September 22, 2020

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

Classic Communities
2138 Flying Horse Club Drive
Colorado Springs, Colorado 80921

Attn: Bill Ritchie

Re: Pavement Recommendations
Hannah Ridge at Feathergrass, Filing No. 6
El Paso County, Colorado

SF 18-039

Dear Mr. Ritchie:

As requested, Entech Engineering, Inc. obtained samples of the pavement subgrade soil from the proposed roadways within the above referenced filing. Laboratory testing was performed in order to determine the pavement support characteristics of the soil at proposed subgrade. This letter presents the results of the laboratory testing and pavement recommendations for the local residential roadways within the filing.

Project Description

The project will consist of the paving of sections of Electronic Drive and Pony Club Lane in the Hannah Ridge at Feathergrass, Filing No. 6 Subdivision. Subsurface Soil Investigation and laboratory testing was performed to determine the pavement support characteristics on the soil. The general layout of the site is presented in the Test Boring Location Plan, Figure 1.

Subgrade Conditions

Four test borings were drilled in the roadways in this filing, not exceeding 500 feet between each test boring. The test boring locations are shown in Figure No. 1. The Test Boring Logs are presented in Appendix A. Representative bulk samples of the subgrade soils were obtained from Test Boring No. 3 at the anticipated subgrade elevation. Soils encountered in the test borings consisted of clayey sand fill. The surficial soils were classified into one soil type (Soil Type 1).

Sieve Analyses were performed on the subgrade soils for the purpose of classification. The Sieve Analyses on the Type 1 soils indicated that approximately 28 to 32 percent of the soil particles passed the No. 200 sieve. The Type 1 soils classify as A-2-4 and A-2-6 soils using the AASHTO classification system. Soil Type 1 soils typically provide good pavement support characteristics. Groundwater was not encountered in the test borings during or subsequent to drilling. The results of laboratory testing are presented Appendix B. Water soluble sulfate tests indicated that the soils exhibited a negligible potential for below grade sulfate attack.

Swell/Consolidation testing was required on two soil samples due to their plastic indexes. The testing resulted in swells of 0.1 and 0.8 percent. Based on these results, mitigation for expansive soils is not required in this filing.

California Bearing Ratio (CBR) testing was performed on a sample of the Type 1 subgrade soils. The results of the CBR and classification testing are summarized in Table 1 and presented in the following tables, and in Appendix B, attached.

Soil Type 1 – Clayey Sand Fill

R @ 90% = 71.0
R @ 95% = 75.0
Use R = 50.0 for design

Classification Testing

Liquid Limit	31
Plasticity Index	11
Percent Passing 200	27.9
AASHTO Classification	A-2-6
Group Index	0
Unified Soils Classification	SC

The CBR testing was used to determine pavement sections for this site. The pavement sections were determined utilizing the El Paso County "Pavement Design Criteria and Report". All of the roadways classify as local roadways which used an 18K ESAL value of 292,000 for design. Pavement alternatives for asphalt over aggregate basecourse and cement stabilized subgrade sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability (Local Roads)	80%
Serviceability Index (Local Roads)	2.0
"R" Value Subgrade - Soil Type 1	50.0
Resilient Modulus - Soil Type 1	13,168 psi
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11
Cement Stabilized Subgrade	0.12

Pavement calculations are attached in Appendix C. Pavement sections recommended for the site are summarized as follows:

Pavement Sections – Soil Type 1

	Urban Local – ESAL = 292,000		
Alternative	Asphalt** (in)	Basecourse (in)	Cement Stabilized Subgrade (in.)
1. Asphalt Over Basecourse	3.5	8.0*	--
2. Cement Stabilized Subgrade	4.0*	--	12.0

* Minimum sections required per the El Paso County "Pavement Design Criteria and Report".

Roadway Construction - Full Depth Asphalt and Asphalt on Aggregate Basecourse Alternatives

Prior to placement of the asphalt, the subgrade should be proofrolled and compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 at ±2 percent of optimum moisture content. Any loose areas should be removed and replaced with suitable materials. Basecourse materials should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 at ±2 percent of optimum moisture content. Special attention should be given to areas adjacent to manholes, inlet structures and valves.

Roadway Construction – Cement Stabilized Subgrade Alternative

Prior to placement of the asphalt, the subgrade shall be stabilized by addition of cement to a depth of at least 12 inches. The amount of cement applied shall be 3.0 percent (by weight) of the subgrade's maximum dry density as determined by the Standard Proctor Test (ASTM D-698) based on laboratory cement stabilization testing. The cement should be spread evenly on the subgrade surface and be thoroughly mixed into the subgrade over a 12-inch depth such that a uniform blend of soil and cement is achieved. Prior to application or mixing of the cement, the upper 12-inches of subgrade should be thoroughly moisture conditioned to the soil's optimum water content or as much as 2 percent more than the optimum water content as necessary to provide a compactable soil condition. Densification of the cement-stabilized subgrade should be completed to obtain a compaction of at least 95 percent of the subgrade maximum dry density as determined by the Standard Proctor Test (ASTM D-698). Satisfactory compaction of the subgrade shall occur within 90 minutes from the time of mixing the cement into the subgrade.

The following conditions shall be observed as part of the subgrade stabilization:

- Type I/II cement as supplied; a local supplier shall be used. All cement used for stabilization should come from the same source. If cement sources are changed a new laboratory mix design should be completed.

- Moisture conditioning of the subgrade and/or mixing of the cement into the subgrade shall not occur when soil temperatures are below 40° F. Cement treated subgrades should be maintained at a temperature of 40° F or greater until the subgrade has been compacted as required.

- Cement placement, cement mixing and compaction of the cement treated subgrade should be observed by a Soils Engineer. The Soils Engineer should complete in situ compaction tests and construct representative compacted specimens of the treated subgrade material for subsequent laboratory quality assurance testing.

If significant grading is performed, the soils at subgrade may change. Modification to the pavement sections should be evaluated after site grading is completed.

In addition to the above guidance, the asphalt, cement, subgrade conditions, compaction of materials and roadway construction methods shall meet the El Paso County specifications.

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.

Daniel P. Stegman

DPS/ts
Encl.

