

December 28, 2020
Revised: April 29, 2021



ENTECH
ENGINEERING, INC.

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

Winsome, LLC
1864 Woodmoor Drive, Suite 100
Monument, CO 80132

Attn: Joe DesJardin

Re: Pavement Recommendations
Winsome Subdivision, Phase 1
El Paso County, Colorado

APPROVED
Engineering Department

05/04/2021 11:52:28 AM


EPC Planning & Community
Development Department

Dear Mr. DesJardin:

As requested, Entech Engineering, Inc. has obtained samples of the pavement subgrade soils for portions of the roadways at the above referenced subdivision. 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 these roadways.

Project Description

The project will consist of paving of the roadways within Phase 1 of the above noted subdivision. This design is valid for sections of Alamar Way and Bison Meadows Court, Winsome Way, Mossy Trail and Clove Hitch Court in the Winsome Subdivision, Phase 1 in El Paso County, Colorado. The acceleration/deceleration lane on the north side of Hodgen Road will be drilled and designed at a later date following the permit process. Subsurface Soil Investigation and laboratory testing were performed to determine the pavement support characteristics of the soils. The filing layout and the locations of the test borings are shown on the Test Boring Location Map, Figure 1.

Subgrade Conditions

Sixteen exploratory test borings were drilled in the roadways to depths of 5 to 10 feet. The borings were spaced at 500 feet intervals, maximum. The Boring Logs are presented in Appendix A. Sieve Analysis and Atterberg Limit testing were performed on soil samples obtained from the test borings for the purpose of classification. The Type 1 and Type 1A samples were grouped together due to the similar characteristics. Sieve analyses performed indicated the percent passing the No. 200 sieve for the Type 1 and 1A soils at subgrade depth ranged from approximately 14 to 34 percent. Atterberg Limit Tests performed on the Type 1 and 1A samples resulted in Liquid Limits ranging from 19 to 37 and no value with Plastic Indexes ranging from 3 to 22 and non-plastic. Soil Type 2 was encountered in one test boring. The Type 2 sandstone soils were encountered at 4 feet below subgrade in Test Boring No. 1, which is below the subgrade influence zone. Soil Type 1 and 1A consisted of silty to clayey sand fill and native silty to clayey sand, which classified as A-1-b, A-2-4, and A-2-6 soils based on the AASHTO classification system, which typically provide good support characteristics. One subgrade soil type was determined for pavement support from field investigation and laboratory testing (Soil Type 1). Groundwater was not encountered in the test borings. Water-soluble sulfate tests indicate a negligible potential for sulfate attack.

Swell testing was performed on samples of the subgrade soils with Plastic Indexes over 10. Swell/Consolidation Tests conducted on the soils exhibited volume change ranging from 0.2 to 1.4 percent. The soils are below the levels in which mitigation is required.

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

Soil Type 1 – Silty Sand

R @ 90% = 22.0
R @ 95% = 65.0
Use R = 50.0 for design

Classification Testing

Liquid Limit	19
Plasticity Index	3
Percent Passing 200	32.4
AASHTO Classification	A-2-4
Group Index	0
Unified Soils Classification	SM

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". The Clove Hitch Court and Mossy Trail cul-de-sac roads classify as rural local roads, which used an 18K ESAL value of 36,500 to determine the pavement sections. Alamar Way, Winsome Way and Bison Meadows Court classify as rural local roads, which used an 18K ESAL value of 109,500 for design. Pavement sections for asphalt over aggregate base course or over recycled concrete base course sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability	80%
Serviceability Index – Rural Local Cul-De-Sac	2.0
Serviceability Index – Rural Local	2.5
Resilient Modulus	13,168 psi
"R" Value Subgrade	50
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Recycled Concrete Base Course	0.11

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

Pavement Sections – Mossy Trail and Clove Hitch Court Cul-De-Sac Roads

Rural Local Road
Soil Type 1, R = 50.0

<u>Alternatives</u>	<u>Asphalt (in)</u>	<u>Aggregate Base Course (in)</u>	<u>Recycled Conc. (in)</u>
1 – Asphalt Over Base Course	3.0	4.0	-
2 – Asphalt Over Recycled Concrete	3.0	-	4.0

Pavement Sections – Alamar Way, Winsome Way and Bison Meadows Court

Rural Local Roads
Soil Type 1, R = 50.0

<u>Alternatives</u>	<u>Asphalt (in)</u>	<u>Aggregate Base Course (in)</u>	<u>Recycled Conc. (in)</u>
1 – Asphalt Over Base Course	4.0	6.0	-
2 – Asphalt Over Recycled Concrete	4.0	-	6.0

Roadway Construction - Asphalt on Base Course or Recycled Concrete Alternatives

Prior to placement of the asphalt, the subgrade should be scarified, moisture-conditioned, compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 at $\pm 2\%$ of 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 $\pm 2\%$ 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, recycled concrete, subgrade conditions, compaction of materials and roadway construction methods shall meet the El Paso County specifications.

Winsome, LLC
Pavement Recommendations - Revised
Winsome Subdivision, Phase 1
El Paso County, Colorado
Page 4

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. 202479
AAprojects/2020/202479 pr-REV 4



Reviewed by:

Mark H. Hauschild, P.E.
Senior Engineer

TABLE


TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT: WINSOME, LLC
 PROJECT: HODGEN AND WINSOME
 JOB NO.: 202479

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
1A	9	1-2			14.0	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1A	11	1-2	11.3	111.0	25.2	28	22		A-2-6	0.2	SC	FILL, SAND, CLAYEY
1A	15	1-2	12.4	117.7	33.6	31	12		A-2-6	1.4	SC	FILL, SAND, CLAYEY
1, CBR	6	0-3			32.4	19	3		A-2-4		SM	SAND, SILTY
1	3	0-3			27.3						SM	SAND, SILTY
1	1	1-2	8.5	116.4	32.0	37	18		A-2-6	0.5	SC	SAND, CLAYEY
1	2	1-2	13.9	115.4	26.4	31	14	<0.01	A-2-6	0.2	SC	SAND, CLAYEY
1	3	1-2			23.3	NV	NP		A-2-4		SM	SAND, SILTY
1	4	1-2			14.6	NV	NP		A-1-b		SM	SAND, SILTY
1	5	1-2			20.4	NV	NP		A-2-4		SM	SAND, SILTY
1	6	1-2			30.8	20	3		A-2-4		SM	SAND, SILTY
1	7	1-2			25.9	NV	NP	<0.01	A-2-4		SM	SAND, SILTY
1	8	1-2			29.3	24	4		A-2-4		SM	SAND, SILTY
1	10	1-2			33.9	NV	NP		A-2-4		SM	SAND, SILTY
1	12	1-2	14.4	113.1	30.2	26	11	<0.01	A-2-6	0.8	SC	SAND, CLAYEY
1	13	1-2	7.2	108.3	33.1	30	13		A-2-6	0.4	SC	SAND, CLAYEY
1	14	1-2			32.3	NV	NP		A-2-4		SM	SAND, SILTY
1	16	1-2			25.1	NV	NP		A-2-4		SM	SAND, SILTY
2	1	5			22.1	NV	NP	<0.01	A-1-b		SM	SANDSTONE, SILTY

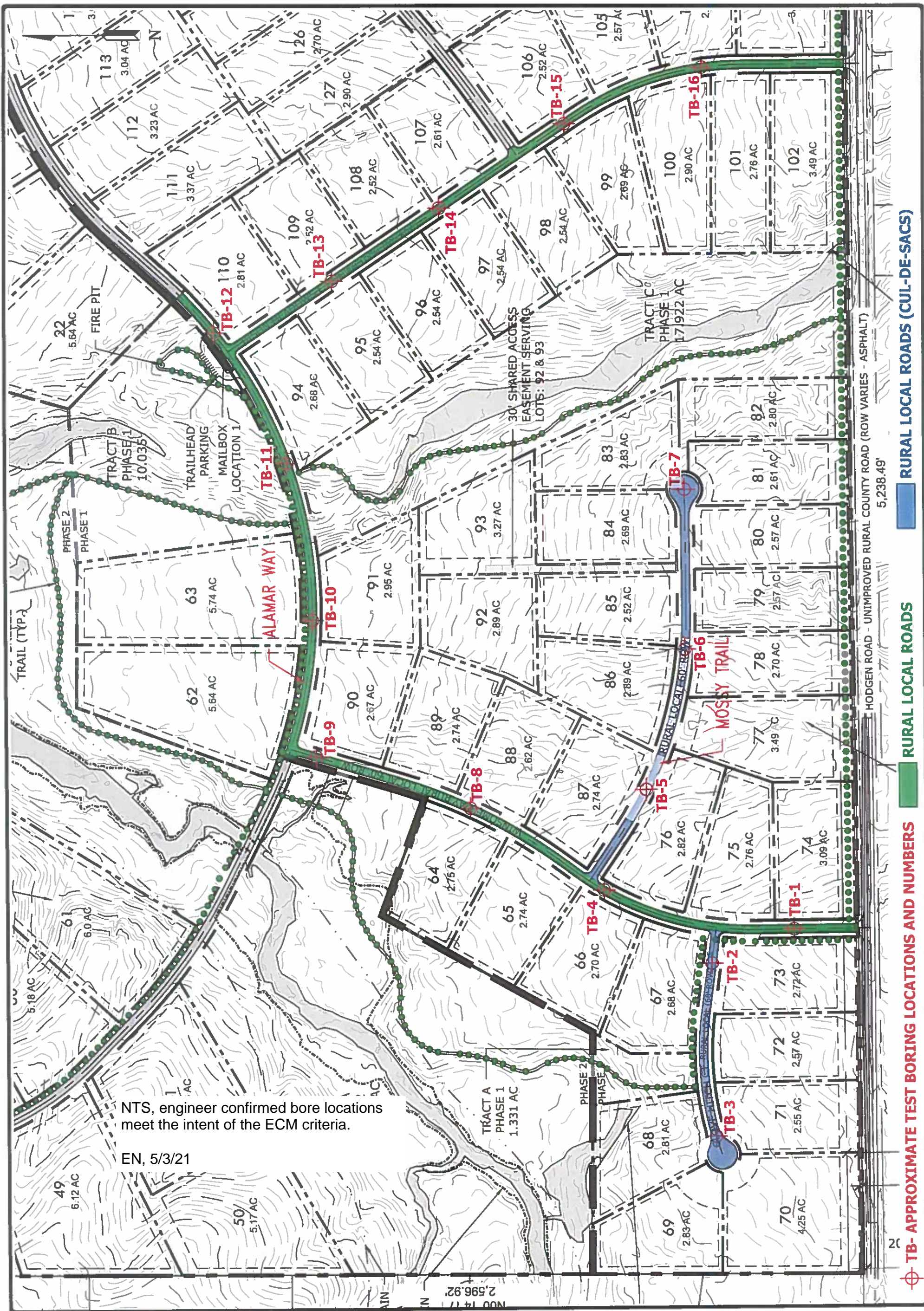
FIGURE

[illegible]

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(719) 531-5599

TEST BORING LOCATION MAP
WINSOME SUBDIVISION, PHASE 1
EL PASO COUNTY, CO
FOR: WINSOME, LLC

TRAIN
JAC
CHORD
DPS
RAIL
12/09/20
SCALE
AS SHOWN
368 ML
202470
120000 ML
1



APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 11/11/2020
Job # 202479

TEST BORING NO. 2
DATE DRILLED 11/11/2020
CLIENT WINSOME, LLC
LOCATION HODGEN AND WINSOME

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 11/11/20							DRY TO 5', 11/11/20						
SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, DENSE, MOIST				39	5.7	1	SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, VERY DENSE TO DENSE, MOIST				50 11"	5.7	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	5			50 10"	5.3	2		5			35	6.2	1
	10							10					
	15							15					
	20							20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED: *h*

DATE:

11/25/20

JOB NO.:
202479

FIG NO.:
A- 1

TEST BORING NO. 3
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 4
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS

DRY TO 10', 11/11/20

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			23	1.3	1
5			38	1.7	1
10			27	9.8	1
15					
20					

REMARKS

DRY TO 5', 11/11/20

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

CLAYEY LENSE

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			24	1.5	1
5			23	10.6	1
10					
15					
20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED: *h*

DATE 11/25/20

JOB NO.
 202479

FIG NO.
 A- 2

TEST BORING NO. 5
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 6
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS

DRY TO 5', 11/11/20
 SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, DENSE, DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			36	2.5	1
5			36	2.1	1
10					
15					
20					

REMARKS

DRY TO 10', 11/11/20
 SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, MEDIUM DENSE,

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			21	9.6	1
5			28	2.5	1
10			22	7.6	1
15					
20					



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TEST BORING LOG

DRAWN:

DATE

CHECKED: *h*

DATE: 11/25/20

JOB NO:
 202479

FIG NO:
 A-3

TEST BORING NO. 7
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 8
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS

DRY TO 5', 11/11/20
 SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, DENSE TO
 MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			30	4.2	1
5			26	4.6	1
10					
15					
20					

REMARKS

DRY TO 5', 11/11/20
 SAND, SILTY WITH ORGANICS,
 FINE TO COARSE GRAINED,
 BROWN TO TAN, MEDIUM DENSE
 TO DENSE, DRY TO MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			26	2.8	1
5			33	3.4	1
10					
15					
20					



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TEST BORING LOG

DRAWN

DATE

CHECKED

DATE
 11/25/20

JOB NO.:
 202479

FIG NO.:
 A- 4

TEST BORING NO. 9
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 10
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS

DRY TO 10', 11/11/20
 POSS. FILL 0-3', SAND, SILTY,
 FINE TO COARSE GRAINED, TAN,
 DENSE, MOIST
 SAND, SILTY, FINE TO COARSE
 GRAINED, BROWN TO TAN,
 DENSE, MOIST TO DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			34	4.8	1A
5			45	7.6	1
10			36	2.4	1
15					
20					

REMARKS

DRY TO 5', 11/11/20
 SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, MEDIUM DENSE,
 MOIST
 CLAYEY LENSE

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			19	11.4	1
5			25	14.9	1
10					
15					
20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

