRAWN	KAH
CHECKED	
DATE	02/12/16
SCALE	AS SHOWN
JOB NO.	160118
FIGURE No.	3



Soil Survey Map
Flying Horse North
El Paso County, CO.

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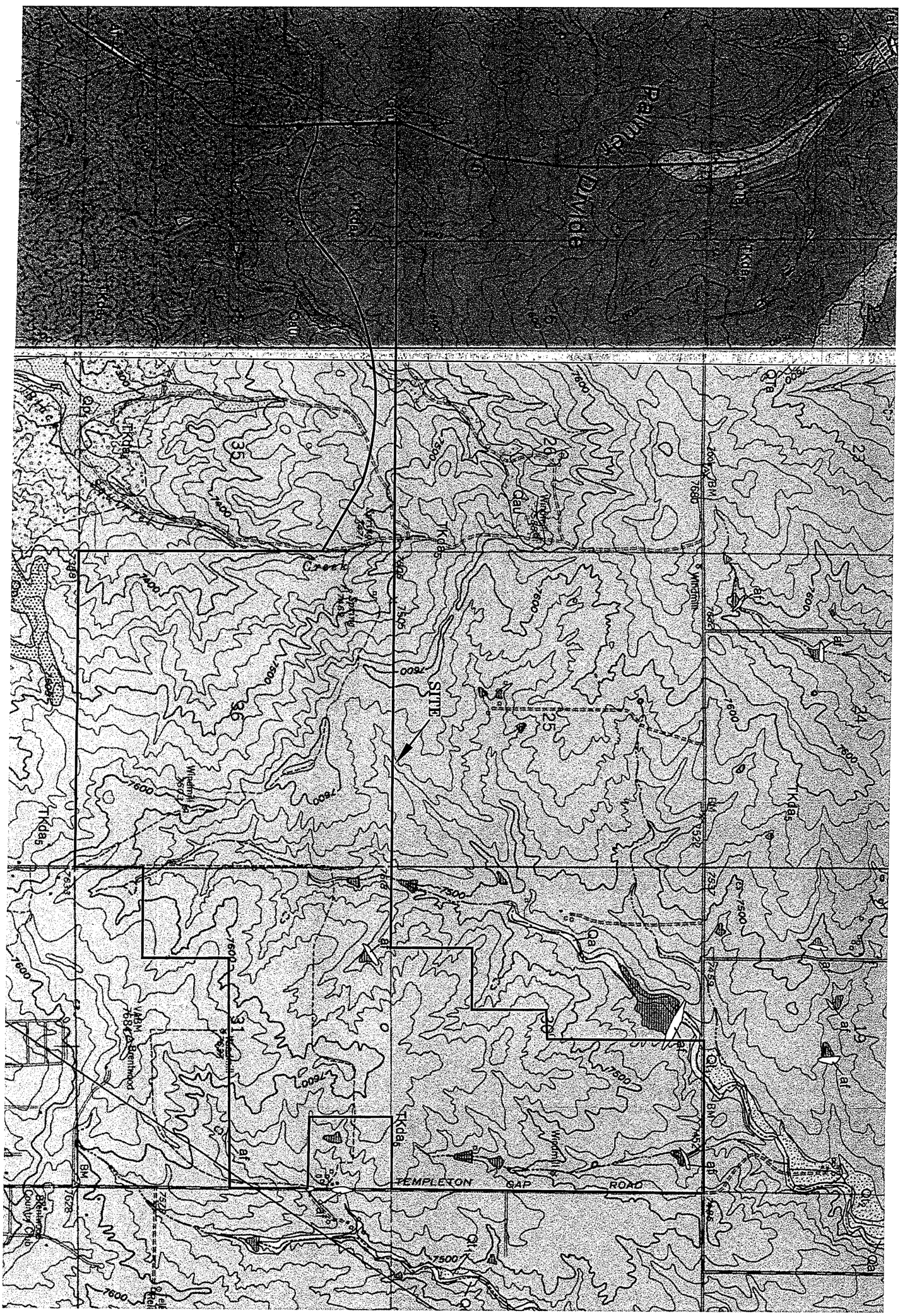
DRAWN	CHECKED
DRAWN BY	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	1618
FIGURE No.	4

REVISION	BY



Mounument/Black Forest Quadrangle
Geology Map
Flying Horse North
El Paso County, CO.

DRAWN: KAH
CHECKED:
DATE: 2/12/16
SCALE: AS SHOWN
JOB NO. 160118
FIGURE No. 5

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Δ PH14 - **APPROXIMATE LOCATION OF PERCOLATION TEST**

LEGEND

Qaf - Artificial Fill of Holocene Age:
Man-made fill deposits.

Qal - Recent Alluvium of Holocene Age:
Recent water deposited materials

Tkd - Dawson Formation of Tertiary and Cretaceous Age:
Arkosic sandstone with siltstone and claystone lenses

dsc - downslope creep

er - areas of erosion

fp - floodplain

psw - potentially seasonal shallow groundwater area

sw - seasonal shallow groundwater area

w - areas of ponded water

N

DESIGN IN PROGRESS

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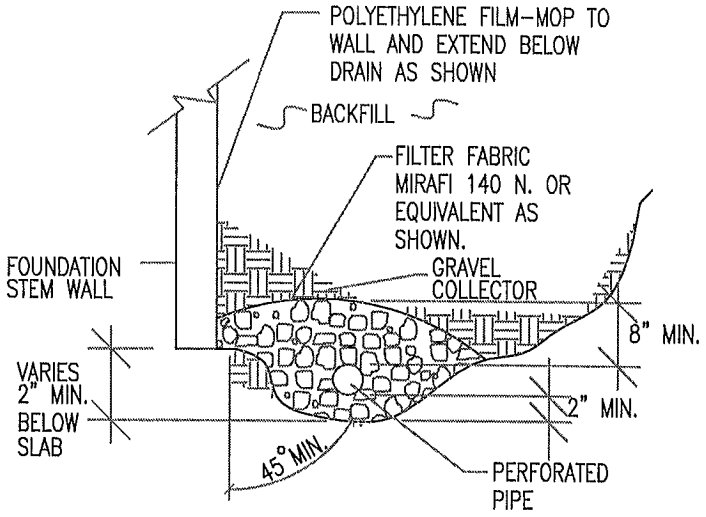
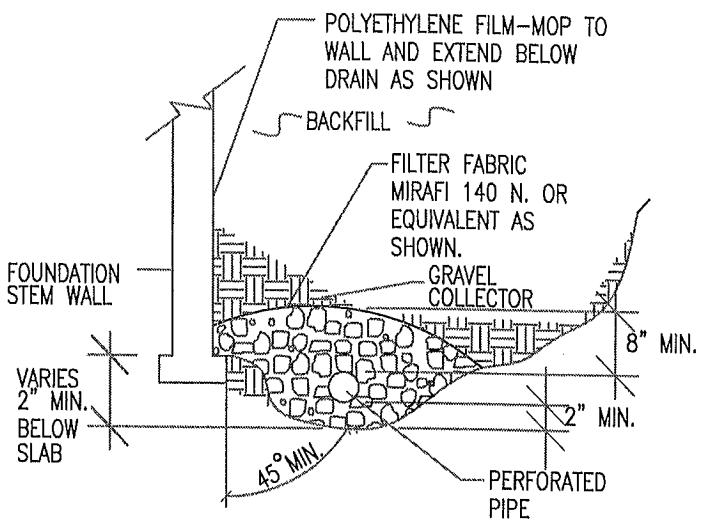
GEOLOGY/ENGINEERING GEOLOGY MAP
FLYING HORSE NORTH
EL PASO COUNTY, CO.

DRAWN	KAH
CHECKED	
DATE	02/22/16
SCALE	AS SHOWN
JOB NO.	160118
FIGURE No.	6





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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PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:
	2/12/16	DS	

JOB NO.: 160118

FIG NO.: 7

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100–YEAR 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, velocities also determined.

ZONE A99 To be protected from 100–year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500–year flood; areas of 100–year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100–year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500–year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

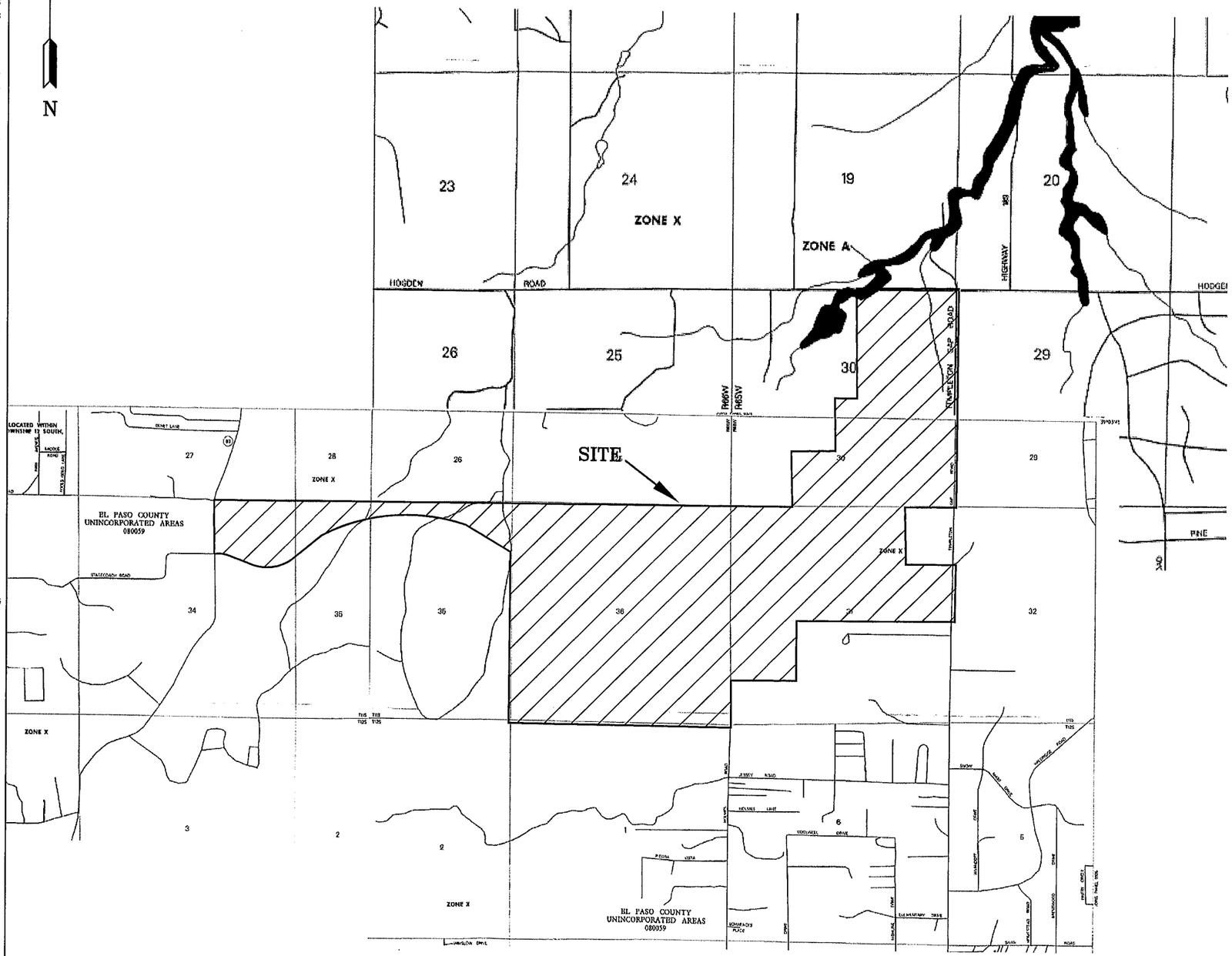
D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 — Elevation Reference Mark

M2 — River Mile

97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.



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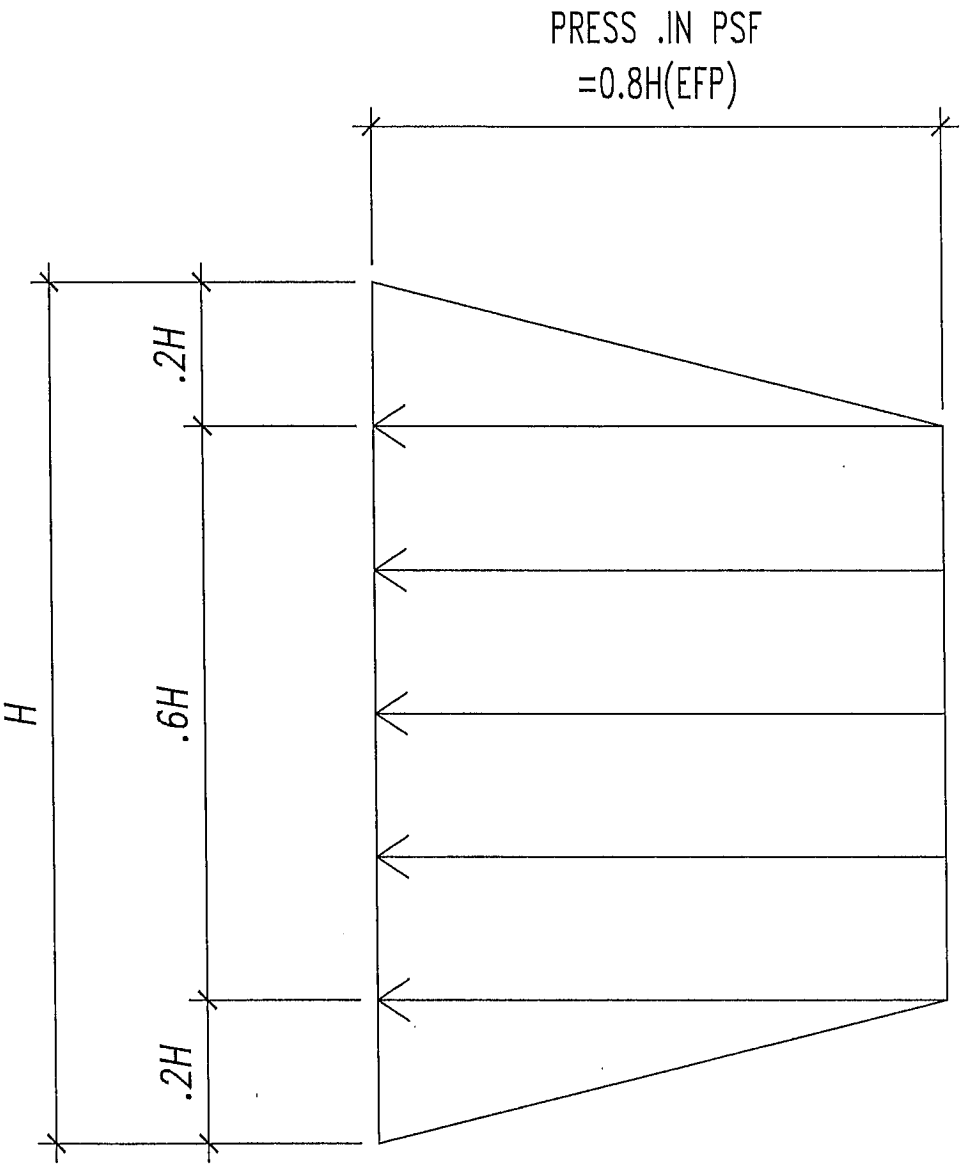
COLORADO SPRINGS, CO. 80907

Floodplain Map
Flying Horse North
El Paso County, CO.

DRAWN	KAH
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	160118
FIGURE No.	8



PRESSURE DISTRIBUTION

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LATERAL PRESSURE DISTRIBUTION
AREA WITH CREEP

DRAWN BY:	DATE DRAWN:		
R. MCBRIDE	03/13/13		2/12/16

JOB NO.: 160118

FIG. NO.: 9

Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

AREAS WHERE DESIGNED SYSTEMS ARE RECONMENDED DUE TO SLOW PERCOLATION RATES

AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED

AREAS WHERE DESIGNED SYSTEMS MAY BE REQUIRED DUE TO SHALLOW BEDROCK

AREAS WHERE CONVENTIONAL SYSTEMS CAN BE USE UNLESS SHALLOW BEDROCK, SHALLOW GROUNDWATER OR SLOW PERCOLATION RATES ARE ENCOUNTERED REQUIRING DESIGNED SYSTEMS

N

POSSIBLE HOUSE LOCATION

TWO POSSIBLE OWS (ON-SITE WASTE WATER TREATMENT SITES)

POSSIBLE WELL LOCATION

HODGEN ROAD

THOMPSON RD

EAGLE CREST ESTATES

FARRAR RD

SIESTA GROVE

KY WAY

HIGH FOREST RANCH

WINDING TRAIL RD

HIDDEN ROCK RD

HIGH FOREST RD

OPEN SKY WAY

SHAMROCK PRESERVE

MILLHAVEN PT

TRAIL CONNECTION

BLACK FOREST ROAD

PALMER DIVIDE CLUB

PH1 PH2 PH3 PH4 PH5 PH6 PH7 PH8 PH9 PH10 PH11 PH12 PH13 PH14 PH15 PH16

DESIGN IN PROGRESS

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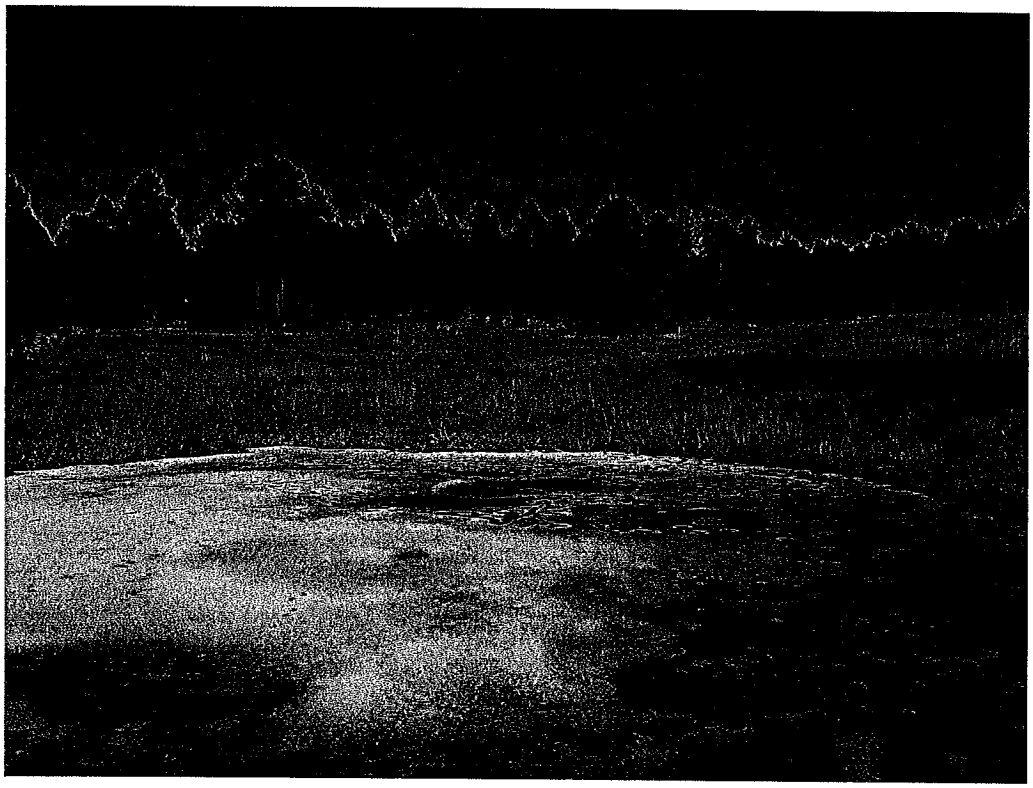
SEPTIC SUITABILITY MAP
FLYING HORSE NORTH
EL PASO COUNTY, CO.

