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SOIL, GEOLOGY, GEOLOGIC HAZARD, AND WASTEWATER STUDY
PONY TRACKS SUBDIVISION FILING NO. 2
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, COLORADO

Prepared for

MVE, Inc
1903 Lelaray Street, Suite 200
Colorado Springs, Colorado 80909

Attn: Chuck Crum

May 24, 2019

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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Encl.

Entech Job No. 190448
AAprojects/2019/190448 countysoil/geo/ww.

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1.0 SUMMARY

Project Location

The project lies in a portion of the NW¼ of Section 4, Township 12 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 5 miles southeast of Monument, Colorado.

Project Description

Total acreage involved in the project is approximately 9.86 acres. The proposed development consists of subdividing the lot into two lots. An existing house and garage are located on Lot 1 which will likely be removed. The lots 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 potentially seasonal shallow groundwater area. Based on the proposed development plan, it appears that these areas will have minor impacts on the development. These conditions will be discussed in greater detail in the report.

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

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the NW¼ of Section 4, Township 12 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located northeast of Silverton Road and Old North Gate Road, approximately 5 miles southeast of Monument and immediately north of the Colorado Springs city limits, in El Paso County, Colorado,. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site is gradually to moderately sloping generally to the south. No major drainages were observed on the site. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land and rural residential development. The site contains primarily field grasses and weeds with areas of ponderosa pines and scrub oak in the northern portion of the site. An existing house and garage are located on Lot 1, which will likely be removed. Site photographs, taken April 18, 2019, are included in Appendix A and indicated on Figure 3.

Total acreage involved in the proposed development is approximately 9.86 acres. Two single-family rural residential lots are proposed as part of the subdivision. The proposed lots are approximately 4.7 and 5 acres each. The lots will be serviced by individual wells and on-site wastewater treatment systems. The Site Plan is presented in Figure 3.

3.0 SCOPE OF THE REPORT

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.

- The site will be evaluated for individual on-site wastewater treatment systems in accordance with El Paso Land Development Code.

4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Geology/Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on April 18, 2019.

Two (2) Test Borings were drilled and two (2) Test Pits were excavated on the site to determine general soil information for development recommendations. The locations of the Test Borings and Test Pits are indicated on the Site Plan, Figure 3. The Test Pit Logs are presented in Appendix B. Results of this testing will be discussed later in this report.

Laboratory testing was also performed on some of the soils to classify and determine the soils engineering characteristics. Laboratory tests included grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. 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 6 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 northwesterly direction (Reference 1). The rocks in the area of the site are sedimentary in nature and typically Tertiary to Upper Cretaceous in age. The bedrock

underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual soils and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. The alluvial soils were deposited by water on site and as sheetwash and alluvial deposits. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has mapped one soil type on the site (Figure 4). In general, they consist of loamy sands. The soils are described as follows:

Type	Description
93	Tomah-Crowfoot Complex, 8-15% slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to typically have moderate to moderately rapid permeabilities. Roads may need to be designed to minimize frost-heave potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have moderate erosion hazards (Reference 3).

5.3 Site Stratigraphy

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

Qas_1 **Younger Alluvial-Slope Deposits of Holocene to Late Pleistocene Age:** These are sheetwash and fluvial deposited sands that exists in the southern portion of the site. These materials typically consist of silty to clayey sands.

Qas_3 **Older Alluvial-Slope Deposits of Early Pleistocene Age:** These are sheetwash and fluvial deposited sands that exists in the northern portion of the site. These materials typically consist of silty to clayey sands.

Tkda **Dawson Formation of Tertiary to Cretaceous Age:** The Dawson Formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty to clayey sands, sandy clays and sandy silts.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Monument Quadrangle* distributed by the Colorado Geological Survey in 2003 (Figure 5, Reference 4), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 5), and the *Geologic Map of the Denver 1^0 x 2^0 Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 6). The Test Borings and Test Pits were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the Test Borings and Test Pits can be grouped into two general soil types. The Test Boring soils were classified using the Unified Soil Classification System (USCS). The Test Pit soils were also classified using the USDA Texture Soil Classification.

Soil Type 1 is a slightly silty sand, very clayey sand and well-graded sand (SM-SW, SC, SW). This material was encountered in all of the test borings and test pits. The sand was encountered at the existing surface and extended to 14 feet in Test Boring No. 2, to the termination of Test Boring No. 1 (20 feet), and the termination of the test pits (8 feet). These soils were encountered at loose to medium dense states and moist to wet conditions. Samples tested had 4 to 46 percent of the soil size particles passing the No. 200 Sieve. Atterberg Limits Testing resulted in the silty sand being non-plastic. FHA Swell Testing on a sample of the very clayey sand resulted in an expansion pressure of 970 psf, which is in the low to moderate expansion range. Sulfate testing resulted in less than 0.01 percent sulfate by weight indicating the sand exhibits negligible potential for below grade concrete degradation.

Soil Type 2 is very clayey to silty sandstone (SC, SM). This material was encountered in Test Boring No. 2 at 14 feet bgs and extending to the termination of of the test boring (20 feet). The sandstone was encountered at dense to very dense states and moist conditions. Samples

tested had 37 to 39 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing resulted in the sandstone being non-plastic. Sulfate testing resulted in less than 0.01 percent sulfate by weight indicating the sand exhibits negligible potential for below grade concrete degradation.

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

5.5 Groundwater

Groundwater was encountered in Test Boring No. 1 at 8.5 feet at the time of drilling. Groundwater was not encountered in Test Boring No. 2 or the Test Pits, which were drilled to 20 feet and excavated to 8 feet. Areas of potentially seasonal shallow groundwater have been mapped in a low-lying area of Lot 1 on-site. This area is discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

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

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

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

Expansive Soils

Expansive soils were not encountered in the test borings or test pits excavated on–site. However, expansive clay soils and claystone commonly encountered within the Dawson Formation and the overlying residual soils. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These expansive soils, if encountered beneath foundations, can cause differential movement in the structure foundation. These occurrences should be identified and mitigated on an individual lot basis.

Mitigation: Should expansive soils be encountered beneath the foundation; mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation of 3 to 4 feet of the expansive soil and replacement with non-expansive soils at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Loose or Collapsible Soils

Areas of loose soils were encountered in the test borings drilled on site. Should loose to collapsible soils be encountered beneath the foundation; mitigation will be necessary. Typical mitigation involves penetration or removal of the upper 2 to 3 feet of loose soils and recompaction at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 with thorough moisture conditioning. Specific recommendations should be made after additional investigation of each building site.

Floodplain and Seasonal Shallow Groundwater Area

The site is not mapped within any floodplains according to the FEMA Map No. 08041CO295G, dated December 7, 2018 (Figure 7, Reference 7). An area of potentially seasonal shallow groundwater associated with a low area was observed in the northeastern portion of Lot 1 on the site. In these areas, we would anticipate the potential for periodically high subsurface

moisture conditions and frost heave potential. These areas lie within low-lying areas and towards the end of a minor drainage swale that originates to the northeast of the site. Water was not observed in the minor drainage swale at the time of our site investigation. These areas can likely be avoided or properly mitigated by development. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following precautions should be followed.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. All organic material would be completely removed prior to any fill placement. Specific drainage studies are beyond the scope of this report.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned, we understand that the development will be rural residential. It is our opinion that the existing geologic and engineering geologic conditions will impose some minor constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the low area and minor drainage swale on site that can be avoided or properly mitigated during site grading. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper materials are typically at loose to medium dense states. The medium dense granular soils encountered in the upper soil profiles of the test borings and test pits should provide good support for foundations. Loose soils, if encountered beneath foundations, will require recompaction. Expansive soils, although sporadic, were encountered. Expansive clay soils, clayey sandstone and claystone are common in the Dawson Formation, and may require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils or loose soils. Areas 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.

A house and garage currently exist on Lot 1. It is our understanding they will to be removed. All existing foundation remnants, utilities, septic field, and debris associated with the existing structures should be completely removed prior to construction. Any fill associated with the existing structures is considered uncontrolled and should be penetrated or removed and recompacted as structural fill.

An area of potentially seasonal shallow groundwater associated with a low area on Lot 1 was encountered on site. Water was not observed on the site. Due to the size of the lots and the proposed development, this area can be avoided by construction. Structures should not block drainages. Septic fields should not be located in these areas due to the potential for periodic high groundwater 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. Investigation on each lot is 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. Two (2) test pits were excavated on the site. The approximate locations of the test pits are indicated on Figure 3, on the Geology/Engineering Geology Map, Figure 6, and on the Septic Suitability Map, Figure 9. A table showing the results of the test pits is presented in Table 2.

