



**ENTECH**  
ENGINEERING, INC.

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

February 15, 2024

DHN Development  
2335 Coralbell Grove, Unit 101  
Colorado Springs, Colorado 80910

Attn: Bryan Kniep

Re: Geologic Hazard Waiver Request  
Southmoor Ridge  
Parcel Nos. 65133-14-015, 65133-00-021,  
65242-00-052, and 65242-00-053  
Southmoor Drive and Fontaine Boulevard  
Fountain, Colorado  
Entech Job No. 240217

Dear Mr. Kniep:

This letter is to request a waiver from the Geologic Hazard Study for the above referenced project. The project is to consist of single family (townhomes) and multi-family residential development. The site is currently zoned as PUD (Planned Unit Development) according to City of Fountain Planning and Zoning (Reference 1).

The site is located in a portion of the SW $\frac{1}{4}$  of Section 13 the NW $\frac{1}{4}$  of Section 24, Township 15 South, Range 66 West, in the northwestern portion of Fountain, Colorado. The location of the site is shown on the Vicinity Map, Figure 1, and the USGS Topography Map, Figure 2. The proposed Development Plan is shown on Figure 3. The geology of the site was evaluated using the following investigations completed by Entech Engineering, Inc. (Entech) *Preliminary Subsurface Soil Investigation* (Reference 2, Appendix B) and *Infiltration Rates (Percolation Testing Method)* (Reference 3, Appendix C), the *Geologic Map of the Fountain Quadrangle* completed by Colorado Geological Survey 2017 (Reference 4, Figure 4). Site photographs taken February 13, 2024, are included in Appendix A.

In our opinion, the site is suitable for a Geologic Hazard Waiver as it does not exhibit any of the following characteristics:

- Slopes (existing or proposed) exceeding 33% or which are unstable or potentially unstable.
- History of underground mining or subsidence activity.
- History of a landfill, uncontrolled or undocumented fill activity.

The conditions on the site were investigated by Entech *Preliminary Subsurface Soil Investigation*, (Reference 2, Appendix B), and *Infiltration Rates (Percolation Testing Method)* (Reference 3, Appendix C). These investigations consisted of drilling fourteen shallow test borings on the site. The test borings were drilled to depths of 10 to 20 feet below the existing surface grade. Soils encountered in the test borings consisted of very clayey sand (SC), gravelly clean to silty sand (SW, SM-SW), sandy silt (ML), and sandy clay (CL) overlying weathered claystone and shale bedrock (CL, ML). Bedrock was encountered in four of the borings a depths ranging from 13 to 19 feet below the existing surface grade. Groundwater was encountered in one test boring TB-2 at a depth of 15.5 feet, the remaining borings were dry.

DHN Development  
Geologic Hazard Waiver Request  
Southmoor Ridge  
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Southmoor Drive and Fontaine Boulevard  
Fountain Colorado, Colorado  
Page 2



The site soils are associated with the Alluvial gravel five (Qag<sub>5</sub>) of lower Pleistocene Age (Reference 4, Figure 4). Overlying the Alluvial gravel five are areas of fill associated with past stockpiling and dumping on the property. Bedrock underlying the site consists of the Pierre Shale Formation of Upper Cretaceous Age. The claystone and shale associated with the Pierre Shale Formation are typically expansive. Additional geotechnical investigation of the site will be required once development plans are finalized to provide foundation recommendations.

No areas of unstable or potentially unstable slopes were observed on the site. The site slopes are gradually sloping to the southeast. The site is not located in any area of past underground mining or subsidence activity (References 5 and 6).

The site does lie within a 500-year floodplain zone according to the FEMA Map No. 08041CO951G (Reference 7). Groundwater was encountered in one test boring TB-2 at a depth of 15.5 feet (Reference 2, Appendix B). Any grading modifications should direct surface flows around the structures. Drainage studies are beyond the scope of this report.

We trust that this has provided you with the information required regarding a Geologic Hazard Waiver, a copy of Geologic Hazard Waiver form is attached with this letter. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:

A handwritten signature in blue ink, appearing to read 'Logan L. Langford'.

Logan L. Langford, P.G.  
Sr. Geologist

A handwritten signature in blue ink, appearing to read 'Joseph C. Goode Jr.'  
**Joseph C  
Goode Jr.**

Digitally signed by  
Joseph C Goode Jr.  
Date: 2024.02.15  
09:50:28 -07'00'

Joseph C. Goode, Jr. P.E.  
President

Encl.

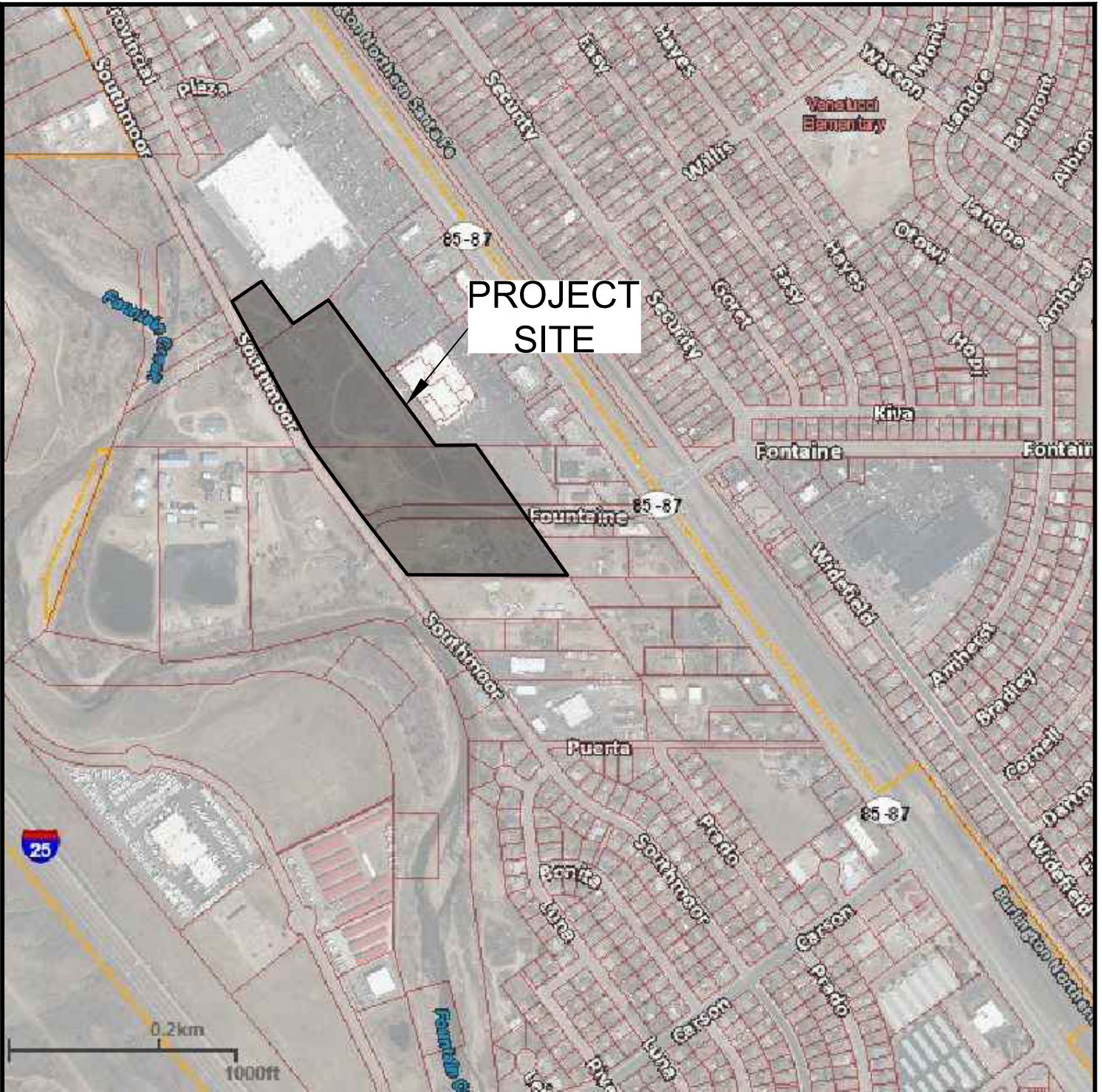
LLL

F:\AA Projects\2024\240217-DHN Dev-Southmoor Ridge-Gehoaz\09-Reports\240217 geo waiver.docx

## REFERENCES

1. City of Fountain, Colorado, updated April 2023. *Fountain Planning & Map*. <https://fountainco.maps.arcgis.com/apps/webappviewer/index.html?id=16d6981f04904cb3b48b24e7f90f9c6b>
2. Entech Engineering, Inc., dated June 29, 2022. *Preliminary Subsurface Soil Investigation, Southmoor Properties, Fountain, Colorado*. Entech Job No. 221305.
3. Entech Engineering, Inc., dated October 26, 2022. *Infiltration Rates (Percolation Test Method), Southmoor Drive, Parcel Nos. 6513314015, 6513300021, 6524200052, and 6524200053, Fountain, Colorado*. Entech Job No. 222077.
4. White, Jonathan L., Lindsey, Kassandra O., Morgan, Matthew L., and Mahan, Shannon A., 2017. *Geologic Map of the Fountain Quadrangle, El Paso County, Colorado*. Colorado Geological Survey. Open-File Report 17-05.
5. Amuedo and Ivey. *Inactive Mine Reclamation Program, Extent of Mining Map*. Colorado Department of Natural Resources.
6. Dames and Moore. 1985. *Colorado Springs Subsidence Investigation*. State of Colorado, Division of Mined Land Reclamation.
7. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado*. Map Number 08041CO951G.

## FIGURES



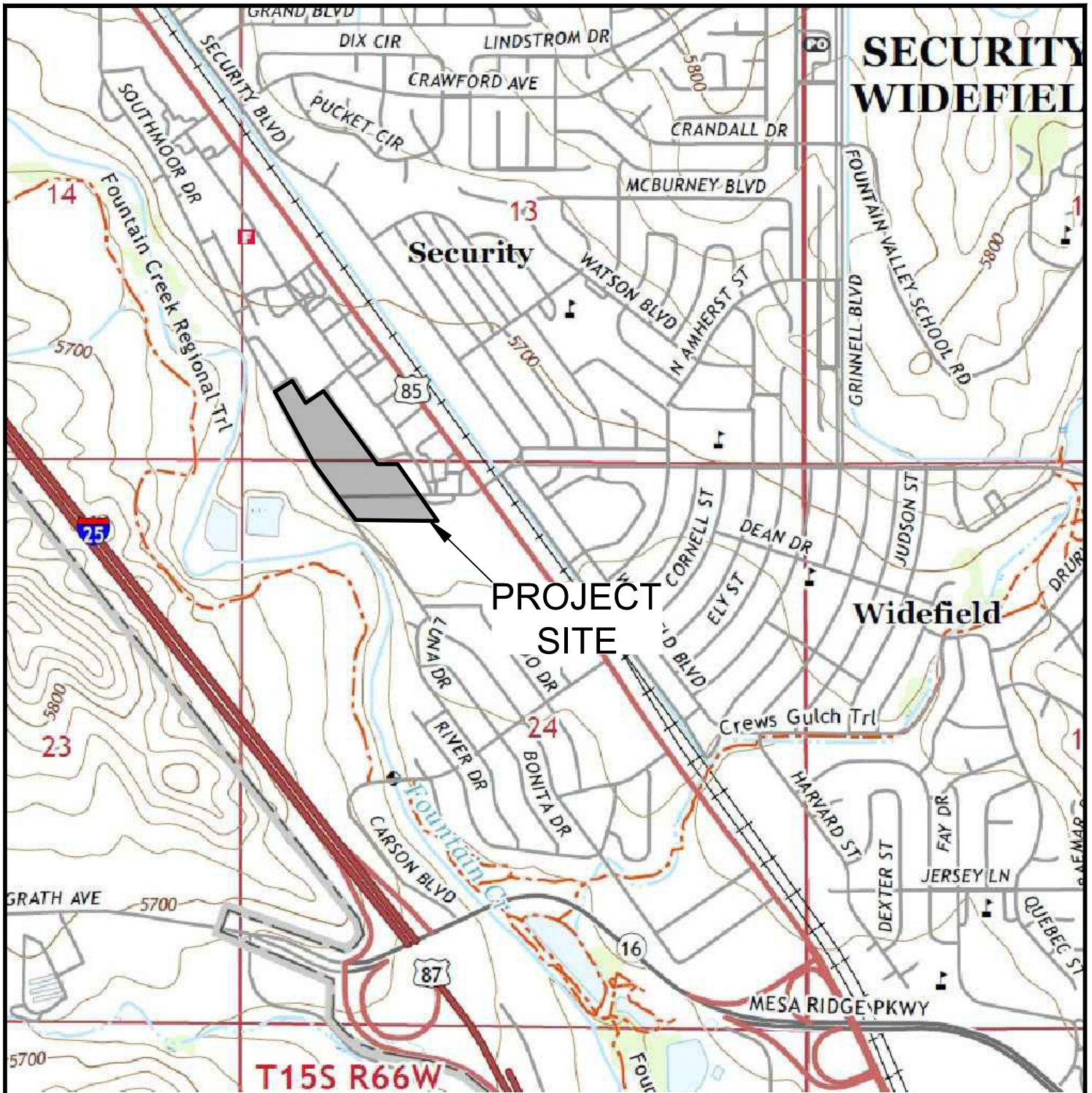
**PROJECT  
SITE**



**VICINITY MAP**  
SOUTHMOOR RIDGE  
FOUNTAIN, COLORADO  
DHN DEVELOPMENT

JOB NO.  
240217

**FIG. 1**



**USGS TOPOGRAPHY MAP**

SOUTHMOOR RIDGE  
 FOUNTAIN, COLORADO  
 DHN DEVELOPMENT

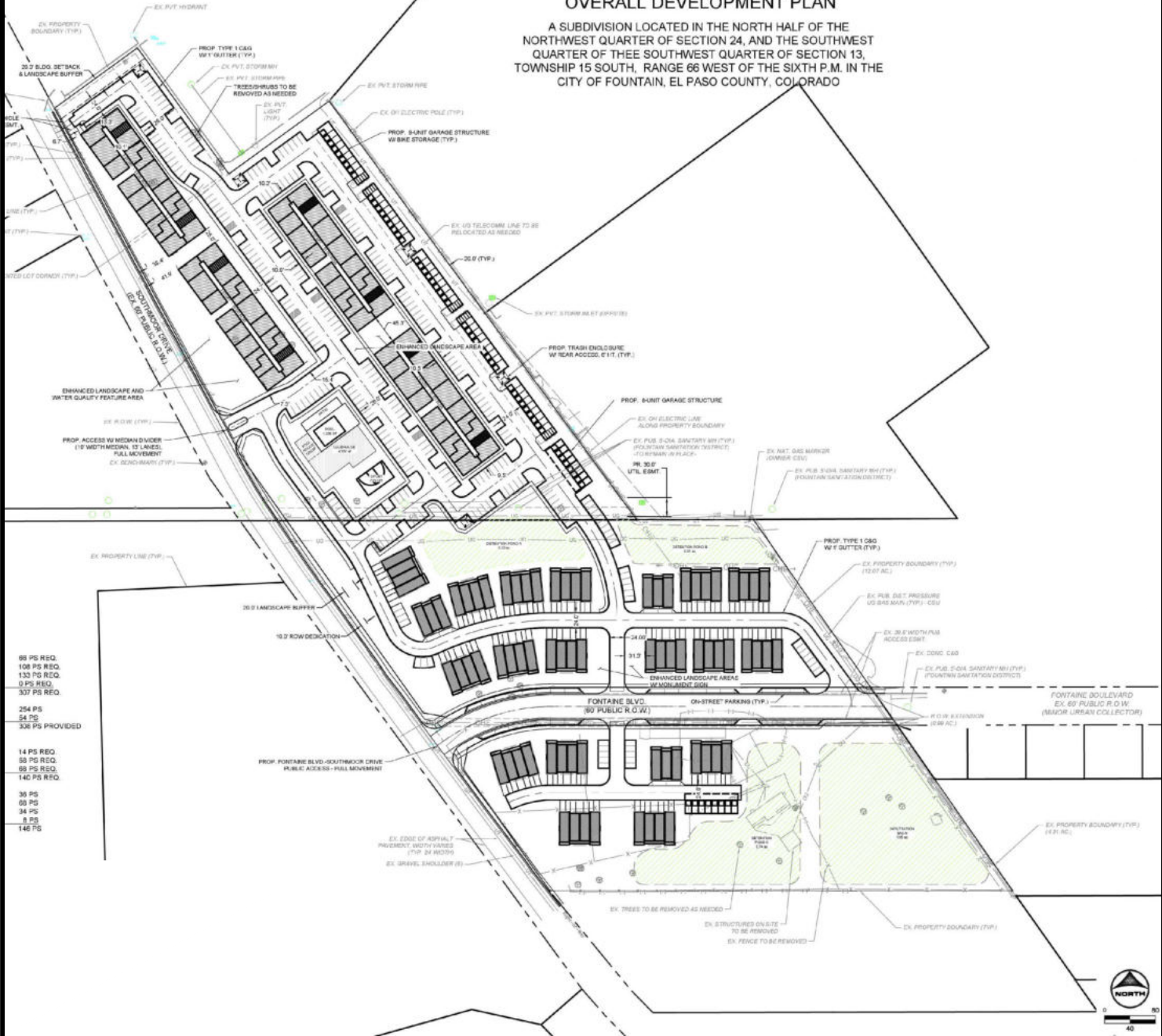
JOB NO.  
 240217

**FIG. 2**

# SOUTHMOOR RIDGE

## OVERALL DEVELOPMENT PLAN

A SUBDIVISION LOCATED IN THE NORTH HALF OF THE NORTHWEST QUARTER OF SECTION 24, AND THE SOUTHWEST QUARTER OF THREE SOUTHWEST QUARTER OF SECTION 13, TOWNSHIP 15 SOUTH, RANGE 66 WEST OF THE SIXTH P.M. IN THE CITY OF FOUNTAIN, EL PASO COUNTY, COLORADO