DRAWN	KAH
CHECKED	
DATE	02/22/16
SCALE	AS SHOWN
JOB NO.	160118
FIGURE No.	10

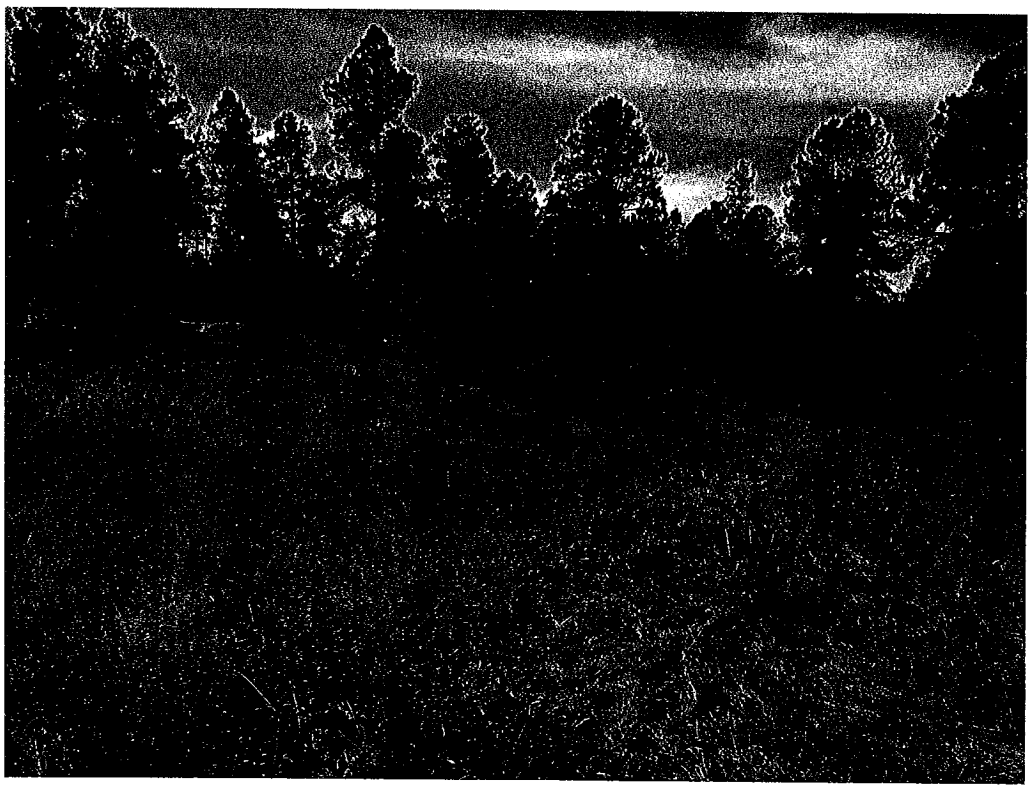
APPENDIX A: Site Photographs



1

Looking north at pond in northwest portion of the site.

November 21, 2014



2

Looking southeast from the northwest portion of the site.

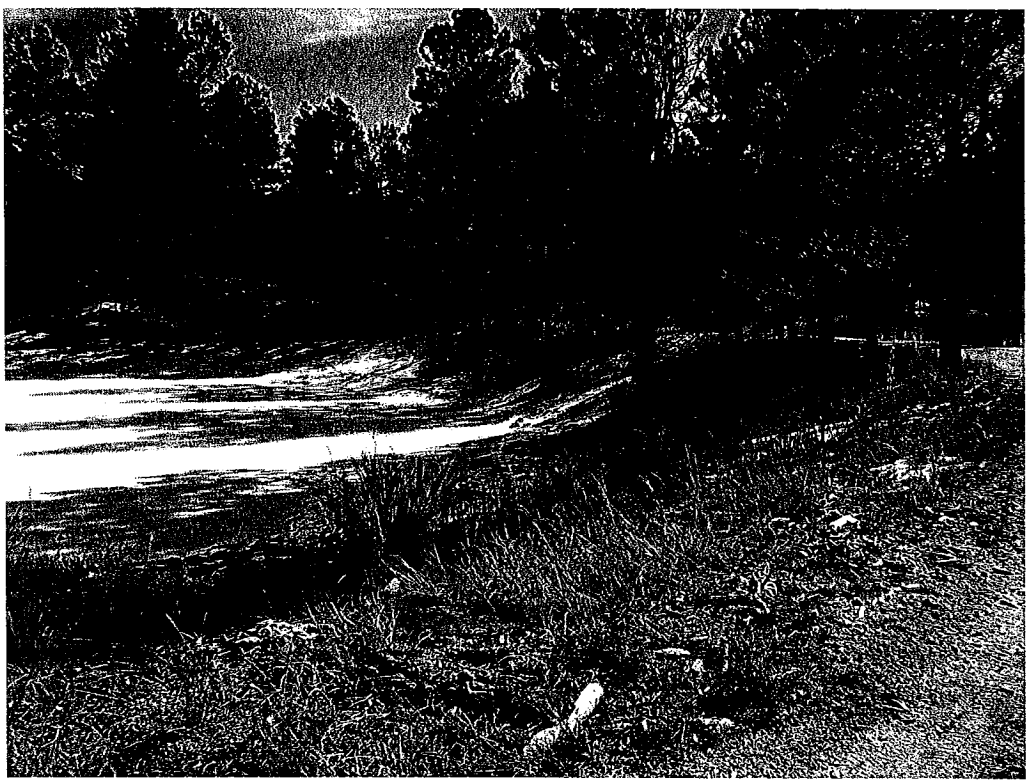
November 21, 2014

Job No. 141588

3

Looking northeast from west portion of the site.

November 21, 2014



4

Looking south at dam in southwest portion of the site.

November 21, 2014

Job No. 141588

5

Looking south from western portion of the site.

November 21, 2014

6

Looking southwest from west portion of the site.

November 21, 2014

Job No. 141588

7

Looking northeast from southwest portion of the site.

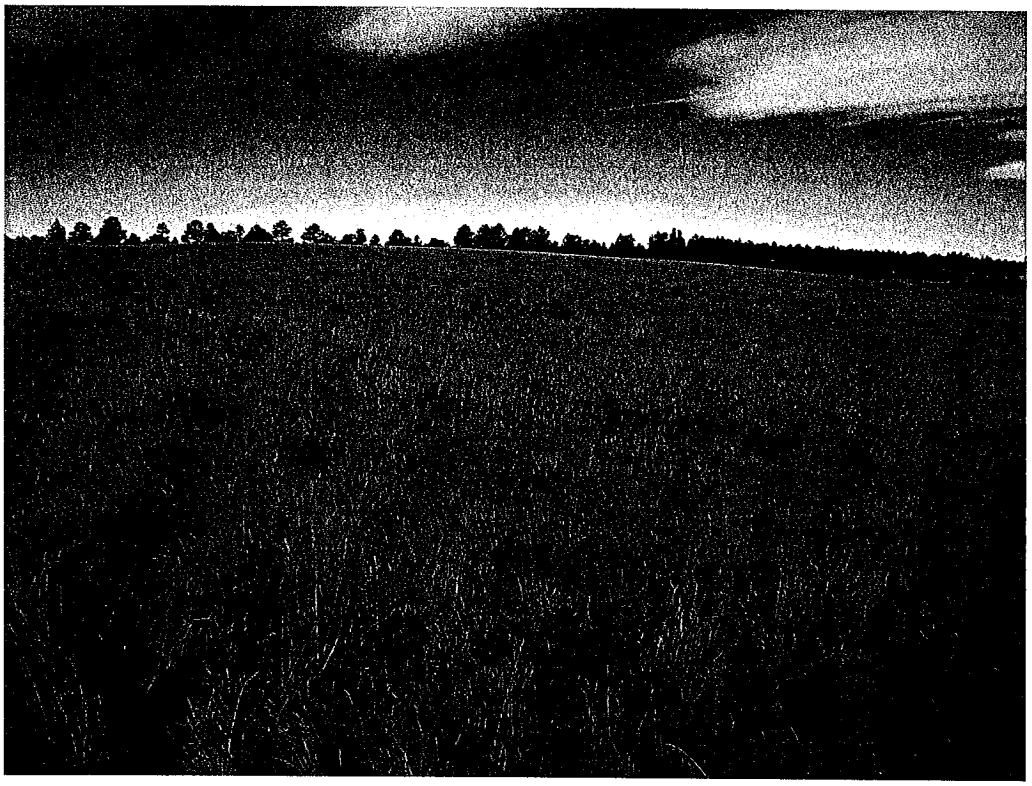
November 21, 2014

8

Looking northeast from south portion of the site.

November 21, 2014

Job No. 141588



9

Looking northwest from south central portion of the site.

December 2, 2014

10

Looking east from central portion of the site.

December 2, 2014

Job No. 141588

11

Looking southwest from north central portion of the site.

December 2, 2014

12

Looking southeast from north central portion of the site.

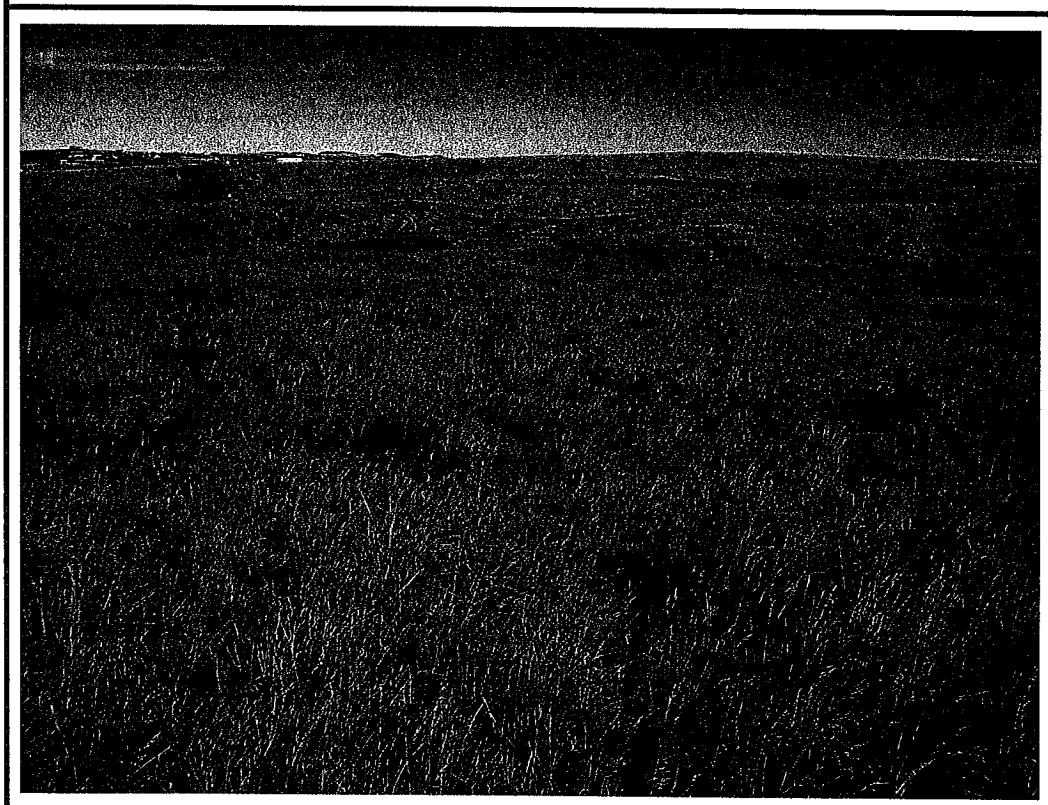
December 2, 2014

Job No. 141588

13

Looking northeast at dam in north central portion of the site.

December 2, 2014

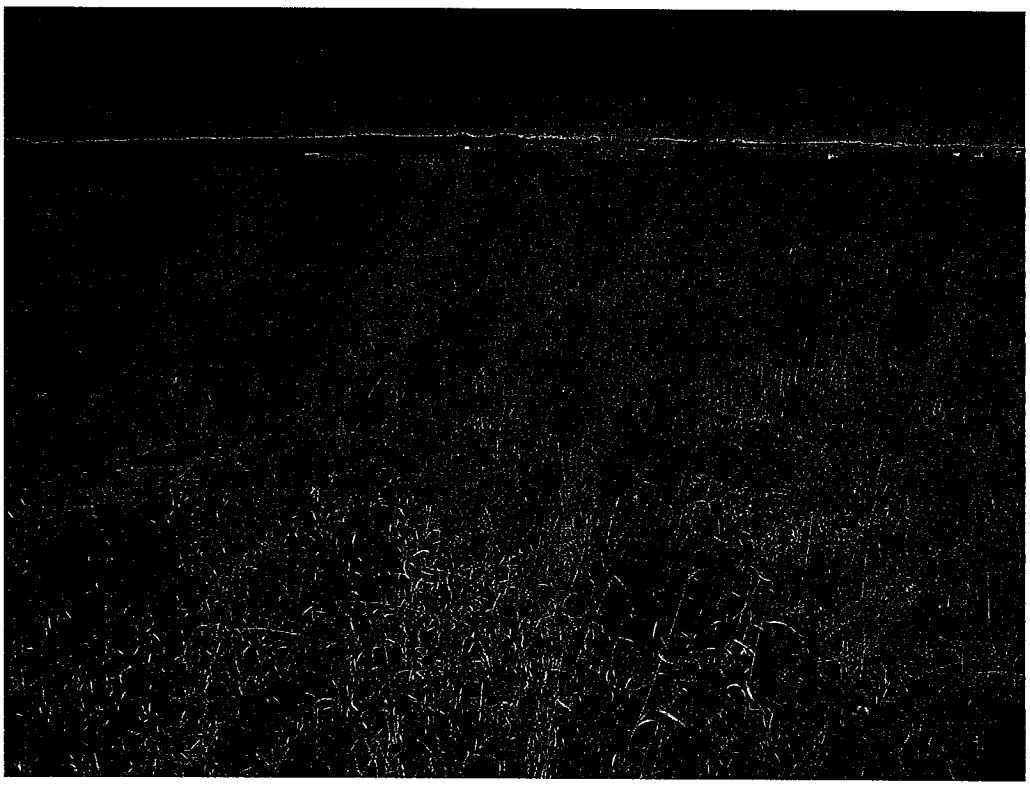


14

Looking north at dam in north central portion of the site.

December 2, 2014

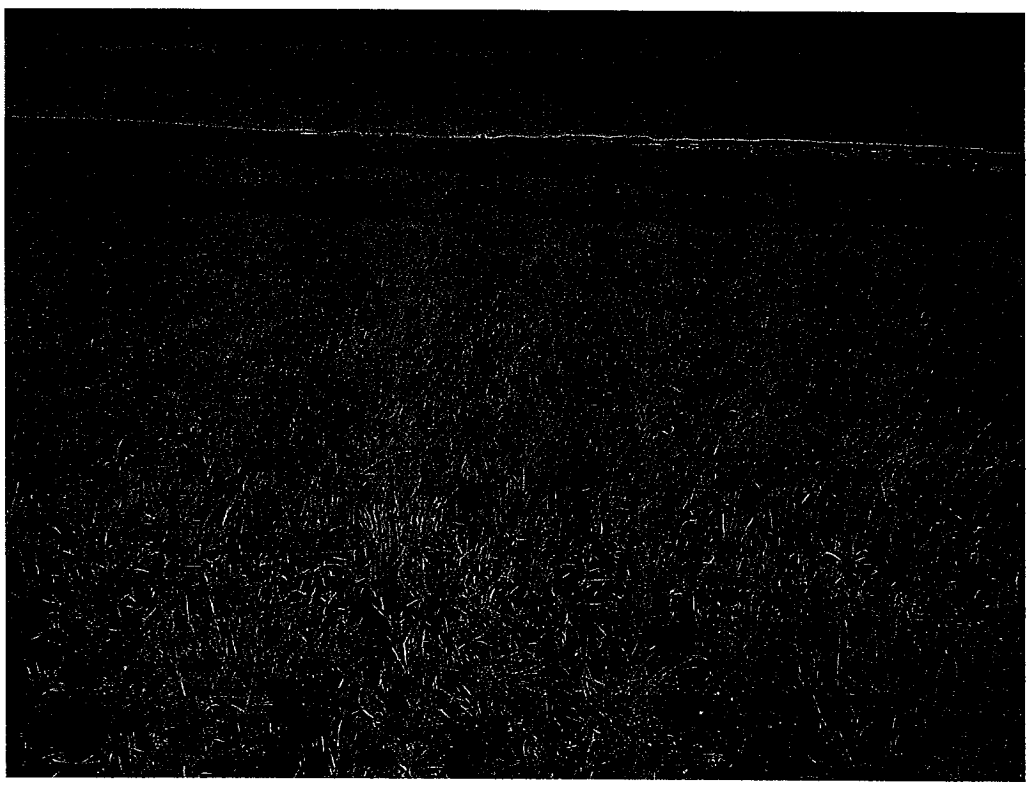
Job No. 141588



15

Looking northwest from south portion of the site.