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has been mapped with one soil description. The Soil Survey Map (Reference 2) is presented in Figure 4, and the Soil Survey Descriptions are presented in Appendix D. The soils are described as having moderate to moderately rapid percolation rates.

Soils encountered in the tactile test pits consisted of gravelly sandy clay loam, sandy clay loam, sandy loam and loamy sand. The limiting layers encountered in the test pits are the gravelly sandy clay loam and sandy loam, which corresponds to an LTAR values of 0.35 to 0.60 gallons per day per square foot. Bedrock or signs of groundwater were not encountered in the test pits. Absorption fields must be maintained a minimum of 4 feet above groundwater or bedrock, or

confining layer. Should groundwater or bedrock be encountered within 6 feet of the surface, designed systems will be required.

In summary, it is our opinion the site is suitable for individual on-site wastewater treatment systems (OWTS) and that contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated and installed according to El Paso County and State Guidelines and properly maintained. Based on the testing performed as part of this investigation, there are areas where conventional systems can be used on the lots. A septic Suitability Map is presented in Figure 9. Individual soil testing is required on each lot prior to construction. Absorption fields must be located a minimum of 100 feet from any well, including those on adjacent properties. Absorption fields must 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 8), portions of the area are mapped with steam terrace deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 9), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), the area of the site has been mapped as "Good" for industrial minerals. 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 10), 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 10).

The site has been mapped as "Fair" for oil and gas resources (Reference 10). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

9.0 EROSION CONTROL

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

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

or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

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

10.0 CLOSURE

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

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Individual investigations for building sites and septic systems will be required prior to construction. Construction and design personnel should be made familiar with the contents of this report. Discrepancies should be reported to Entech Engineering, Inc. soon after they are discovered so that the evaluation and recommendations presented can be reviewed and revised if necessary. Planning and design personnel should be made familiar with the contents of this report.

This report has been prepared for MVE, Inc., 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.

BIBLIOGRAPHY

1. Bryant, Bruce; McGrew, Laura W, and Wabus, Reinhard A. 1981. *Geologic Structure Map of the Denver 1° x 2° Quadrangle, North-Central Colorado.* Sheet 2. U.S. Geologic Survey. Map I-1163.

2. Natural Resource Conservation *Service,* September 23, 2016. *Web Soil Survey.* United States Department Agriculture, http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

3. United States Department of Agriculture Soil Conservation Service. June 1981. *Soil Survey of El Paso County Area, Colorado.*

4. Thorson, Jon P. and Madole, Richard F., 2003. *Geologic Map of the Monument Quadrangle, El Paso County, Colorado.* Colorado Geological Survey. Open-File Report 02-40.

5. Trimble, Donald E. and Machette, Michael N. 1979. *Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor, Colorado.* USGS, Map I-857-F.

6. Bryant, Bruce; McGrew, Laura W. and Wobus, Reinhard A. 1981. *Geologic Map of the Denver 1° x 2° Quadrangle, North-Central Colorado.* U.S. Geologic Survey. Map 1-1163.

7. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado.* Map Number 08041CO295G

8. El Paso County Planning Development. December 1995. *El Paso County Aggregate Resource Evaluation Maps.*

9. Schwochow, S.D.; Shroba, R.R. and Wicklein, P.C. 1974. *Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties.* Colorado Geological Survey. Special Publication 5-B.

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

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT MVE, INC.
PROJECT 2030 OLD NORTHGATE ROAD
JOB NO. 190448

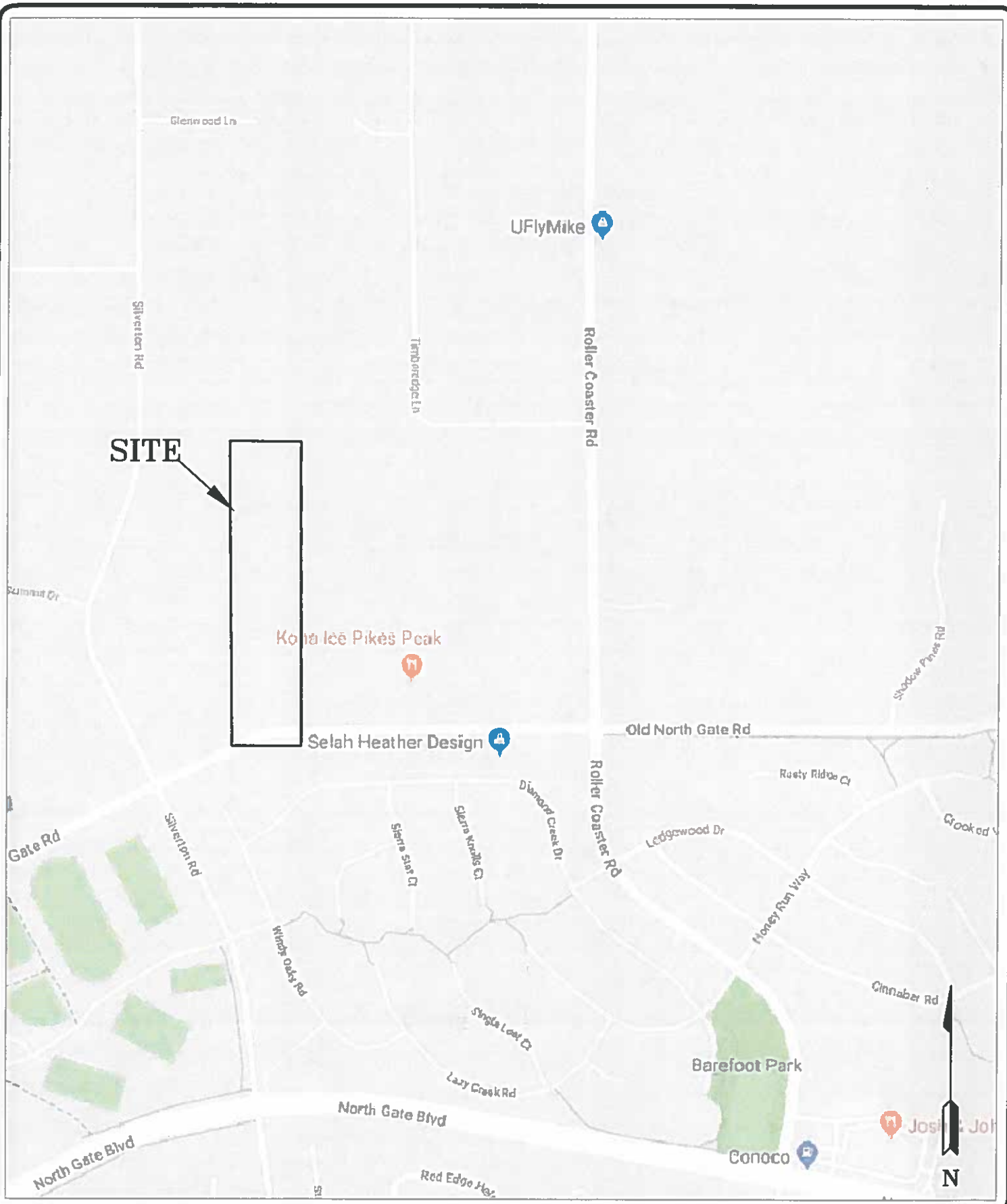
SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			8.8	NV	NP	<0.01			SM-SW	SAND, SLIGHTLY SILTY
1	2	5			7.6						SM-SW	SAND, SLIGHTLY SILTY
1	2	2-3			45.9				970		SC	SAND, VERY CLAYEY
1	TP-1	2-3			43.4						SC	SANDY CLAY LOAM
1	TP-2	5-6			4.3						SW	SAND
2	2	17			39.2						SC	SANDSTONE, VERY CLAYEY
2	2	15			36.6	NV	NP	<0.01			SM	SANDSTONE, SILTY

Table 2: Summary Tactile Test Pit Results

Test Pit No.	USDA Soil Type	LTAR Value	Depth to Bedrock (ft.)	Depth to Seasonally Occurring Groundwater (ft.)
1	3	0.35	N/A	N/A
2	2	0.60	N/A	N/A