89 PS REQ.  
108 PS REQ.  
130 PS REQ.  
9 PS REQ.  
337 PS REQ.

254 PS  
54 PS  
338 PS PROVIDED

14 PS REQ.  
55 PS REQ.  
69 PS REQ.  
140 PS REQ.

35 PS  
65 PS  
34 PS  
8 PS  
146 PS

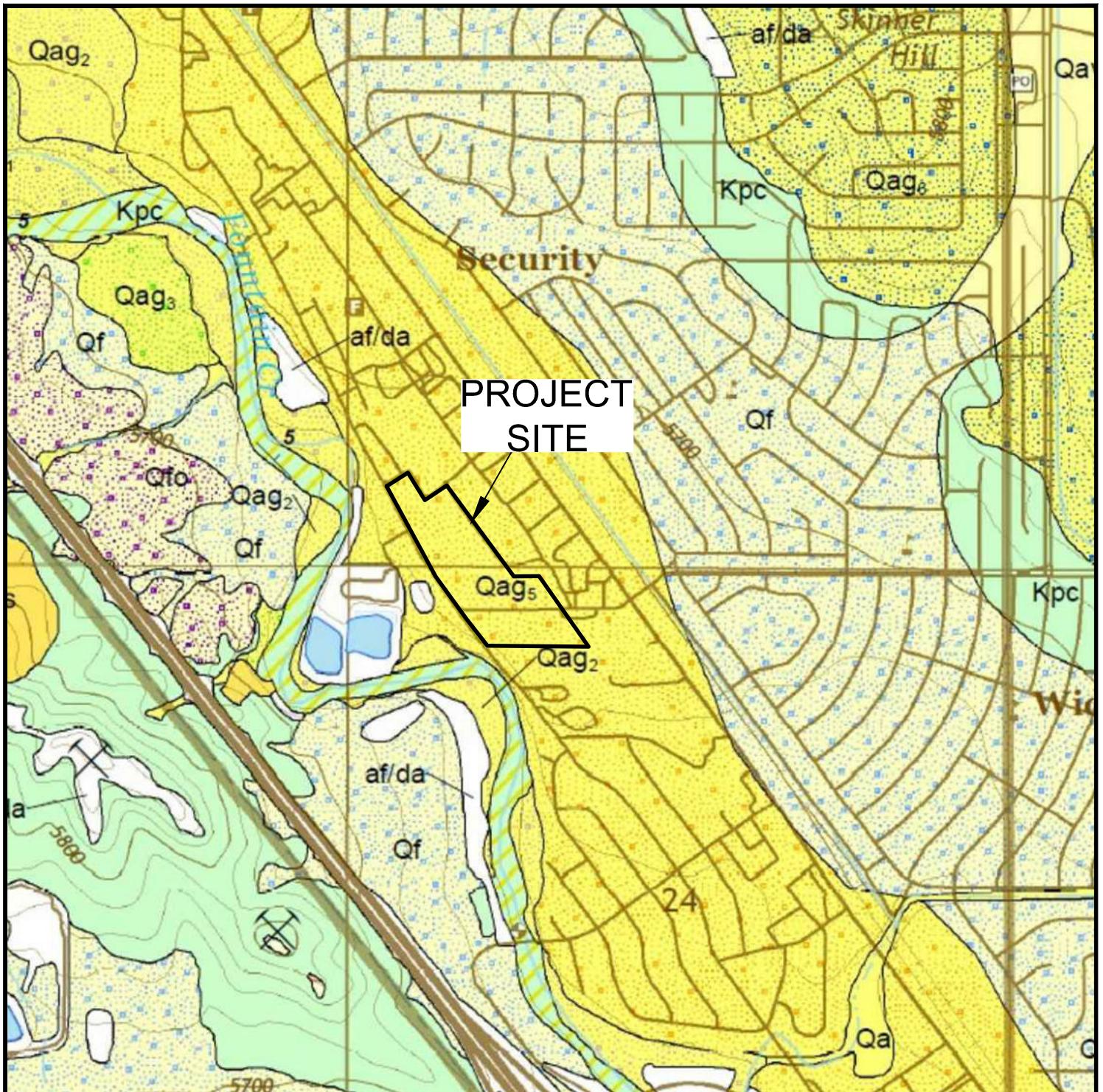


### DEVELOPMENT PLAN

SOUTHMOOR RIDGE  
FOUNTAIN, COLORADO  
DHN DEVELOPMENT

JOB NO.  
240217

**FIG. 3**



**GEOLOGIC MAP OF THE  
FOUNTAIN QUADRANGLE**  
SOUTHMOOR DRIVE  
FOUNTAIN, COLORADO  
DHN DEVELOPMENT

JOB NO.  
240217

**FIG. 4**





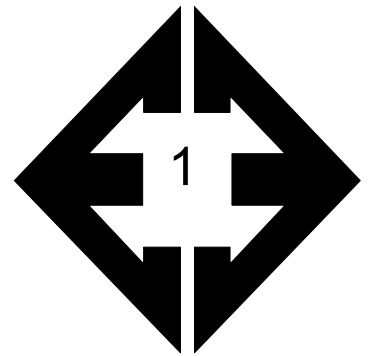
**FEMA FLOODPLAIN MAP**

SOUTHMOOR RIDGE  
 FOUNTAIN, COLORADO  
 DHN DEVELOPMENT

JOB NO.  
 240217

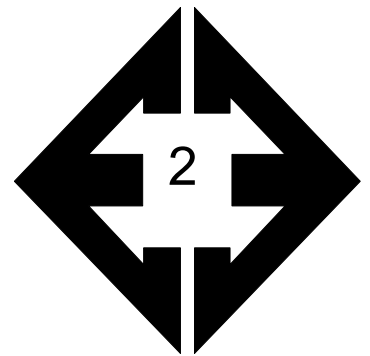
**FIG. 5**

## **APPENDIX A: Site Photographs**



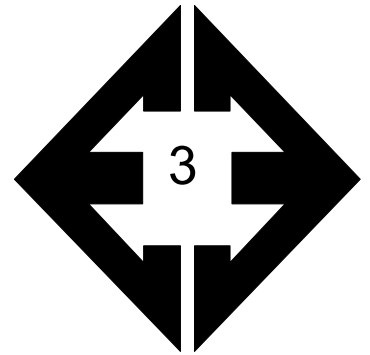
**Looking northwest  
from eastern side of  
the site.**

February 13, 2024



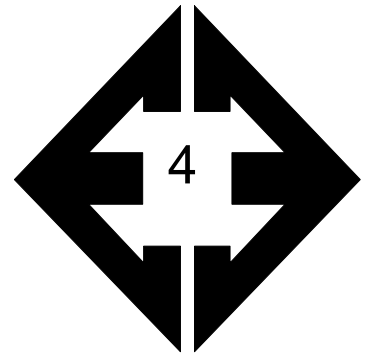
**Looking southeast  
from the western side  
of site.**

February 13, 2024



**Looking north from  
western side of the  
site.**

February 13, 2024



**Looking south from  
the northern side of  
site.**

February 13, 2024



**APPENDIX B: EEI, Preliminary Subsurface Soil  
Investigation, Job No. 221305**



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO 80907  
PHONE (719) 531-5599  
FAX (719) 531-5238

June 29, 2022

Front Row Properties  
1378 Promontory Bluff View  
Colorado Springs, CO 80921

Attn: Ron Waldthausen

Re: Preliminary Subsurface Soil Investigation  
Southmoor Properties  
Fountain, Colorado

Dear Mr. Waldthausen:

As requested, personnel of Entech Engineering, Inc. have drilled twelve test borings to evaluate the site soil conditions for the anticipated development. This letter presents the results of our soils investigation, laboratory testing, and preliminary foundation recommendations.

**SITE CONDITIONS:**

The site development has not been determined and will likely consist of commercial and/or residential development with associated site improvements. Adjacent properties consist of commercial shopping center to the north and east, and a mix of rural residential and commercial properties to the west. The location of the site is shown in the vicinity map, Figure, 1. The site is gradually sloping to the southeast. At the time of our site investigation stables and out buildings were located in the southern portion of the site, and the remaining portion of the site was undeveloped. Vegetation consists of field grasses and weeds, with scattered trees in portions of the site, and fill piles were observed in the western portion of the site.

**FIELD INVESTIGATION AND LABORATORY TESTING PROGRAM:**

Subsurface conditions on the site were explored by drilling twelve test borings across the site. The test borings were drilled at the approximate locations shown on the Site Map/Test Boring Location Map, Figure 2. The borings were drilled to approximately 20 feet below the existing ground surface (bgs). The drilling was performed using a truck-mounted, continuous flight auger-drilling rig supplied and operated by Entech. Boring logs descriptive of the subsurface conditions encountered during drilling are presented in Appendix A. At the conclusion of drilling, observations for groundwater levels were made in the open boreholes.

Soil samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D-1586) using 2-inch O.D. split-barrel and California samplers. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified and recorded on the boring logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the boring logs and in the provided chart. It should be understood that the soil descriptions shown on the boring logs may vary between boring location and sample depth. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types and the actual stratigraphic transitions may be more gradual and vary with location.

Moisture content testing (ASTM D-2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-Size Analysis Testing (ASTM D-422) was performed on selected samples to assist in classifying the materials encountered in the borings. Volume change testing was performed on selected samples using Swell/Consolidation (ASTM D-4546) tests in order to evaluate potential expansion/compression characteristics of the soil. Sulfate testing was performed on selected samples to evaluate potential for below grade concrete degradation due to sulfate attack. The Laboratory Testing Results are summarized on Table 1 and are presented in Appendix B.

#### **SUBSURFACE CONDITIONS:**

Three soil and rock types were encountered during drilling. The soils consisted of Type 1: very clayey sand, clean sand, and silty to slightly silty sand (SC, SW, SM, SM-SW), Type 2: sandy silt and sandy clay (ML, CL). The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 classified as very clayey sand, clean sand, and silty to slightly silty sand (SC, SW, SM, SM-SW). The sand was encountered in all test borings from the existing ground surface to depths of 13 to 18 feet bgs, and to the termination of Test Boring Nos. 6, and 8 – 10 (20 feet). Standard Penetration Testing resulted in SPT N-values of 2 to 41 bpf, indicating very loose to dense states. The majority of the sands were encountered at medium dense states. Moisture contents of 1 to 9 percent were measured, indicating dry to moist conditions. Grain size testing resulted in 5 to 49 percent of the soil passing the No. 200 sieve. Atterberg Limits Testing on a sample of the very clayey sand resulted in a liquid limit of 26 and plastic index of 10. Sulfate testing on a sample of very clayey sand resulted in less than 0.1 percent sulfate by weight, indicating a low potential for below grade concrete degradation.

Soil Type 2 is classified as sandy silt and sandy clay (ML, CL). The silt and clay were encountered in five the test borings at depths of 13 to 19 feet bgs, extending to depths ranging from 17 to 19 feet, and the termination of Test Boring Nos. 4, 5, and 12 (20 feet bgs). Standard Penetration Testing resulted in an SPT N-value of 19 to 45 bpf, indicating stiff to very stiff consistencies. Moisture contents of 11 to 22 percent were measured, indicating moist conditions. Grain size testing resulted in 70 to 99 percent of the soil passing the No. 200 sieve. Atterberg Limits Testing resulted in a liquid limit of 49 and a plastic index of 21. Swell/Consolidation Testing resulted in volume changes of 0.7 to 1.7 percent, indicating a low to moderate expansion potential. Sulfate testing on the clay resulted in less than 0.1 percent sulfate by weight, indicating a low potential for below grade concrete degradation.

Soil Type 3 is classified as claystone and shale (CL, ML). The claystone and shale were encountered in four the test borings at depths of 13 to 19 feet bgs, extending to the termination of the test borings (20 feet bgs). Standard Penetration Testing resulted in an SPT N-value of 28 to greater than 50 bpf, indicating stiff to hard consistencies. Moisture contents of 13 to 17 percent were measured, indicating moist conditions. Grain size testing resulted in 88 to 97 percent of the soil passing the No. 200 sieve. Atterberg Limits Testing on the shale resulted in liquid limits of 40 and 44 and plastic indexes of 14 to 16. Swell/Consolidation Testing resulted in a volume change of 0.8 percent, indicating a low expansion potential. Sulfate testing on the shale resulted in 0.00 to 0.02 percent sulfate by weight, indicating a low potential for below grade concrete degradation.

Depth to groundwater was measured in each of the borings at the conclusion and subsequent to drilling. Groundwater was encountered in Test Boring No. 2 at 15.5 feet, groundwater was not

encountered in the remaining test borings were which drilled to depths of 20 feet bgs. It is anticipated groundwater will not affect construction on the site. Development of this site and adjacent properties, as well as seasonal precipitation changes, and changes in runoff may affect groundwater elevations.

#### **GEOTECHNICAL EVALUATION AND RECOMMENDATIONS:**

*The following discussion is based on the subsurface conditions encountered in the borings drilled for the planned development. If subsurface conditions different from those described herein are encountered during construction or if the project elements change from those described, Entech Engineering, Inc. should be notified so that the evaluation and recommendations presented can be reviewed and revised if necessary.*

The site is to be developed with commercial and/or residential structures and associated site improvements. Very loose to loose soils were encountered in several of the borings in the upper profile. Fill piles were observed on the site, however, fill was not encountered in the testing borings. If uncontrolled fill is encountered beneath foundations mitigation will be required. Loose soils or uncontrolled fill encountered within the building areas must be completely removed and recompacted. To provide a uniform bearing pad, at a minimum, it is recommended that the loose soils be penetrated or moisture-conditioned, and recompacted below the building(s). Prior to placing the structural fill, the subgrade should be scarified, moisture-conditioned, and compacted. Fill placed in building areas should be compacted according to the "Structural Fill" paragraph. Preliminary design considerations are discussed in the following sections. Additional subsurface soil investigation is recommended once development plans are prepared. The extent of overexcavation/recompaction will be determined at the time of the open excavation observations.

Expansive soils were encountered in the borings, however, are sporadic. Should expansive soils be encountered beneath the foundations, mitigation will be necessary. Mitigation of expansive soils will require overexcavation and replacement with non-expansive soils at 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. Final recommendations should be determined after additional investigation of each building site.

#### **PRELIMINARY FOUNDATION RECOMMENDATIONS:**

Shallow spread footing/stemwall foundation systems in conjunction with overexcavation/fill mitigation is anticipated for any structures to be built on this site. An allowable bearing pressure of 2000 pounds per square foot (psf) are anticipated for the site soils. Exterior footings should extend to a minimum of 30 inches for frost protection. Recommendations should be made after additional investigation and completion of the grading plans. Density testing of the reconditioned soil or structural fill placed on this site should be performed by a qualified individual.

Foundation walls retaining soils should be designed to resist lateral pressures generated by the soils. An equivalent hydrostatic fluid pressure (in the active state) of 45 pcf is recommended for the site soils. It should be noted that this value applies to level backfill conditions. Pressures may increase depending on the conditions adjacent to the walls. Surcharge loading if any, should be considered in wall designs. Equivalent fluid pressures for sloping conditions should be determined on an individual basis.