December 2, 2014

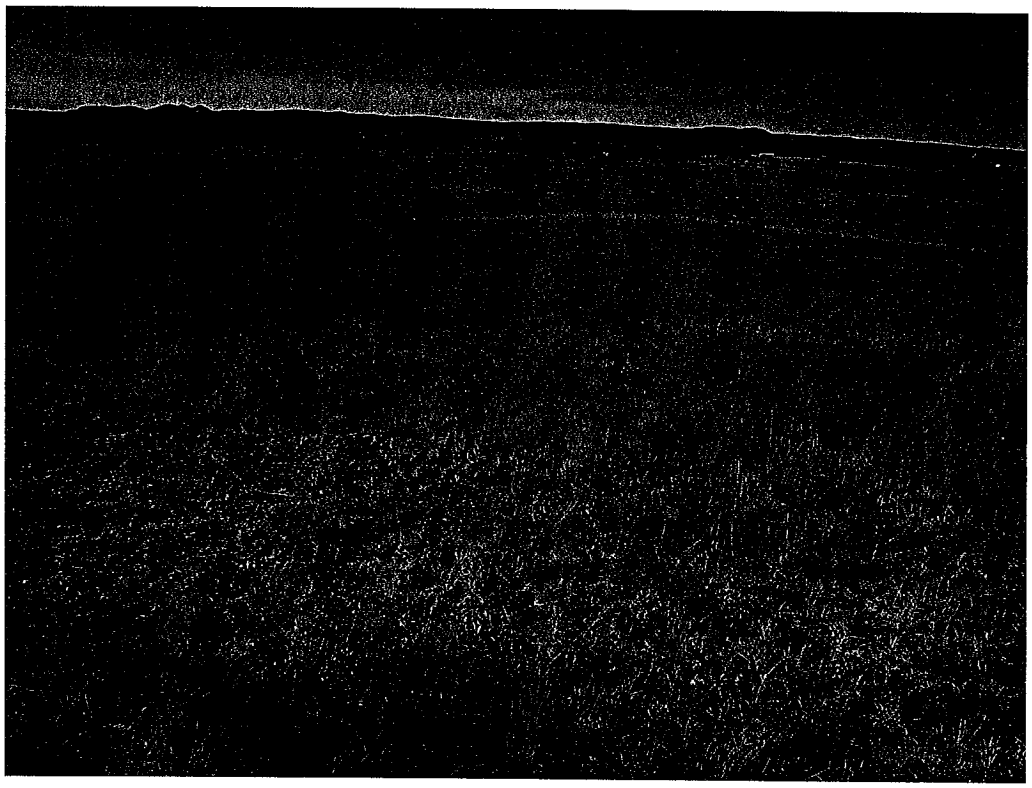


16

Looking northeast at dam in southeast portion of the site.

December 2, 2014

Job No. 141588



17

Looking west from east portion of the site.

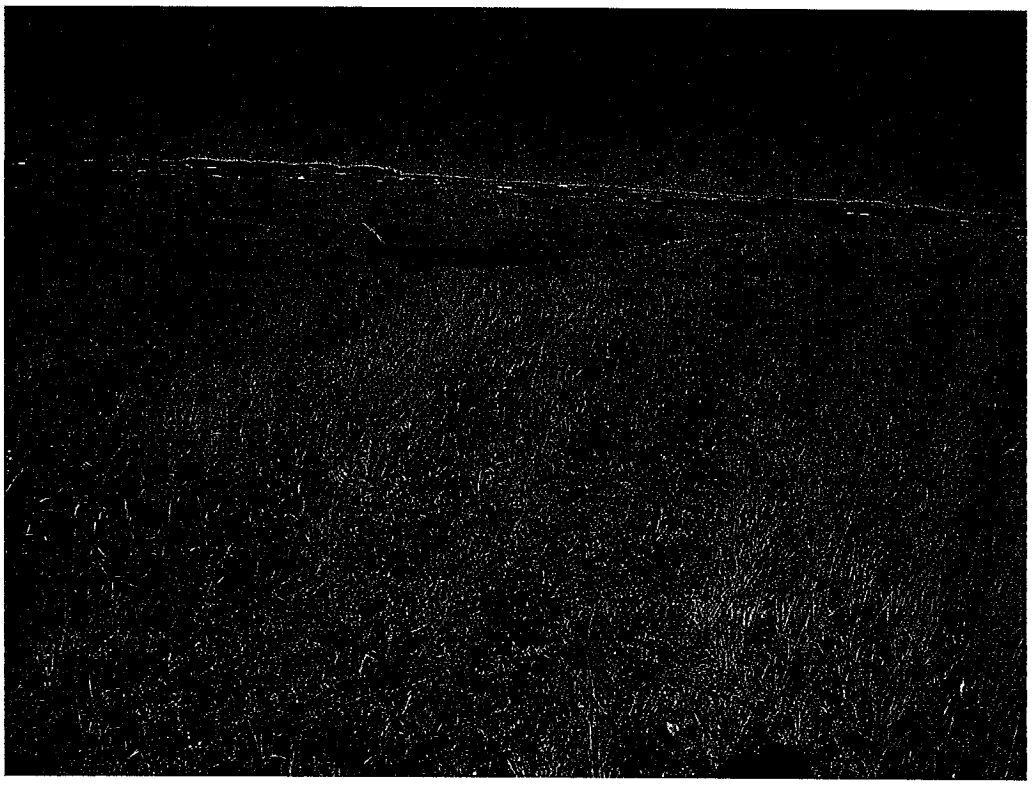
December 2, 2014

18

Looking southeast from north portion of the site.

December 2, 2014

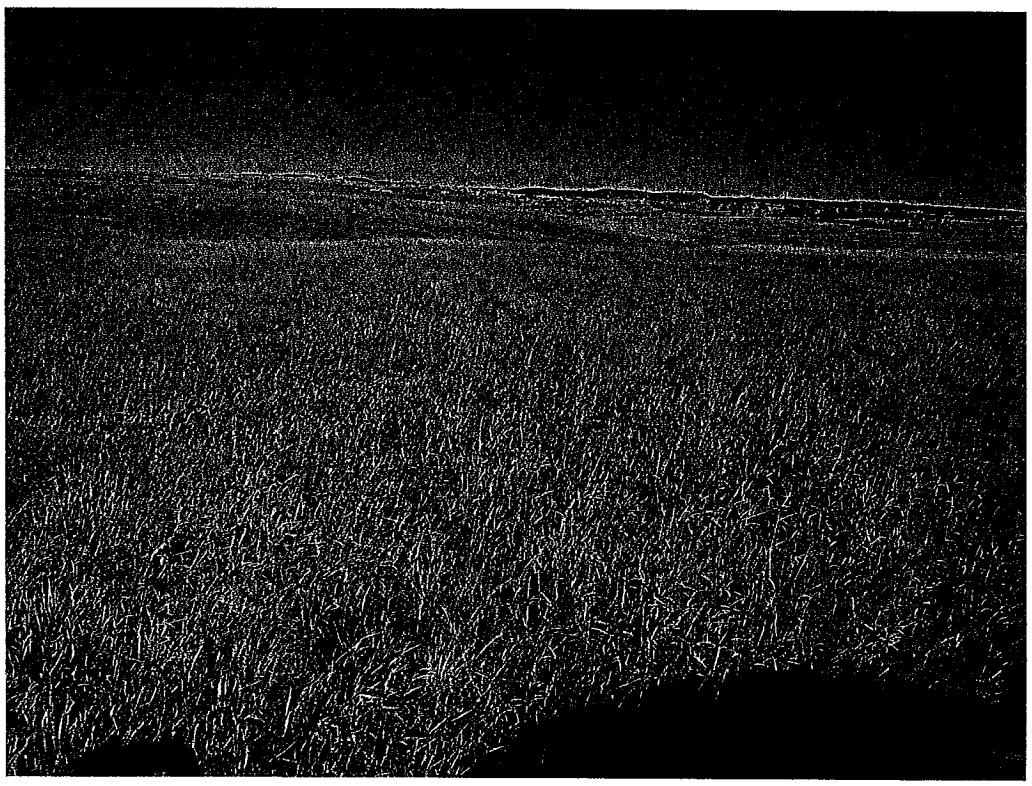
Job No. 141588



19

Looking northwest at dam in east portion of the site.

December 2, 2014



20

Looking south from north portion of the site.

December 2, 2014

Job No. 141588

21

Looking southeast from northwest portion of the site.

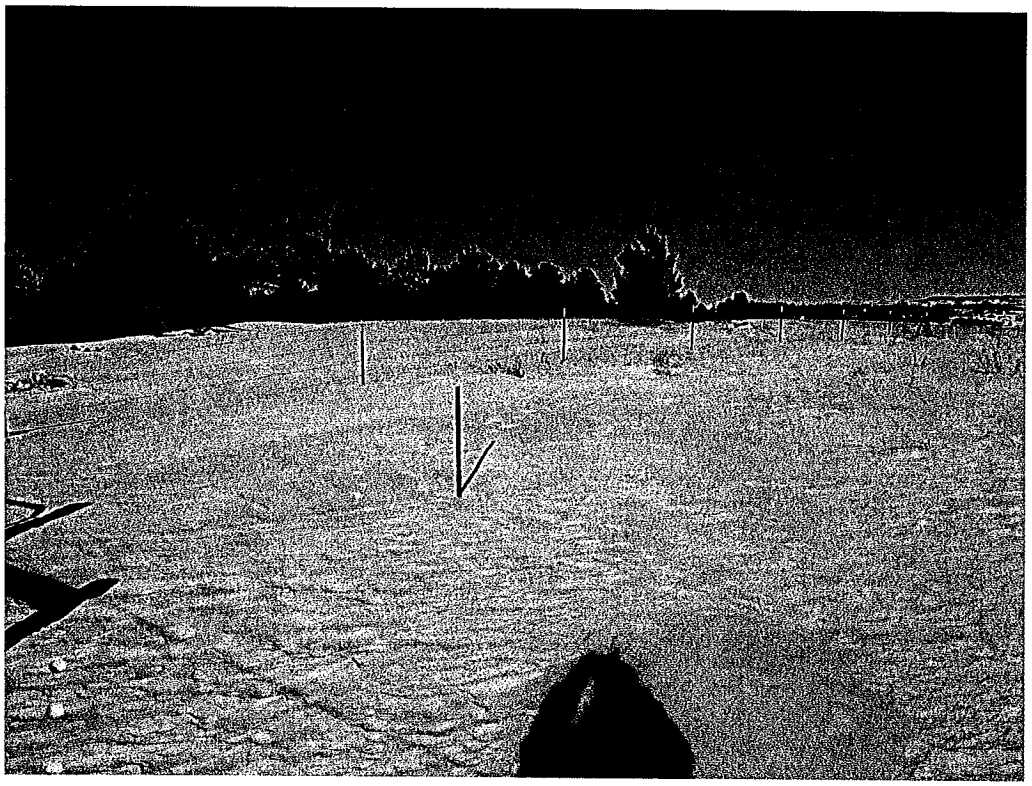
December 2, 2014

22

Looking south from north portion of the site.

December 2, 2014

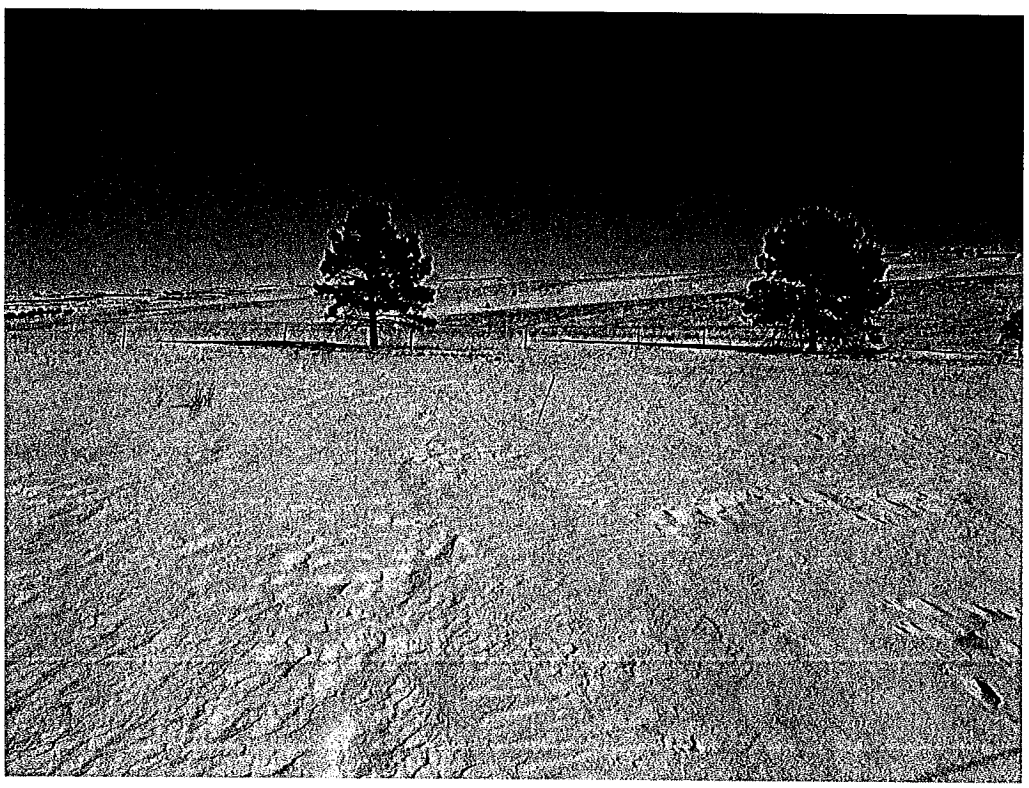
Job No. 141588



23

Looking northwest from the south portion of the site.

January 22, 2016



24

Looking north from the south portion of the site.

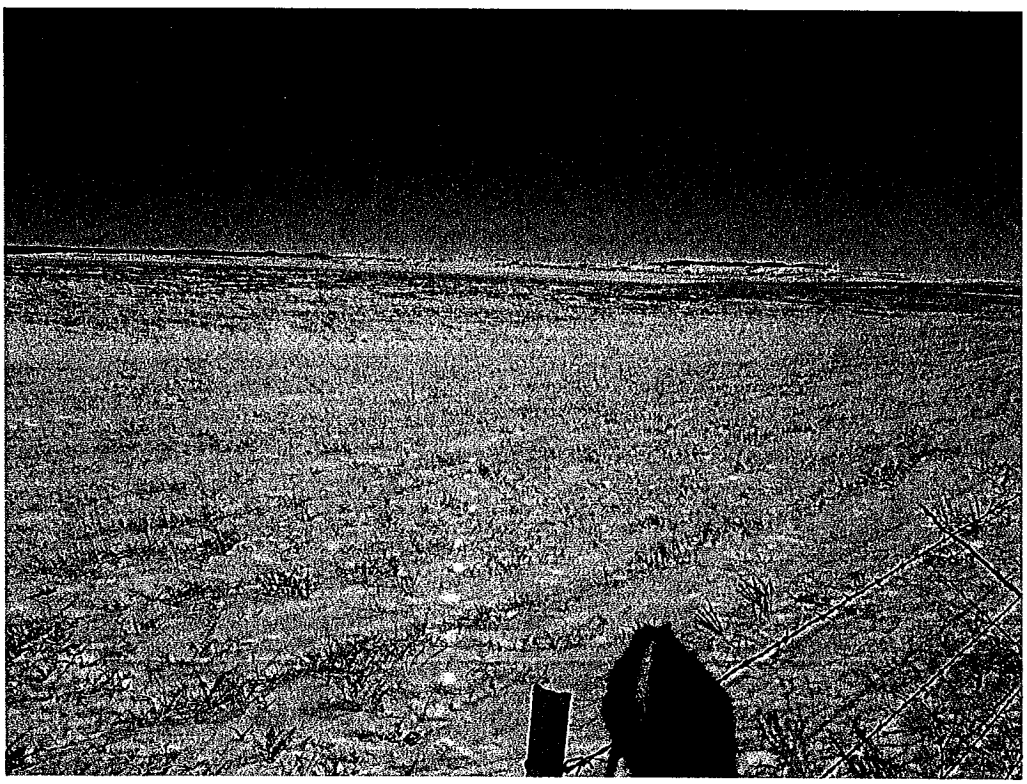
January 22, 2016

Job No. 160118

25

Looking west from the east portion of the site.

January 22, 2016



26

Looking northeast from the west portion of the site.

January 22, 2016

Job No. 160118

APPENDIX B: Test Boring Logs From the Profile Holes

PROFILE HOLE NO. 1
DATE DRILLED 1/23/2015
Job # 141588

REMARKS

DRY TO 15', 1/24/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					2
			19	6.1	1
5			21	4.7	1
10			35	11.1	3
15			50 10"	15.9	3
20					

CLAY, SANDY, BROWN

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

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

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

PROFILE HOLE NO. 2
DATE DRILLED 1/23/2015
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS

DRY TO 15', 1/24/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			25	7.2	2
5			9	7.8	2
10			22	4.9	1
15			29	5.8	1
20					

CLAY, SANDY TO VERY SANDY, BROWN TO TAN, STIFF TO FIRM, MOIST

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

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COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		N	2/12/15

JOB NO.: 141588
FIG NO.: B-1

PROFILE HOLE NO. 3
DATE DRILLED 1/23/2015
Job # 141588

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 1/24/15						
CLAY, SANDY, BROWN, STIFF TO FIRM, MOIST				24	8.2	2
	5			13	6.8	2
SAND, SILTY, TAN						1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST	10			40	4.1	3
	15			42	8.3	3
	20					

PROFILE HOLE NO. 4
DATE DRILLED 1/23/2015
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 1/24/15						
CLAY, SANDY, TAN, STIFF, MOIST				16	8.6	2
	5			15	9.1	2
SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	10			18	8.8	1
CLAY, SANDY, BROWN, FIRM, MOIST	15			12	18.2	2
	20					

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: B-2

PROFILE HOLE NO. 5
DATE DRILLED 2/2/2015
Job # 141588

REMARKS

DRY TO 15', 2/3/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			16	2.7	1
5			42	11.5	3
10			42	14.3	3
15			45	4.4	3
20					

SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO DENSE, MOIST TO VERY MOIST

WEATHERED SANDSTONE, SILTY, CLAYEY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST

PROFILE HOLE NO. 6
DATE DRILLED 1/26/2015
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS

DRY TO 15', 1/27/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			21	22.4	2
5			16	8.9	2
10			42	8.7	3
15			50/11"	4.9	3
20					

CLAY, SANDY, TAN, STIFF, MOIST

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

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

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PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: B-3

PROFILE HOLE NO. 7
DATE DRILLED 1/26/2015
Job # 141588

REMARKS

DRY TO 15', 1/27/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			12	6.6	2	CLAY, SANDY, TAN, FIRM, MOIST
5			44	7.3	2	SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, DENSE, MOIST
10			14	7.5	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
						WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST
15			46	8.8	3	
20						

PROFILE HOLE NO. 8
DATE DRILLED 2/2/2015
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS

DRY TO 15', 2/3/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			15	9.0	2	CLAY, SANDY TO VERY SANDY, TAN, STIFF, MOIST
5			28	9.2	2	
10			24	5.7	2	
15			29	6.9	2	
20						

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PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: B-4

PROFILE HOLE NO. 9
DATE DRILLED 2/3/2015
Job # 141588

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 2/4/15						
SAND, SILTY WITH CLAYEY LENSES, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST				24	5.6	1
	5			18	6.2	1
	10			6	8.9	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST	15			50	11.2	3
	20					

PROFILE HOLE NO. 10
DATE DRILLED 2/2/2015
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 2/5/15						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST				32	3.8	1
CLAY, SANDY, TAN, VERY STIFF, MOIST	5			42	9.2	2
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST	10			17	3.7	1
	15			6	3.3	1
	20					

