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

December 18, 2021

COLA, LLC
555 Middle Creek Parkway, Suite 200
Colorado Springs, Colorado 80921

Attn: Mark Hollenbeck

Re: Pavement Recommendations
Trails at Aspen Ridge, Filing 2
El Paso County, Colorado

Dear Mr. Hollenbeck:

As requested, Entech Engineering, Inc. has obtained samples of the subgrade soils from sections of the roadways in the Trails at Aspen Ridge Subdivision, Filing No. 2, in El Paso County, Colorado. Laboratory testing to determine the pavement support characteristics of the soils was performed. This letter presents the results of the laboratory testing and pavement recommendations for the roadways.

Project Description

The roadways in this project consist of the following roadways: Big Johnson Drive, Nutter Butter Point, Turtle Lake Way, Roundhouse Drive, Bird Ridge Drive, Beartrack Point, and Moose Meadow Street. The site layout and the locations of the test borings, drilled at approximate 500-foot intervals, are shown on the Test Boring Location Plan, Figure 1.

Subgrade Conditions

Eleven exploratory test borings were drilled in the roadways to depths of approximately 5 to 10 feet. The Boring Logs are presented in Appendix A. Based on the test results one soil type was encountered at the subgrade depth. The soils were categorized as Soil Type 1. Sieve Analysis and Atterberg Limit testing were performed on soil samples obtained from the test borings for the purpose of classification. Sieve analyses performed on the subgrade soils indicated the percent passing the No. 200 sieve ranged from 58 to 89 percent. Atterberg Limit Tests performed on subgrade soil samples resulted in Liquid Limits of 33 to 45 percent and Plastic Indexes of 18 to 26 percent. Soil Type 1 consisted of sandy to very sandy clay fill, which classify as A-6 and A-7-6 soils based on the AASHTO classification system. The Type 1 subgrade soils encountered in this filing typically exhibit poor pavement support characteristics. Soils with high sulfate levels are common in this area. Sulfate testing of the subgrade indicated that the sulfate levels were in the moderate to severe potential range for sulfate attack. Groundwater was not encountered in the test borings.

Sulfate testing on site soils indicated the subgrade soils exhibit negligible to severe potential for concrete degradation due to sulfate attack. Due to the sulfate content of the soils, Type 1L or Type 5 cement is recommended for concrete on this site. Type 1L or Type 5 cement, or equivalent sulfate resistant materials, should be used for all portions of the roadways on this site. If these cement types are not readily available, the cement supplier shall provide a cement which is highly resistant to sulfate degradation.

Swell/Consolidation testing conducted on the in-situ site subgrade soils showed swells ranging from 0.8 and 6.2 percent. Many samples exceeded the level in which mitigation is required (2.0 percent). These results indicate that soil mitigation due to expansive soils is required for the roadway sections investigated. The samples were remolded to 3 percent above optimum moisture content and were retested. Test results for the remolded samples resulted in volume changes of 0.8 to 1.7 percent, which are below the mitigation levels. It is our opinion that the swell potential can be mitigated through moisture conditioning and recompacting the soils. The subgrade should be scarified to a minimum depth of 12 inches, be moisture conditioned to 3% over optimum moisture content, and be recompacted to 95 % of the soils maximum Standard Proctor Dry Density, ASTM D-698. Laboratory test results are presented in Appendix B and are summarized on Table 1.

California Bearing Ratio (CBR) testing was performed on a sample of the Type 1 soils to determine the support characteristic of the subgrade soils for the roadway sections. The results of the CBR testing are presented in Appendix B and summarized as follows:

Soil Type 1 – Sandy Clay

R @ 90% = 1.0
R @ 95% = 6.0
Use R = 6.0 for design

Classification Testing

Liquid Limit	41
Plasticity Index	24
Percent Passing 200	84.6
AASHTO Classification	A-7-6
Group Index	20
Unified Soils Classification	CL

Pavement Design

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” and the Traffic Impact and Access Analysis report by LSC Transportation Consultants, LSC Job No. 184362, dated October 15, 2019. Big Johnson Drive, Nutter Butter Point, Turtle Lake Way, Roundhouse Drive, Bird Ridge Drive, Beartrack Point, and Moose Meadow Street classified as urban local roadways, which used an 18K ESAL value of 292,000 for design. Pavement alternatives for asphalt over aggregate basecourse subgrade sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability (Urban Local Roads)	80%
Serviceability Index (Urban Local Roads)	2.2
"R" Value Subgrade	6.0
Resilient Modulus	3,126 psi
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11

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 – Big Johnson Drive, Nutter Butter Point, Turtle Lake Way, Roundhouse Drive, Bird Ridge Drive, Beartrack Point, and Moose Meadow Street

Alternative	Asphalt (in)	Basecourse (in)
1. Asphalt Over Basecourse	5.5	10.0

Mitigation

El Paso County criteria requires mitigation of expansive soils for roadway subgrade that have a swell of 2 percent or greater with a 150 pound per square foot surcharge. Samples resulted in volume changes from 0.8 to 6.2 percent. Remolded swell tests moisture conditioned to 3 percent over optimum, exhibited volume changes of 0.8 to 1.7 percent. These swell levels are below the threshold for mitigation. The roadway subgrade soils were initially moisture conditioned and processed during utility installation. The subgrade was conditioned and compacted to specified requirements during the utility installations. Prior to paving, the subgrade should be evaluated for proper moisture conditions. In areas that need additional moisture-conditioning, we recommend that the top 12-inches of the subgrade be scarified and moisture-conditioned to 3 percent over optimum moisture content and be recompacted. Mitigation limits should be field determined. The subgrade soils should be observed and tested by Entech personnel prior to paving. Testing during construction is recommended to verify that the compaction and moisture content of the subgrade meets requirements. It should also be noted that the soils were moisture conditioned and compacted.

Roadway Construction - Asphalt on Basecourse

Prior to placement of the asphalt, the subgrade should be scarified, moisture-conditioned, compacted to a minimum of 95% of its maximum Standard Proctor Dry Density, ASTM D-1557 at 3% over optimum moisture content and proofrolled after properly compacted. Any loose or soft areas should be removed and replaced with suitable materials approved by Entech. Base course materials should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 at ± 2% of optimum moisture content. Special attention should be given to areas adjacent to manholes, inlet structures and valves.

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, 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.

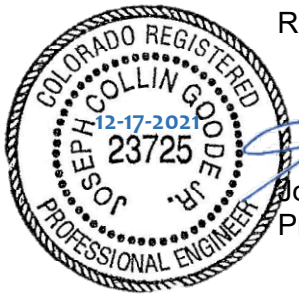
Daniel P. Stegman

DPS/bs

Encl.

Entech Job No. 200979
AAprojects/2020/200979 pr

Reviewed by:



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

TABLE

TABLE 1

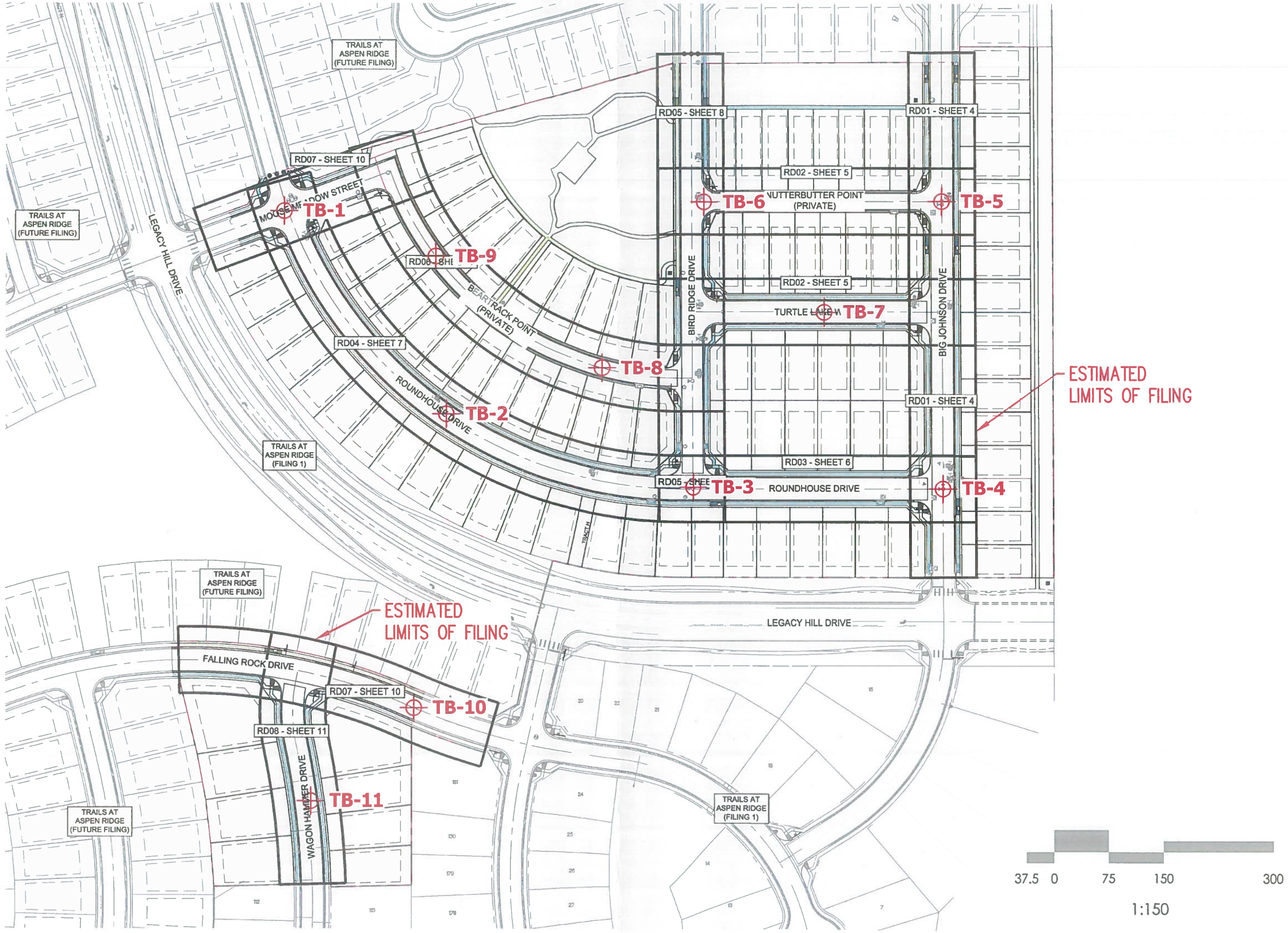
SUMMARY OF LABORATORY TEST RESULTS

CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
JOB NO. 200979

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	1	0-3			84.6	41	24		A-7-6		CL	FILL, CLAY, SANDY
1	1	1-2	10.7	118.3	79.8	45	26	0.22	A-7-6	6.2	CL	FILL, CLAY, SANDY
1	1	1-2	13.5	117.4						1.4*	CL	FILL, CLAY, SANDY
1	2	1-2	14.3	118.0	57.8	34	19		A-6	5.6	CL	FILL, CLAY, VERY SANDY
1	2	1-2	17.4	117.4						1.7*	CL	FILL, CLAY, VERY SANDY
1	3	1-2	12.2	121.3	77.4	40	23	0.15	A-6	5.9	CL	FILL, CLAY, SANDY
1	3	1-2	15.2	119.9						1.3*	CL	FILL, CLAY, SANDY
1	4	1-2	9.5	97.2	75.9	40	23	0.19	A-6	5.0	CL	FILL, CLAY, SANDY
1	4	1-2	12.2	104.9						0.7*	CL	FILL, CLAY, SANDY
1	5	1-2	7.4	96.8	88.6	47	29		A-7-6	4.5	CL	FILL, CLAY, SANDY
1	5	1-2	11.3	101.2						.6*	CL	FILL, CLAY, SANDY
1	6	1-2	9.2	113.6	61.8	33	18		A-6	2.8	CL	FILL, CLAY, VERY SANDY
1	6	1-2	12.7	112.8						1.5*	CL	FILL, CLAY, VERY SANDY
1	7	1-2	15.7	110.2	82.1	40	25	0.20	A-6	3.1	CL	FILL, CLAY, SANDY
1	7	1-2	18.5	110.6						1.1*	CL	FILL, CLAY, SANDY
1	8	1-2	11.9	115.5	71.3	38	21		A-6	1.7	CL	FILL, CLAY, SANDY
1	9	1-2	13.5	114.2	79.4	36	20		A-6	4.0	CL	FILL, CLAY, SANDY
1	9	1-2	16.6	114.6						0.8*	CL	FILL, CLAY, SANDY
1	10	1-2			55.9				A-6		CL	FILL, CLAY, VERY SANDY
1	11	1-2			75.7				A-6		CL	FILL, CLAY, SANDY

* - REMOLDED SAMPLES

FIGURE



TB- APPROXIMATE TEST BORING LOCATIONS AND NUMBERS

REVISION	BY

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TEST BORING LOCATION MAP
THE TRAILS AT ASPEN RIDGE, F2
COLORADO SPRINGS, CO.
For: COLA, LLC

DRAWN	JAC
CHECKED	DPS
DATE	12/17/21
SCALE	1:150
JOB NO.	200979
FIGURE No.	1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 12/2/2021
Job # 200979

REMARKS

DRY TO 5', 12/2/21

FILL 0-5', CLAY, SANDY, TAN, FIRM TO STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			13	9.4	1
5			15	9.6	1
10					
15					
20					

TEST BORING NO. 2
DATE DRILLED 12/2/2021
CLIENT COLA, LLC
LOCATION ASPEN RIDGE, FILING 2

REMARKS

DRY TO 10', 12/2/21

FILL 0-10', CLAY, VERY SANDY, TAN, STIFF TO FIRM, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			24	10.6	1
5			11	9.3	1
10			9	4.7	1
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 12/2/2021
Job # 200979

REMARKS

DRY TO 5', 12/2/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-5', CLAY, SANDY, TAN, FIRM, MOIST			11	9.0	1
5			13	14.7	1
10					
15					
20					

TEST BORING NO. 4
DATE DRILLED 12/2/2021
CLIENT COLA, LLC
LOCATION ASPEN RIDGE, FILING 2

REMARKS

DRY TO 5', 12/2/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-5', CLAY, SANDY, TAN, STIFF, MOIST			16	7.1	1
5			18	17.4	1
10					
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: A- 2

TEST BORING NO. 5
DATE DRILLED 12/2/2021
Job # 200979

REMARKS

DRY TO 10', 12/2/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			29	5.0	1
5			13	6.8	1
10			9	8.7	1
15					
20					

FILL 0-10', CLAY, SANDY, TAN, STIFF TO FIRM, MOIST

TEST BORING NO. 6
DATE DRILLED 12/2/2021
CLIENT COLA, LLC
LOCATION ASPEN RIDGE, FILING 2

REMARKS

DRY TO 5', 12/2/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			27	9.4	1
5			32	11.5	1
10					
15					
20					

FILL 0-5', CLAY, VERY SANDY, TAN, STIFF TO VERY STIFF, MOIST

TEST BORING NO. 7
DATE DRILLED 12/2/2021
Job # 200979

REMARKS

DRY TO 5', 12/2/21

FILL 0-5', CLAY, SANDY, TAN, FIRM TO STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			9	10.6	1
5			23	16.2	1
10					
15					
20					

TEST BORING NO. 8
DATE DRILLED 12/2/2021
CLIENT COLA, LLC
LOCATION ASPEN RIDGE, FILING 2

REMARKS

DRY TO 10', 12/2/21

FILL 0-10', CLAY, SANDY, TAN, SOFT TO STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			13	10.8	1
5			4	7.7	1
10			28	8.5	1
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DJ	12/14/21

JOB NO.: 200979
FIG NO.: A- 4

TEST BORING NO. 9
DATE DRILLED 12/2/2021
Job # 200979

REMARKS

DRY TO 5', 12/2/21

FILL 0-5', CLAY, SANDY, TAN, STIFF TO FIRM, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			18	10.7	1
5			8	11.4	1
10					
15					
20					