*- Conditions that will require an engineered OWTS

FIGURES



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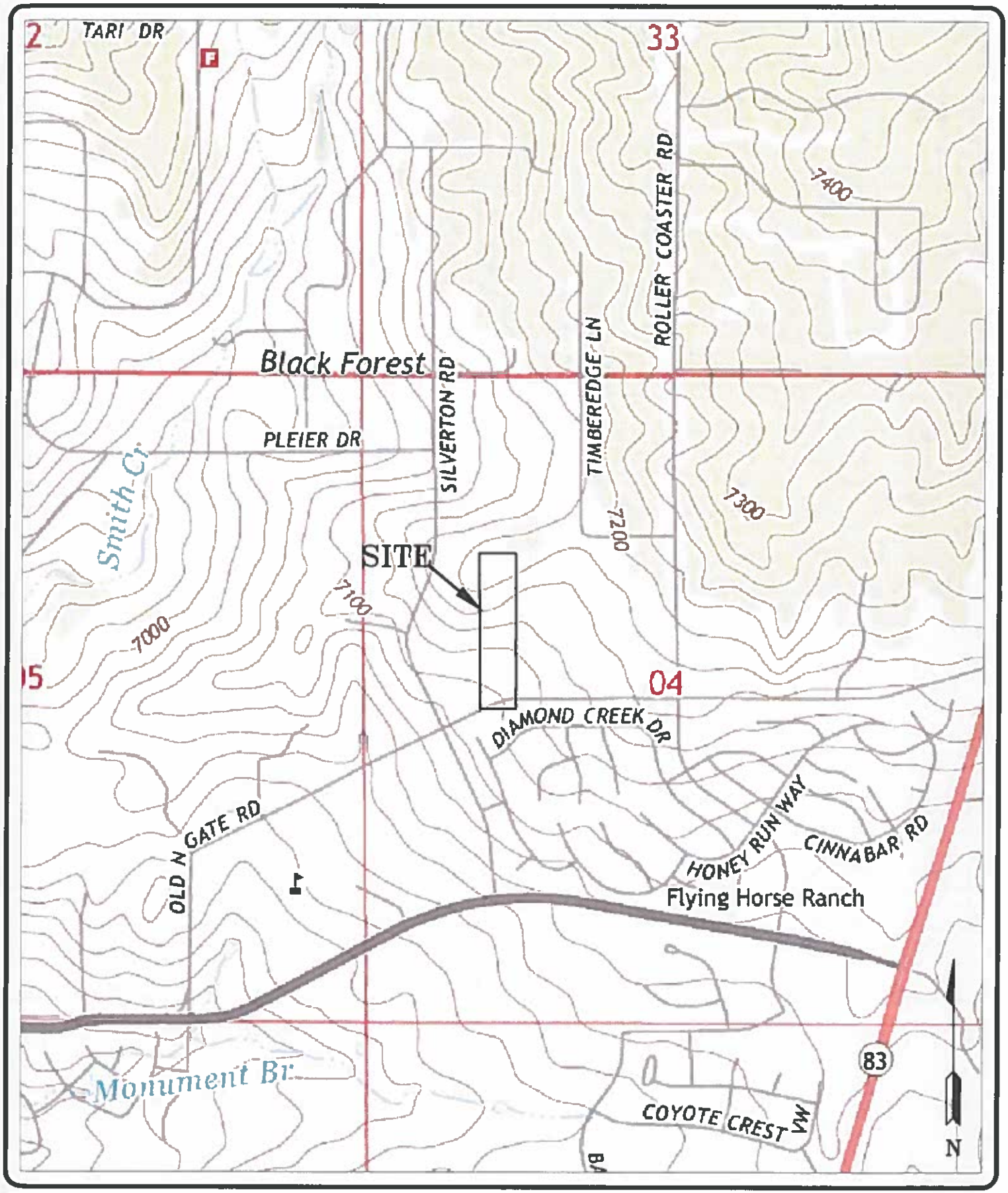
VICINITY MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/14/19		

JOB NO.: 190448

FIG NO.: 1



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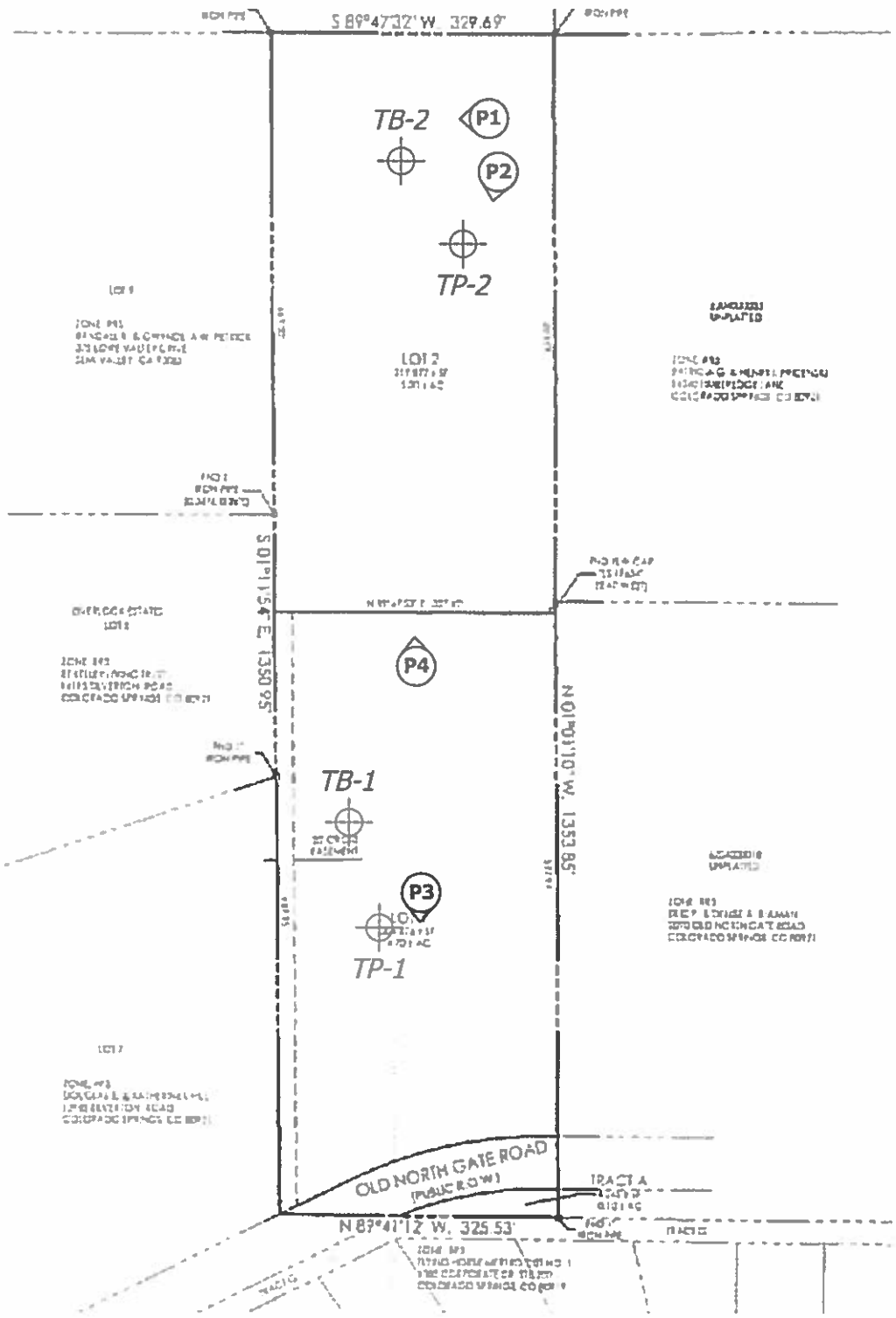
USGS MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/14/19		

JOB NO.: 190448

FIG NO.: 2



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

TP- APPROXIMATE TEST PIT LOCATION AND NUMBER

P2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

N

ENTECH ENGINEERING, INC.
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SITE PLAN
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

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JOB NO.: 190448

FIG NO.: 3

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SOIL SURVEY MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