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PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: B-5

PROFILE HOLE NO. 11
DATE DRILLED 12/1/2014
Job # 141588

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 12/2/14						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				27	6.7	1
	5			25	4.8	1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST	10			32	7.8	3
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	15			50/6"	10.0	3
	20					

PROFILE HOLE NO. 12
DATE DRILLED 12/1/2014
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 12/2/14						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO MEDIUM DENSE, MOIST				7	10.5	1
	5			22	5.6	1
	10			25	8.8	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	15			50/7"	7.7	3
	20					

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PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		h	2/12/15

JOB NO.: 141588
FIG NO.: B-6

PROFILE HOLE NO. 13
DATE DRILLED 12/1/2014
Job # 141588

REMARKS

DRY TO 15', 12/2/14

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
					1	SAND, SILTY, TAN
						SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
			50/10"	8.0	3	
5			50/10"	8.3	3	
10			50/6"	9.9	3	
15			50/4"	8.2	3	
20						

PROFILE HOLE NO. 14
DATE DRILLED 1/26/2015
CLIENT NES, INC.
LOCATION SHAMROCK RANCH

REMARKS

DRY TO 15', 12/2/14

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						SAND, SILTY TO CLAYEY, FINE TO COARSE GRAINED, TAN, LOOSE, MOIST
			4	12.2	1	
5			9	15.2	2	CLAY, SANDY, TAN, FIRM, MOIST
						SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
10			12	14.4	1	
						SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO VERY DENSE, MOIST
15			50/6"	8.8	3	
20						

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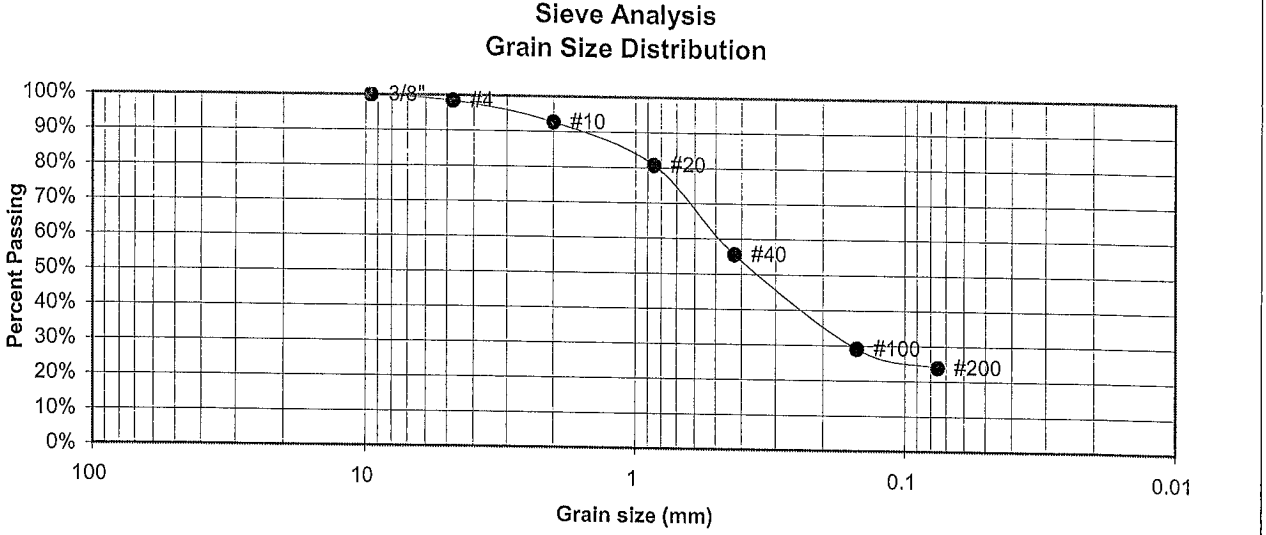
PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: B-7

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	1	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.5%
10	92.7%
20	80.7%
40	55.5%
100	29.1%
200	23.9%

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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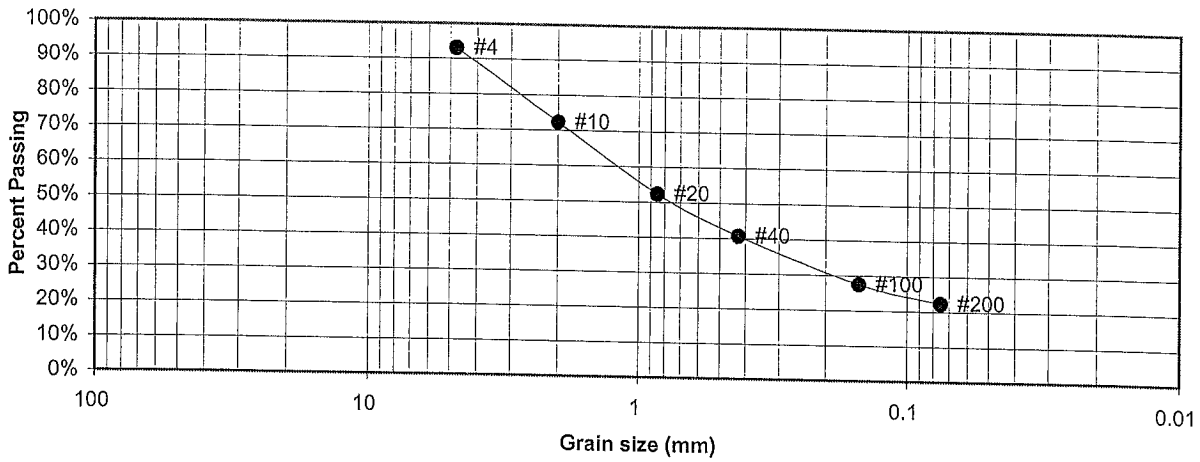
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-1

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	5	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	93.1%
10	72.3%
20	52.4%
40	40.7%
100	27.6%
200	22.3%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	22
Plastic Index	3

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

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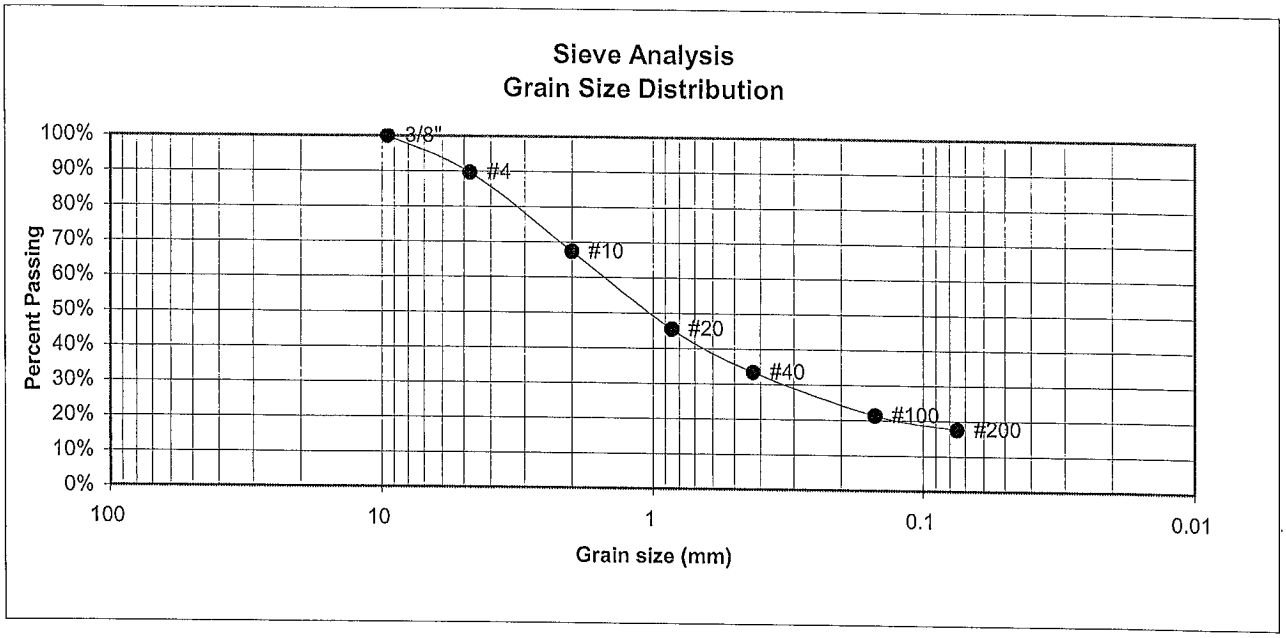
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-2

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	11	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	89.7%
10	67.3%
20	45.5%
40	33.4%
100	21.4%
200	17.6%

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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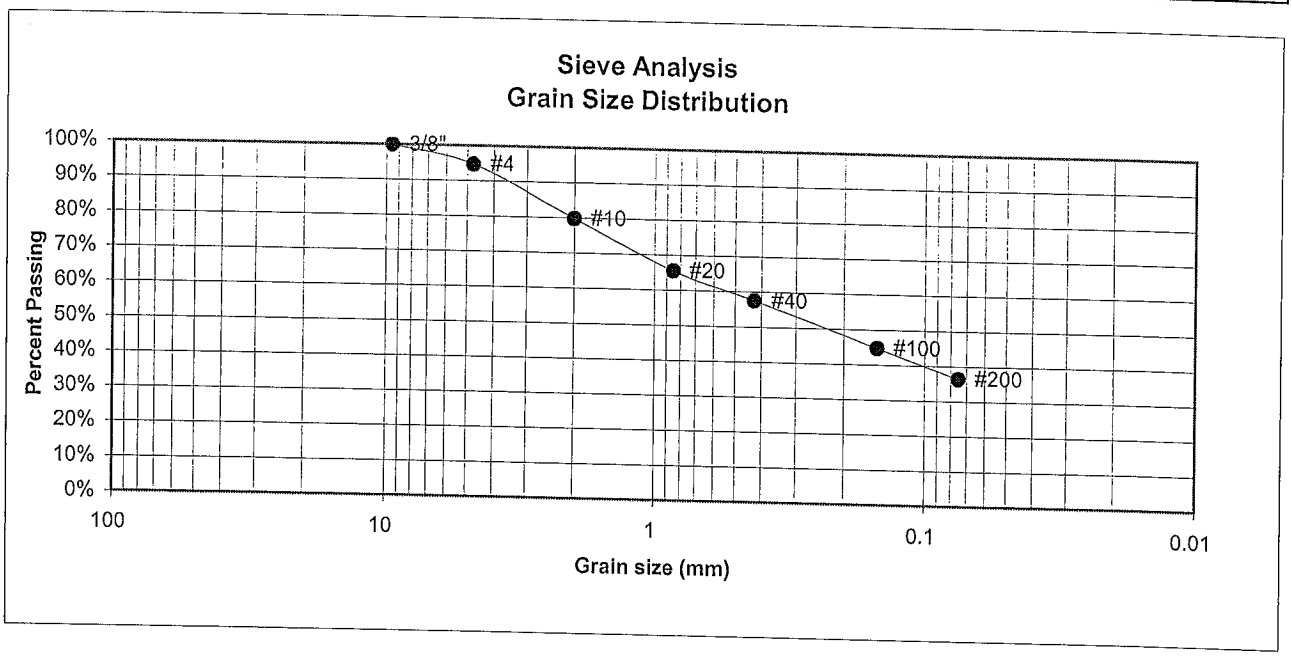
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588

FIG NO.: C-3

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	12	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.7%
10	79.8%
20	65.5%
40	57.4%
100	44.8%
200	36.5%

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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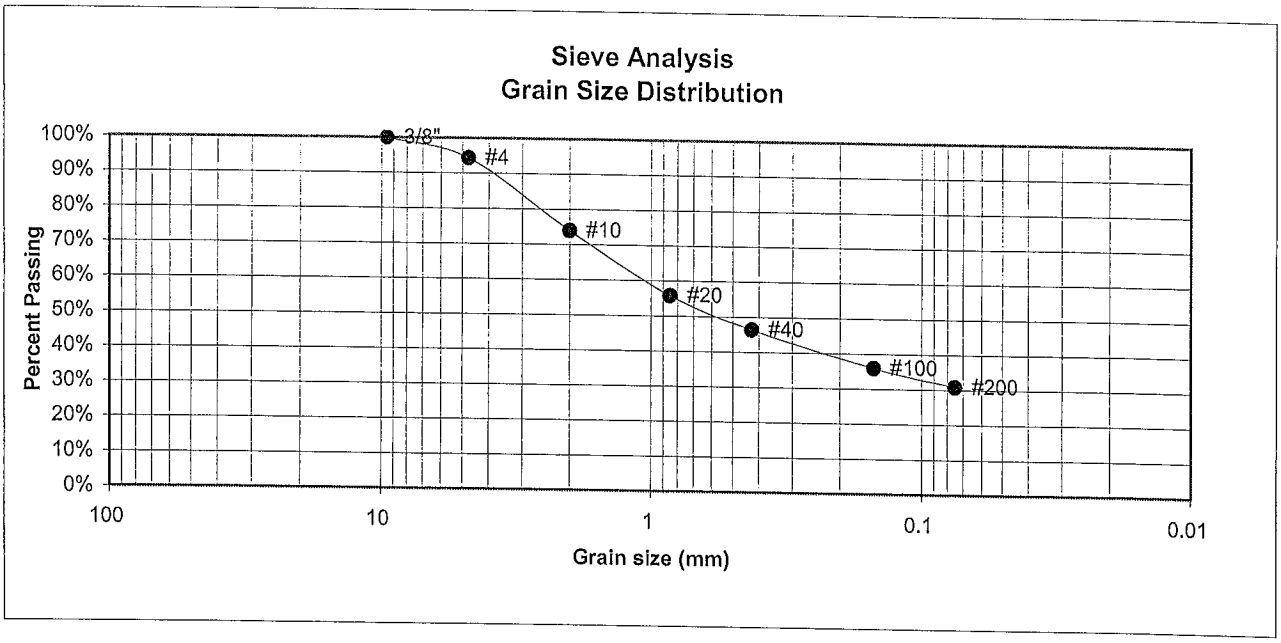
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-4

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	14	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.4%
10	73.9%
20	55.8%
40	46.4%
100	35.9%
200	30.8%

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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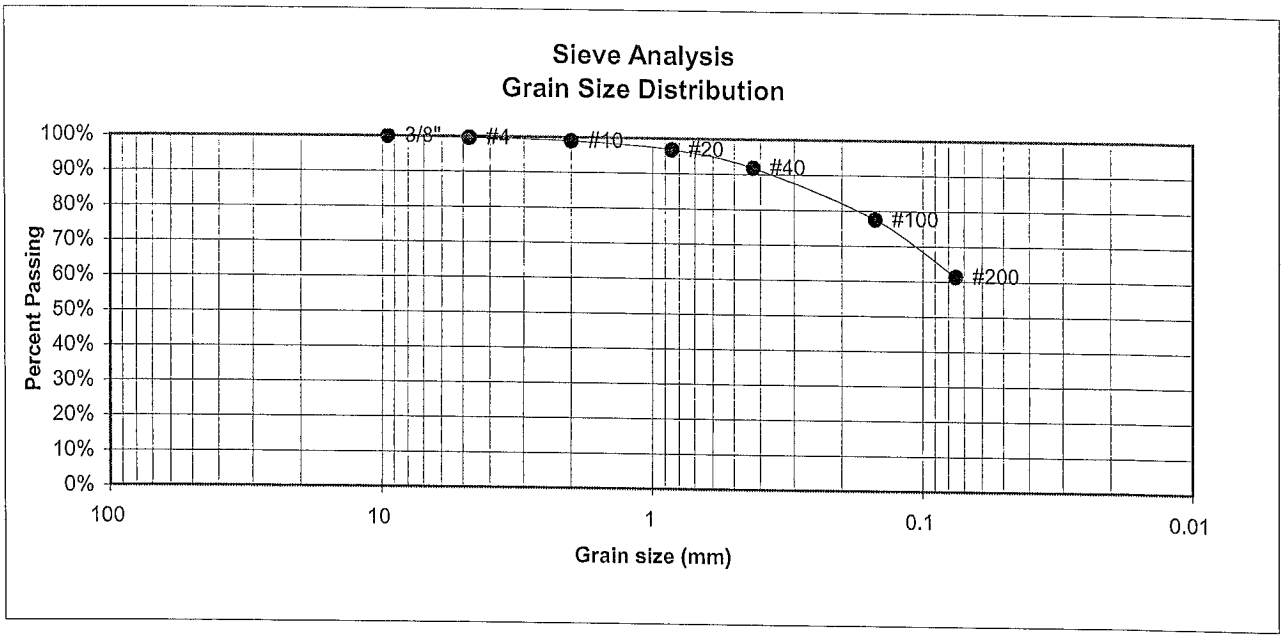
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-5

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	2	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	99.0%
20	96.8%
40	91.9%
100	77.5%
200	61.4%

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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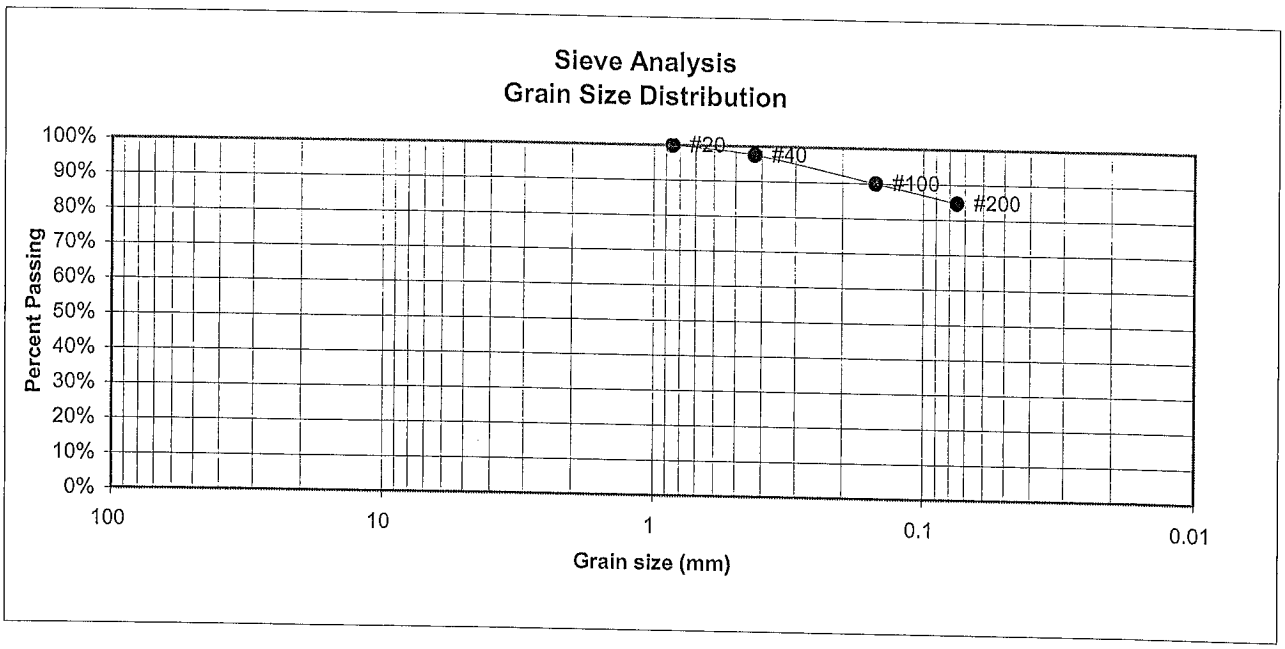
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-6