TEST BORING NO. 10
DATE DRILLED 12/16/2021
CLIENT COLA, LLC
LOCATION ASPEN RIDGE, FILING 2

REMARKS

DRY TO 10', 12/16/21

FILL 0-10', CLAY, VERY SANDY TO SANDY, TAN, STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			26	7.3	1
5			25	4.4	1
10			23	3.5	1
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/18/21

JOB NO.: 200979
FIG NO.: A- 5

TEST BORING NO. 11
DATE DRILLED 12/16/2021
Job # 200979

TEST BORING NO.
DATE DRILLED
CLIENT COLA, LLC
LOCATION ASPEN RIDGE, FILING 2

REMARKS

DRY TO 5', 12/16/21

FILL 0-5', CLAY, SANDY, TAN, STIFF TO FIRM, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			23	8.7	1
			26	3.2	1
10					
15					
20					

REMARKS

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

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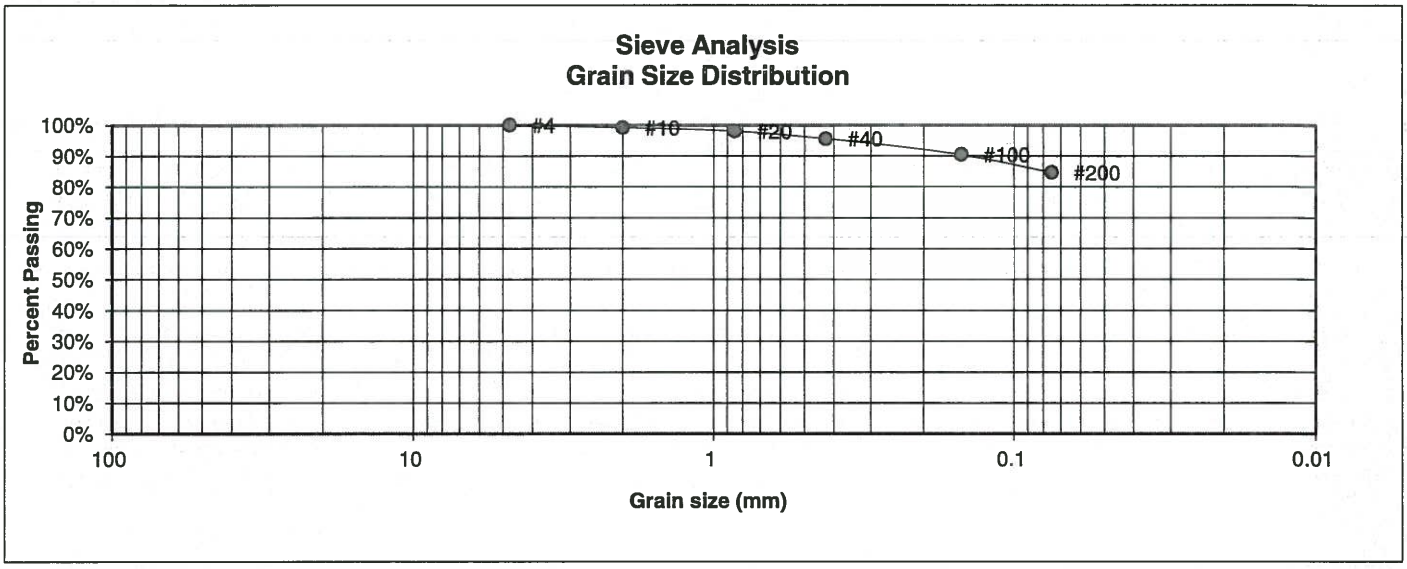
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DJ	12/16/21

JOB NO.: 200979
FIG NO.: A- 6

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1, CBR	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	1	JOB NO.	200979
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-7-6	GROUP INDEX	20



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.2%
20	98.1%
40	95.6%
100	90.4%
200	84.6%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	41
Plastic Index	24

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

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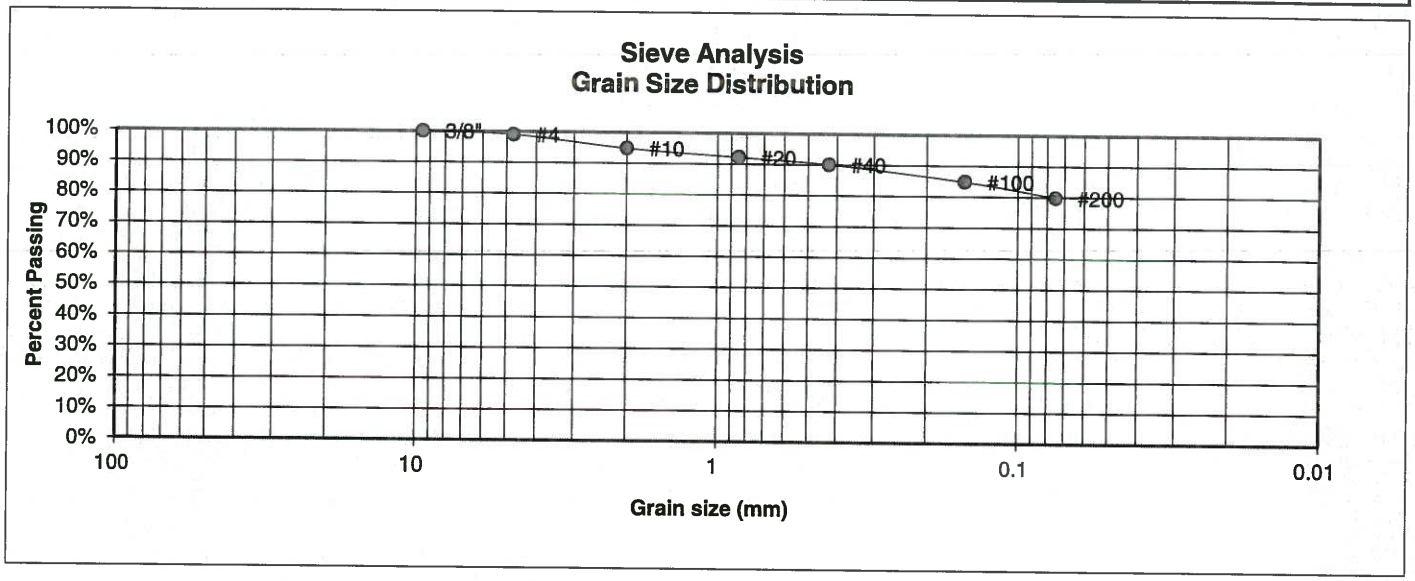
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/10/14

JOB NO.: 200979
FIG NO.: B-1

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	1	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-7-6	GROUP INDEX	20



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	94.8%
20	92.2%
40	90.1%
100	84.8%
200	79.8%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	45
Plastic Index	26

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

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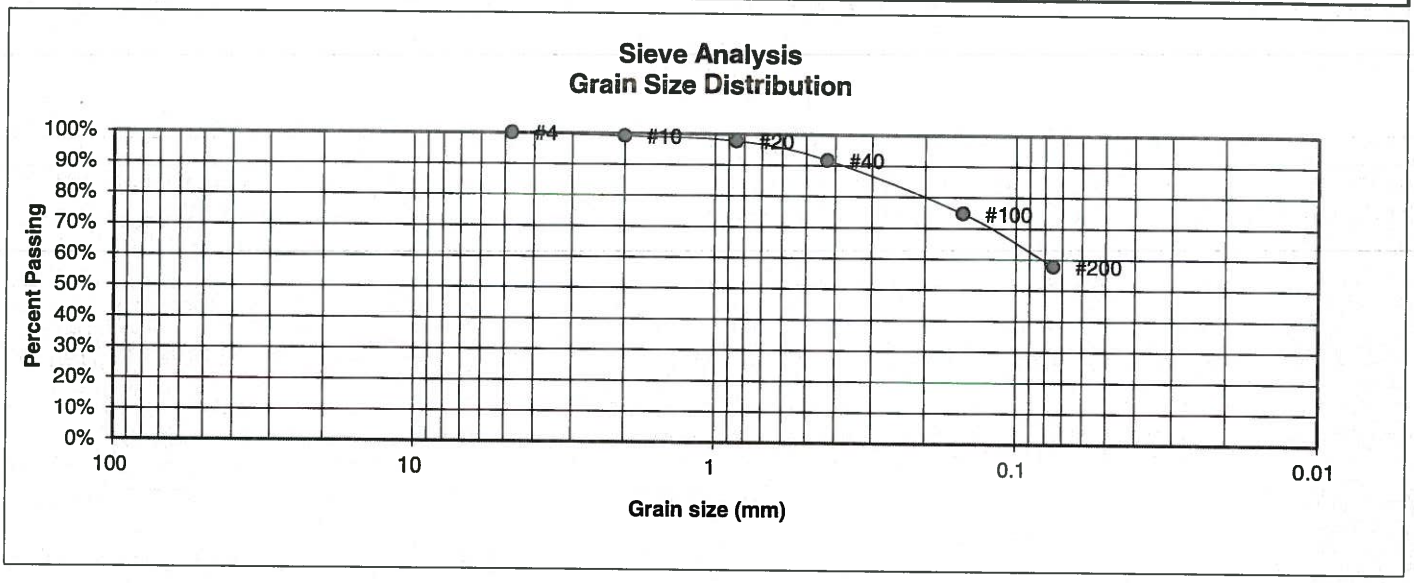
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/19/07

JOB NO.: 200979
FIG NO.: B-2

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	2	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	8



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.2%
20	97.8%
40	91.8%
100	74.8%
200	57.8%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	34
Plastic Index	19

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

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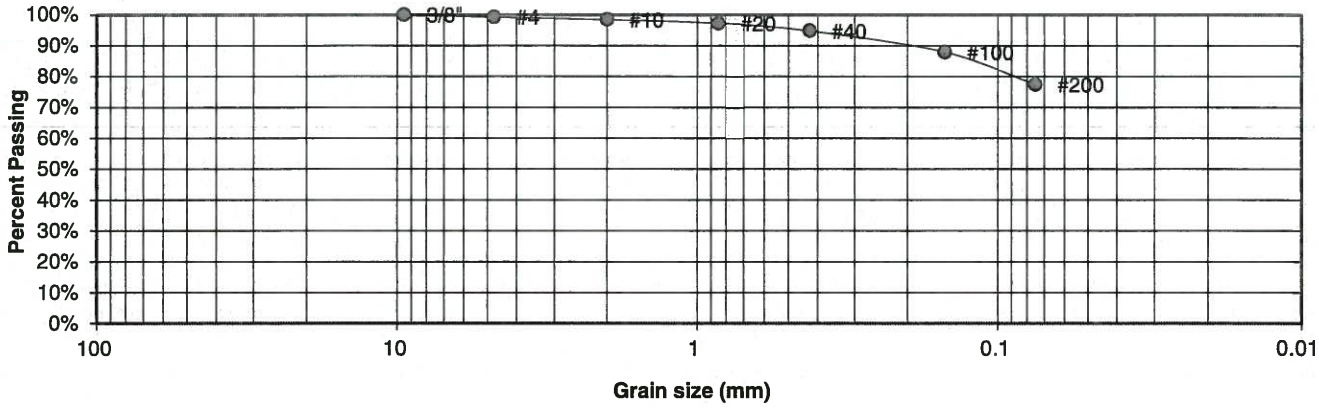
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12-14-21

JOB NO.: 200979
FIG NO.: B-3

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	3	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	17



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	98.4%
20	97.2%
40	94.8%
100	87.9%
200	77.4%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	40
Plastic Index	23

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

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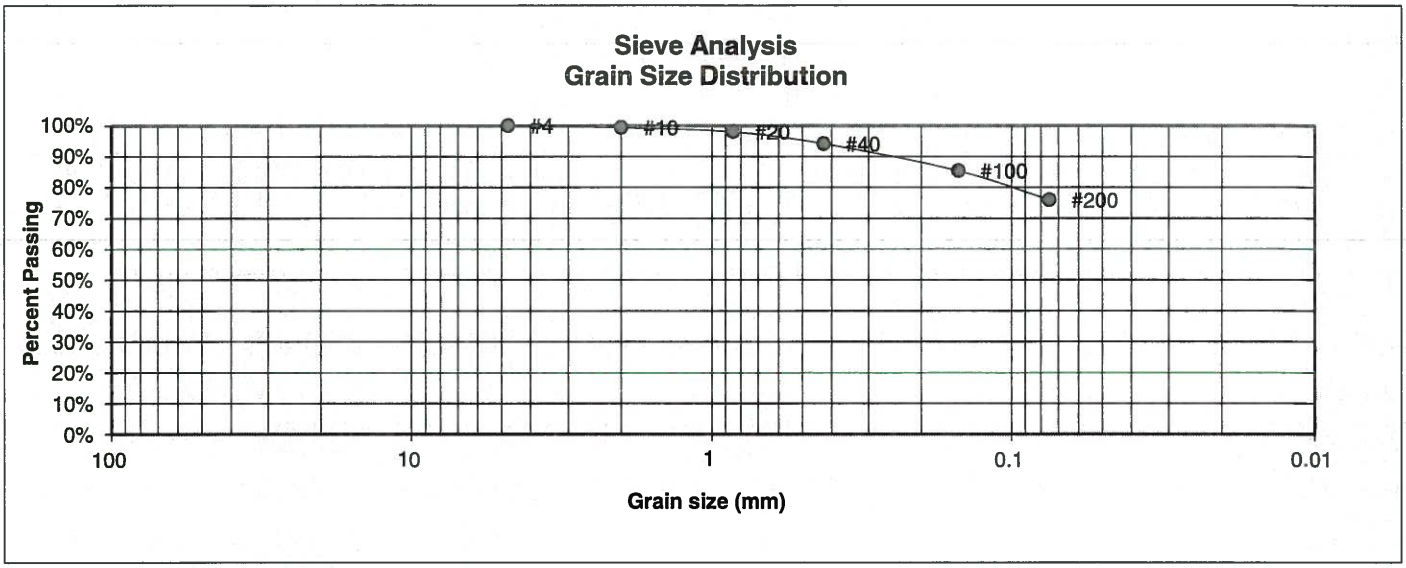
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-4

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	4	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	16



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.4%
20	98.0%
40	94.1%
100	85.4%
200	75.9%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	40
Plastic Index	23

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

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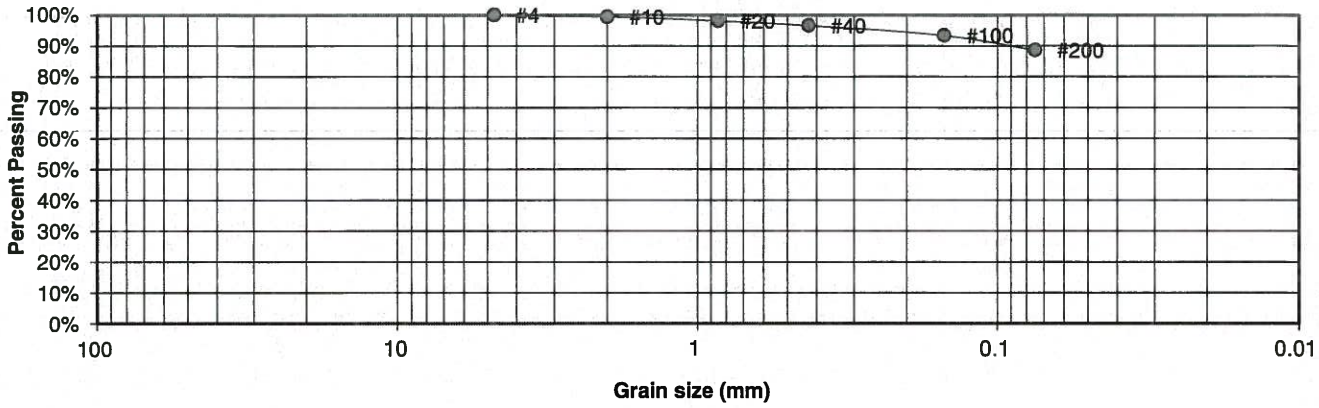
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-5

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	5	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-7-6	GROUP INDEX	20