11/25/20

JOB NO.:
 202479

FIG NO.:
 A- 5

TEST BORING NO. 11
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 12
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 11/11/20							DRY TO 10', 11/11/20						
POSS. FILL 0-3', SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				17	7.9	1A	SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				19	5.4	1
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	5			25	10.0	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, DRY TO MOIST	5			27	2.4	1
	10							10			29	4.4	1
	15							15					
	20							20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

11/25/20

JOB NO.
202479

FIG NO:
A- 6

TEST BORING NO. 13
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 14
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS

DRY TO 5', 11/11/20

SAND, CLAYEY, FINE TO COARSE
 GRAINED, TAN, MEDIUM DENSE,
 MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			13	5.6	1
5			27	2.8	1
10					
15					
20					

REMARKS

DRY TO 5', 11/11/20

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			22	7.4	1
5			47	2.3	1
10					
15					
20					



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TEST BORING LOG

DRAWN:

DATE

CHECKED: *h*

DATE 11/25/20

JOB NO.
 202479

FIG NO.
 A-7

TEST BORING NO. 15
 DATE DRILLED 11/11/2020
 Job # 202479

TEST BORING NO. 16
 DATE DRILLED 11/11/2020
 CLIENT WINSOME, LLC
 LOCATION HODGEN AND WINSOME

REMARKS

DRY TO 5', 11/11/20

POSS. FILL 0-3', SAND, CLAYEY,
 FINE TO COARSE GRAINED,
 BROWN, MEDIUM DENSE, MOIST
 SAND, SILTY, FINE TO COARSE
 GRAINED, BROWN, DENSE,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			19	10.6	1A
5			39	4.6	1
10					
15					
20					

REMARKS

DRY TO 5', 11/11/20

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			22	5.7	1
5			28	4.8	1
10					
15					
20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE: 11/25/20

JOB NO.:
 202479

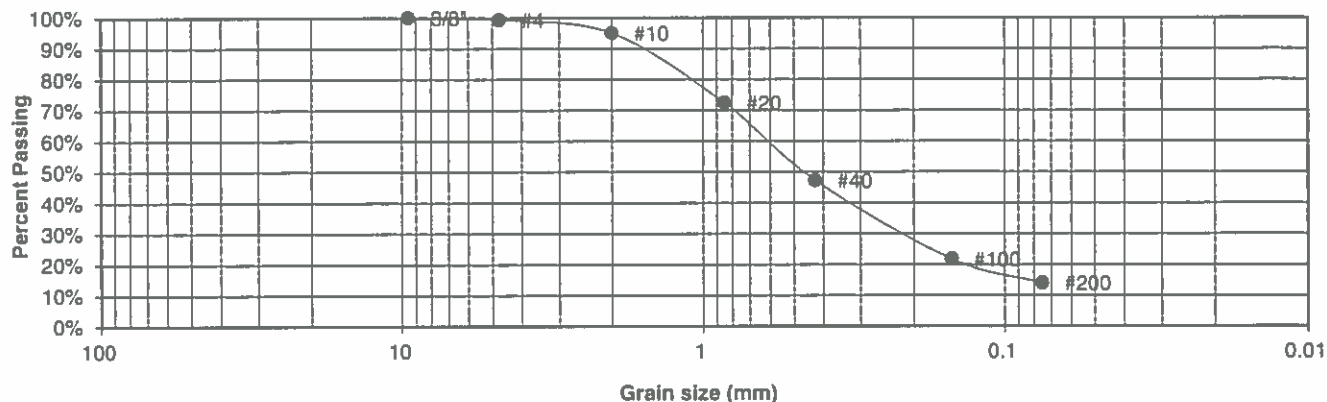
FIG NO.:
 A- 8

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1A
TEST BORING # 9
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME
JOB NO. 202479
TEST BY BL
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	99.3%
10	95.0%
20	72.4%
40	47.2%
100	21.7%
200	14.0%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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LABORATORY TEST RESULTS

DRAWN: DATE: CHECKED: *h* DATE: 4/25/20

JOB NO.:

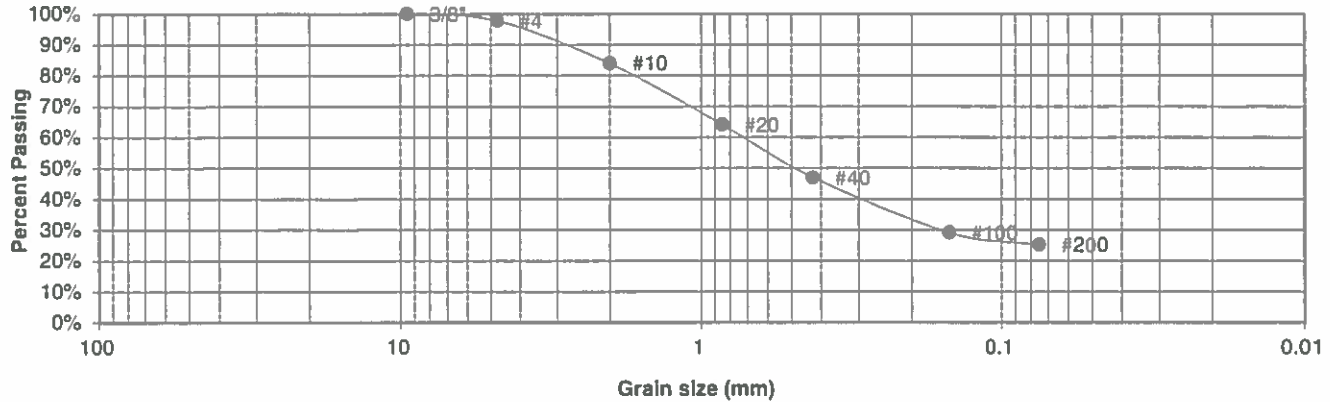
202479

FIG NO.:

B-1

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	1A	<u>PROJECT</u>	HODGEN AND WINSOME
<u>TEST BORING #</u>	11	<u>JOB NO.</u>	202479
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-6	<u>GROUP INDEX</u>	1

**Sieve Analysis
Grain Size Distribution**



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.8%
10	84.0%
20	64.1%
40	47.0%
100	29.1%
200	25.2%

<u>Atterberg Limits</u>	
Plastic Limit	6
Liquid Limit	28
Plastic Index	22

<u>Swell</u>	
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>	<u>DATE:</u>
		h	4/25/20

JOB NO.:

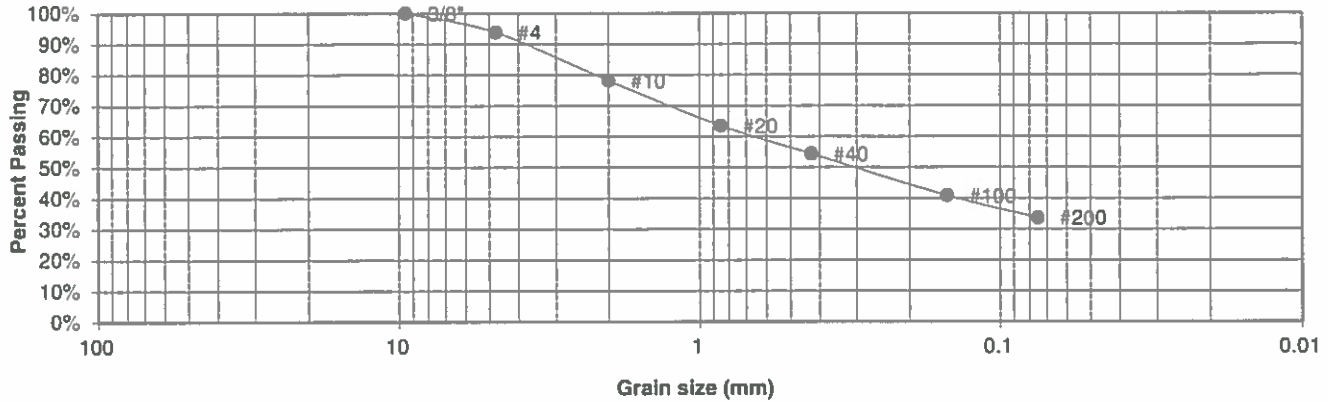
202479

FIG NO.:

82

UNIFIED CLASSIFICATION	SC	CLIENT	WINSOME, LLC
SOIL TYPE #	1A	PROJECT	HODGEN AND WINSOME
TEST BORING #	15	JOB NO.	202479
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	93.8%
10	78.1%
20	63.5%
40	54.4%
100	40.8%
200	33.6%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	31
Plastic Index	12

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:
		<i>[Signature]</i>	4/25/20

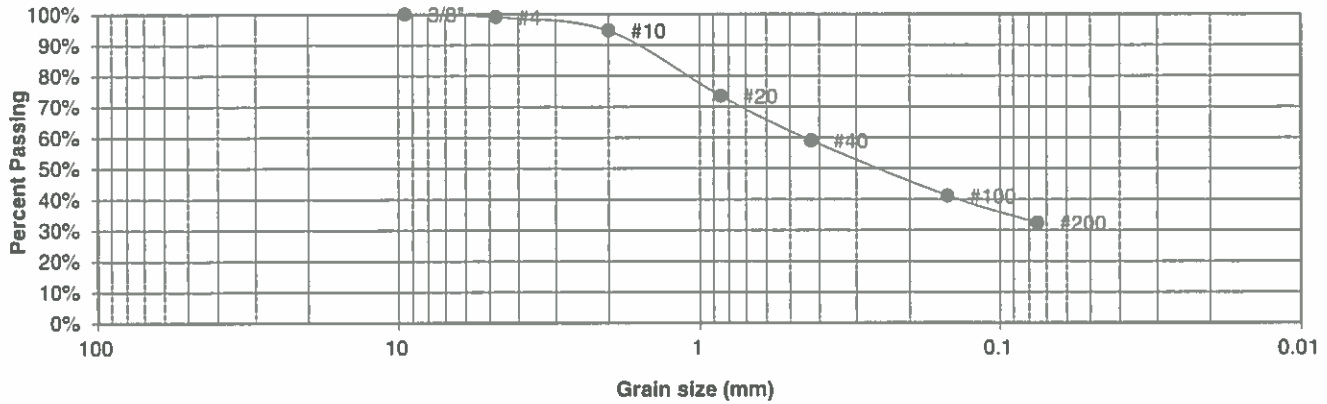
JOB NO.:

202479
FIG NO.:

6-3

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	1, CBR	<u>PROJECT</u>	HODGEN AND WINSOME
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	202479
<u>DEPTH (FT)</u>	0-3	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0

**Sieve Analysis
Grain Size Distribution**



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.1%
10	94.7%
20	73.4%
40	59.0%
100	41.1%
200	32.4%

<u>Atterberg Limits</u>	
Plastic Limit	16
Liquid Limit	19
Plastic Index	3

<u>Swell</u>	
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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			11/25/20

JOB NO. 202479

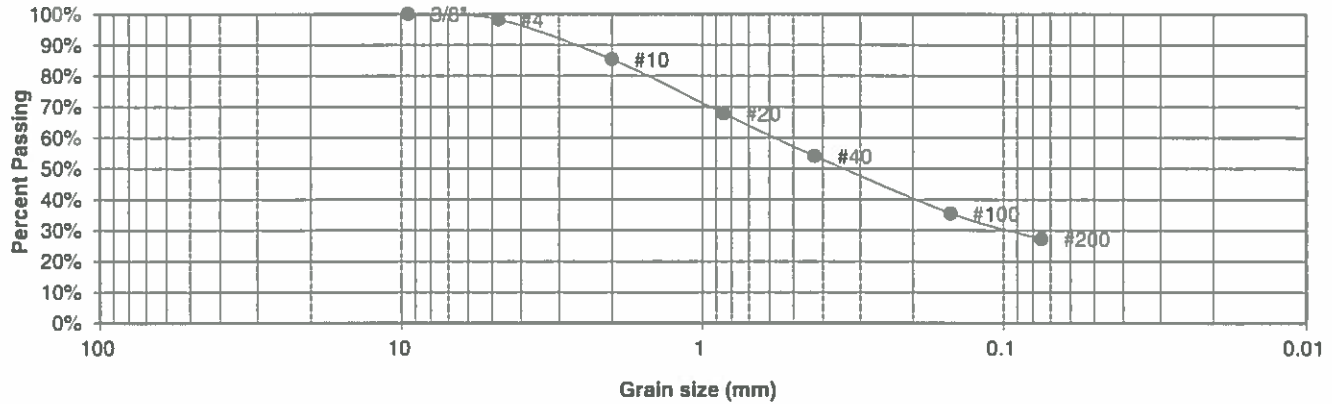
FIG NO.