#### **FOUNDATION EXCAVATION OBSERVATION:**

The open foundation excavations should be observed by a representative of Entech Engineering, Inc. prior to construction of the foundation in order to verify that no anomalies are present, materials at the proper design bearing capacity have been encountered, and no soft or loose areas or debris are present in the excavation. Loose areas that require removal and or recompaction should be identified during site observations.

#### **CONCRETE:**

Type II cement is recommended for all concrete on this site. Concrete should not be placed on frozen or wet ground. Care should be taken to prevent the accumulation and ponding of water in the footing excavation prior to the placement of concrete. If standing water is present in the excavation, it should be removed from the excavation by pumping it away from the building area. Concrete placed during cold temperatures must be kept from freezing, which may require covering the concrete with insulated blankets and heating it.

#### **FLOOR SLABS:**

Floor slabs placed on loose soils should be expected to experience movement. The uncontrolled fill must be mitigated below slabs. Floor slabs on grade, if any should be separated from structural portions of the building, unless they are designed as part of the foundation system. Backfill placed below floor slabs should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

#### **SITE SEISMIC CLASSIFICATION**

Based on the subsurface conditions encountered at the site and in accordance with Section 1613 of the 2015 International Building Code (IBC), the site meets the conditions of a Site Class E.

#### **SURFACE AND SUBSURFACE DRAINAGE:**

Positive surface drainage must be maintained around the structure to minimize infiltration of surface water. A minimum gradient of 5 percent in the first 10 feet adjacent to foundations is recommended. A minimum gradient of 2 percent is recommended for paved areas. All grades should be directed away from the structure. All downspouts should be extended to discharge well beyond the backfill zone of the structure.

A subsurface drain is recommended around portions of the structure which will have useable space located below the finished ground surface. A perimeter drain will not be required for slab on grade construction if the slab is above exterior grade. Typical drain details are included with this letter.

#### **STRUCTURAL FILL:**

Areas to receive structural fill should have all topsoil, organic material or debris removed. Fill must be properly benched. Prior to placing new fill, the surface should be scarified and moisture conditioned to within  $\pm 2$  percent of its optimum moisture content and compacted to 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557) or to 95 percent of the soils maximum Standard Proctor Dry Density, ASTM D-698 at or above optimum moisture content. New fill should be placed in lifts not to exceed 6 inches after compaction while maintaining the above noted compaction requirements. Fill should be placed at a moisture

Front Row Properties  
Preliminary Subsurface Soil Investigation  
Southmoor Properties  
Fountain, Colorado

content conducive to compaction. The placement and compaction of fill should be observed and tested by Entech. Any imported soils should be approved by Entech prior to being hauled to the site. The on-site soils may be used as structural fill pending approval by Entech.

**UTILITIES:**

Backfill placed in utility trenches should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557). Utility backfill should be placed in lifts having a compacted thickness of six inches or less and a moisture content conducive to adequate compaction, usually  $\pm 2$  percent of its optimum Proctor moisture content. Mechanical methods should be used in placement of backfill; however, heavy equipment should be kept away from foundation walls. No water flooding techniques of any type should be used in compaction of backfill on the site.

Trench backfilling should be performed in accordance with City of Fountain specifications. Excavating should be performed in accordance with OSHA guidelines.

**CLOSING:**

The test borings were located to provide preliminary geotechnical information; variations in subsurface conditions may be encountered. In the event that the project scope changes, the conclusions and recommendations in this report should not be considered valid unless the changes are reviewed and the conclusions of this report are verified in writing or, if necessary, modified. Additional investigation will be required on the site as development/grading plans are prepared.

This report has been prepared for Front Row Properties for application to the proposed project in accordance with generally accepted soil and foundation engineering practices. No other warranty expressed or implied is made.

Respectfully Submitted,

ENTECH ENGINEERING, INC.



Logan L. Langford, P.G.  
Geologist  
LLL

Encl.

Entech Job No. 221305  
AA projects\2022\221305-pssi



Reviewed by:



Joseph C. Goode, Jr., P.E.  
President

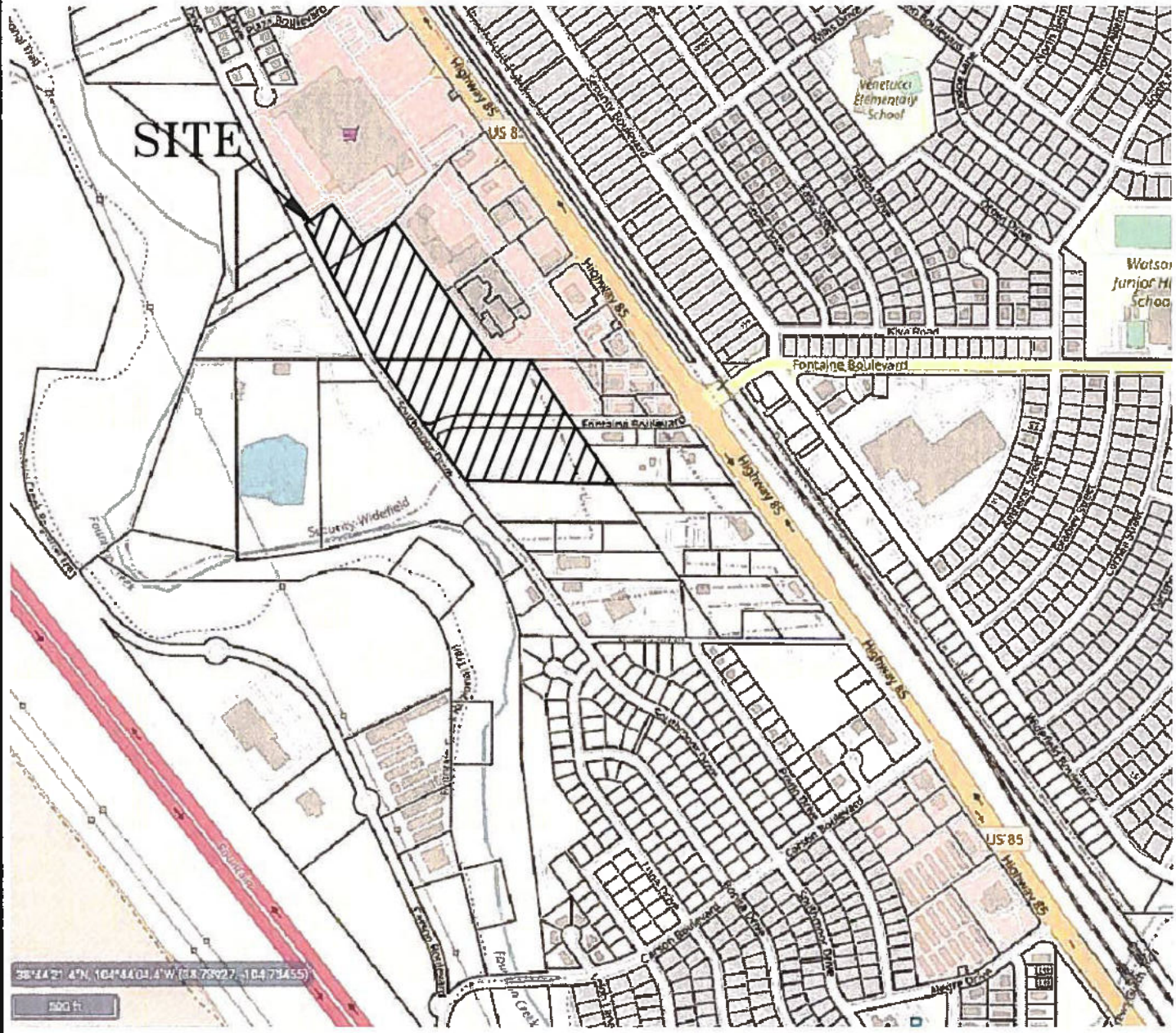
## TABLE

**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT FRONT ROW PROPERTIES  
PROJECT SOUTHMOOR DRIVE  
JOB NO. 221305

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			43.9	26	10	<0.01			SC	SAND, VERY CLAYEY
1	4	5			4.7						SW	SAND
1	6	5			5.1						SM-SW	SAND, SLIGHTLY SILTY
1	8	2-3			10.2						SM-SW	SAND, SLIGHTLY SILTY
1	9	2-3			49.1						SC	SAND, VERY CLAYEY
1	10	5			24.2						SM	SAND, SILTY
1	11	10			22.4						SM	SAND, SILTY
2	5	15	14.9	100.0	97.4	49	21	<0.01		1.7	ML	SILT, SANDY
2	7	15	21.9	97.7	98.5					1.3	CL	CLAY, SANDY
2	12	20	23.4	89.5	70.2					0.7	CL	CLAY, SANDY
3	2	15	15.1	97.5	97.0	44	16	0.00		0.8	ML	SHALE
3	3	20			88.2	40	14	0.02			ML	SHALE

## FIGURES



**ENTECH**  
**ENGINEERING, INC.**  
 305 ELKTON DRIVE  
 COLORADO SPRINGS, CO. 80907 (719) 531-3939

VICINITY MAP  
 SOUTHMOOR DRIVE PROPERTIES  
 FOUNTAIN, COLORADO  
 FOR: FRONT ROW PROPERTIES

DRAWN:  
 LLL

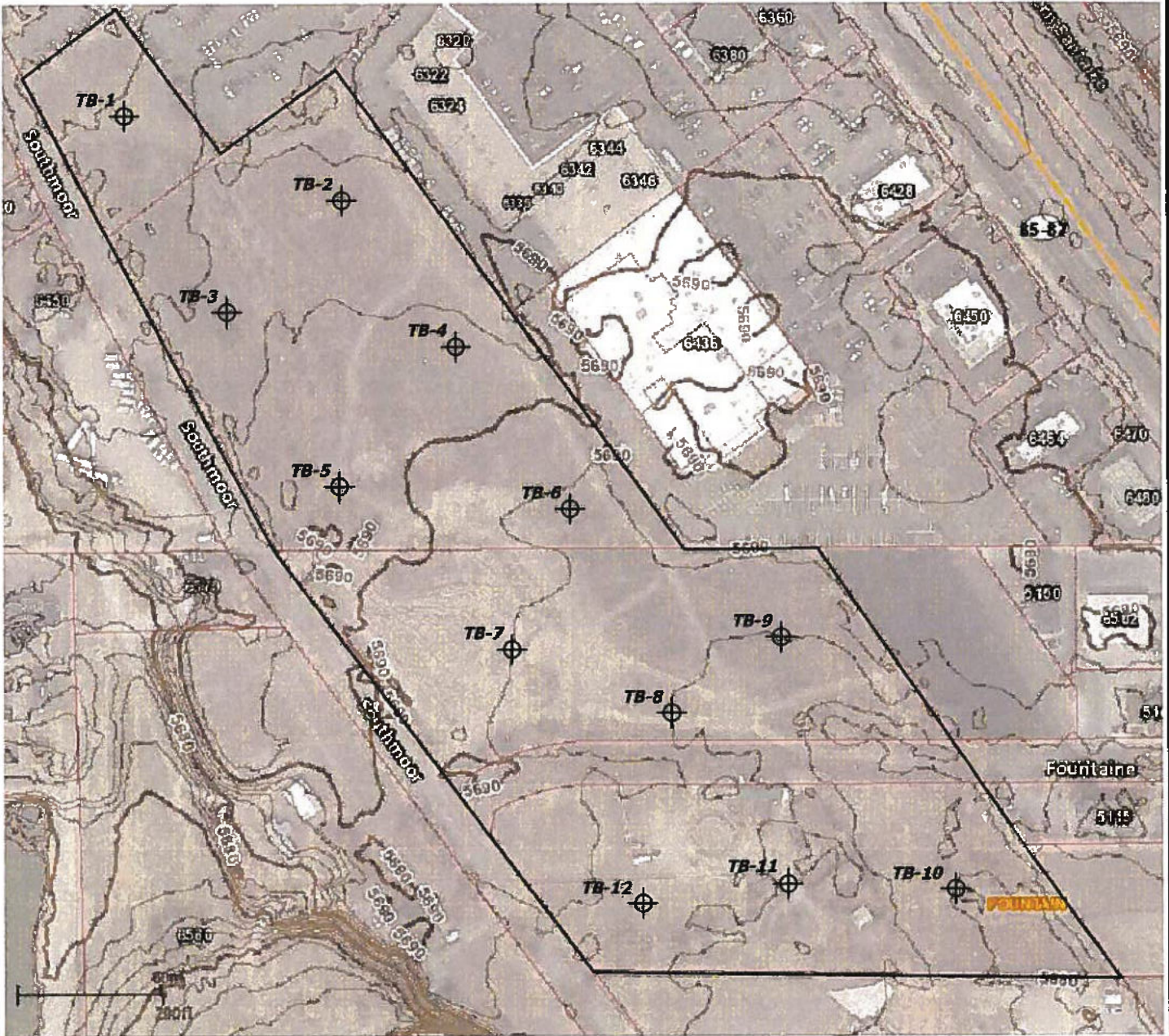
DATE:  
 6/28/22

CHECKED:

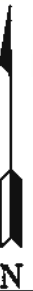
DATE:

JOB NO.:  
 221305

FIG NO.:  
 1



**TB- APPROXIMATE TEST BORING LOCATION AND NUMBER**



**ENTECH**  
**ENGINEERING, INC.**  
 585 ELKTON DRIVE  
 COLORADO SPRINGS, CO 80907 (719) 531-9599

**SITE MAP/TEST BORING LOCATION MAP**  
**SOUTHMOOR DRIVE PROPERTIES**  
**FOUNTAIN, COLORADO**  
**FOR: FRONT ROW PROPERTIES**

DRAWN:  
 LLL

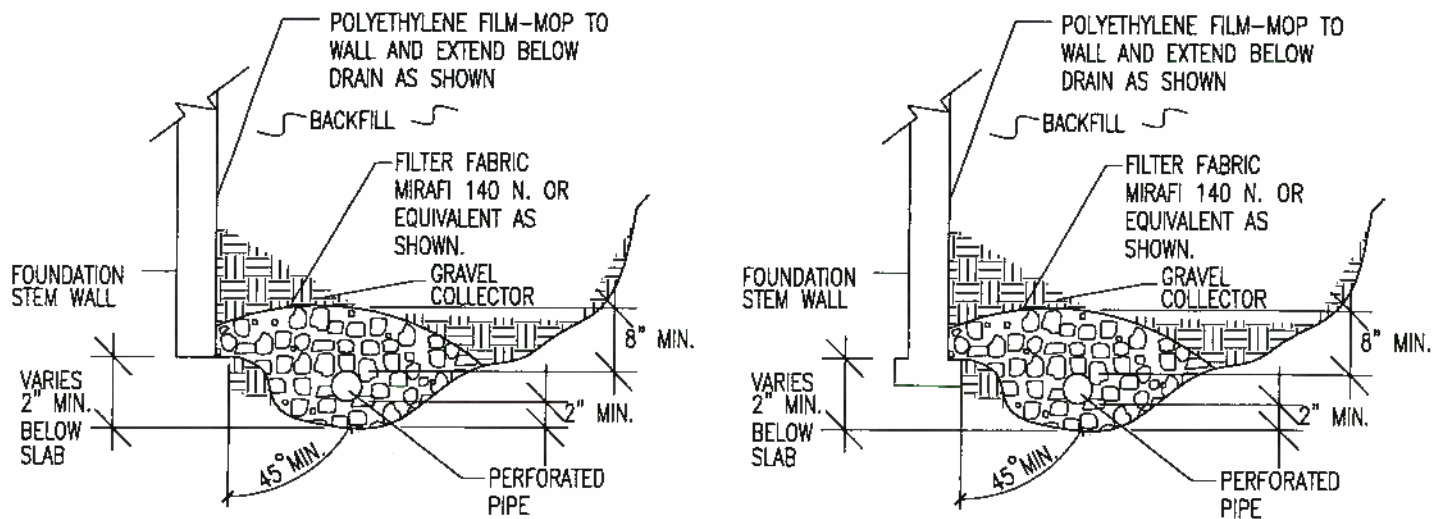
DATE:  
 6/28/22

CHECKED:

DATE:

JOB NO:  
 221305

FIG NO:  
 2



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 OUTFALL IS NOT AVAILABLE.