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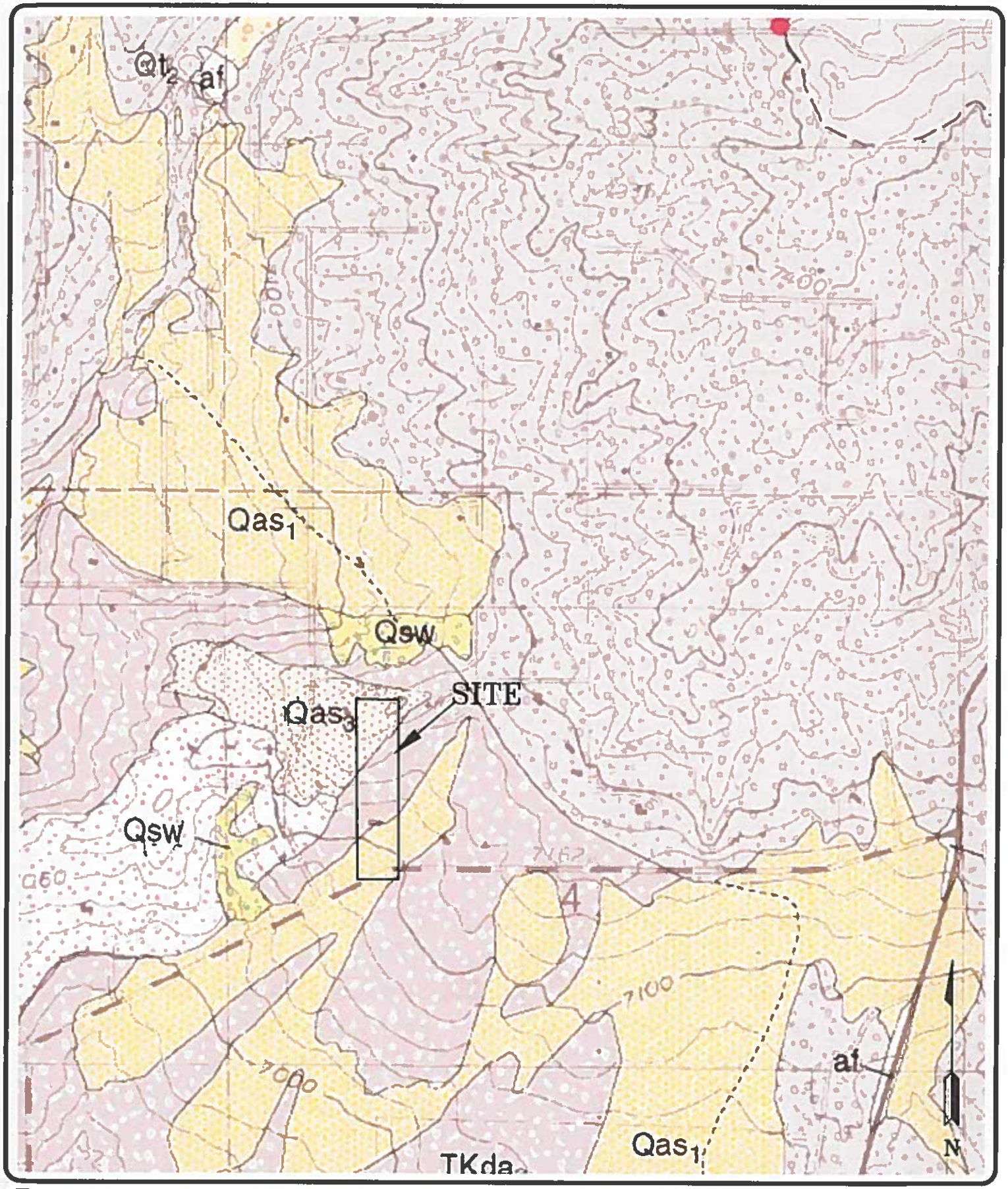
FIG NO.: 4



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MONUMENT QUADRANGLE GEOLOGIC MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

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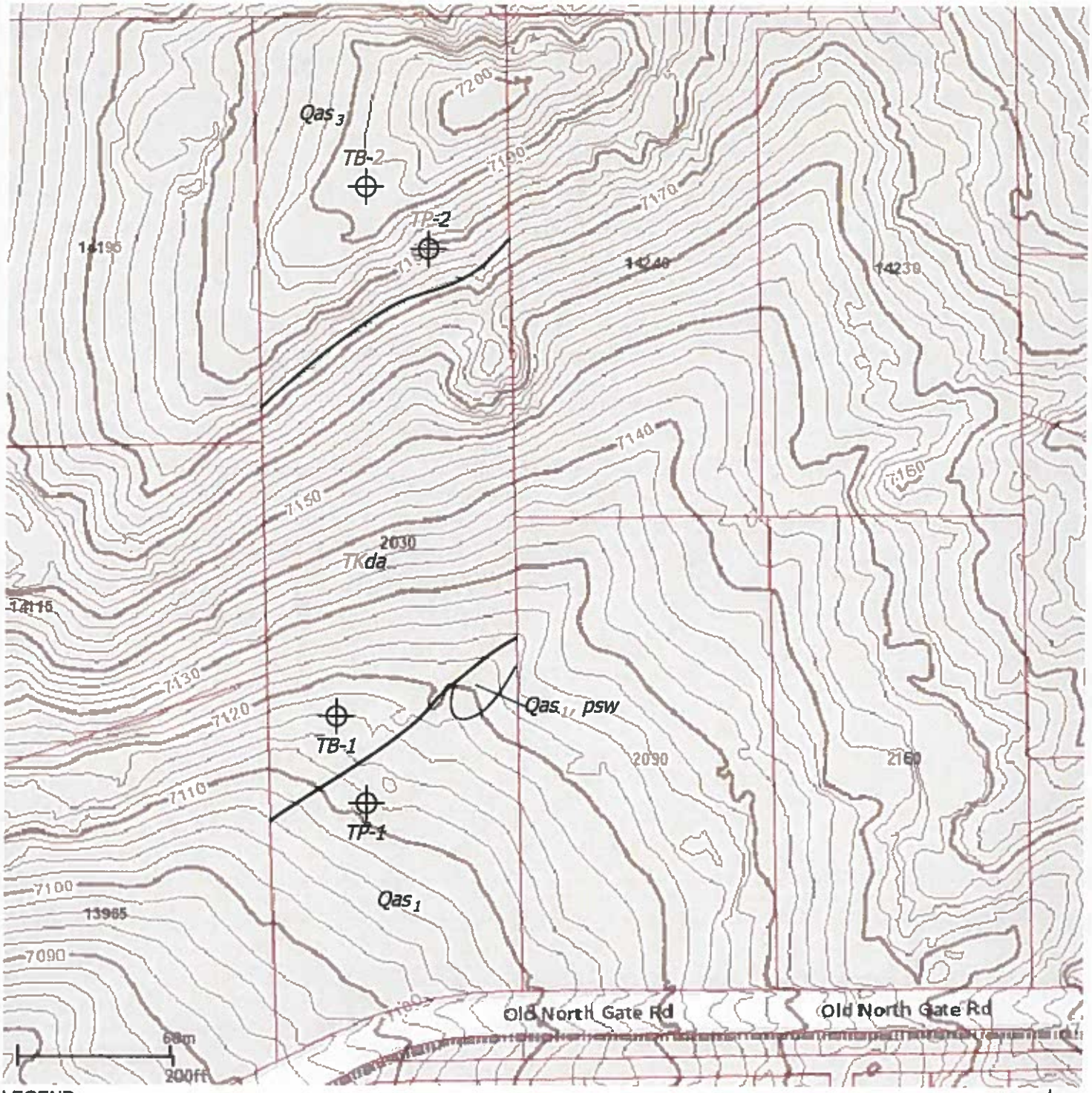
LLL	5/14/19		

JOB NO.: 190448

FIG NO.: 5



LEGEND:

Qas_1 - Younger Alluvial-Slope Deposits of Holocene to Late Pleistocene Age: sheet flow and fluvial sand deposits

Qas_3 - Older Alluvial-Slope Deposits of Early Pleistocene Age: sheet flow and fluvial sand deposits

TKda - Dawson Formation of Tertiary to Cretaceous Age: arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone

psw - potentially seasonal shallow groundwater area

⌖ - approximate Test Boring/Test Pit Locations

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

GEOLOGY/ENGINEERING GEOLOGY MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/14/19		