B-4

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 3
DEPTH (FT) 0-3
AASHTO CLASSIFICATION

CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME
JOB NO. 202479
TEST BY BL
GROUP INDEX

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	85.4%
20	67.8%
40	54.1%
100	35.5%
200	27.3%

Atterberg
Limits
 Plastic Limit
 Liquid Limit
 Plastic Index

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



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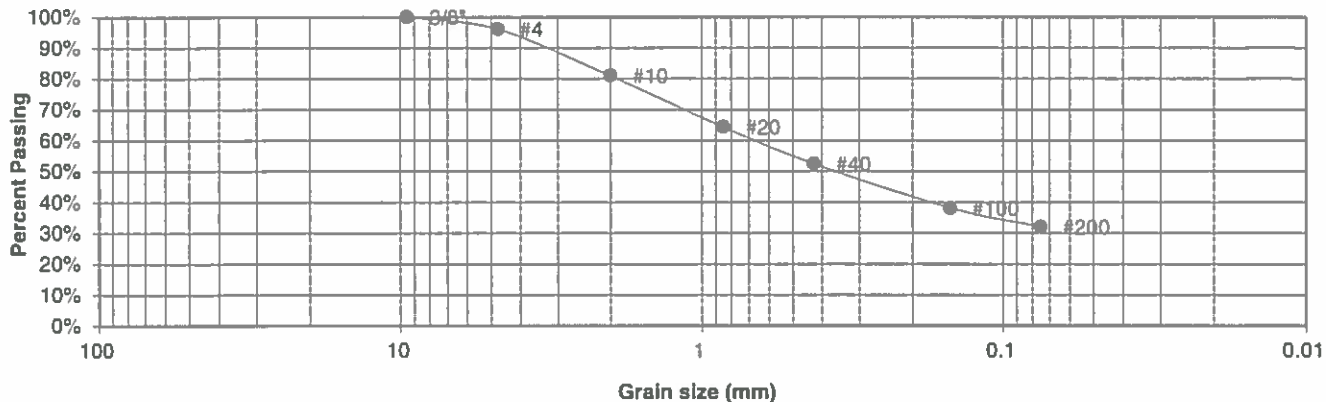
202479

FIG NO:

B-5

UNIFIED CLASSIFICATION	SC	CLIENT	WINSOME, LLC
SOIL TYPE #	1	PROJECT	HODGEN AND WINSOME
TEST BORING #	1	JOB NO.	202479
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	1

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.1%
10	81.0%
20	64.4%
40	52.5%
100	38.1%
200	32.0%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	37
Plastic Index	18

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



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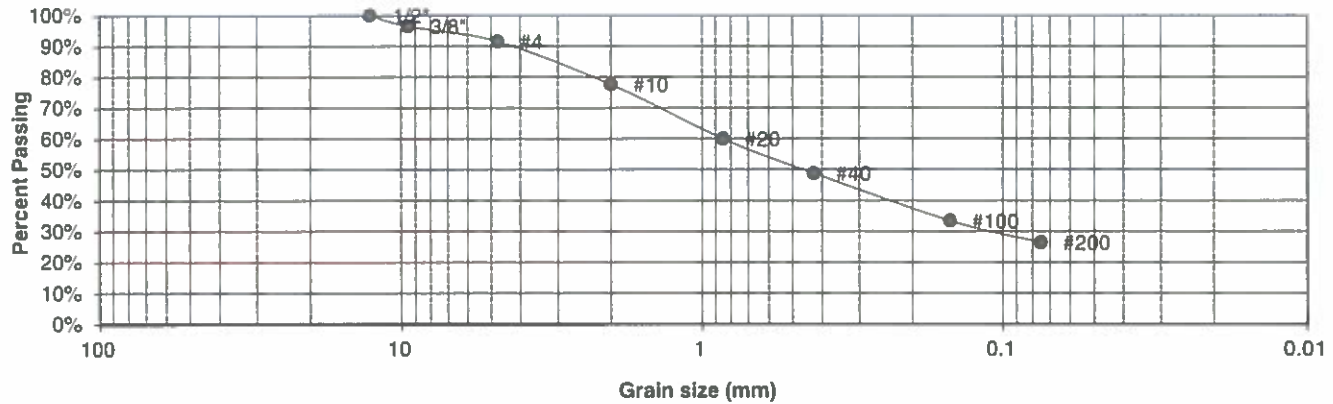
202479

FIG NO.:

BL

UNIFIED CLASSIFICATION	SC	CLIENT	WINSOME, LLC
SOIL TYPE #	1	PROJECT	HODGEN AND WINSOME
TEST BORING #	2	JOB NO.	202479
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"	100.0%
3/8"	96.5%
4	91.5%
10	77.6%
20	60.0%
40	48.8%
100	33.3%
200	26.4%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	31
Plastic Index	14

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



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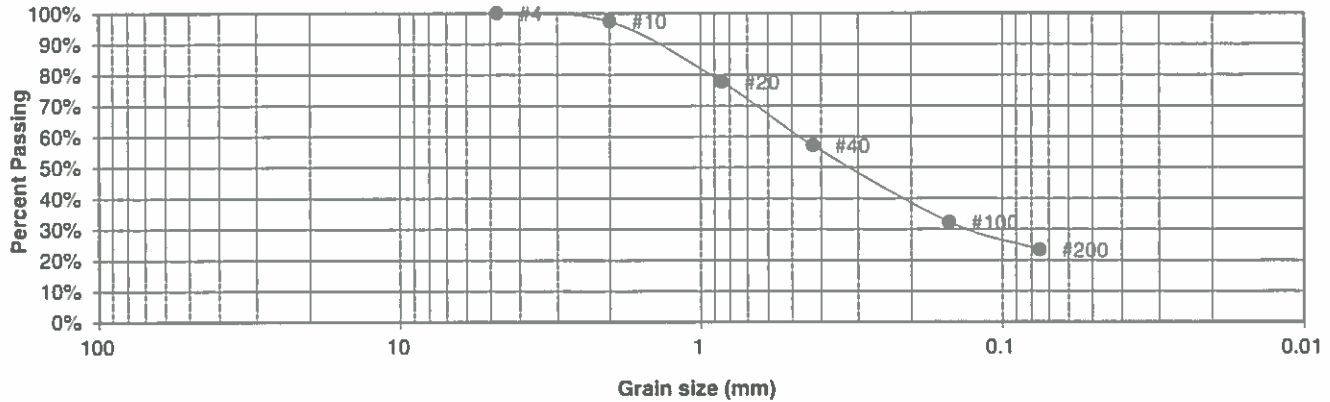
FIG NO.:

B-7

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 3
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME
JOB NO. 202479
TEST BY BL
GROUP INDEX 0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.4%
20	77.7%
40	57.1%
100	32.3%
200	23.3%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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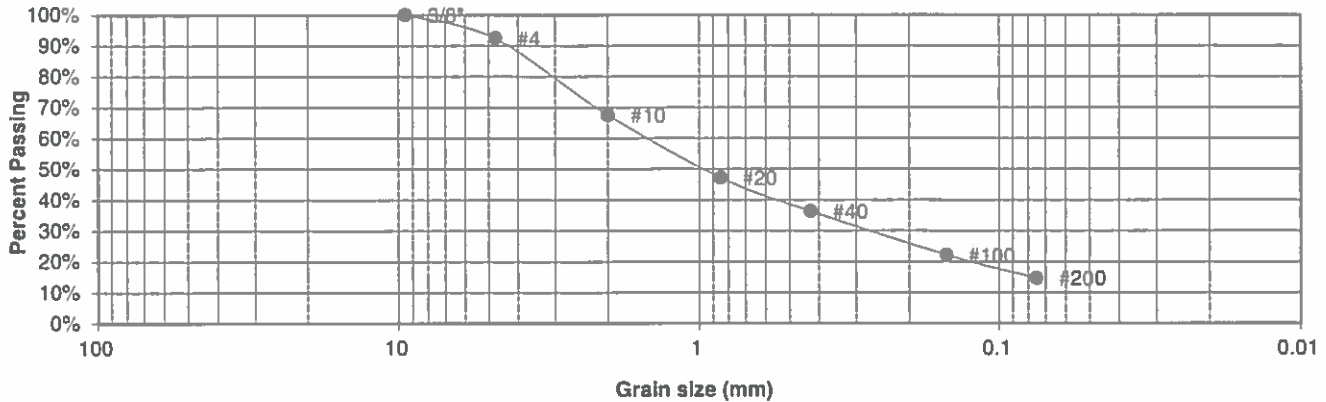
FIG NO.:

B-8

UNIFIED CLASSIFICATION	SM
SOIL TYPE #	1
TEST BORING #	4
DEPTH (FT)	1-2
AASHTO CLASSIFICATION	A-1-b

CLIENT	WINSOME, LLC
PROJECT	HODGEN AND WINSOME
JOB NO.	202479
TEST BY	BL
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	92.4%
10	67.5%
20	47.2%
40	36.3%
100	22.1%
200	14.6%

Atterberg
Limits
Plastic Limit NP
Liquid Limit NV
Plastic Index NP

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



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JOB NO.:

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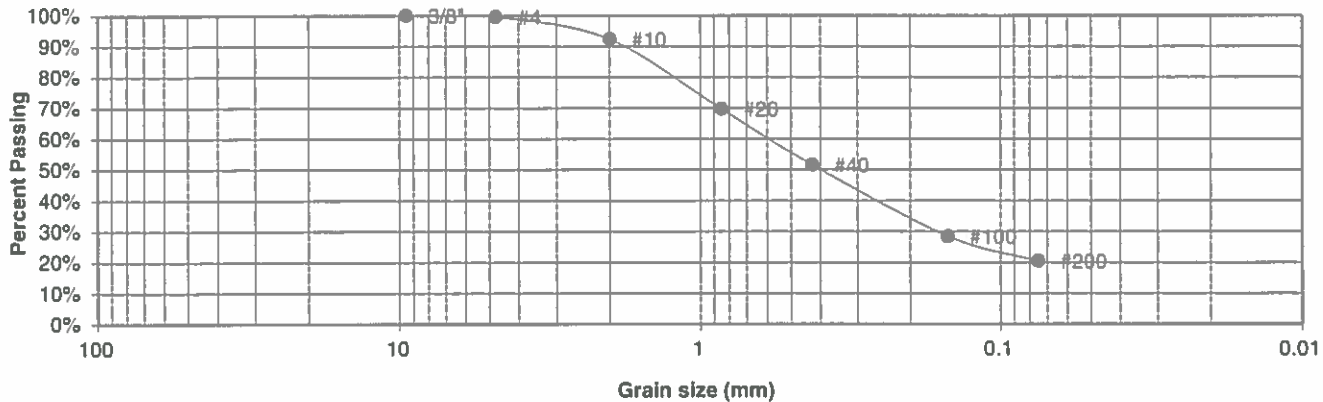
FIG NO.:

B-9

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 5
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME
JOB NO. 202479
TEST BY BL
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	99.6%
10	92.3%
20	69.7%
40	51.6%
100	28.4%
200	20.4%

Atterberg
Limits
 Plastic Limit NP
 Liquid Limit NV
 Plastic Index NP

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



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JOB NO.:

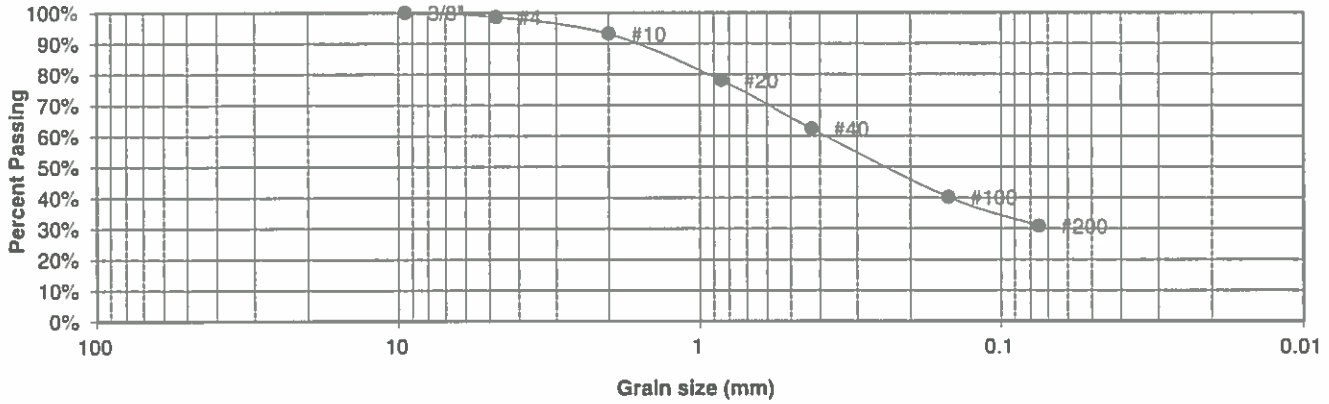
202479
 FIG NO.:

B-10

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 6
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME
JOB NO. 202479
TEST BY BL
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	98.6%
10	93.1%
20	78.1%
40	62.3%
100	40.2%
200	30.8%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	20
Plastic Index	3

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



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JOB NO.:

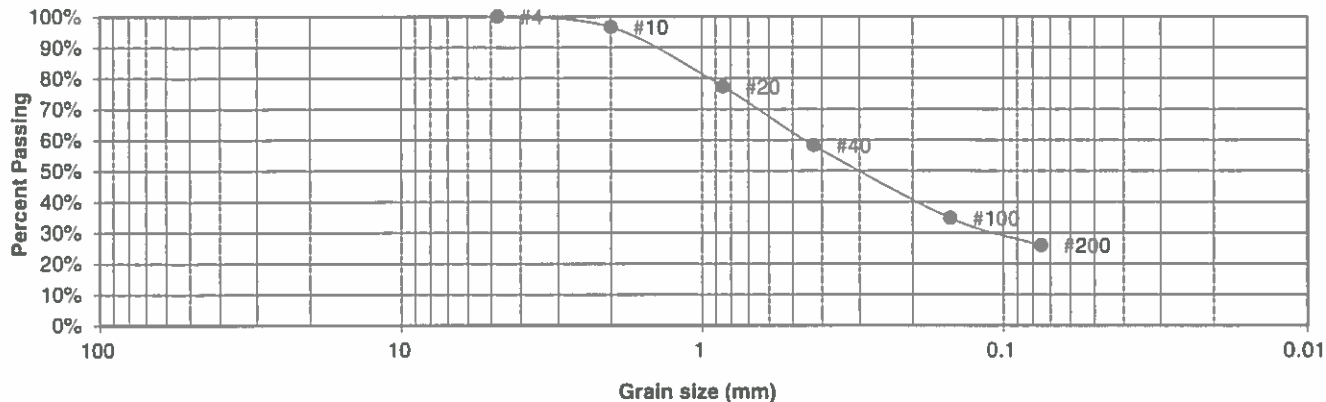
202479

FIG NO.:

B-11

UNIFIED CLASSIFICATION	SM	CLIENT	WINSOME, LLC
SOIL TYPE #	1	PROJECT	HODGEN AND WINSOME
TEST BORING #	7	JOB NO.	202479
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	96.6%
20	77.3%
40	58.3%
100	34.7%
200	25.9%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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JOB NO:

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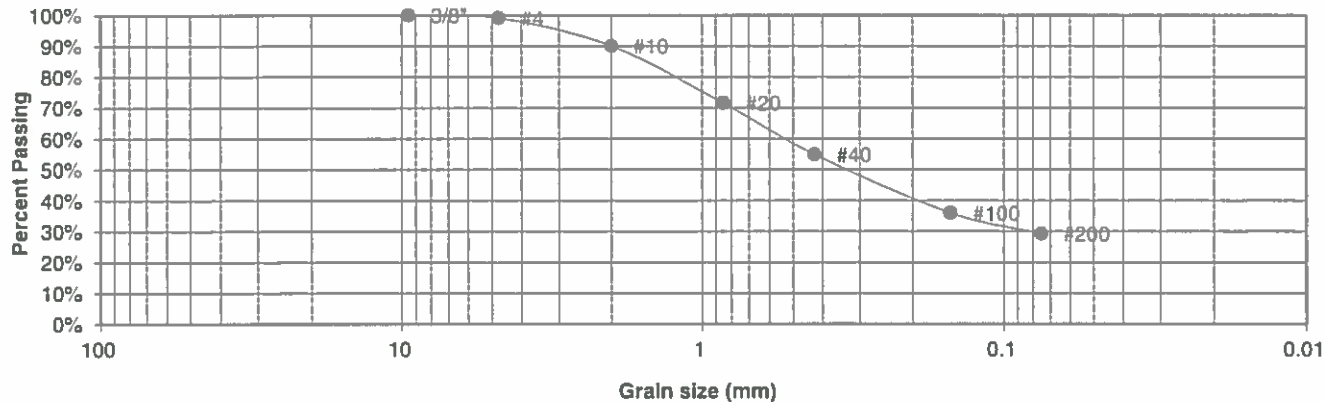
FIG NO:

B12

UNIFIED CLASSIFICATION SM
 SOIL TYPE # 1
 TEST BORING # 8
 DEPTH (FT) 1-2
 AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
 PROJECT HODGEN AND WINSOME
 JOB NO. 202479
 TEST BY BL
 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	99.1%
10	90.1%
20	71.6%
40	54.9%
100	35.9%
200	29.3%

Atterberg Limits	
Plastic Limit	20
Liquid Limit	24
Plastic Index	4

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



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202479

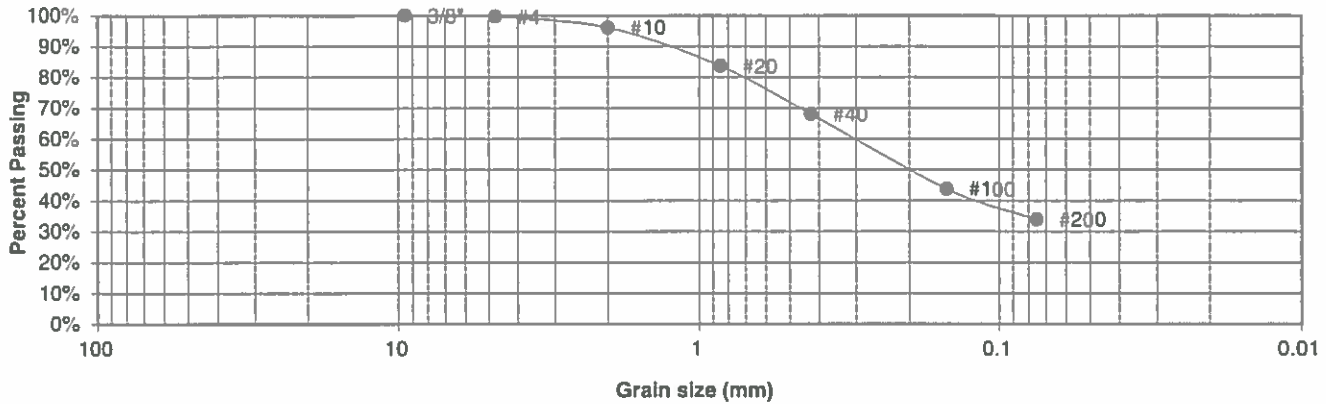
FIG NO:

B-13

UNIFIED CLASSIFICATION SM
 SOIL TYPE # 1
 TEST BORING # 10
 DEPTH (FT) 1-2
 AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
 PROJECT HODGEN AND WINSOME
 JOB NO. 202479
 TEST BY BL
 GROUP INDEX #VALUE!

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	96.1%
20	83.6%
40	68.1%
100	43.7%
200	33.9%

Atterberg
Limits
 Plastic Limit NP
 Liquid Limit NV
 Plastic Index NP

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



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JOB NO.:

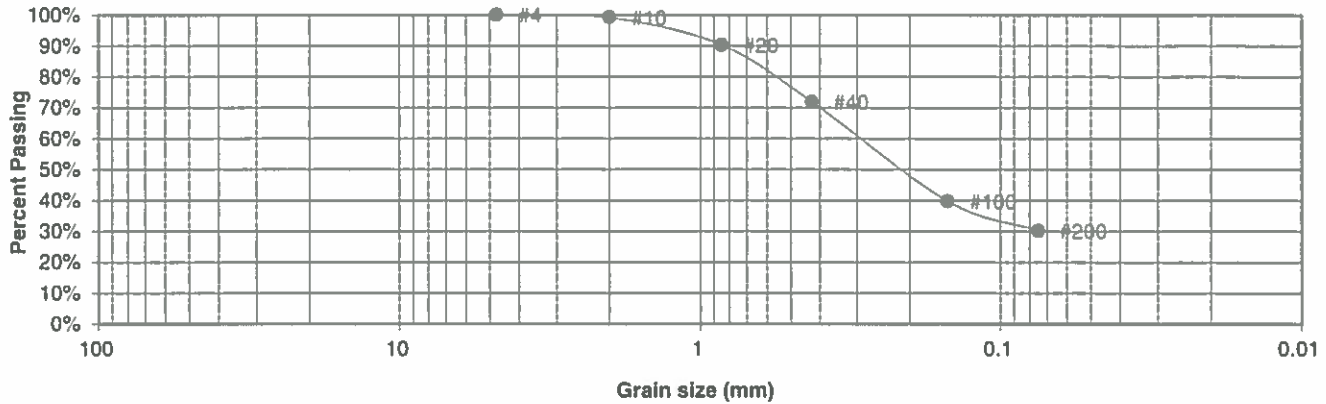
202479

FIG NO.:

B-14

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	HODGEN AND WINSOME
<u>TEST BORING #</u>	12	<u>JOB NO.</u>	202479
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-6	<u>GROUP INDEX</u>	1

**Sieve Analysis
Grain Size Distribution**



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.2%
20	90.3%
40	71.9%
100	39.7%
200	30.2%

<u>Atterberg Limits</u>	
Plastic Limit	15
Liquid Limit	26
Plastic Index	11

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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202479

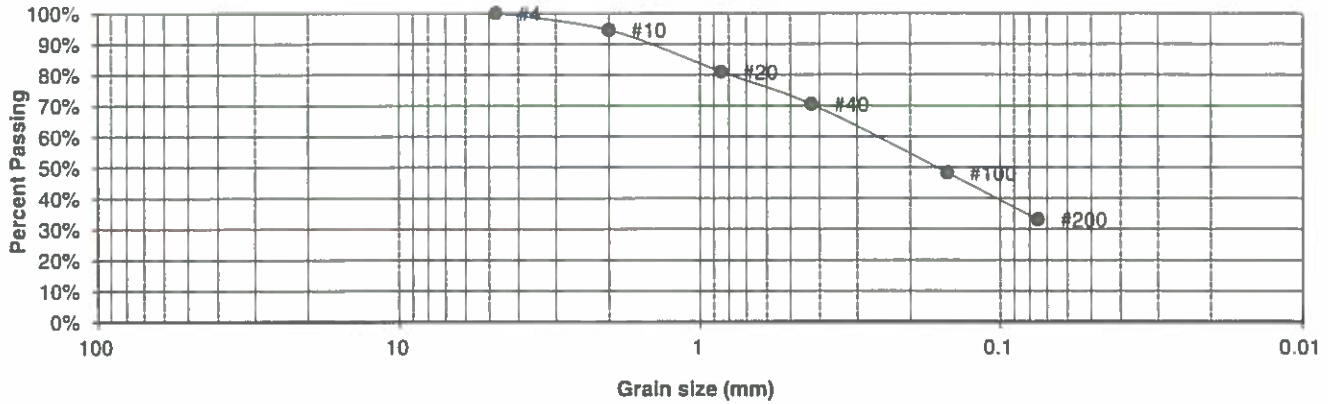
FIG NO.:

B-15

UNIFIED CLASSIFICATION SC
 SOIL TYPE # 1
 TEST BORING # 13
 DEPTH (FT) 1-2
 AASHTO CLASSIFICATION A-2-6

CLIENT WINSOME, LLC
 PROJECT HODGEN AND WINSOME
 JOB NO. 202479
 TEST BY BL
 GROUP INDEX 1

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	94.5%
20	81.0%
40	70.4%
100	48.2%
200	33.1%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	30
Plastic Index	13

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



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202479

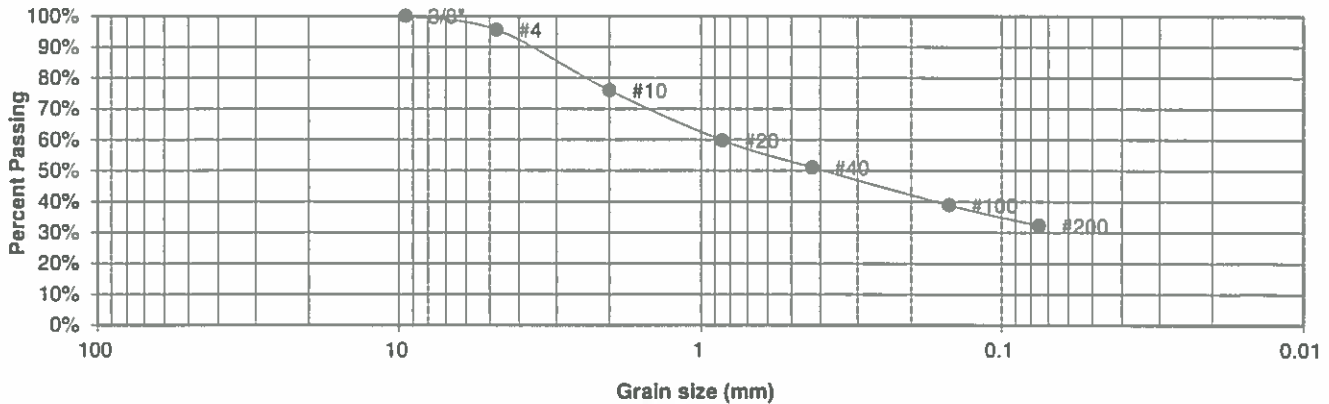
FIG NO.:

B-16

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 14
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME
JOB NO. 202479
TEST BY BL
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	95.6%
10	76.0%
20	59.8%
40	51.1%
100	38.9%
200	32.3%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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DATE: 4/25/20

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202479

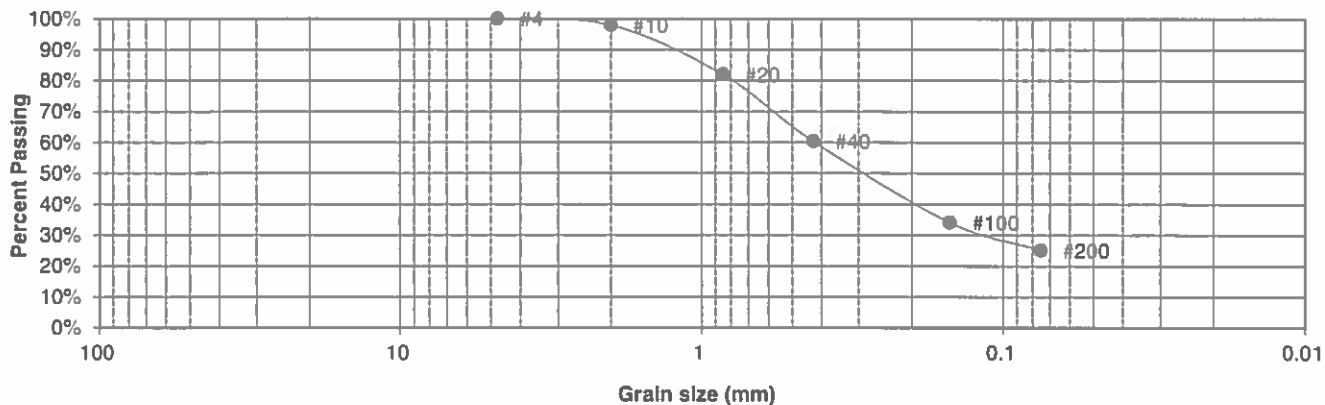
FIG NO:

8-17

UNIFIED CLASSIFICATION SM
 SOIL TYPE # 1
 TEST BORING # 16
 DEPTH (FT) 1-2
 AASHTO CLASSIFICATION A-2-4

CLIENT WINSOME, LLC
 PROJECT HODGEN AND WINSOME
 JOB NO. 202479
 TEST BY BL
 GROUP INDEX 0

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.0%
20	82.0%
40	60.4%
100	34.1%
200	25.1%

Atterberg
Limits
 Plastic Limit NP
 Liquid Limit NV
 Plastic Index NP

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



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JOB NO.:

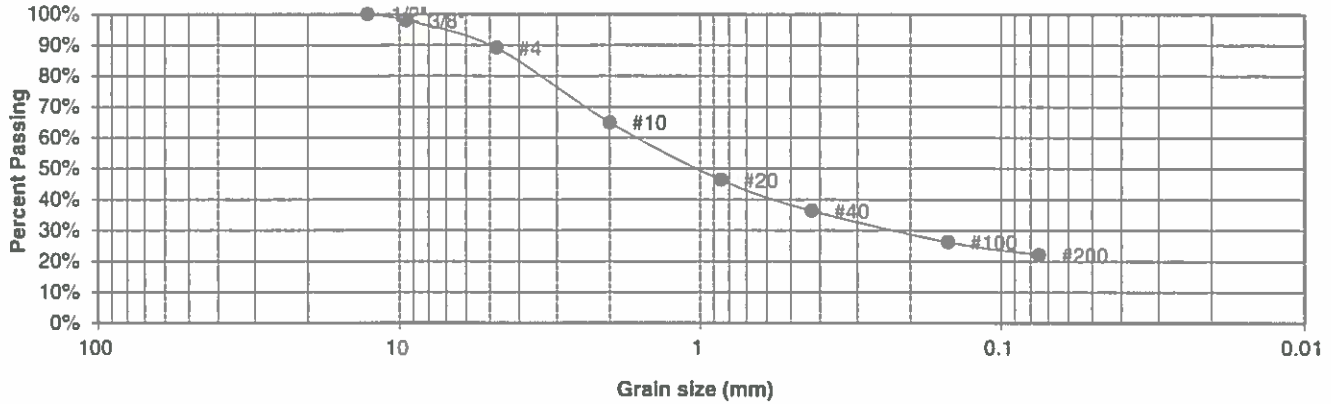
202479

FIG NO.