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

*PERIMETER DRAIN DETAIL*

DRAWN:

DATE:

DESIGNER:

CHECKED:

JOB NO.:

221305

FIG NO.:

3



## **APPENDIX A: Test Boring Logs**

TEST BORING NO. 1  
 DATE DRILLED 6/7/2022  
 Job # 221305

TEST BORING NO. 2  
 DATE DRILLED 6/7/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 18.5', 6/9/22							WATER @ 15.5', 6/9/22						
SAND, VERY CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST	5			24	3.8	1	SAND, GRAVELLY, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE TO LOOSE, MOIST	5			25	5.0	1
SAND, GRAVELLY, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE TO DENSE, MOIST TO DRY	5			15	3.1	1		5			8	2.3	1
	10			33	1.3	1		10			11	1.6	1
CLAYSTONE, SANDY, DARK GRAY, HARD, MOIST	15			50	12.9	3	SHALE, GRAY BROWN, VERY STIFF TO HARD, MOIST	15			44	14.0	3
	20			50	13.4	3		20			50	13.8	3
				5"							9"		



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/27/22

JOB NO.:  
 221305

FIG NO.:  
 A- 1

TEST BORING NO. 3  
 DATE DRILLED 6/7/2022  
 Job # 221305

TEST BORING NO. 4  
 DATE DRILLED 6/7/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS

DRY TO 18.5', 6/9/22

SAND, GRAVELLY, SILTY, FINE TO COARSE GRAINED, BROWN TO TAN, MEDIUM DENSE TO DENSE, DRY

CLAY, SANDY, GRAY BROWN, STIFF, MOIST

WEATHERED SHALE, GRAY BROWN, STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
13			13	0.9	1
41			41	0.8	1
14			14	2.4	1
20			20	10.7	2
28			28	17.3	3

REMARKS

DRY TO 19', 6/9/22

SAND, GRAVELLY, CLEAN TO SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO MEDIUM DENSE, DRY TO MOIST

CLAY, SANDY, GRAY BROWN, VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
32			32	1.7	1
27			27	2.3	1
15			15	2.7	1
19			19	3.2	1
33			33	10.9	2



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/27/22

JOB NO.: 221305

FIG NO.: A-2

TEST BORING NO. 5  
 DATE DRILLED 6/7/2022  
 Job # 221305

TEST BORING NO. 6  
 DATE DRILLED 6/7/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 19', 6/9/22						
SAND, GRAVELLY, SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO DENSE, DRY	5			7	1.0	1
	5			8	1.5	1
	10			33	1.7	1
SILT, SANDY, DARK GRAY, VERY STIFF TO STIFF, MOIST	15			45	13.8	2
	20			23	12.1	2

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 18', 6/9/22						
SAND, GRAVELLY, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO MEDIUM DENSE, DRY TO MOIST	5			4	1.2	1
	5			14	1.2	1
	10			2	7.3	1
	15			26	3.0	1
	20			9	2.9	1



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/27/22

JOB NO:  
221305

FIG NO:  
A-3

TEST BORING NO. 7  
 DATE DRILLED 6/7/2022  
 Job # 221305

TEST BORING NO. 8  
 DATE DRILLED 6/7/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 18.5', 6/9/22						
SAND, GRAVELLY, SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO DENSE, DRY	5			23	0.9	1
	5			24	1.5	1
	10			22	1.9	1
CLAY, SANDY, TAN, STIFF, MOIST	15			28	22.1	2
CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST	20			50	17.3	3
				8"		

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15.5', 6/9/22						
SAND, GRAVELLY, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	5			15	6.0	1
	5			14	5.6	1
	10			20	3.1	1
	15			28	4.3	1
	20			12	8.5	1



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/27/22

JOB NO.:  
 221305

FIG NO.:  
 A-4

TEST BORING NO. 9  
 DATE DRILLED 6/8/2022  
 Job # 221305

TEST BORING NO. 10  
 DATE DRILLED 6/8/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS

DRY TO 20', 6/9/22

SAND, VERY CLAYEY, FINE  
 GRAINED, BROWN, MEDIUM  
 DENSE, MOIST

SAND, GRAVELLY, SILTY, FINE  
 TO COARSE GRAINED, BROWN,  
 MEDIUM DENSE, DRY TO MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			17	5.8	1
5			19	6.1	1
10			14	1.6	1
15			27	4.1	1
20			28	4.5	1

REMARKS

DRY TO 20', 6/8/22

SAND, GRAVELLY, SILTY, FINE  
 TO COARSE GRAINED, BROWN,  
 MEDIUM DENSE TO DENSE,  
 MOIST TO DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			24	8.7	1
5			17	2.8	1
10			32	2.1	1
15			35	7.3	1
20			36	6.3	1



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/28/22

JOB NO.:  
 221305

FIG NO.:  
 A- 5

TEST BORING NO. 11  
 DATE DRILLED 6/8/2022  
 Job # 221305

TEST BORING NO. 12  
 DATE DRILLED 6/8/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS

DRY TO 20', 6/8/22

2" ASPHALT, SAND, GRAVELLY,  
 SILTY, FINE TO COARSE GRAINED,  
 TAN, DENSE TO MEDIUM DENSE,  
 DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			30	1.2	1
			28	1.1	1
10			29	1.8	1
15			30	2.4	1
20			13	1.9	1

REMARKS

DRY TO 20', 6/8/22

SAND, GRAVELLY, SILTY, FINE  
 TO COARSE GRAINED, BROWN,  
 MEDIUM DENSE TO DENSE,  
 MOIST TO DRY

CLAY, SANDY, BROWN, STIFF,  
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			10	1.3	1
			21	1.4	1
10			32	3.4	1
15			27	2.1	1
20			19	12.0	2



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLC	6/27/22

JOB NO:  
 221305

FIG NO:  
 A- 6

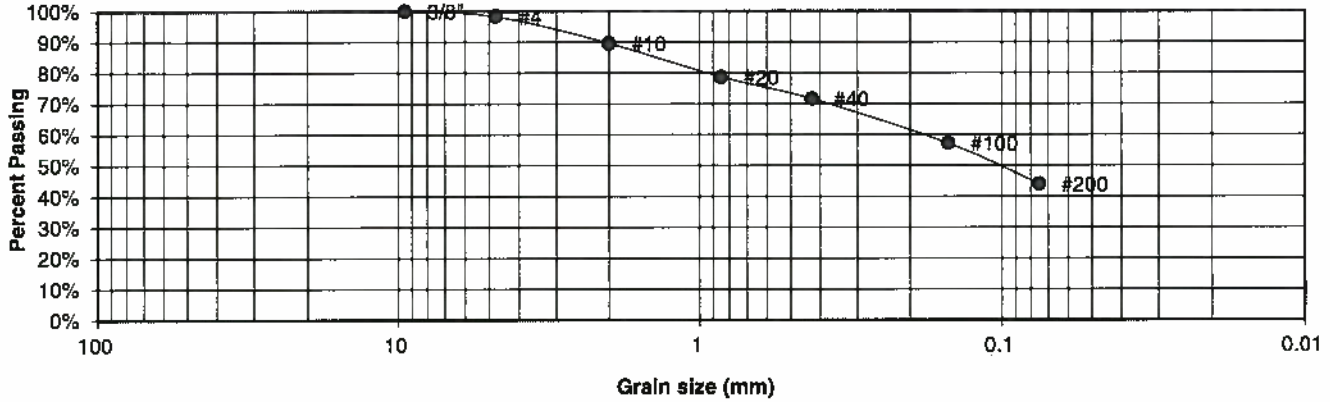
## **APPENDIX B: Laboratory Test Results**



UNIFIED CLASSIFICATION SC  
 SOIL TYPE # 1  
 TEST BORING # 1  
 DEPTH (FT) 2-3

CLIENT FRONT ROW PROPERTIES  
 PROJECT SOUTHMOOR DRIVE  
 JOB NO. 221305  
 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	98.3%
10	89.6%
20	78.7%
40	71.6%
100	57.2%
200	43.9%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	26
Plastic Index	10

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



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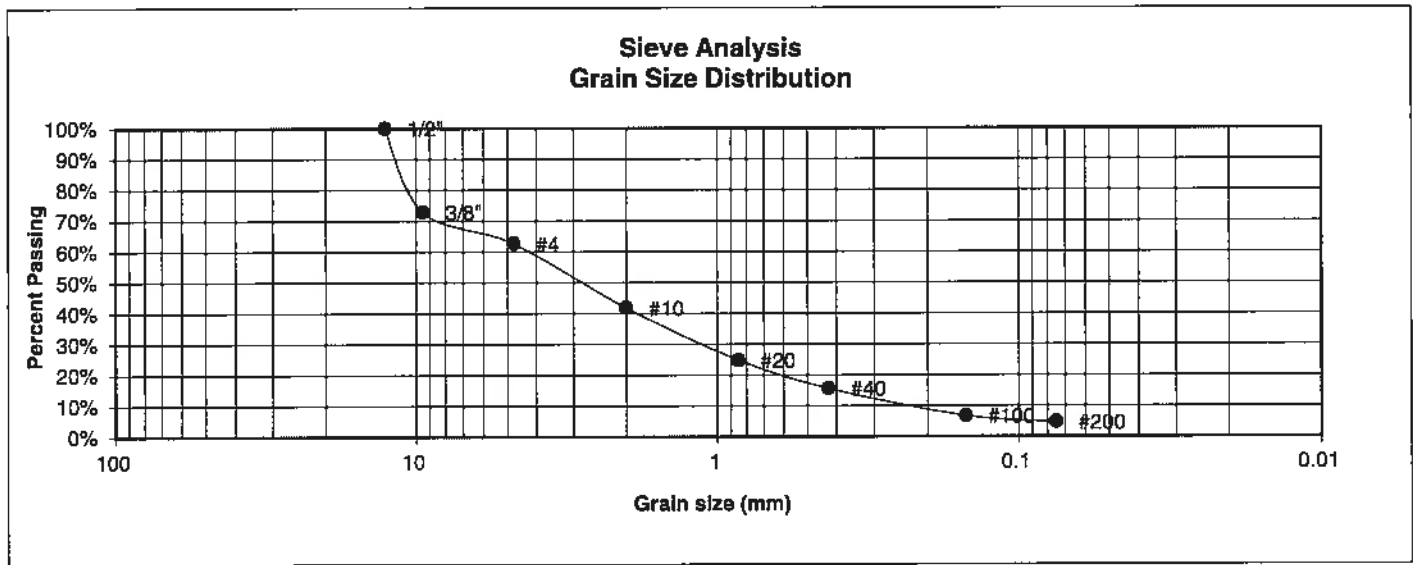
**LABORATORY TEST  
 RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/27/22

JOB NO.:  
 221305

FIG NO.:  
 B-1

<u>UNIFIED CLASSIFICATION</u>	SW	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	72.8%
4	62.6%
10	41.8%
20	24.8%
40	15.6%
100	6.7%
200	4.7%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

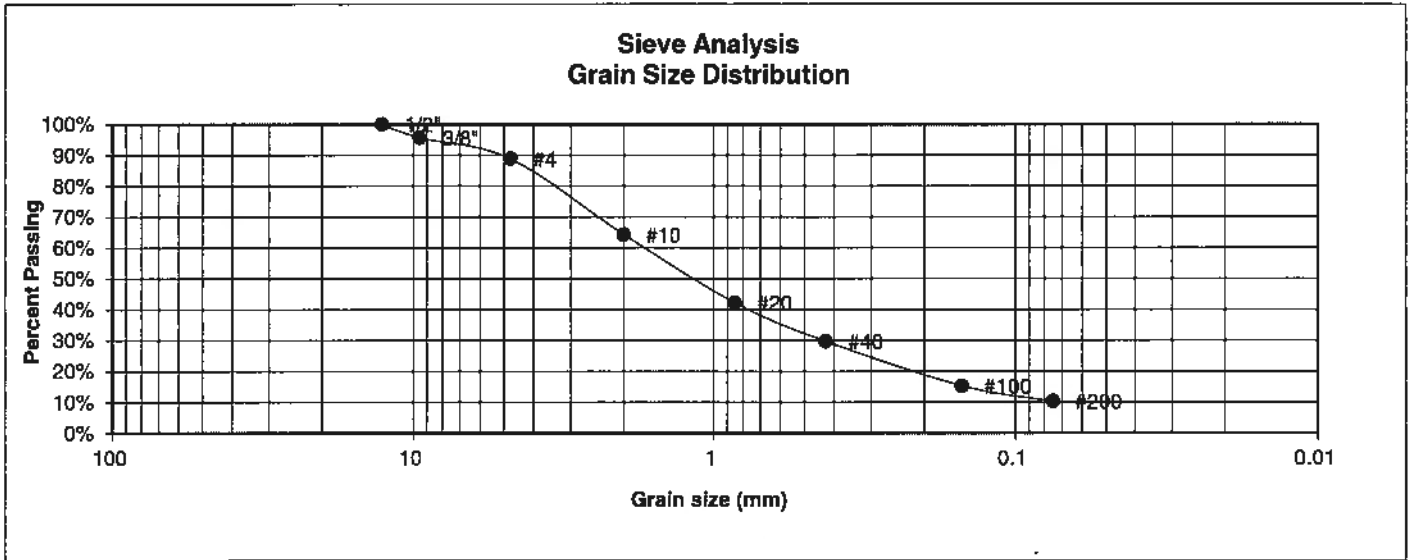
<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 6/27/22
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JOB NO.:  
221305

FIG NO.:

B-Z

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	8	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.5%
4	88.8%
10	64.3%
20	42.2%
40	29.7%
100	15.3%
200	10.2%

- 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

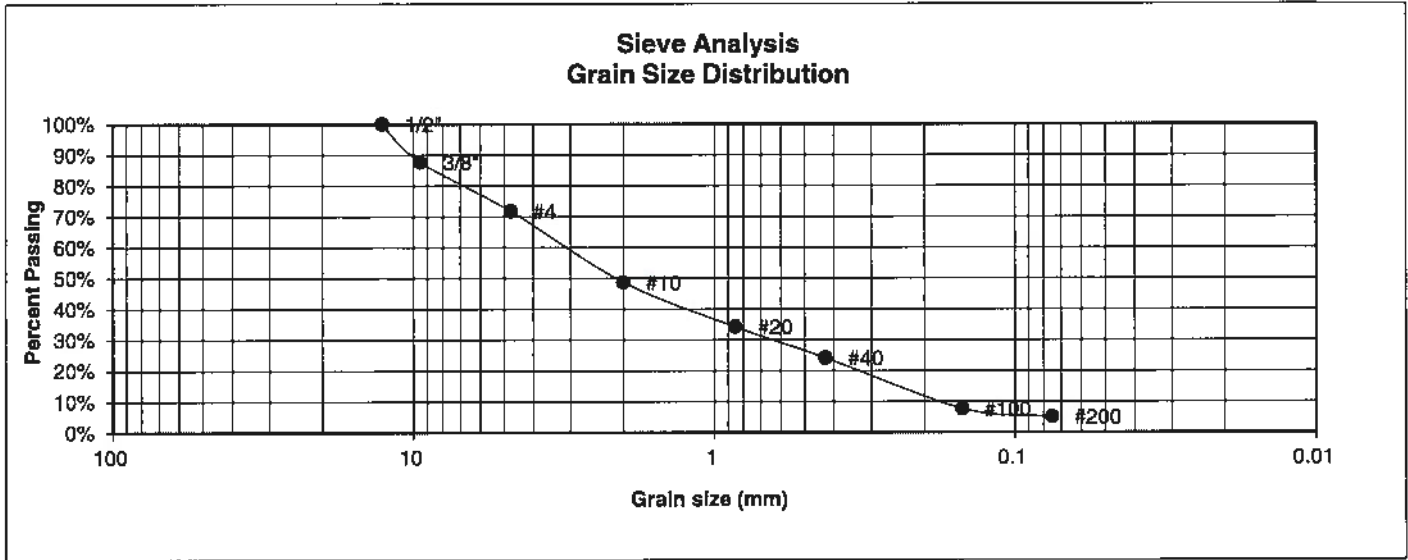
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 6/27/22
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JOB NO.:  
221305

FIG NO.:  
B-3

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	87.7%
4	71.8%
10	48.6%
20	34.2%
40	24.1%
100	7.7%
200	5.1%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

