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SOIL, GEOLOGY, AND GEOLOGIC HAZARD STUDY
THE VILLAS AT CLAREMONT RANCH
CLAREMONT RANCH FILING NO. 7
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, COLORADO

Prepared for

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Colorado Springs, Colorado 80903

Attn: Chaz Collins

September 22, 2017
Revised April 16, 2020

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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LLL/nc

Encl.

Entech Job No. 171247
AAprojects/2017/171247 countysoil/geo

Reviewed by:

Joseph C. Goode, Jr., P.E.
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23725
4/17/2020
PROFESSIONAL ENGINEER

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1.0 SUMMARY

Project Location

The project lies in portions of the SW¼ of the SW¼ of Section 4, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located in the southeastern portion of Colorado Springs, Colorado.

Project Description

Total acreage involved in the project is approximately nine acres. The proposed site development consists of 83 single-family residential lots. The development will utilize municipal sewer and water.

Scope of Report

This report presents the results of our geologic evaluation and treatment of engineering geologic hazard study.

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 minor constraints on development and land use. These include areas of loose collapsible soils, and artificial fill. These conditions will be discussed in greater detail in the report.

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

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in portions of the SW¼ of the SW¼ of Section 4, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located in the southeastern portion of Colorado Springs, Colorado, at Marksheffel Road and Meadowbrook Parkway. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site is generally gradually sloping to the northwest towards the East Fork of Sand Creek. A small drainage was observed in the northwest portion of the site near Sand Creek. Water was observed in Sand Creek, and the small drainage on the site was dry at the time of this investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily field grasses, weeds, cacti, and yuccas, with areas of scattered trees along Sand Creek in the northern portion of the site. Site photographs, taken September 16, 2017, are included in Appendix A.

Total acreage involved in the proposed development is approximately nine acres. Eighty-three single-family residential lots are proposed. The proposed lots are approximately 1,250 square-feet. The area will be serviced municipal sewer and water. The Development 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.

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 September 16, 2017.

Six Test Borings were drilled on the site to determine general soil and bedrock characteristics. The locations of the test borings are indicated on the Development Plan/Test Boring Location Map, Figure 3. The Test Boring 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, Atterberg Limits ASTM D-4318, volume change testing using Swell/Consolidation test. Sulfate testing was performed on select samples to evaluate potential for below grade concrete degradation due to sulfate attack. 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 eleven miles to the west is a major structural feature known as the Ute Pass 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 was not encountered in the test borings which were drilled to depths of 20 feet. Bedrock in the area tends to be very gently dipping in a northeasterly direction (Reference 1). The rocks in the area of the site are sedimentary in nature and typically Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Formation. Overlying this formation are unconsolidated deposits of man-made fill of Quaternary Age with underlying alluvial and eolian soils of Quaternary Age. The alluvial soils were deposited as stream terraces along Sand Creek in the northern portion of the site. Man-made soils exist as fill piles located in the western and northern portion of the site. Additionally, overlot fill was encountered in all of the test borings drilled on the site to depths ranging from 7 to 9 feet. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

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

Type	Description
8	Blakeland Loamy Sand, 1 to 9% slopes
10	Blendon Sandy Loam, 0 to 3% slopes
28	Ellicott Loamy Coarse Sand, 0 to 5% slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to have moderate to moderately rapid permeabilities. 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 slight to moderate erosion hazards.

5.3 Site Stratigraphy

The Elsmere 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. Two mappable units were identified on this site which are described as follows:

Qal **Recent alluvium of Holocene Age:** These are recent deposits that have been deposited along the small drainage in the northwestern portion of the site.

Qaf **Artificial Fill of Holocene Age:** These are recent deposits of man-made fill. Fill was encountered in the test borings to depths of 7 to 9 feet. It is our understanding the fill was placed during overlot grading of the nearby residential development. Additionally, small areas of fill piles were observed in the northern and western portions of the site.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Elsmere Quadrangle* distributed by the Colorado Geological Survey in 2003 (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 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 7.

5.4 Soil Conditions

The soils encountered in the Test Borings can be grouped into three general soil types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 silty sand fill (SM), encountered in all of Test Borings at the existing ground surface and extending to depths ranging from 7 feet to 9 feet bgs. These soils were encountered at medium dense states and at moist conditions. Samples tested had 12 to 19 percent passing the No. 200 Sieve. Atterberg Limits Testing resulted in the sand fill 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.

Soil Type 2 native slightly silty to silty sand (SM-SW, SM), encountered in all of the test borings at depths ranging from 7 to 10 feet bgs, and extending to the termination of the test borings (20 feet). These soils were encountered at loose to medium dense states and moist to wet conditions. Samples tested had 6 to 13 percent passing the No. 200 Sieve. Sulfate testing resulted in less than 0.01 to 0.01 percent sulfate by weight indicating the clay exhibits negligible potential for below grade concrete degradation.

Soil Type 3 native very sandy clay and very clayey sand (CL, SC), encountered in Test Boring Nos. 2, 3, and 6 at depths ranging from 7 to 8 feet bgs and extending to depths of 10 to 11 feet bgs. The very sandy clay and very clayey sand were encountered at soft consistencies and at moist conditions. Samples tested had 40 to 59 percent passing the No. 200 Sieve. Atterberg Limits Testing resulted in a liquid limit of 22 and a plastic index of 11. Swell/Consolidation Testing resulted in a consolidation of 0.5 percent, which indicates a low to moderate consolidation potential.

The Test Boring 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 two of the test borings at depths ranging from 16.5 to 18.5 feet, water was not encountered in the remaining borings which were drilled to 20 feet. Areas of potential seasonal shallow groundwater have been mapped along the small drainage in the northwestern portion of the 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 an Engineering Geology Map Figure 7. 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 recent man-made fill deposits associated with overlot fill encountered across the site, and small fill piles observed in the northern and western portions of the site. It is our understanding the fill was placed during the site grading for the nearby residential development. The fill was encountered at medium dense states and moist conditions.

Mitigation: The fill on this site appears to have been placed in a controlled manor; however, records for the fill placement should be obtained. If records cannot be obtained the fill should be considered uncontrolled. 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.

Collapsible Soils

The majority of the soils encountered on-site do not exhibit collapsible characteristics, however, areas of loose soils were encountered in the test borings drilled on site. The soil underlying the fill on the site consist of eolian sands of Quaternary age. These soils may be subject to hydrocompaction, additionally walls of trenches may collapse if not supported.

Mitigation: Should loose or collapsible soils be encountered beneath foundations, recompaction and moisture conditioning of the upper 2 to 3 feet of soil at 95% of its maximum Modified Proctor Dry Density ASTM D-1557 will be required. Exterior flatwork and parking areas may also experience movement. Proofrolling and recompaction of soft areas should be performed during site work.

Expansive Soils

Expansive soils were not encountered in the test borings drilled on site, but the potential for isolated clay lenses does exist across the site. These occurrences are typically sporadic; therefore, none have been indicated on the maps. Expansive clays, if encountered at foundation grade, can cause differential movement in structures. These occurrences should be identified and dealt with on an individual basis.

Mitigation Should expansive soils be encountered beneath foundations, 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. 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.

Areas of Erosion

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

Mitigation: Due to the nature of the soils on this site, virtually all the soils are subject to erosion by wind and water. Minor areas of erosion were observed in the northwestern portion of the site, particularly where some gully 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).

Groundwater and Floodplain Areas

Areas within the drainage on-site have been identified as areas of potentially seasonally high groundwater areas. Water was not observed in the small drainage on-site, and water was observed flowing in the East Fork of Sand Creek located north of the site. The northern portion of site is mapped within floodplain zones according to the FEMA Map No. 08041CO756G,

Figure 8 (Reference 7). The floodplain area is along the East Fork of Sand Creek, and the proposed development will avoid this area. These areas are discussed as follows:

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. This area is associated with the small drainage in the northwestern portion of the site which can likely be mitigated during the proposed site development. The same mitigation recommendations for the seasonal shallow groundwater areas apply to the potentially seasonal shallow groundwater areas.

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 9. 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. Finished floor levels must be located a minimum of one-foot above floodplain levels.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, we understand that the development will be single family 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 artificial fill and loose or collapsible soils encountered across the site. The minor drainages are being mitigated by site grading. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

Fill was encountered in all of the test borings on the site at depths ranging from 7 to 9 feet. The fill was encountered at medium dense states and appeared to be placed in a controlled manor; however, records of the fill should be obtained. If records cannot be obtained, the fill should be considered uncontrolled. The native soils beneath the fill were encountered at loose conditions. The granular soils encountered in the upper soil profiles of the test borings should provide good support for foundations. Loose soils if encountered at or near foundation depth will require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils or loose soils. Excavation is

anticipated to be moderate with rubber-tired equipment for the site sand materials, and will require track mounted equipment for the dense sandstone. Expansive layers may also be encountered in the soil 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 potentially seasonal high groundwater areas and ponded water were located in the northwestern portion of the site. Minor erosion was also observed in this area. General recommendations for erosion control are discussed under Section 9.0 "Erosion Control".

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

7.0 EMBANKMENT CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed embankment. Groundwater is not expected to be encountered in proposed cuts for the detention pond in the northern portion of the site. However, if excavations encroach on the groundwater level unstable soil conditions may be encountered.

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

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of its maximum Modified Proctor Dry Density, ASTM D-1557. These materials should be placed at a moisture content conducive to compaction, usually 0 to ±2% of Proctor

optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any import materials prior to placing or hauling them to the site.