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.4%
20	98.1%
40	96.6%
100	93.4%
200	88.6%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	47
Plastic Index	29

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

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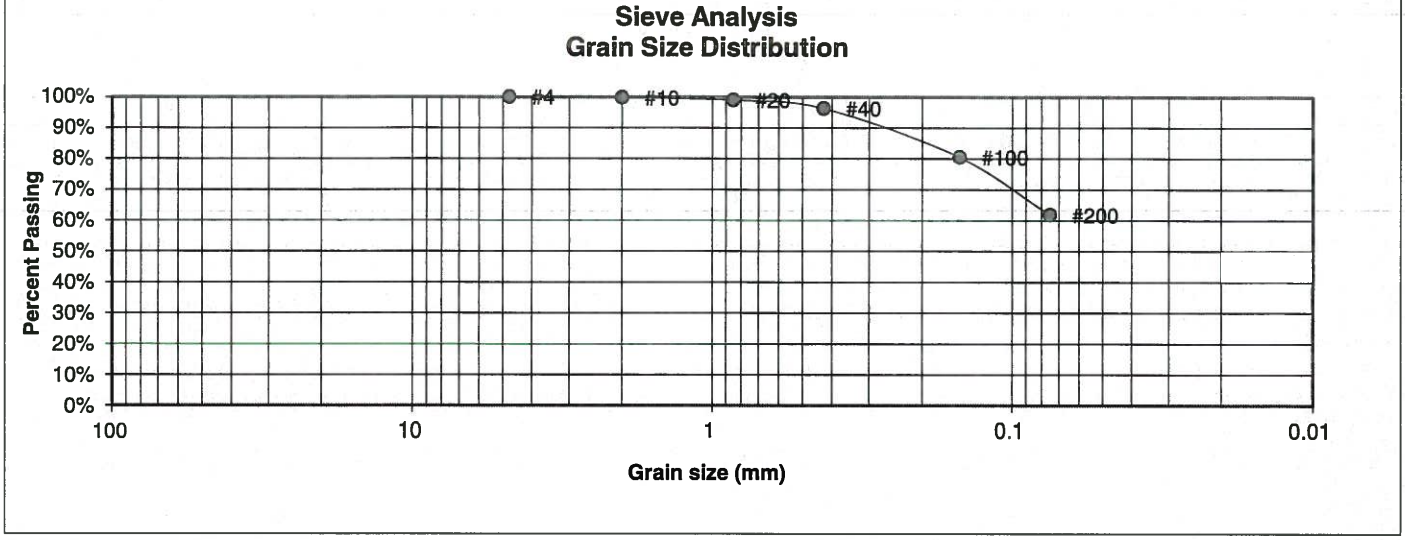
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		TDC	12/14/21

JOB NO.: 200979
FIG NO.: B-6

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	6	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	8



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	99.0%
40	96.3%
100	80.5%
200	61.8%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	33
Plastic Index	18

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

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LABORATORY TEST RESULTS

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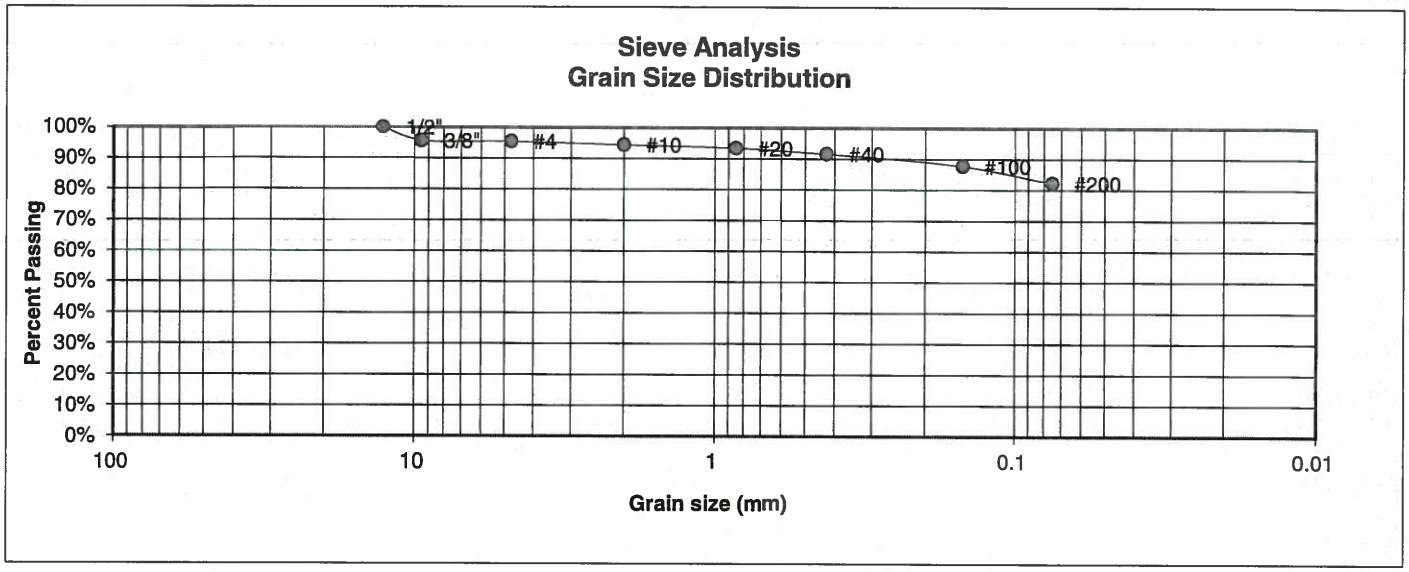
		DS	12/14/24

JOB NO.: 200979
FIG NO.: B-7

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	7	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	19



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.6%
4	95.4%
10	94.4%
20	93.4%
40	91.6%
100	87.8%
200	82.1%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	40
Plastic Index	25

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

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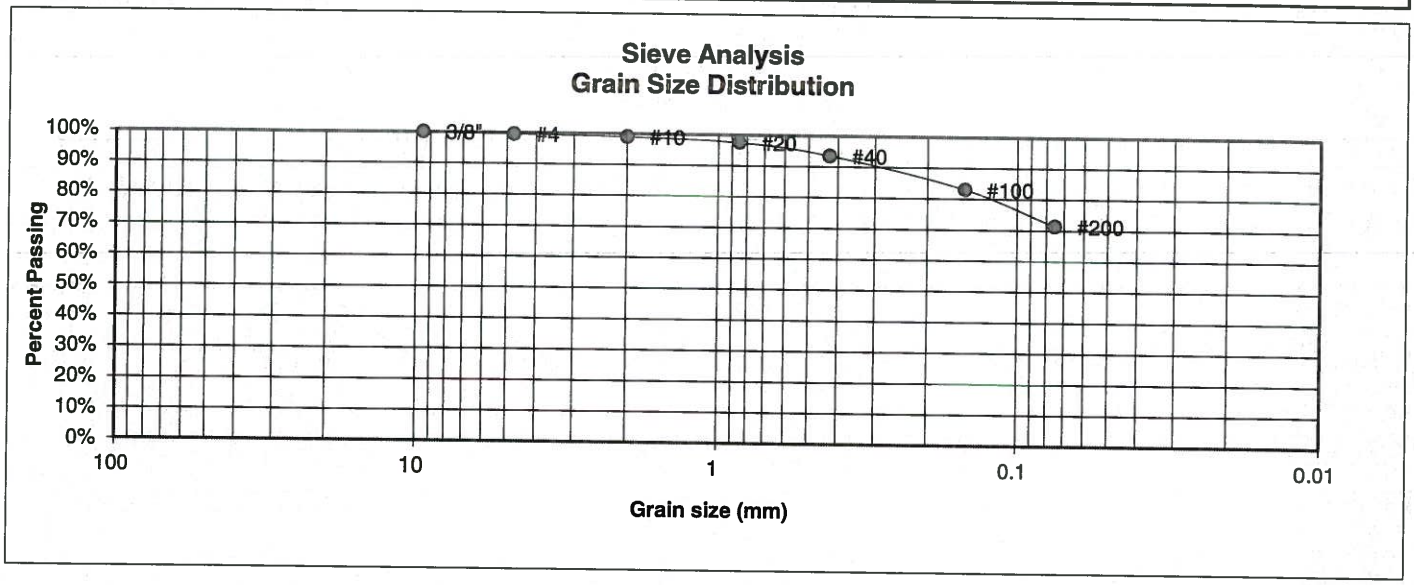
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-8

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	8	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	13



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.5%
10	99.0%
20	97.5%
40	93.5%
100	83.0%
200	71.3%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	38
Plastic Index	21

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

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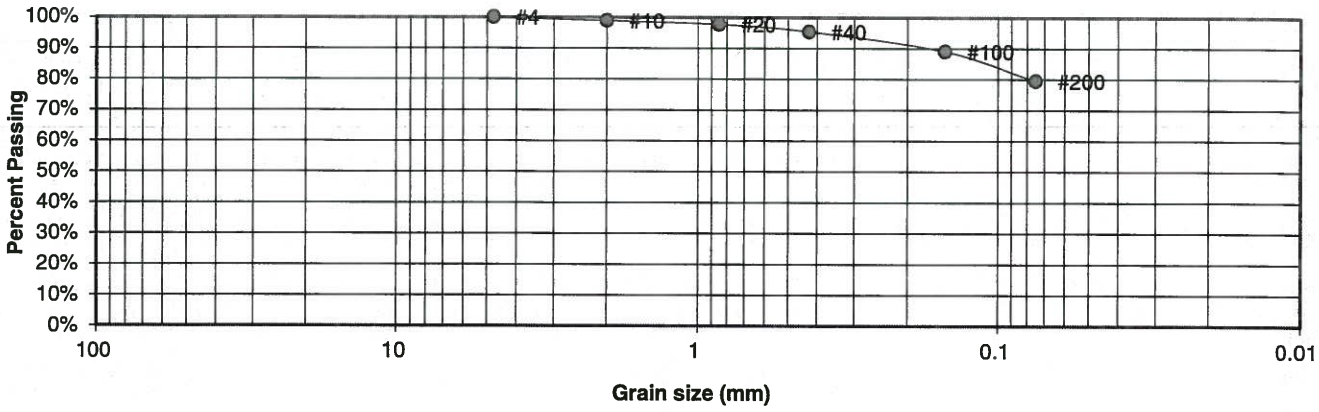
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-9

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	9	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	14



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.9%
20	97.7%
40	95.3%
100	89.1%
200	79.4%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	36
Plastic Index	20

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

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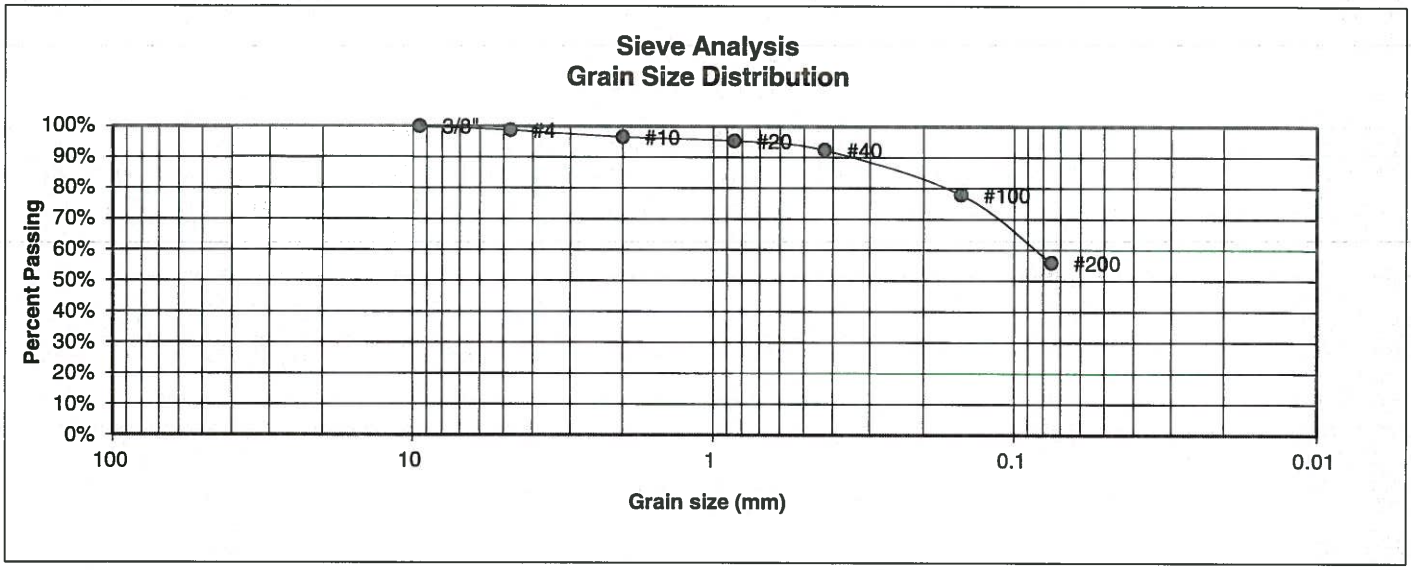
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-16

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	10	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.7%
10	96.5%
20	95.2%
40	92.3%
100	77.9%
200	55.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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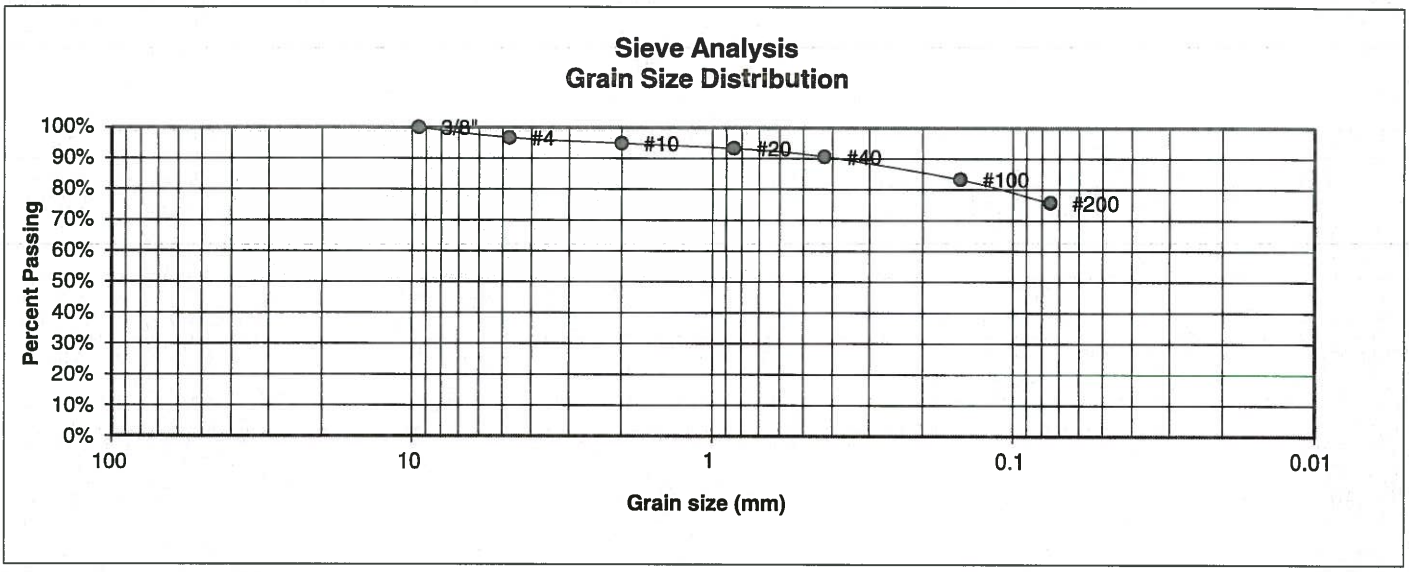
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/16/21

JOB NO.: 200979
FIG NO.: B1GA

UNIFIED CLASSIFICATION	CL	CLIENT	COLA, LLC
SOIL TYPE #	1	PROJECT	ASPEN RIDGE, FILING 2
TEST BORING #	11	JOB NO.	200979
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.6%
10	94.8%
20	93.3%
40	90.6%
100	83.3%
200	75.7%