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	3	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	97.5%
100	90.0%
200	84.8%

Atterberg Limits

Plastic Limit	19
Liquid Limit	32
Plastic Index	13

Swell

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

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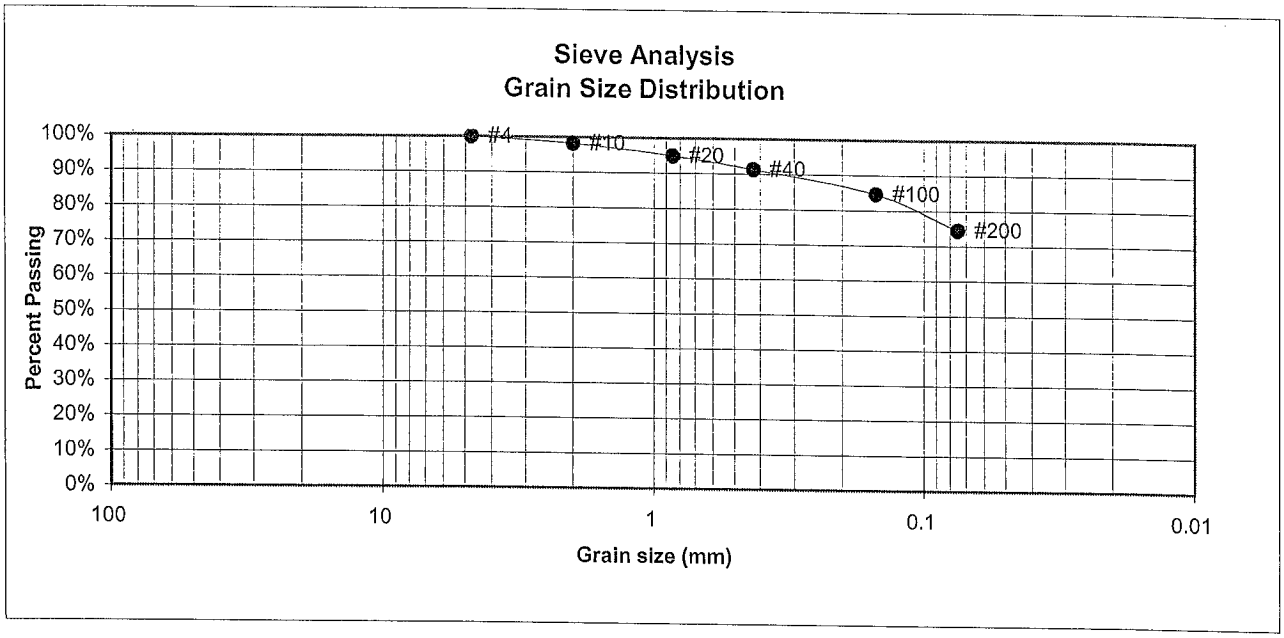
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-7

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	4	JOB NO.	141588
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	98.2%
20	95.0%
40	91.3%
100	84.6%
200	74.5%

Atterberg Limits

Plastic Limit

Liquid Limit

Plastic Index

Swell

Moisture at start	12.6%
Moisture at finish	19.9%
Moisture increase	7.3%
Initial dry density (pcf)	108
Swell (psf)	1485

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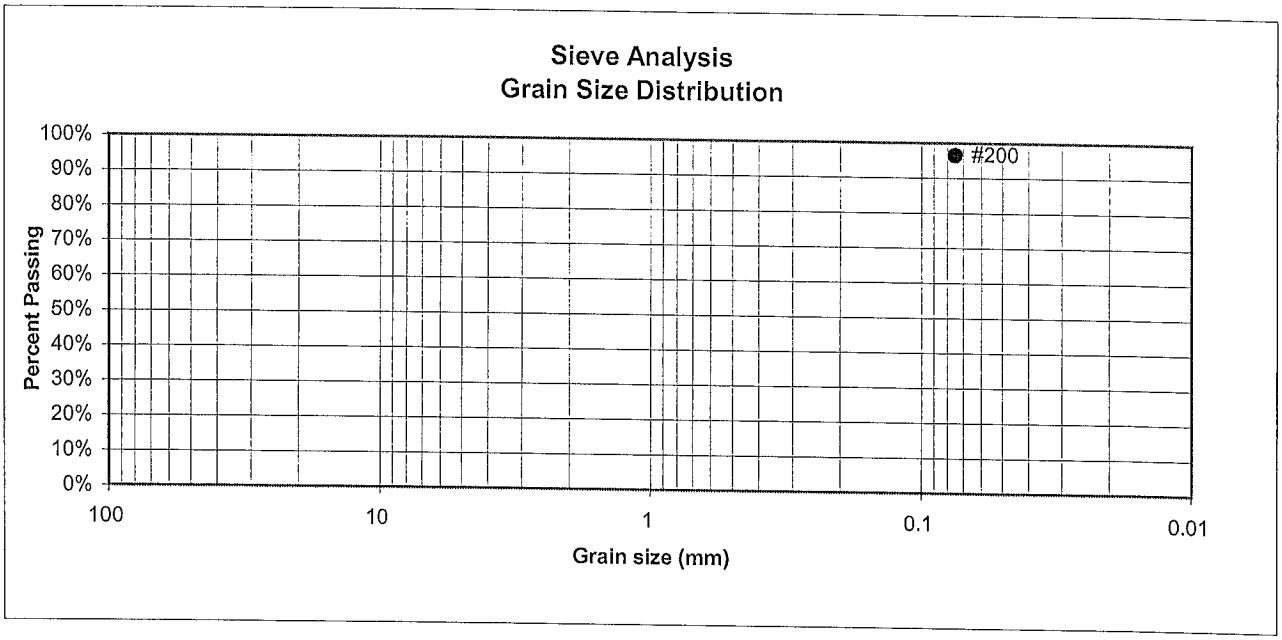
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588

FIG NO.: C-8

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	6	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	
100	
200	96.5%

Atterberg Limits

Plastic Limit	23
Liquid Limit	39
Plastic Index	17

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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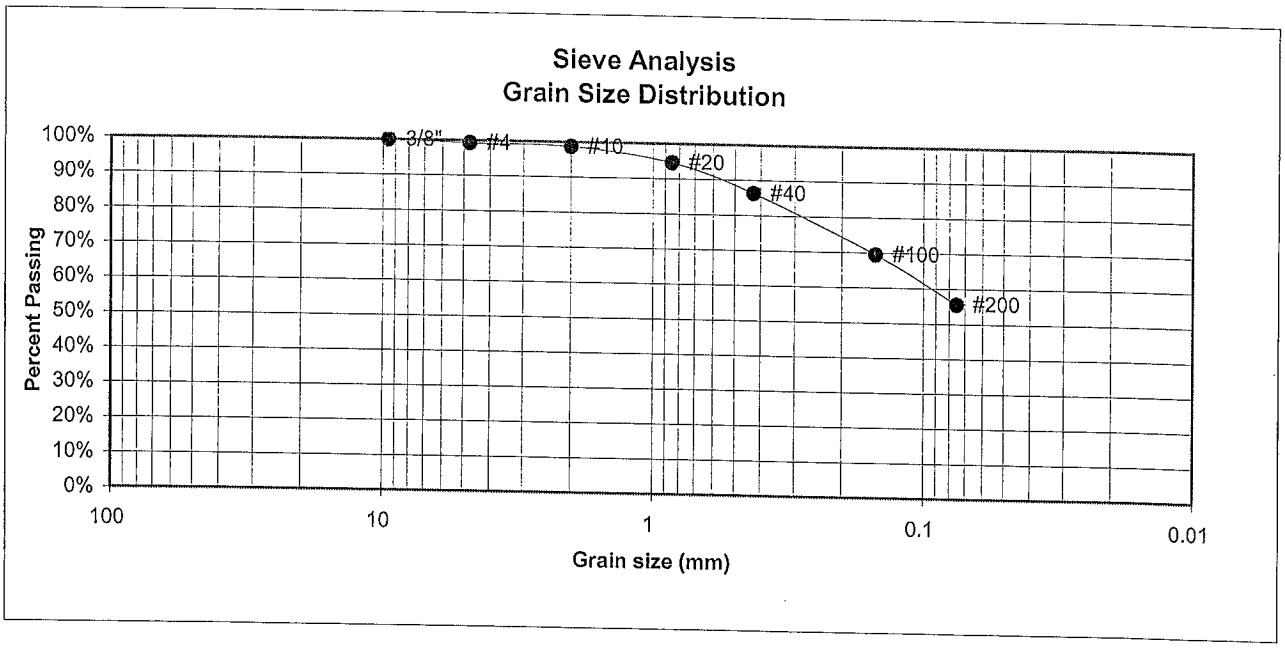
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		u	7/12/15

JOB NO.: 141588
FIG NO.: C-9

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	8	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	98.7%
20	94.6%
40	86.3%
100	69.5%
200	55.5%

Atterberg Limits	
Plastic Limit	24
Liquid Limit	36
Plastic Index	12

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

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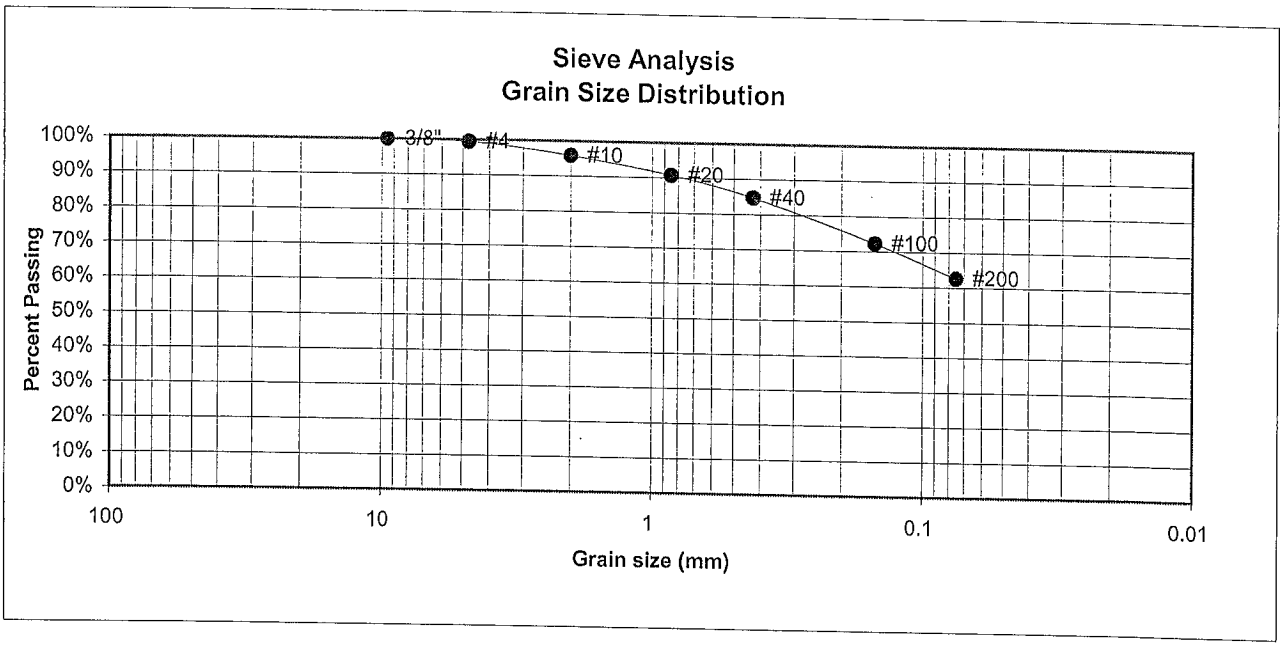
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-10

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	10	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	95.9%
20	90.8%
40	84.8%
100	72.2%
200	62.5%

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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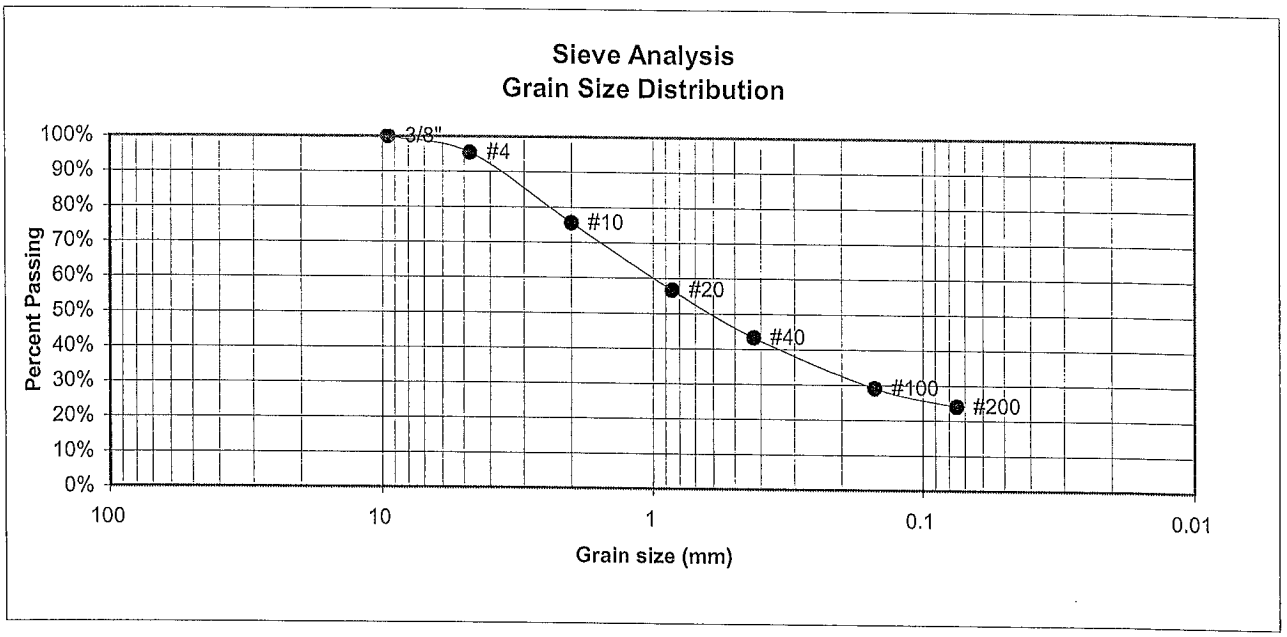
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/12/15

JOB NO.: 141588
FIG NO.: C-11

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	1	JOB NO.	141588
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.5%
10	75.6%
20	56.6%
40	43.3%
100	29.1%
200	24.0%

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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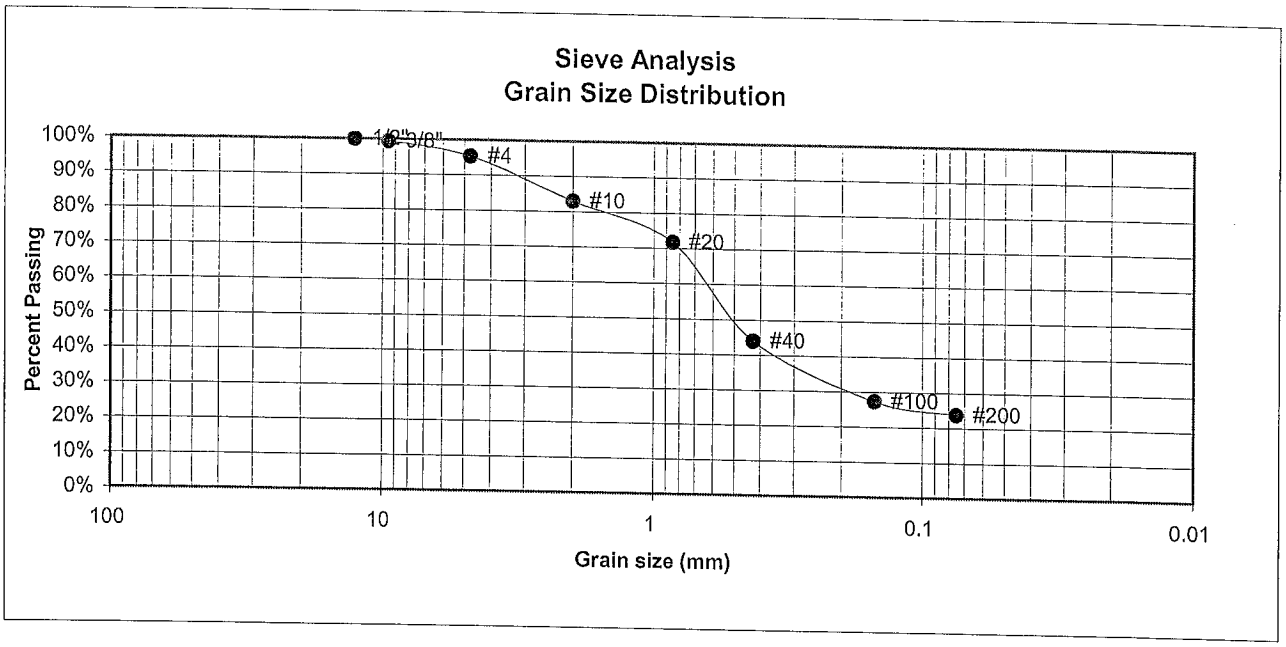
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-12

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	3	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	99.3%
4	95.3%
10	83.0%
20	71.8%
40	44.0%
100	27.3%
200	23.8%

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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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