Entech Job No. 201225
AAprojects/2020/201225 pr

Reviewed by:

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

TABLE

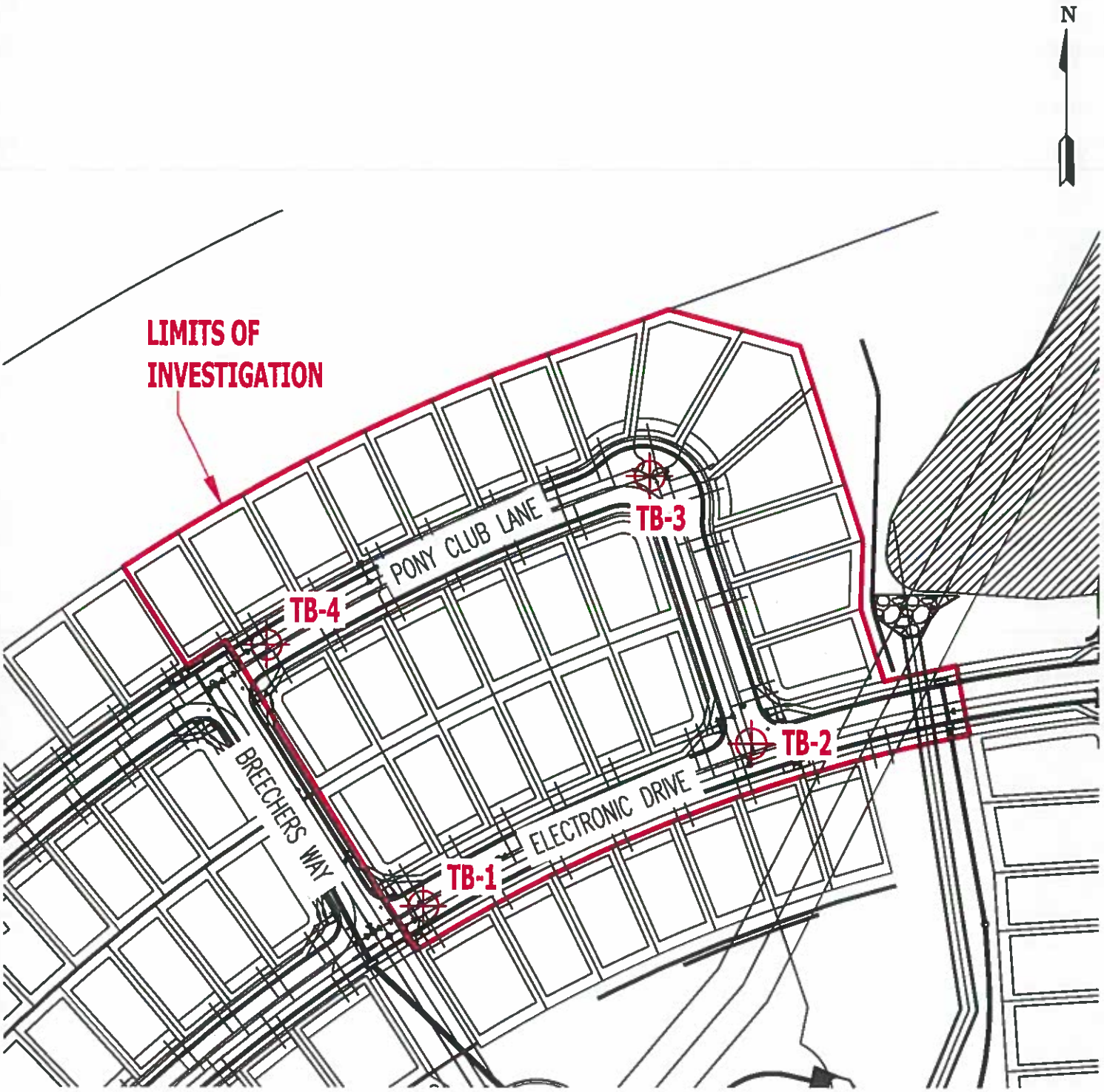
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT CLASSIC COMMUNITIES
PROJECT HANNAH RIDGE, FILING 6
JOB NO. 201225

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	AASHTO CLASS.	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1, CBR	3	0-3			27.9	31	11		A-2-6		SC	FILL, SAND, CLAYEY
1	1	1-2	12.2	116.0	31.9	31	13	<0.01	A-2-6	0.1	SC	FILL, SAND, CLAYEY
1	2	1-2	11.0	110.4	33.0	34	16		A-2-6	0.8	SC	FILL, SAND, CLAYEY
1	3	1-2			32.0	30	9	<0.01	A-2-4		SC	FILL, SAND, CLAYEY
1	4	1-2			29.3	26	10		A-2-4		SC	FILL, SAND, CLAYEY

FIGURE



⊕ TB-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER

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

TEST BORING LOCATION PLAN
HANNAH RIDGE AT FEATHERGRASS, F6
EL PASO COUNTY, CO
FOR: CLASSIC COMMUNITIES

DRAWN BY:	DATE DRAWN:	DESIGNED BY:	CHECKED:
SDJ	9/22/20	DS	DS

JOB NO.: 201225
FIG. NO.: 1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 9/15/2020
Job # 201225

REMARKS

DRY TO 10', 9/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	FILL 0-10', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST		10	10.0	1
5			18	18.0	1
10			23	23.0	1
15					
20					

TEST BORING NO. 2
DATE DRILLED 9/15/2020
CLIENT CLASSIC COMMUNITIES
LOCATION HANNAH RIDGE, FILING 6

REMARKS

DRY TO 5', 9/15/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	FILL 0-5', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE TO DENSE, MOIST		14	10.0	1
5			35	10.2	1
10					
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 9/15/2020
Job # 201225

REMARKS

DRY TO 10', 9/15/20

FILL 0-10', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			23	11.8	1
5			20	11.5	1
10			27	12.6	1
15					
20					

TEST BORING NO. 4
DATE DRILLED 9/15/2020
CLIENT CLASSIC COMMUNITIES
LOCATION HANNAH RIDGE, FILING 6

REMARKS

DRY TO 5', 9/15/20

FILL 0-5', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			23	8.7	1
5			15	5.5	1
10					
15					
20					