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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LABORATORY TEST RESULTS

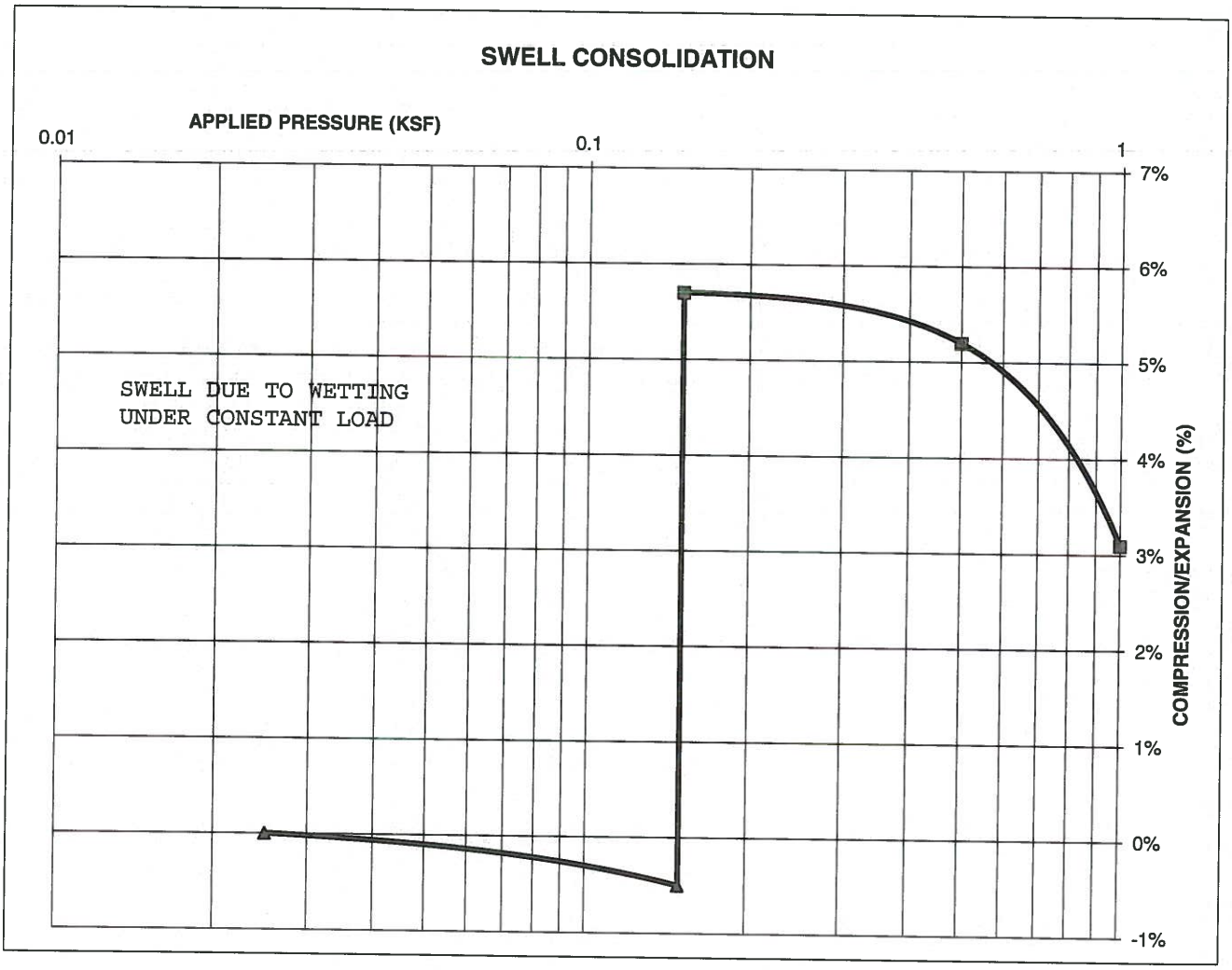
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/16/21

JOB NO.: 200979
FIG NO.: B108

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			118
NATURAL MOISTURE CONTENT			10.7%
SWELL/CONSOLIDATION (%)			6.2%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

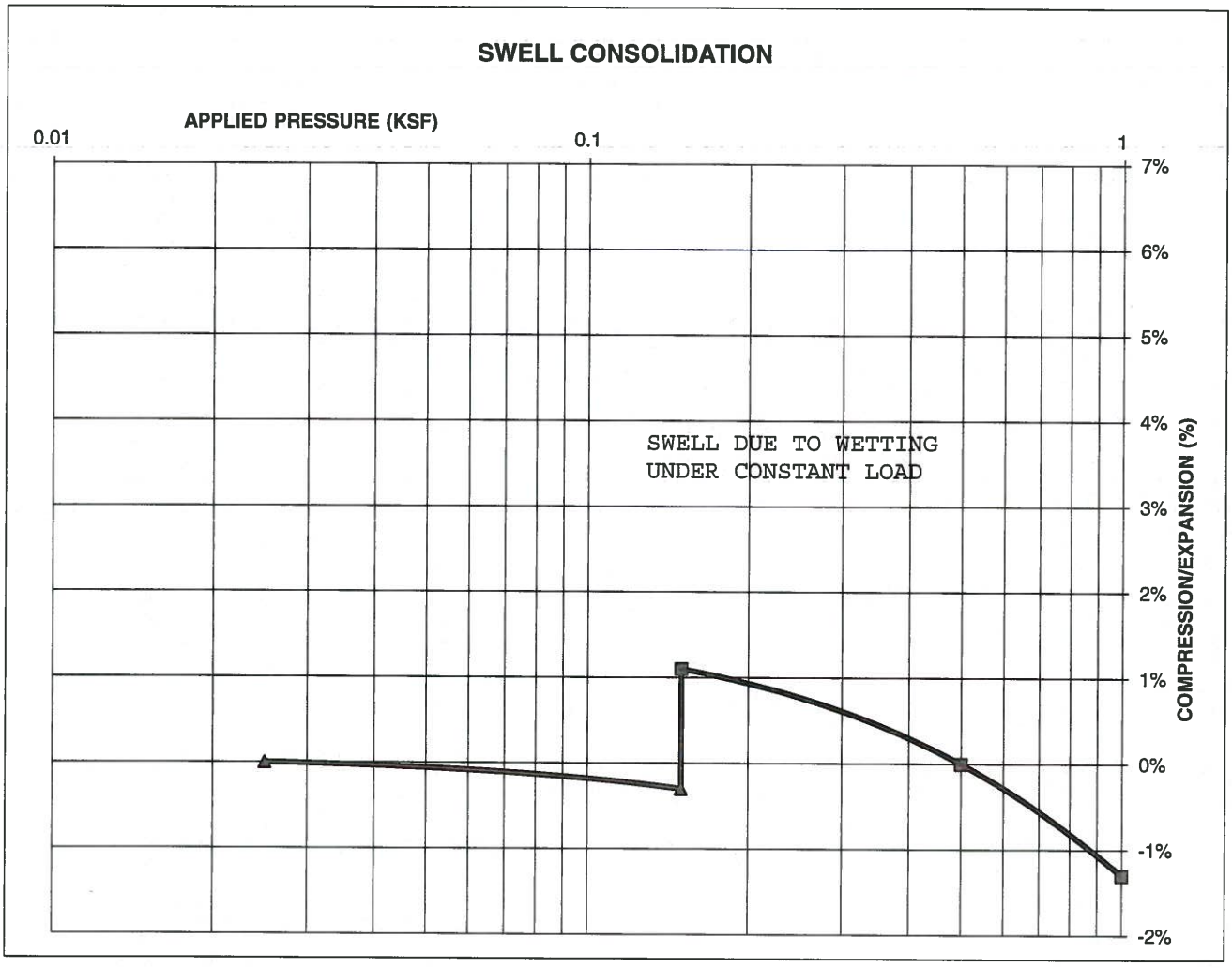
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-11

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			117
NATURAL MOISTURE CONTENT			13.5%
SWELL/CONSOLIDATION (%)			1.4%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

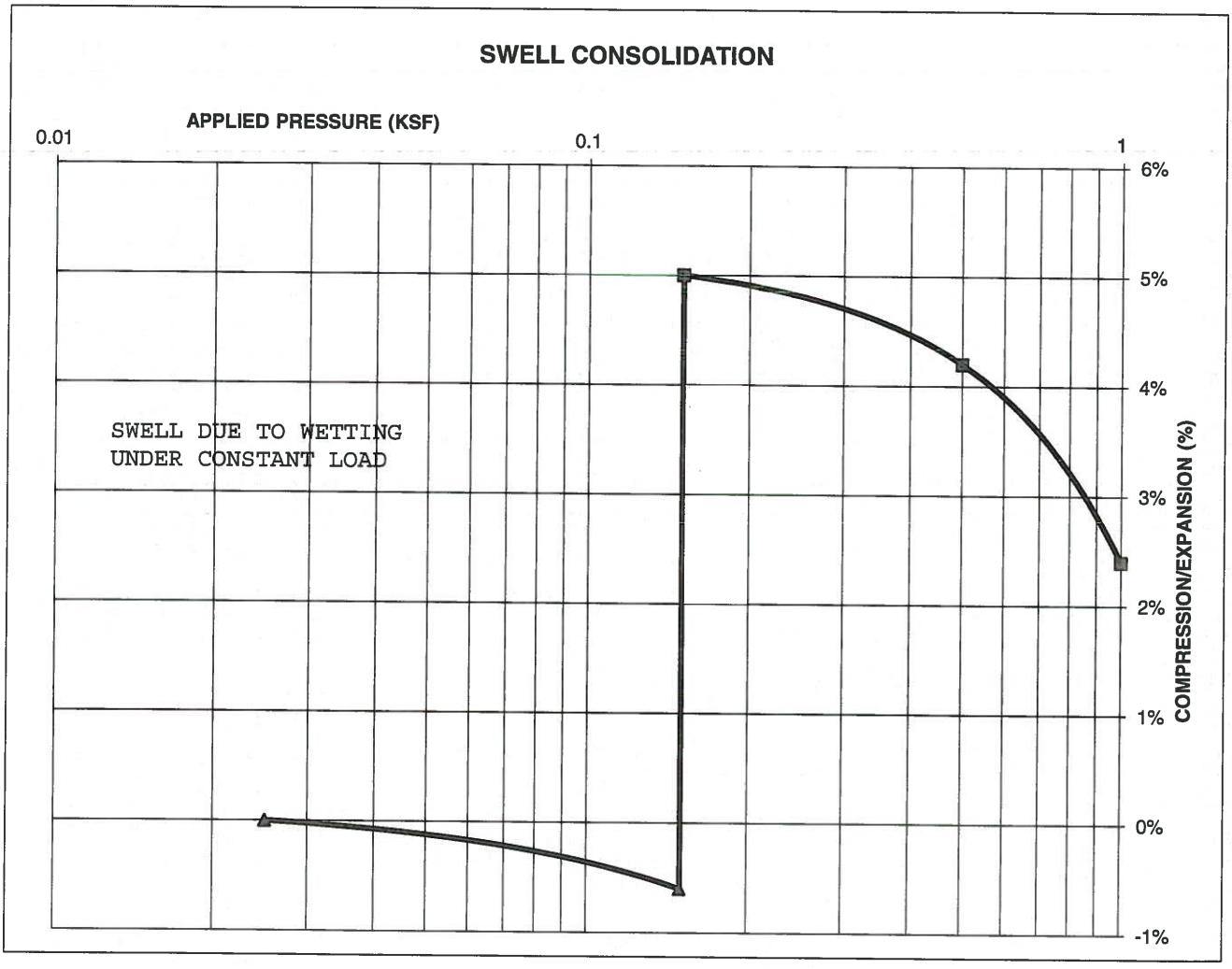
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-12

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			118
NATURAL MOISTURE CONTENT			14.3%
SWELL/CONSOLIDATION (%)			5.6%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

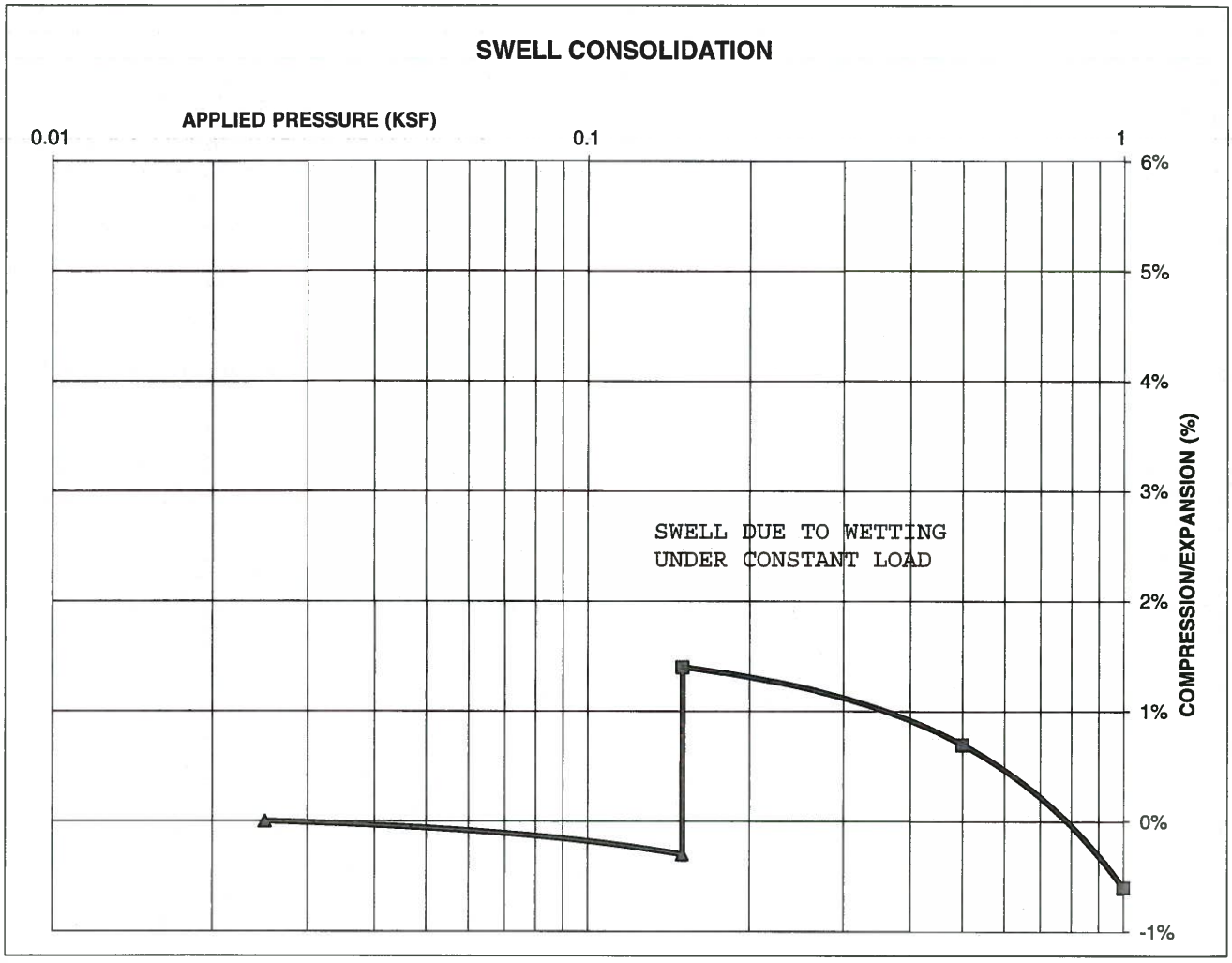
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-13

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			117
NATURAL MOISTURE CONTENT			17.4%
SWELL/CONSOLIDATION (%)			1.7%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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