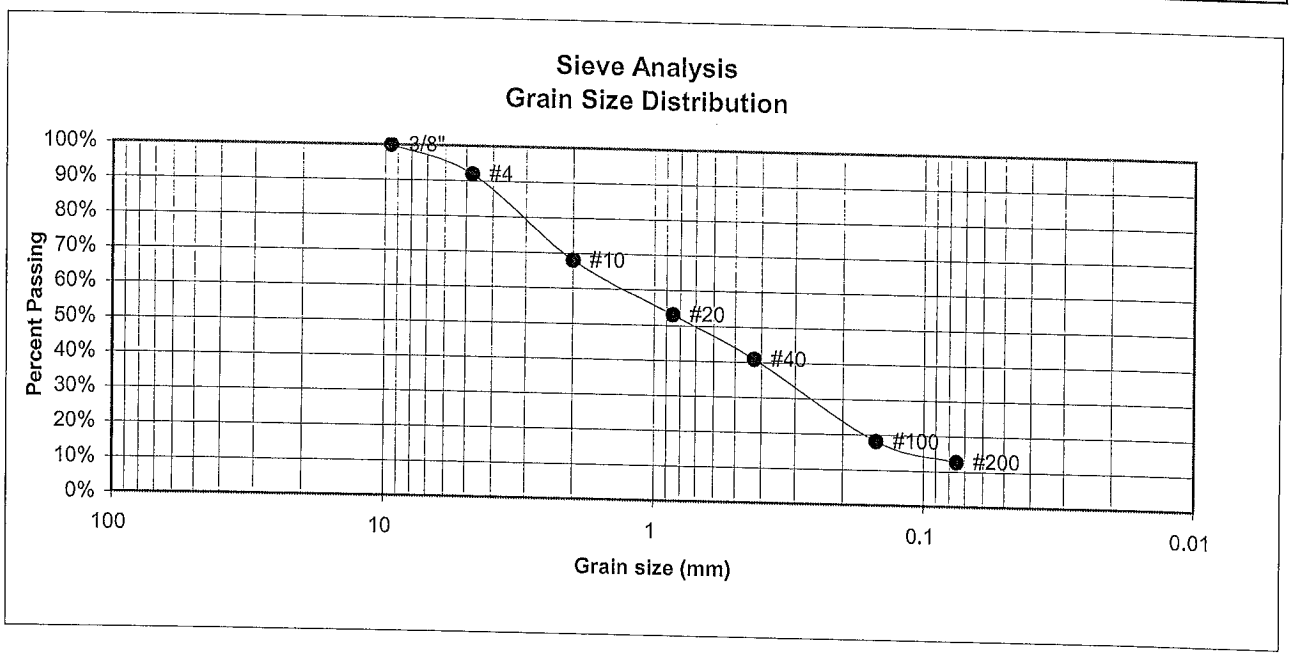
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588

FIG NO.: C-13

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	6	JOB NO.	141588
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	91.9%
10	68.0%
20	53.1%
40	40.9%
100	18.2%
200	12.7%

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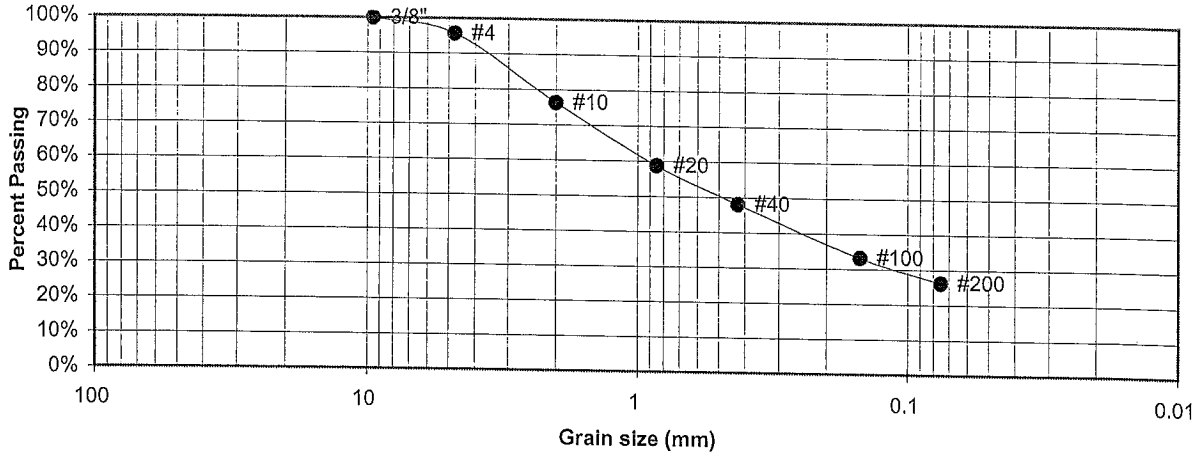
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/05

JOB NO.: 141588
FIG NO.: C-14

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	7	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.7%
10	76.3%
20	58.8%
40	48.0%
100	33.2%
200	26.3%

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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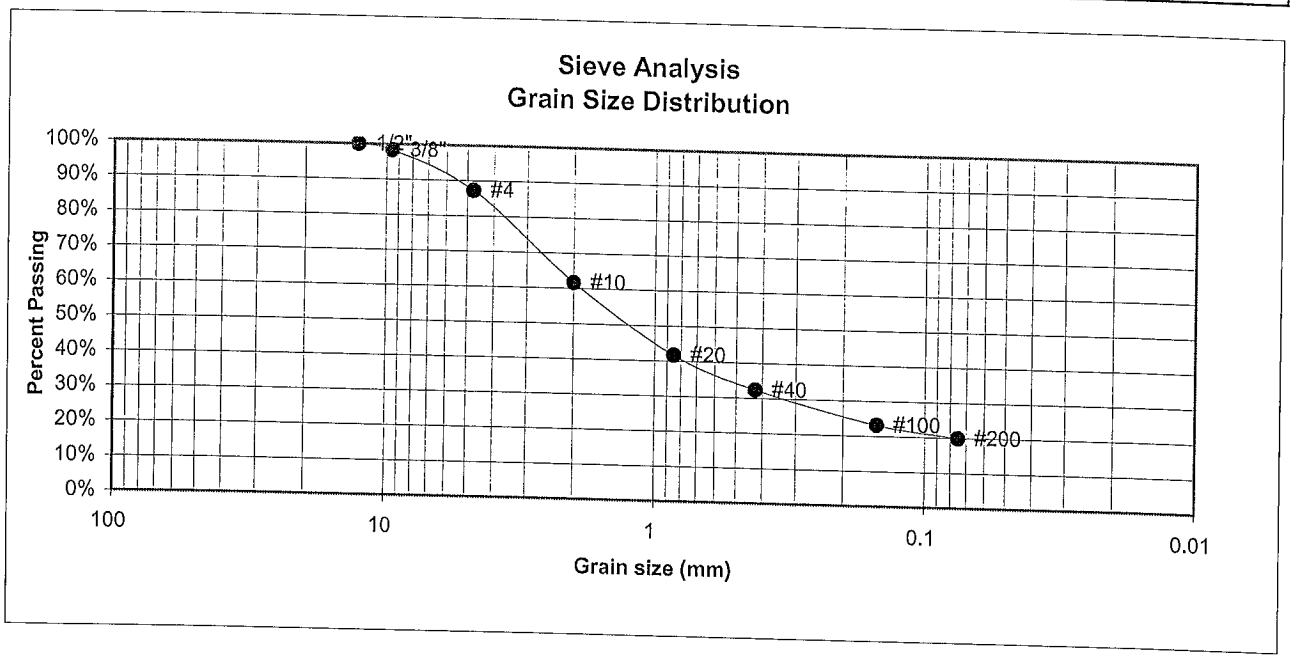
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-15

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	13	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.4%
4	87.3%
10	61.7%
20	41.8%
40	32.4%
100	23.3%
200	20.0%

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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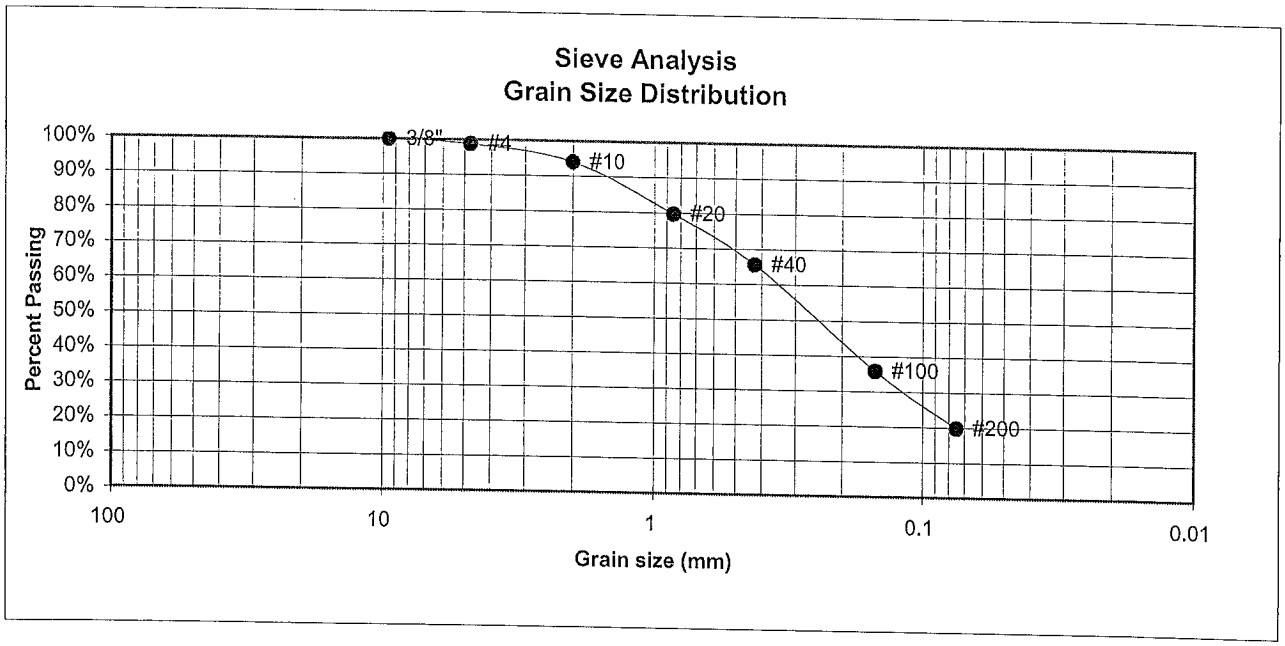
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-16

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	9	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.8%
10	94.0%
20	79.7%
40	65.6%
100	35.9%
200	19.8%

Atterberg Limits

Plastic Limit	
Liquid Limit	
Plastic Index	

Swell

Moisture at start	9.7%
Moisture at finish	20.0%
Moisture increase	10.3%
Initial dry density (pcf)	99
Swell (psf)	152

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LABORATORY TEST RESULTS

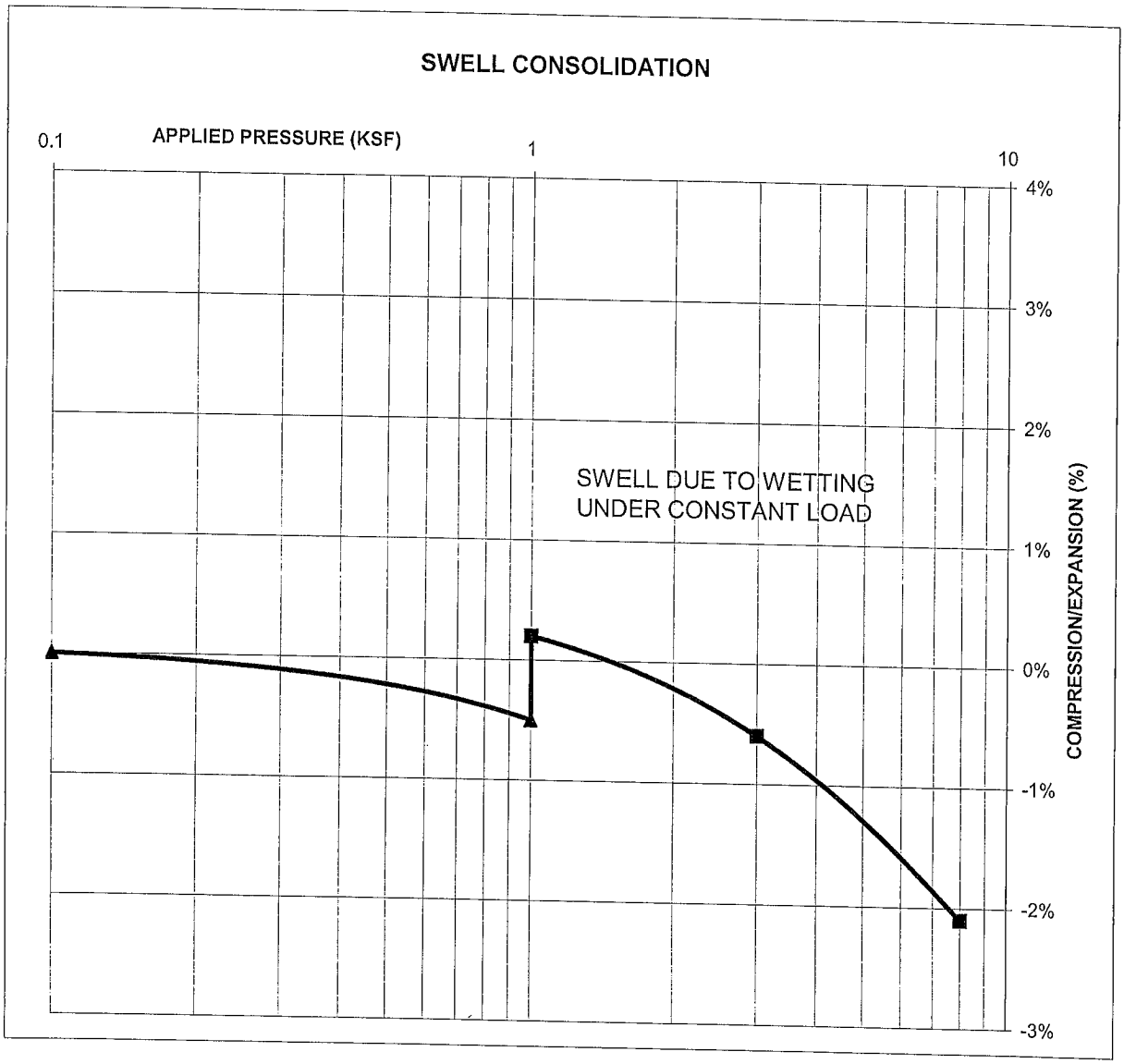
DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-17

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			11.1%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 141588
CLIENT NES, INC.
PROJECT SHAMROCK RANCH



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SWELL CONSOLIDATION
TEST RESULTS

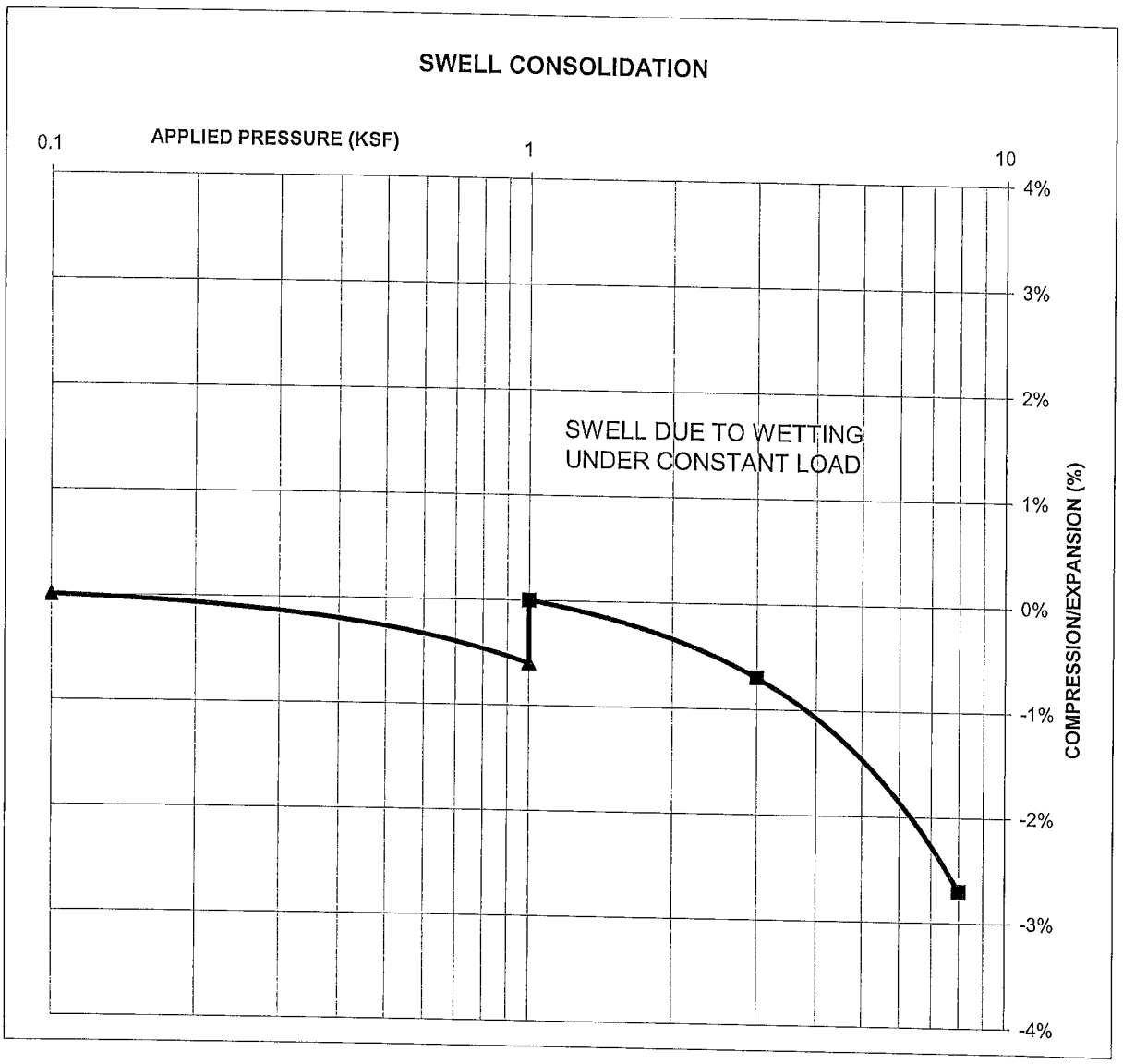
DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-18

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			112
NATURAL MOISTURE CONTENT			10.7%
SWELL/CONSOLIDATION (%)			0.6%

JOB NO. 141588
CLIENT NES, INC.
PROJECT SHAMROCK RANCH



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COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