8-12

UNIFIED CLASSIFICATION	SM	CLIENT	WINSOME, LLC
SOIL TYPE #	2	PROJECT	HODGEN AND WINSOME
TEST BORING #	1	JOB NO.	202479
DEPTH (FT)	5	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.0%
4	89.1%
10	64.9%
20	46.3%
40	36.4%
100	26.2%
200	22.1%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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JOB NO.:

202479

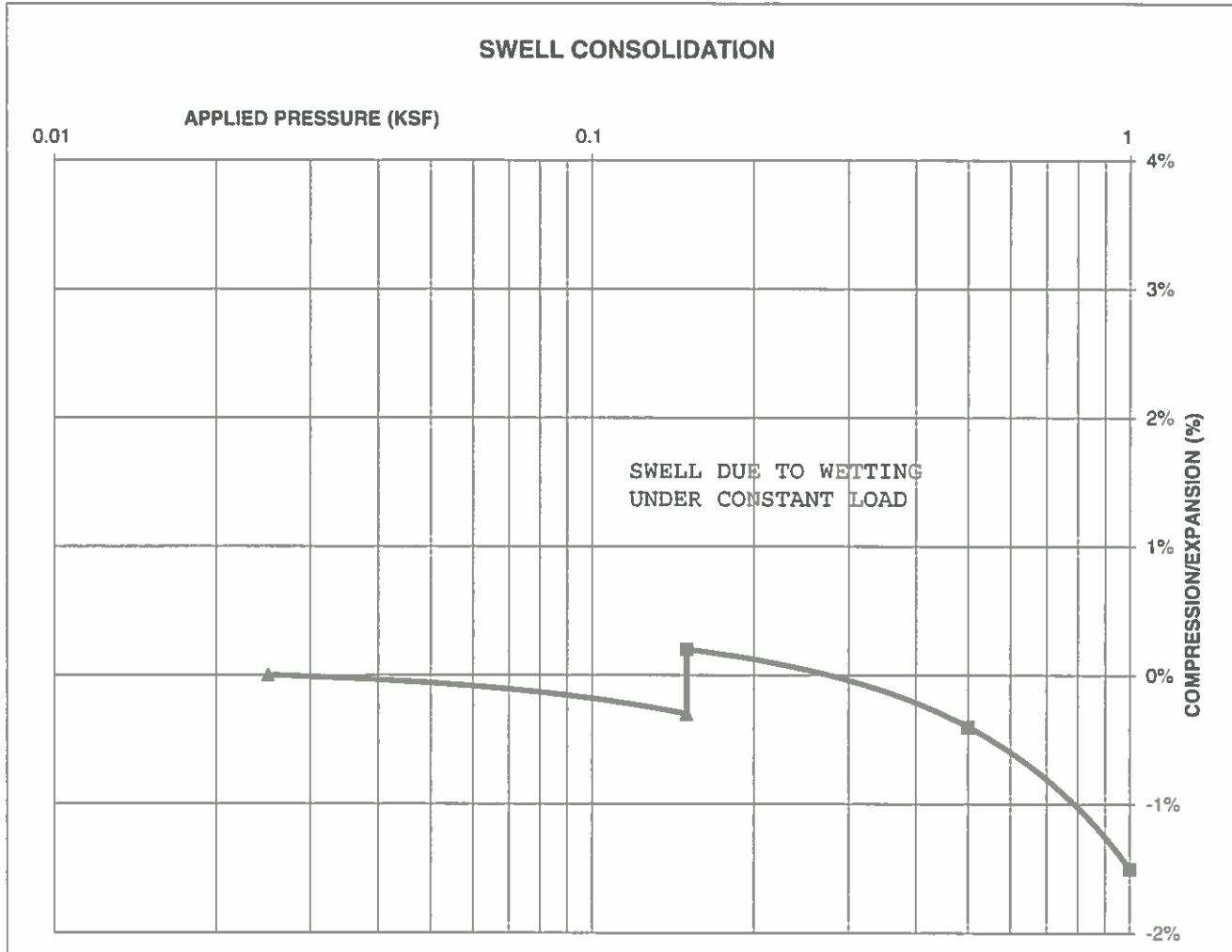
FIG NO.:

B-19

CONSOLIDATION TEST RESULTS

TEST BORING #	I	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)	116		
NATURAL MOISTURE CONTENT	8.5%		
SWELL/CONSOLIDATION (%)	0.5%		

JOB NO. 202479
 CLIENT WINSOME, LLC
 PROJECT HODGEN AND WINSOME



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SWELL CONSOLIDATION TEST RESULTS

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h 4/25/20

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202479

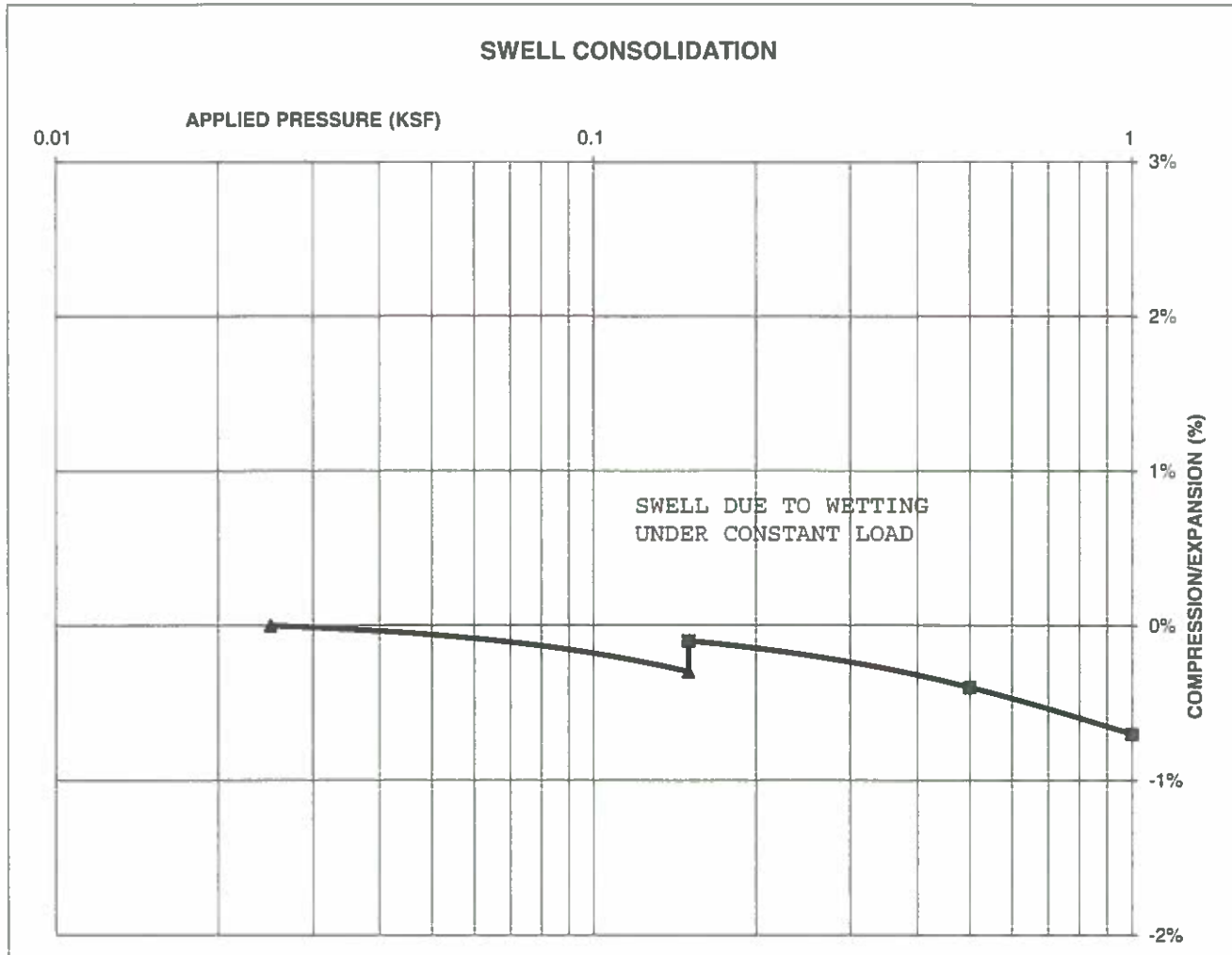
FIG NO.:

B-20

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			115
NATURAL MOISTURE CONTENT			13.9%
SWELL/CONSOLIDATION (%)			0.2%

JOB NO.	202479
CLIENT	WINSOME, LLC
PROJECT	HODGEN AND WINSOME



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505 ELKTON DRIVE
COLORADO SPRINGS COLORADO 80907

SWELL CONSOLIDATION TEST RESULTS

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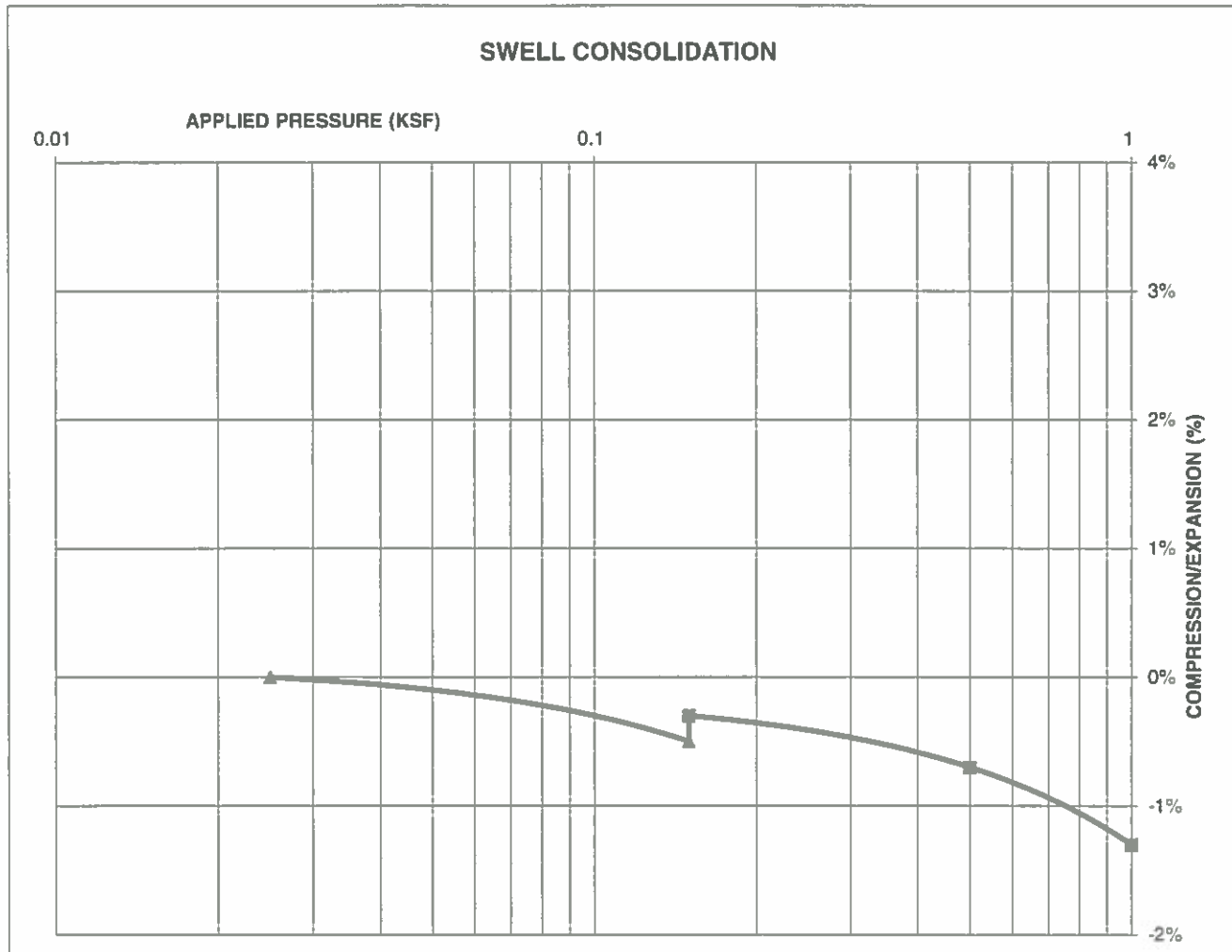
JOB NO.:
202479

FIG NO.:
B-21

CONSOLIDATION TEST RESULTS

TEST BORING #	11	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1A
NATURAL UNIT DRY WEIGHT (PCF)	111		
NATURAL MOISTURE CONTENT	11.3%		
SWELL/CONSOLIDATION (%)	0.2%		

JOB NO. 202479
 CLIENT WINSOME, LLC
 PROJECT HODGEN AND WINSOME



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SWELL CONSOLIDATION TEST RESULTS