SWELL CONSOLIDATION
TEST RESULTS

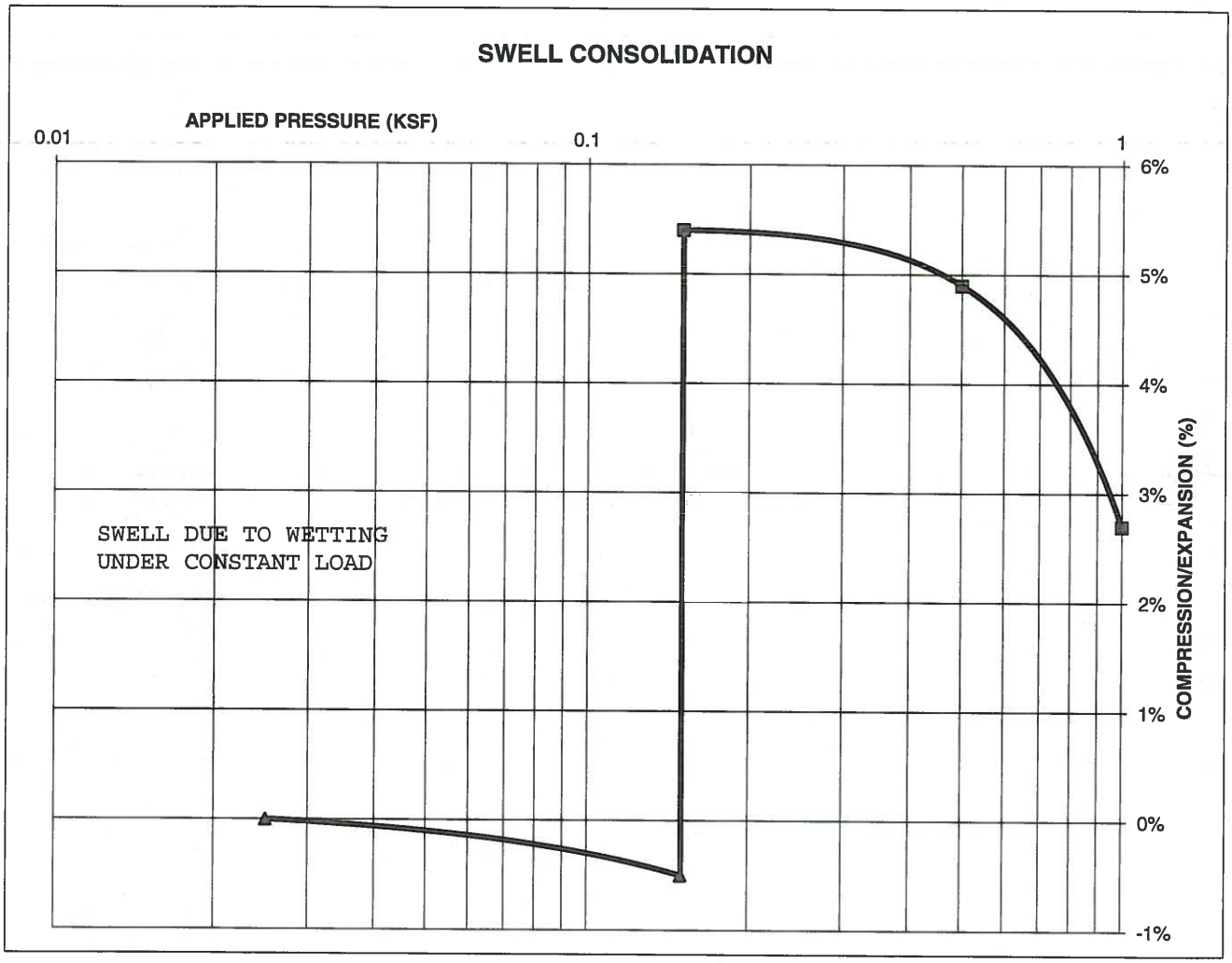
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-4

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			121
NATURAL MOISTURE CONTENT			12.2%
SWELL/CONSOLIDATION (%)			5.9%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

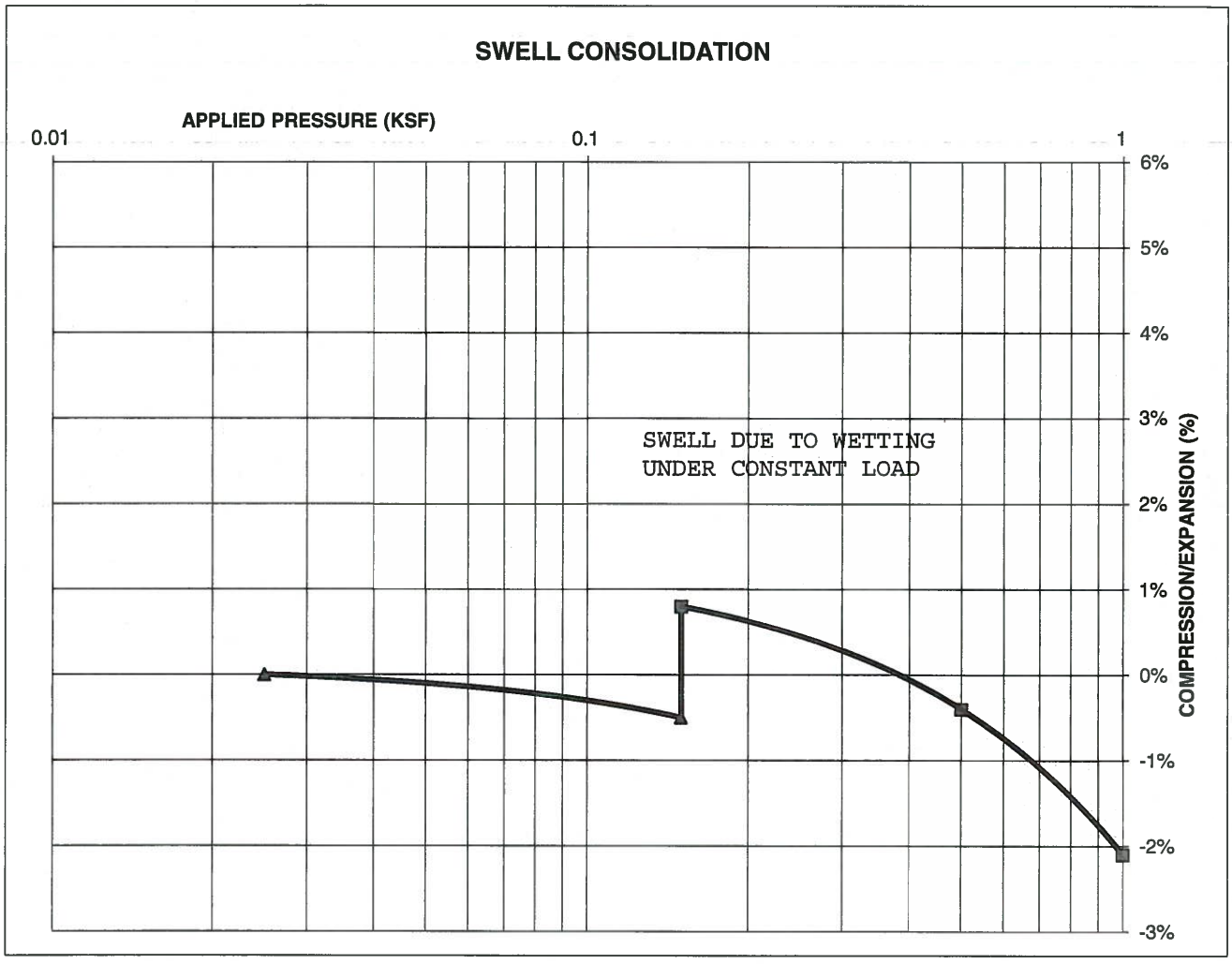
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-15

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			120
NATURAL MOISTURE CONTENT			15.2%
SWELL/CONSOLIDATION (%)			1.3%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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505 ELKTON DRIVE
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SWELL CONSOLIDATION
TEST RESULTS

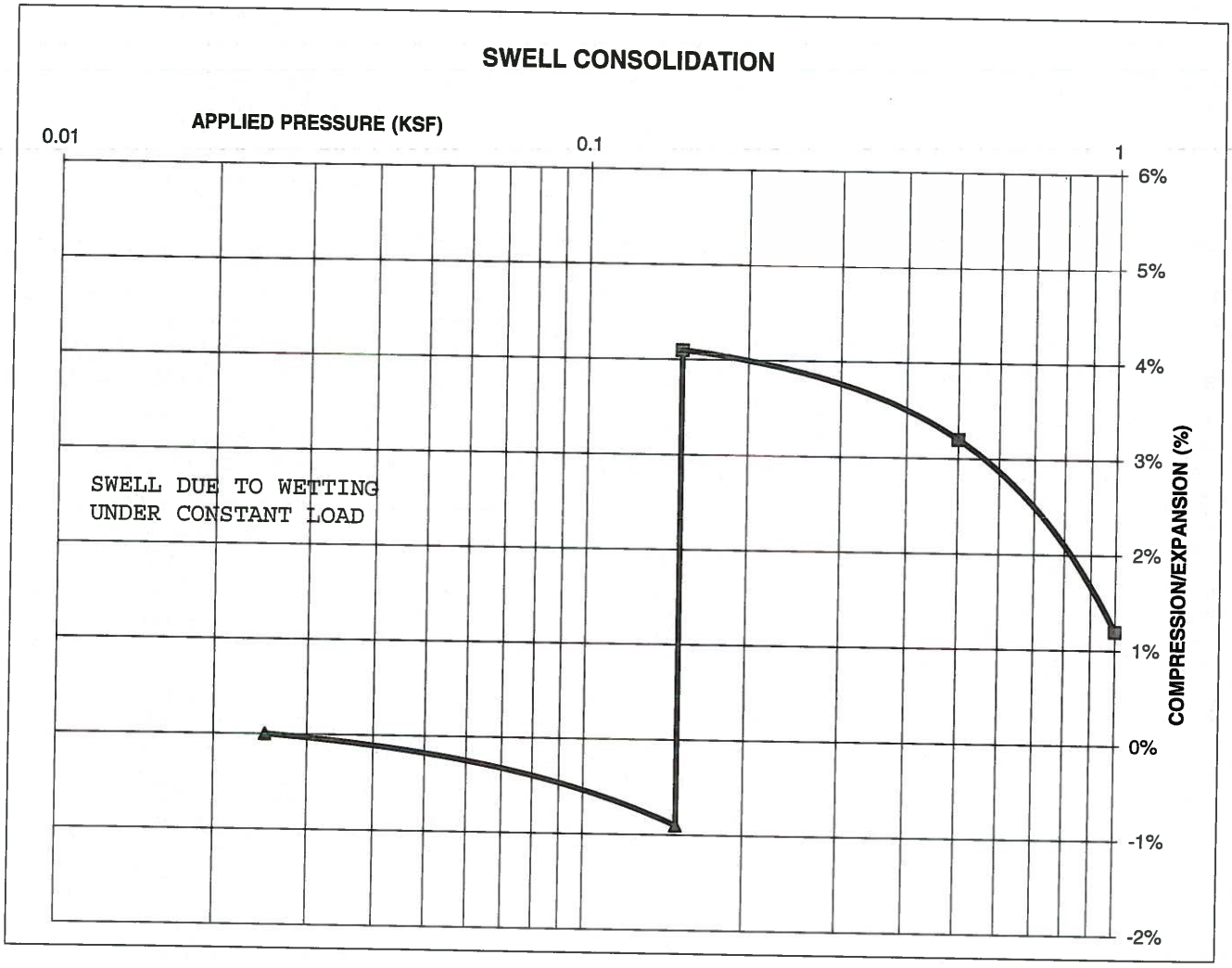
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-16

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			97
NATURAL MOISTURE CONTENT			9.5%
SWELL/CONSOLIDATION (%)			5.0%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

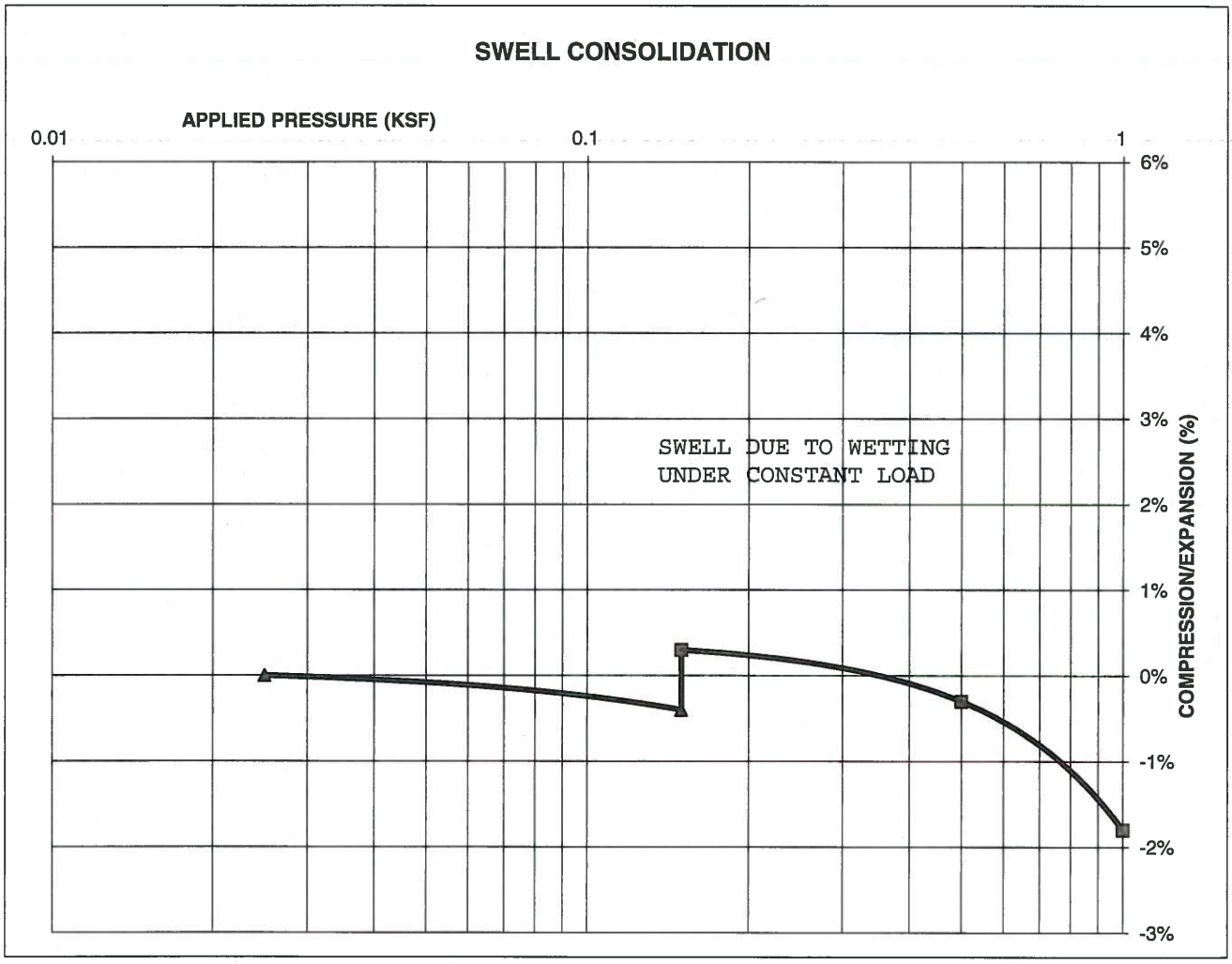
DRAWN:	DATE:	CHECKED:	DATE:
		JS	12/14/21

JOB NO.: 200979
FIG NO.: B-17

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			105
NATURAL MOISTURE CONTENT			12.2%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