JOB NO.: 190448

FIG NO.: 6

N

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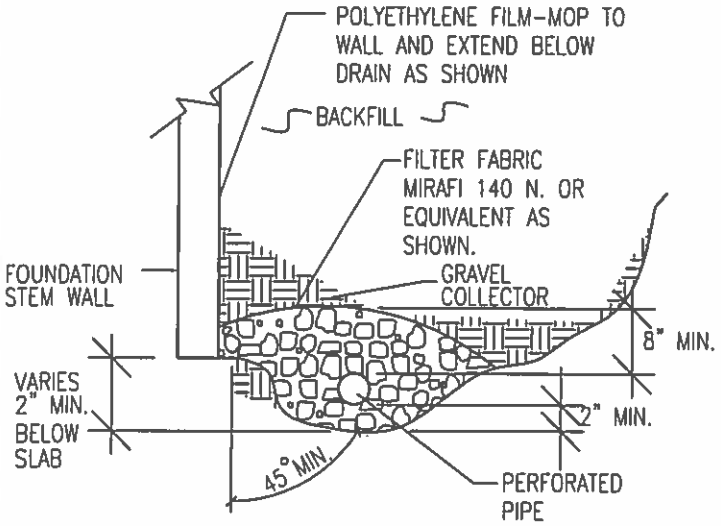
COLORADO SPRINGS, CO. 80907 (719) 531-5599

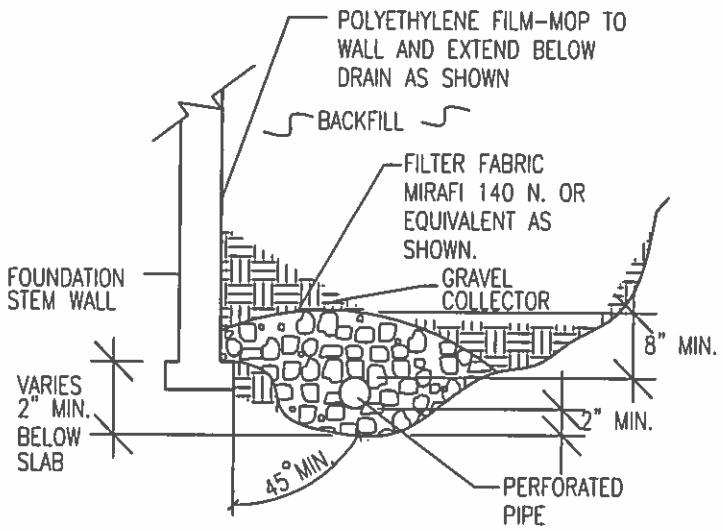
FEMA FLOODPLAIN MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/14/19		

JOB NO.: 190448

FIG NO.: 7





NOTES:

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

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

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

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

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

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

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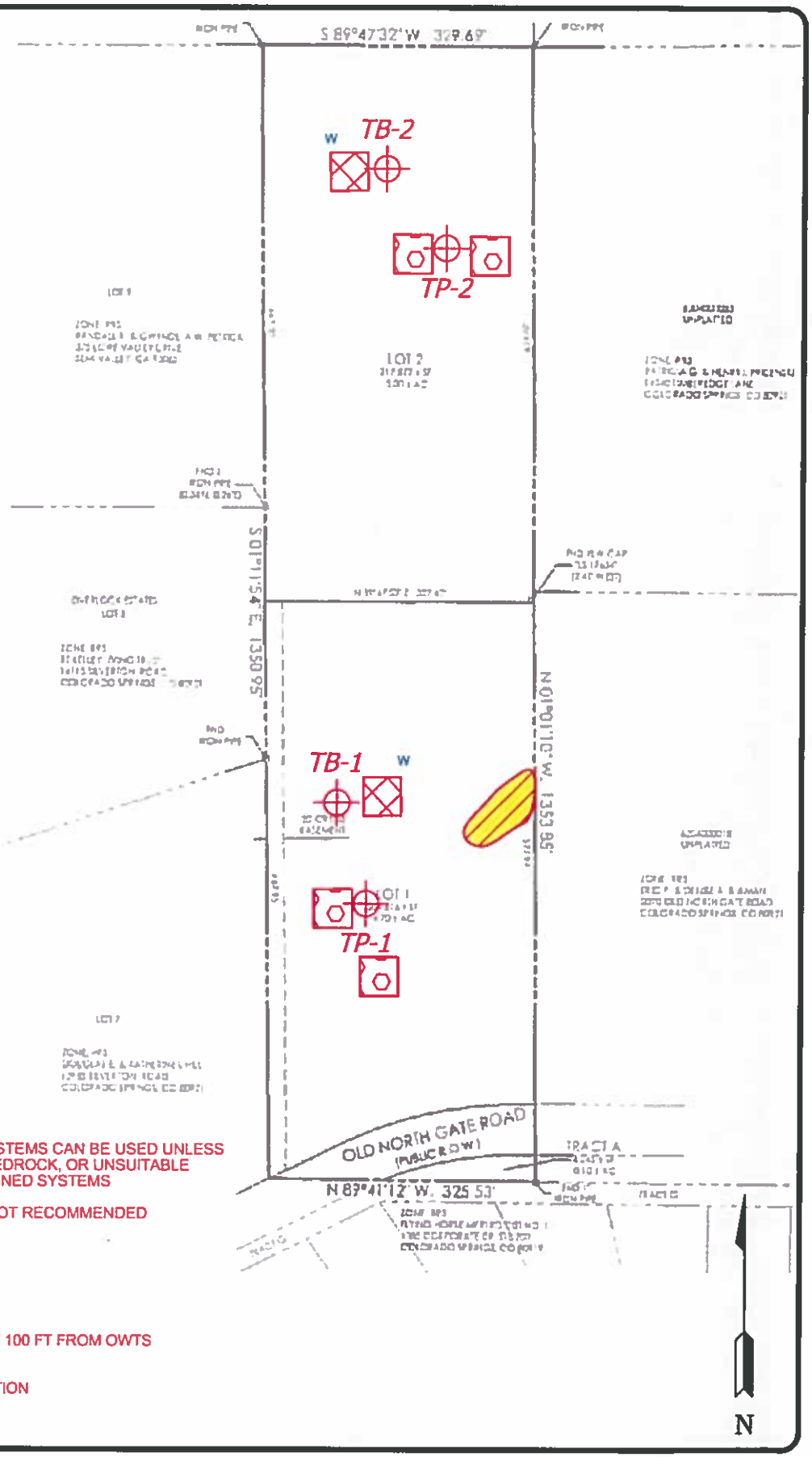
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

PERIMETER DRAIN DETAIL

DRAWN:	DATE DRAWN:	DESIGNED BY:	CHECKED:
		DS	LLL

JOB NO.: 190448

FIG. NO.: 8



LEGEND:

- AREAS WHERE CONVENTIAL SEPTIC SYSTEMS CAN BE USED UNLESS SHALLOW GROUNDWATER, SHALLOW BEDROCK, OR UNSUITABLE SOILS ENCOUTNERED REQURING DESIGNED SYSTEMS
- AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED
- POSSIBLE HOUSE LOCATION
- TWO POSSIBLE OWTS SITES
- W - POSSIBLE WELL LOCATION
- *- WATER WELLS MUST BE A MINIMUM OF 100 FT FROM OWTS ABSORPTION FIELDS
- TB - APPROXIMATE TEST BORING LOCATION
- TP - APPROXIMATE TEST PIT LOCATION

ENTECH ENGINEERING, INC.
565 ELKTON DRIVE
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SEPTIC SUITABILITY MAP
2030 OLD NORTH GATE ROAD
EL PASO COUNTY, CO.
FOR: MVE, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/14/19		

JOB NO.: 190448

FIG NO.: 9

APPENDIX A: Site Photographs

1

Looking northwest from the northeastern portion of the site.

April 18, 2019

2

Looking south from the northeastern portion of the site.

April 18, 2019

Job No. 190448

3

Looking southwest from the central portion of Lot 1.

April 18, 2019

4

Looking north from the central portion of the site.