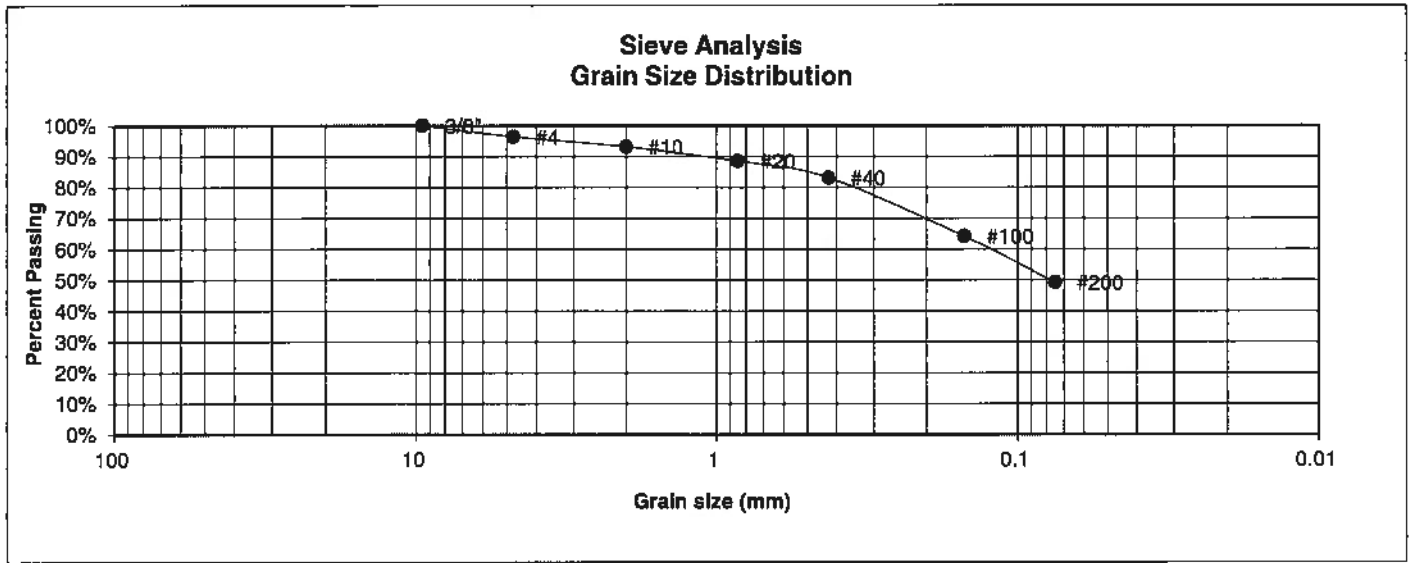
<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 6/27/22
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JOB NO.:  
221305

FIG NO.:

B-4

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	9	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.4%
10	93.2%
20	88.5%
40	83.1%
100	64.2%
200	49.1%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED:  
LLL

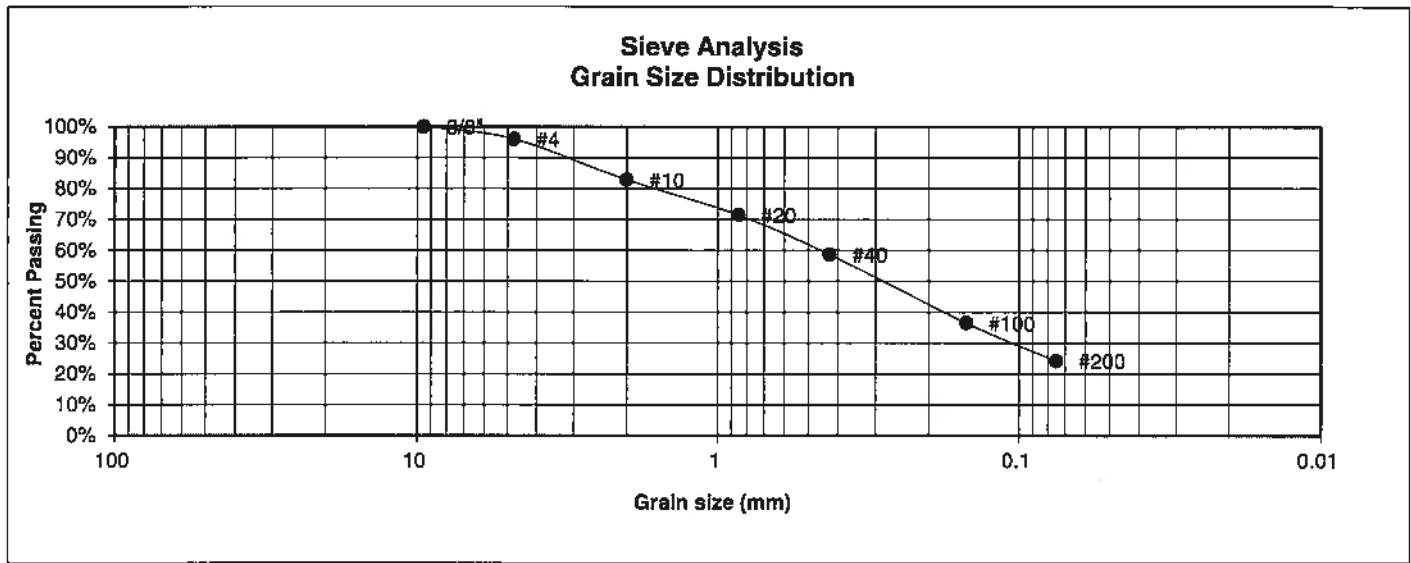
DATE:  
6/27/22

JOB NO.:  
221305

FIG NO.:

B-5

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	10	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.0%
10	82.8%
20	71.4%
40	58.6%
100	36.5%
200	24.2%

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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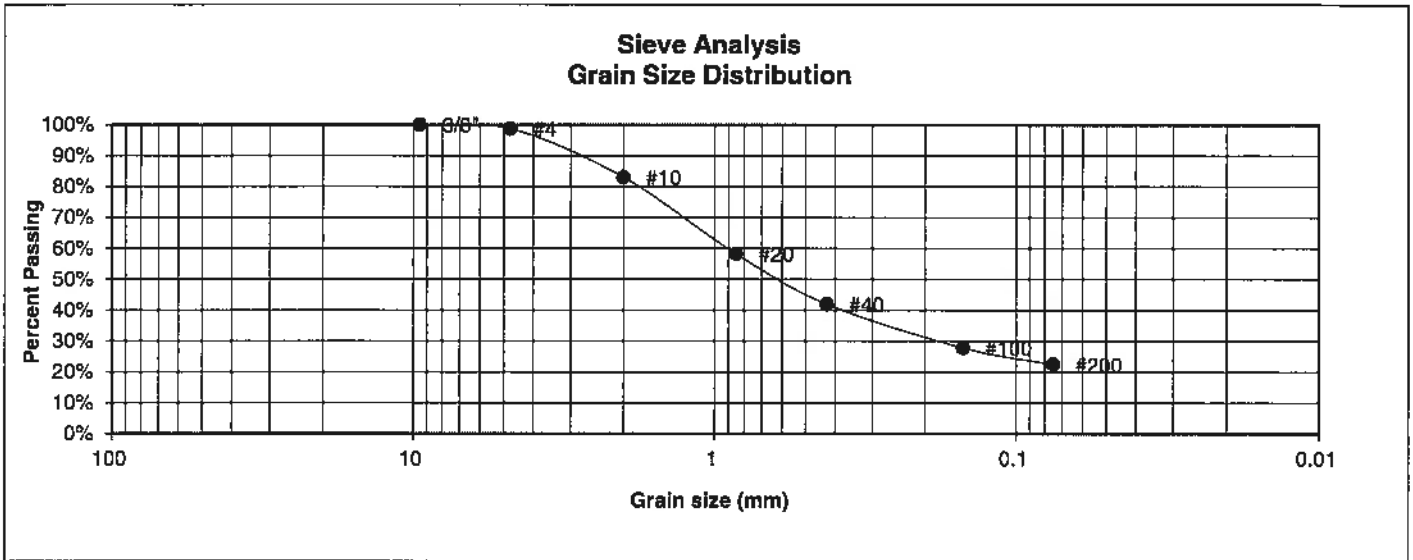
**LABORATORY TEST  
 RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 6/27/22
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JOB NO.:  
221305

FIG NO.:  
B-4

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	11	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.7%
10	83.0%
20	58.2%
40	41.9%
100	27.8%
200	22.4%

- 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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 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

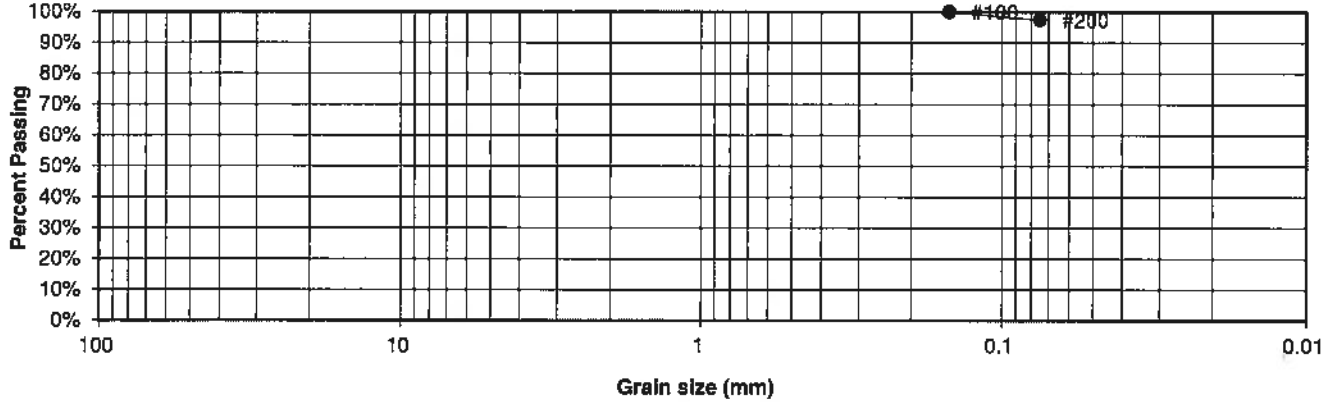
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JOB NO.:  
221305

FIG NO.:  
B-7

<u>UNIFIED CLASSIFICATION</u>	ML	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	5	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	15	<u>TEST BY</u>	BL

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	
100	100.0%
200	97.4%

<u>Atterberg Limits</u>	
Plastic Limit	28
Liquid Limit	49
Plastic Index	21

<u>Swell</u>	
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**

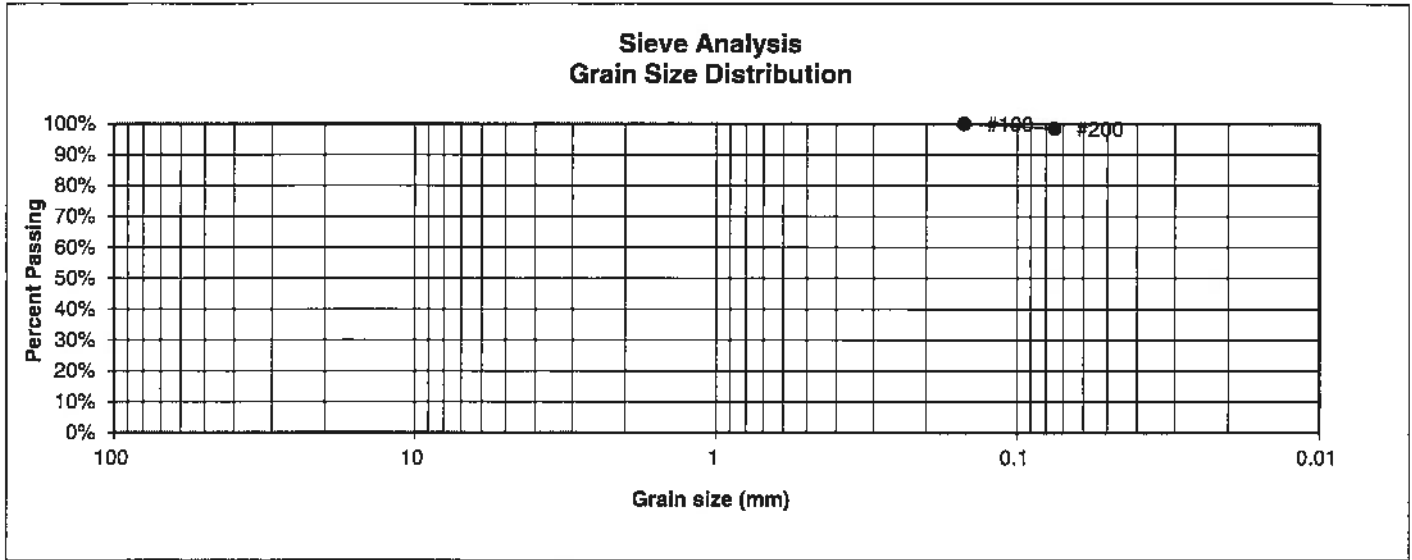
DRAWN:	DATE:	CHECKED: <i>LLL</i>	DATE: <i>6/27/22</i>
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JOB NO.:  
221305

FIG NO.:  
*B-8*



<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	7	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	15	<u>TEST BY</u>	BL



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

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

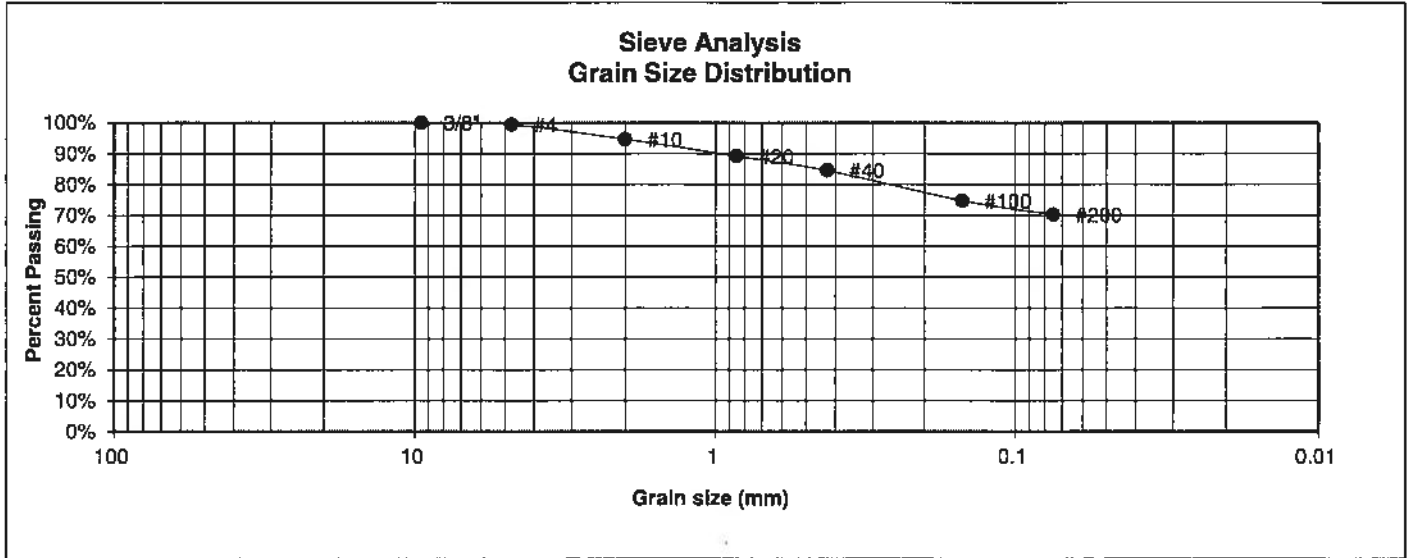
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 6/27/22
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JOB NO.:  
221305

FIG NO.:  
B-9

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	12	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	94.7%
20	89.2%
40	84.5%
100	74.7%
200	70.2%