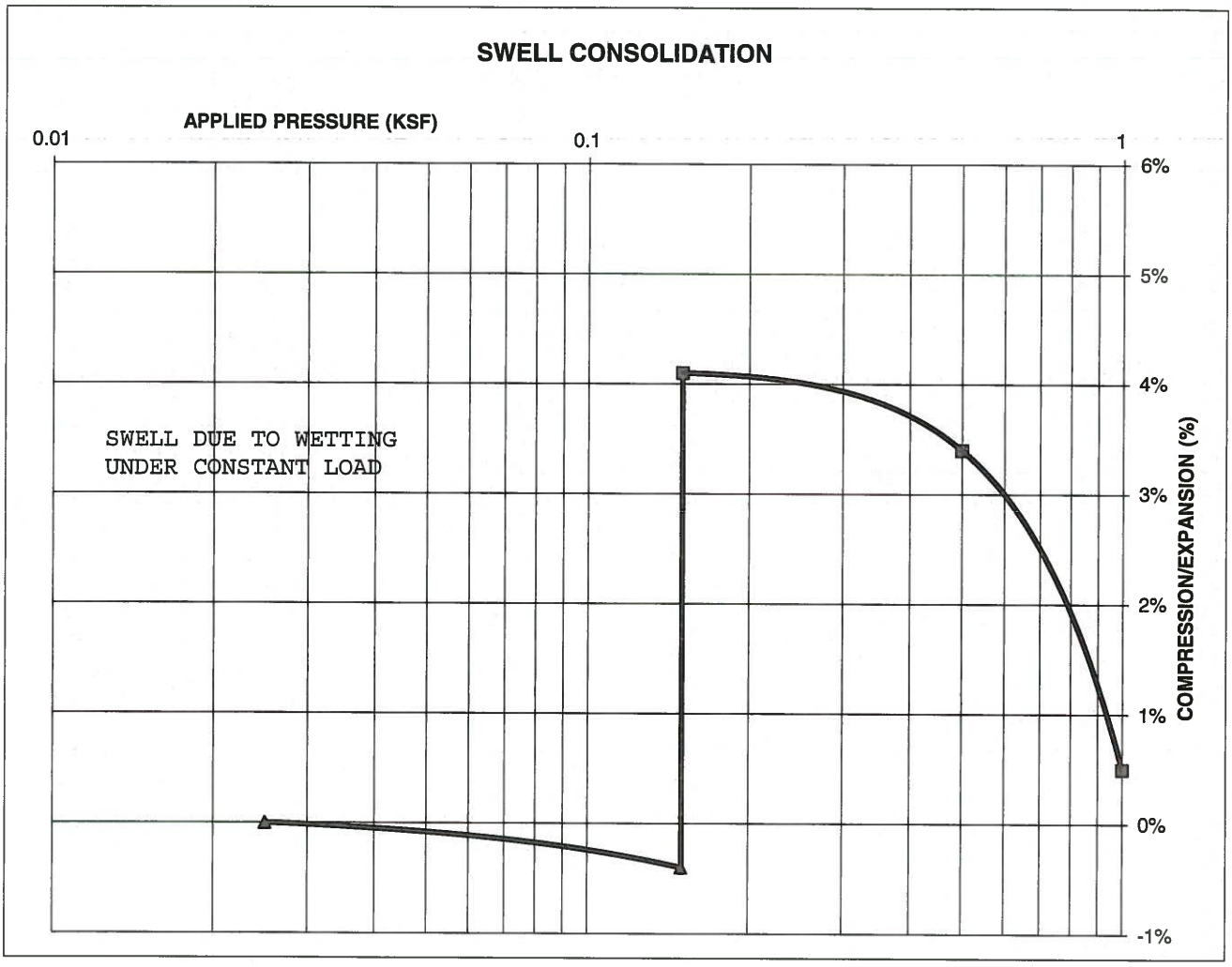
DRAWN:	DATE:	CHECKED:	DATE:
		DJ	12/14/21

JOB NO.: 200979
FIG NO.: B-18

CONSOLIDATION TEST RESULTS

TEST BORING #	5	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			97
NATURAL MOISTURE CONTENT			7.4%
SWELL/CONSOLIDATION (%)			4.5%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

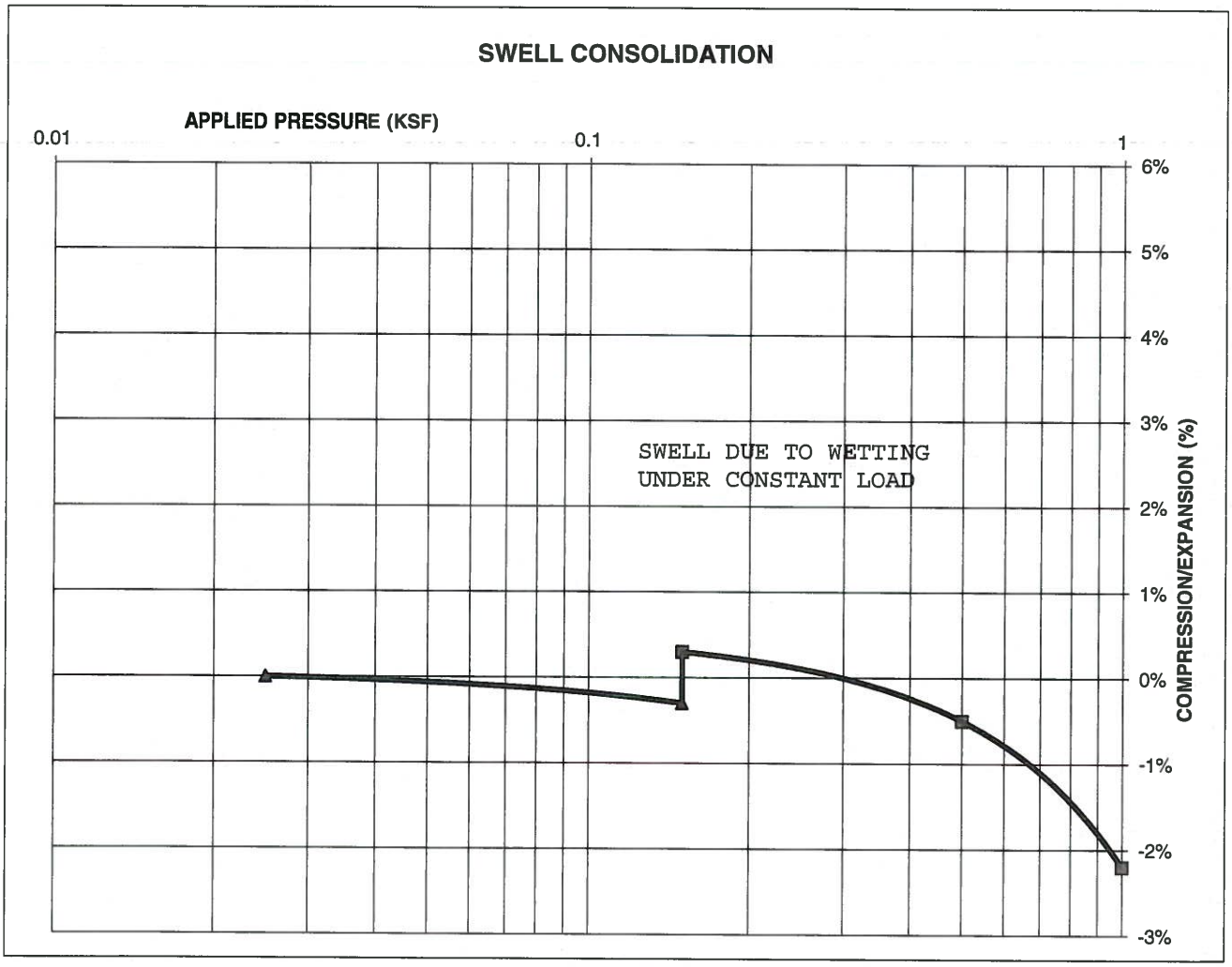
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-19

CONSOLIDATION TEST RESULTS

TEST BORING #	5	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			101
NATURAL MOISTURE CONTENT			11.3%
SWELL/CONSOLIDATION (%)			0.6%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

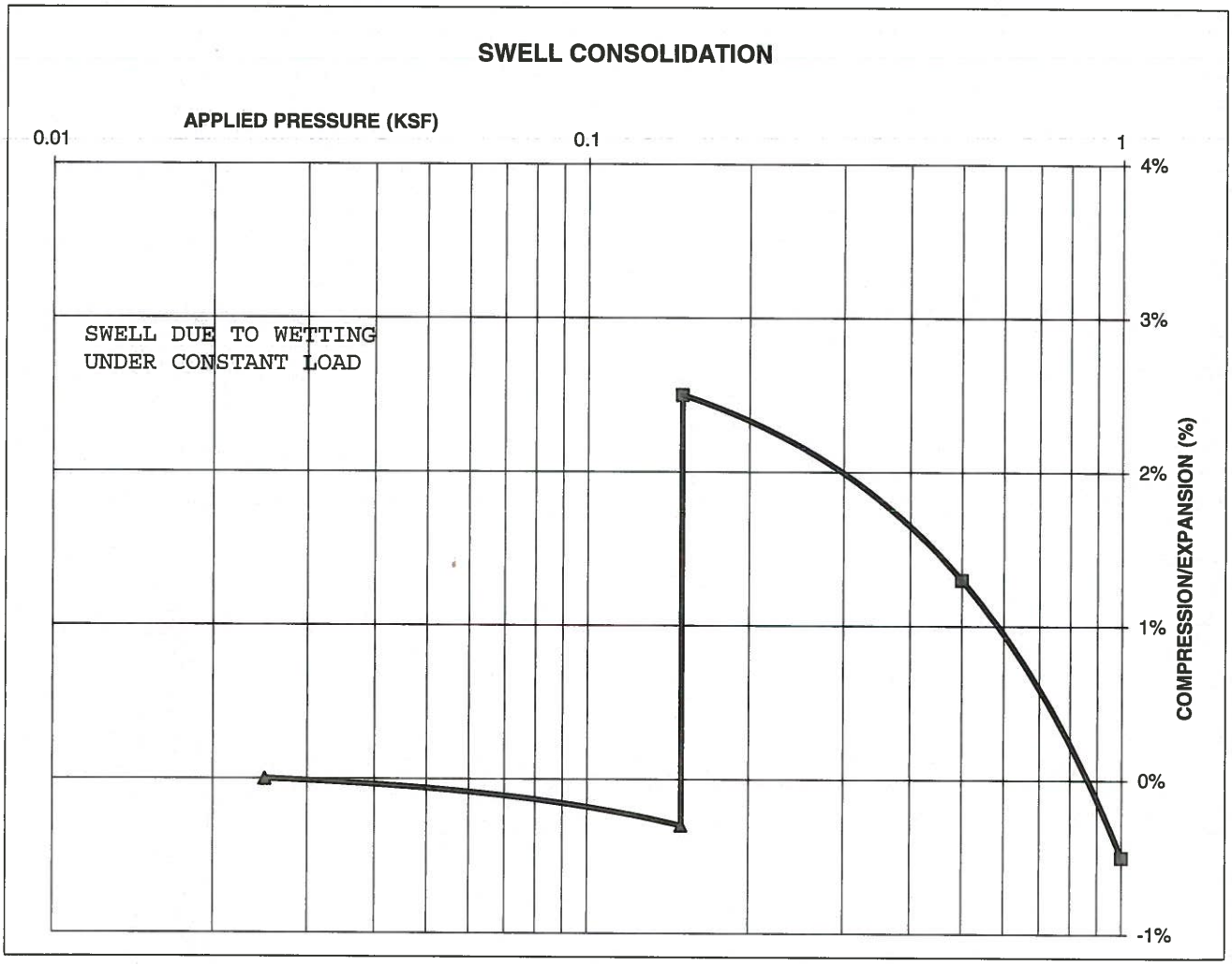
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-20

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			114
NATURAL MOISTURE CONTENT			9.2%
SWELL/CONSOLIDATION (%)			2.8%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

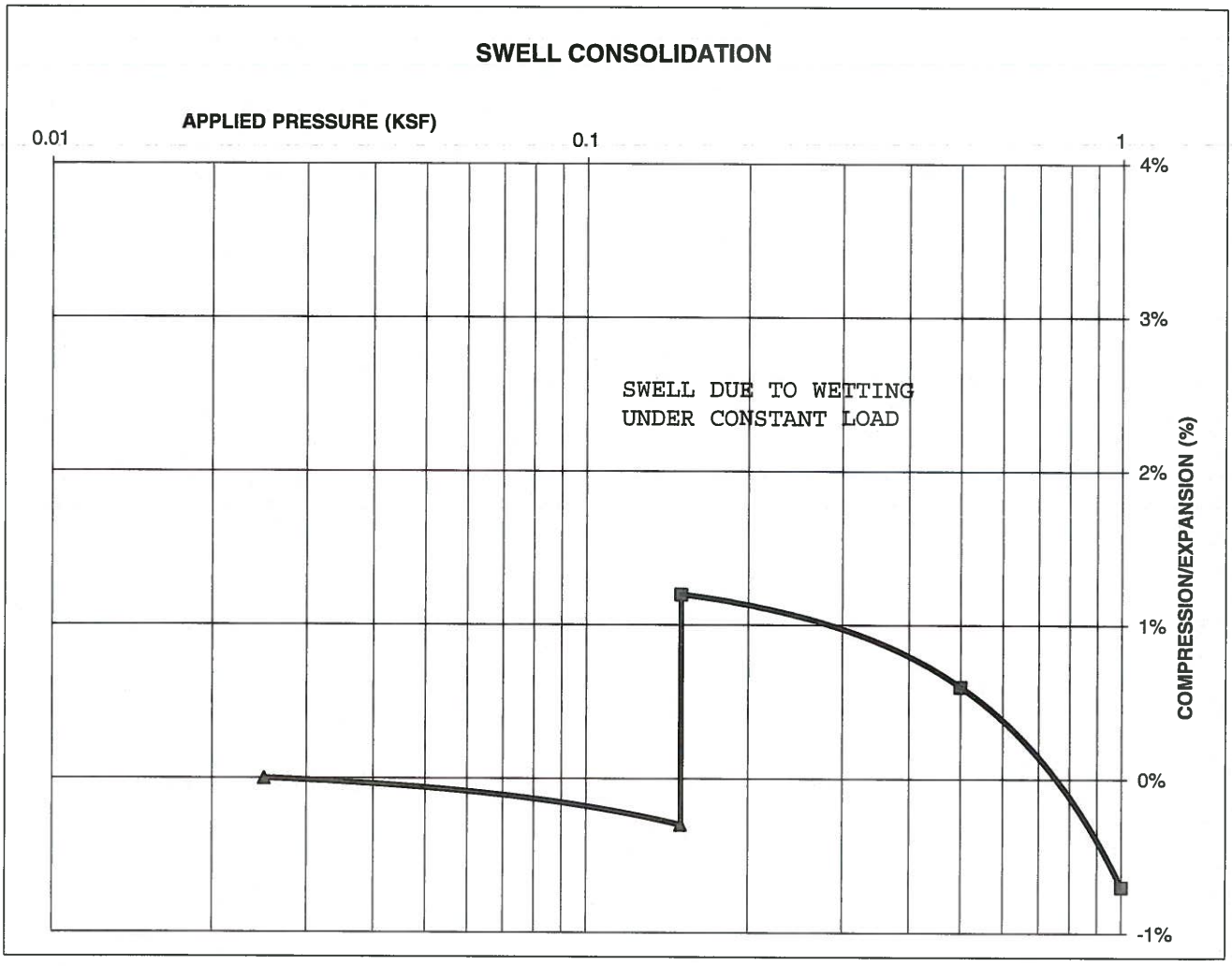
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-21

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			113
NATURAL MOISTURE CONTENT			12.7%
SWELL/CONSOLIDATION (%)			1.5%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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SWELL CONSOLIDATION
TEST RESULTS