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TEST BORING LOG

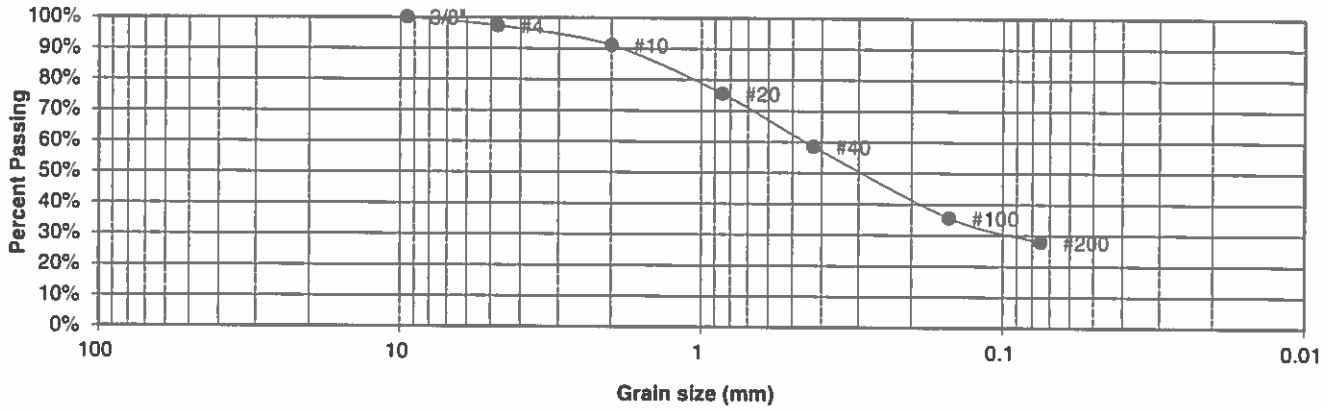
DRAWN:	DATE:	CHECKED: DS	DATE: 9/22/20

JOB NO.: 201225
FIG NO.: A- 2

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1, CBR	PROJECT	HANNAH RIDGE, FILING 6
TEST BORING #	3	JOB NO.	201225
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.3%
10	91.1%
20	75.5%
40	58.5%
100	35.6%
200	27.9%

Atterberg Limits

Plastic Limit	20
Liquid Limit	31
Plastic Index	11

Swell

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

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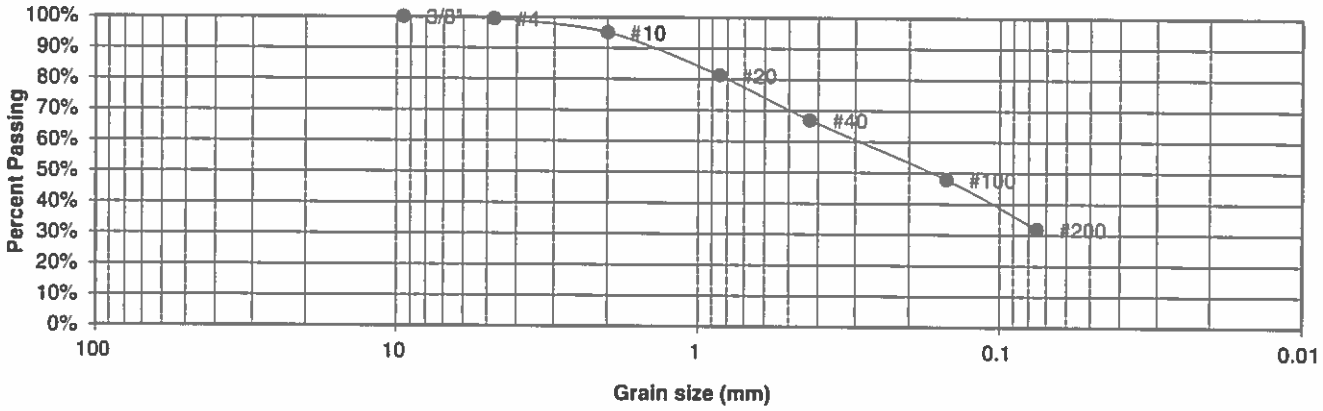
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-1

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	HANNAH RIDGE, FILING 6
TEST BORING #	1	JOB NO.	201225
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	95.0%
20	81.3%
40	66.9%
100	47.8%
200	31.9%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	31
Plastic Index	13

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

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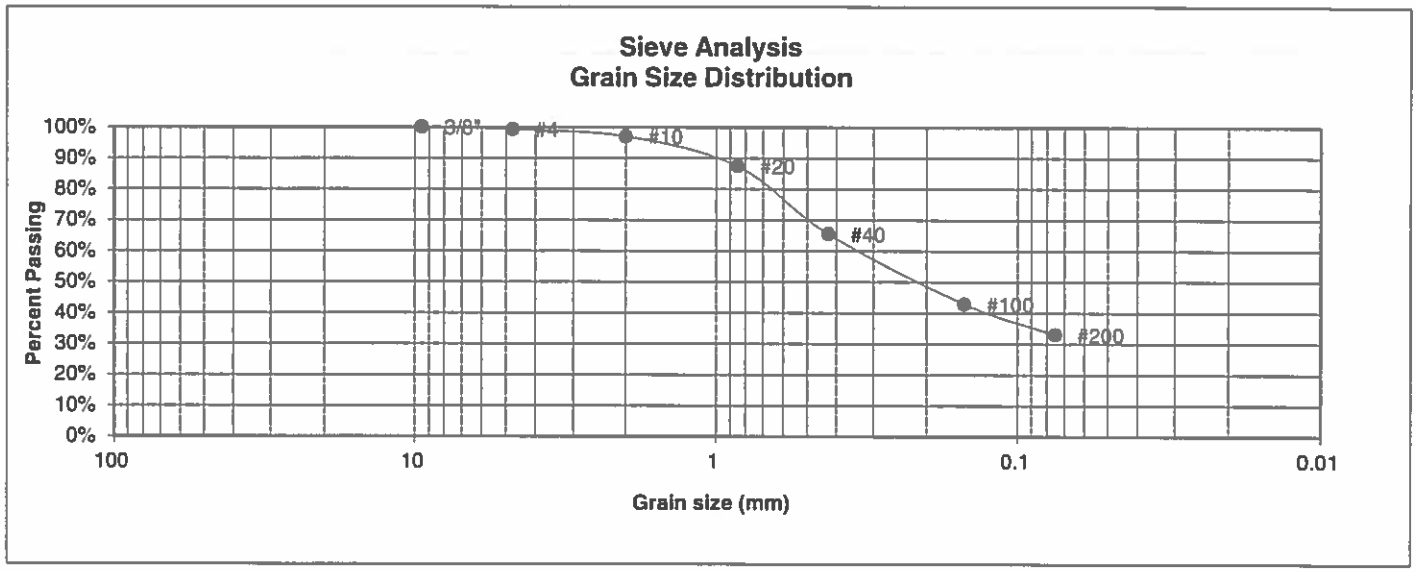
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-2