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

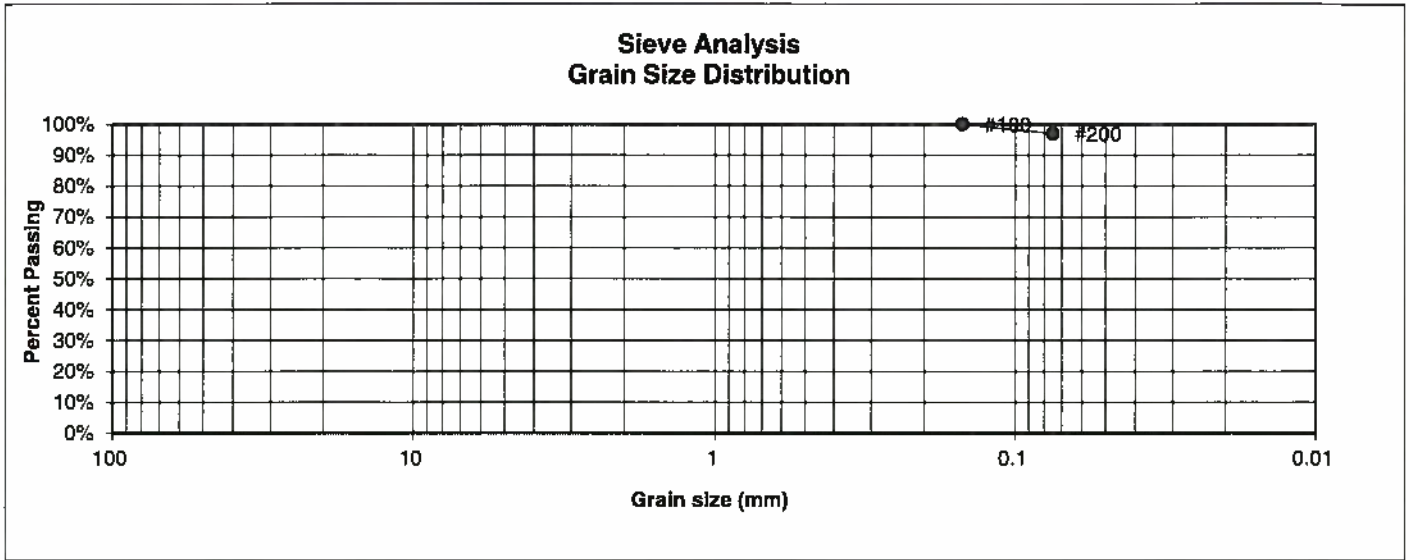
**LABORATORY TEST  
 RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> L.L.L.	<u>DATE:</u> 6/27/22
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JOB NO.:  
221305

FIG NO.:  
B-10

<b>UNIFIED CLASSIFICATION</b>	ML	<b>CLIENT</b>	FRONT ROW PROPERTIES
<b>SOIL TYPE #</b>	3	<b>PROJECT</b>	SOUTHMOOR DRIVE
<b>TEST BORING #</b>	2	<b>JOB NO.</b>	221305
<b>DEPTH (FT)</b>	15	<b>TEST BY</b>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	
100	100.0%
200	97.0%

Atterberg Limits	
Plastic Limit	28
Liquid Limit	44
Plastic Index	16

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

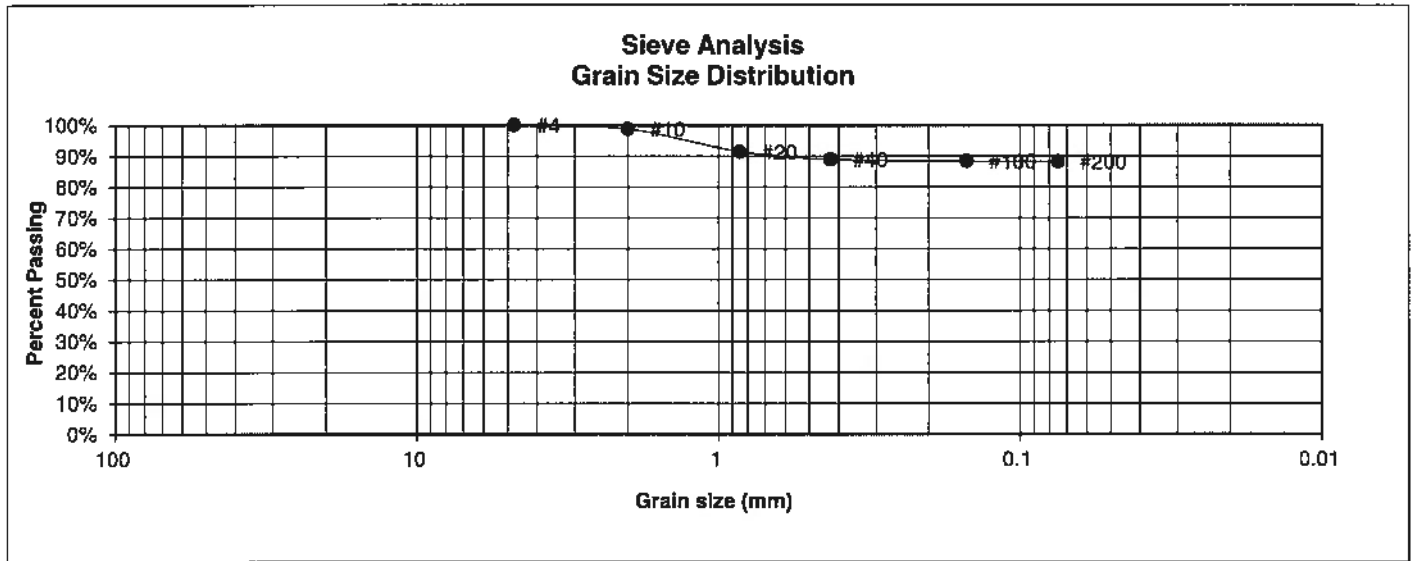
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/27/22

JOB NO.:  
221305

FIG NO.:  
B-11

<u>UNIFIED CLASSIFICATION</u>	ML	<u>CLIENT</u>	FRONT ROW PROPERTIES
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	SOUTHMOOR DRIVE
<u>TEST BORING #</u>	3	<u>JOB NO.</u>	221305
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.8%
20	91.4%
40	88.9%
100	88.3%
200	88.2%

Atterberg Limits	
Plastic Limit	26
Liquid Limit	40
Plastic Index	14

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: LLL	DATE: 6/27/22
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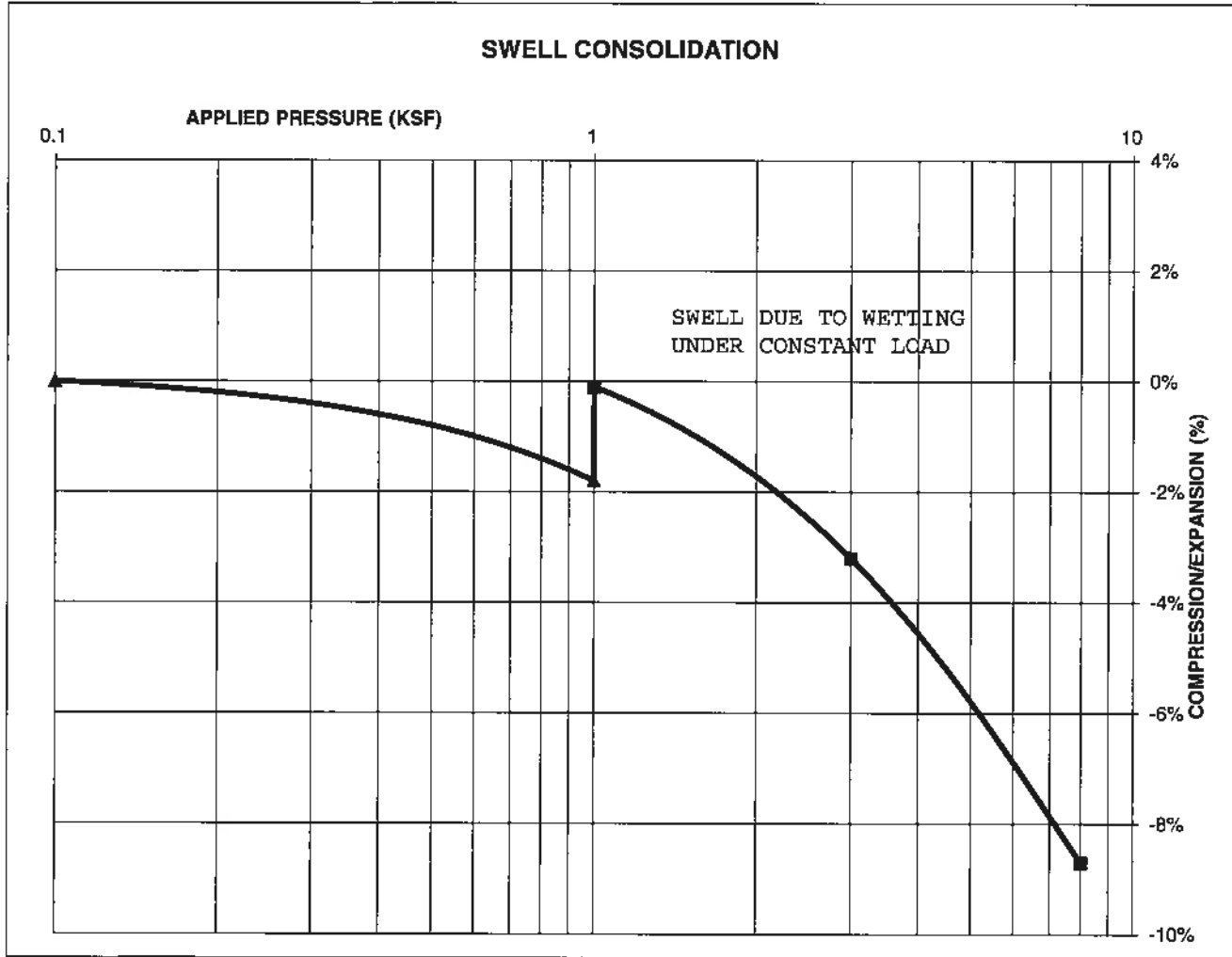
JOB NO.:  
221305

FIG NO.:  
B-12

**CONSOLIDATION TEST RESULTS**

TEST BORING #	5	DEPTH(ft)	15
DESCRIPTION	ML	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			100
NATURAL MOISTURE CONTENT			14.9%
SWELL/CONSOLIDATION (%)			1.7%

JOB NO. 221305  
 CLIENT FRONT ROW PROPERTIES  
 PROJECT SOUTHMOOR DRIVE



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION  
 TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

LLL

6/27/22

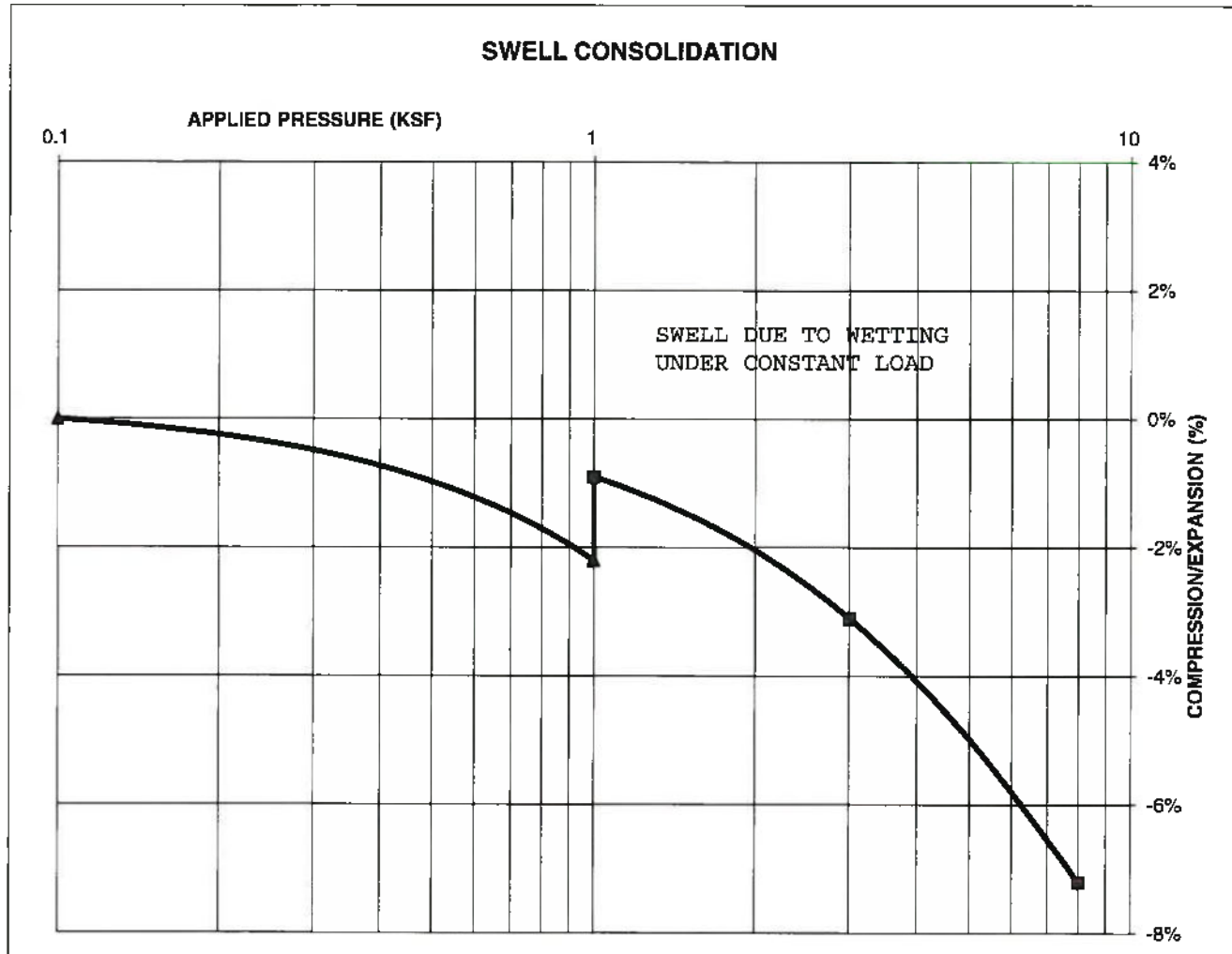
JOB NO:  
 221305

FIG NO:  
 B-13

**CONSOLIDATION TEST RESULTS**

TEST BORING #	7	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	98		
NATURAL MOISTURE CONTENT	21.9%		
SWELL/CONSOLIDATION (%)	1.3%		

JOB NO. 221305  
 CLIENT FRONT ROW PROPERTIES  
 PROJECT SOUTHMOOR DRIVE



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505 ELKTON DRIVE  
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**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 6/27/22
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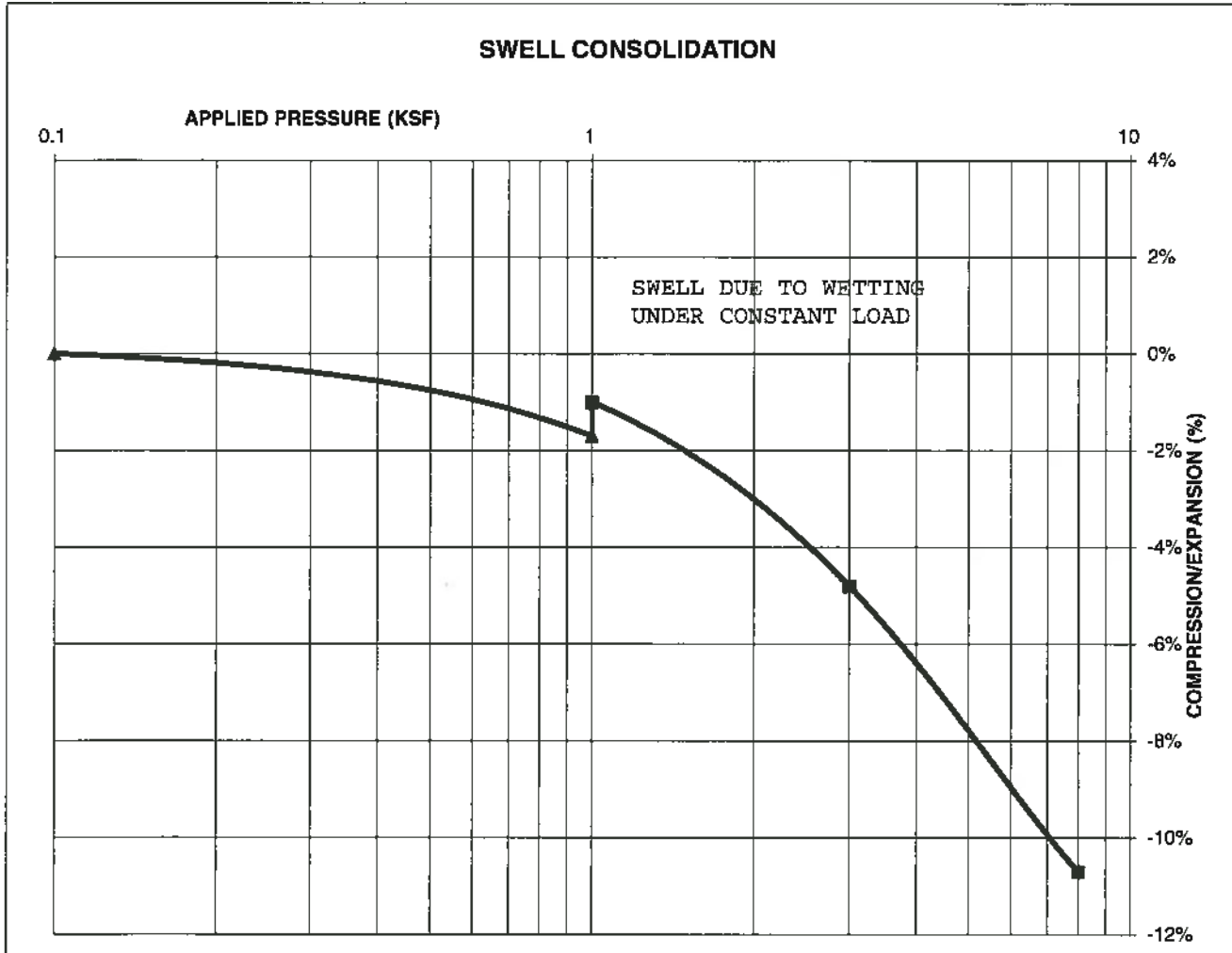
JOB NO.:  
221305