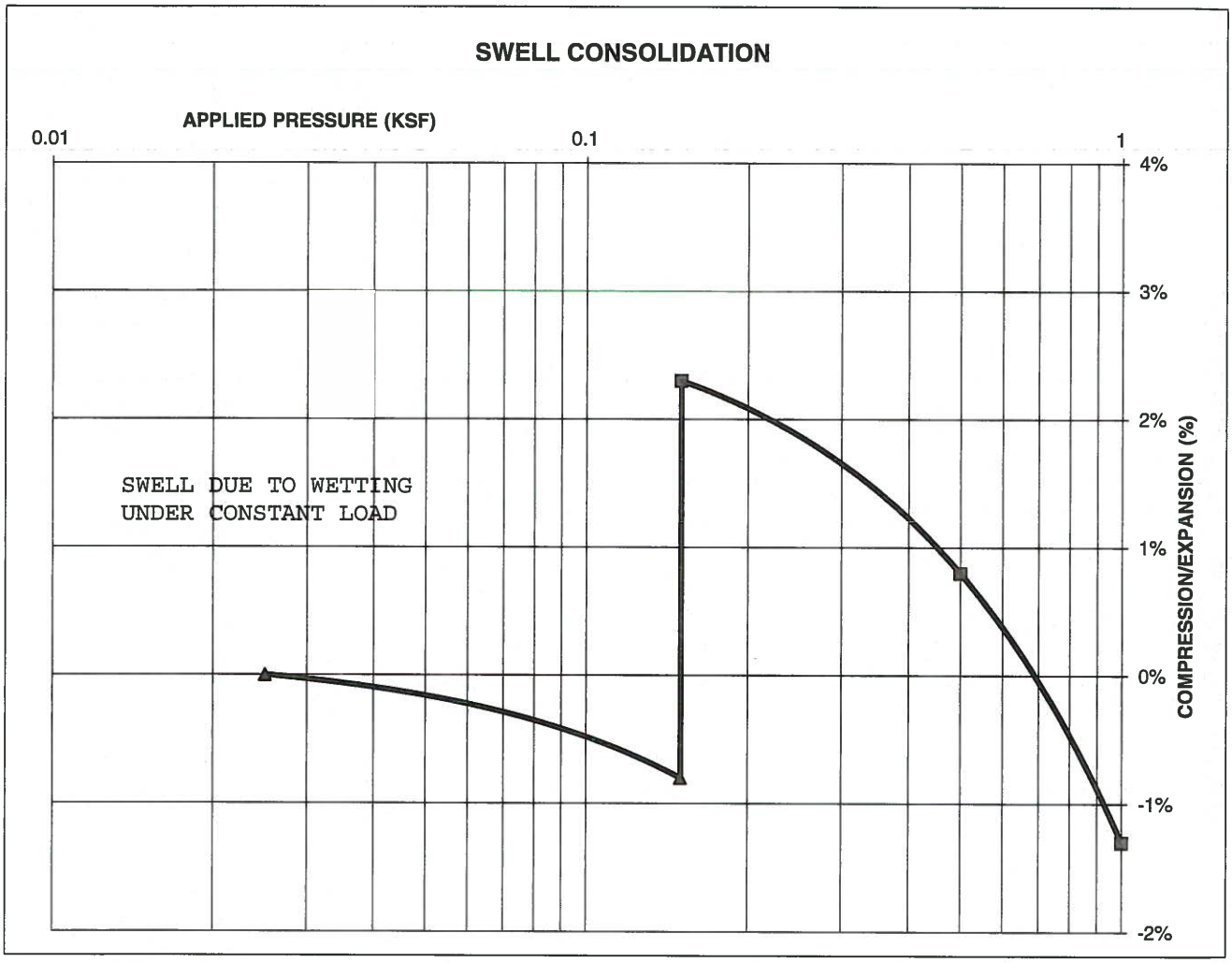
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-22

CONSOLIDATION TEST RESULTS

TEST BORING #	7	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			110
NATURAL MOISTURE CONTENT			15.7%
SWELL/CONSOLIDATION (%)			3.1%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

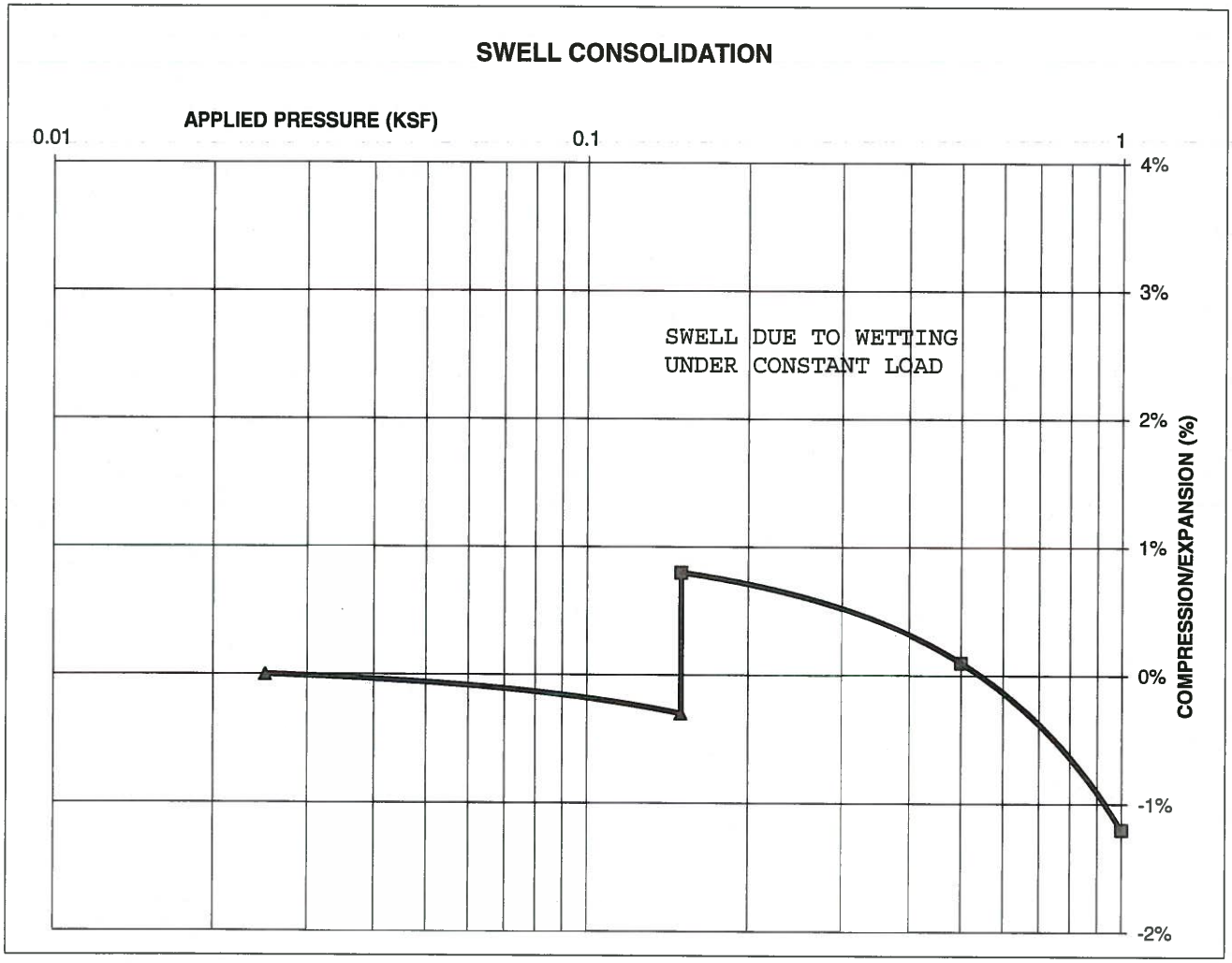
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/10/21

JOB NO.: 200979
FIG NO.: B-23

CONSOLIDATION TEST RESULTS

TEST BORING #	7	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			111
NATURAL MOISTURE CONTENT			18.5%
SWELL/CONSOLIDATION (%)			1.1%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

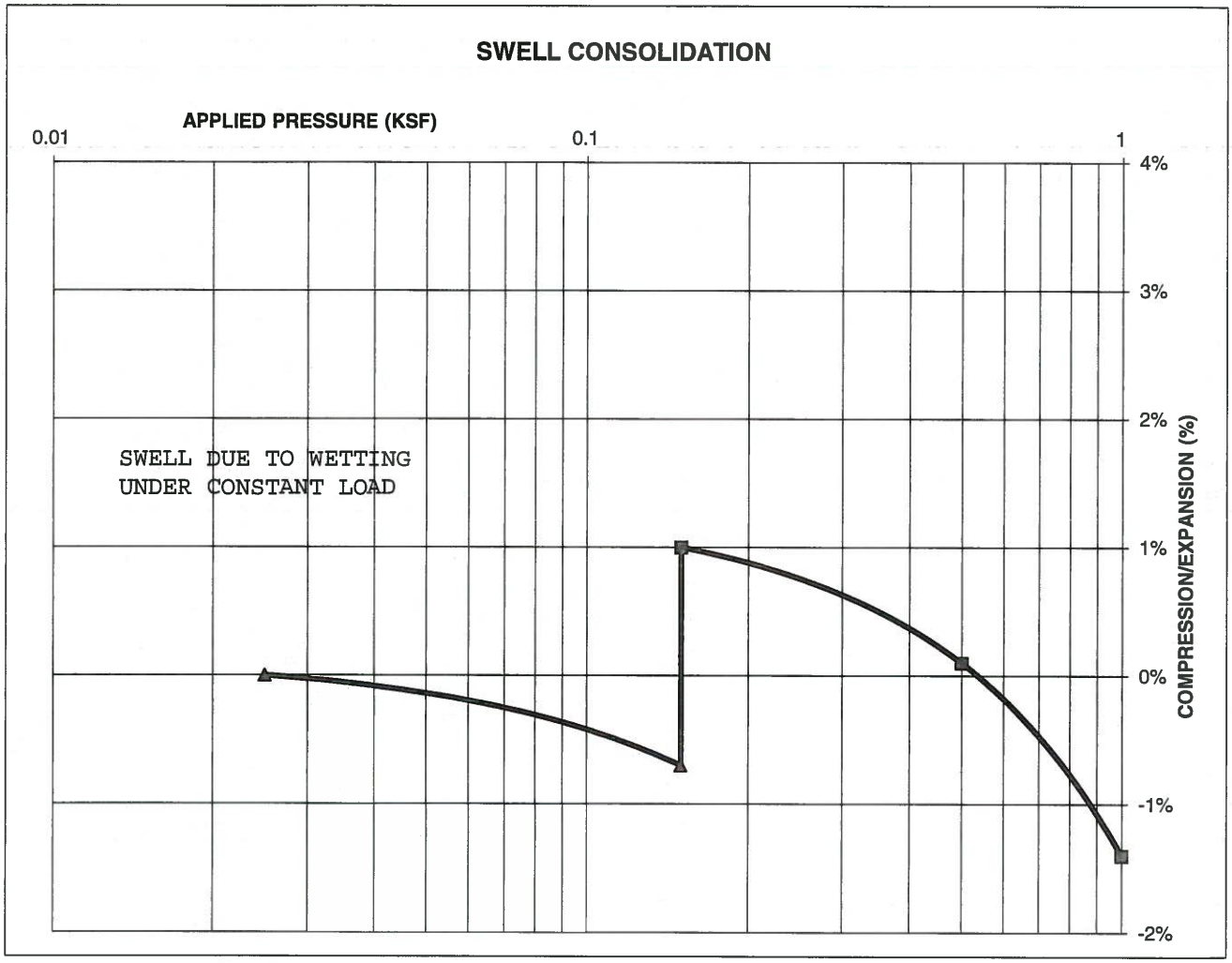
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-2A

CONSOLIDATION TEST RESULTS

TEST BORING #	8	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			11.9%
SWELL/CONSOLIDATION (%)			1.7%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

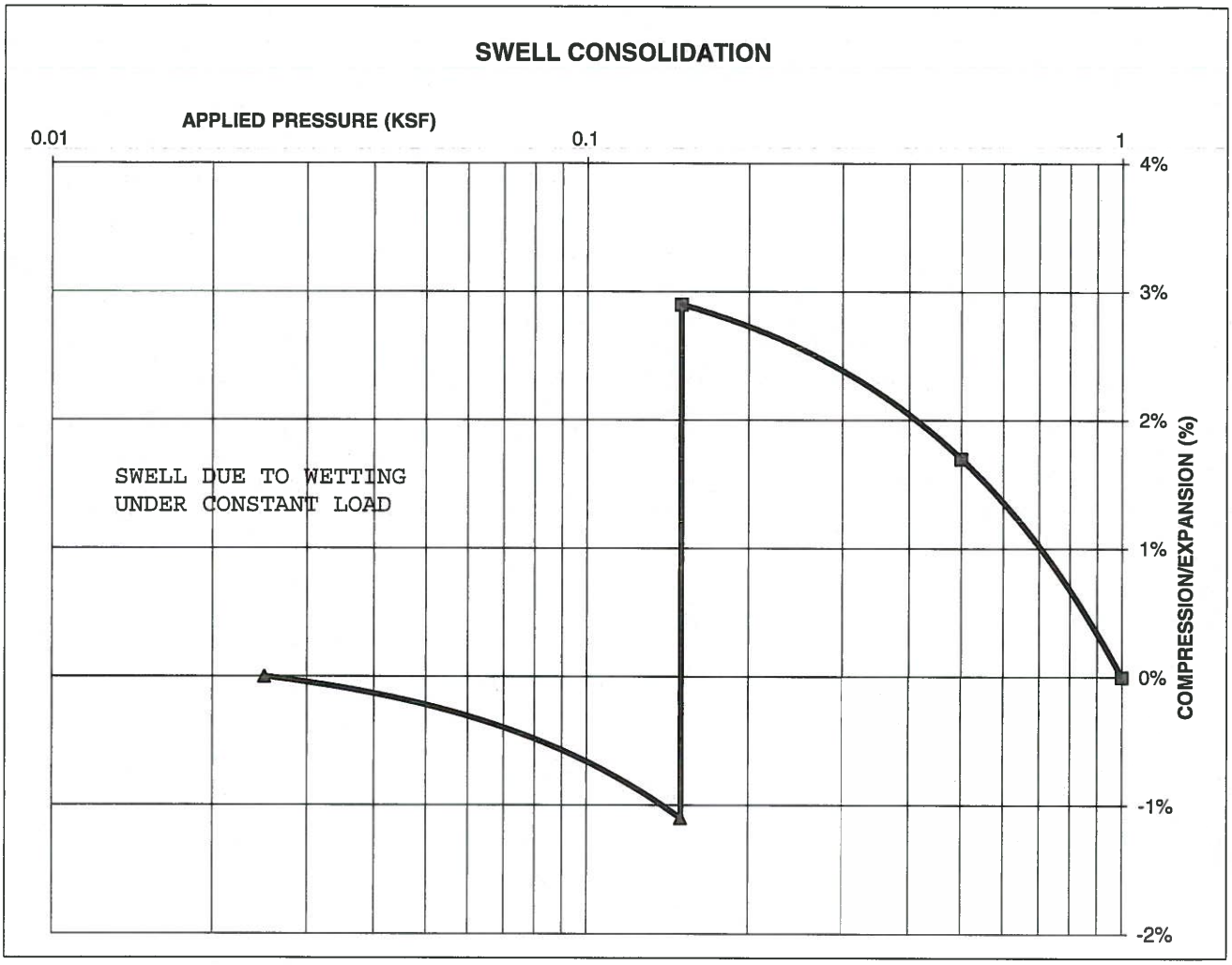
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-25

CONSOLIDATION TEST RESULTS

TEST BORING #	9	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			114
NATURAL MOISTURE CONTENT			13.5%
SWELL/CONSOLIDATION (%)			4.0%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

