

February 6, 2020  
Revised April 28, 2020



**ENTECH**  
ENGINEERING, INC.

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

SR Land, LLC  
20 Boulder Crescent, 2<sup>nd</sup> Floor  
Colorado Springs, CO 80903

Attn: Chaz Collins

Re: Pavement Recommendations - Revised  
Homestead at Sterling Ranch, Filing No. 2  
El Paso County, Colorado



Dear Mr. Collins:

As requested, Entech Engineering, Inc. has obtained samples of the subgrade soils for Beaver Brook Drive, Cut Bank Drive, Glendive Drive, and Niarada Drive in the Homestead at Sterling Ranch, Filing No. 2 Subdivision, 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 these roadways.

### Project Description

The roadways in this subdivision will be used by local traffic. Subsurface Soil Investigation and laboratory testing was performed in order to determine the pavement support characteristics of the soils. The filing lot layout, roadway alignments, and the locations of the test borings are shown on the Test Boring Location Plan, Figure 1.

### Subgrade Conditions

Twenty exploratory test borings were drilled in the roadways to depths of 5 to 10 feet, not to exceed 500 feet between each testing boring. 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. Two subgrade soil types were encountered in this investigation. Sieve analyses performed indicated the percent passing the No. 200 sieve for the Type 1 soils at subgrade depth ranged from approximately 7 to 31 percent, and approximately 35 to 47 percent for the Type 2 soils. Atterberg Limit Tests performed on the Type 1 soils resulted in Liquid Limits ranging from 26 to 41 and no value with Plastic Indexes ranging from 10 to 15 and non-plastic, and the Type 2 soils resulted in Liquid Limits ranging from 29 to 41 and no value with Plastic Indexes ranging from 6 to 17 and non-plastic. Soil Type 3: silty to clayey sand; Type 4 silty to slightly silty sandstone; and Type 5 very sandy siltstone. The majority of Soil Types 3, 4 and 5 were encountered below the subgrade influence zone. Shallow expansive bedrock was encountered in Test Boring 19, which may require mitigation. Soil Type 4 is grouped with the Soil Type 1 soils, which classified as A-1-b, A-2-4, A-2-6, and A-2-7 soils based on the AASHTO classification system which typically provide good support characteristics. Soil Type 2 classified as A-4 A-6, and A-7-6 soils based on the AASHTO classification system which typically provide fair to poor support characteristics. Groundwater was not encountered in the test borings. Water-soluble sulfate tests indicate a negligible potential for sulfate attack.

Two subgrade soil types were evaluated for pavement support by the field investigation and laboratory testing (Soil Types 1 and 2). The Type 2 and 5 soils areas can be overexcavated and replaced with on-site granular Type 1 soils to provide similar support characteristics to Soil

Type 1 or kept in place and paved with the thicker (Type 2 soils) pavement and base course sections to account for the different pavement support characteristics of the site soils.

Swell/Consolidation testing was performed on the soils based on the AASHTO Classifications and Plastic Indexes. Swell/Consolidation Tests conducted on the Type 1 soils exhibited volume changes ranging from -0.1 to 0.7 percent, which are below the levels in which mitigation is required. The Type 2 soils exhibited volume changes ranging from -0.5 to 3.4 percent (TB3 at 1-2'). A remolded sample from TB3 at 1-2' resulted in a swell of 1.7 percent, when moisture-conditioned to 3.5 percent above in-situ moisture content. Mitigation of areas of expansive Type 2 and 5 soils will not be required within this filing providing they are properly moisture-conditioned. Mitigation recommendations are present later in this report. Laboratory test results are presented in Appendix B and are summarized on Table 1.

California Bearing Ratio (CBR) testing was performed on representative samples 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 – Clayey Sand Fill**

R @ 90% = 22.0  
R @ 95% = 71.0  
Use R = 40.0 for design

**Classification Testing**

Liquid Limit	28
Plasticity Index	13
Percent Passing 200	30.6
AASHTO Classification	A-2-6
Group Index	0
Unified Soils Classification	SC

**Soil Type 2 – Very Clayey Sand Fill**

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

**Classification Testing**

Liquid Limit	32
Plasticity Index	14
Percent Passing 200	35.4
AASHTO Classification	A-6
Group Index	1
Unified Soils Classification	SC

**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". All cul-de-sacs classify as low volume urban local roads, which use an 18K ESAL value of 36,500 to determine the pavement sections. The remainder of the roads classify as local roads which use an 181K ESAL value of 292,000 to determine the pavement sections. Pavement sections for asphalt over aggregate base course and recycled concrete base course sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability (Urban Local & Urban Local Low Volume)	80%
Serviceability Index (Urban Local & Urban Local Low Volume)	2.2
"R" Value Subgrade (Soil Type 1)	40
"R" Value Subgrade (Soil Type 2)	6
Resilient Modulus (Soil Type 1)	9,497 psi
Resilient Modulus (Soil Type 2)	3,126 psi
<b>Structural Coefficients:</b>	
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 – Cul-De-Sac Roads,**

**Low Volume Urban Local Road**

Soil Type 1, R = 40.0

<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 Conc	3.0*	-	4.0*

**Low Volume Urban Local Road**

Soil Type 2, R = 6.0

<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	8.0	-
2 – Asphalt Over Recycled Conc	4.0	-	8.0

**Local Roads**

Soil Type 1, R = 40

<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*	8.0	-
2 – Asphalt Over Recycled Conc	4.0*	-	8.0

Soil Type 2, R = 6.0

<u>Alternatives</u>	<u>Asphalt (in)</u>	<u>Aggregate Base Course (in)</u>	<u>Recycled Conc. (in)</u>
1 – Asphalt Over Base Course	5.0	12.0	-
2 – Asphalt Over Recycled Conc	5.0	-	12.0

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

**Mitigation**

Mitigation for expansive soils will not be required for the Soil Type 1 areas of this filing of Homestead at Sterling Ranch based on the laboratory testing; however, moisture-conditioning is recommended for the isolated areas of the Soil Types 2 and 5 subgrade soils. The estimated transitions between the subgrade soil types are shown in Figure 1. The actual transitions should be field determined. Personnel of Entech Engineering, Inc. should be on site to verify the locations for moisture-conditioning, if required, and to test the subgrade soils compacted in these areas during the subgrade preparation. Density testing should be performed on all fill placed within these roadway subgrade areas. The Type 2 and 5 soils can be overexcavated and replaced with on-site granular Type 1 soils to provide similar support characteristics or kept in

place with different pavement and base course sections to account for the varied pavement support characteristics of the site soils.

### 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 0 to 2 percent over optimum moisture content for cohesionless soils or to 0 to 4 percent over optimum moisture content and compacted to 95% of the soils maximum Standard Proctor Dry Density, ATSM D-698 for cohesive soils. The soils should be proof rolled after properly compacted. Areas of mitigated soils, should be placed at a moisture content of 3.5 percent over optimum. 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, 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/ao

Encl.

Entech Job No. 190014

AAprojects/2019/190014/190014 pr-Rev



Reviewed by:



Mark H. Hauschild, P.E.  
Senior Engineer

## TABLE

**TABLE 1**

**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT SR LAND, LLC  
 PROJECT HOMESTEAD AT STERLING RANCH  
 JOB NO. 190014

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	4	0-3	9.4	116.5	30.6	28	13		A-2-6	0.7*	SC	FILL, SAND, CLAYEY
1	2	1-2	12.2	113.5	28.3	33	11		A-2-6	0.1	SC	FILL, SAND, CLAYEY
1	4	1-2	10.6	120.0	29.6	27	10	<0.01	A-2-4	0.5	SC	FILL, SAND, CLAYEY
1	5	1-2	10.1	99.8	24.7	38	14		A-2-6	-0.1	SC	FILL, SAND, CLAYEY
1	6	1-2			17.9	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	7	1-2			17.2	NV	NP	<0.01	A-2-4		SM	FILL, SAND, SILTY
1	8	1-2			16.6	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	9	1-2	10.8	119.0	25.0	38	15		A-2-6	0.3	SC	FILL, SAND, CLAYEY
1	10	1-2			18.9	26	10		A-2-4		SC	FILL, SAND, SILTY
1	11	1-2	8.1	115.8	22.6	41	15		A-2-7	0.6	SC	FILL, SAND, CLAYEY
1	13	1-2			14.8	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	16	1-2			13.2	NV	NP	<0.01	A-1-b		SM	FILL, SAND, SILTY
1	17	1-2			7.4	NV	NP		A-1-b		SM-SW	FILL, SAND, SLIGHTLY SILTY
1	18	1-2			7.3	NV	NP		A-1-b		SM-SW	FILL, SAND, SLIGHTLY SILTY
2, CBR	8	0-3	7.5	119.4	35.4	32	14		A-6	0.5*	SC	FILL, SAND, VERY CLAYEY
2	1	1-2	15.1	111.4	46.5	35	14	0.00	A-6	1.4	SC	FILL, SAND, VERY CLAYEY
2	3	1-2	16.2	111.1	38.8	41	17		A-7-6	3.4	SC	FILL, SAND, VERY CLAYEY
2	3	1-2	19.7	110.0					A-7-6	1.7*	SC	FILL, SAND, VERY CLAYEY
2	12	1-2			40.9	29	6		A-4		SM	FILL, SAND, VERY SILTY
2	15	1-2			35.2	32	15		A-6		SC	FILL, SAND, VERY CLAYEY
2	20	1-2	17.1	110.9	41.3	40	15		A-6	1.4	SM	FILL, SAND, VERY SILTY
2	7	5	6.2	90.8	36.8	NV	NP	<0.01	A-4	-0.5	SM	FILL, SAND, VERY SILTY
3	8	10			15.4	NV	NP	<0.01	A-1-b		SM	SAND, SILTY
3	17	5			30.9	27	7		A-2-4		SC-SM	SAND, CLAYEY, SILTY
4	4	10			21.1	41	12		A-2-7		SM	SANDSTONE, SILTY
4	14	1-2			11.8	NV	NP		A-1-b		SM-SW	SANDSTONE, SLIGHTLY SILTY
5	19	1-2			59.7	24	2	<0.01	A-4		ML	SILTSTONE, VERY SANDY

\* - REMOLDED SAMPLES

**FIGURE**

-  SOIL TYPE 1 - R=40.0:  
4" OF ASPHALT OVER 8" OF AGGREGATE OR RECYCLED CONCRETE BASE COURSE
-  SOIL TYPE 2 - R=6.0:  
4" OF ASPHALT OVER 8" OF AGGREGATE OR RECYCLED CONCRETE BASE COURSE
-  SOIL TYPE 2 - R=6.0:  
5" OF ASPHALT OVER 12" OF AGGREGATE OR RECYCLED CONCRETE BASE COURSE



DENOTES START OF  
CUL-DE-SAC  
SECTIONS.(TYP.)

 TB-2- APPROXIMATE TEST BORING LOCATION AND NUMBER



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505 ELIJAH DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-5099

TEST BORING LOCATION PLAN  
HOMESTEAD AT STERLING RANCH, F2  
EL PASO COUNTY, CO  
FOR: SR LAND, LLC

DRAWN BY:  
SC

DATE DRAWN:  
1/14/20

DESIGNED BY:  
SC

CHECKED:  


JOB NO.:  
190014  
FIG. NO.:

1

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

TEST BORING NO. 1  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 2  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

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', 11/4/19							DRY TO 5', 11/4/19						
FILL 0-5', SAND, VERY CLAYEY, FINE GRAINED, BROWN, MEDIUM DENSE, MOIST	0-5	[Symbol]		18	14.6	2	FILL 0-4', SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST	0-4	[Symbol]		15	12.8	1
	5	[Symbol]		14	11.3	2	SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	5	[Symbol]		50 9"	7.4	4
	10							10					
	15							15					
	20							20					



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**TEST BORING LOG**

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE:

1/13/20

JOB NO.:  
 190014

FIG NO.:  
 A- 1

TEST BORING NO. 3  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 4  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

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', 11/4/19							DRY TO 10', 11/4/19						
FILL 0-5', SAND, VERY CLAYEY, TO MEDIUM GRAINED, BROWN, MEDIUM DENSE TO LOOSE, MOIST	0-5	[Symbol]		14	9.3	2	FILL 0-4', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, DENSE, MOIST	0-4	[Symbol]		42	11.9	1
	5	[Symbol]		40	14.1	2	SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	5	[Symbol]		50 10"	11.0	4
	10	[Symbol]						10	[Symbol]		50 10"	11.4	4
	15	[Symbol]						15	[Symbol]				
	20	[Symbol]						20	[Symbol]				



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**TEST BORING LOG**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 1/13/20
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JOB NO.: 190014

FIG NO.: A-2

TEST BORING NO. 5  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 6  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 11/4/19						
FILL 0-5', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST	0-5	[Symbol]		23	8.7	1
	5	[Symbol]		11	7.8	1
	10					
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 11/4/19						
FILL 0-5', SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST	0-5	[Symbol]		19	11.5	1
	5	[Symbol]		18	8.6	1
	10					
	15					
	20					



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**TEST BORING LOG**

DRAWN:	DATE:	CHECKED: <i>[Signature]</i>	DATE: 1/13/20
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JOB NO:  
 190014

FIG NO:  
 A- 3

TEST BORING NO. 7  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 8  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

REMARKS

DRY TO 5', 11/4/19

FILL 0-5', SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, DRY

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Symbol]		25	1.3	1
5	[Symbol]		17	4.5	2
10					
15					
20					

REMARKS

DRY TO 10', 11/4/19

FILL 0-6', SAND, VERY CLAYEY, FILL, SAND, SILTY, FINE TO COARSE GRAINED, DARK BROWN TO BROWN, MEDIUM DENSE TO DENSE, MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-6	[Symbol]		15	2.8	2
6-10	[Symbol]		35	3.8	1
10	[Symbol]		30	9.1	3
15					
20					



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TEST BORING LOG

DRAWN:	DATE:	CHECKED/	DATE:
		[Signature]	1/13/20

JOB NO:  
 190014

FIG NO:  
 A- 4

TEST BORING NO. 9  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 10  
 DATE DRILLED 12/12/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

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', 11/4/19 FILL 0-5', SAND, CLAYEY, FINE TO MEDIUM GRAINED, DARK BROWN TO BROWN, MEDIUM DENSE, MOIST	5	[Symbol]		14	11.4	1	DRY TO 5', 12/12/19 FILL 0-5', SAND, CLAYEY, FINE MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST	5	[Symbol]		17	7.2	1
	5	[Symbol]		18	6.5	1		5	[Symbol]		15	12.4	1
	10							10					
	15							15					
	20							20					



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**TEST BORING LOG**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 1/13/20
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JOB NO:  
190014

FIG NO:  
A-5

TEST BORING NO. 11  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 12  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

REMARKS

DRY TO 5', 11/4/19  
 FILL 0-5', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			17	6.7	1
5			15	7.2	1

REMARKS

DRY TO 5', 11/4/19  
 FILL 0-5', SAND, VERY SILTY, FINE GRAINED, BROWN, LOOSE, MOIST  
 FILL, SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			8	11.1	2
5			17	6.8	1



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TEST BORING LOG

DRAWN

DATE

CHECKED: *h*

DATE 11/3/20

JOB NO.:  
 190014

FIG NO.:  
 A-6

TEST BORING NO. 13  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 14  
 DATE DRILLED 12/12/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

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', 11/4/19							DRY TO 10', 12/12/19						
FILL 0-5', SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST	0-5	[Symbol]		11	9.7	1	FILL 0-1', SAND, SILTY, BROWN SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	0-1	[Symbol]		50 8"	7.1	4
FILL, SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST	5	[Symbol]		15	14.8	1		5	[Symbol]		50 7"	8.6	4
	10						CLAYSTONE, SANDY, DARK BROWN, VERY STIFF, MOIST	10	[Symbol]		46	20.6	5
	15							15					
	20							20					



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TEST BORING LOG

DRAWN: DATE: CHECKED: *h* DATE: 1/13/20

JOB NO.:  
 190014

FIG NO.:  
 A-7

TEST BORING NO. 15  
 DATE DRILLED 12/12/2019  
 Job # 190014

TEST BORING NO. 16  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

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', 12/12/19 FILL 0-5', SAND, VERY CLAYEY TO CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST	5		2	12	11.7	2	DRY TO 5', 11/4/19 FILL 0-5', SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST	5		2	20	6.3	1
	5		2	10	7.8	2		5		2	18	8.3	1
	10							10					
	15							15					
	20							20					



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TEST BORING LOG

DRAWN: DATE: CHECKED: *h* DATE: 1/13/20

JOB NO:  
 190014

FIG NO:  
 A-8

TEST BORING NO. 17  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 18  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