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	HANNAH RIDGE, FILING 6
TEST BORING #	2	JOB NO.	201225
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	97.0%
20	87.4%
40	65.5%
100	42.9%
200	33.0%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	34
Plastic Index	16

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

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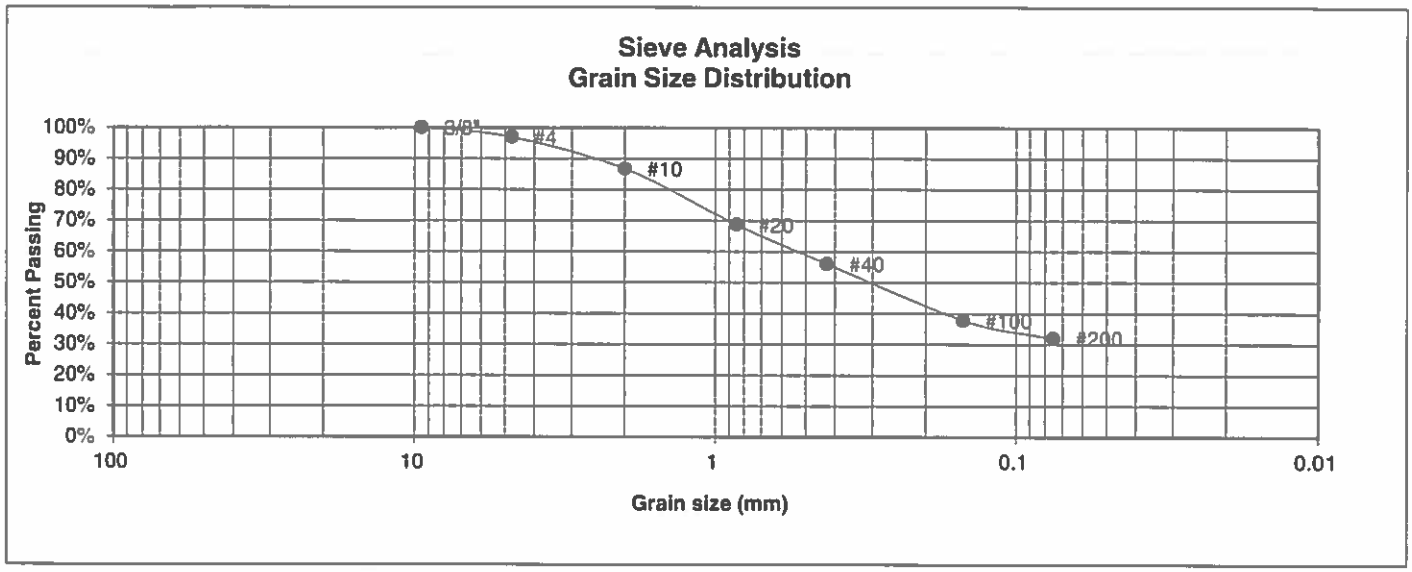
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-3

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	HANNAH RIDGE, FILING 6
TEST BORING #	3	JOB NO.	201225
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.0%
10	86.8%
20	68.7%
40	56.0%
100	37.8%
200	32.0%

Atterberg Limits

Plastic Limit	21
Liquid Limit	30
Plastic Index	9

Swell

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

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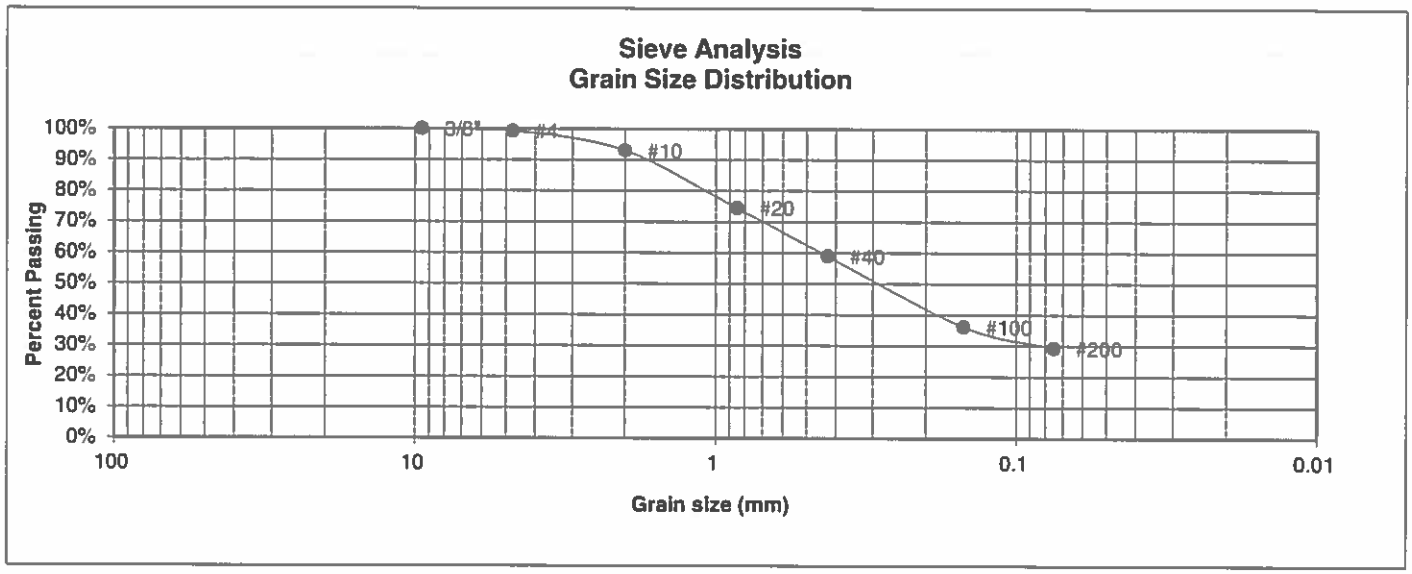
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-4