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DATE: 11/25/20

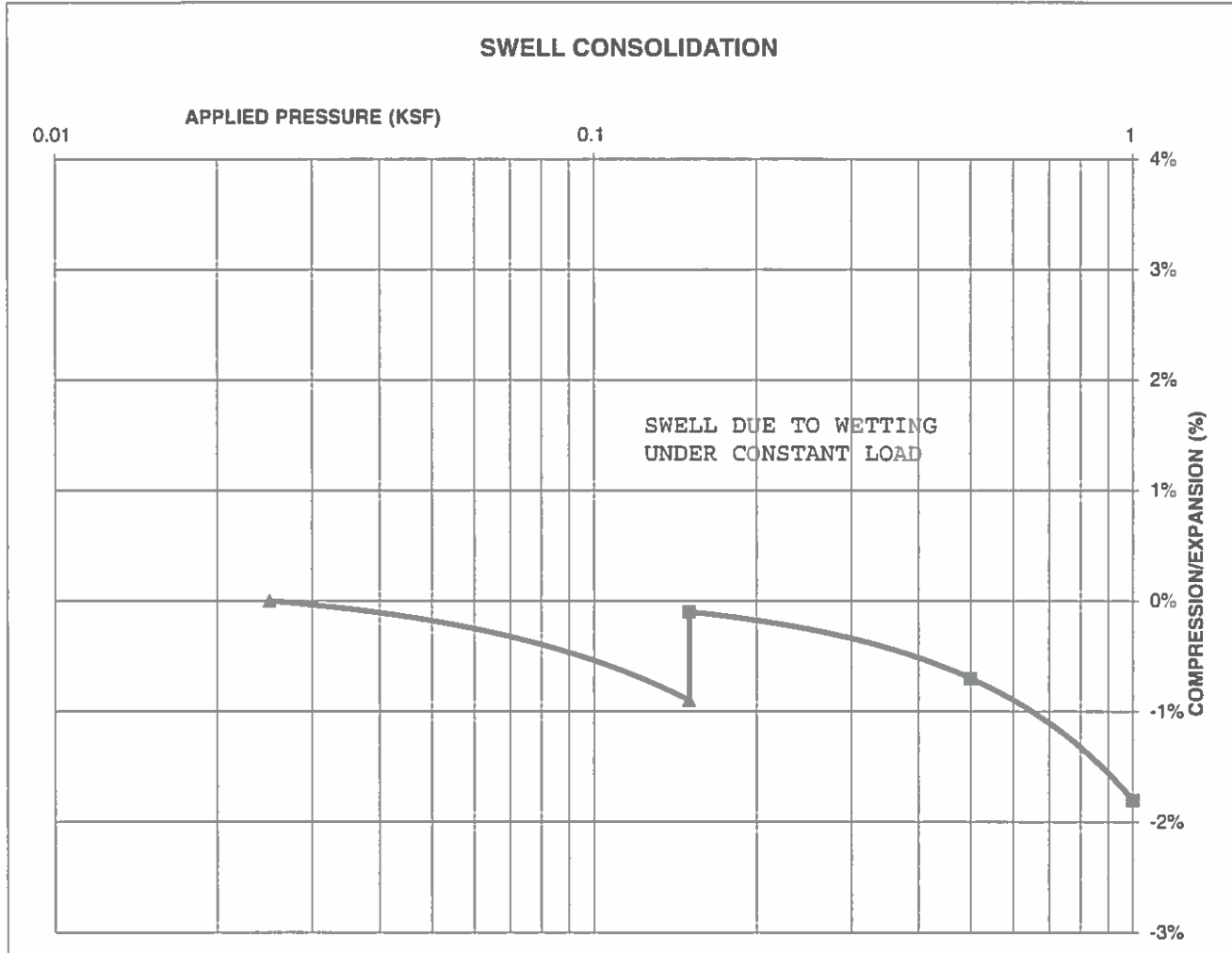
JOB NO.:
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FIG NO.:
B-22

CONSOLIDATION TEST RESULTS

TEST BORING #	12	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			113
NATURAL MOISTURE CONTENT			14.4%
SWELL/CONSOLIDATION (%)			0.8%

<u>JOB NO.</u>	202479
<u>CLIENT</u>	WINSOME, LLC
<u>PROJECT</u>	HODGEN AND WINSOME



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SWELL CONSOLIDATION TEST RESULTS

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JOB NO.:

202479

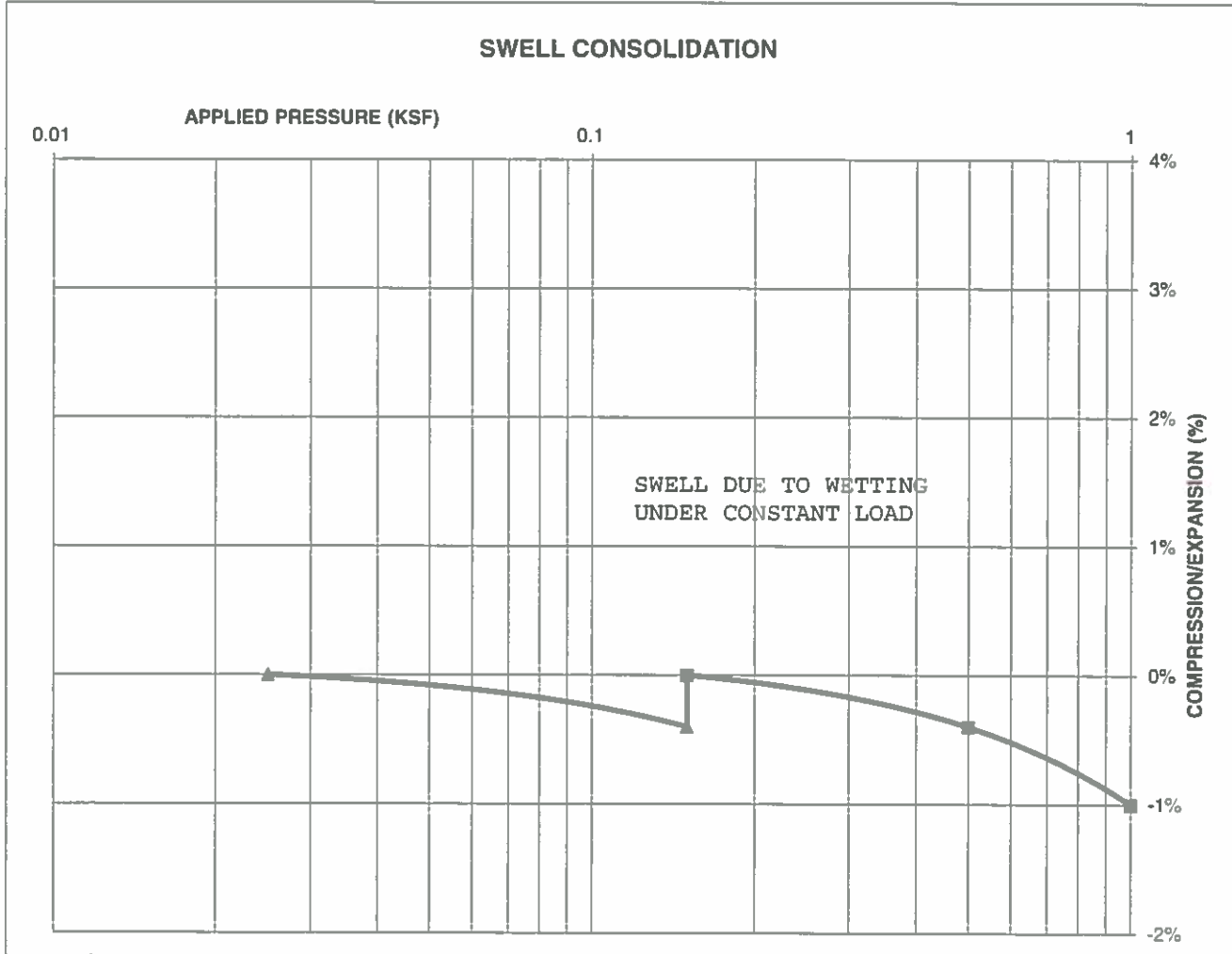
FIG NO.:

B-23

CONSOLIDATION TEST RESULTS

TEST BORING #	I3	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			108
NATURAL MOISTURE CONTENT			7.2%
SWELL/CONSOLIDATION (%)			0.4%

JOB NO. 202479
CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS COLORADO 80907

SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *h*

DATE: 11/25/20

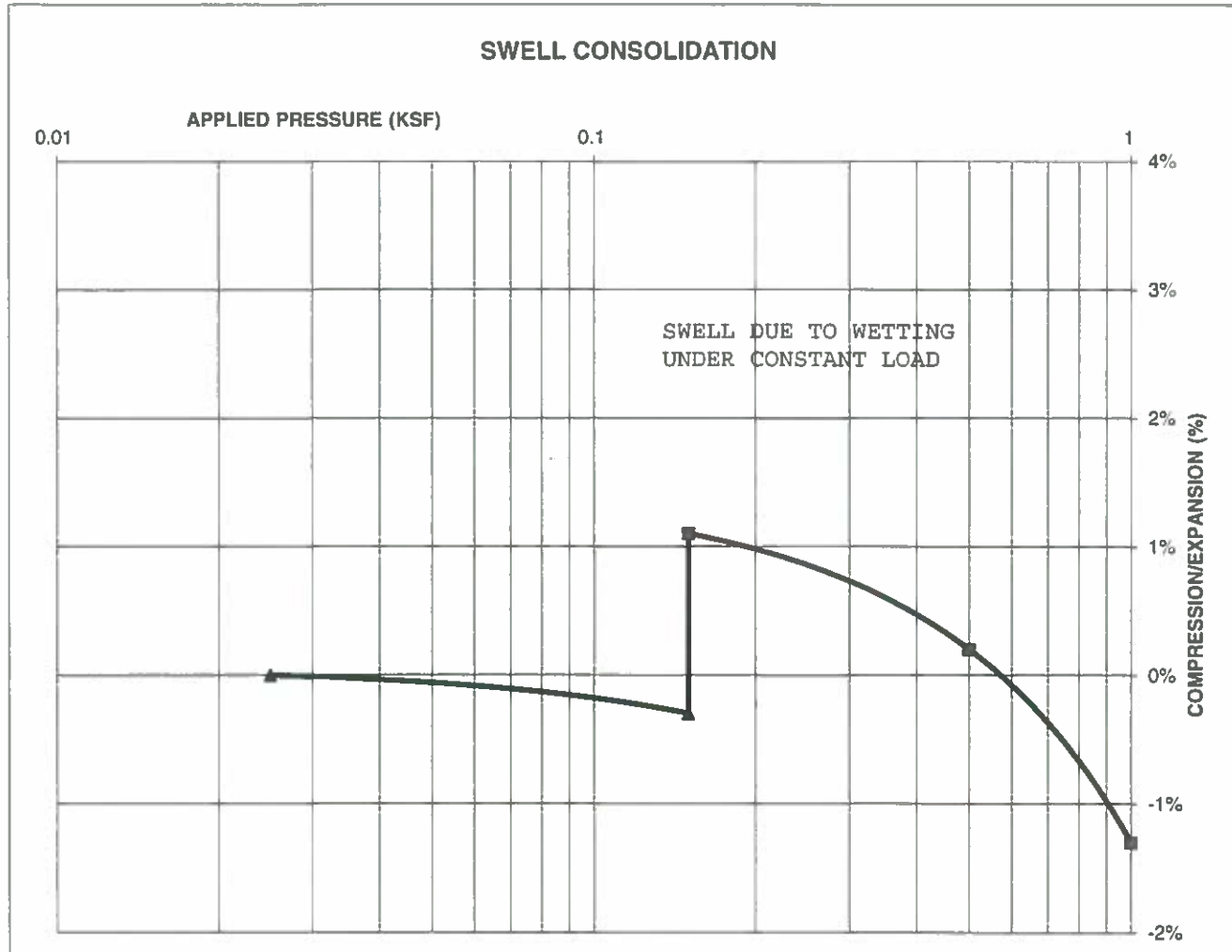
JOB NO.:
202479

FIG NO.:
8-24

CONSOLIDATION TEST RESULTS

TEST BORING #	15	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1A
NATURAL UNIT DRY WEIGHT (PCF)			118
NATURAL MOISTURE CONTENT			12.4%
SWELL/CONSOLIDATION (%)			1.4%

JOB NO. 202479
CLIENT WINSOME, LLC
PROJECT HODGEN AND WINSOME



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *h*

DATE: 11/25/20

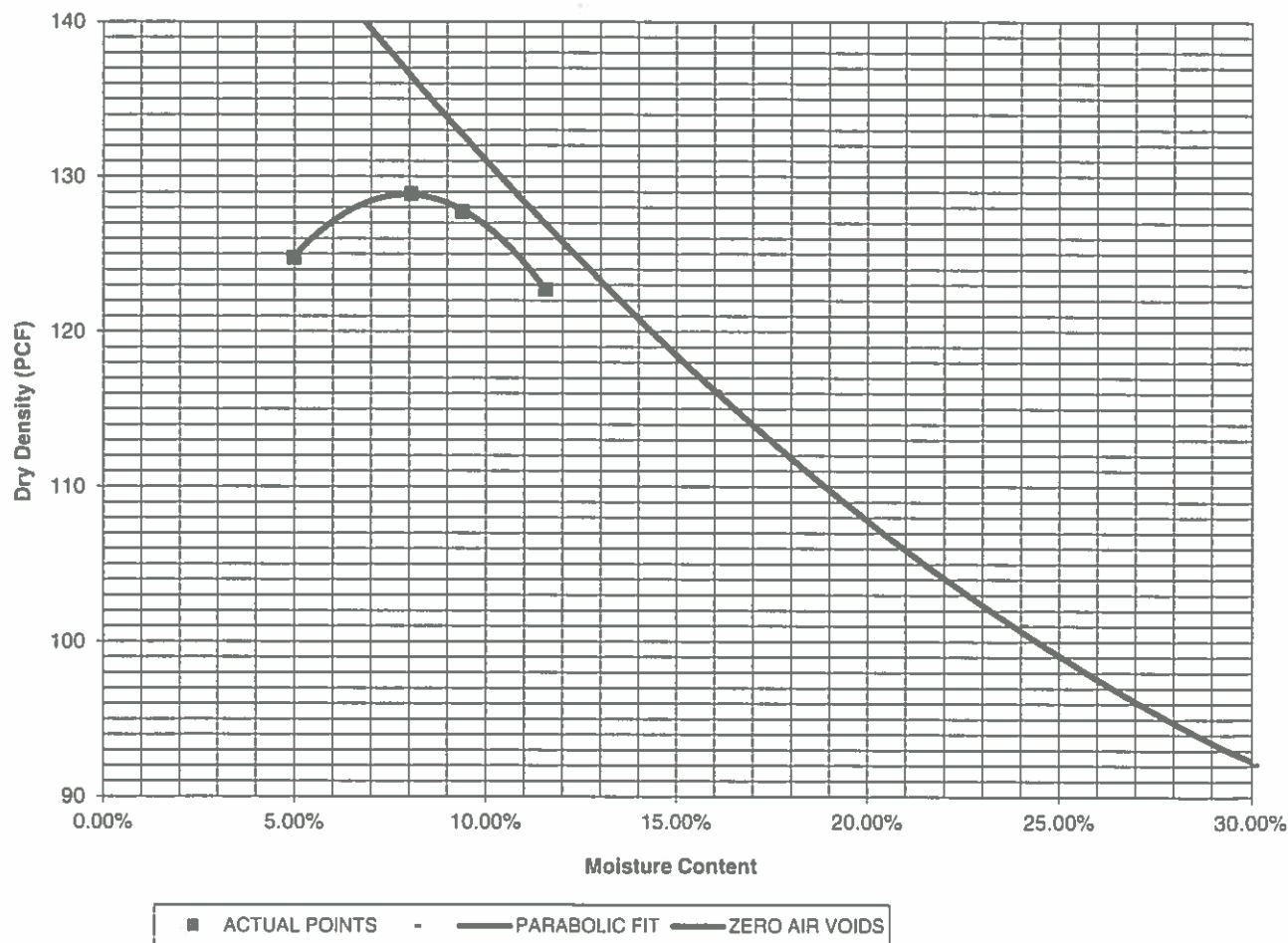
JOB NO.:
202479

FIG NO.:
B-25

<u>PROJECT</u>	HODGEN AND WINSOME	<u>CLIENT</u>	WINSOME, LLC
<u>SAMPLE LOCATION</u>	TB-6 @ 0-3'	<u>JOB NO.</u>	202479
<u>SOIL DESCRIPTION</u>	SAND, SILTY, TAN	<u>DATE</u>	11/18/20