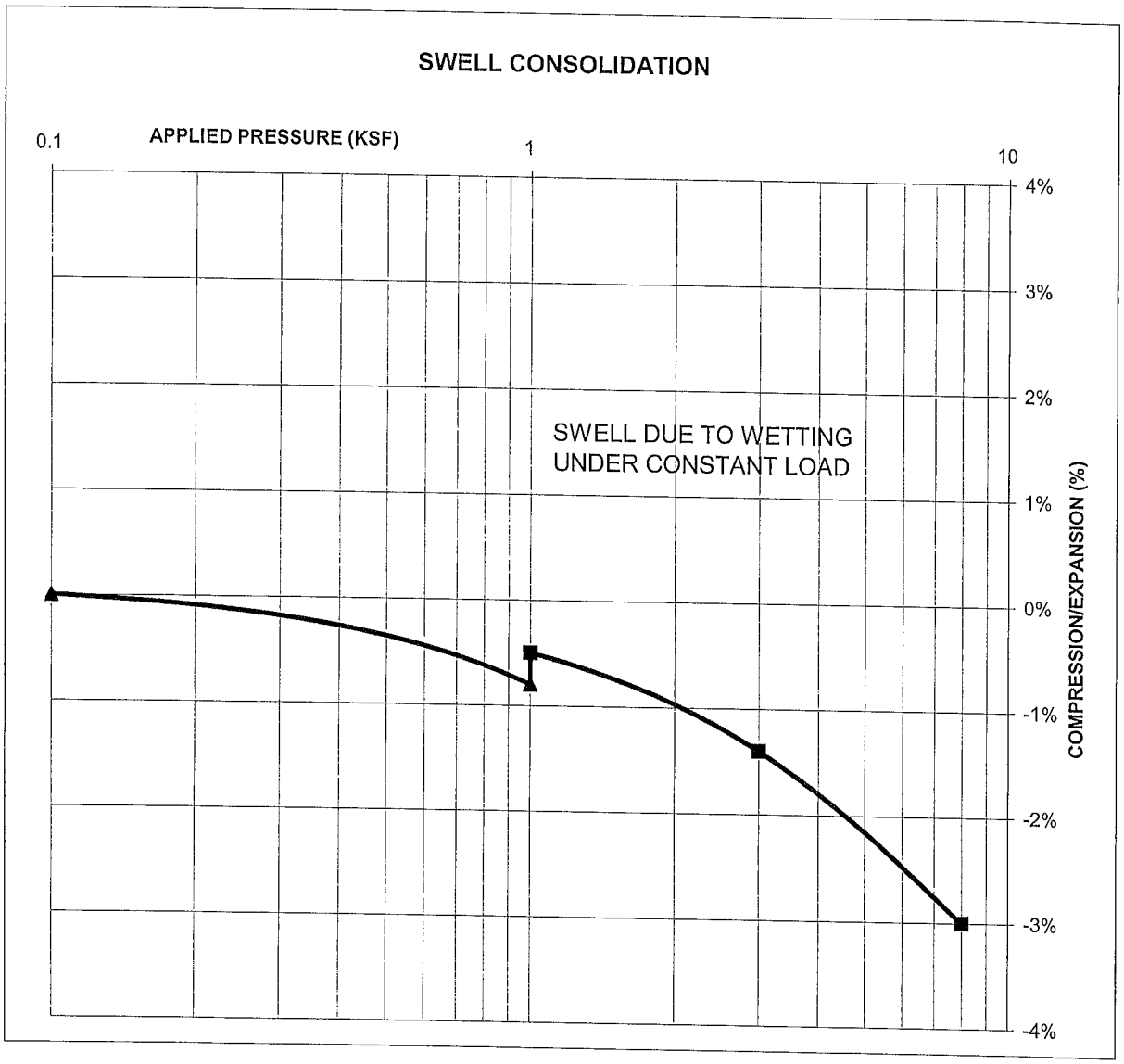
DRAWN:	DATE:	CHECKED:	DATE: 2/12/15

JOB NO.: 141588
FIG NO.: C-19

CONSOLIDATION TEST RESULTS

TEST BORING #	8	DEPTH(ft)	10
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			112
NATURAL MOISTURE CONTENT			10.8%
SWELL/CONSOLIDATION (%)			0.3%

JOB NO. 141588
CLIENT NES, INC.
PROJECT SHAMROCK RANCH



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COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

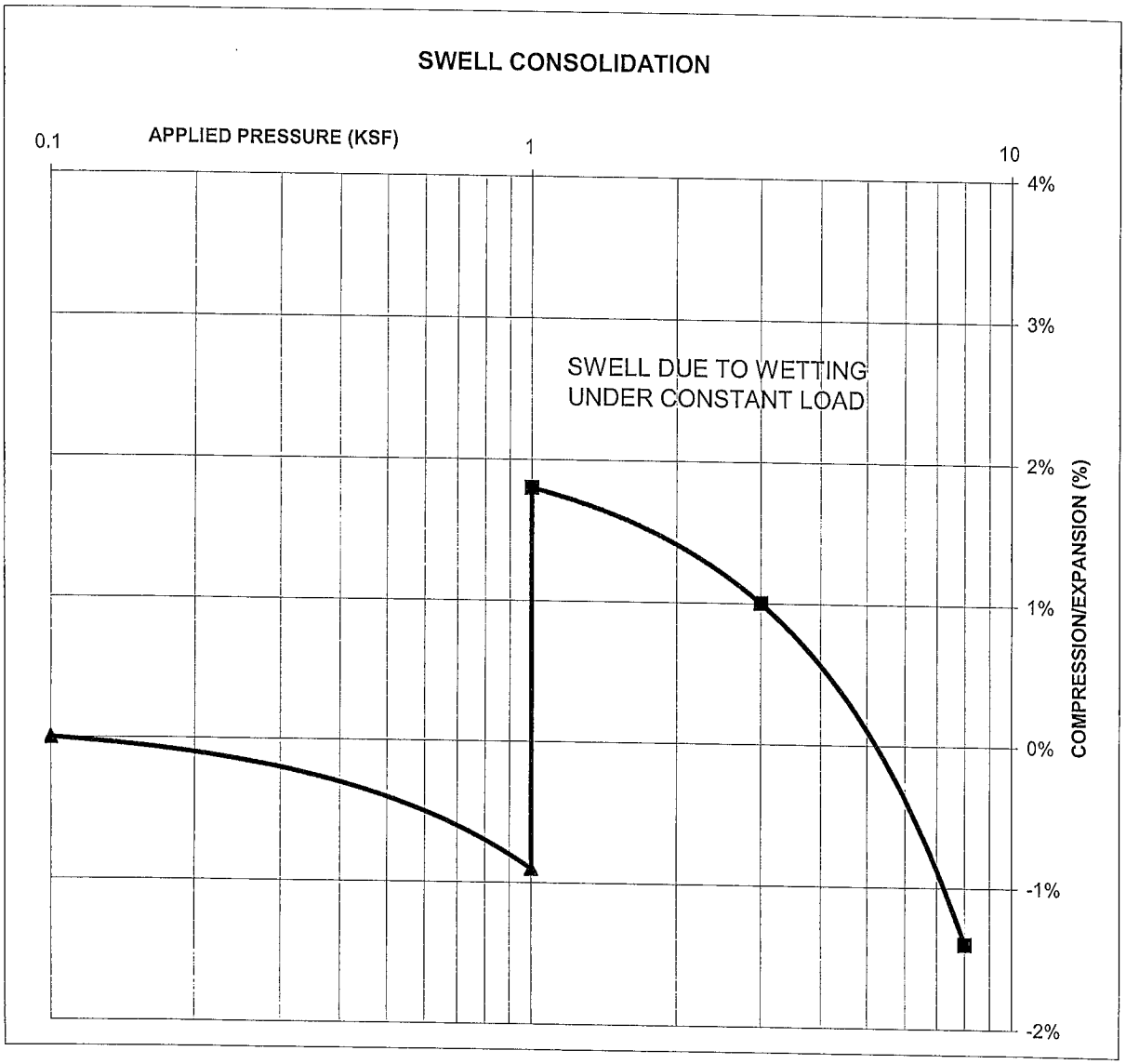
DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-20

CONSOLIDATION TEST RESULTS

TEST BORING #	10	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			114
NATURAL MOISTURE CONTENT			14.3%
SWELL/CONSOLIDATION (%)			2.7%

JOB NO. 141588
CLIENT NES, INC.
PROJECT SHAMROCK RANCH



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-21

CLIENT	NES, INC.	JOB NO.	141588
PROJECT	SHAMROCK RANCH	DATE	2/10/2015
LOCATION	SHAMROCK RANCH	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-11	2-3	1	SM	<0.01
TB-12	10	3	SM	0.01

QC BLANK PASS

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 2/10/15

JOB NO.: 141588
FIG NO.: C.22

APPENDIX D: Soil Survey Descriptions

14—Brussett loam, 1 to 3 percent slopes. This deep, well drained soil formed in eolian silt and sand on uplands. Elevation ranges from 7,200 to 7,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 43 degrees F.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is grayish brown and brown clay loam about 26 inches thick. The substratum is pale brown silt loam. Mycelia and soft masses of lime are common in the substratum.

Included with this soil in mapping are small areas of Peyton sandy loam, 1 to 5 percent slopes.

Permeability of this Brussett soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is moderate.

Nearly all the acreage of this soil is used for nonirrigated winter wheat, spring oats, and improved pasture that is grazed by cattle and sheep. The chief pasture grasses are smooth brome, intermediate wheatgrass, and pubescent wheatgrass. Winter wheat is grown under a wheat-fallow system. Stubble mulching is the most important conservation practice. Application of fertilizer generally is not needed in the wheat-fallow system. Other crops respond to application of nitrogen. The growing season is too short for warm-season field crops. Management of the plant cover is needed to control erosion.

Rangeland vegetation consists of mountain muhly, little bluestem, needleandthread, Parry oatgrass, and junegrass.

Deferment of grazing in spring helps to maintain the vigor and reproduction of the cool-season bunchgrasses. Fencing and properly distributing livestock watering facilities may be needed to control grazing. Locating salt blocks in areas not generally grazed increases the amount of forage that is used on this soil.

Windbreaks and environmental plantings are generally well suited to this soil. Summer fallow a year prior to planting and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Trees that are best suited and have good survival potential are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations for urban development are moderate shrink-swell potential and frost action potential. Dwellings and roads can be designed to overcome these limitations. Permeability adversely affects the performance of septic tank absorption fields. Capability subclass IIIc.

26—Elbeth sandy loam, 8 to 15 percent slopes. This deep, well drained soil formed in material transported from arkose deposits on uplands. Elevation ranges from 7,300 to 7,600 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 43 degrees F, and the average frost-free season is about 120 days.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is light gray loamy sand about 20 inches thick. The subsoil is brown sandy clay loam about 45 inches thick. The substratum is light brown.

Included with this soil in mapping are small areas of Tomah-Crowfoot loamy sand, 8 to 15 percent slopes; Peyton-Pring complex, 8 to 15 percent slopes; Kettle gravelly loamy sand, 8 to 40 percent slopes; and Kettle-Rock outcrop complex.

Permeability of this Elbeth soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow to medium, and the hazard of erosion is moderate.

This soil is used for woodland, limited livestock grazing, recreation, wildlife habitat, and homesites.

This soil is suited to the production of ponderosa pine. It is capable of producing about 2,240 cubic feet, or 4,900 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. Conventional methods can be used for harvesting, but operations may be restricted during wet periods. Reforestation, after harvesting, must be carefully managed to reduce competition of undesirable understory plants.

Woodland wildlife, such as mule deer and wild turkey, is attracted to this soil because of its potential to produce ponderosa pine, Gambel oak, and various grasses and shrubs. Water developments, such as guzzlers, would enhance populations of wild turkey as well as other kinds of wildlife. Where wildlife and livestock share the same range, proper grazing management is needed to prevent overuse and to reduce competition. Livestock watering facilities would also benefit wildlife on this soil.

This soil has good potential for use as homesites. The main limitation is the moderate shrink-swell potential in the subsoil and frost action potential. Special road design is necessary on this soil to overcome these limitations. Slope is also a limitation. Special planning is needed on this soil to minimize site disturbance and tree and seedling damage. During seasons of low precipitation, fire may become a hazard to homesites on this soil. The hazard can be minimized by installing firebreaks and reducing the amount of potential fuel on the forest floor. Capability subclass VIe.

41—Kettle gravelly loamy sand, 8 to 40 percent slopes. This deep, well drained soil formed in sandy arkosic deposits on uplands. Elevation ranges from 7,000 to 7,700 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer is gray gravelly loamy sand about 3 inches thick. The subsurface layer is light gray gravelly loamy sand about 13 inches thick. The subsoil is very pale brown gravelly sandy loam about 24 inches thick. It consists of a matrix of loamy coarse sand that has thin bands of coarse sandy loam or sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown extremely gravelly loamy sand.

Included with this soil in mapping are small areas of Elbeth sandy loam, 8 to 15 percent slopes; Pring coarse sandy loam, 8 to 15 percent slopes; Tomah-Crowfoot loamy sands, 8 to 15 percent slopes; and a few rock outcrops.

Permeability of this Kettle soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies have formed in drainageways.

The soil is used for woodland, livestock grazing, wildlife habitat, recreation, and homesites.

This soil is suited to the production of ponderosa pine. It is capable of producing 2,240 cubic feet, or 4,900 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. The main limitation for this use is the moderate hazard of erosion. Measures must be taken to reduce erosion when harvesting timber, especially on the steeper slopes. The low to moderate available water capacity also influences seedling survival, especially in areas where understory plants are plentiful.

This soil has good potential for mule deer, tree squirrel, cottontail, and wild turkey. These animals obtain their food and shelter from pine trees, shrubs, and ground cover, which provide browse, forbs, fruit, and seeds. The presence of ponderosa pine and Gambel oak should encourage wild turkey populations; however, where water is not naturally present, wildlife watering facilities must be provided to attract and maintain wild turkey and other wildlife species. Livestock grazing management is vital on this soil if wildlife populations are to be maintained.

The moderately sloping to steep slopes limit the suitability of this soil for homesites. Special practices must be provided to minimize surface runoff and thus keep erosion to a minimum. This soil requires special site or building designs because of the slope. Deep cuts, to provide essentially level building sites, may expose bedrock. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. During seasons of low precipitation, fire may become a hazard to homesites. This hazard can be minimized by installing firebreaks and reducing the amount of litter on the forest floor. Capability subclass VIe.

66—**Peyton sandy loam, 1 to 5 percent slopes.** This deep, noncalcareous, well drained soil formed in alluvium and residuum derived from weathered arkosic sedimentary rock on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Brussett loam, 1 to 3 percent slopes; Brussett loam, 3 to 5 percent slopes; Holderness loam, 1 to 5 percent slopes; and Pring coarse sandy loam, 3 to 8 percent slopes.

Permeability of this Peyton soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

About half of the acreage of this soil is used for winter wheat grown in a wheat-fallow cropping system. The other half is used for range or pasture. This soil is also suited to oats. Choice of crops is limited by the short growing season. Crop residue management, such as stubble mulching, is needed to control water erosion.

This soil is well suited to the production of native vegetation suitable for grazing. The native vegetation is mainly mountain muhly, bluestem grasses, mountain brome, needleandthread, and blue grama. This soil is subject to invasion by Kentucky bluegrass and Gambel oak. Minor amounts of forbs such as hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat are in the stand.

Proper location of livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ringnecked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has a good potential for homesites and dwellings. The main limitations are its limited ability to support a load and potential frost action on roads and streets. Roads and buildings can be designed to overcome these limitations. Capability subclass IVe.

67—**Peyton sandy loam, 5 to 9 percent slopes.** This deep, noncalcareous, well drained soil formed in alluvium and residuum derived from weathered arkosic sedimentary rock on uplands. Elevation ranges from 6,800 to 7,600 feet.

Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Holderness loam, 5 to 8 percent slopes; Pring coarse sandy loam, 3 to 8 percent slopes; and Tomah-Crowfoot loamy sands, 3 to 8 percent slopes.

Permeability of this soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Gullies and rills are common.

Most of the acreage of this Peyton soil is used as rangeland. Some areas are used for wheat and oats. Stubble mulching or other crop residue management practices are needed to control water erosion. Wildlife habitat is also an important use.

This soil is well suited to the production of native vegetation suitable for grazing. The native vegetation is mainly mountain muhly, bluestem, mountain brome, needleandthread, and blue grama. This soil is subject to invasion by Kentucky bluegrass and Gambel oak. Minor amounts of forbs such as hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat are in the stand.

Proper location of livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be necessary when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to habitat for openland and rangeland wildlife. Rangeland wildife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for homesites. The main limitation is the limited ability to support a load and potential frost action. Buildings and roads can be designed to overcome these limitations. Capability subclass IVe.

68—**Peyton-Pring complex, 3 to 8 percent slopes.** These gently sloping to moderately sloping soils are on valley side slopes and on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

The Peyton soil makes up about 40 percent of the complex, the Pring soil about 30 percent, and other soils about 30 percent.

Included with these soils in mapping are areas of Holderness loam, 1 to 5 percent slopes; Holderness loam, 5 to 8 percent slopes; and Tomah-Crowfoot loamy sands, 3 to 8 percent slopes. In some places arkosic beds of sandstone and shale are at a depth of 0 to 40 inches.

The Peyton soil is commonly on the less sloping part of the landscape. It is deep, noncalcareous, and well drained. It formed in alluvium and residuum derived from weathered arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches or more.

Permeability of the Peyton soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

The Pring soil is deep, noncalcareous, and well drained. It formed in sandy sediment derived from weathered arkosic sedimentary rock. Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The substratum is dark grayish brown coarse sandy loam about 10 inches thick over pale brown gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability of the Pring soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used as rangeland, for wildlife habitat, and for homesites.

These soils are well suited to the production of native vegetation suitable for grazing. The dominant native species are mountain muhly, bluestem, needleandthread, and blue grama. These soils are subject to invasion of Kentucky bluegrass and Gambel oak. Common forbs are hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat.

Properly locating livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to these soils. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

These soils have a good potential for homesites. The main limitations, especially on the Peyton soil, are low bearing strength and frost-action potential. Buildings and roads can be designed to overcome these limitations. Access roads should have adequate cut-slope grade and be provided with drains to control surface runoff and keep soil losses to a minimum. Capability subclass VIe.