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', 11/4/19							DRY TO 5', 11/4/19						
FILL 0-4', SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST				17	3.2	1	FILL 0-4', SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST				22	5.8	1
SAND, SILTY WITH ORGANICS, FINE TO MEDIUM GRAINED, DARK BROWN, MEDIUM DENSE, MOIST	5			20	3.7	3	SILTSTONE, VERY SANDY, TAN, HARD, MOIST	5			50 8"	10.5	5
	10							10					
	15							15					
	20							20					



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 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: *h* / DATE: 11/13/20

JOB NO.:  
 190014

FIG NO.:  
 A-9

TEST BORING NO. 19  
 DATE DRILLED 11/4/2019  
 Job # 190014

TEST BORING NO. 20  
 DATE DRILLED 11/4/2019  
 CLIENT SR LAND, LLC  
 LOCATION HOMESTEAD AT STERLING RANCH

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 10/4/19							DRY TO 5', 11/4/19						
SAND, VERY SILTY, BROWN SILTSTONE, VERY SANDY, BROWN, HARD, MOIST				50 8"	13.4	2 5	FILL 0-5', SAND, VERY CLAYEY, VERY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE TO LOOSE, MOIST				15	12.9	2
	5			50 6"	13.6	5		5			8	13.8	2
	10			50 10"	15.9	5		10					
	15							15					
	20							20					



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**TEST BORING LOG**

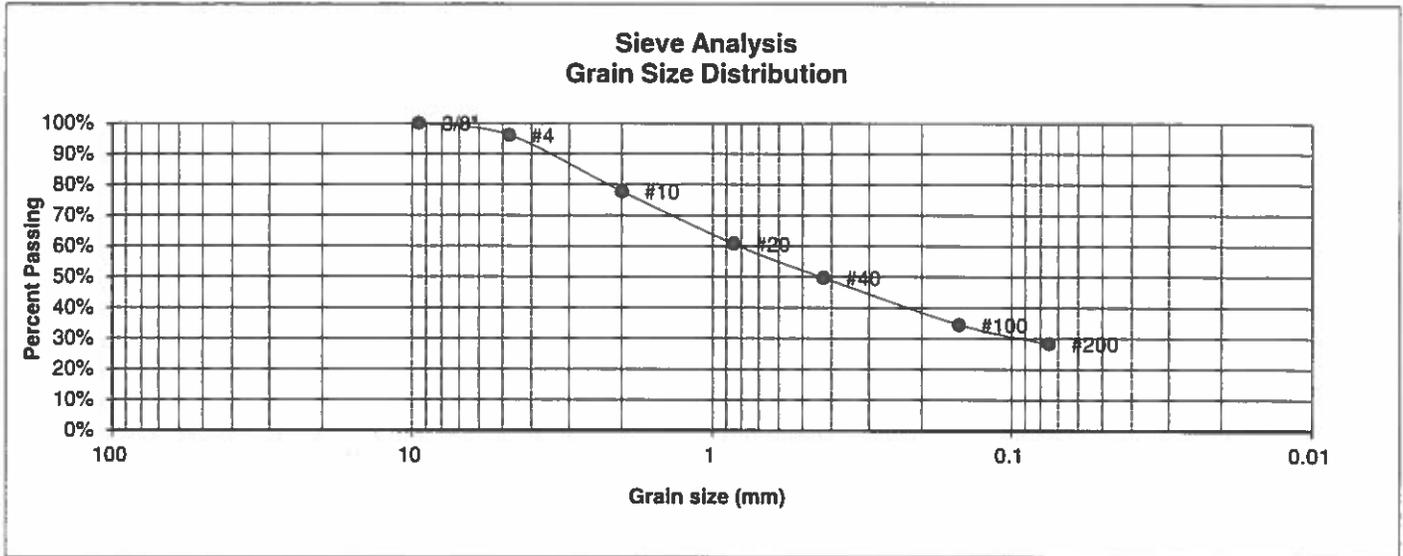
DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 11/13/20
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JOB NO:  
 190014

FIG NO:  
 A-10

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

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	2	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-6	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.1%
10	77.7%
20	60.7%
40	49.7%
100	34.5%
200	28.3%

Atterberg Limits	
Plastic Limit	22
Liquid Limit	33
Plastic Index	11

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



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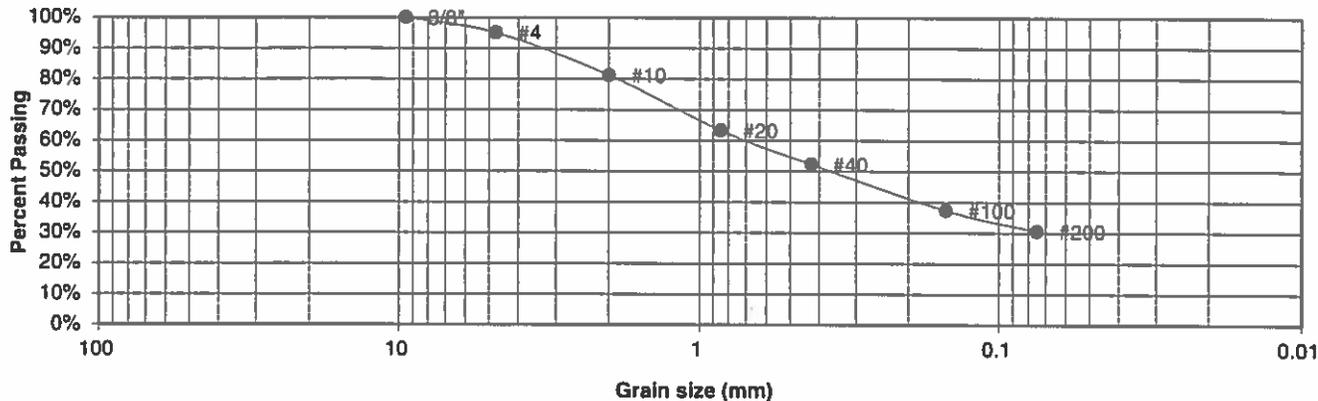
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 1/13/20
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JOB NO.:  
190014  
FIG NO.:  
B-1

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1, CBR	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	4	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	0-3	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-6	<b>GROUP INDEX</b>	0

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.1%
10	81.3%
20	63.3%
40	52.3%
100	37.3%
200	30.6%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	28
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:
		<i>W</i>	1/13/20

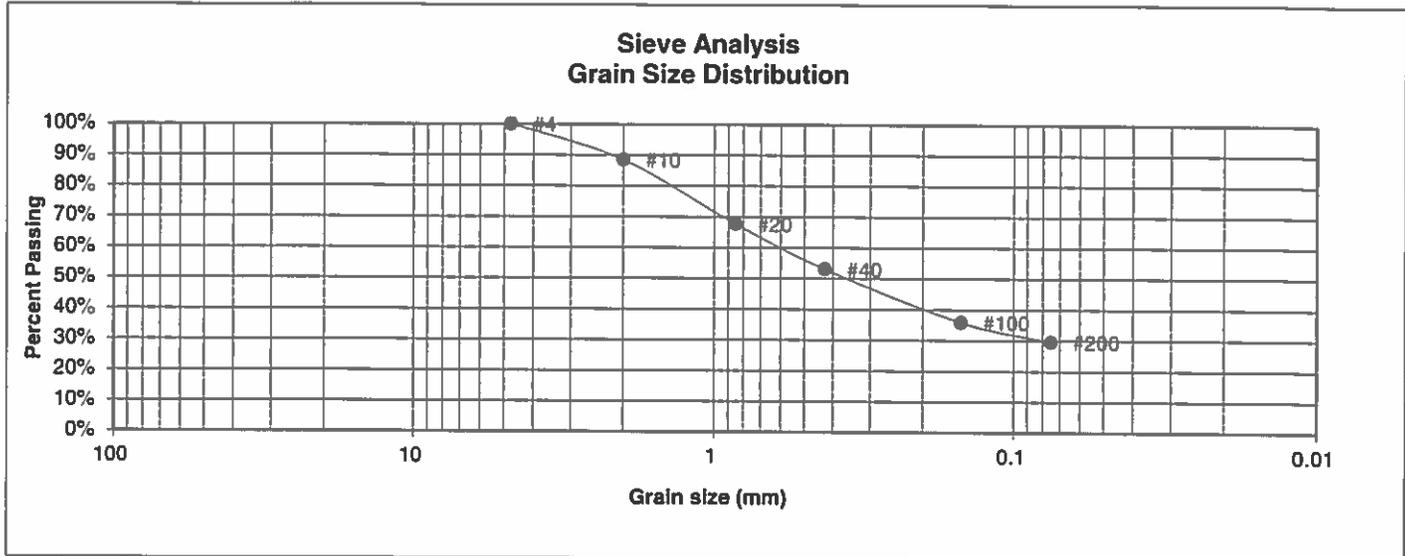
JOB NO.:

190014

FIG NO.:

B-2

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	4	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-4	<b>GROUP INDEX</b>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>	
3"		Plastic Limit	17
1 1/2"		Liquid Limit	27
3/4"		Plastic Index	10
1/2"			
3/8"		<u>Swell</u>	
4	100.0%	Moisture at start	
10	88.5%	Moisture at finish	
20	67.6%	Moisture increase	
40	53.0%	Initial dry density (pcf)	
100	35.9%	Swell (psf)	
200	29.6%		



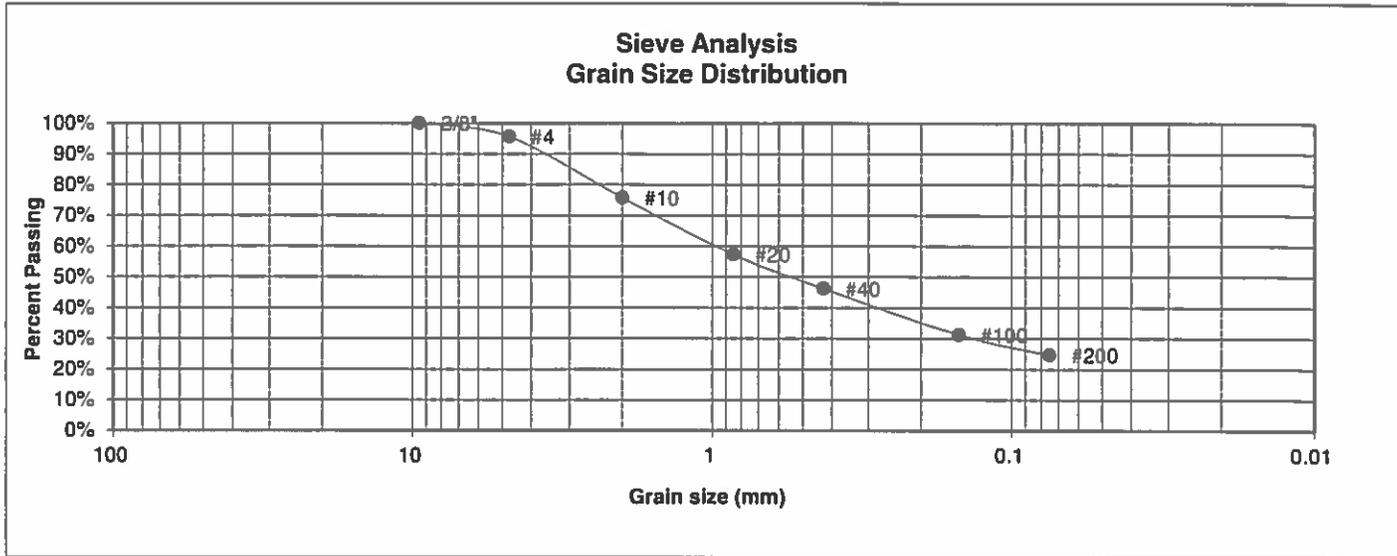
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**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE
		<i>W</i>	1/15/20

JOB NO.:  
190014  
FIG NO.:  
**8-3**

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	5	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-6	<b>GROUP INDEX</b>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>	
3"		Plastic Limit	24
1 1/2"		Liquid Limit	38
3/4"		Plastic Index	14
1/2"			
3/8"	100.0%	<u>Swell</u>	
4	95.7%	Moisture at start	
10	75.7%	Moisture at finish	
20	57.3%	Moisture increase	
40	46.2%	Initial dry density (pcf)	
100	31.2%	Swell (psf)	
200	24.7%		



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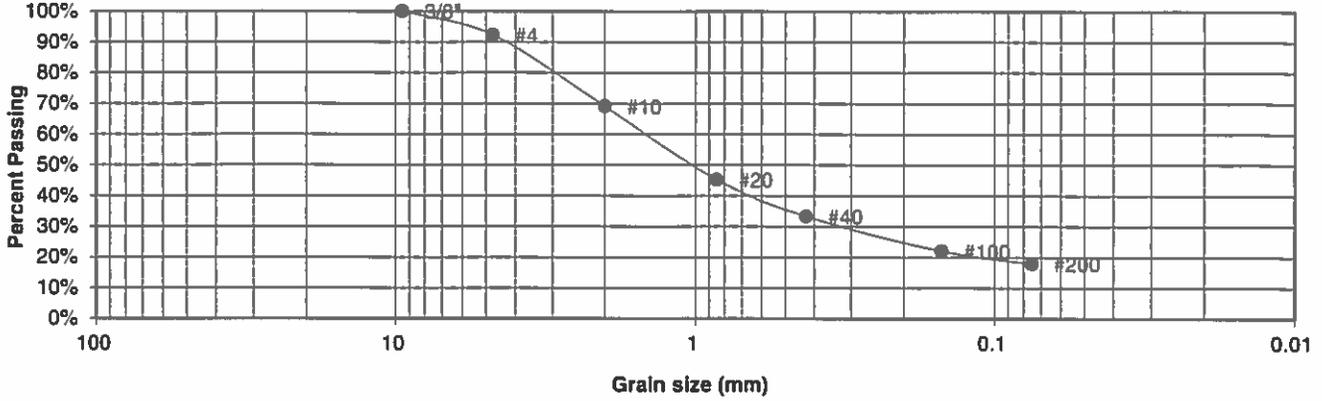
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 1/13/20
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JOB NO.:  
190014  
FIG NO.:  
8-4

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	6	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-1-b	<b>GROUP INDEX</b>	0

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.3%
10	69.1%
20	45.2%
40	33.3%
100	22.0%
200	17.9%

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)	



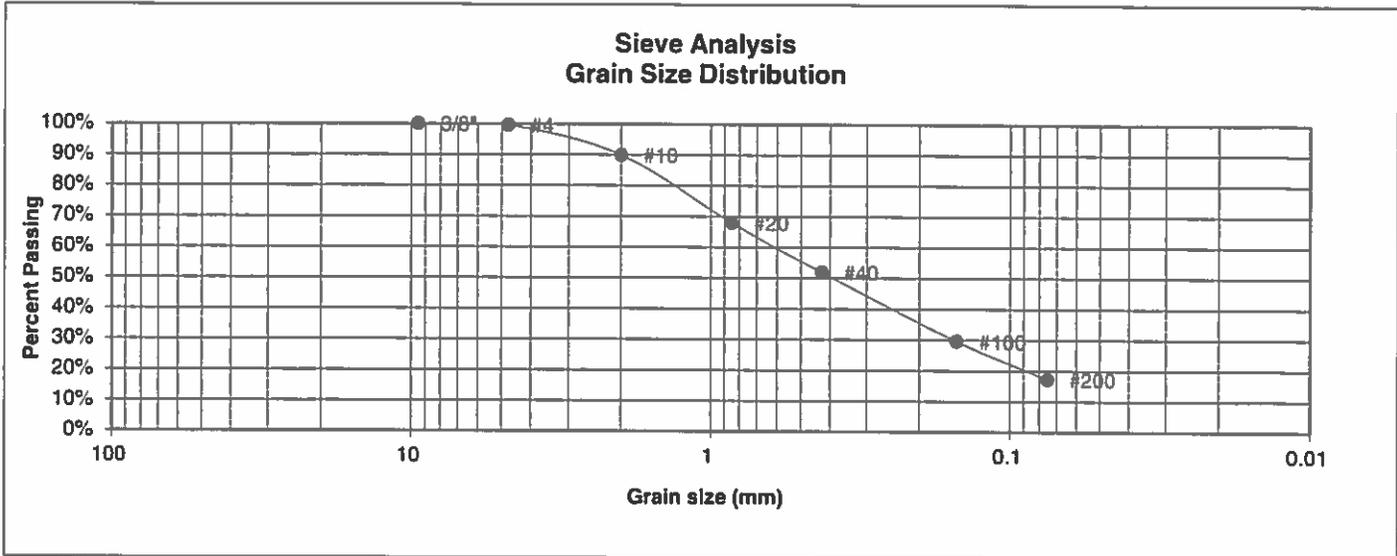
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**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>h</i>	1/13/20