<u>IDENTIFICATION</u>	SM	<u>COMPACTION TEST #</u>	1
<u>TEST DESIGNATION / METHOD</u>	ASTM D-1557-A	<u>TEST BY</u>	BL
<u>MAXIMUM DRY DENSITY (PCF)</u>	128.9	<u>OPTIMUM MOISTURE</u>	8.0%

Compaction Curve



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED:

DATE:

h 11/25/20

JOB NO.:

202479

FIG NO.:

B-27

CBR TEST LOAD DATA

JOB NO: 202479
 CLIENT: WINSOME, LLC
 PROJECT: HODGEN AND WINSOME
 SOIL TYPE: 1

PISTON DIAMETER (cm)	PISTON AREA (in ²)						
4.958	2.993						
PENETRATION DEPTH (INCHES)	10 BLOWS		25 BLOWS		56 BLOWS		
	MOLD # 1		MOLD # 2		MOLD # 3		
	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	
0.000	0	0.00	0	0.00	0	0.00	
0.025	54	18.05	78	26.07	78	26.07	
0.050	123	41.10	153	51.13	283	94.57	
0.075	189	63.16	316	105.60	574	191.81	
0.100	279	93.23	594	198.50	910	304.09	
0.125	427	142.69	712	237.93	1255	419.38	
0.150	599	200.17	983	328.49	1455	486.21	
0.175	732	244.61	1264	422.39	1867	623.89	
0.200	900	300.75	1675	559.73	2331	778.94	
0.300	1426	476.52	2349	784.96	3134	1047.28	
0.400	1782	595.49	3232	1080.03	4663	1558.22	
0.500	2238	747.87	4289	1433.25	6000	2005.01	

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	102	117	307
WT. CAN	9.27	9.5	6.87
WT. CAN+WET	113.73	128.44	132.36
WT. CAN+DRY	101.89	116.74	121.56
WT. H2O	11.84	11.7	10.8
WT. DRY SOIL	92.62	107.24	114.69
MOISTURE CONTENT	12.78%	10.91%	9.42%

WET DENSITY (PCF)	125.7	132.9	139.6
DRY DENSITY (PCF)	116.4	123.0	129.3

BEARING RATIO 9.32 19.85 30.41

90% OF DRY DENSITY 116.0

95% OF DRY DENSITY 122.5

BEARING RATIO AT 90% OF MAX	8.74 ~ R VALUE	22
BEARING RATIO AT 95% OF MAX	18.91 ~ R VALUE	65



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

CBR TEST DATA

DRAWN:

DATE:

CHECKED:

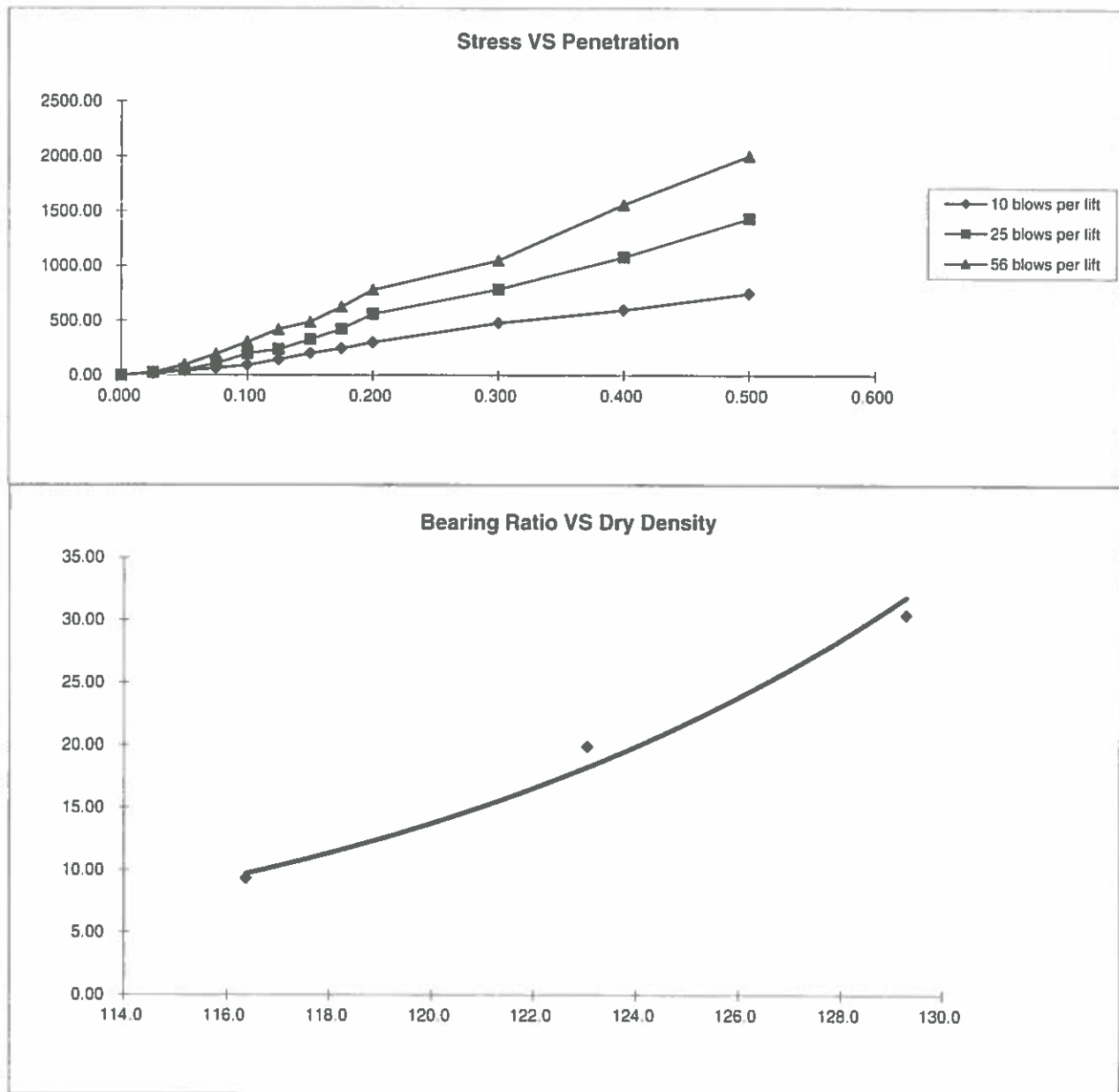
DATE:

11/25/20

JOB NO:
 202479

FIG NO:

B-28



BEARING RATIO AT 90% OF MAX	8.74 ~ R VALUE	22.00
BEARING RATIO AT 95% OF MAX	18.91 ~ R VALUE	65.00

JOB NO: 202479
SOIL TYPE: I



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED:

DATE:

6/25/20

JOB NO: 202479

FIG NO:

B-29

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

WINSOME SUBDIVISION - PHASE I

RURA LOCAL CUL-DE-SAC ROADS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) =	36,500
R =	50
S_o =	0.45
Δpsi =	2.0
Reliability =	80
Z_R =	-0.84
M_R =	13168

Weighted Structural Number (WSN):



WSN = 1.46

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
4.56	4.56	0.0

Job No. 202479

Fig. No. C-1

DESIGN CALCULATIONS

DESIGN DATA

WINSOME SUBDIVISION - PHASE I

SOIL TYPE 1 - RURAL LOCAL CUL-DE-SAC ROADS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	1.47

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ 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 FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1 = 3.3$ inches of Full Depth Asphalt
Use N/A inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 3 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 1.4$ inches of Aggregate
Base Course, use 4.0

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Aggregate Base Course, or
2. N/A inches of Asphalt

Job No. 202479

Fig. No. C-2

DESIGN CALCULATIONS

RECYCLED CONCRETE

DESIGN DATA

WINSOME SUBDIVISION - PHASE 1

SOIL TYPE 1 - RURAL LOCAL CUL-DE-SAC ROADS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

ESAL = 36,500

Hveem Stabilometer (R Value) Results:

R = 50

Weighted Structural Number (WSN):

WSN = 1.47

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.11$ Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1 = 3.3$ inches of Full Depth Asphalt

Use N/A inches Full Depth

FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

Asphalt Thickness (t) = 3 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 1.4$ inches of Recycled Concrete

Base Course, use 4.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Recycled Concrete Base Course, or
2. N/A inches of Asphalt

Job No. 202479

Fig. No. C-3

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

WINSOME SUBDIVISION - PHASE 1
RURAL LOCAL ROAD

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	109,500
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.5
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 1.77

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

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

Left	Right	Difference
5.04	5.04	0.0

Job No. 202479
Fig. No. C-4

DESIGN CALCULATIONS

DESIGN DATA

WINSOME SUBDIVISION - PHASE I

RURAL LOCAL ROAD

Equivalent (18 kip) Single Axle Load Applications (ESAL):

ESAL = 109,500

Hveem Stabilometer (R Value) Results:

R = 50

Weighted Structural Number (WSN):

WSN = 1.77

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ 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 FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1 = 4.0$ inches of Full Depth Asphalt

Use N/A inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 4 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 0.1$ inches of Aggregate

Base Course, use 6.0

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 6.0 inches of Aggregate Base Course, or
2. N/A inches of Asphalt

Job No. 202479

Fig. No. C-5

DESIGN CALCULATIONS

RECYCLED CONCRETE

DESIGN DATA

WINSOME SUBDIVISION - PHASE I

RURAL LOCAL ROAD

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 109,500
Hveem Stabilometer (R Value) Results:	R = 50
Weighted Structural Number (WSN):	WSN = 1.77

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.11$ Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1 = 4.0$ inches of Full Depth Asphalt

Use N/A inches Full Depth

FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

Asphalt Thickness (t) = 4 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 0.1$ inches of Recycled Concrete

Base Course, use 6.0 inches

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 6.0 inches of Recycled Concrete Base Course, or
2. N/A inches of Asphalt

Job No. 202479

Fig. No. C-6



SUBMITTAL FORM

SUBMITTAL # 001

DATE: 11-10-2020

ROUTING: **Elizabeth Nijkamp, PE**

PROJECT TITLE: **Winsome Filing No 1**

REQUESTED BY: Contractor: Monks Construction
Address: 8355 Vollmer Rd
Colo Springs, CO 80936

Name: Jason Greer
Title: Project Manager

Item #	Description	Spec	Source	Action Comments
1	Recycled Class 6 Aggregate Base Course	CDOT - 703-3 County - Table D-6	Monks	
2				
3				
4				

DATE ACTION REQUIRED BY:

For Approval ☒ **Routine** ☐ **Immediate!** ☐ **URGENT!!**

ENGINEERING ACTION



Monks Constuction Company

Date 11/10/2020

Submittal Number 001

Submittal Description Vollmer - Recycled Aggregate Base Course

Summary of test results provided by CTL Thompson.

CDOT Standard Specifications

Section - 703-3

Sieve Analysis

Sieve Size	Percent Passing	Class 6		
		Spec - Min	Spec - Max	Pass / Fail
1"	100	100	100	Pass
3/4"	100	95	100	Pass
1/2"	89			
3/8"	77			
No. 4	57	30	65	Pass
No. 8	46	35	55	Pass
No. 200	8.1	3	12	Pass

Material Properties

Test	Test Result	Spec - Min	Spec - Max	Pass / Fail
Liquid Limit	0	0	30	Pass
Plastisity Index	0	0	6	Pass
L.A Abrasion	35%	0%	50%	Pass
R-Value	86	72		Pass
Maximum Dry Density	127.0			

November 5, 2020

R.E. Monks Construction
8355 Vollmer Drive
Colorado Springs, Colorado 80908

Attention: Mr. Jason Greer

Subject: Physical Property Testing
Recycled Concrete – Vollmer Pit
Colorado Springs, Colorado
Project No. CS17790.000-300

Gentlemen:

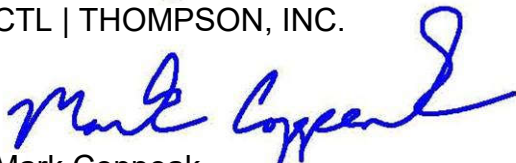
As requested, we performed physical property testing on recycled concrete material from the Vollmer Pit submitted on October 1, 2020. Testing was performed in accordance with applicable ASTM Standards. The test results are presented below, and figures 1, 2, and 3 enclosed with this letter.

Sieve Size	Percent Passing	Specifications
		CDOT
1"	100	100
3/4"	100	95-100
1/2"	89	
3/8"	77	
No. 4	57	30-65
No. 8	46	35-55
No. 200	8.1	3-12
L.A. Abrasion:	35%	
Loose Unit Wt.	95.2 lb/ft. ³	
Date Sampled:	10/01/2020	

If we can be of further service, please call.