APPENDIX E: Percolation Test Results

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 1

Date Holes Prepared: 1/16/2015

Date Hole Completed: 1/17/2015

Hole No. 1
Depth: 38"

Trial	Time (min.)	Water Level Change (in.)
1	10	0
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 2
Depth: 30"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/4
2	10	3/8
3	10	3/8

Perc Rate (min./in.): 27

Hole No. 3
Depth: 30"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 63*

PROFILE HOLE

Date Profile Hole Completed: 1/16/2015

Depth	Visual Classification	Remarks
0-1'	Clay, sandy, brown	
1-9'	Sand, silty, fine to coarse grained, tan	Weathered Bedrock at 9'
9-15'	Weathered to formational sandstone, silty, gray	No Groundwater
	19 Blows / ft. @ 2'	
	21 Blows / ft. @ 4'	
	35 Blows / ft. @ 9'	
	50 Blows / 10" @ 14'	

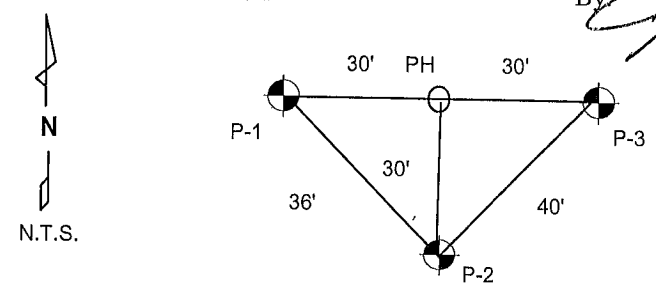
Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 04.124' N, 104° 42.098' W

Observer: Blake Leonard

By:



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-1

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 2

Date Holes Prepared: 1/16/2015

Date Hole Completed: 1/17/2015

Hole No. 1
Depth: 36"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 2
Depth: 34"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 3
Depth: 37"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Average Perc Rate (min./in.) 240*

PROFILE HOLE

Date Profile Hole Completed: 1/16/2015

Depth	Visual Classification
0-8'	Clay, sandy to very sandy, brown to tan
8-15'	Sand, silty, fine to coarse grained, tan

Remarks

No Bedrock
No Groundwater

25 Blows / ft. @ 3'
9 Blows / ft. @ 4'
22 Blows / ft. @ 9'
29 Blows / ft. @ 14'

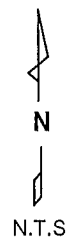
Remarks:

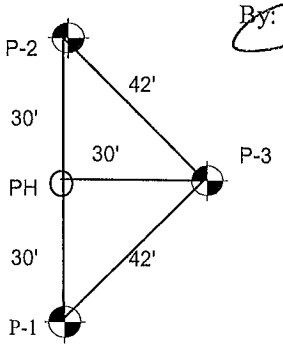
* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 04.083' N, 104° 42.397' W

Observer: Blake Leonard

By:





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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		a	2/12/15

JOB NO.: 141588
FIG NO.: E-2

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 3

Date Holes Prepared: 1/16/2015

Date Hole Completed: 1/17/2015

Hole No. 1
Depth: 33"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/4
2	10	1/8
3	10	1/4

Perc Rate (min./in.): 40

Hole No. 2
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	0
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 38"

Trial	Time (min.)	Water Level Change (in.)
1	10	0
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 67*

PROFILE HOLE

Date Profile Hole Completed: 1/16/2015

Depth	Visual Classification	Remarks
0-6'	Clay, sandy, brown	
6-9'	Sand, silty, tan	
9-15'	Weathered sandstone, silty, fine to coarse grained,	Weathered Bedrock at 9'
	24 Blows / ft. @ 2'	No Groundwater
	13 Blows / ft. @ 4'	
	40 Blows / ft. @ 9'	
	42 Blows / ft. @ 14'	

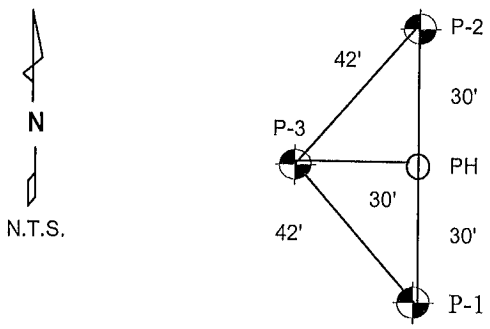
Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 03.710' N, 104° 42.300' W

Observer: Blake Leonard

By:



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-3

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 4

Date Holes Prepared: 1/16/2015

Date Hole Completed: 1/17/2015

Hole No. 1
Depth: 34"

Trial	Time (min.)	Water Level Change (in.)
1	10	0
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 2
Depth: 34"

Trial	Time (min.)	Water Level Change (in.)
1	10	0
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 32"

Trial	Time (min.)	Water Level Change (in.)
1	10	0
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 80*

PROFILE HOLE

Date Profile Hole Completed: 1/16/2015

Depth	Visual Classification	Remarks
0-9'	Clay, sandy, tan, stiff, moist	
9-14'	Sand, clayey, fine to coarse grained, tan	No Bedrock
14-15'	Clay, sandy, brown	No Groundwater
	16 Blows / ft. @ 2'	
	15 Blows / ft. @ 4'	
	18 Blows / ft. @ 9'	
	12 Blows / ft. @ 14'	

Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

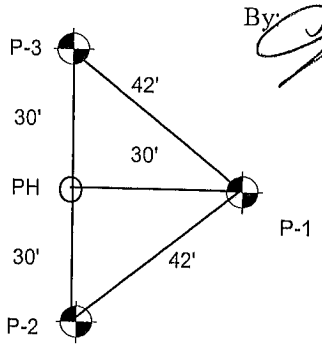
GPS Coordinates: 39° 03' 28.76" N, 104° 42' 05.19" W

Observer: Blake Leonard

By:

N

N.T.S.



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-4

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 5

Date Holes Prepared: 2/2/2015

Date Hole Completed: 2/3/2015

Hole No. 1
Depth: 36"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 2
Depth: 36"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 3
Depth: 39"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Average Perc Rate (min./in.) 240*

PROFILE HOLE

Date Profile Hole Completed: 2/2/2015

Depth	Visual Classification
0-3'	Sand, silty, fine to coarse grained, tan
3-15'	Weathered sandstone, silty, clayey, tan

Remarks

Weathered Bedrock at 3'
No Groundwater

16 Blows / ft. @ 2'
42 Blows / ft. @ 4'
42 Blows / ft. @ 9'
45 Blows / ft. @ 14'

Remarks:

* - Due to slow percolation rate and shallow bedrock, a designed system or additional drilling is recommended

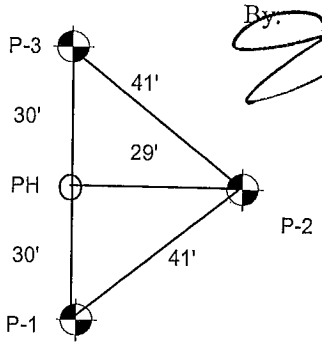
GPS Coordinates: 39° 03.453' N, 104° 42.708' W

Observer: Blake Leonard

By:

N

N.T.S.



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		W	2/12/15

JOB NO.: 141588
FIG NO.: E-5

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 6

Date Holes Prepared: 1/26/2015

Date Hole Completed: 1/27/2015

Hole No. 1
Depth: 40"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 2
Depth: 32"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 27"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Average Perc Rate (min./in.) 187*

PROFILE HOLE

Date Profile Hole Completed: 1/26/2015

Depth	Visual Classification	Remarks
0-8'	Clay, sandy, tan	
8-15'	Weathered to formational sandstone, silty, tan	Weathered Bedrock at 8' No Groundwater

21 Blows / ft. @ 2'
16 Blows / ft. @ 4'
42 Blows / ft. @ 9'
50 Blows / 11" @ 14'

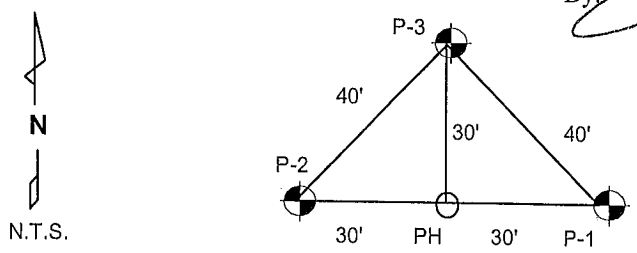
Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 03.319' N, 104° 42.380' W

Observer: Blake Leonard

By:



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-6

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 7

Date Holes Prepared: 1/26/2015

Date Hole Completed: 1/27/2015

Hole No. 1
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 2
Depth: 23"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 3
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	
2	10	
3	30	1/8

Perc Rate (min./in.): 240

Average Perc Rate (min./in.) 240*

PROFILE HOLE

Date Profile Hole Completed: 1/26/2015

Depth	Visual Classification	Remarks
0-4'	Clay, sandy, tan	
4-8'	Sand, clayey, fine to coarse grained, brown	Weathered Bedrock at 11'
8-11'	Sand, silty, fine to coarse grained, tan	No Groundwater
11-15'	Weathered sandstone, silty, fine to coarse grained	
	12 Blows / ft. @ 2'	
	44 Blows / ft. @ 4'	
	14 Blows / ft. @ 9'	
	46 Blows / ft. @ 14'	

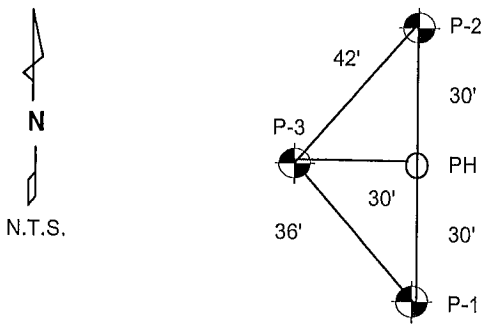
Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 03.021' N, 104° 42.345' W

Observer: Blake Leonard

By:



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LW	2/12/15

JOB NO.: 141588
FIG NO.: E-7

Client: NES, INC. Job Number: 141588
Test Location: SHAMROCK RANCH

PERCOLATION HOLES-TEST NO. 8

Date Holes Prepared: 2/2/2015 Date Hole Completed: 2/3/2015

Hole No. 1
Depth: 37"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 2
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 3
Depth: 39"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Average Perc Rate (min./in.) 240*

PROFILE HOLE

Date Profile Hole Completed: 2/2/2015

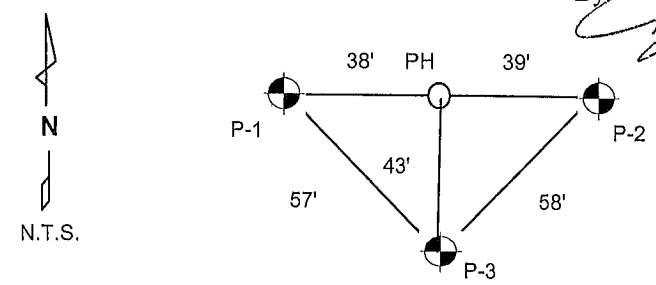
Depth	Visual Classification	Remarks
0-15'	Clay, sandy to very sandy, tan	No Bedrock No Groundwater

15 Blows / ft. @ 2'
28 Blows / ft. @ 4'
24 Blows / ft. @ 9'
29 Blows / ft. @ 14'

Remarks:
* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 03.188' N, 104° 42.862' W

Observer: Blake Leonard By:



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-8

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 9

Date Holes Prepared: 2/3/2015

Date Hole Completed: 2/4/2015

Hole No. 1
Depth: 39"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 2
Depth: 36"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 36"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Average Perc Rate (min./in.) 134*

PROFILE HOLE

Date Profile Hole Completed: 2/3/2015

Depth	Visual Classification
0-14'	Sand, silty with clayey lenses, tan
14-15'	Sandstone, silty, fine to coarse grained, gray

Remarks

Sandstone Bedrock at 14'
No Groundwater

24 Blows / ft. @ 2'
18 Blows / ft. @ 4'
6 Blows / ft. @ 9'
50 Blows / ft. @ 14'

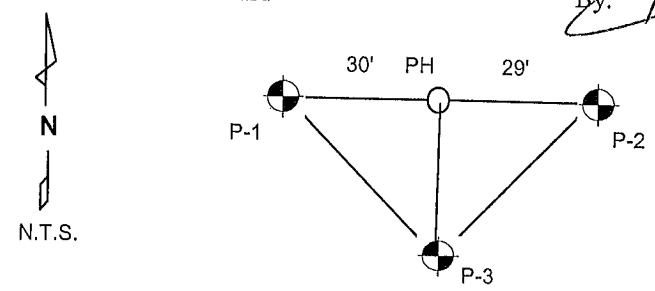
Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

GPS Coordinates: 39° 02.870' N, 104° 42.947' W

Observer: Blake Leonard

By:



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-9

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 10

Date Holes Prepared: 2/2/2015

Date Hole Completed: 2/3/2015

Hole No. 1
Depth: 34"

Trial	Time (min.)	Water Level Change (in.)
1		
2		
3	30	1/8

Perc Rate (min./in.): 240

Hole No. 2
Depth: 34"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 33"

Trial	Time (min.)	Water Level Change (in.)
1	10	3/4
2	10	3/4
3	10	3/4

Perc Rate (min./in.): 13

Average Perc Rate (min./in.) 111*

PROFILE HOLE

Date Profile Hole Completed: 2/2/2015

Depth	Visual Classification	Remarks
0-3'	Sand, silty, fine to coarse grained, tan	
3-8'	Clay, sandy, tan	No Bedrock
8-15'	Sand, silty, fine to coarse grained, tan	No Groundwater
	32 Blows / ft. @ 2'	
	42 Blows / ft. @ 4'	
	17 Blows / ft. @ 9'	
	6 Blows / ft. @ 14'	

Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

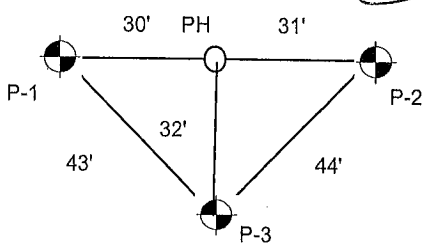
GPS Coordinates: 39° 03.292' N, 104° 43.254' W

Observer: Blake Leonard

By:

N

N.T.S.



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-10

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 11

Date Holes Prepared: 12/1/2015

Date Hole Completed: 12/2/2015

Hole No. 1
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	3/8
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 2
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1 1/4
2	10	1/2
3	10	1/2

Perc Rate (min./in.): 20

Hole No. 3
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	3/8
2	10	3/8
3	10	1/2

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 40

PROFILE HOLE

Date Profile Hole Completed: 12/1/2015

Depth	Visual Classification	Remarks
0-9'	Sand, silty, fine to coarse grained, tan	
9-15'	Weathered to formational sandstone, silty, tan	Weathered Bedrock at 9' No Groundwater

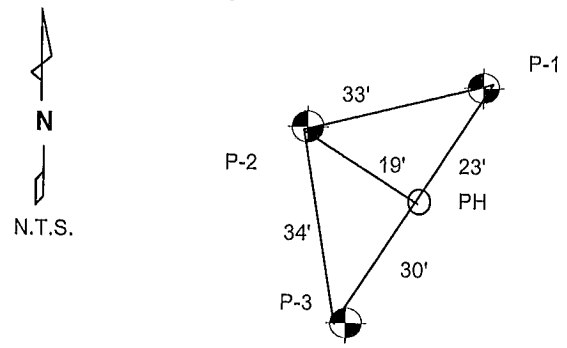
27 Blows / ft. @ 2'
25 Blows / ft. @ 4'
32 Blows / ft. @ 9'
50 Blows / 6" @ 14'

Remarks:

GPS Coordinates: 39° 02' 41" N, 104° 43' W

Observer: Logan Langord

By:



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-11

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 12

Date Holes Prepared: 12/1/2015

Date Hole Completed: 12/2/2015

Hole No. 1
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/4
2	10	5/8
3	10	1/4

Perc Rate (min./in.): 40

Hole No. 2
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/4
2	10	1/4
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 67*

PROFILE HOLE

Date Profile Hole Completed: 12/1/2015

Depth	Visual Classification
0-11'	Sand, silty, fine to coarse grained, tan
11-15'	Sandstone, silty, fine to coarse grained, tan

Remarks

Sandstone Bedrock at 11'
No Groundwater

7 Blows / ft. @ 2'
22 Blows / ft. @ 4'
25 Blows / ft. @ 9'
50 Blows / 7" @ 14'

Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

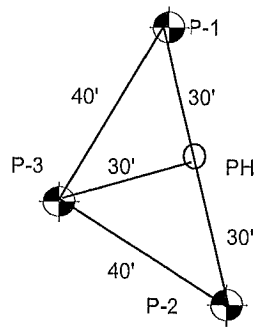
GPS Coordinates: 39° 03' 02" N, 104° 43' W

Observer: Logan Langford

By:

N

N.T.S.



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-12

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 13

Date Holes Prepared: 12/1/2015

Date Hole Completed: 12/2/2015

Hole No. 1
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/4
2	10	0
3	10	1/4

Perc Rate (min./in.): 40

Hole No. 2
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	3/4
2	10	1/2
3	10	1/2

Perc Rate (min./in.): 20

Hole No. 3
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	3/8
2	10	3/8
3	10	1/4

Perc Rate (min./in.): 40

Average Perc Rate (min./in.) 34

PROFILE HOLE

Date Profile Hole Completed: 12/1/2015

Depth	Visual Classification	Remarks
0-1'	Sand, silty, tan	
1-15'	Sandstone, silty, fine to coarse grained, tan	Sandstone Bedrock at 1' No Groundwater

50 Blows / 10' @ 2'
50 Blows / 10" @ 4'
50 Blows / 6" @ 9'
50 Blows / 4" @ 14'

Remarks:

* - Due to shallow bedrock, a designed system or additional drilling is recommended

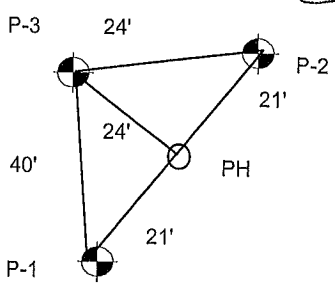
GPS Coordinates: 39° 03' 06" N, 104° 44' W

Observer: Logan Langford

By:

N

N.T.S.



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

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-13

Client: NES, INC.
Test Location: SHAMROCK RANCH

Job Number: 141588

PERCOLATION HOLES-TEST NO. 14

Date Holes Prepared: 12/1/2015

Date Hole Completed: 12/2/2015

Hole No. 1
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	3/4
2	10	1/8
3	10	3/8

Perc Rate (min./in.): 27

Hole No. 2
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/2
2	10	3/4
3	10	1/4

Perc Rate (min./in.): 40

Hole No. 3
Depth: 35"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/16

Perc Rate (min./in.): 160

Average Perc Rate (min./in.) 76

PROFILE HOLE

Date Profile Hole Completed: 12/1/2015

Depth	Visual Classification
0-4'	Sand,s ilty to clayey, fine to coarse grained
4-5'	Clay, sandy, tan
5-11'	Sand, silty, fine to coarse grained, tan
11-15'	Sandstone, silty, fine to coarse grained, tan
	4 Blows / ft. @ 2'
	9 Blows / ft. @ 4'
	12 Blows / ft. @ 9'
	50 Blows / 6" @ 14'

Remarks

Sandstone Bedrock at 11'
No Groundwater

Remarks:

* - Due to slow percolation rate, a designed system or additional drilling is recommended

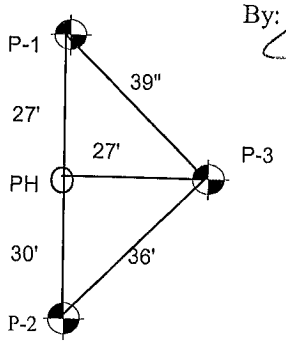
GPS Coordinates: 39° 02.823' N, 104° 43.95' W

Observer: Logan Langford

By:

N

N.T.S.



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PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: E-14