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	HANNAH RIDGE, FILING 6
TEST BORING #	4	JOB NO.	201225
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	93.0%
20	74.5%
40	58.9%
100	36.1%
200	29.3%

Atterberg Limits	
Plastic Limit	17
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

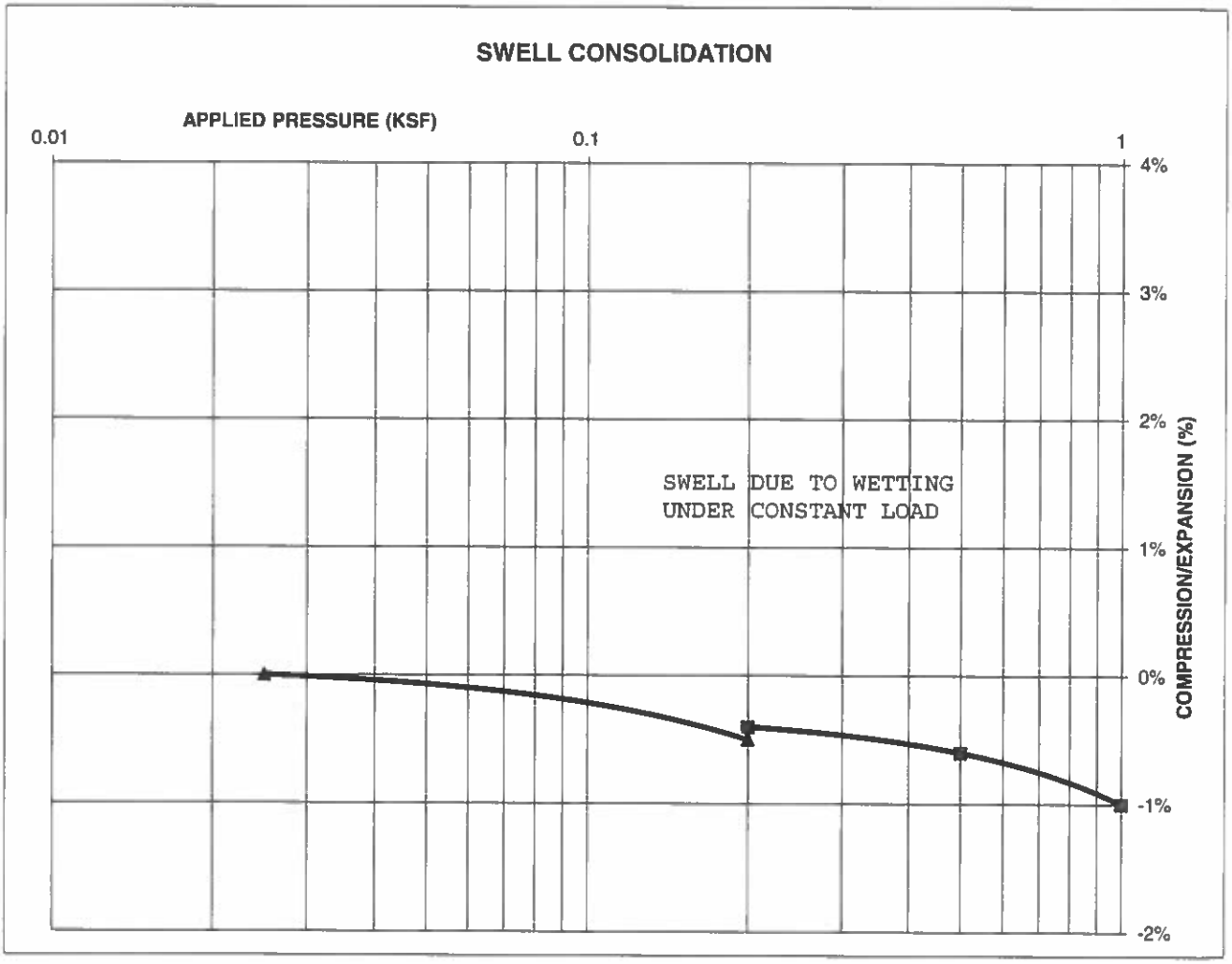
DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-5

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			12.2%
SWELL/CONSOLIDATION (%)			0.1%

JOB NO. 201225
CLIENT CLASSIC COMMUNITIES
PROJECT HANNAH RIDGE, FILING 6



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SWELL CONSOLIDATION
TEST RESULTS

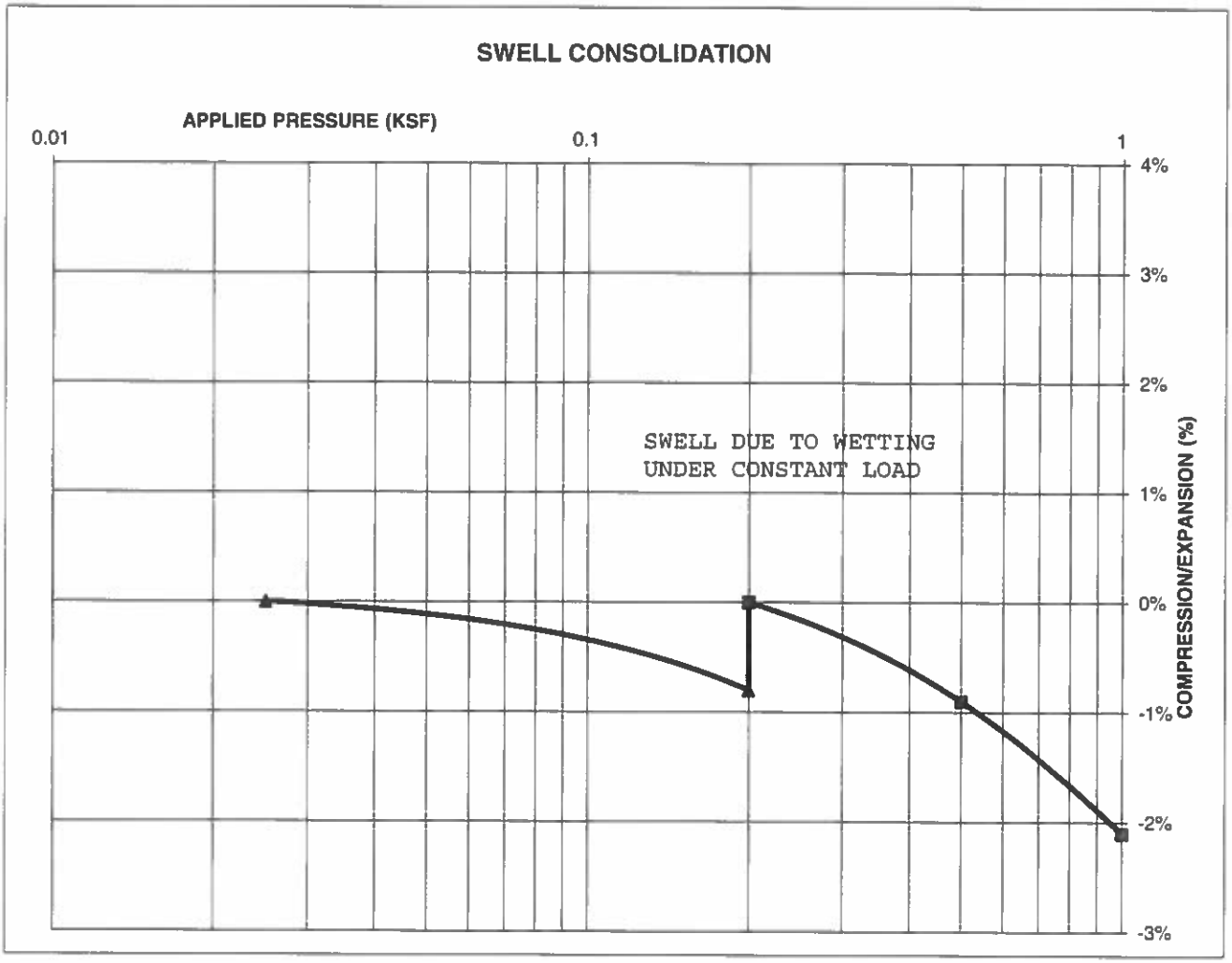
DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-6