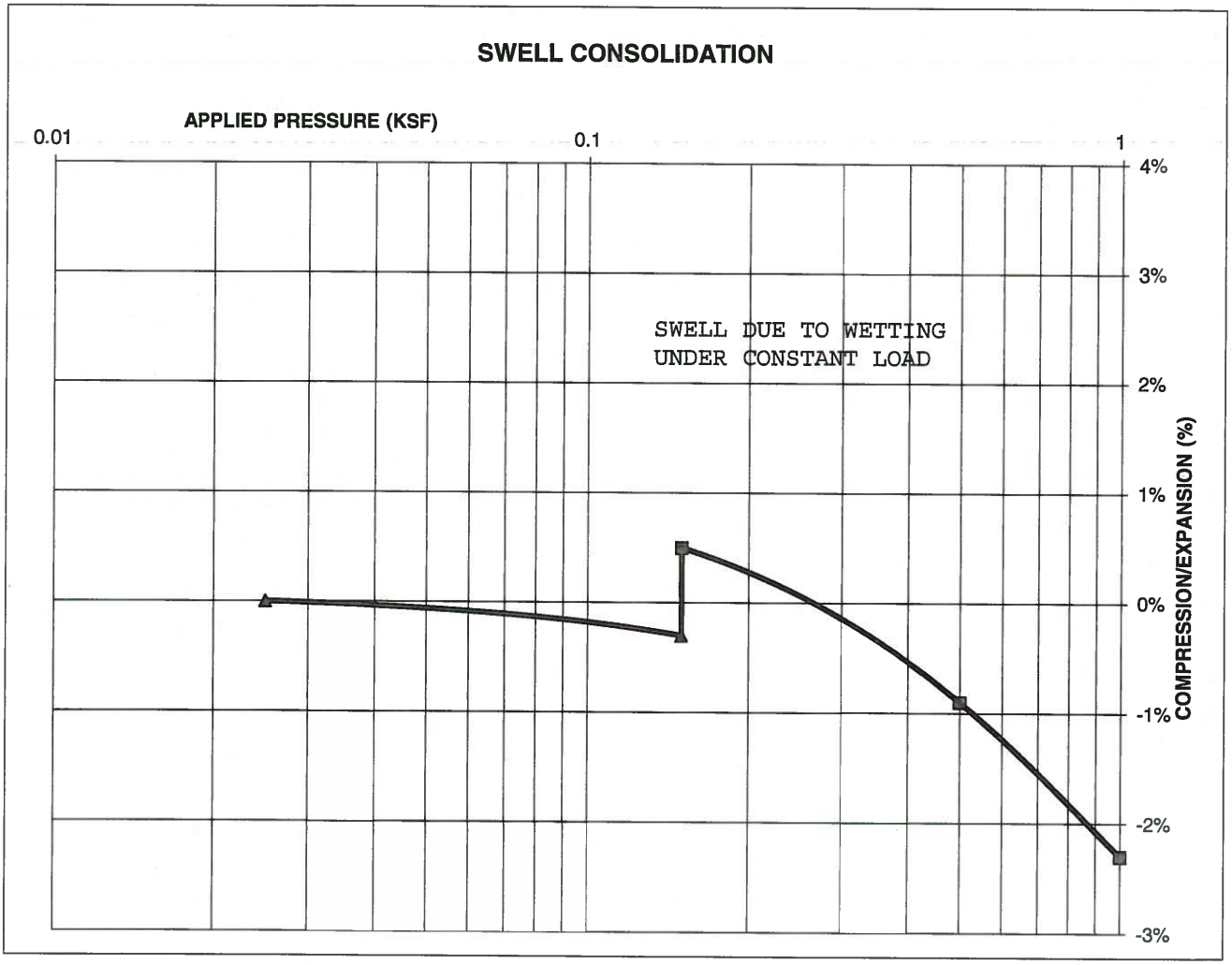
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/nd/21

JOB NO.: 200979
FIG NO.: B-26

CONSOLIDATION TEST RESULTS

TEST BORING #	9	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			115
NATURAL MOISTURE CONTENT			16.6%
SWELL/CONSOLIDATION (%)			0.8%

JOB NO. 200979
CLIENT COLA, LLC
PROJECT ASPEN RIDGE, FILING 2
REMOLDED SAMPLE - +3%



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-27

CLIENT	COLA, LLC	JOB NO.	200979
PROJECT	ASPEN RIDGE, FILING 2	DATE	12/9/2021
LOCATION	ASPEN RIDGE, FILING 2	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-3	1-2	1	CL	0.15
TB-7	1-2	1	CL	0.20
TB-1	1-2	1	CL	0.22
TB-4	1-2	1	CL	0.19

QC BLANK PASS

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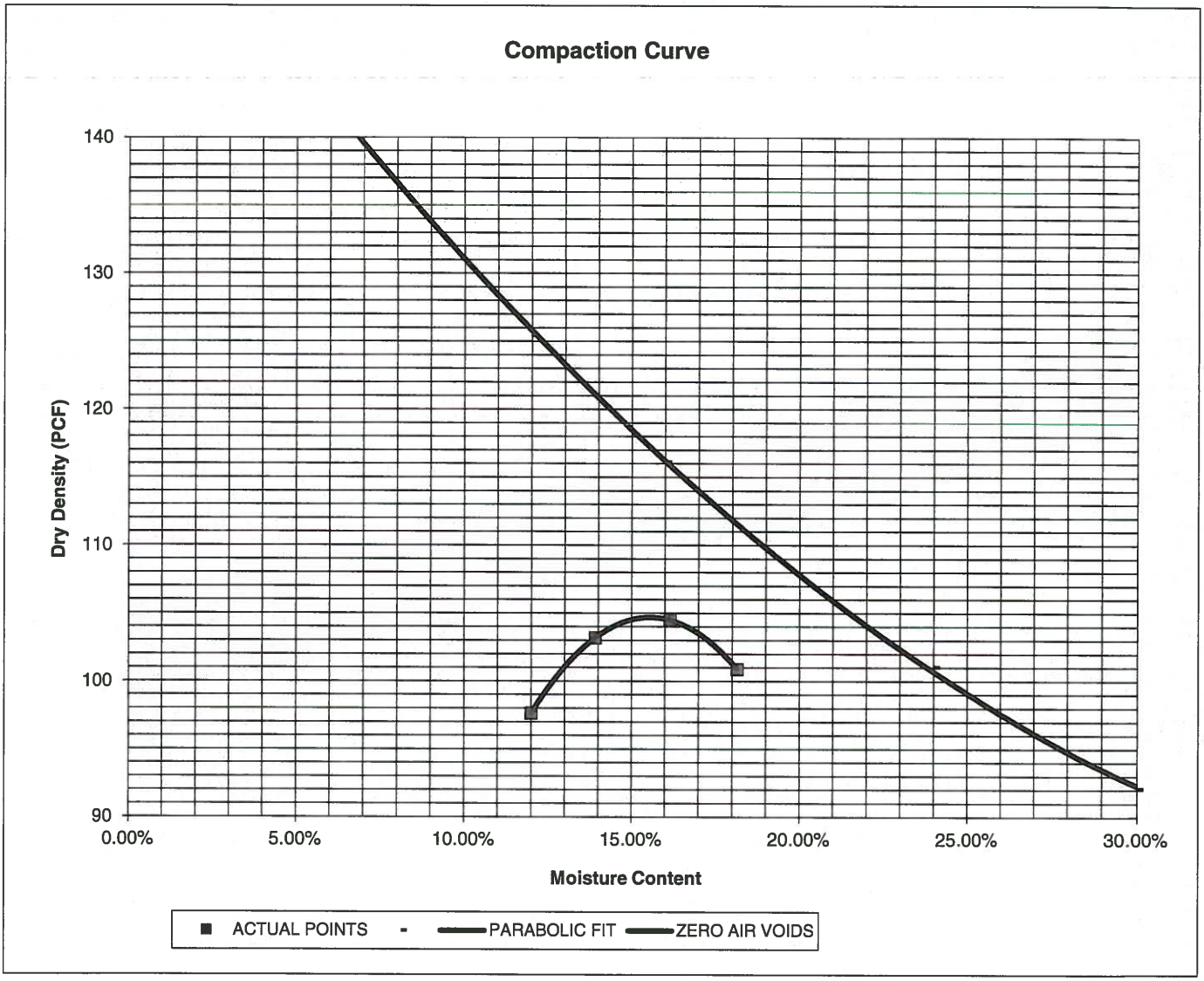
LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DJ	12/14/21

JOB NO.:
200979
FIG NO.:
B-28

PROJECT	ASPEN RIDGE, FILING 2	CLIENT	COLA, LLC
SAMPLE LOCATION	TB-1 @ 0-3'	JOB NO.	200979
SOIL DESCRIPTION	CLAY, SANDY, BROWN	DATE	12/02/21

IDENTIFICATION	CL	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-698-A	TEST BY	AL
MAXIMUM DRY DENSITY (PCF)	104.9	OPTIMUM MOISTURE	15.8%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-29

CBR TEST LOAD DATA

JOB NO: 200979
CLIENT: COLA, LLC
PROJECT: ASPEN RIDGE, FILING 2
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	14	4.68	36	12.03	48	16.04
0.050	21	7.02	46	15.37	61	20.38
0.075	24	8.02	50	16.71	66	22.06
0.100	27	9.02	54	18.05	74	24.73
0.125	29	9.69	59	19.72	78	26.07
0.150	30	10.03	64	21.39	83	27.74
0.175	33	11.03	69	23.06	86	28.74
0.200	34	11.36	74	24.73	89	29.74
0.300	35	11.70	76	25.40	89	29.74
0.400	36	12.03	79	26.40	98	32.75
0.500	39	13.03	88	29.41	109	36.42

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	303	341	342
WT. CAN	8.29	8.57	8.51
WT. CAN+WET	184.54	210.76	239.12
WT. CAN+DRY	170.22	160.77	185.27
WT. H20	14.32	49.99	53.85
WT. DRY SOIL	161.93	152.2	176.76
MOISTURE CONTENT	8.84%	32.84%	30.47%
WET DENSITY (PCF)	107.3	112.5	118.3
DRY DENSITY (PCF)	92.7	97.2	102.1
BEARING RATIO	0.90	1.80	2.47

90% OF DRY DENSITY	94.4
95% OF DRY DENSITY	99.7

BEARING RATIO AT 90% OF MAX	1.25	~ R VALUE	1
BEARING RATIO AT 95% OF MAX	2.14	~ R VALUE	6

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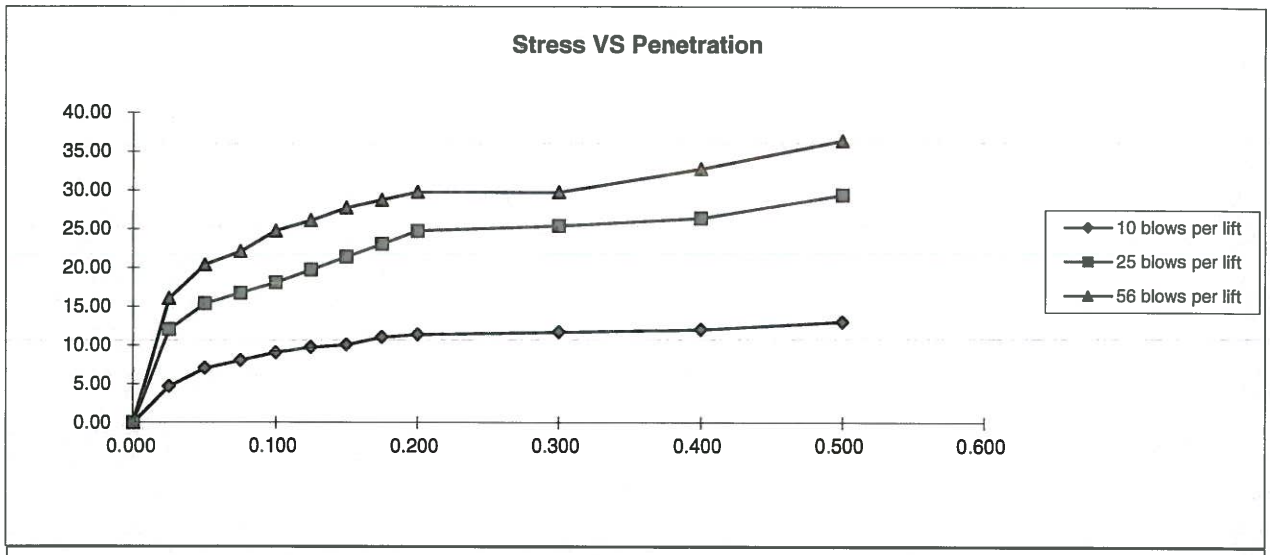
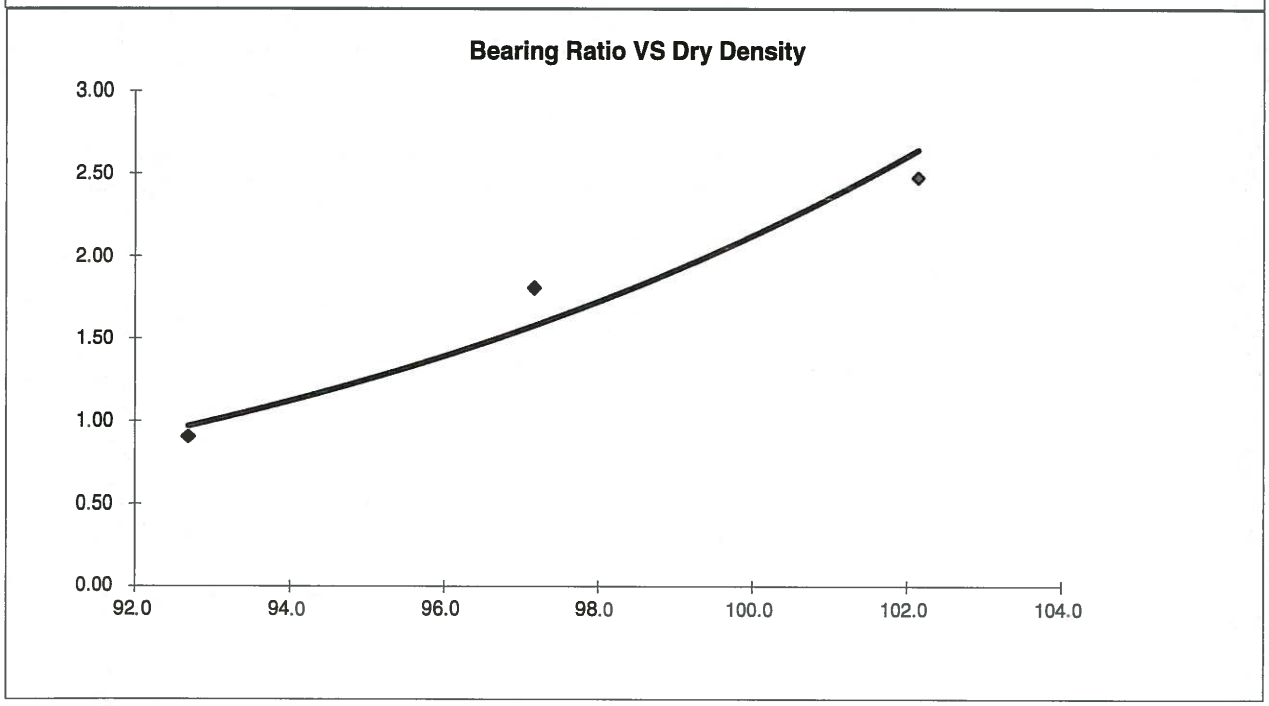
CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-30





BEARING RATIO AT 90% OF MAX	1.25	~ R VALUE	1.00
BEARING RATIO AT 95% OF MAX	2.14	~ R VALUE	6.00

JOB NO: 200979
SOIL TYPE: 1

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CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/14/21

JOB NO.: 200979
FIG NO.: B-31

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

COLA, LLC
TRAILS AT ASPEN RIDGE, FILING 2 - URBAN LOCAL ROADS
SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	292,000
Hveem Stabilometer (R Value) Results:	R =	6
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	3126

Weighted Structural Number (WSN): → WSN = 3.49

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	5.46	0.0

Job No. 200979
Fig. No. C-1

DESIGN CALCULATIONS

DESIGN DATA COLA, LLC
TRAILS AT ASPEN RIDGE, FILING 2 - URBAN LOCAL ROADS
SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	6
Weighted Structural Number (WSN):	WSN =	3.49

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 Base Course

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Base Course (inches)

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [5.5] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 9.8 inches of Aggregate
Base Course, use 10.0 inches

RECOMMENDED ALTERNATIVE

1. 5.5 inches of Asphalt + 10.0 inches of Aggregate Base Course

Job No. 200979
Fig. No. C-2