JOB NO.:  
190014  
FIG NO.:  
**B-5**

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	7	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-4	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	89.9%
20	68.0%
40	51.9%
100	29.5%
200	17.2%

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)	



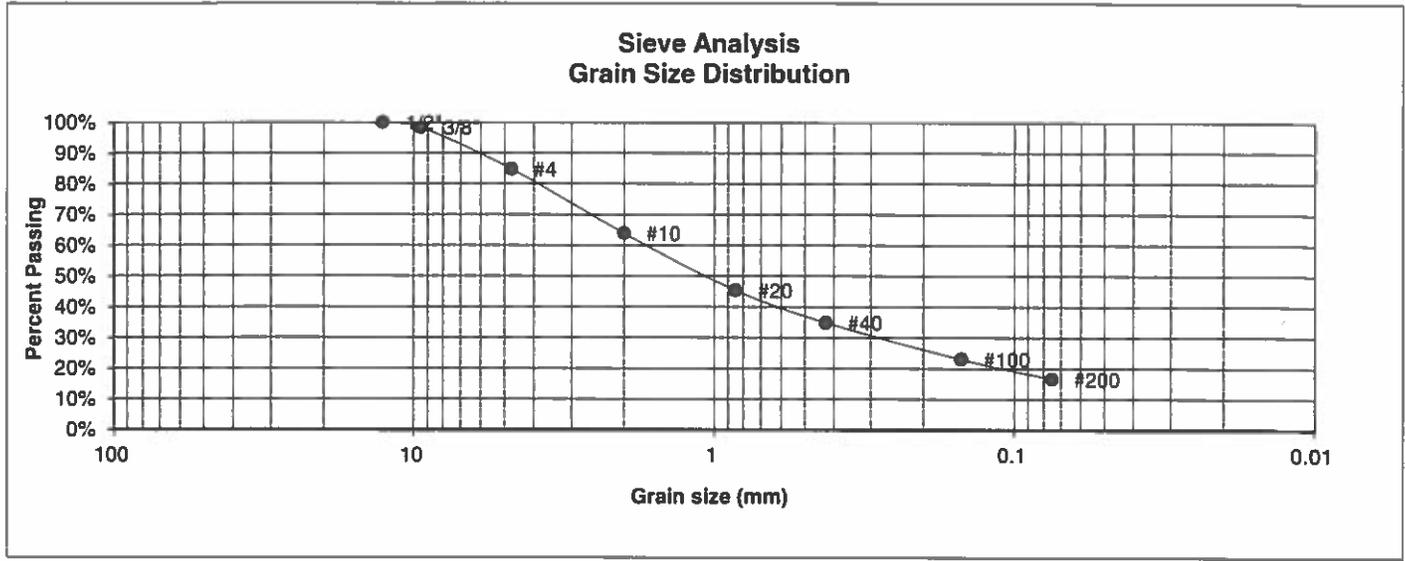
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 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>W</i>	1/13/20

JOB NO.:  
 190014  
 FIG NO.:  
 B-6

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	8	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-1-b	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.3%
#4	84.8%
#10	63.9%
#20	45.3%
#40	34.9%
#100	23.0%
#200	16.6%

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)	



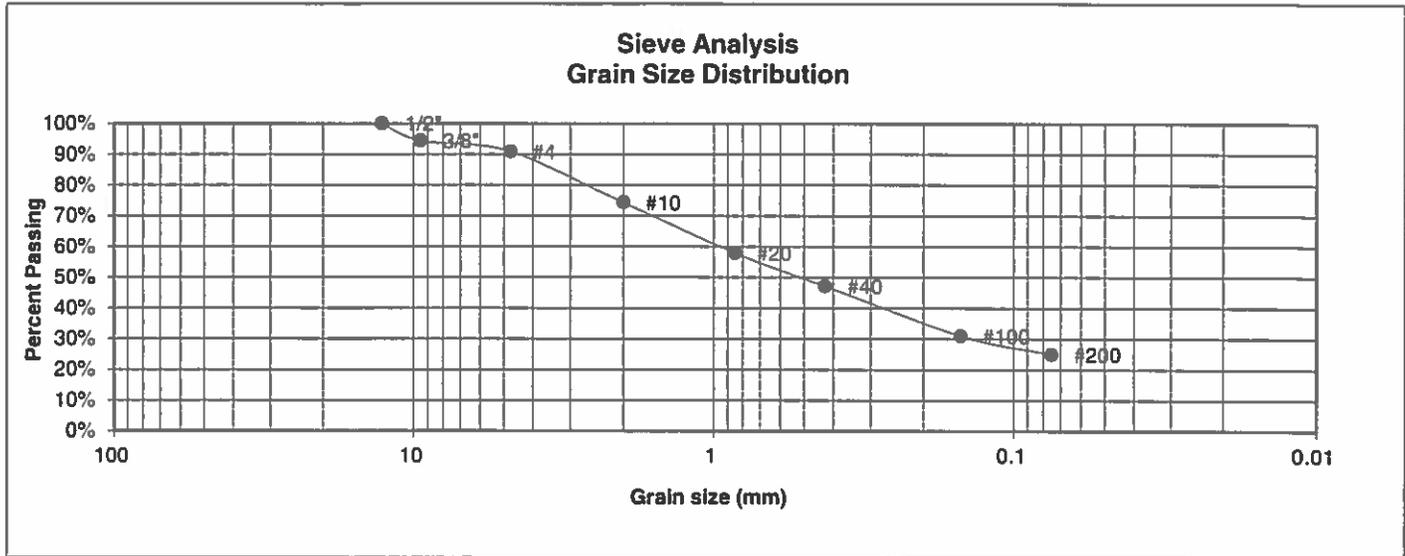
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**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/13/20

JOB NO.:  
190014  
FIG NO.:  
B-7

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	9	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-6	<b>GROUP INDEX</b>	1



<b>U.S. Sieve #</b>	<b>Percent Finer</b>	<b>Atterberg Limits</b>	
3"		Plastic Limit	23
1 1/2"		Liquid Limit	38
3/4"		Plastic Index	15
1/2"	100.0%		
3/8"	94.4%	<b>Swell</b>	
4	90.9%	Moisture at start	
10	74.3%	Moisture at finish	
20	57.9%	Moisture increase	
40	47.2%	Initial dry density (pcf)	
100	31.0%	Swell (psf)	
200	25.0%		



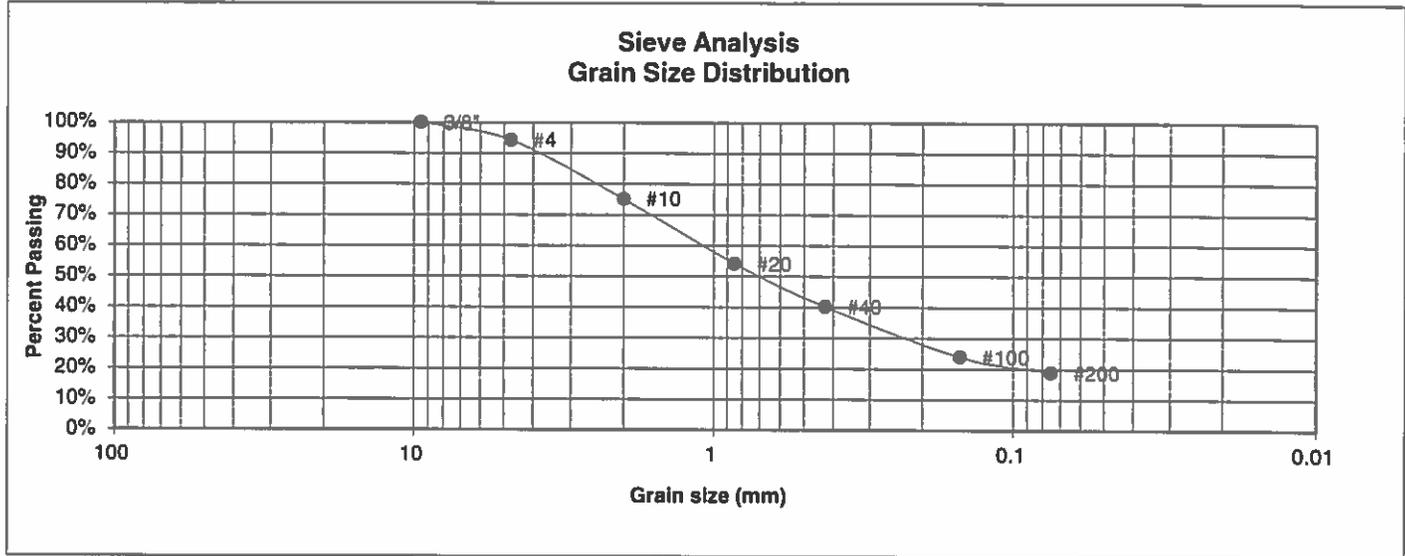
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COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE: 1/13/20
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JOB NO.:  
190014  
FIG NO.:  
B-3

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	10	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-4	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.3%
10	75.1%
20	54.2%
40	40.2%
100	23.9%
200	18.9%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	26
Plastic Index	10

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



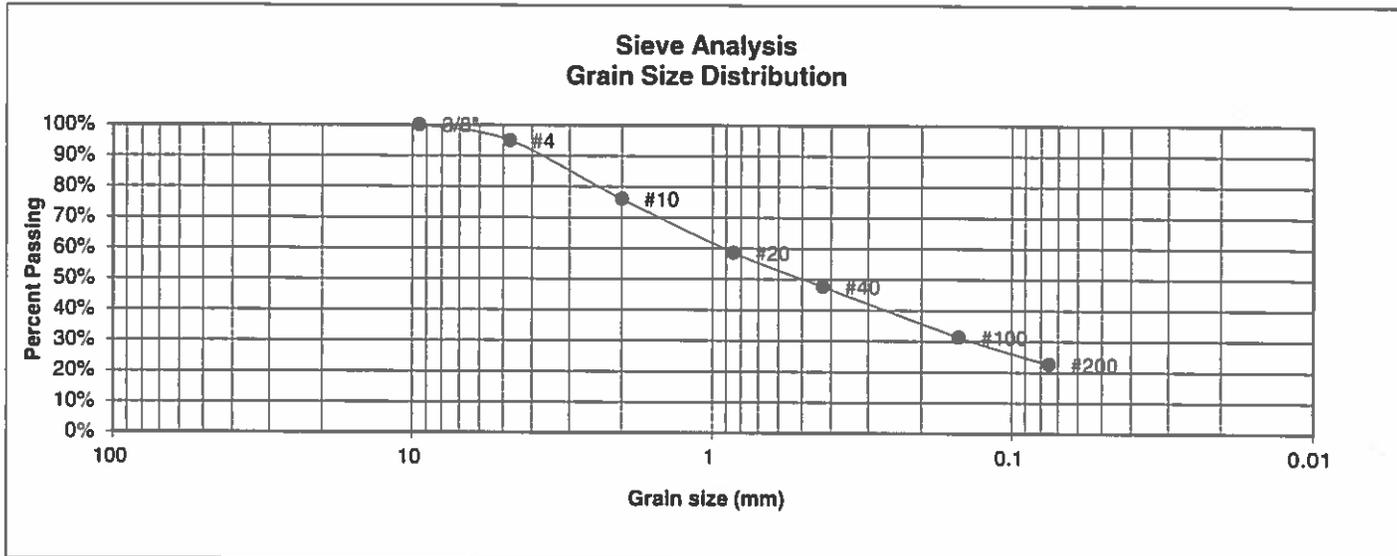
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**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>h</i>	1/13/20

JOB NO.:  
190014  
FIG NO.:  
B-9

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	11	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-7	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.9%
10	76.0%
20	58.6%
40	47.7%
100	31.3%
200	22.6%

Atterberg Limits	
Plastic Limit	26
Liquid Limit	41
Plastic Index	15
Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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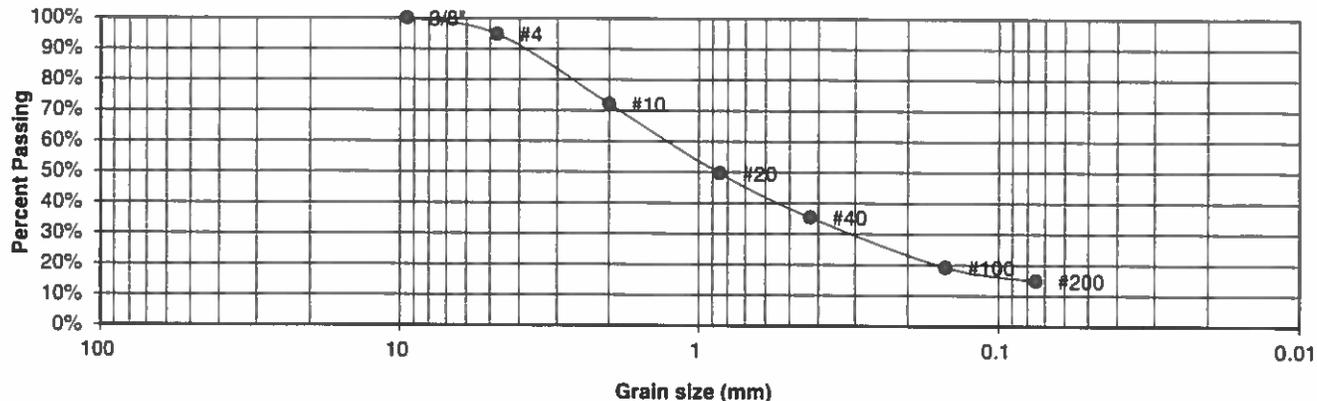
**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE: 11/13/20
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JOB NO.:  
 190014  
 FIG NO.:  
 B-10

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	SR LAND, LLC
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	HOMESTEAD AT STERLING RANCH
<u>TEST BORING #</u>	13	<u>JOB NO.</u>	190014
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-1-b	<u>GROUP INDEX</u>	0

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.9%
10	72.1%
20	49.6%
40	35.3%
100	19.2%
200	14.8%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

<u>Swell</u>	
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:

11/13/20

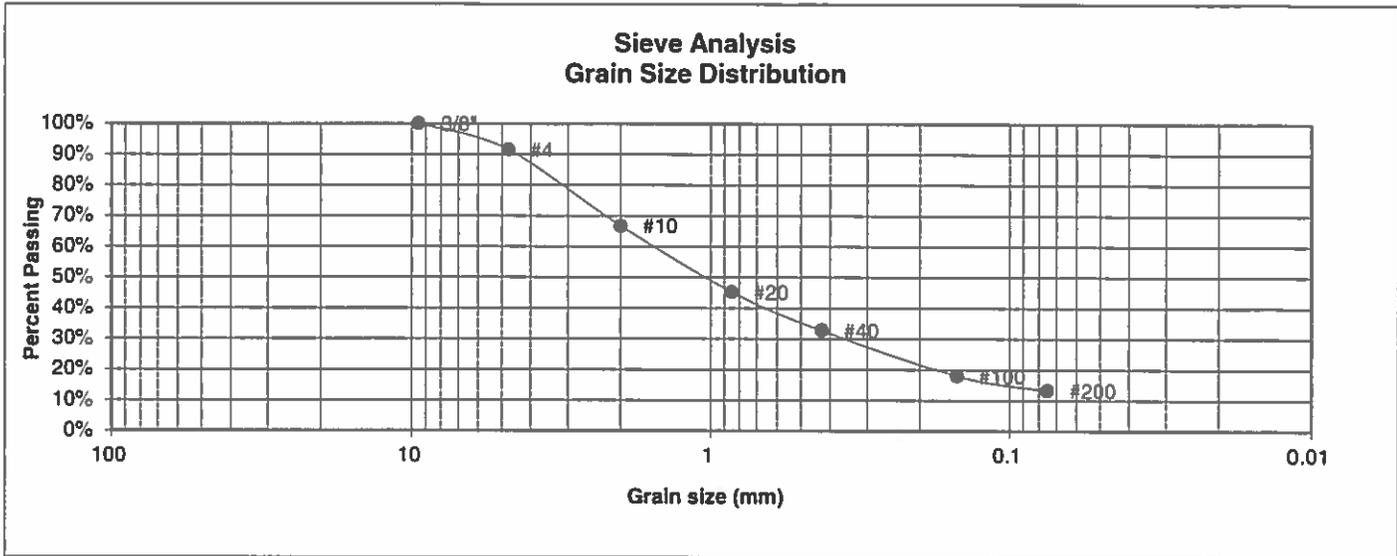
JOB NO.:

190014

FIG NO.:

B-11

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	16	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-1-b	<b>GROUP INDEX</b>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>	
3"		Plastic Limit	NP
1 1/2"		Liquid Limit	NV
3/4"		Plastic Index	NP
1/2"			
3/8"	100.0%	<u>Swell</u>	
4	91.5%	Moisture at start	
10	66.7%	Moisture at finish	
20	45.3%	Moisture increase	
40	32.7%	Initial dry density (pcf)	
100	17.9%	Swell (psf)	
200	13.2%		