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			110
NATURAL MOISTURE CONTENT			11.0%
SWELL/CONSOLIDATION (%)			0.8%

JOB NO. 201225
CLIENT CLASSIC COMMUNITIES
PROJECT HANNAH RIDGE, FILING 6



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-7

CLIENT	CLASSIC COMMUNITIES	JOB NO.	201225
PROJECT	HANNAH RIDGE, FILING 6	DATE	9/17/2020
LOCATION	HANNAH RIDGE, FILING 6	TEST BY	BL

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

QC BLANK PASS

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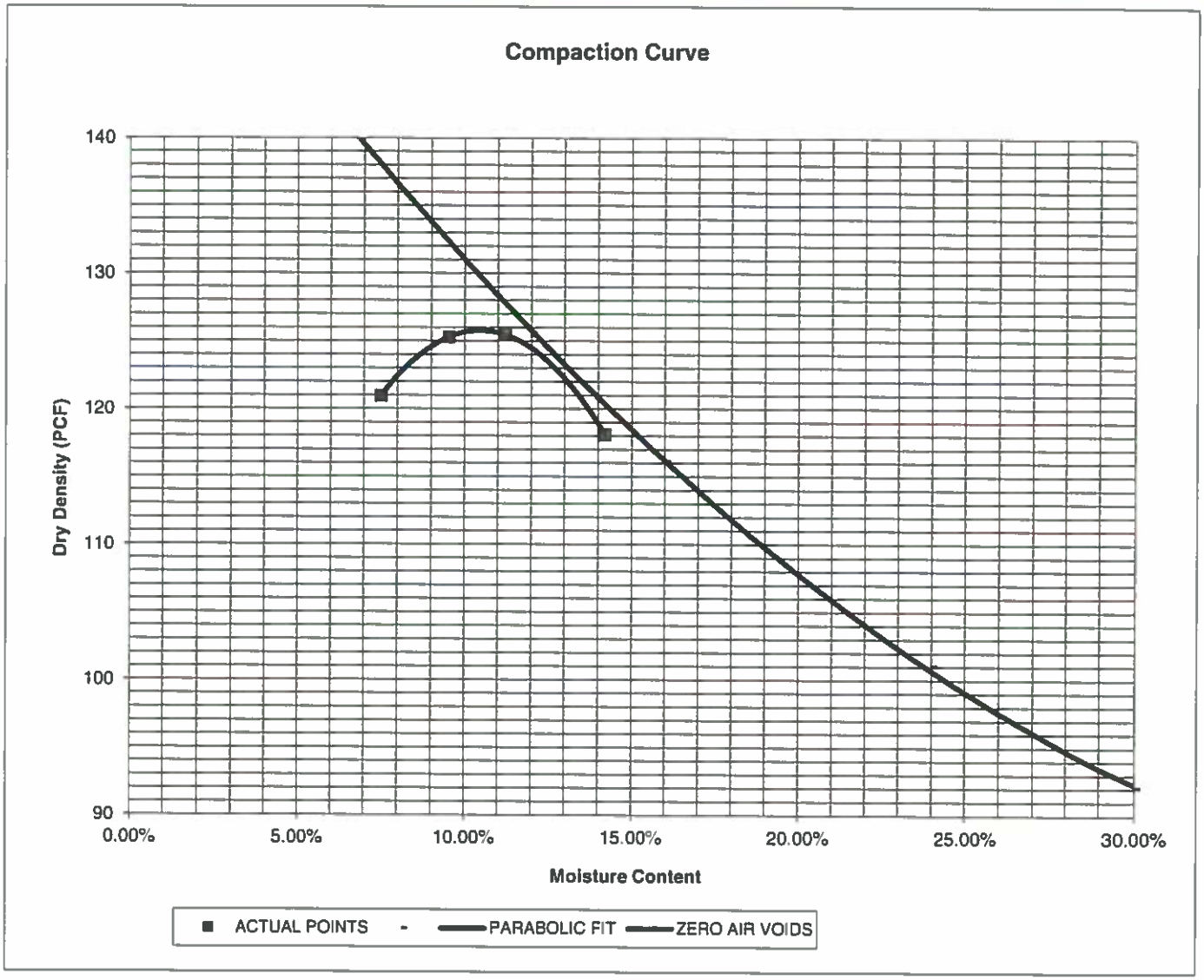
LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-6

PROJECT	HANNAH RIDGE, FILING 6	CLIENT	CLASSIC COMMUNITIES
SAMPLE LOCATION	TB-3 @ 0-3'	JOB NO.	201225
SOIL DESCRIPTION	SAND, CLAYEY, BROWN	DATE	09/17/20