Very truly yours,

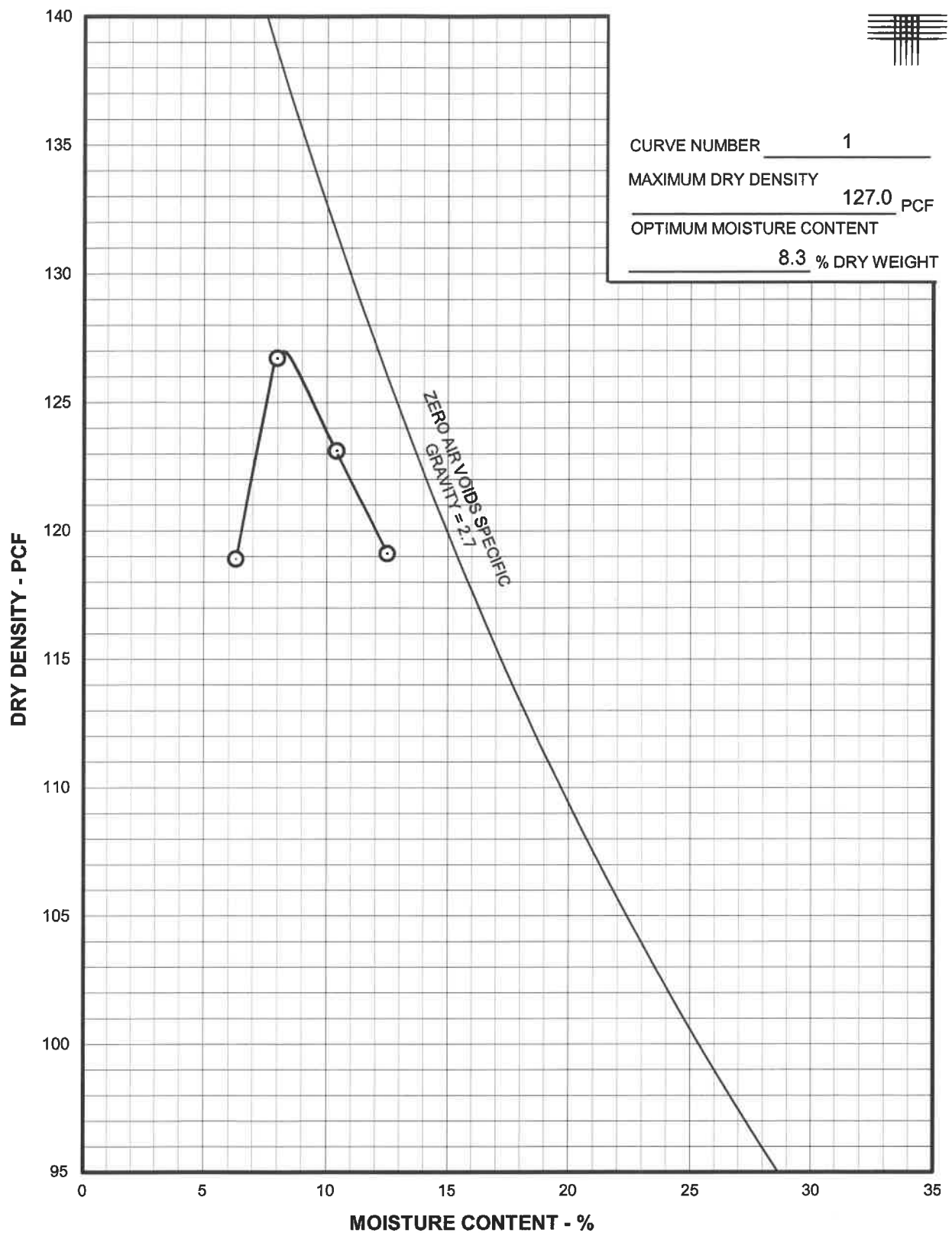
CTL | THOMPSON, INC.



Mark Coppeak
Senior Engineering Technician

MC:vc

Via Email: jason.greer@remonks.com



Sample Description SAND, GRAVEL, SL. SILTY, BROWN
CLASS 6 RECYCLED CONCRETE

Location SUBMITTED 10-1-20 FROM VOLLMER PIT

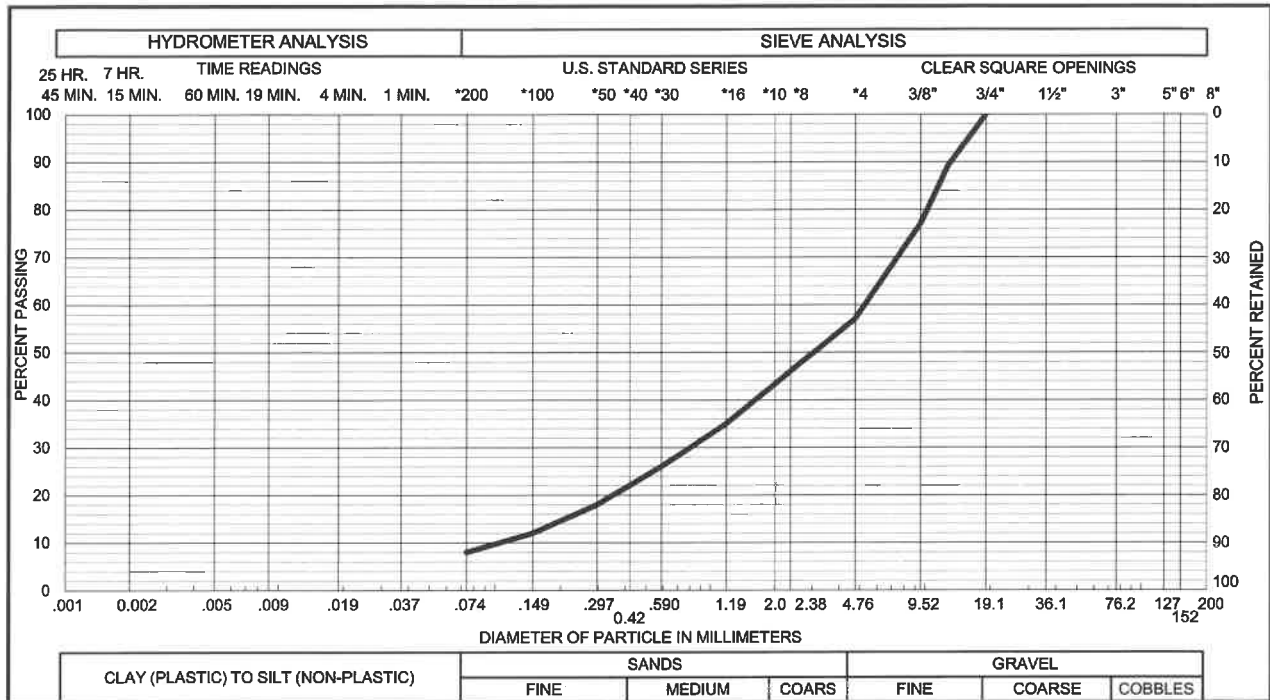
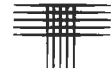
Compaction Test Procedure ASTM D 1557
METHOD C

LIQUID LIMIT NV
 PLASTICITY INDEX NP
 GRAVEL 43 %
 SAND 49 %
 SILT AND CLAY 8 %
 DATE 10/29/2020

R.E. MONKS
 VOLLMER PIT
 CTLJT PROJECT NO. CS17790.000-300

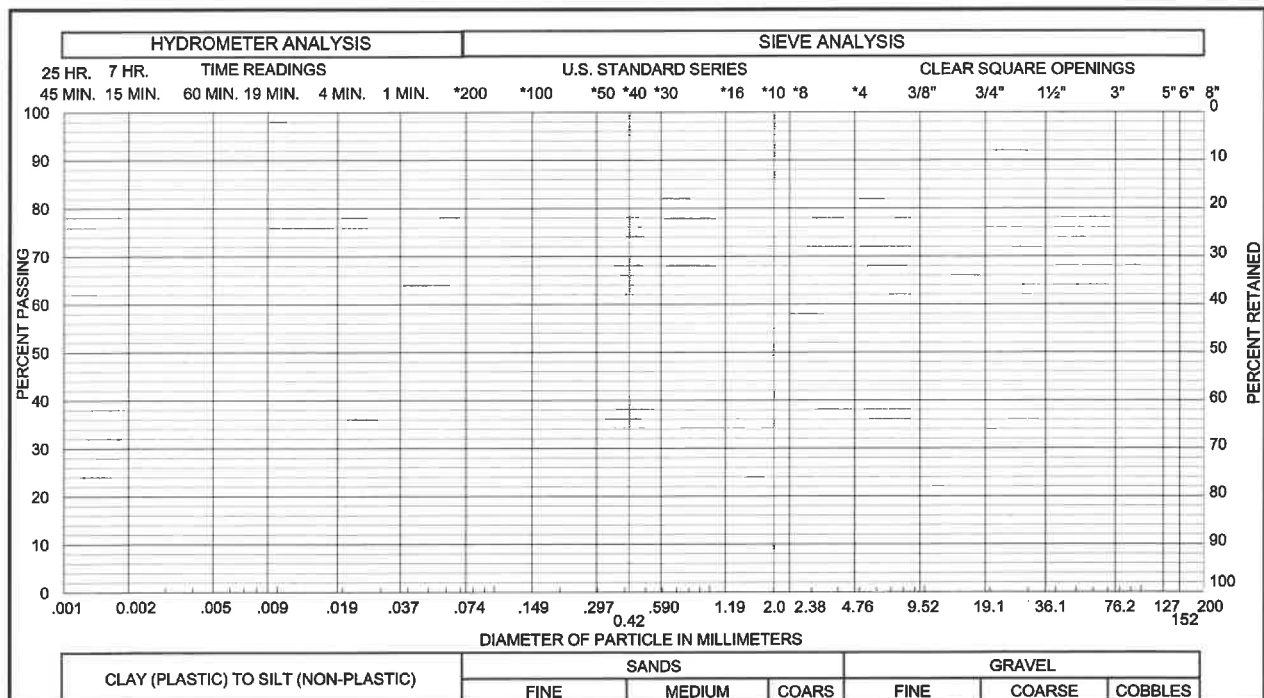
Laboratory Moisture-Density Test Results

FIG. 1



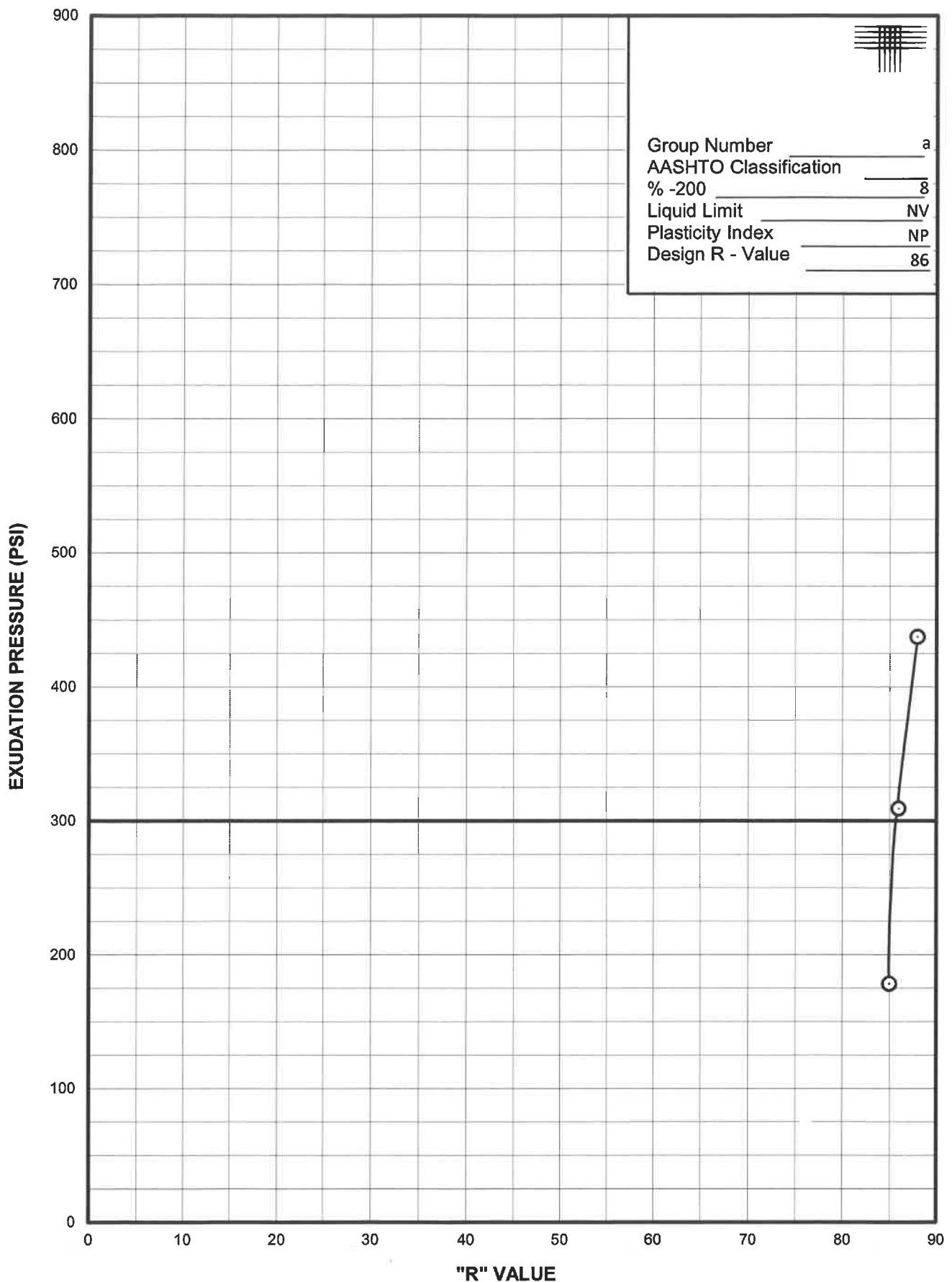
Sample of SAND, GRAVEL, SL. SILTY (SW-SM)
From RECYCLED CONCRETE, VOLLMER PIT

GRAVEL	43 %	SAND	49 %
SILT & CLAY	8 %	LIQUID LIMIT	%
PLASTICITY INDEX			%



Sample of _____
From _____

GRAVEL	%	SAND	%
SILT & CLAY	%	LIQUID LIMIT	%
PLASTICITY INDEX			%



R.E. MONKS
VOLLMER PIT
CTL/T PROJECT NO.CS17790.000-300

Hveem Stabilometer Test Results

FIG. 3