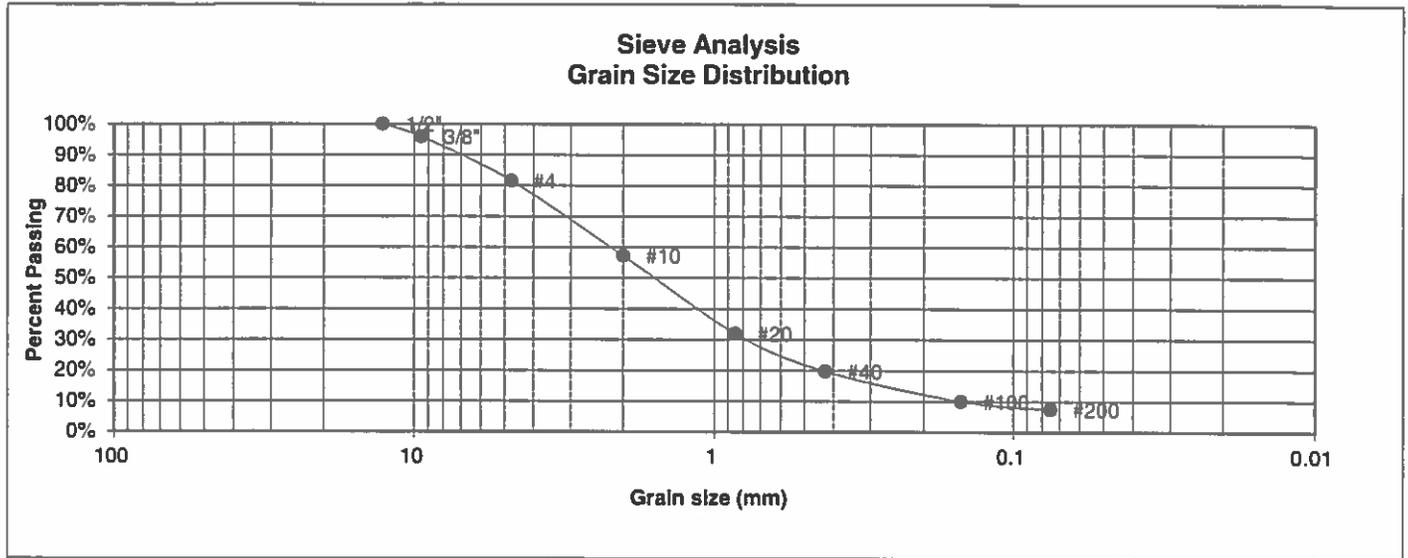
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COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>[Signature]</i>	DATE: 1/13/20
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JOB NO.:  
190014  
FIG NO.:  
**B-12**

<b>UNIFIED CLASSIFICATION</b>	SM-SW	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	17	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-1-b	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.9%
4	81.6%
10	57.2%
20	31.9%
40	19.7%
100	10.0%
200	7.4%

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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**LABORATORY TEST  
RESULTS**

DRAWN

DATE

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DATE  
1/3/20

JOB NO.:

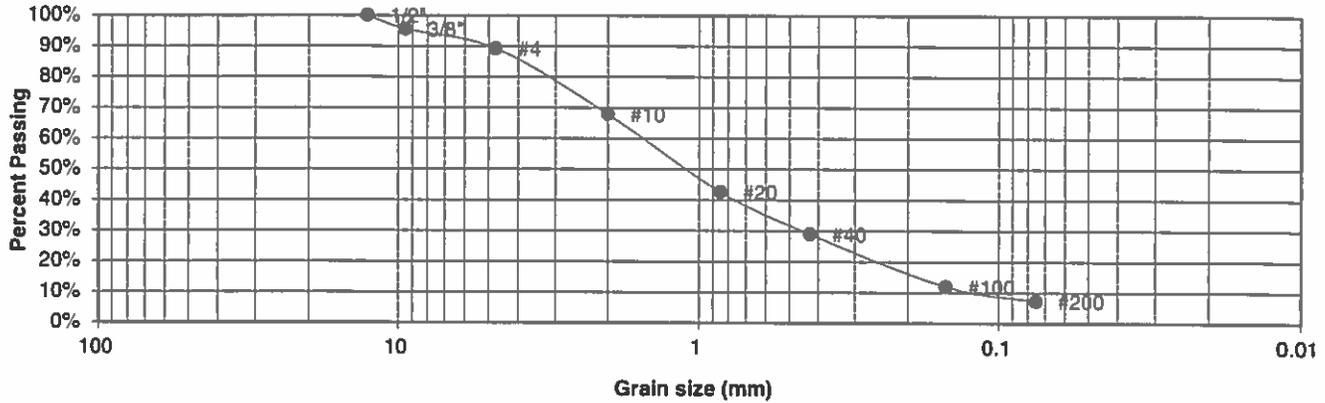
190014

FIG NO.:

B-13

<b>UNIFIED CLASSIFICATION</b>	SM-SW	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	18	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-1-b	<b>GROUP INDEX</b>	0

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.6%
4	89.2%
10	67.9%
20	42.7%
40	28.9%
100	11.9%
200	7.3%

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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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

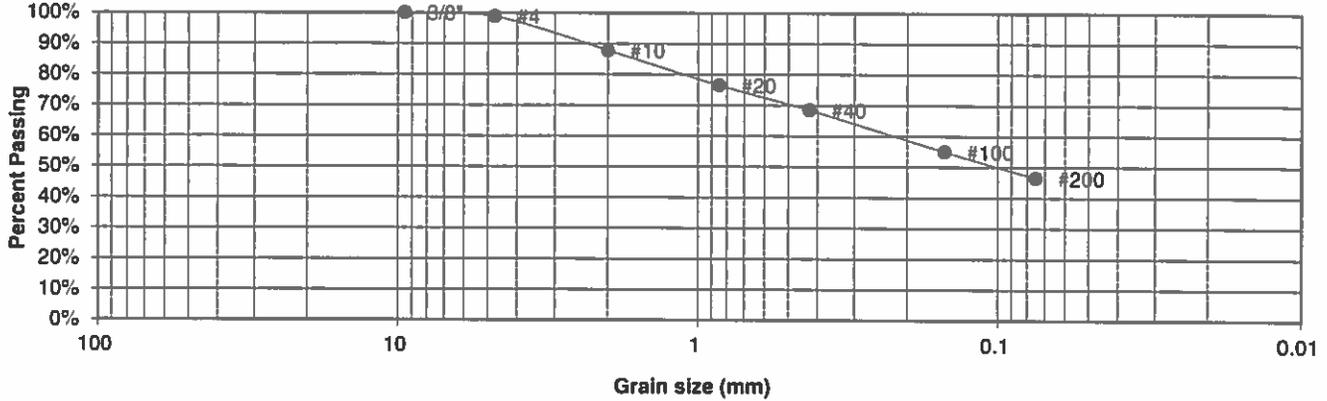
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>h</i>	1/13/20

JOB NO.:  
190014  
FIG NO.:  
B-14

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	2	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	1	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-6	<b>GROUP INDEX</b>	3

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.8%
10	87.8%
20	76.5%
40	68.5%
100	55.0%
200	46.5%

Atterberg Limits	
Plastic Limit	21
Liquid Limit	35
Plastic Index	14

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



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**LABORATORY TEST  
RESULTS**

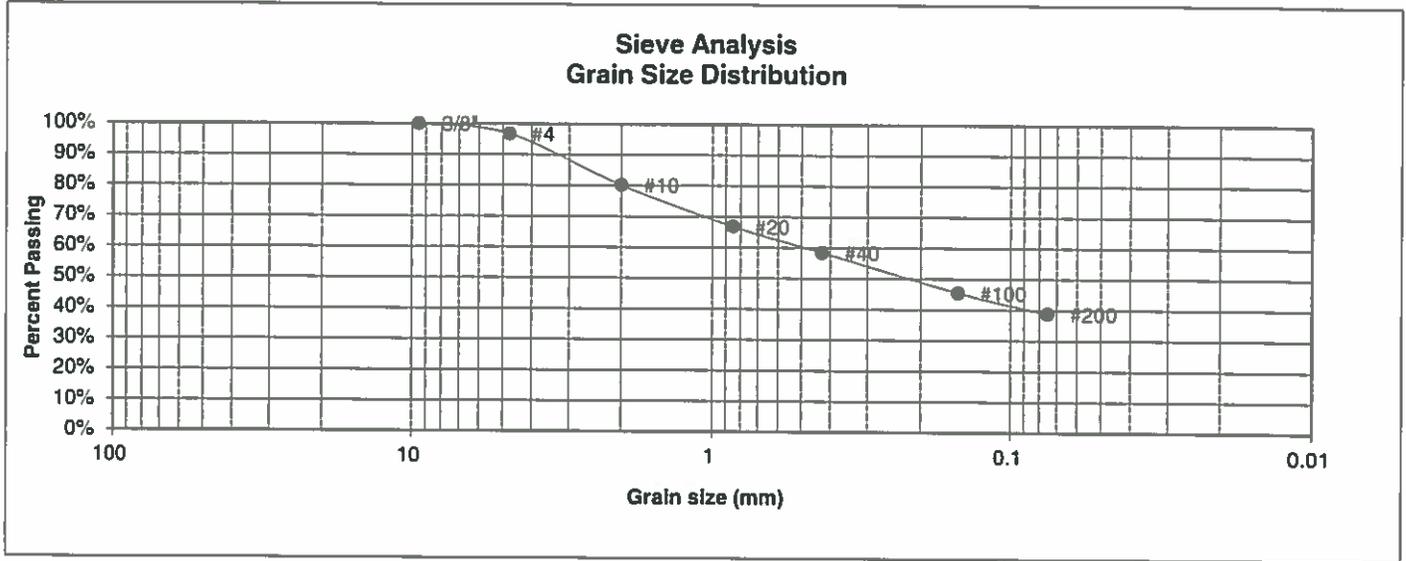
DRAWN:	DATE:	CHECKED:	DATE: 1/13/20
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JOB NO.:

190014  
FIG NO.:

B-15

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	2	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	3	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-7-6	<b>GROUP INDEX</b>	2



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.7%
10	80.2%
20	66.8%
40	58.4%
100	45.4%
200	38.8%

Atterberg Limits	
Plastic Limit	24
Liquid Limit	41
Plastic Index	17

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	1/29/26

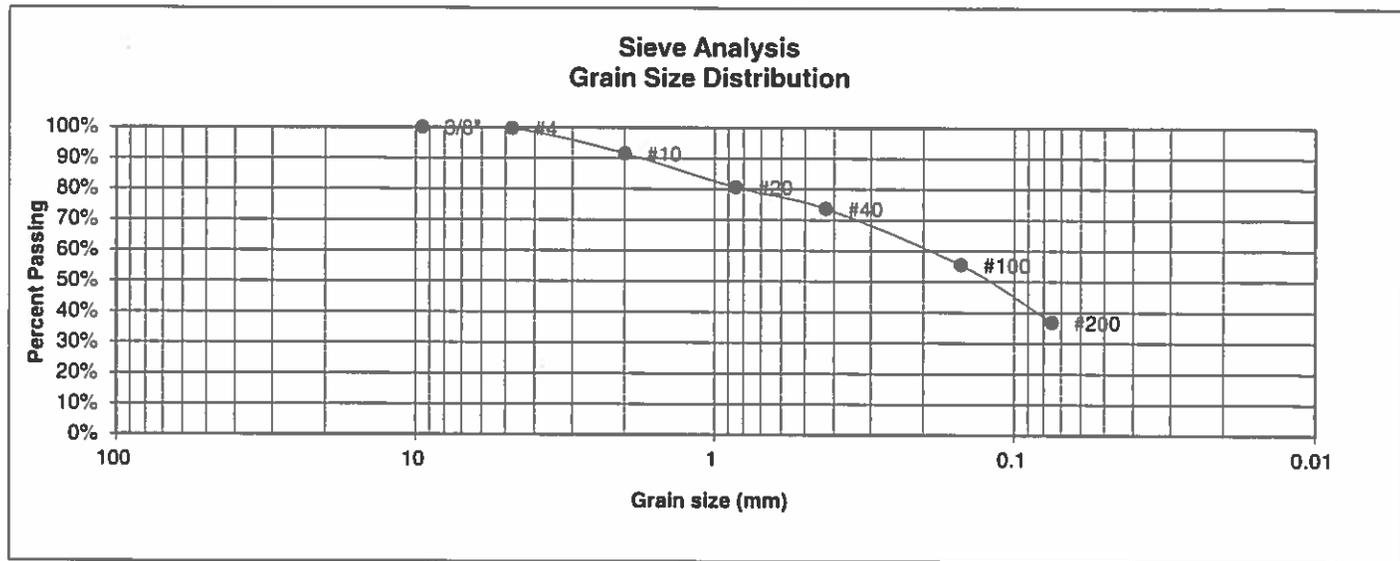
JOB NO.:

190014

FIG NO.:

B-16

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	SR LAND, LLC
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	HOMESTEAD AT STERLING RANCH
<u>TEST BORING #</u>	7	<u>JOB NO.</u>	190014
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-4	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	91.5%
20	80.6%
40	73.7%
100	55.5%
200	36.8%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

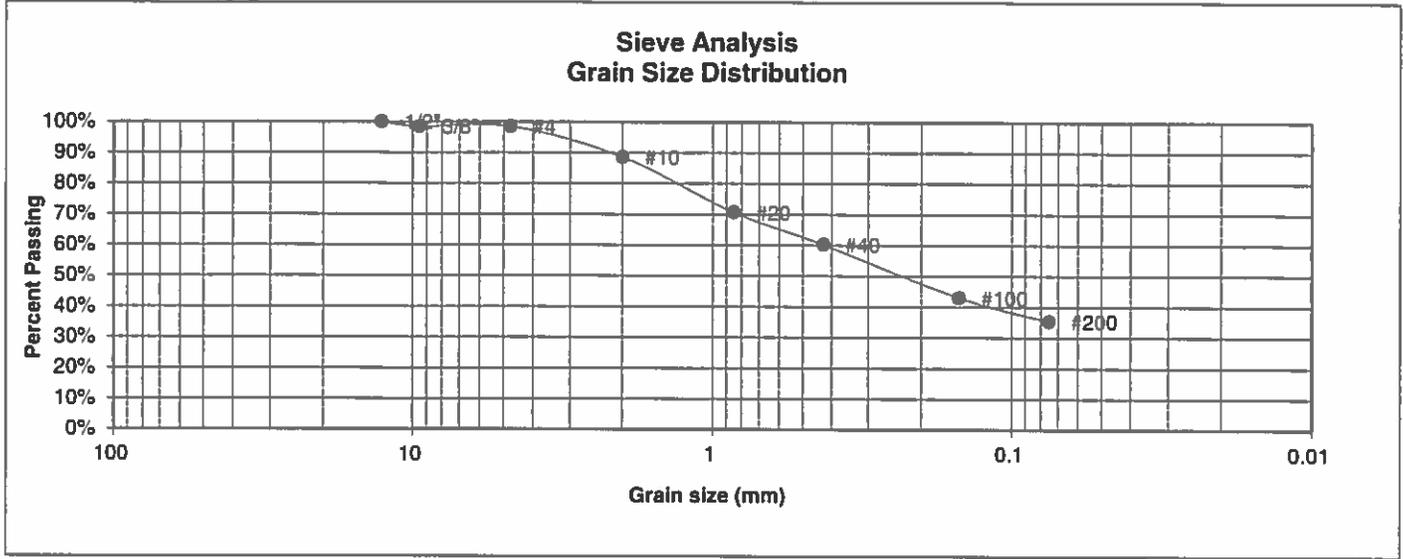
DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/13/20

JOB NO.:

190014  
FIG NO.:

B-17

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	2, CBR	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	8	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	0-3	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-6	<b>GROUP INDEX</b>	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.5%
4	98.5%
10	88.6%
20	70.6%
40	60.3%
100	43.0%
200	35.4%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	32
Plastic Index	14