8.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 8), the area is not mapped with any aggregate 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 "Fair" for industrial minerals. However, considering the silty 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 "Good" for coal resources. No active mines have been mapped in the area of the site, several inactive mines are located approximately 2.5 miles south and southeast of the site. No metallic mineral resources have been mapped on-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 moderately 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 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 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 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 Engineering and Surveying, 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.

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TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

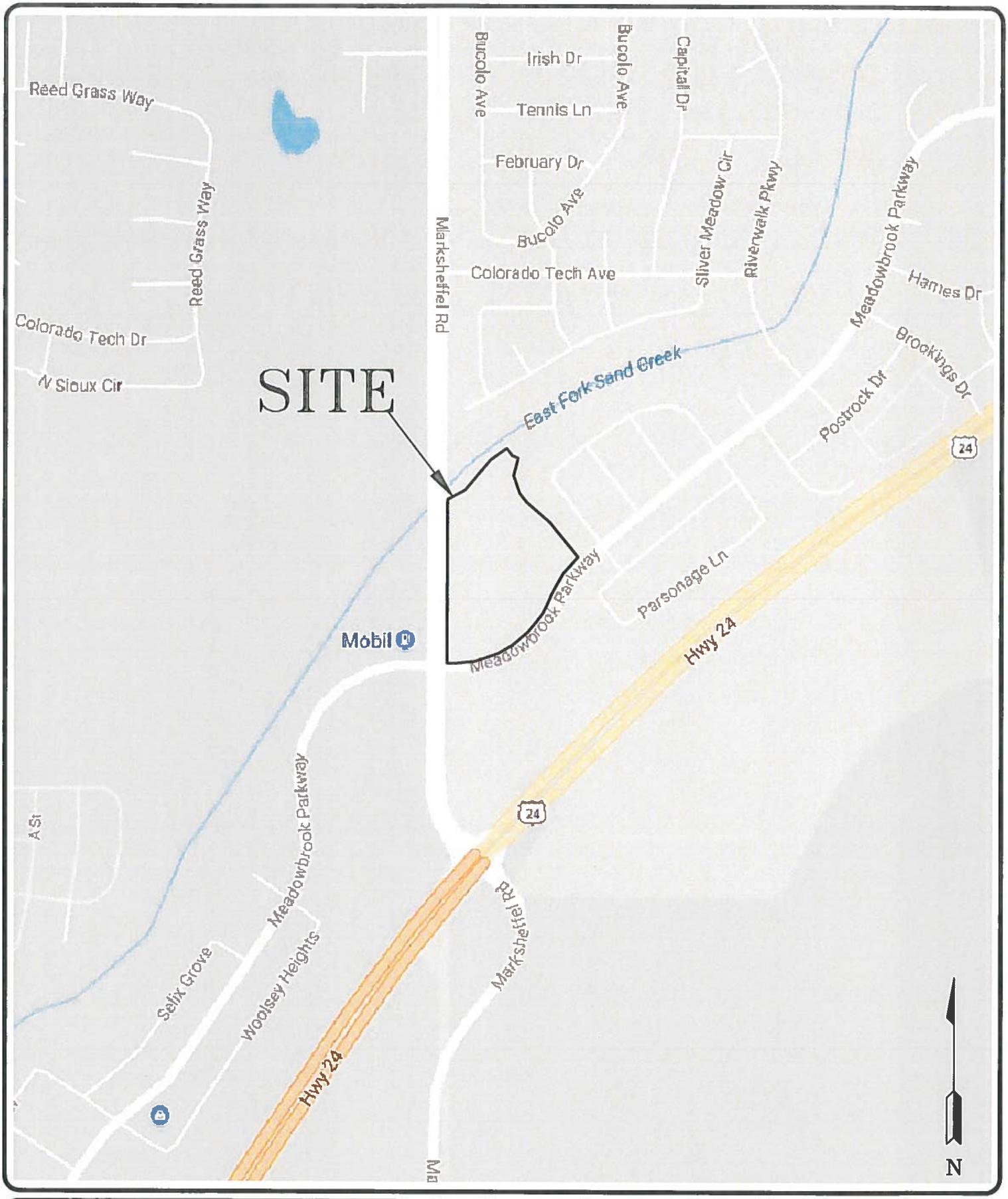
CLIENT ENGINEERING AND SURVEYING
PROJECT 1250 MEADOWBROOK PARKWAY
JOB NO. 171247

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			18.8	NV	NP				SM	FILL, SAND, SILTY
1	3	2-3			17.7			<0.01			SM	FILL, SAND, SILTY
1	5	5			12.4						SM	FILL, SAND, SILTY
2	1	15			5.6			<0.01			SM-SW	SAND, SLIGHTLY SILTY
2	4	15			13.2			0.01			SM	SAND, SILTY
3	2	10			59.4						CL	CLAY, VERY SANDY
3	3	10	15.0	110	41.1					-0.5	SC	SAND, VERY CLAYEY
3	6	10			39.6	22	11				SC	SAND, VERY CLAYEY

Table 2: Summary of Depth of Fill and Depth to Groundwater

Test Boring No.	Depth of Fill (ft.)	Depth to Groundwater (ft.)
1	9	N/A
2	8	N/A
3	7	N/A
4	7	N/A
5	8	16.5
6	8	18.5

FIGURES



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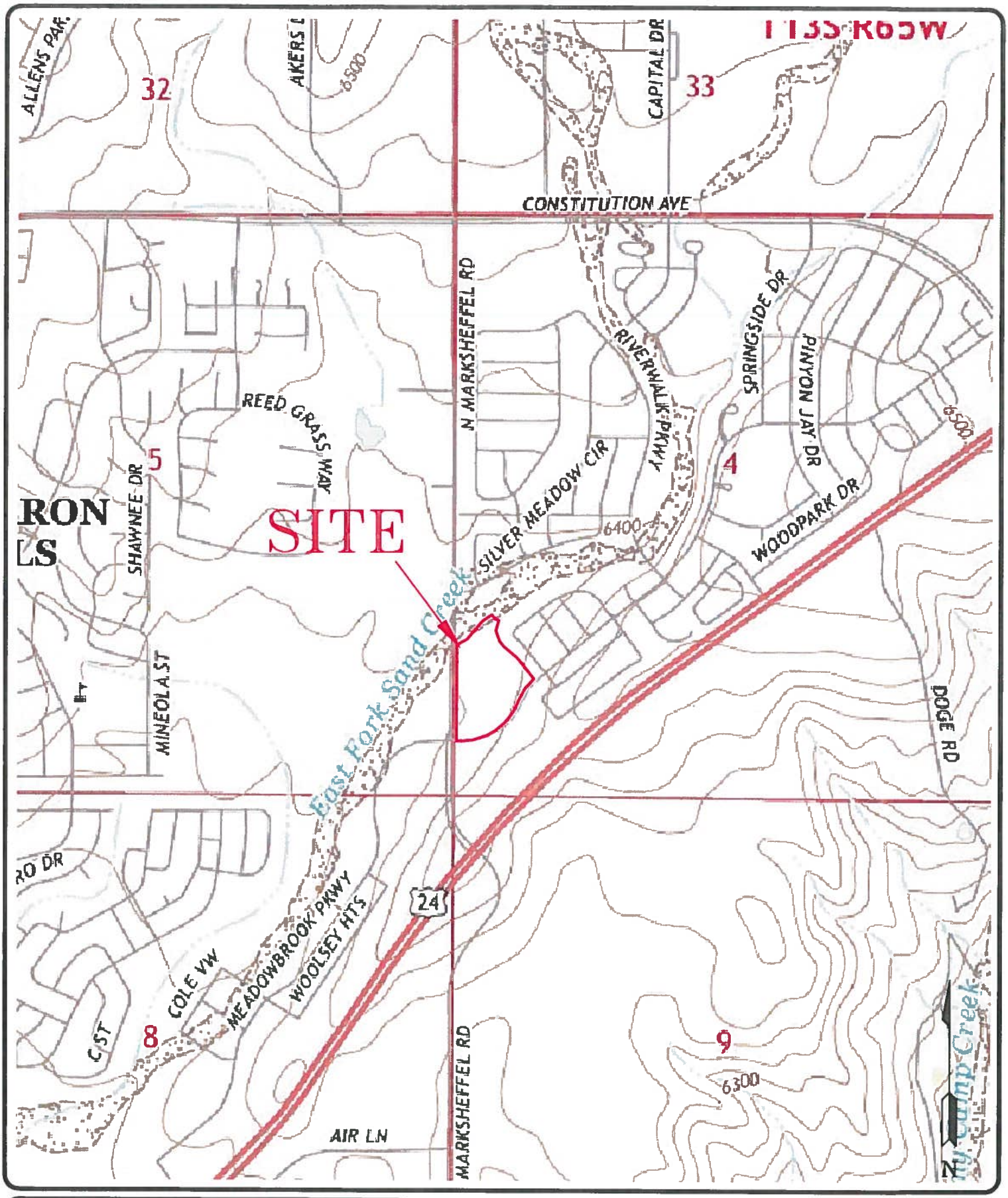
VICINITY MAP
THE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/22/17		