IDENTIFICATION	SC	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	AL
MAXIMUM DRY DENSITY (PCF)	125.9	OPTIMUM MOISTURE	10.5%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-9

CBR TEST LOAD DATA

JOB NO: 201225
CLIENT: CLASSIC COMMUNITIES
PROJECT: HANNAH RIDGE, FILING 6
SOIL TYPE: 1

PISTON DIAMETER (cm)	PISTON AREA (in^2)
4.958	2.993

PENETRATION DEPTH (INCHES)	*10 BLOWS* MOLD # 1 LOAD(LBS) (LBS)	STRESS (PSI)	*25 BLOWS* MOLD # 2 LOAD(LBS) (LBS)	STRESS (PSI)	*56 BLOWS* MOLD # 3 LOAD(LBS) (LBS)	STRESS (PSI)
0.000	0	0.00	0	0.00	0	0.00
0.025	158	52.80	194	64.83	256	85.55
0.050	389	129.99	445	148.70	789	263.66
0.075	633	211.53	837	279.70	1219	407.35
0.100	904	302.09	1336	446.45	1616	540.02
0.125	1128	376.94	1835	613.20	1963	655.97
0.150	1341	448.12	2054	686.38	2269	758.23
0.175	1532	511.94	2324	776.61	2707	904.59
0.200	1704	569.42	2530	845.44	2905	970.76
0.300	2255	753.55	3291	1099.75	4978	1663.49
0.400	2491	832.41	4058	1356.05	5813	1942.52
0.500	2664	890.22	4456	1489.05	6000	2005.01

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	G-11	G-11	G-10
WT. CAN	262.19	262.19	266.39
WT. CAN+WET	401.26	397.63	382.48
WT. CAN+DRY	384.78	383.21	372.12
WT. H20	16.48	14.42	10.36
WT. DRY SOIL	122.59	121.02	105.73
MOISTURE CONTENT	13.44%	11.92%	9.80%

WET DENSITY (PCF)	127.0	131.5	135.8
DRY DENSITY (PCF)	114.9	119.0	122.9

BEARING RATIO	30.21	44.64	54.00

90% OF DRY DENSITY	113.3
95% OF DRY DENSITY	119.6

BEARING RATIO AT 90% OF MAX	24.63	~ R VALUE	71
BEARING RATIO AT 95% OF MAX	46.13	~ R VALUE	75

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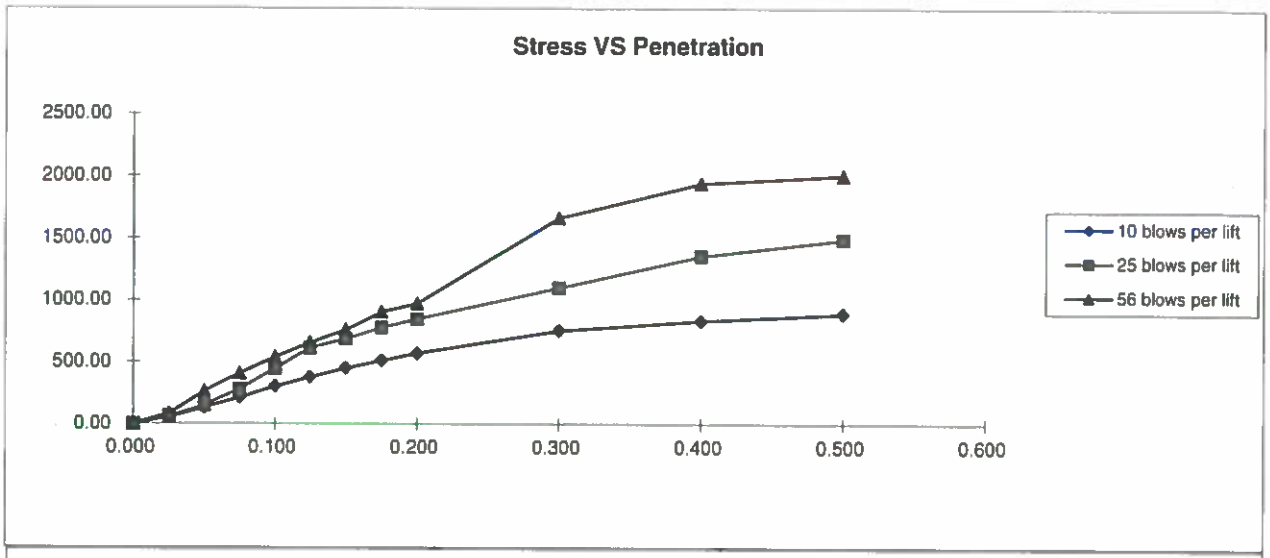
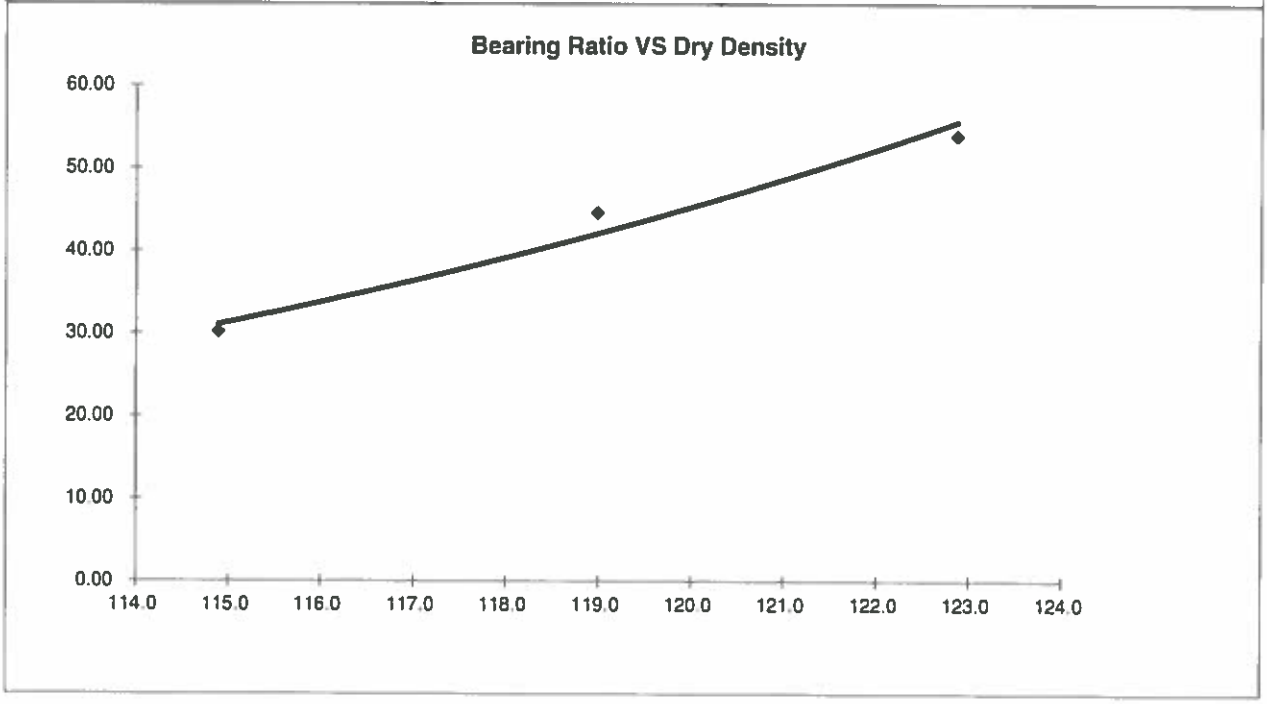
COLORADO SPRINGS, COLORADO 80907

CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201225
FIG NO.: B-16





BEARING RATIO AT 90% OF MAX	24.63	~ R VALUE	71.00
BEARING RATIO AT 95% OF MAX	46.13	~ R VALUE	75.00

JOB NO: 201225
SOIL TYPE: 1

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

CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO: 201225
FIG NO: B-11

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA — CLASSIC COMMUNITIES - HANNAH RIDGE AT FEATHERGRASS, F6
LOCAL ROADS - SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 2.10

DESIGN TABLES AND EQUATIONS

$S_1 = [(R - 5) / 11.29] + 3$

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$

$k = M_R / 19.4$

Where:

M_R = resilient modulus (psi)

S_1 = the soil support value

R = R-value obtained from the Hveem stabilometer

CBR = California Bearing Ratio

Reliability (%)	Z_R (z-statistic)
80	-0.84
85	-1.04
90	-1.28
93	-1.48
94	-1.56
95	-1.65
96	-1.75
97	-1.88
98	-2.05
99	-2.33
99.9	-3.09
99.99	-3.75

$$\log_{10}W_{18} = Z_R * S_O + 9.36*\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32*\log_{10}M_R - 8.07$$

Left	Right	Difference
5.47	5.47	0.0

Job No. 201225
Fig. No. C-1

DESIGN CALCULATIONS

DESIGN DATA CLASSIC COMMUNITIES - HANNAH RIDGE AT FEATHERGRASS, F6
LOCAL ROADS - SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.10

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.11 Strength Coefficient - Aggregate Basecourse

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Basecourse (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 4.8 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASECOURSE SECTION

Asphalt Thickness (t) = [3.5] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 5.1 inches of Aggregate
Basecourse, use 8.0 inches

RECOMMENDED ALTERNATIVES

1. 3.5 inches of Asphalt + 8.0 inches of Aggregate Basecourse, or
2. 5.0 inches of Asphalt

Job No. 201225
Fig. No. C-2

DESIGN CALCULATIONS

CEMENT TREATED SECTIONS - SOIL TYPE 1

DESIGN DATA: CLASSIC COMMUNITIES - HANNAH RIDGE AT FEATHERGRASS, F6

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.10

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Cement Treated Subgrade

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Cement Treated Subgrade (inches)

FOR FULL DEPTH ASPHALT SECTION - (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 4.8 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + CEMENT TREATED SUBGRADE SECTION

Asphalt Thickness (t) = 4 inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 2.8 inches
Use 12.0 inches of Cement Treated Subgrade

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 12 inches of Cement Treated Subgrade
2. 5.0 inches of Full Depth Asphalt

Job No. 201225
Fig. No. C-3

September 22, 2020

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

Classic Communities
2138 Flying Horse Club Drive
Colorado Springs, CO 80921

Attn: Bill Ritchie

Re: Cement Stabilized Subgrade Results - Laboratory Testing (Soil Type 1)
Hannah Ridge at Feathergrass, Filing No. 6
El Paso County, Colorado

Ref: Pavement Recommendations Report by Entech Engineering, Inc., dated September 22, 2020, Entech Job No. 201225.

Dear Mr. Ritchie:

As requested, personnel of Entech Engineering, Inc. have performed strength testing on two sets of three soil/cement composite samples of for the above reference project. Testing was performed on soil samples prepared with 2% and 4% Portland Cement Type 1/2, from Martin Marietta, near Pueblo, Colorado.

The 5-day average strength value of the 2% mix was 266 psi. The 5-day average strength value of the 4% mix was 328 psi. A 3% mix is recommended based on the laboratory test results. A summary of the testing results is attached.

Pending the results of the field density testing, microfracturing of the stabilized subgrade may be required. Soil strengths in excess of 200 psi require microfracturing.

We trust 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.

Daniel P. Stegman

DPS/ts

Encl.

Entech Job No. 201225
AAprojects/2020/201225 cssr – lab ST1

Reviewed by:

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

COLORADO REGISTERED
JOSEPH COLLIN GOODE JR.
09.22.2020
23725
PROFESSIONAL ENGINEER

SUMMARY OF CTS TEST RESULTS

LAB TESTING

CLIENT CLASSIC COMMUNITIES
PROJECT FEATHERGRASS, HANNAH RIDGE, F-6
FIELD SAMPLE ID TB-2 @ 0-3'
SOIL ADDITIVE TYPE I/II CEMENT

JOB NO 201225
DATE 9/18/20
BY BL

ADDITIVE %	*WATER %*	*DENSITY (dry)*	*AGE (days)*	*STRENGTH (psi)*
2	14.8	108.9	4	242
2	14.8	110.1	4	262
2	14.8	109.2	3	294
			AVERAGE:	**266**
4	14.8	108.9	4	319
4	14.8	108.2	4	289
4	14.8	108.3	4	376
			AVERAGE:	**328**

CURING METHOD

100° HUMIDIFIED OVEN