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



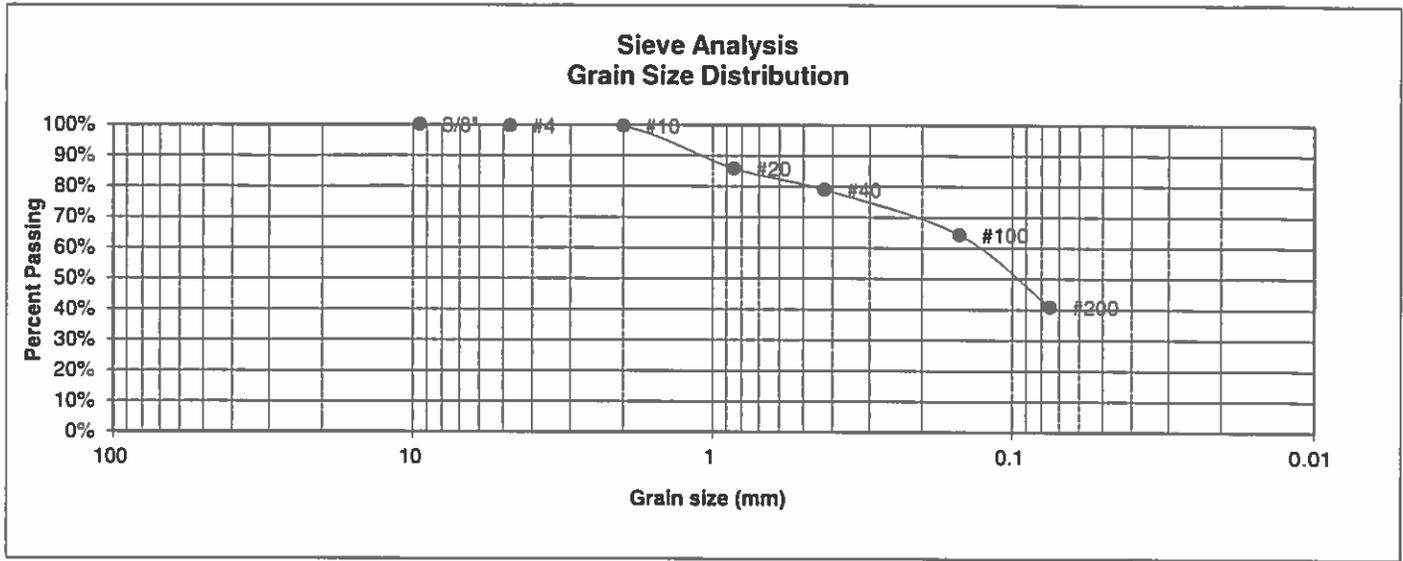
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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/13/21

JOB NO:  
190014  
FIG NO:  
B-18

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	2	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	12	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-4	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	99.6%
20	85.8%
40	78.9%
100	64.3%
200	40.9%

Atterberg Limits	
Plastic Limit	23
Liquid Limit	29
Plastic Index	6
Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



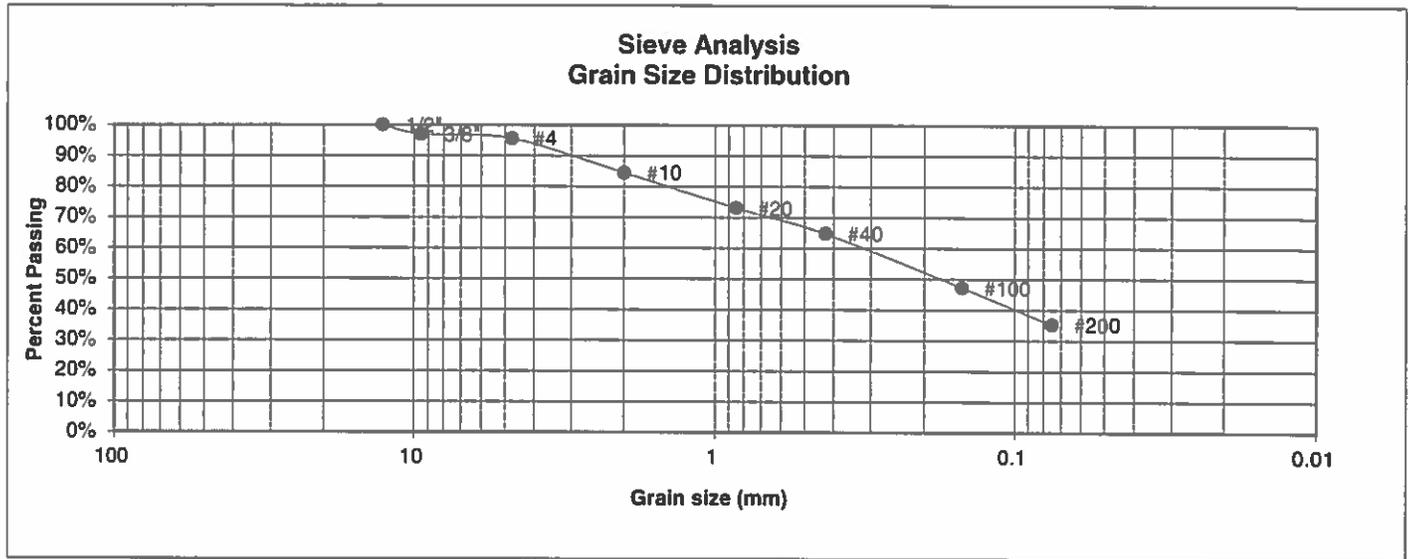
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COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>W</i>	1/22/20

JOB NO.:  
190014  
FIG NO.:  
B-19

<b>UNIFIED CLASSIFICATION</b>	SC	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	2	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	15	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-6	<b>GROUP INDEX</b>	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.0%
4	95.6%
10	84.5%
20	73.0%
40	64.8%
100	47.2%
200	35.2%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	32
Plastic Index	15

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>W</i>	1/13/20

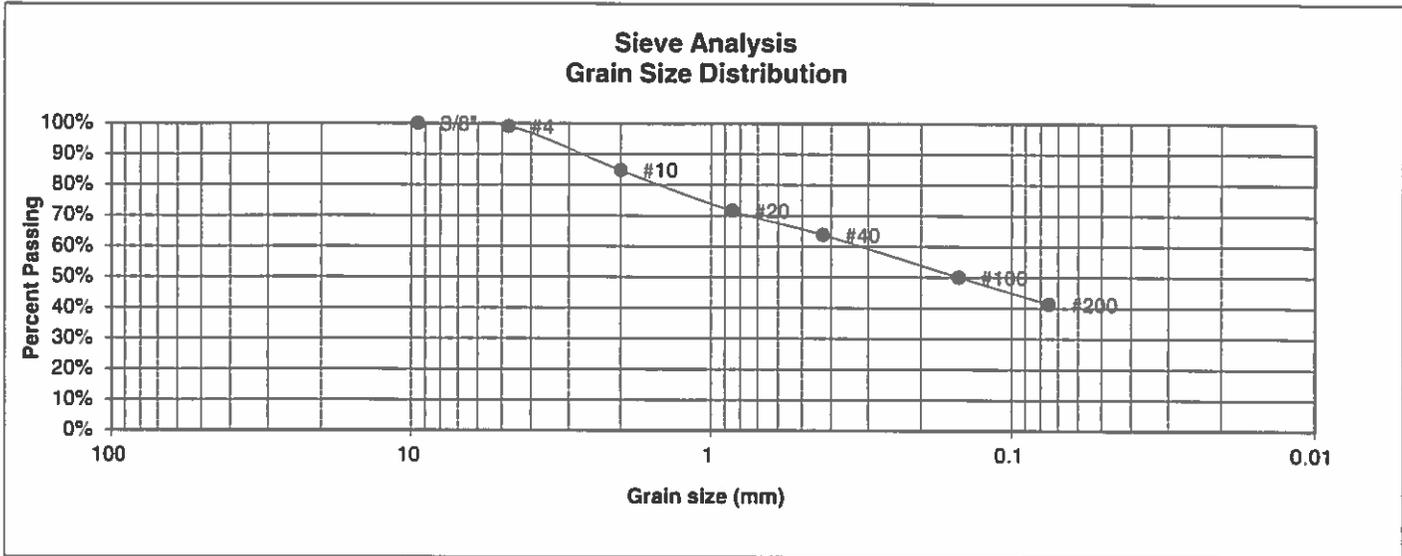
JOB NO.:

190014

FIG NO.:

8-20

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	2	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	20	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-6	<b>GROUP INDEX</b>	3



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	84.7%
20	71.6%
40	63.8%
100	50.0%
200	41.3%

Atterberg Limits	
Plastic Limit	25
Liquid Limit	40
Plastic Index	15

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



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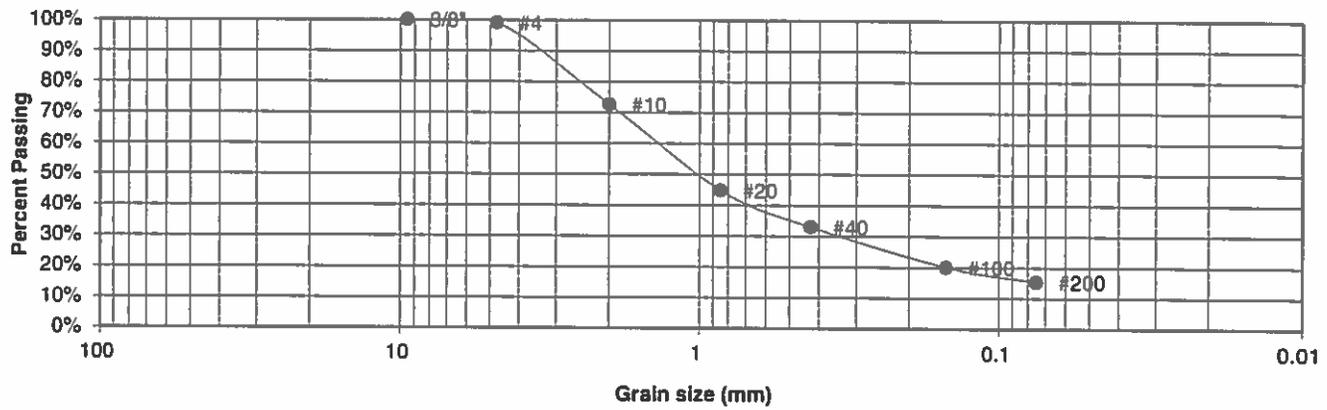
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE
		<i>W</i>	11/13/20

JOB NO:  
190014  
FIG NO:  
B-21

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	SR LAND, LLC
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	HOMESTEAD AT STERLING RANCH
<u>TEST BORING #</u>	8	<u>JOB NO.</u>	190014
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-1-b	<u>GROUP INDEX</u>	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	72.6%
20	44.8%
40	33.0%
100	20.0%
200	15.4%

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)	



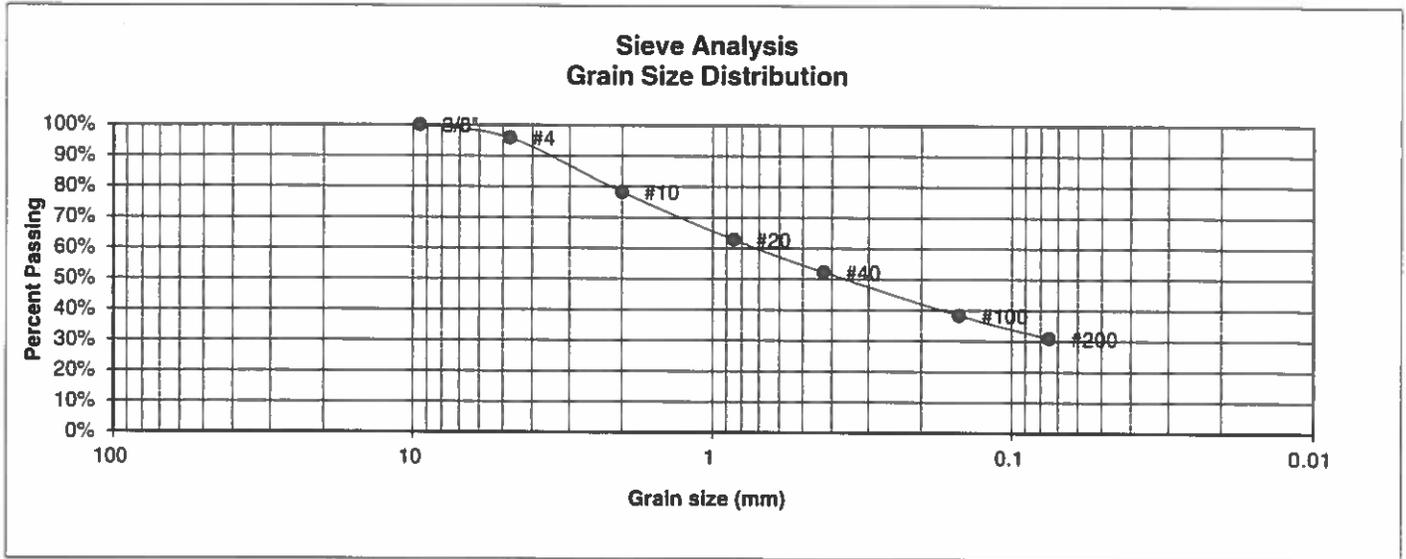
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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	11/13/20

JOB NO.:  
190014  
FIG NO.:  
B-22

<b>UNIFIED CLASSIFICATION</b>	SC-SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	3	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	17	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	5	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-4	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.8%
10	78.2%
20	62.8%
40	52.3%
100	38.3%
200	30.9%

Atterberg Limits	
Plastic Limit	20
Liquid Limit	27
Plastic Index	7

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



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**LABORATORY TEST  
RESULTS**

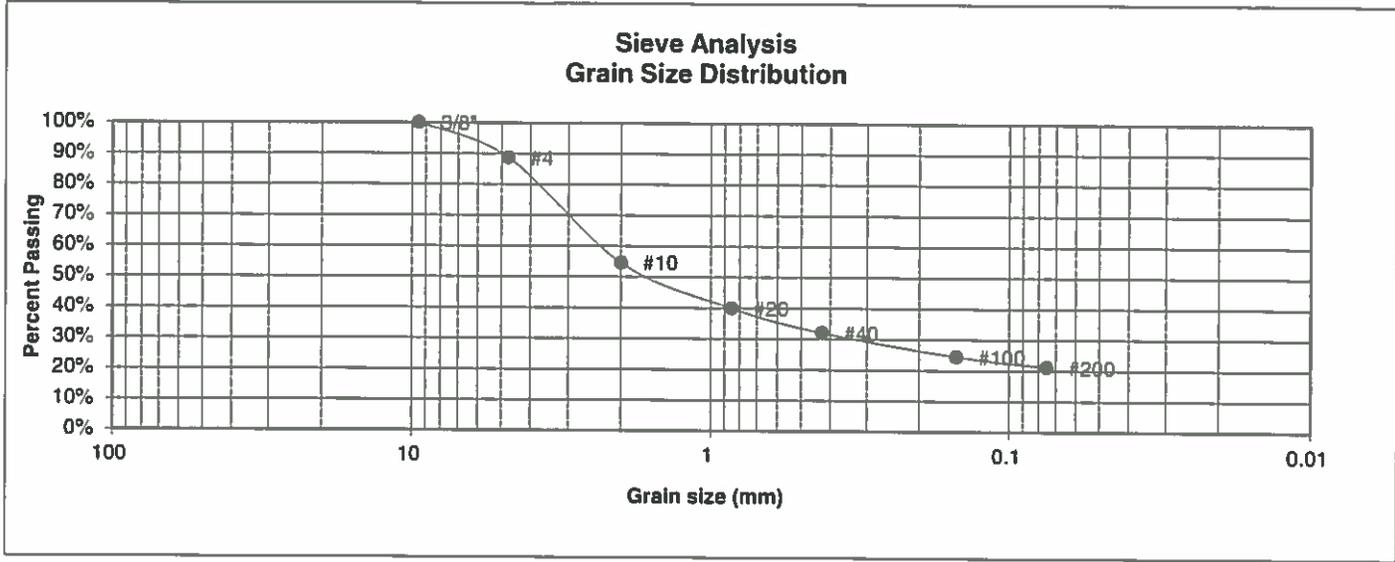
DRAWN:	DATE:	CHECKED:	DATE:
		<i>h</i>	1/13/20

JOB NO:

190014  
FIG NO:

8-23

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	4	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	4	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	10	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-2-7	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	88.7%
10	54.5%
20	39.9%
40	32.0%
100	24.5%
200	21.1%

Atterberg Limits	
Plastic Limit	29
Liquid Limit	41
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>BL</i>	1/20/2

JOB NO.:

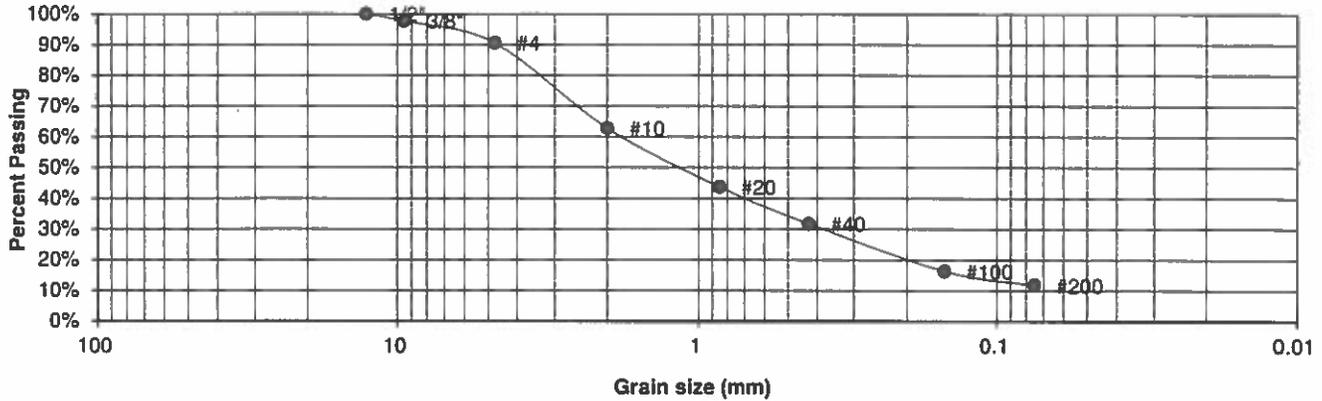
190014

FIG NO.:

*B-24*

<b>UNIFIED CLASSIFICATION</b>	SM-SW	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	4	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	14	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-1-b	<b>GROUP INDEX</b>	0

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.7%
4	90.5%
10	62.8%
20	43.7%
40	31.8%
100	16.3%
200	11.8%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>a</i>	11/13/20

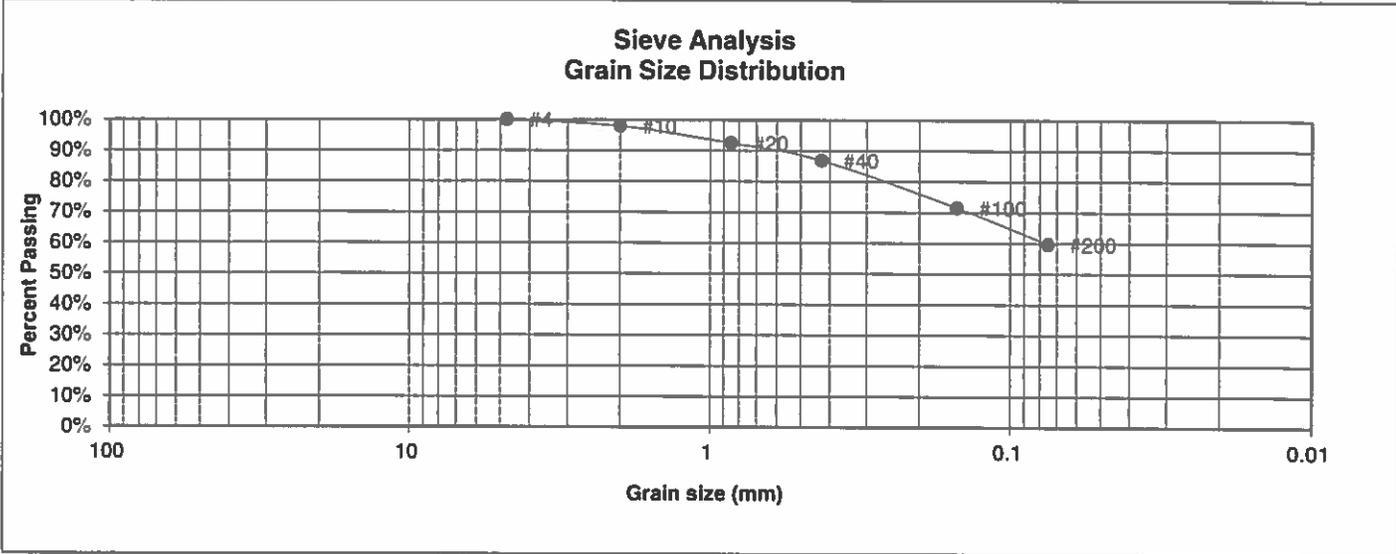
JOB NO.:

190014

F/G NO.:

B-25

<b>UNIFIED CLASSIFICATION</b>	ML	<b>CLIENT</b>	SR LAND, LLC
<b>SOIL TYPE #</b>	5	<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH
<b>TEST BORING #</b>	19	<b>JOB NO.</b>	190014
<b>DEPTH (FT)</b>	1-2	<b>TEST BY</b>	BL
<b>AASHTO CLASSIFICATION</b>	A-4	<b>GROUP INDEX</b>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.0%
20	92.4%
40	86.9%
100	71.5%
200	59.7%

Atterberg Limits	
Plastic Limit	23
Liquid Limit	24
Plastic Index	2

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>h</i>	1/13/20

JOB NO:

190014

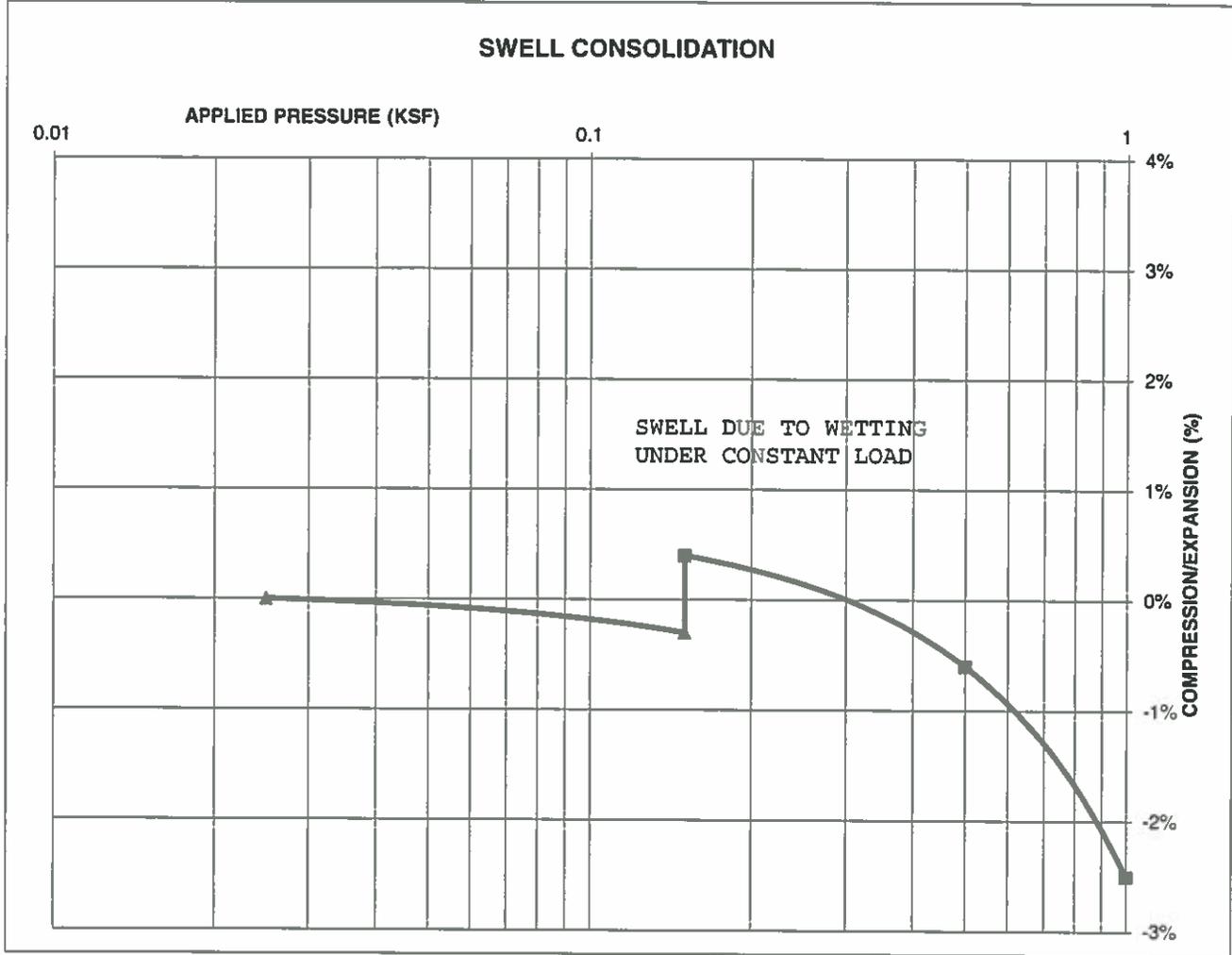
FIG NO:

B-26

**CONSOLIDATION TEST RESULTS**

TEST BORING #	1	DEPTH(ft)	0-3
DESCRIPTION	SC	SOIL TYPE	1, CBR
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			9.4%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH



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**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/22/2

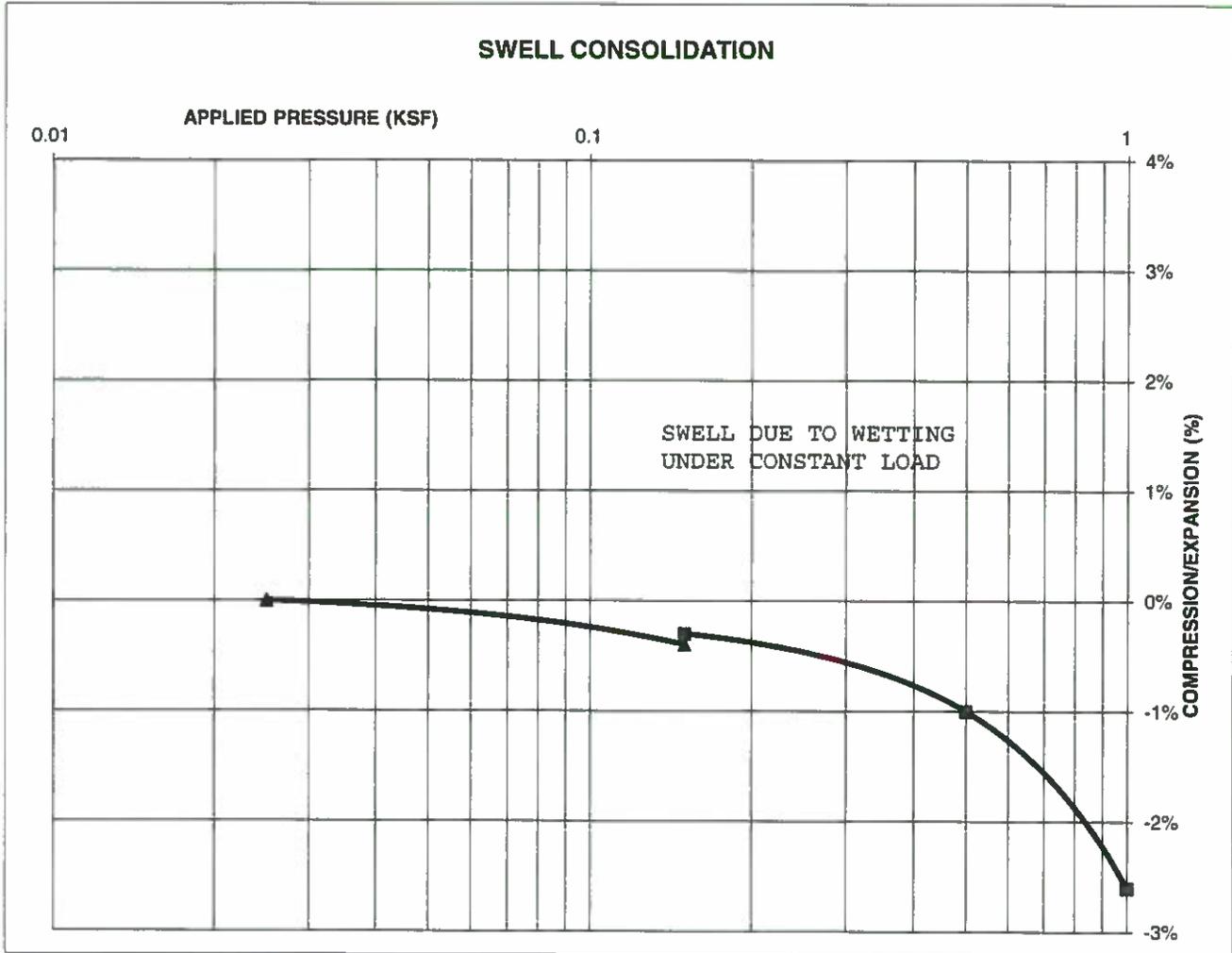
JOB NO:  
190014

FIG NO:  
B-27

**CONSOLIDATION TEST RESULTS**

TEST BORING #	2	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			114
NATURAL MOISTURE CONTENT			12.2%
SWELL/CONSOLIDATION (%)			0.1%

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *h*

DATE

*1/15/20*

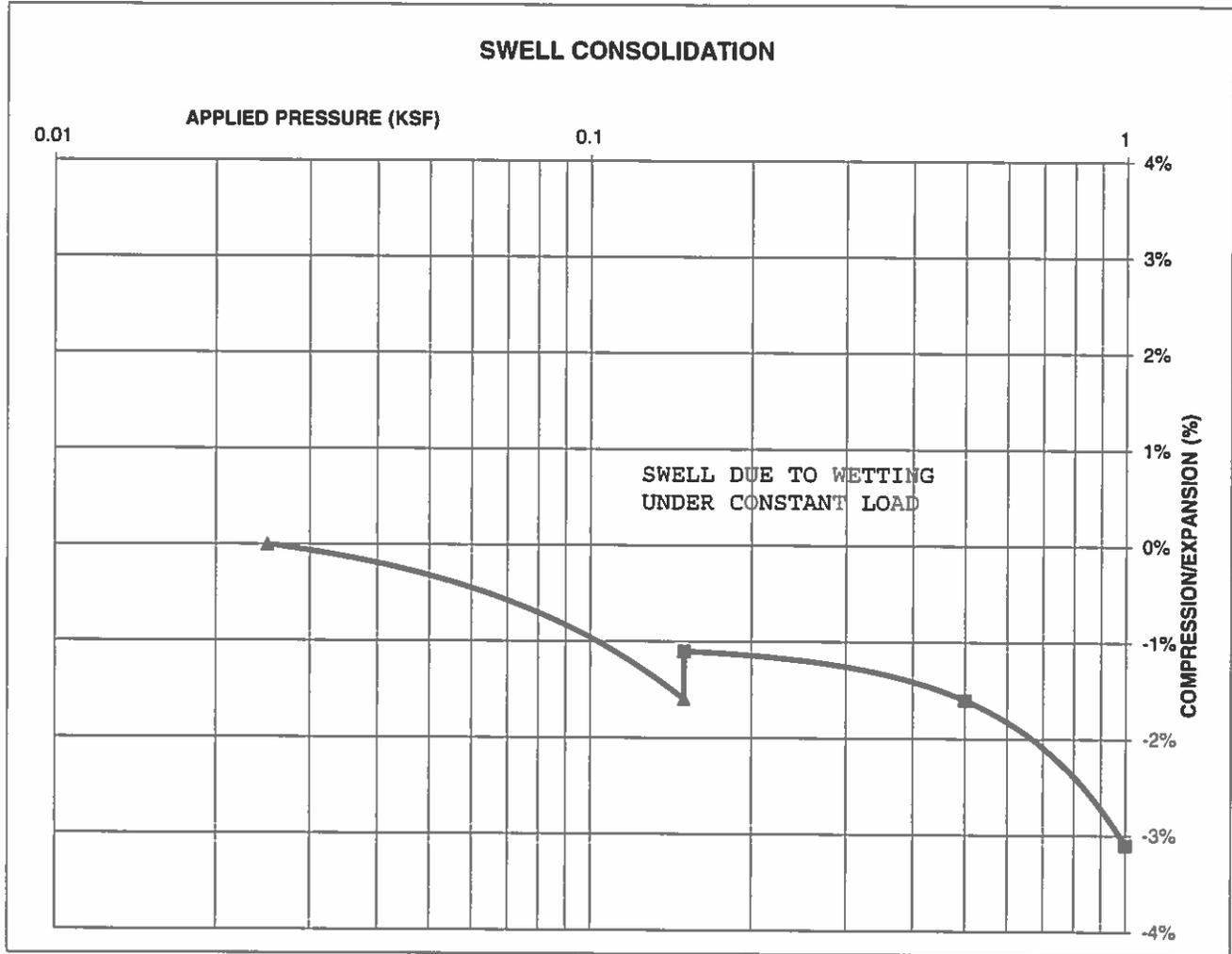
JOB NO:  
 190014

FIG NO:  
**8-28**

**CONSOLIDATION TEST RESULTS**

TEST BORING #	4	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			120
NATURAL MOISTURE CONTENT			10.6%
SWELL/CONSOLIDATION (%)			0.5%