JOB NO.: 171247

FIG NO.: 1



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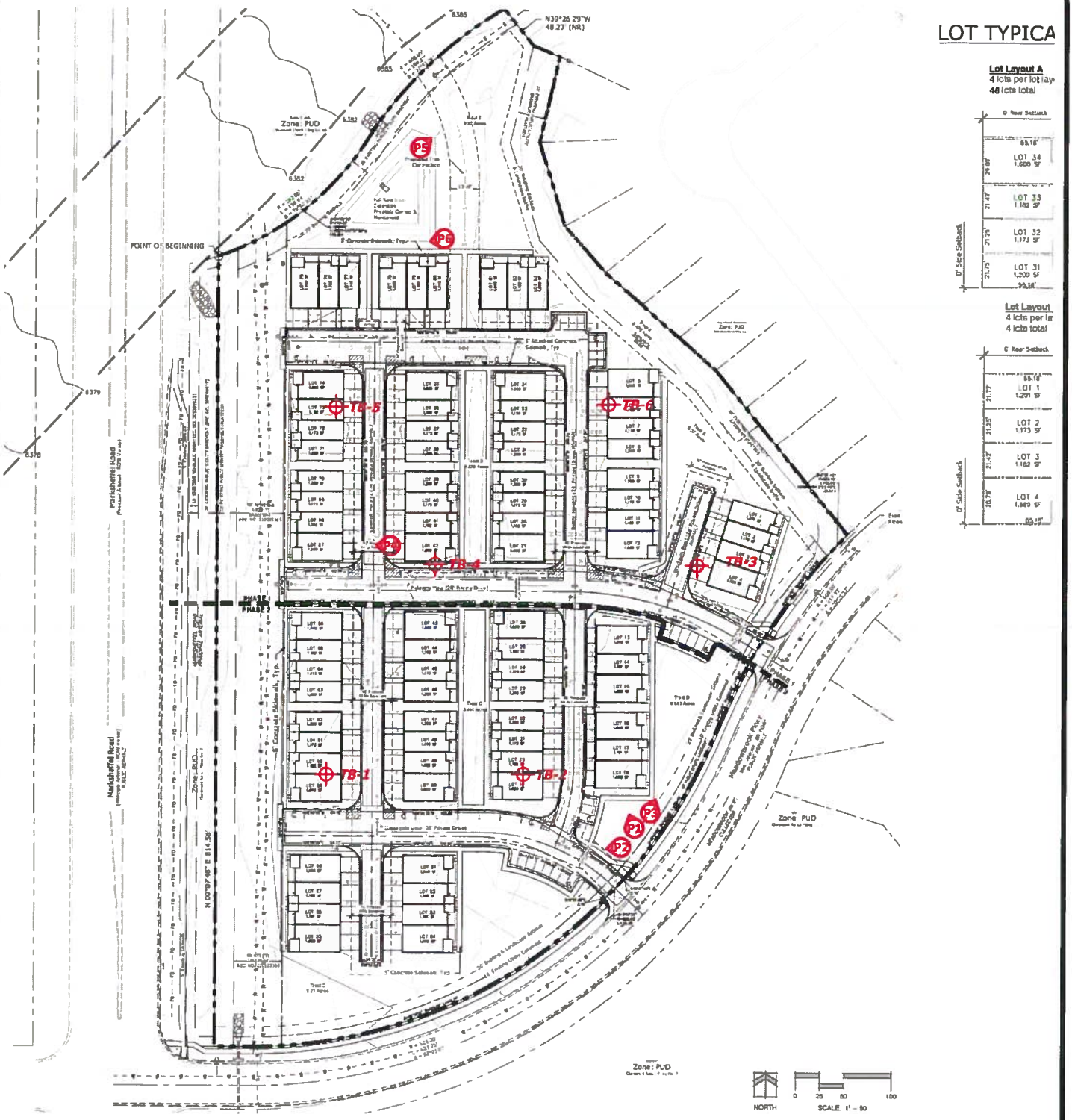
USGS MAP
THE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/22/17		

JOB NO.: 171247

FIG NO.: 2



TB– APPROXIMATE TEST BORING LOCATION AND NUMBER

P2 – APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

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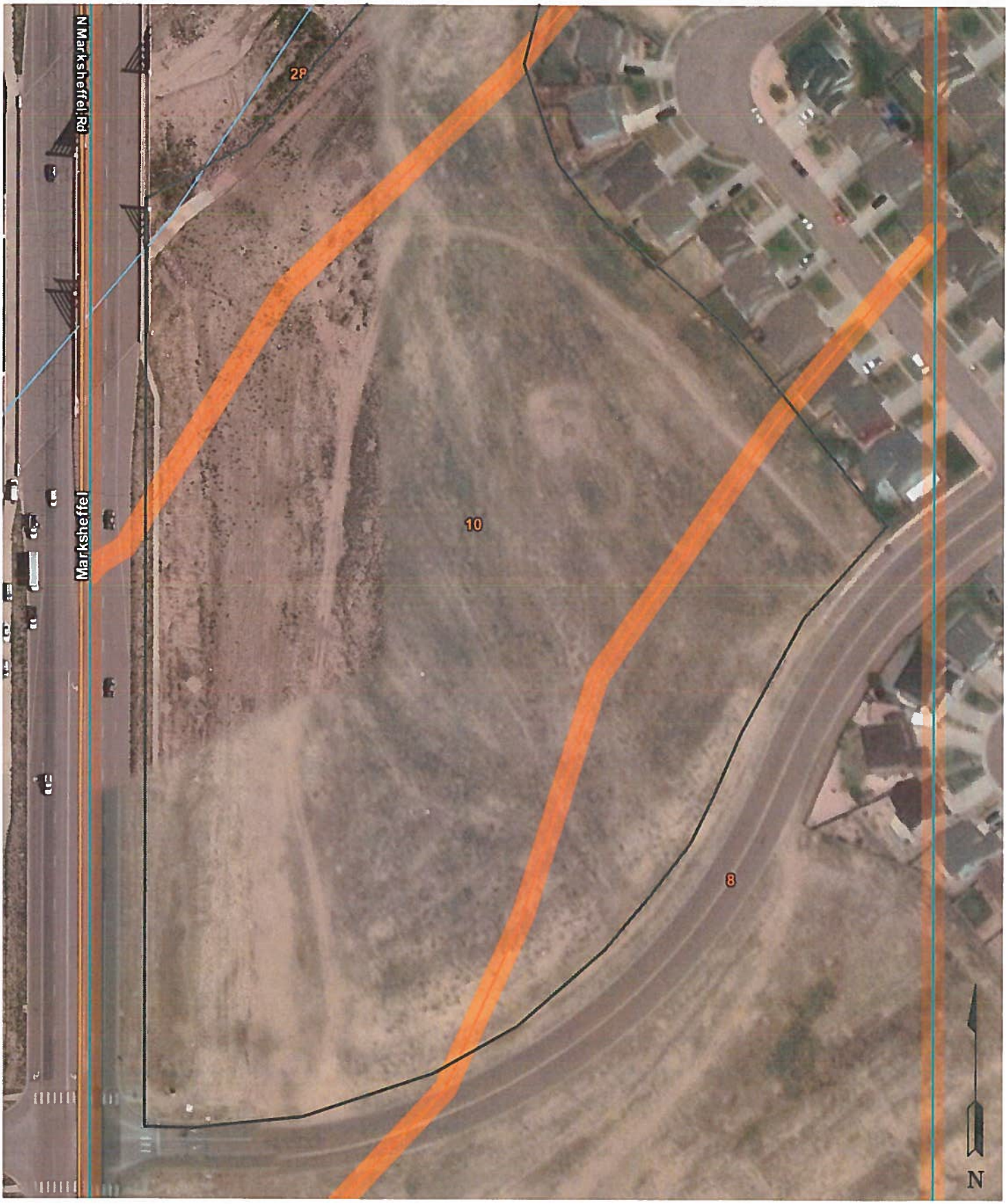
DEVELOPMENT PLAN/TEST BORING LOCATION MAP
THE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	3/30/20		

JOB NO.: 171247

FIG NO.: 3



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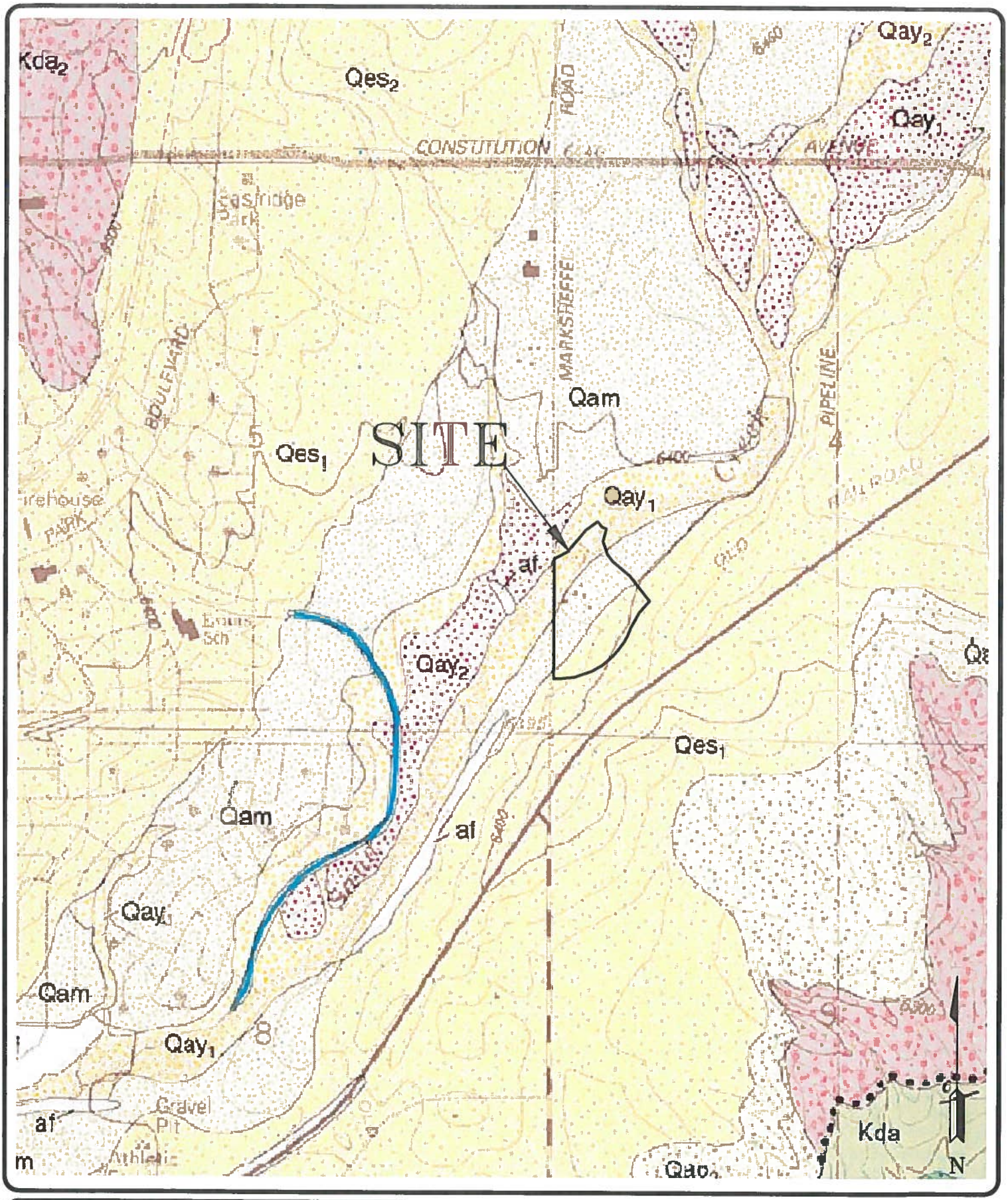
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SOIL SURVEY MAP
THE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/22/17		