April 18, 2019

Job No. 190448

APPENDIX B: Test Boring and Test Pit Logs

TEST BORING NO. 1
DATE DRILLED 4/17/2019
Job # 190448

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 8.5', 4/17/19						
6" TOPSOIL, SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN TO TAN, LOOSE TO MEDIUM DENSE, MOIST TO WET				9	5.5	1
	5			14	9.1	1
SLIGHTLY CLAYEY OXIDIZED LENSES	10			14	18.6	1
	15			11	7.8	1
FINE GRAINED LAYERS	20			15	12.4	1

TEST BORING NO. 2
DATE DRILLED 4/17/2019
CLIENT MVE, INC.
LOCATION 2030 OLD NORTHGATE ROAD

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 4/17/19						
6" TOPSOIL, SAND, VERY CLAYEY, FINE TO COARSE GRAINED, RUSTY BROWN, LOOSE, VERY MOIST				5	22.4	1
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, DRY TO MOIST	5			14	1.2	1
	10			15	4.1	1
WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO VERY DENSE, MOIST	15			45	11.3	2
VERY CLAYEY LENSE				*	7.6	2
	20			50 / 3"	11.3	2

* - BULK SAMPLE TAKEN

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

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448
FIG NO.: B- 1

TEST PIT NO. 1
DATE EXCAVATED 4/17/2019
Job # 190448

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy clay loam, brown	1					
gravelly sandy clay loam, fine to coarse grained, light brown	2			gr	m	3
sandy clay loam, fine to medium grained, light brown	3–4			gr	m	3
sandy loam, fine to coarse grained, tan	5–10			gr	w	2A

TEST PIT NO. 2
DATE EXCAVATED 4/17/2019
CLIENT MVE, INC.
LOCATION 2030 OLD NORTHGATE ROAD

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy loam, brown	1					
sandy loam, fine to medium grained, light brown	2			gr	m	2
loamy sand, fine to coarse grained, tan to buff	3–10			sg		1

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

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

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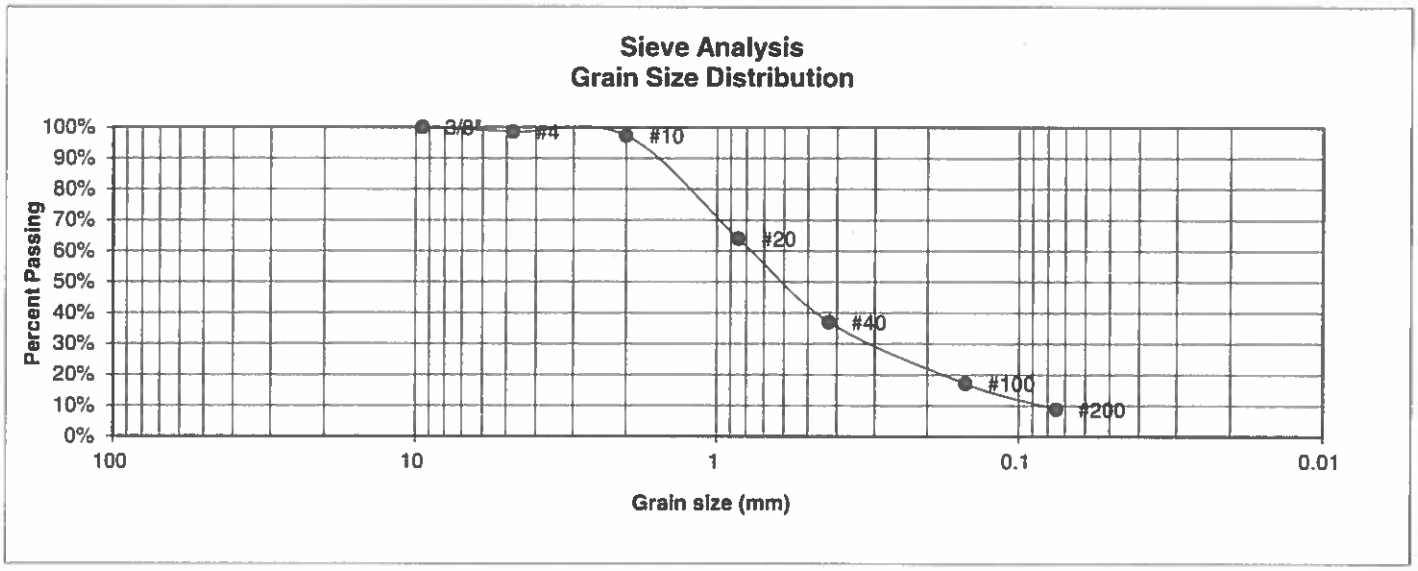
TEST PIT LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 5/14/19

JOB NO.: 190448
FIG NO.: B-2

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM-SW	CLIENT	MVE, INC.
SOIL TYPE #	1	PROJECT	2030 OLD NORTHGATE ROAD
TEST BORING #	1	JOB NO.	190448
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	98.6%
10	97.3%
20	64.0%
40	37.1%
100	17.2%
200	8.8%

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

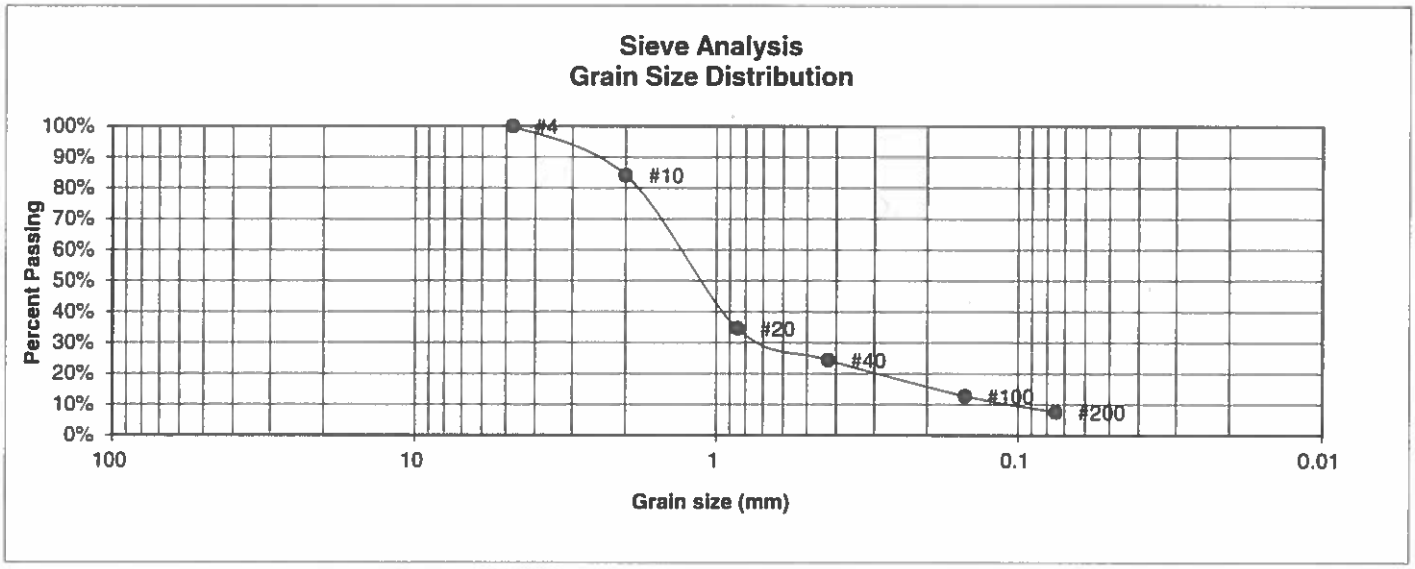
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-1

UNIFIED CLASSIFICATION	SM-SW	CLIENT	MVE, INC.
SOIL TYPE #	1	PROJECT	2030 OLD NORTHGATE ROAD
TEST BORING #	2	JOB NO.	190448
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	84.2%
20	34.6%
40	24.4%
100	12.8%
200	7.6%

Atterberg Limits	
Plastic Limit	
Liquid Limit	
Plastic Index	
Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

ENTECH
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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

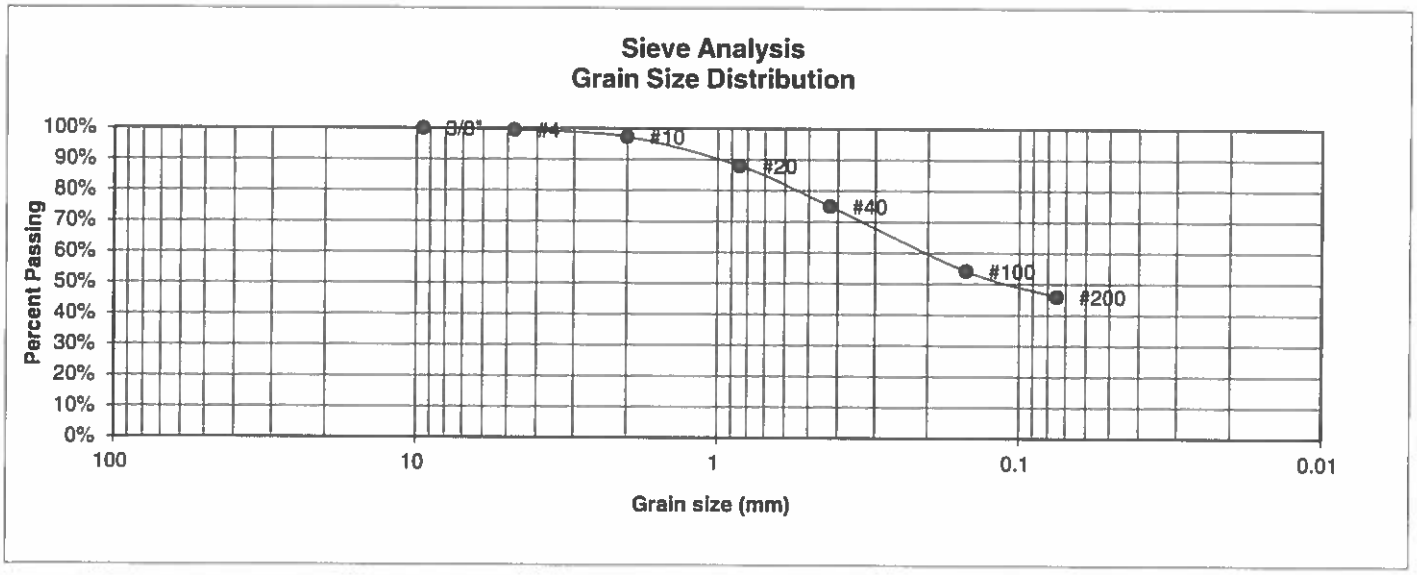
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-2