JOB NO. 190014  
 CLIENT SR LAND, LLC  
 PROJECT HOMESTEAD AT STERLING RANCH



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *W*

DATE: 1/13/20

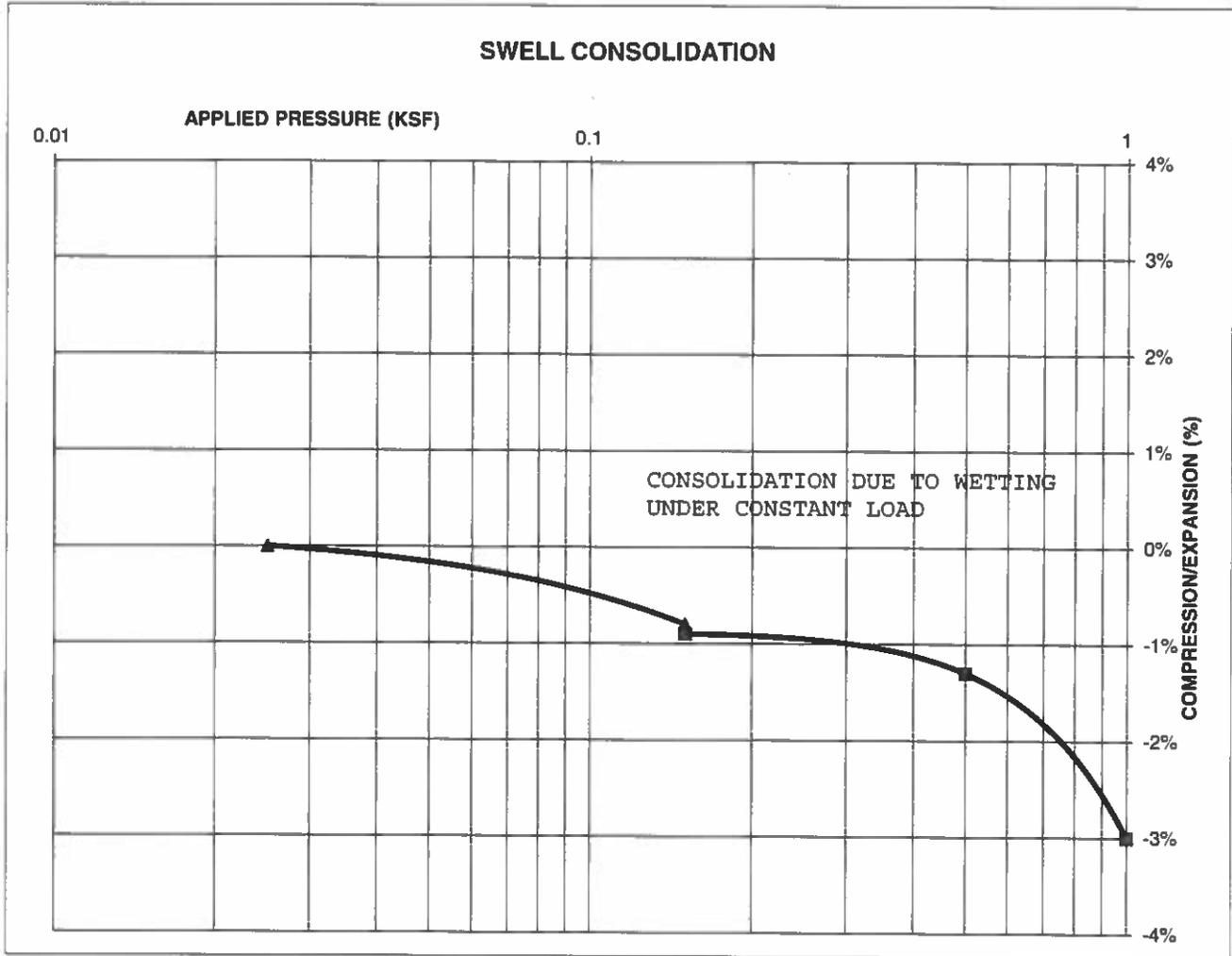
JOB NO.:  
 190014

FIG NO.:  
 B-29

**CONSOLIDATION TEST RESULTS**

TEST BORING #	5	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			100
NATURAL MOISTURE CONTENT			10.1%
SWELL/CONSOLIDATION (%)			-0.1%

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH



**ENTECH  
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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
TEST RESULTS**

DRAWN:

DATE:

CHECKED *h*

DATE 1/13/20

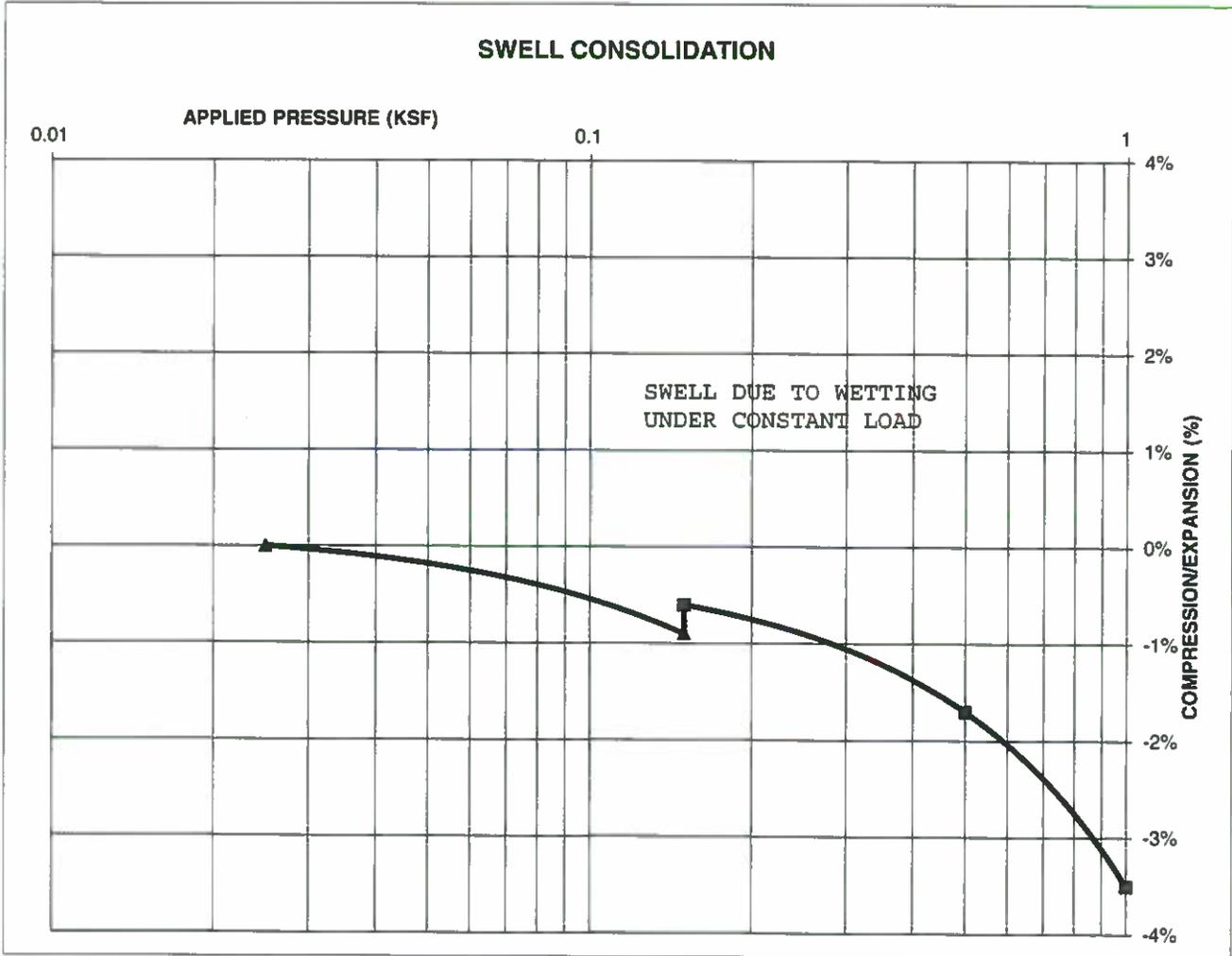
JOB NO:  
190014

FIG NO:  
B-30

**CONSOLIDATION TEST RESULTS**

TEST BORING #	9	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			119
NATURAL MOISTURE CONTENT			10.8%
SWELL/CONSOLIDATION (%)			0.3%

JOB NO. 190014  
 CLIENT SR LAND, LLC  
 PROJECT HOMESTEAD AT STERLING RANCH



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *h*

DATE: 1/13/20

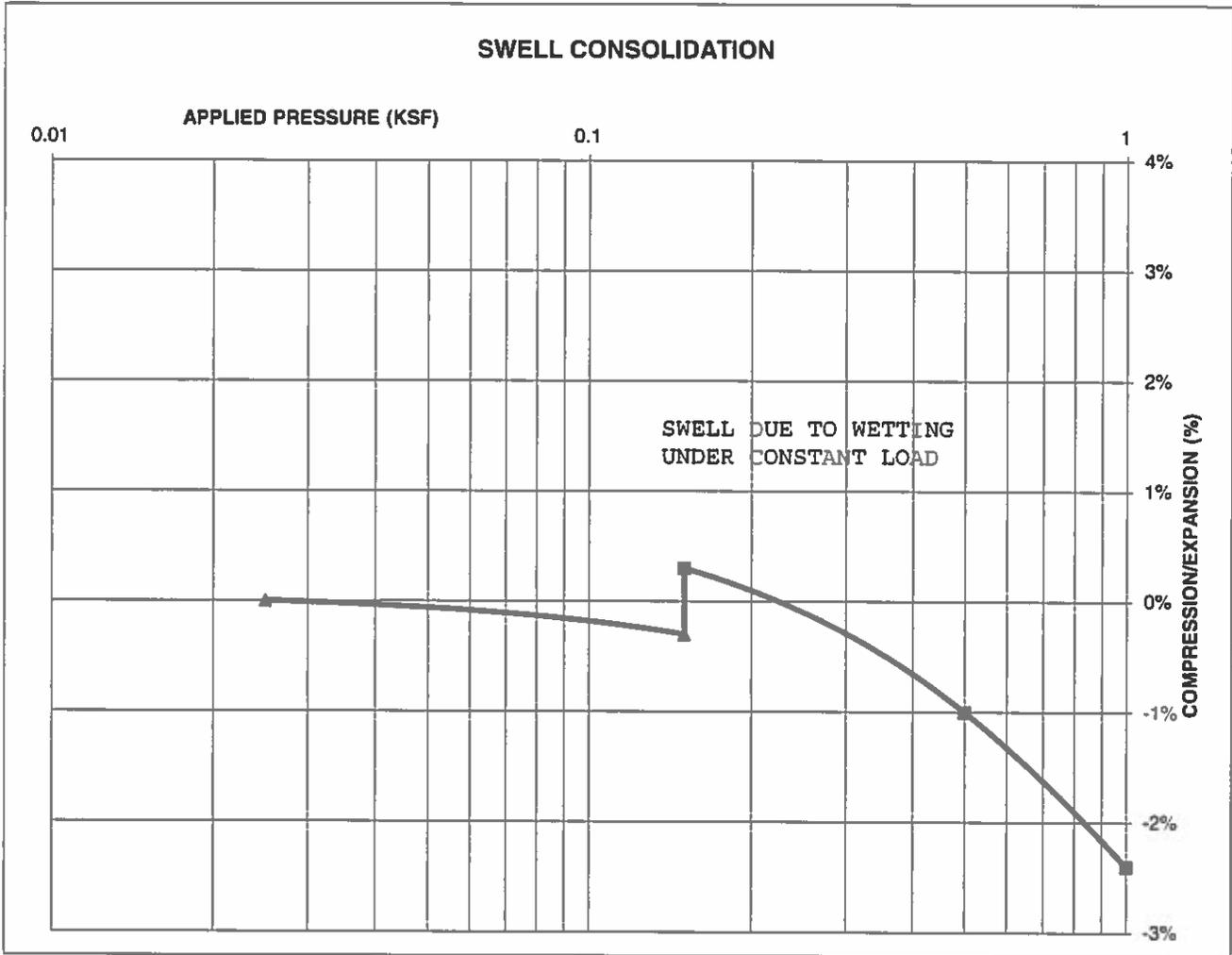
JOB NO.:  
 190014

FIG NO.:  
 B-31

**CONSOLIDATION TEST RESULTS**

TEST BORING #	11	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			8.1%
SWELL/CONSOLIDATION (%)			0.6%

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *h*

DATE: 1/3/20

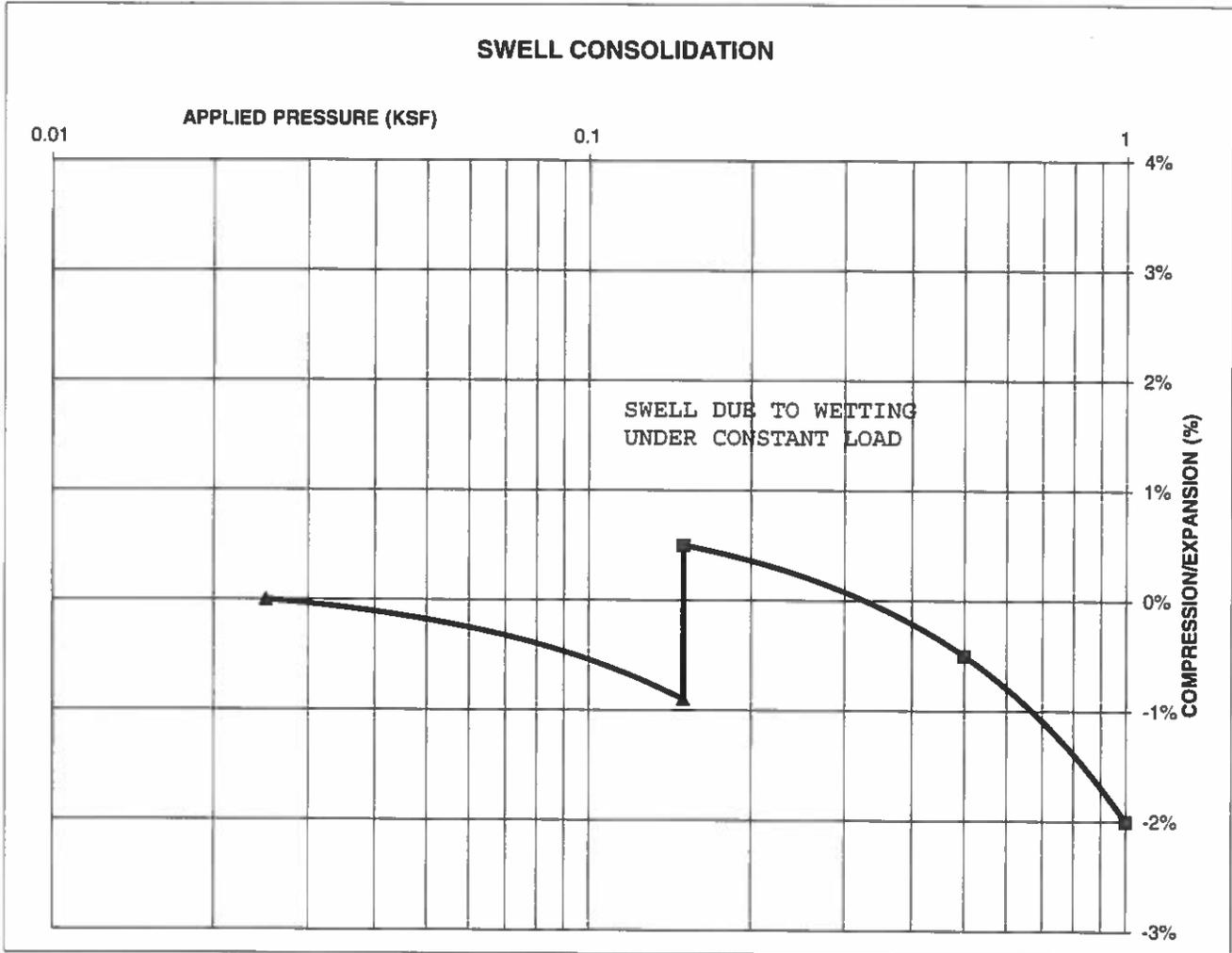
JOB NO.:  
 190014

FIG NO.:  
 B-32

**CONSOLIDATION TEST RESULTS**

TEST BORING #	1	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			111
NATURAL MOISTURE CONTENT			15.1%
SWELL/CONSOLIDATION (%)			1.4%

JOB NO. 190014  
 CLIENT SR LAND, LLC  
 PROJECT HOMESTEAD AT STERLING RANCH



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 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *m*