FIG NO.:  
B-14

**CONSOLIDATION TEST RESULTS**

TEST BORING #	12	DEPTH(ft)	20
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			89
NATURAL MOISTURE CONTENT			23.4%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 221305  
 CLIENT FRONT ROW PROPERTIES  
 PROJECT SOUTHMOOR DRIVE



**ENTECH**  
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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *LLL*

DATE: *6/27/22*

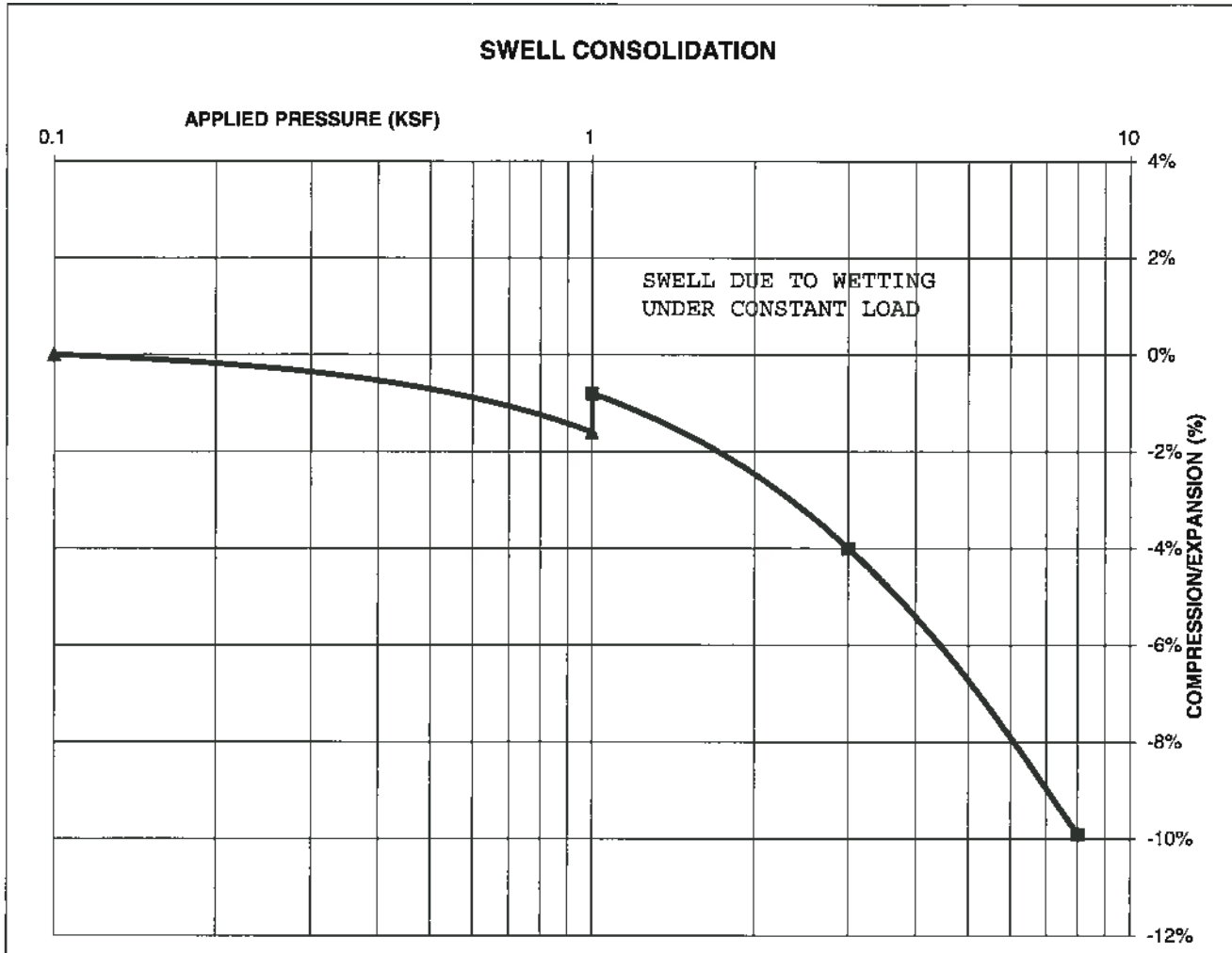
JOB NO.:  
 221305

FIG NO.:  
*B-15*

**CONSOLIDATION TEST RESULTS**

TEST BORING #	2	DEPTH(ft)	15
DESCRIPTION	ML	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			98
NATURAL MOISTURE CONTENT			15.1%
SWELL/CONSOLIDATION (%)			0.8%

JOB NO. 221305  
 CLIENT FRONT ROW PROPERTIES  
 PROJECT SOUTHMOOR DRIVE



**ENTECH**  
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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION  
 TEST RESULTS

DRAWN:

DATE:

CHECKED:  
*LLL*

DATE:

*6/27/22*

JOB NO.:  
 221305

FIG NO.:  
*B-16*



CLIENT	<u>FRONT ROW PROPERTIES</u>	JOB NO.	<u>221305</u>
PROJECT	<u>SOUTHMOOR DRIVE</u>	DATE	<u>6/22/2022</u>
LOCATION	<u>SOUTHMOOR DRIVE</u>	TEST BY	<u>BL</u>

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	2-3	1	SC	<0.01
TB-2	15	3	ML	0.00
TB-3	20	3	ML	0.02
TB-5	15	2	ML	<0.01

QC BLANK PASS



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
SULFATE RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<u>LLL</u>	<u>6/27/22</u>

JOB NO.:  
221305

FIG NO.:  
B-17



**APPENDIX C: EEI, Infiltration Rates (Percolation  
Test Method), Job No. 222077**



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO 80907  
PHONE (719) 531-5599  
FAX (719) 531-5238

October 26, 2022

Front Row Properties  
1378 Promontory Bluff View  
Colorado Springs, CO 80921

Attn: Ron Waldthausen

Re: Infiltration Rates (Percolation Test Method)  
Southmoor Drive  
Parcel Nos. 6513314015, 6513300021, 6524200052, and 6524200053  
Fountain, Colorado

Dear Mr. Waldthausen:

As requested, personnel of Entech Engineering, Inc. have performed percolation testing at the above referenced site to evaluate the site soils to determine the infiltration rate for the proposed detention pond.

The testing was performed on October 21, 2022. The site vicinity map is shown in Figure 1 and the test locations are shown in Figure 2. The Test Boring Logs, Percolation Test results, Infiltration Rates, and Laboratory Test results are shown in Figures 3 through 11. Soils encountered in the profile and percolation hole consisted of silty to very silty sand. Bedrock and groundwater were not encountered in the profile holes, which was drilled to 10 feet.

The percolation rates were 4 minutes/inch for P1, 3 minutes/inch for P2, and 4 minutes/inch for P3. The percolation rates correspond to adjusted average Infiltration Rate of 1.95 inches/hour for pond 1, 3.31 inches/hour for pond 2, and 2.15 inches/hour for pond 3.

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.  
Geologist

LLL/jr

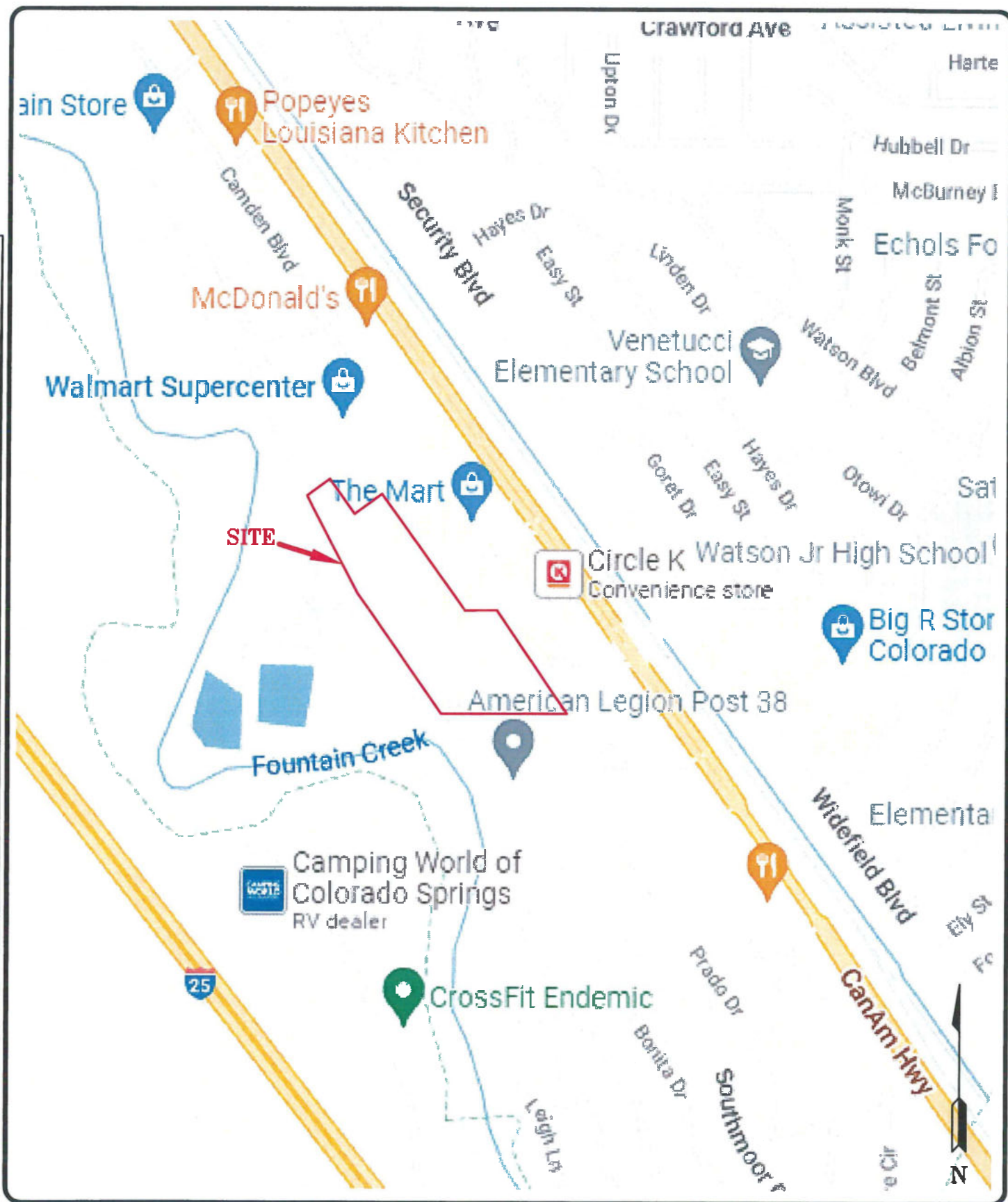
Encl.

Entech Job No. 222077  
AAprojects/2022/222077 Infiltration Rate



Reviewed by:

Austin M. Nossokoff, P.E.  
Project Engineer



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

**VICINITY MAP  
 SOUTHMOOR DRIVE  
 FOUNTAIN, CO  
 FOR: FRONT ROW PROPERTIES**

**DRAWN:**  
 JHR

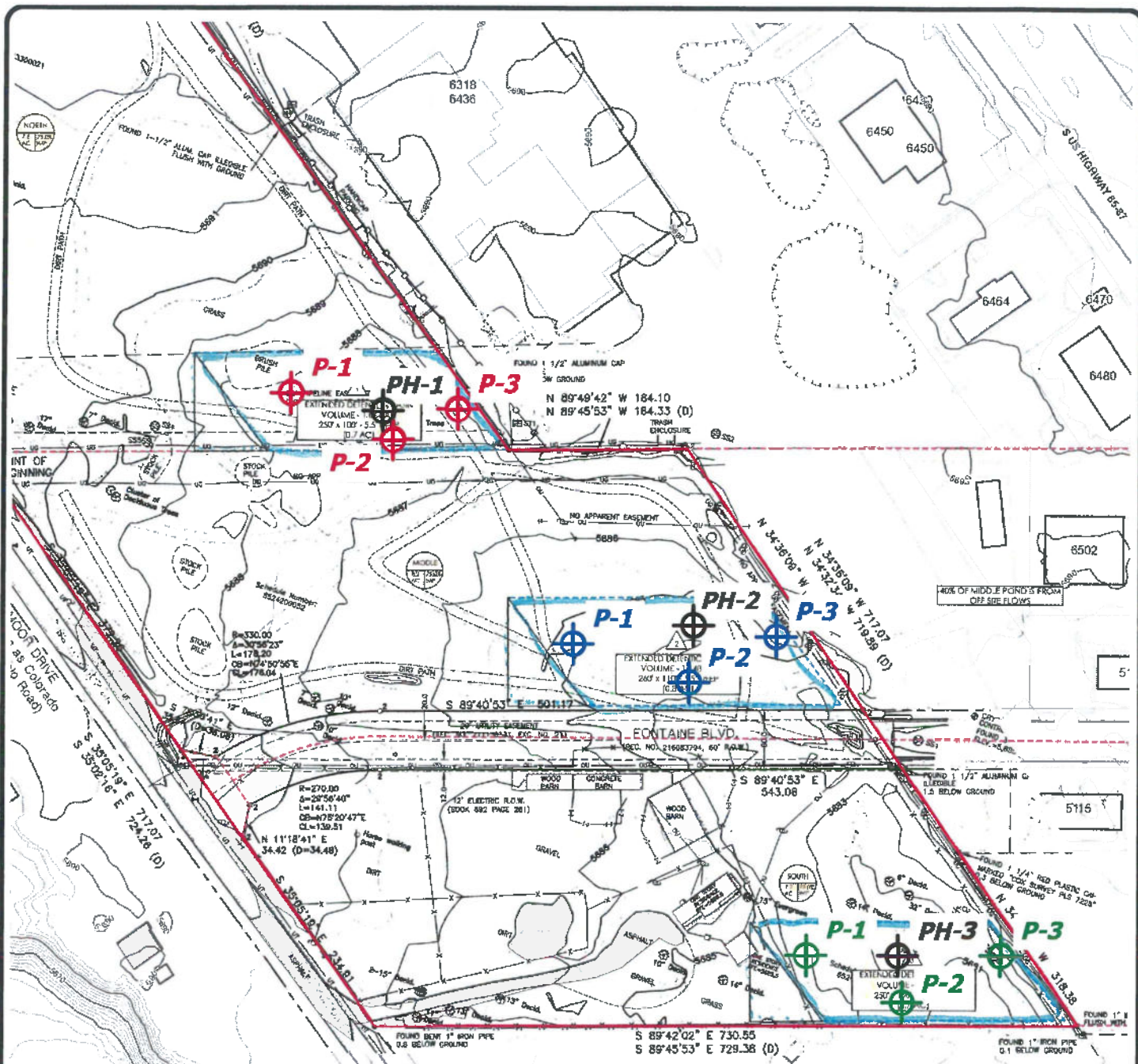
**DATE:**  
 10/21/22





**CHECKED:**  
 LLL

**DATE:**

**JOB NO.:**  
 222077

**FIG NO.:**  
 1



-  **PH- APPROXIMATE PROFILE HOLE LOCATION AND NUMBER**
-  **P- APPROXIMATE PERCOLATION HOLE LOCATION AND NUMBER (POND 1)**
-  **P- APPROXIMATE PERCOLATION HOLE LOCATION AND NUMBER (POND 2)**
-  **P- APPROXIMATE PERCOLATION HOLE LOCATION AND NUMBER (POND 3)**




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

**SITE PLAN/PERCOLATION HOLE LOCATION MAP**  
SOUTHMOOR DRIVE  
FOUNTAIN, COLORADO  
FOR: FRONT ROW PROPERTIES

DRAWN: JHR	DATE: 10/21/22	CHECKED: LLL	DATE:
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JOB NO.:  
**222077**