UNIFIED CLASSIFICATION	SC	CLIENT	MVE, INC.
SOIL TYPE #	1	PROJECT	2030 OLD NORTHGATE ROAD
TEST BORING #	2	JOB NO.	190448
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	99.5%
10	97.3%
20	88.0%
40	75.0%
100	54.2%
200	45.9%

Atterberg Limits	
Plastic Limit	
Liquid Limit	
Plastic Index	

Swell	
Moisture at start	11.3%
Moisture at finish	23.2%
Moisture increase	11.9%
Initial dry density (pcf)	102
Swell (psf)	970

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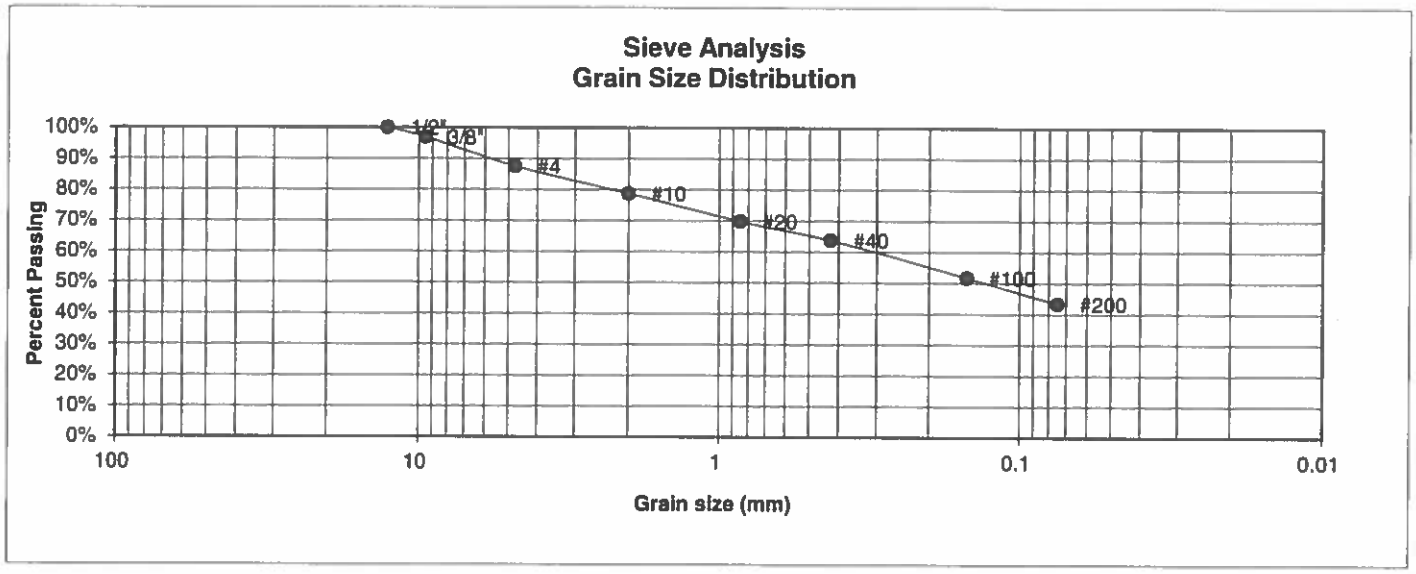
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: L-3

UNIFIED CLASSIFICATION	SC	CLIENT	MVE, INC.
SOIL TYPE #	1	PROJECT	OLD NORTHGATE
TEST BORING #	TP-1	JOB NO.	190448
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.9%
4	87.6%
10	78.8%
20	69.8%
40	63.8%
100	51.7%
200	43.4%

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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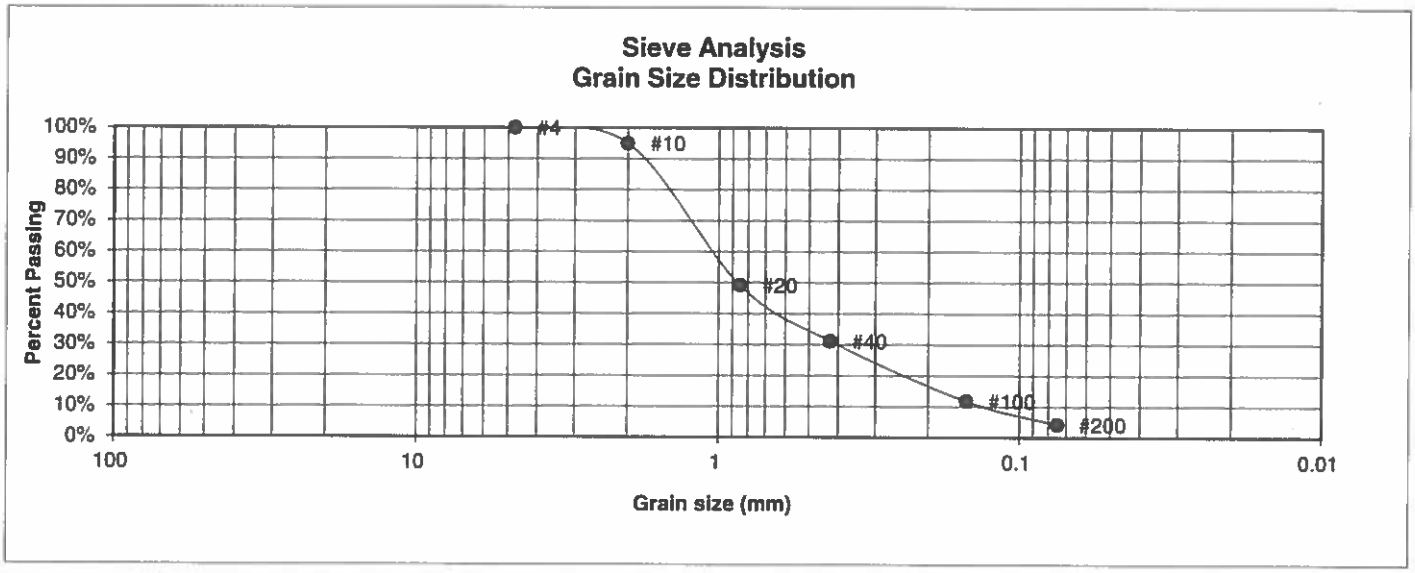
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-4

UNIFIED CLASSIFICATION	SW	CLIENT	MVE, INC.
SOIL TYPE #	1	PROJECT	OLD NORTHGATE
TEST BORING #	TP-2	JOB NO.	190448
DEPTH (FT)	5-6	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.1%
20	49.2%
40	31.2%
100	11.8%
200	4.3%