JOB NO.: 171247

FIG NO.: 4



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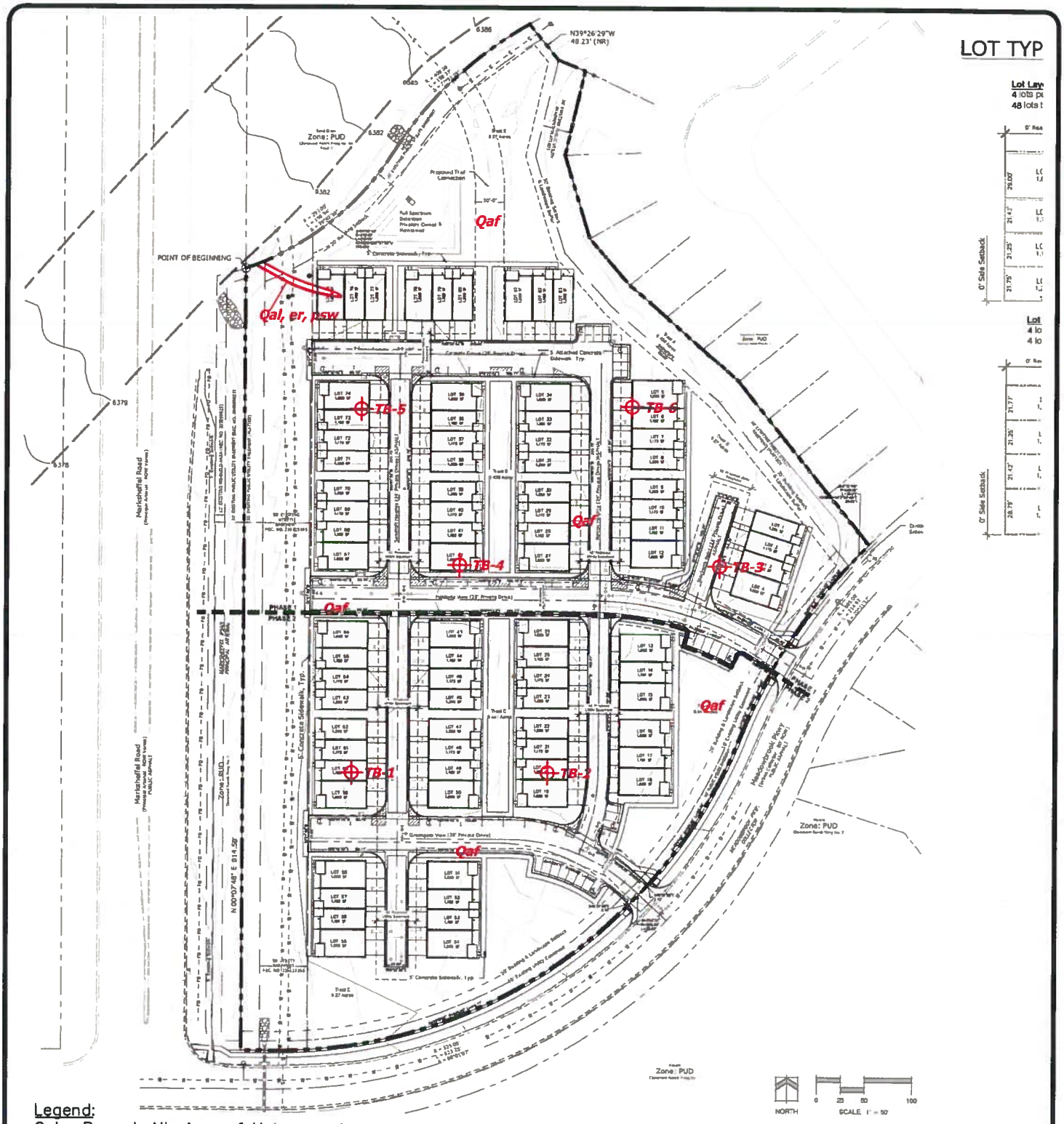
ELSMERE QUADRANGLE GEOLOGY MAP
TTHE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/22/17		

JOB NO.: 171247

FIG NO.: 5



Legend:

Qal– Recent Alluvium of Holocene Age:
recent water deposited materials

Qaf– Artificial Fill Deposits of Holocene Age:
man–made fill deposits

er– areas of erosion

psw– potentially seasonally shallow groundwater area

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

GEOLOGY/ENGINEERING GEOLOGY MAP
THE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	3/30/20		

JOB NO.: 171247

FIG NO.: 6

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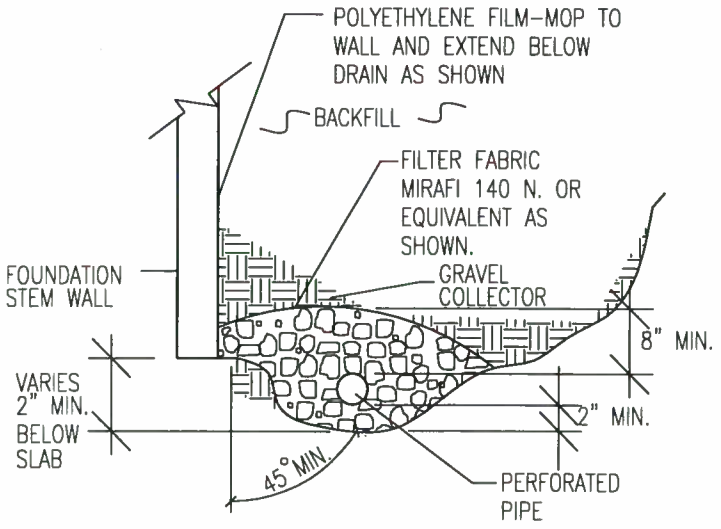
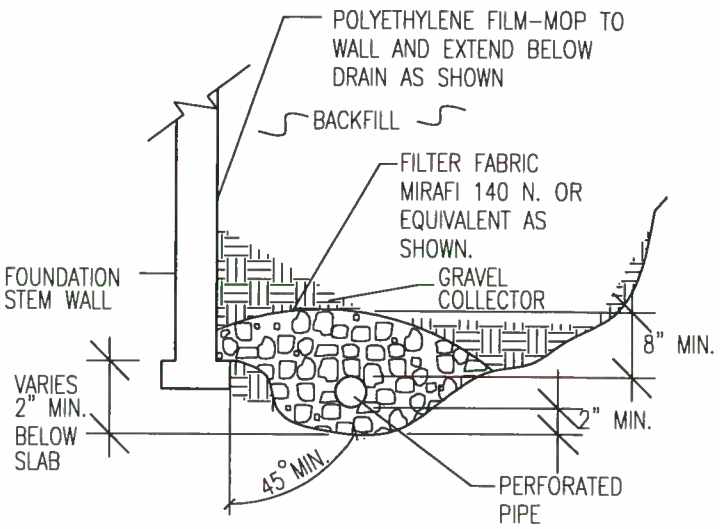
FLOODPLAIN MAP
THE VILLAS AT CLAREMONT RANCH
1250 MEADOWBROOK PARKWAY
EL PASO COUNTY, CO.
FOR: ENGINEERING AND SURVEYING, INC.