FIG NO.:  
**2**

TEST BORING NO. 1  
 DATE DRILLED 10/19/2022  
 Job # 222077

TEST BORING NO. 2  
 DATE DRILLED 10/19/2022  
 CLIENT FRONT ROW PROPERTIES  
 LOCATION SOUTHMOOR DRIVE

REMARKS

REMARKS

DRY TO 10', 10/19/22

DRY TO 10', 10/19/22

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

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

\* - BULK SAMPLE TAKEN

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
				23	3.5						24	6.7	
	5			26	1.3			5			12	4.4	
	10			*	1.4			10			30	4.6	
	15							15					
	20							20					



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

JHR

10-21-22

JOB NO.:  
 222077

FIG NO.:

3

TEST BORING NO. 3  
 DATE DRILLED 10/19/2022  
 Job # 222077

TEST BORING NO.  
 DATE DRILLED  
 CLIENT  
 LOCATION FRONT ROW PROPERTIES  
 SOUTHMOOR DRIVE

REMARKS

REMARKS

DRY TO 10', 10/19/22

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

\* - BULK SAMPLE TAKEN

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			20	6.0		5					
10			*	1.9		10					
15						15					
20						20					



**ENTECH**  
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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

JHR

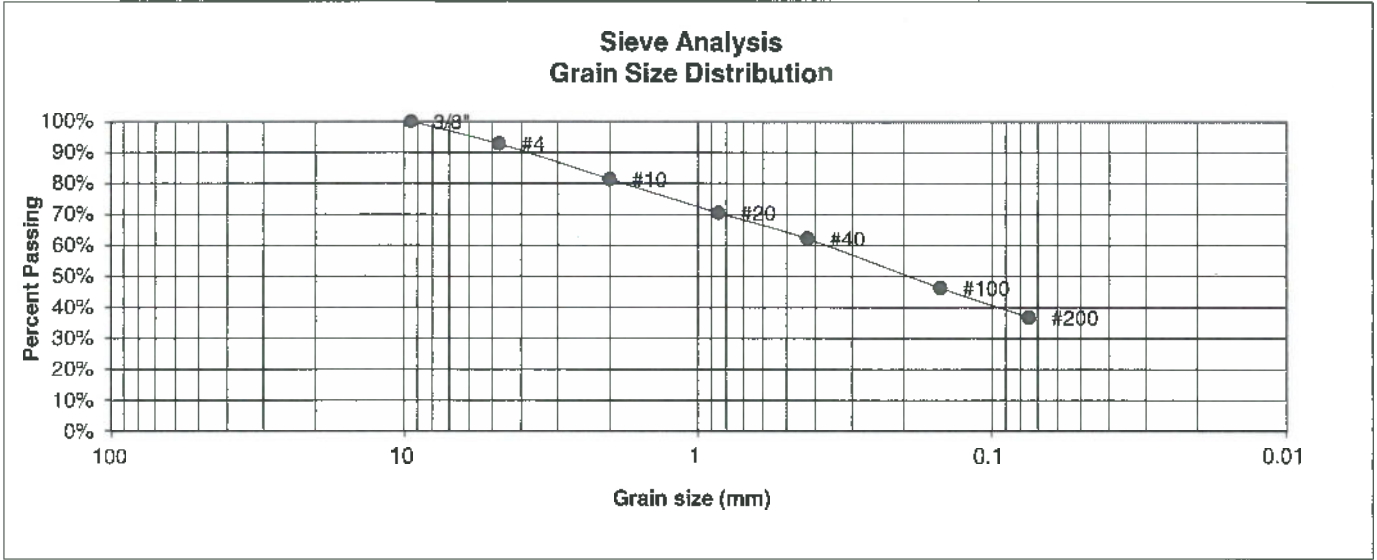
10-21-22

JOB NO.:  
 222077

FIG NO.:

4

BORING NO.	PH-1	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	2-3	AASHTO CLASSIFICATION		JOB NO.	222077
CLIENT	FRONT ROW PROPERTIES				
PROJECT	SOUTHMOOR DRIVE				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.8%
10	81.3%
20	70.5%
40	62.2%
100	46.3%
200	36.7%

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:
		JHR	10-24-22

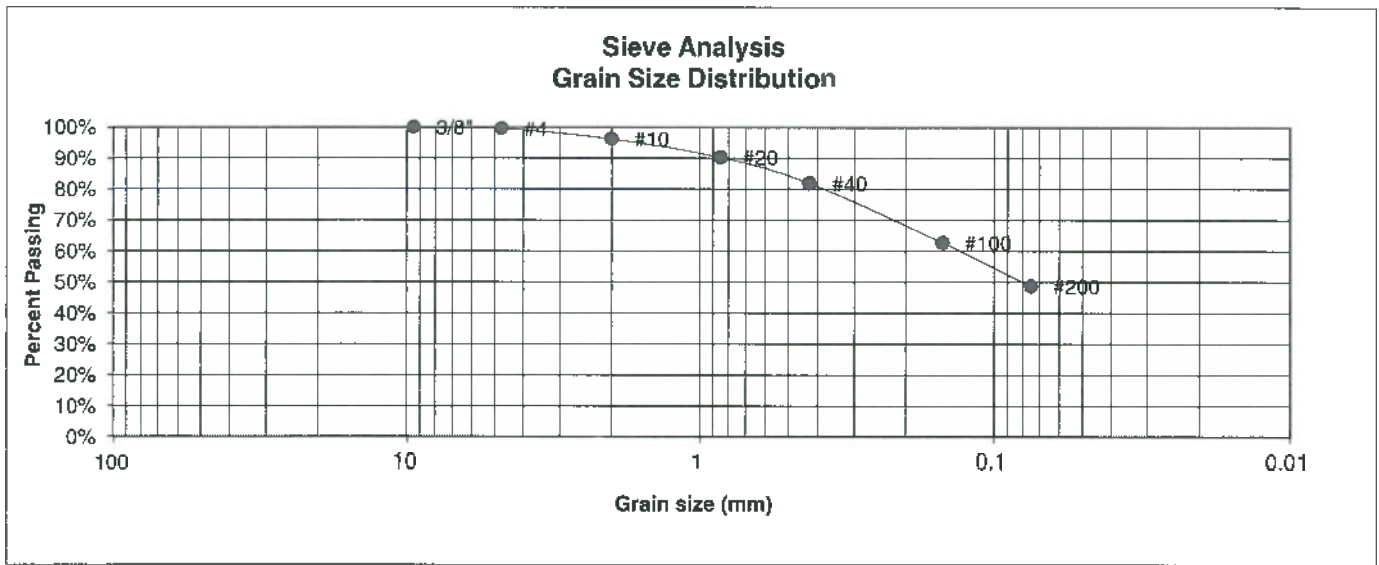
JOB NO.:

FIG NO.:

5



BORING NO.	PH-2	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	2-3	AASHTO CLASSIFICATION		JOB NO.	222077
CLIENT	FRONT ROW PROPERTIES				
PROJECT	SOUTHMOOR DRIVE				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
#4	99.5%
#10	96.2%
#20	90.3%
#40	81.9%
#100	62.7%
#200	48.6%

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

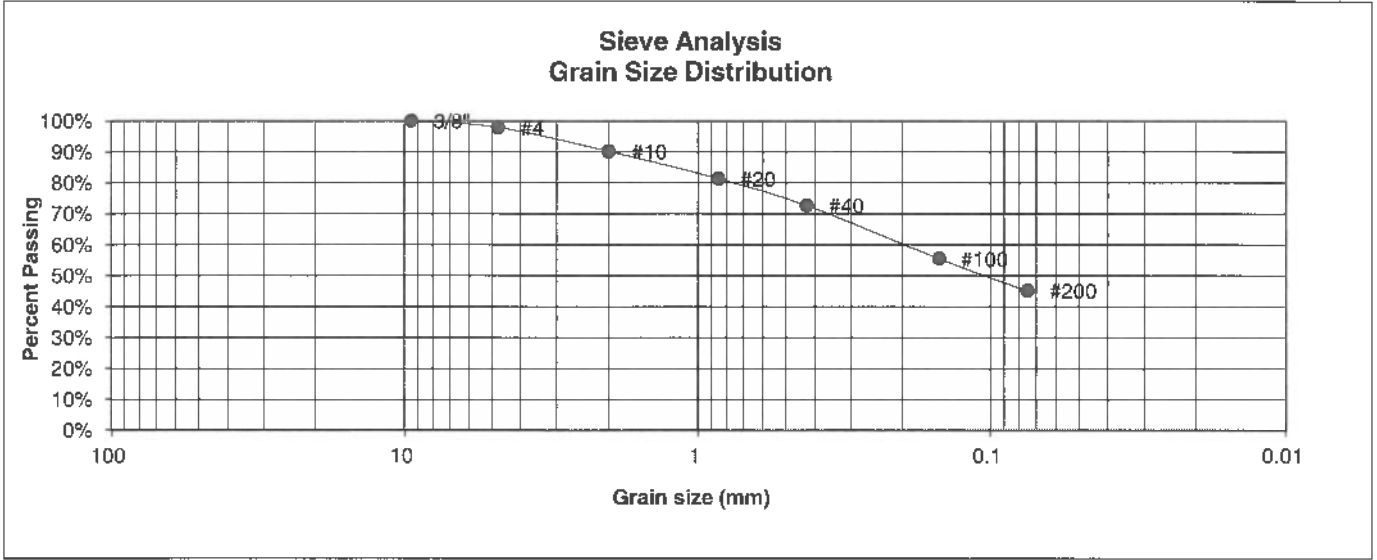
DRAWN:	DATE:	CHECKED:	DATE:
		JHR	10-21-22

JOB NO.:

FIG NO.:

6

BORING NO.	PH-3	<u>UNIFIED CLASSIFICATION</u>	SM	<u>TEST BY</u>	BL
DEPTH(ft)	2-3	<u>AASHTO CLASSIFICATION</u>		<u>JOB NO.</u>	222077
CLIENT	FRONT ROW PROPERTIES				
PROJECT	SOUTHMOOR DRIVE				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.8%
10	90.1%
20	81.3%
40	72.6%
100	55.5%
200	45.1%

- 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:
		JMR	10-21-22

JOB NO.:

FIG NO.:

7

Client: Front Row Properties  
Test Location: Southmoor Drive

Job Number: 222077

### PERCOLATION HOLES #1

Date Holes Prepared: 10/19/2022

Date Hole Completed: 10/20/2022

Hole No. 1

Depth: 59"

Hole No. 2

Depth: 61"

Hole No. 3

Depth: 70"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	5	1	1	5	2	1	5	1
2	5	2	2	5	2	2	5	1
3	5	1	3	5	2	3	5	1

Perc Rate (min./in.): 4

Perc Rate (min./in.): 2.5

Perc Rate (min./in.): 5

Average Perc Rate (min./in.) 4

### PROFILE HOLE

Date Profile Hole Completed: 10/19/2022

Depth

0-10'

Visual Classification

Sand, silty, fine to coarse grained, tan

Remarks

No Bedrock  
No Groundwater

23 Blows / ft. @ 2'

26 Blows / ft. @ 4'

Remarks:

GPS Coordinates: 38° 73.74694' N, -104° 73.4822' W

Observer: N. Schletzbaum

By:



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### PERCOLATION TEST RESULTS

DRAWN:

DATE:

CHECKED: JHR

DATE: 10/21/22

JOB NO.:

222077

FIG NO.:

8

Client: Front Row Properties  
Test Location: Southmoor Drive

Job Number: 222077

### PERCOLATION HOLES #2

Date Holes Prepared: 10/19/2022

Date Hole Completed: 10/20/2022

Hole No. 4  
Depth:

Hole No. 5  
Depth:

Hole No. 6  
Depth:

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	5	1 1/2	1	5	0	1	5	3
2	5	1/2	2	5	0	2	5	2
3	5	1	3	5	1	3	5	2

Perc Rate (min./in.): 3 1/2

Perc Rate (min./in.): 2

Perc Rate (min./in.): 2

Average Perc Rate (min./in.) 3

### PROFILE HOLE

Date Profile Hole Completed: 10/19/2022

Depth                      Visual Classification  
0-10'                      Sand, very silty, fine to coarse grained, tan

Remarks  
No Bedrock  
No Groundwater

24 Blows / ft. @ 2'  
12 Blows / ft. @ 4'  
30 Blows / ft. @ 9'

Remarks:

GPS Coordinates: 38° 73.76873' N, -104° 73.3695' W

Observer: N. Schletzbaum

By:



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### PERCOLATION TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

JHR

10-22-22

JOB NO.:

FIG NO.:

9

Client: Front Row Properties  
Test Location: Southmoor Drive

Job Number: 222077

### PERCOLATION HOLES #3

Date Holes Prepared: 10/19/2022

Date Hole Completed: 10/20/2022

Hole No. 7  
Depth:

Hole No. 8  
Depth:

Hole No. 9  
Depth:

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	5	1	1	5	2	1	5	2
2	5	1	2	5	1	2	5	1
3	5	1	3	5	1	3	5	2

Perc Rate (min./in.): 5

Perc Rate (min./in.): 4

Perc Rate (min./in.): 3

Average Perc Rate (min./in.) 4

### PROFILE HOLE

Date Profile Hole Completed: 10/19/2022

Depth  
0-10'

Visual Classification  
Sand, very silty, fine to coarse grained, tan

Remarks

No Bedrock  
No Groundwater

20 Blows / ft. @ 2'  
15 Blows / ft. @ 4'

Remarks:

GPS Coordinates: 38° 73.59461' N, -104° 73.2943' W

Observer: N. Schletzbaum

By:



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### PERCOLATION TEST RESULTS

DRAWN:

DATE:

CHECKED:  
JHR

DATE:  
10-21-22

JOB NO.:

FIG NO.:

10

Infiltration Rate (I) = Percolation Rate (P)/ Reduction Factor(Rf)  
I=P/Rf

CLIENT FRONT ROW PROPERTIES  
PROJECT SOUTHMOOR DRIVE  
JOB NO. 222077

$$R_f = [(2d_1 - \Delta d) / \text{dia}] + 1$$

$d_1$  = initial water depth (in.)

$\Delta d$  = final water level drop (in.)

dia = diameter of the percolation hole (in.)

**Test No. P1 (PH-1)**

Perc Rate= 15 in/hr  
dia = 8

**P1**

$d_1$  = 36.0  
 $\Delta d$  = 1.0  
 $R_f$  = 9.9

I = 1.519 in/hr

(PH-1) I AVG= 1.954 in/hr

**Test No. P2 (PH-1)**

Perc Rate= 24 in/hr  
dia = 8

**P2**

$d_1$  = 26.0  
 $\Delta d$  = 2.0  
 $R_f$  = 7.3

I = 3.310 in/hr

**Test No. P3 (PH-1)**

Perc Rate= 12 in/hr  
dia = 8

**P3**

$d_1$  = 43.0  
 $\Delta d$  = 1.0  
 $R_f$  = 11.6

I = 1.032 in/hr

**Test No. P1 (PH-2)**

Perc Rate= 17.14 in/hr  
dia = 8

**P1**

$d_1$  = 32.0  
 $\Delta d$  = 1.0  
 $R_f$  = 8.9

I = 1.932 in/hr

(PH-2) I AVG= 3.313 in/hr

**Test No. P2 (PH-2)**

Perc Rate= 30.00 in/hr  
dia = 8

**P2**

$d_1$  = 19.0  
 $\Delta d$  = 0.0  
 $R_f$  = 5.8

I = 5.217 in/hr

**Test No. P3 (PH-2)**

Perc Rate= 30 in/hr  
dia = 8

**P3**

$d_1$  = 40.0  
 $\Delta d$  = 2.0  
 $R_f$  = 10.8

I = 2.791 in/hr

**Test No. P1 (PH-3)**

Perc Rate= 12.00 in/hr  
dia = 8

**P1**

$d_1$  = 21.0  
 $\Delta d$  = 1.0  
 $R_f$  = 6.1

I = 1.959 in/hr

(PH-3) I AVG= 2.149 in/hr

**Test No. P2 (PH-3)**

Perc Rate= 15.00 in/hr  
dia = 8

**P2**

$d_1$  = 39.0  
 $\Delta d$  = 1.0  
 $R_f$  = 10.6

I = 1.412 in/hr

**Test No. P3 (PH-3)**

Perc Rate= 20 in/hr  
dia = 8

**P3**

$d_1$  = 23.0  
 $\Delta d$  = 2.0  
 $R_f$  = 6.5

I = 3.077 in/hr



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**INFILTRATION TEST RESULTS**

DRAWN:

DATE:

CHECKED:  
JHL

DATE:  
10-26-22

JOB NO.:

FIG NO.:

11