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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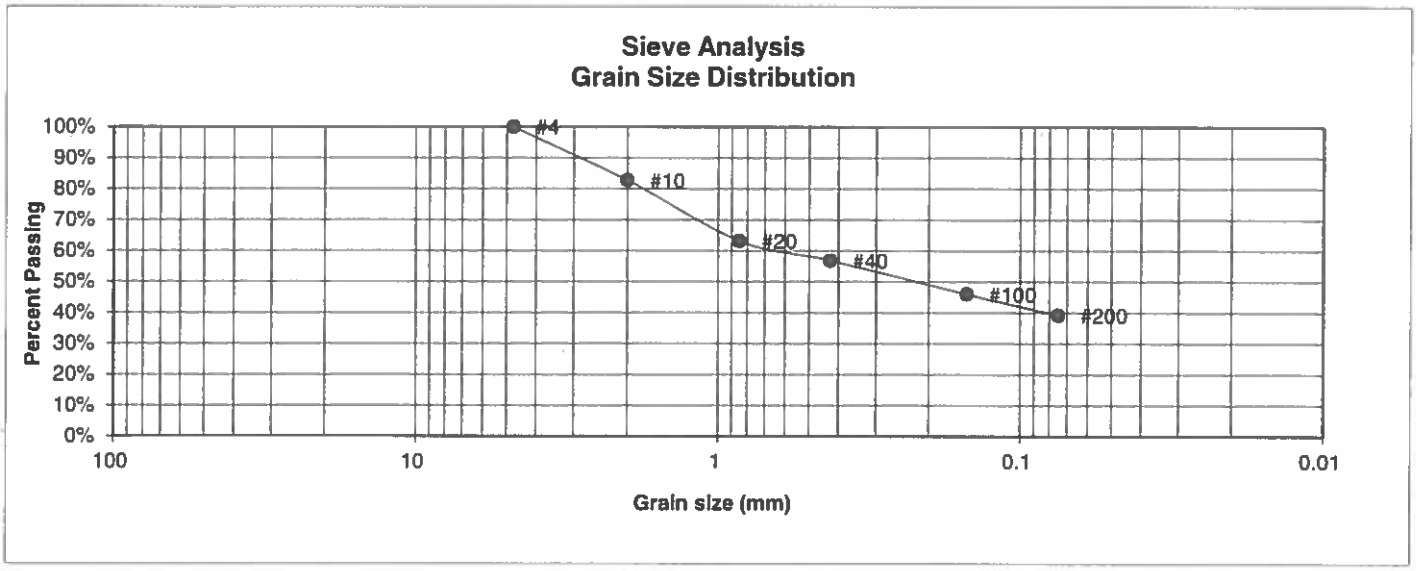
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-5

UNIFIED CLASSIFICATION	SC	CLIENT	MVE, INC.
SOIL TYPE #	2	PROJECT	2030 OLD NORTHGATE ROAD
TEST BORING #	2	JOB NO.	190448
DEPTH (FT)	17	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	82.7%
20	63.2%
40	56.9%
100	46.0%
200	39.2%

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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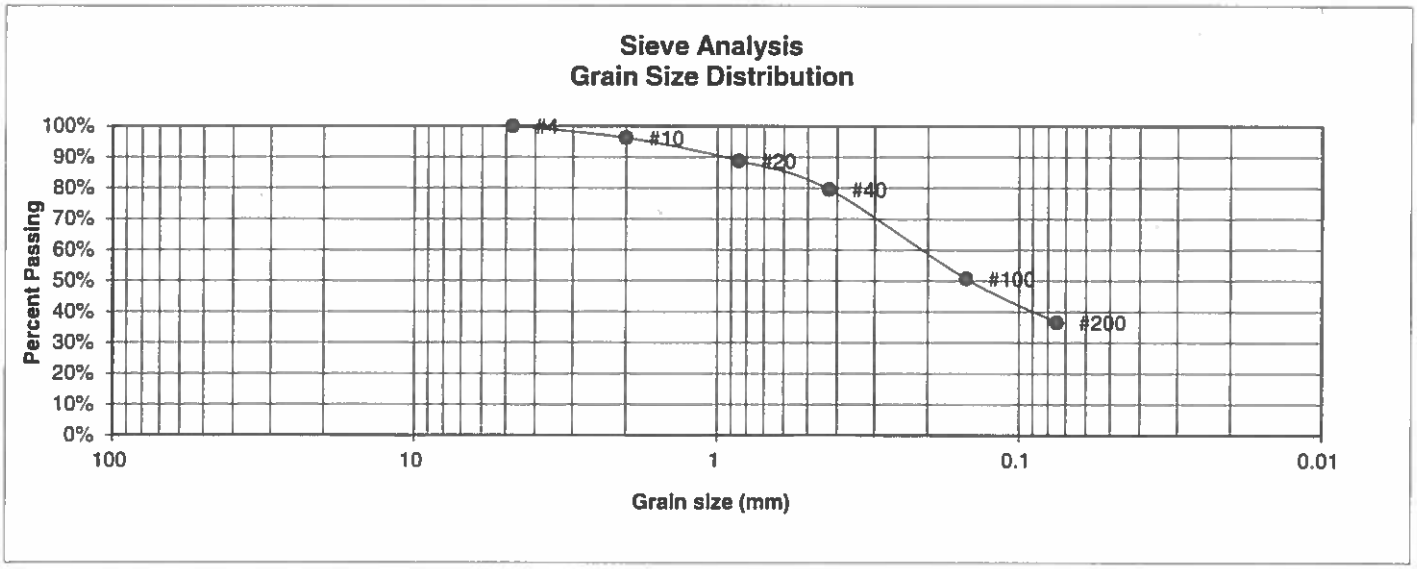
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-6

UNIFIED CLASSIFICATION	SM	CLIENT	MVE, INC.
SOIL TYPE #	2	PROJECT	2030 OLD NORTHGATE ROAD
TEST BORING #	2	JOB NO.	190448
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	96.2%
20	88.8%
40	79.6%
100	50.7%
200	36.6%

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

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-7

CLIENT	MVE, INC.	JOB NO.	190448
PROJECT	2030 OLD NORTHGATE ROAD	DATE	5/3/2019
LOCATION	2030 OLD NORTHGATE ROAD	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	2-3	1	SM-SW	<0.01
TB-2	15	2	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:
		LLL	5/14/19

JOB NO.: 190448

FIG NO.: C-8

APPENDIX D: Soil Survey Descriptions

93—Tomah-Crowfoot loamy sands, 8 to 15 percent slopes. These moderately sloping to strongly sloping soils are on alluvial fans, hills, and ridges in the uplands. Elevation ranges from about 7,300 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 120 days.

The Tomah soil makes up about 50 percent of the complex, the Crowfoot soil about 30 percent, and other soils about 20 percent.

Included with these soils in mapping are areas of Elbeth sandy loam, 8 to 15 percent slopes; Peyton-Pring complex, 8 to 15 percent slopes; and Kettle gravelly loamy sand, 8 to 40 percent slopes.

The Tomah soil is deep and well drained. It formed in alluvium or residuum derived from arkose beds. Typically, the surface layer is dark grayish brown loamy sand about 10 inches thick. The subsurface layer is very pale brown coarse sand about 12 inches thick. The subsoil, about 26 inches thick, consists of a matrix of very pale brown coarse sandy clay loam. The substratum is very pale brown coarse sand to a depth of 60 inches or more.

Permeability of the Tomah soil is moderately 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. Some gullies are present in some drainageways and along stock trails.

The Crowfoot soil is deep and well drained. It formed in sediment weathered from arkosic sandstone. Typically, the surface layer is grayish brown loamy sand about 12 inches thick. The subsurface layer is very pale brown sand about 11 inches thick. The subsoil is light yellowish brown sandy clay loam about 13 inches thick. The substratum is very pale brown coarse sand to a depth of about 68 inches.

Permeability of the Crowfoot soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies are present in some drainageways and along stock trails.

The soils in this complex are used as rangeland, for recreation and wildlife habitat, and as homesites.

Native vegetation is mainly mountain muhly, bluestem, mountain brome, needleandthread, and blue grama. These soils are subject to invasion by Kentucky bluegrass and Gambel oak. Noticeable forbs are hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat.

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 are fairly well suited to these soils. Blowing sand and moderate available water capacity are the main limitations for the establishment of trees and shrubs. The soils are so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are best suited to habitat for openland wildlife species, such as pronghorn antelope and sharp-tailed grouse. Although sharp-tailed grouse are not plentiful, they could be encouraged on these soils, especially where brush species are interspersed with grasses and forbs. If these soils are used as rangeland, wildlife production can be increased by managing livestock grazing to preclude overuse of the more desirable grass species and depletion of the various brush species.

The main limitations for urban uses are frost-action potential and slope on the Crowfoot soil and slope on the Tomah soil. Buildings and roads must be designed to overcome these limitations. Access roads must have adequate cut-slope grade and be provided with drains to control surface runoff. Maintaining the existing vegetation on building sites during construction helps to control erosion. Capability subclass VIe.