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/22/17		

JOB NO.: 171247

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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PERIMETER DRAIN DETAIL

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

JOB NO.: 171247

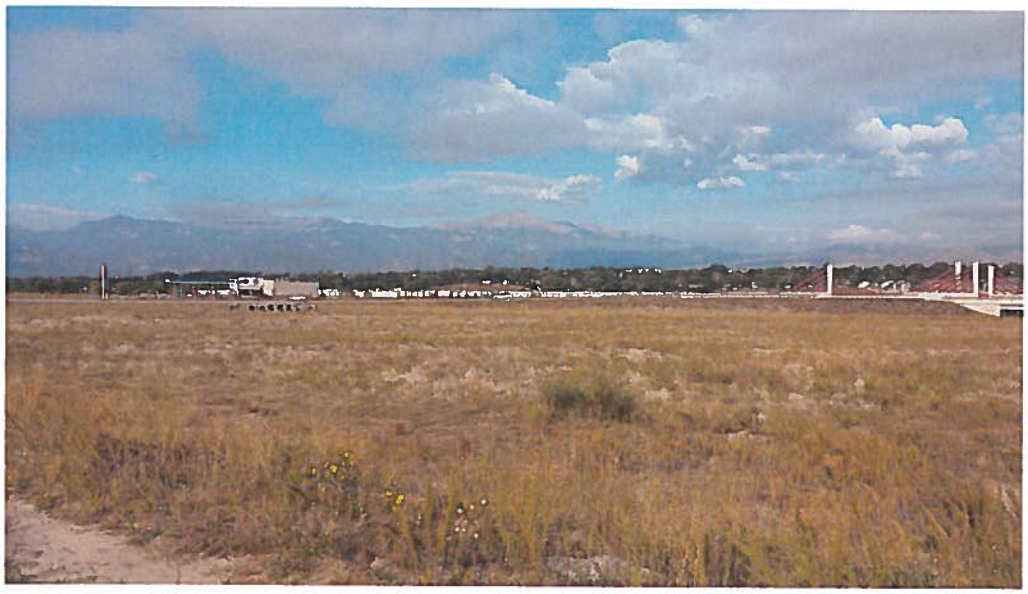
FIG. NO.: 8

APPENDIX A: Site Photographs

1

Looking north from the southern side of the site.

September 16, 2017

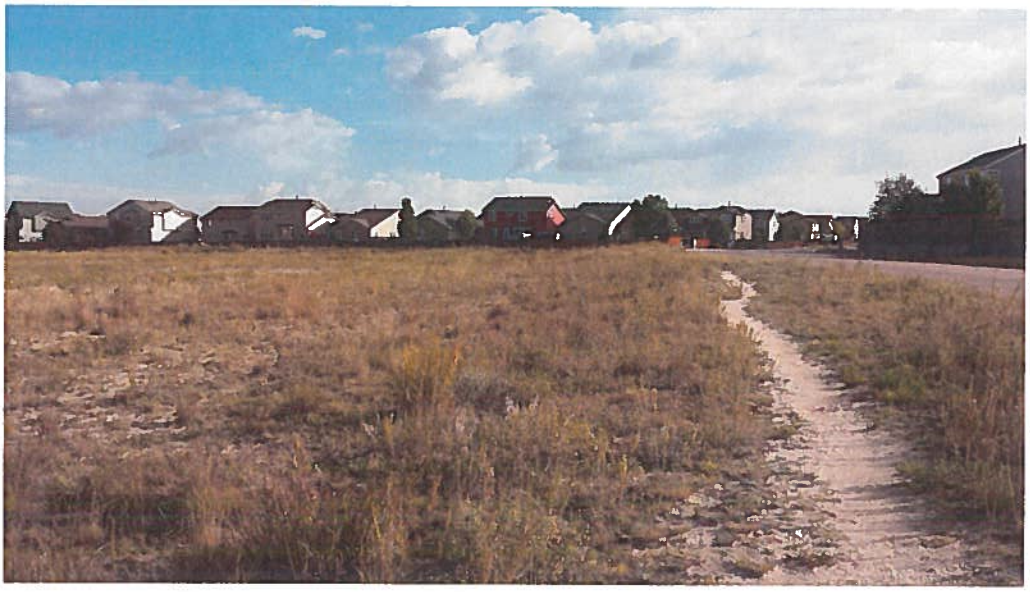


2

Looking northwest from the southern side of the site.

September 16, 2017

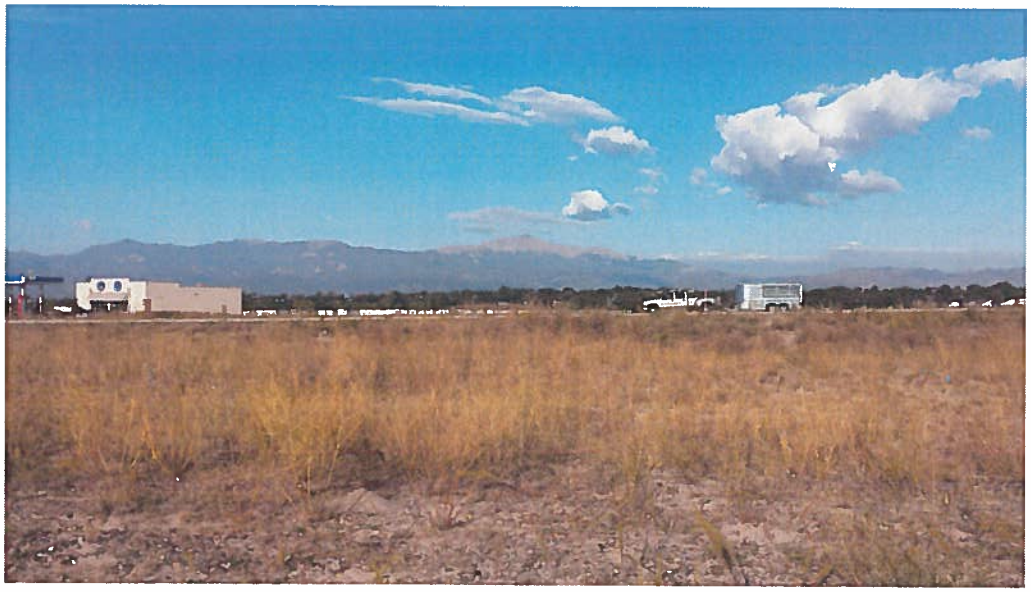
Job No. 171247



3

Looking east from the southern side of the site.

September 16, 2017



4

Looking west from the northwestern portion of the.

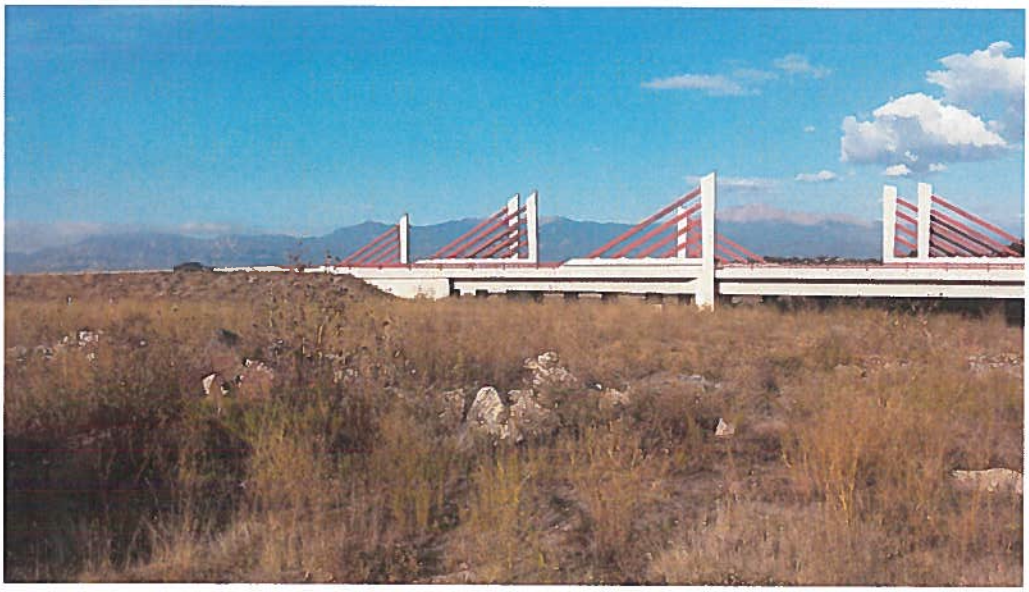
September 16, 2017

Job No. 171247

5

Looking east from the northern side of the site.

September 16, 2017



6

Looking west from the northern side of the site.

September 16, 2017

Job No. 171247

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 8/15/2017
Job # 171247

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 8/16/17						
FILL 0-9', SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST				22	8.0	1
	5			14	8.8	1
SAND, SILTY, FINE GRAINED, DARK BROWN, LOOSE, MOIST	10			6	11.7	2
SAND, SLIGHTLY SILTY, FINE TO MEDIUM GRAINED, TAN, LOOSE TO MEDIUM DENSE, MOIST	15			5	4.0	2
	20			13	7.0	2

TEST BORING NO. 2
DATE DRILLED 8/15/2017
CLIENT ENGINEERING AND SURVEYING
LOCATION 1250 MEADOWBROOK PARKWAY

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 8/16/17						
FILL 0-8', SAND, SILTY, FINE TO MEDIUM GRAINED, TAN TO BROWN, MEDIUM DENSE, MOIST				16	11.5	1
	5			16	8.1	1
CLAY, VERY SANDY, GRAY BROWN, SOFT, MOIST	10			6	16.4	3
SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST	15			15	9.0	2
	20			11	6.8	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/21/17

JOB NO.: 171247
FIG NO.: B- 1

TEST BORING NO. 3
DATE DRILLED 8/15/2017
Job # 171247

REMARKS

DRY TO 20', 8/16/17

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			19	10.4	1
5			11	12.2	1
10			7	14.4	3
15			17	3.3	2
20			10	6.5	2

FILL 0-7', SAND, SILTY, FINE TO MEDIUM GRAINED, TAN TO BROWN, MEDIUM DENSE, MOIST

SAND, VERY CLAYEY, FINE GRAINED, DARK BROWN, LOOSE, MOIST

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

TEST BORING NO. 4
DATE DRILLED 8/15/2017
CLIENT ENGINEERING AND SURVEYING
LOCATION 1250 MEADOWBROOK PARKWAY

REMARKS

DRY TO 20', 8/16/17

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			16	12.3	1
5			10	9.1	1
					2
10			8	3.5	2
15			11	8.7	2
20			12	7.1	2

FILL 0-7', SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST

SAND, SILTY, DARK BROWN SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, LOOSE

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 9/21/17

JOB NO.: 171247
FIG NO.: B- 2

TEST BORING NO. 5
DATE DRILLED 8/15/2017
Job # 171247

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 16.5', 8/16/17						
FILL 0-8', SAND, SILTY, FINE TO MEDIUM GRAINED, TAN TO BROWN, MEDIUM DENSE, MOIST				19	9.0	1
	5			11	7.2	1
SAND, SILTY, FINE TO MEDIUM GRAINED, DARK BROWN, LOOSE, MOIST	10			5	7.6	2
SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST TO WET	15			15	4.2	2
	20			16	17.0	2

TEST BORING NO. 6
DATE DRILLED 8/15/2017
CLIENT ENGINEERING AND SURVEYING
LOCATION 1250 MEADOWBROOK PARKWAY

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 18.5', 8/16/17						
FILL 0-8', SAND, SILTY, FINE TO MEDIUM GRAINED, TAN TO BROWN, MEDIUM DENSE, MOIST				13	11.3	1
	5			10	13.4	1
SAND, VERY CLAYEY, FINE GRAINED, DARK BROWN, LOOSE, MOIST	10			4	11.6	3
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST TO WET	15			13	3.2	2
	20			12	6.5	2

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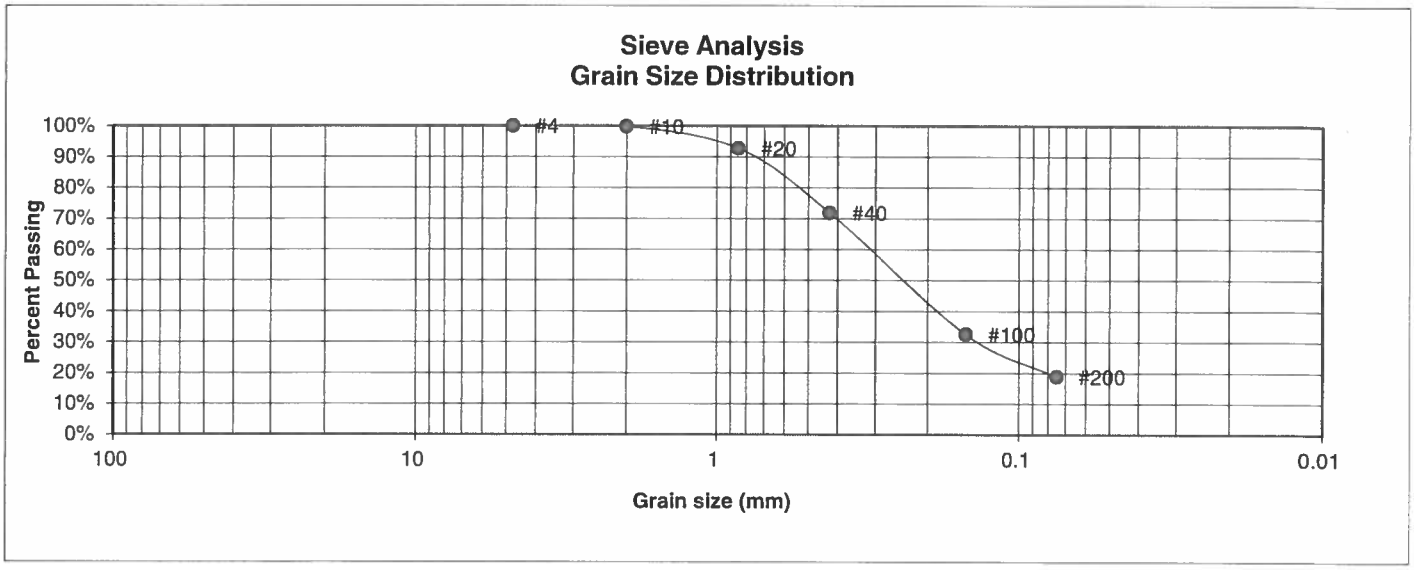
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/21/17

JOB NO.: 171247
FIG NO.: B- 3

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	1	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	1	JOB NO.	171247
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	92.7%
40	71.9%
100	32.5%
200	18.8%

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

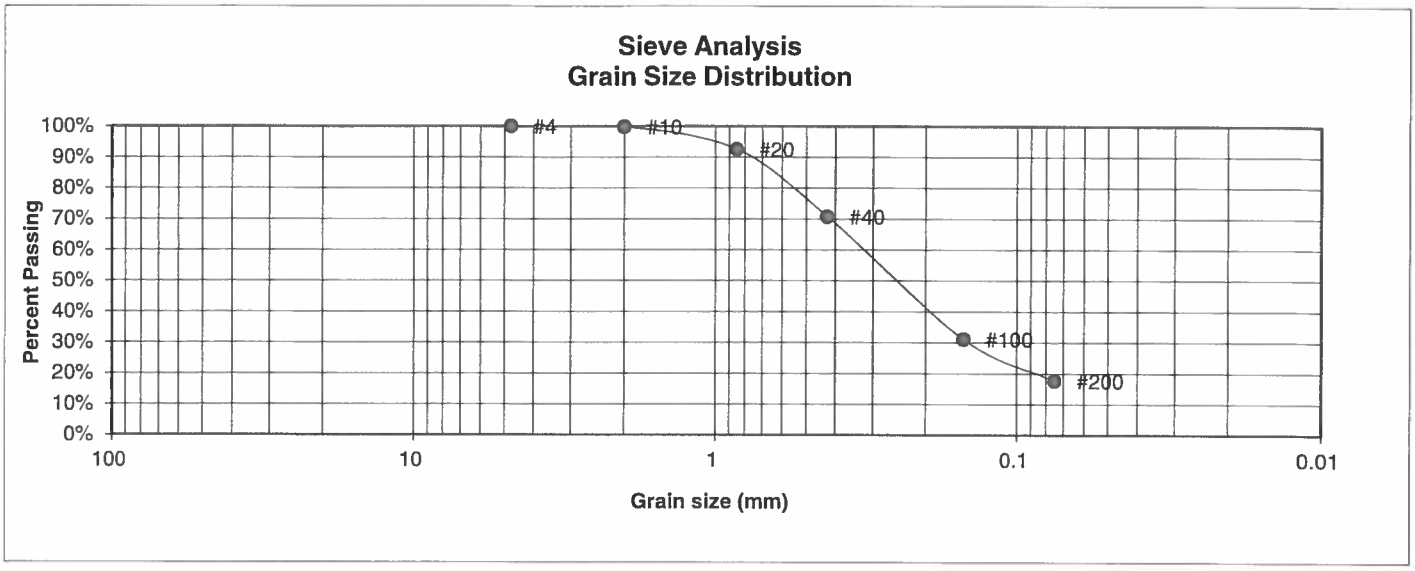
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8/28/17

JOB NO.: 171247

FIG NO.: C-1

UNIFIED CLASSIFICATION	SM	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	1	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	3	JOB NO.	171247
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	92.6%
40	70.8%
100	31.1%
200	17.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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

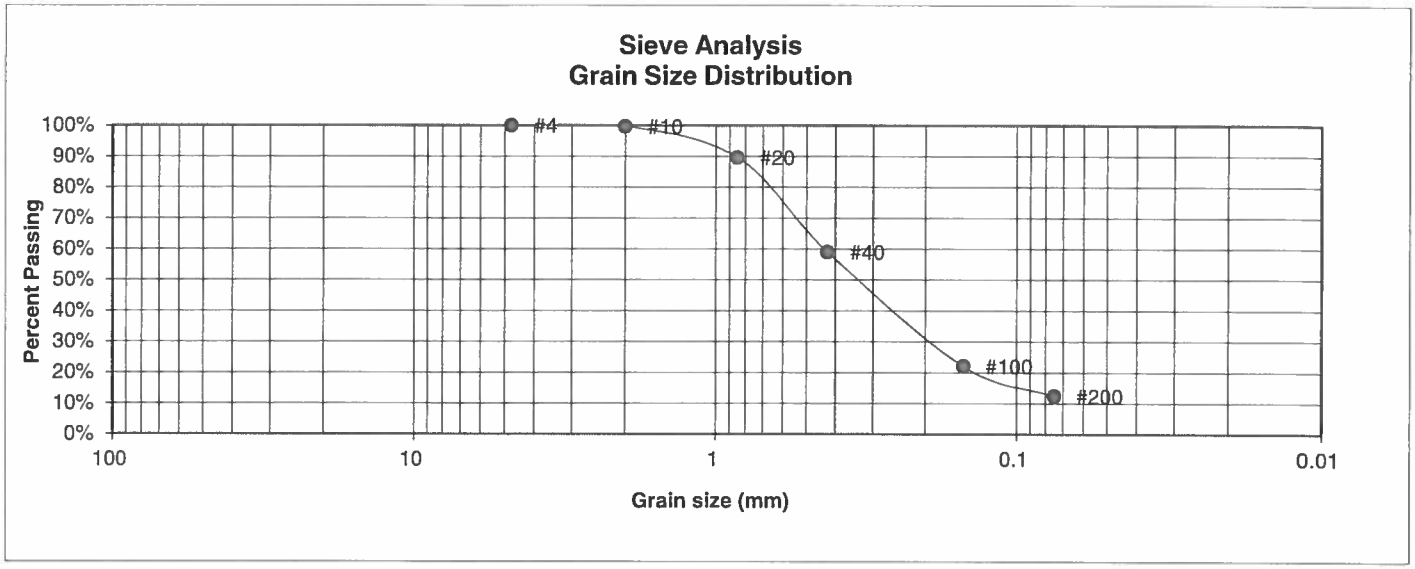
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8/28/17

JOB NO.: 171247

FIG NO.: C-2

UNIFIED CLASSIFICATION	SM	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	1	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	5	JOB NO.	171247
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	99.7%
20	89.7%
40	59.0%
100	22.1%
200	12.4%

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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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

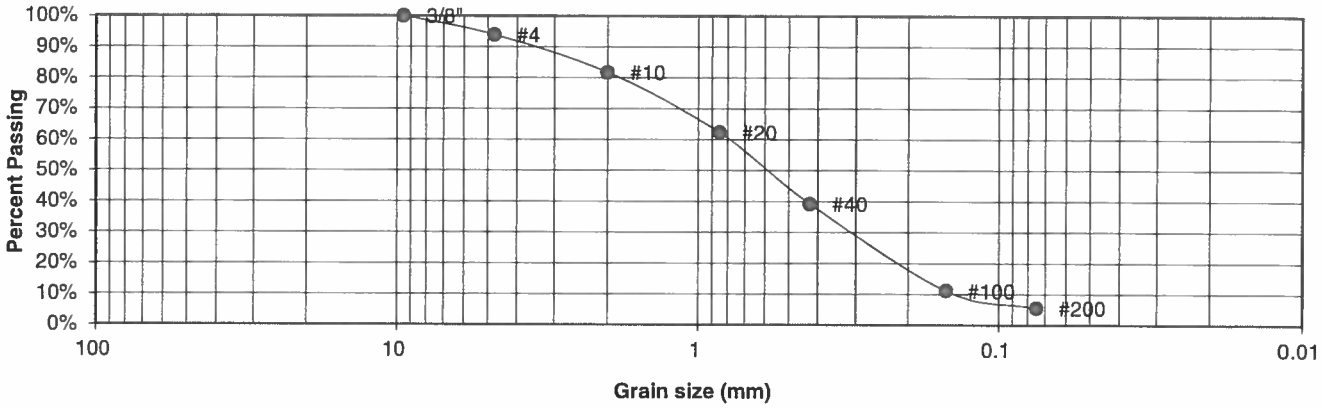
DRAWN:	DATE:	CHECKED:	DATE: 8/28/17

JOB NO.: 171247

FIG NO.: C-3

UNIFIED CLASSIFICATION	SM-SW	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	2	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	1	JOB NO.	171247
DEPTH (FT)	15	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.9%
10	81.8%
20	62.3%
40	39.2%
100	11.1%
200	5.6%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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

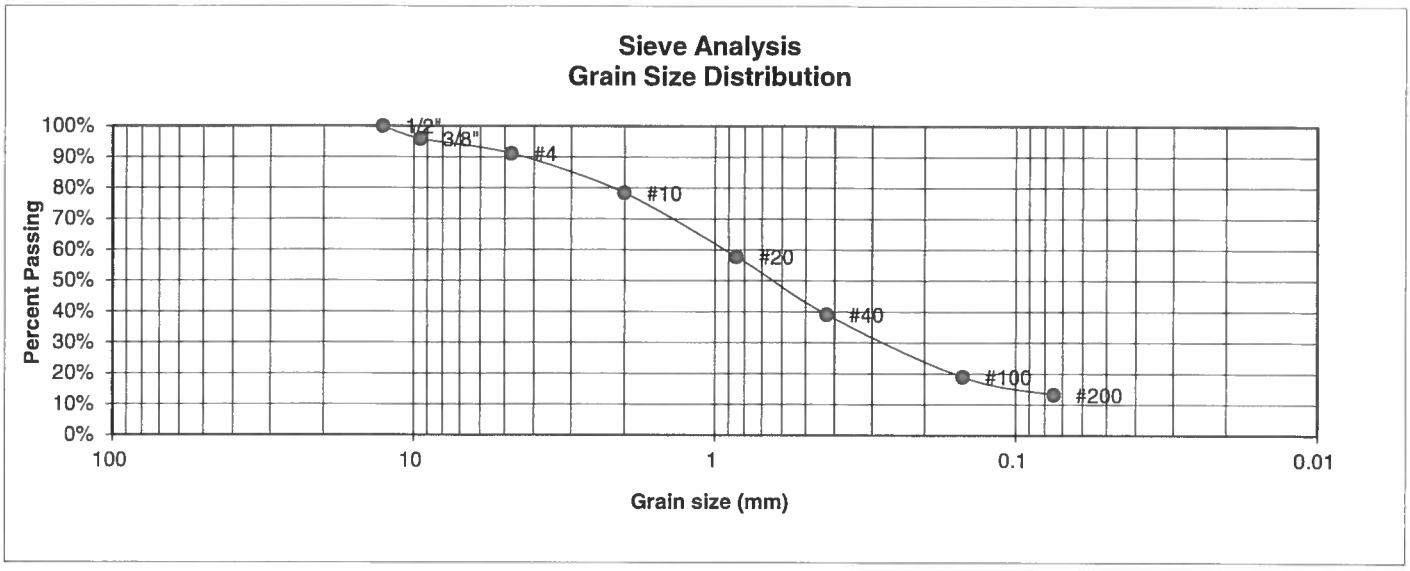
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8/28/17

JOB NO.: 171247

FIG NO.: C-4

UNIFIED CLASSIFICATION	SM	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	2	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	4	JOB NO.	171247
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.9%
4	91.1%
10	78.4%
20	57.8%
40	39.1%
100	18.9%
200	13.2%

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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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

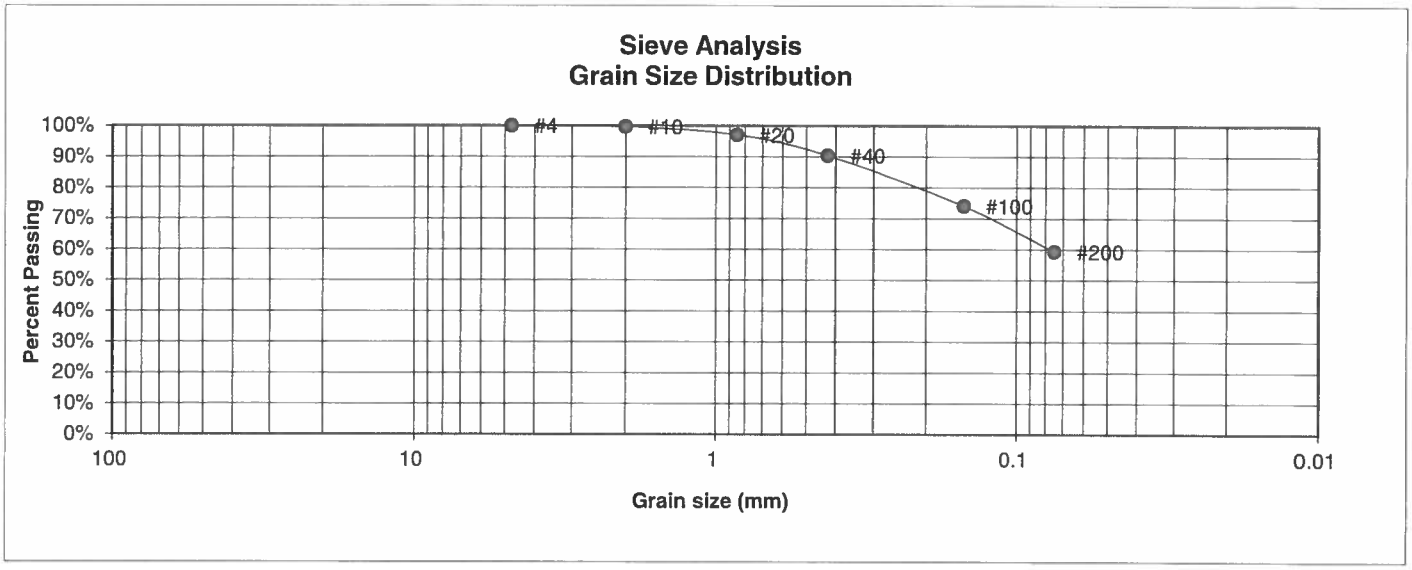
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8/28/17

JOB NO.: 171247

FIG NO.: C-5

UNIFIED CLASSIFICATION	CL	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	3	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	2	JOB NO.	171247
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.7%
20	97.1%
40	90.4%
100	74.0%
200	59.4%

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

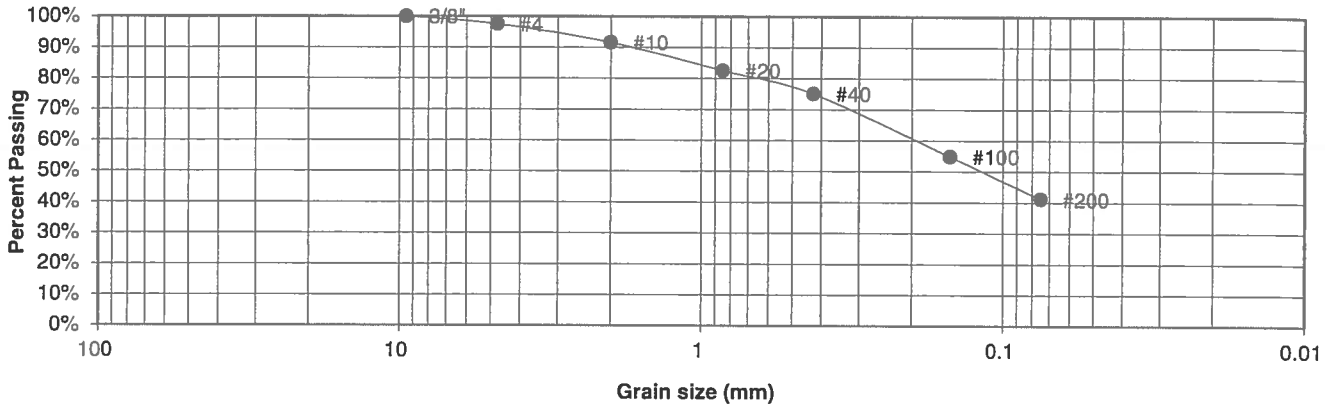
DRAWN:	DATE:	CHECKED:	DATE: 8/28/17

JOB NO.: 171247

FIG NO.: C-6

UNIFIED CLASSIFICATION	SC	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	3	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	3	JOB NO.	171247
DEPTH (FT)	10	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.5%
10	91.6%
20	82.6%
40	75.1%
100	54.9%
200	41.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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

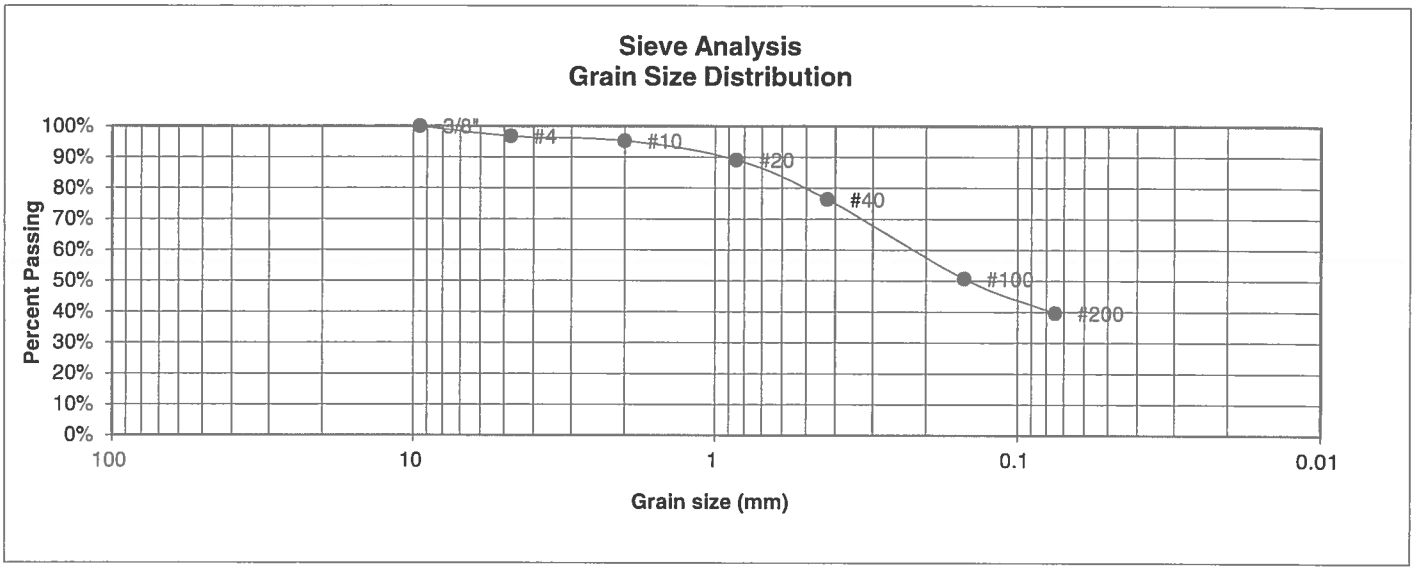
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8/28/17

JOB NO.: 171247

FIG NO.: C-7

UNIFIED CLASSIFICATION	SC	CLIENT	ENGINEERING AND SURVEYING
SOIL TYPE #	3	PROJECT	1250 MEADOWBROOK PARKWAY
TEST BORING #	6	JOB NO.	171247
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.8%
10	95.2%
20	89.1%
40	76.4%
100	50.7%
200	39.6%

Atterberg Limits	
Plastic Limit	11
Liquid Limit	22
Plastic Index	11

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:
			8/28/17

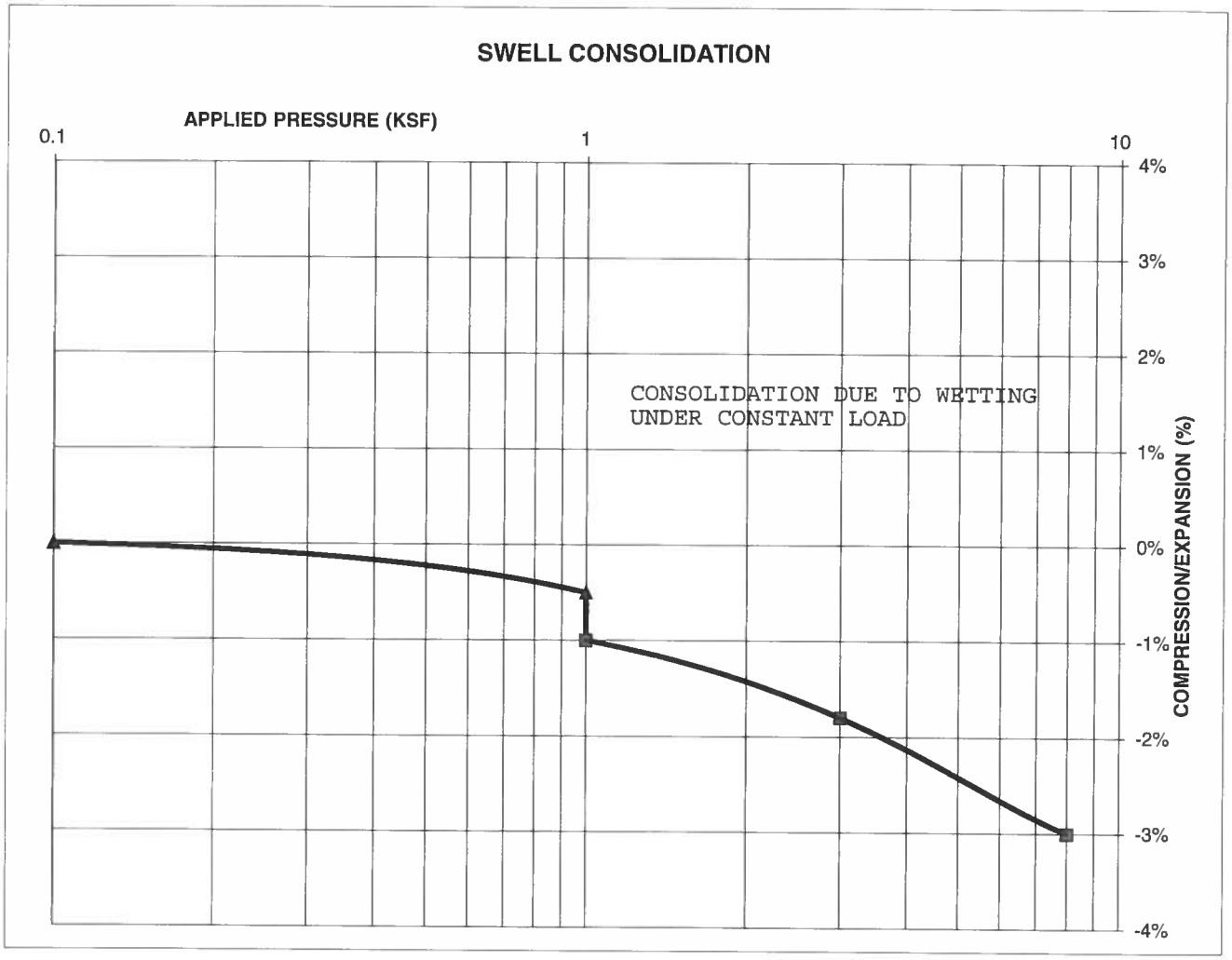
JOB NO.: 171247

FIG NO.: C-8

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	10
DESCRIPTION	SC	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			110
NATURAL MOISTURE CONTENT			15.0%
SWELL/CONSOLIDATION (%)			-0.5%

JOB NO. 171247
CLIENT ENGINEERING AND SURVEYING
PROJECT 1250 MEADOWBROOK PARKWAY



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8/28/17

JOB NO.: 171247
FIG NO.: C-9

CLIENT	ENGINEERING AND SURVEYING	JOB NO.	171247
PROJECT	1250 MEADOWBROOK PARKWAY	DATE	8/17/2017
LOCATION	1250 MEADOWBROOK PARKWAY	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-3	2-3	1	SM	<0.01
TB-4	15	2	SM	0.01
TB-1	15	2	SM-SW	<0.01

QC BLANK PASS

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 8/28/17

JOB NO.: 171247

FIG NO.: C-10

APPENDIX D: Soil Survey Descriptions

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

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

Map Unit Composition

Blakeland and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

El Paso County Area, Colorado

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Alluvial fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

El Paso County Area, Colorado

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: Sandy Bottomland LRU's A & B (R069XY031CO)
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll
Percent of map unit:
Landform: Swales
Hydric soil rating: Yes

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

Pleasant
Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016