DATE: 1/2/20

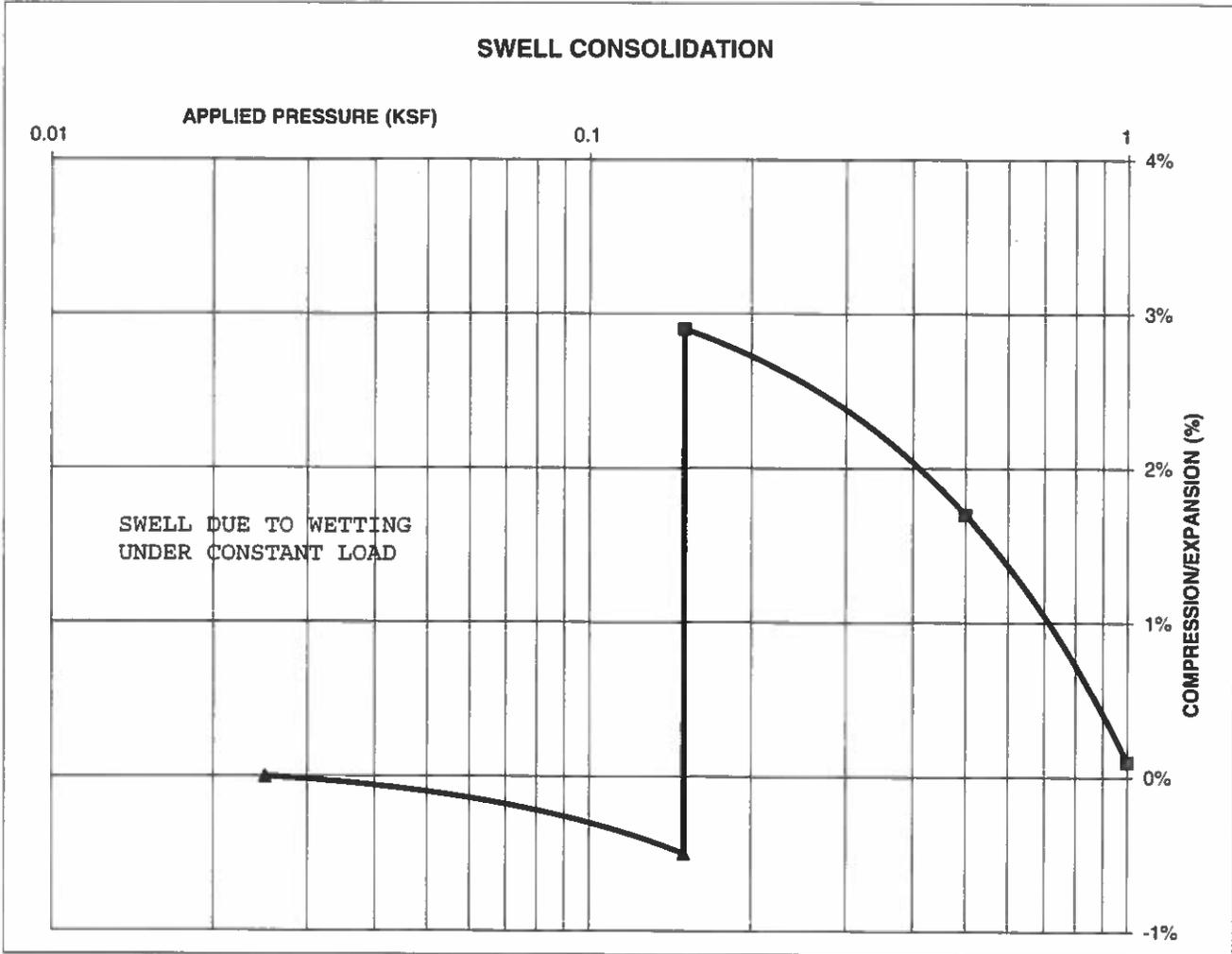
JOB NO.:  
 190014

FIG NO.:  
 B-33

**CONSOLIDATION TEST RESULTS**

TEST BORING #	3	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	111		
NATURAL MOISTURE CONTENT	16.2%		
SWELL/CONSOLIDATION (%)	3.4%		

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH



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 COLORADO SPRINGS COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE 1/13/20

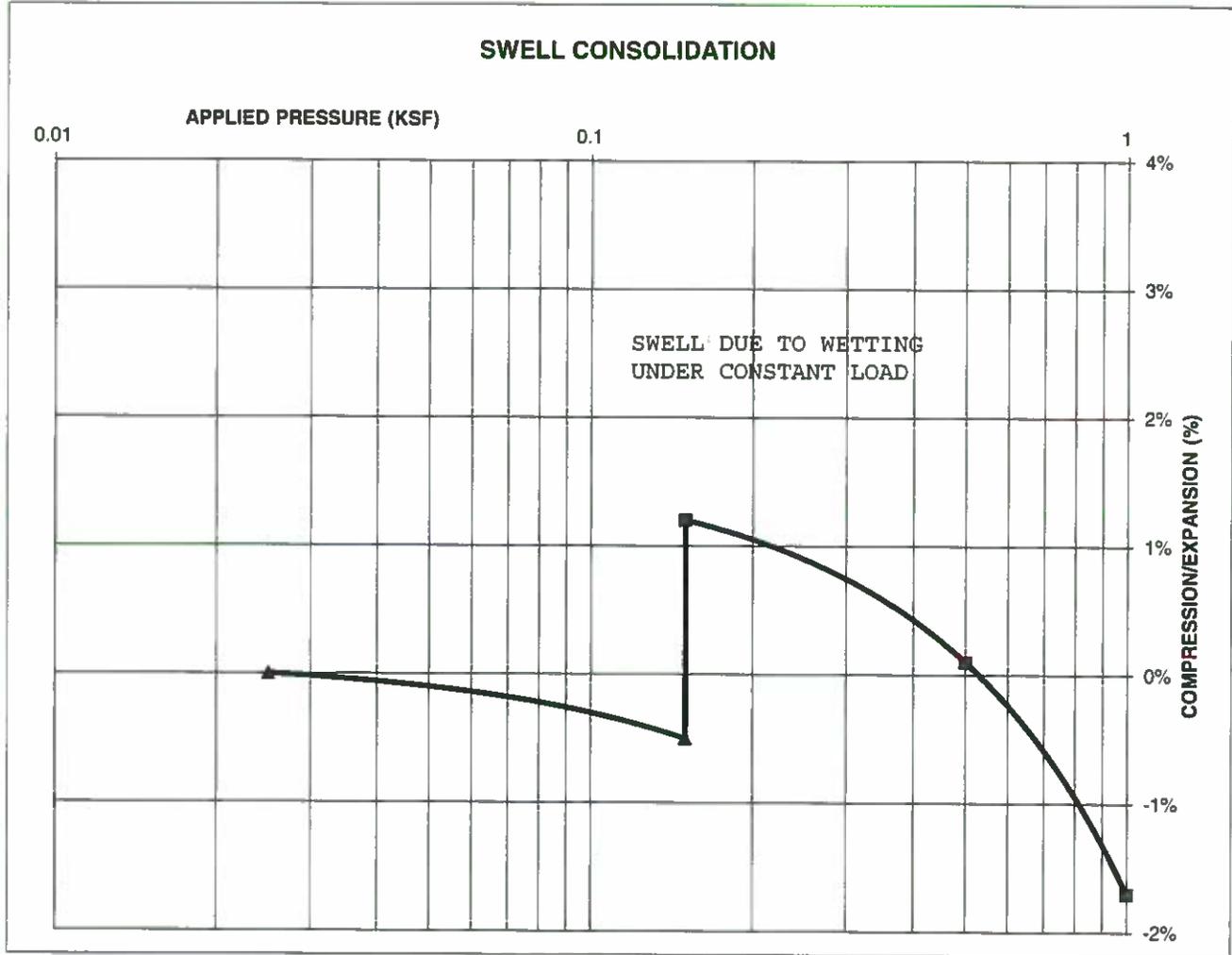
JOB NO.:  
 190014

FIG NO.:  
 B-34

**CONSOLIDATION TEST RESULTS**

TEST BORING #	3	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			110
NATURAL MOISTURE CONTENT			19.7%
SWELL/CONSOLIDATION (%)			1.7%

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH  
 REMODED AT +3.5% MOISTURE



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**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE  
 1/23/20

DS

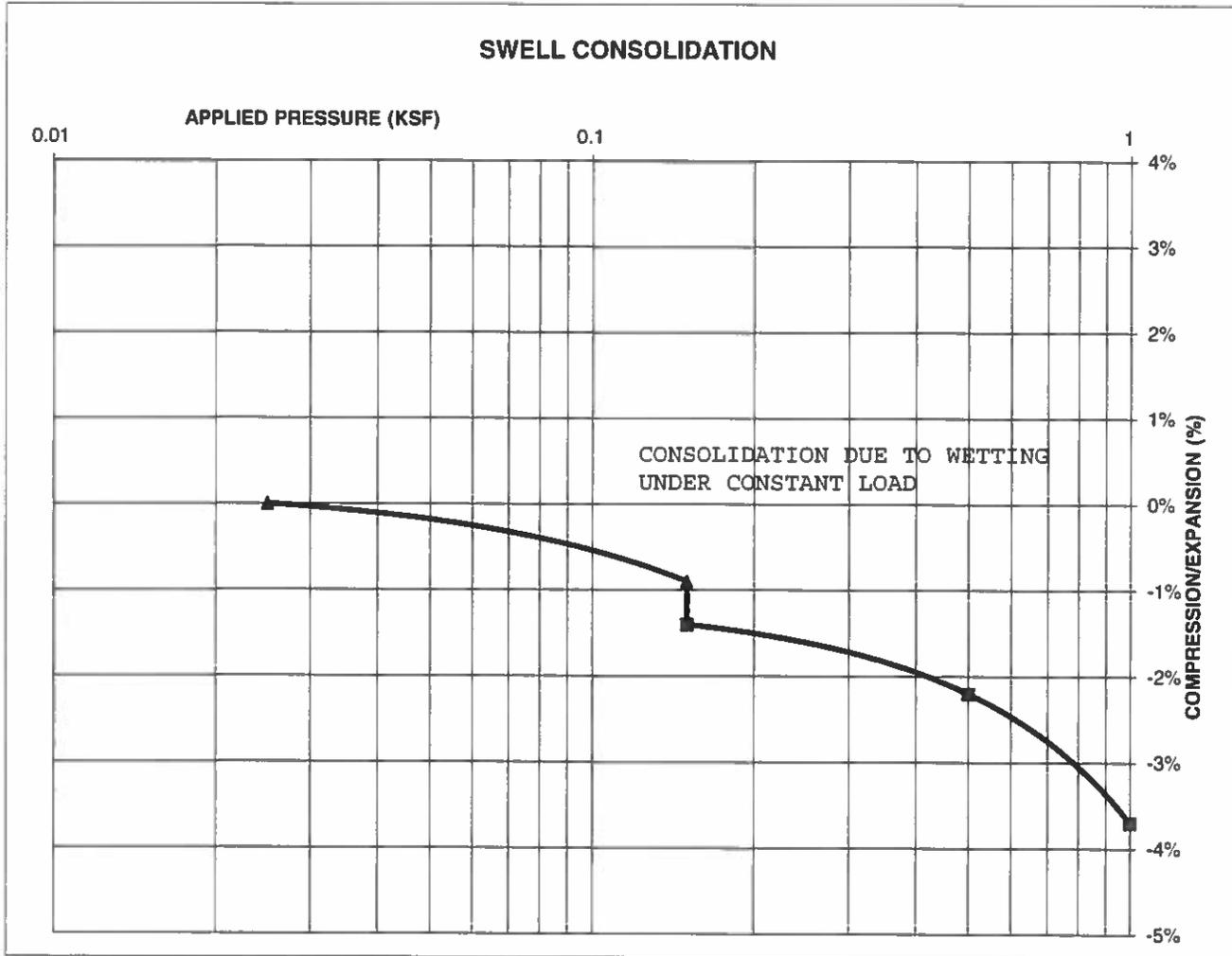
JOB NO.:  
 190014

FIG NO.:  
 B-44A

**CONSOLIDATION TEST RESULTS**

TEST BORING #	7	DEPTH(ft)	5
DESCRIPTION	SM	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			91
NATURAL MOISTURE CONTENT			6.2%
SWELL/CONSOLIDATION (%)			-0.5%

JOB NO. 190014  
 CLIENT SR LAND, LLC  
 PROJECT HOMESTEAD AT STERLING RANCH



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 COLORADO SPRINGS COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

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CHECKED: *[Signature]*

DATE: 1/13/20

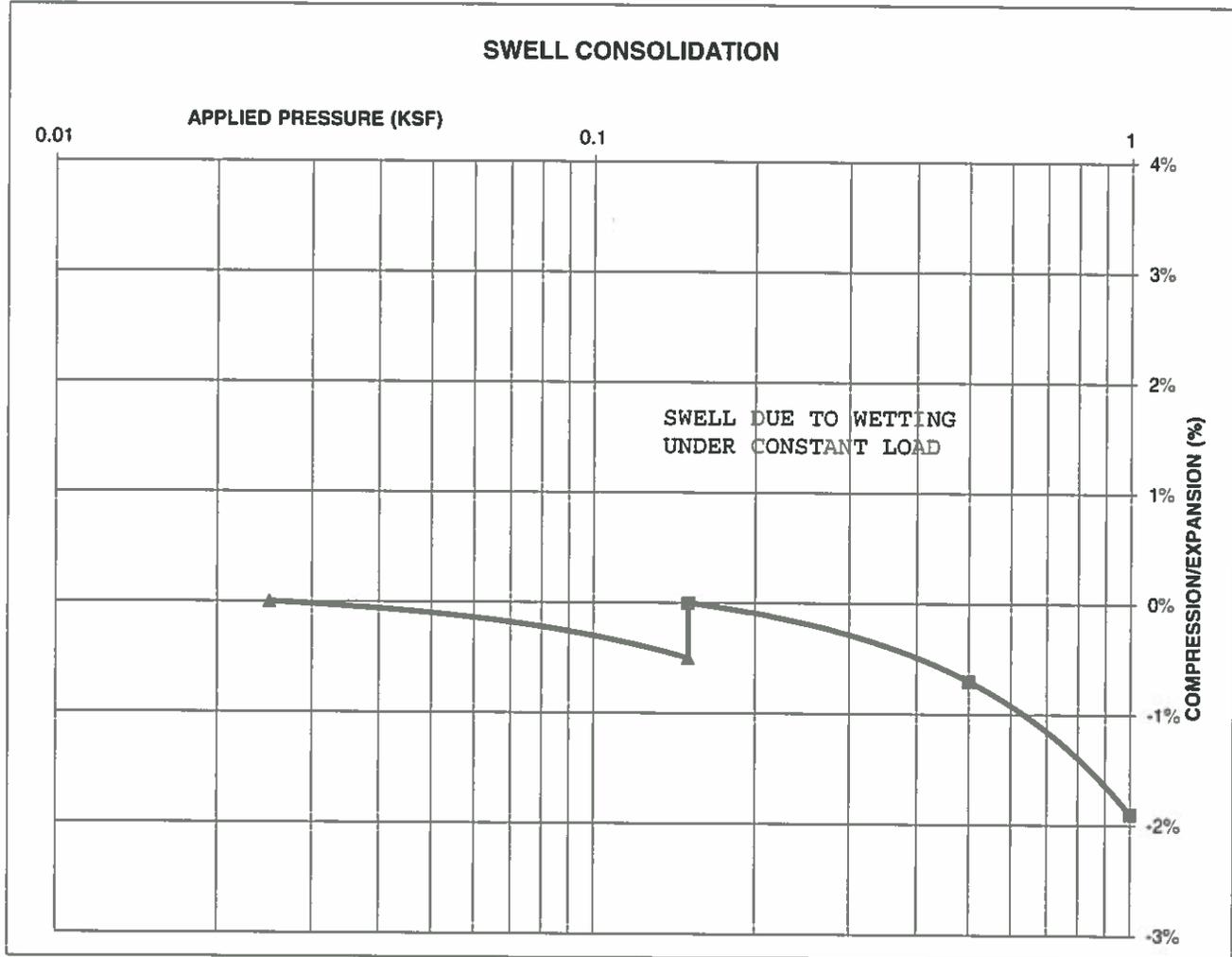
JOB NO:  
 190014

FIG NO:  
 B-35

**CONSOLIDATION TEST RESULTS**

TEST BORING #	8	DEPTH(ft)	0-3
DESCRIPTION	SC	SOIL TYPE	2, CBR
NATURAL UNIT DRY WEIGHT (PCF)			119
NATURAL MOISTURE CONTENT			7.5%
SWELL/CONSOLIDATION (%)			0.5%

JOB NO. 190014  
 CLIENT SR LAND, LLC  
 PROJECT HOMESTEAD AT STERLING RANCH



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**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

DS

11/22/20

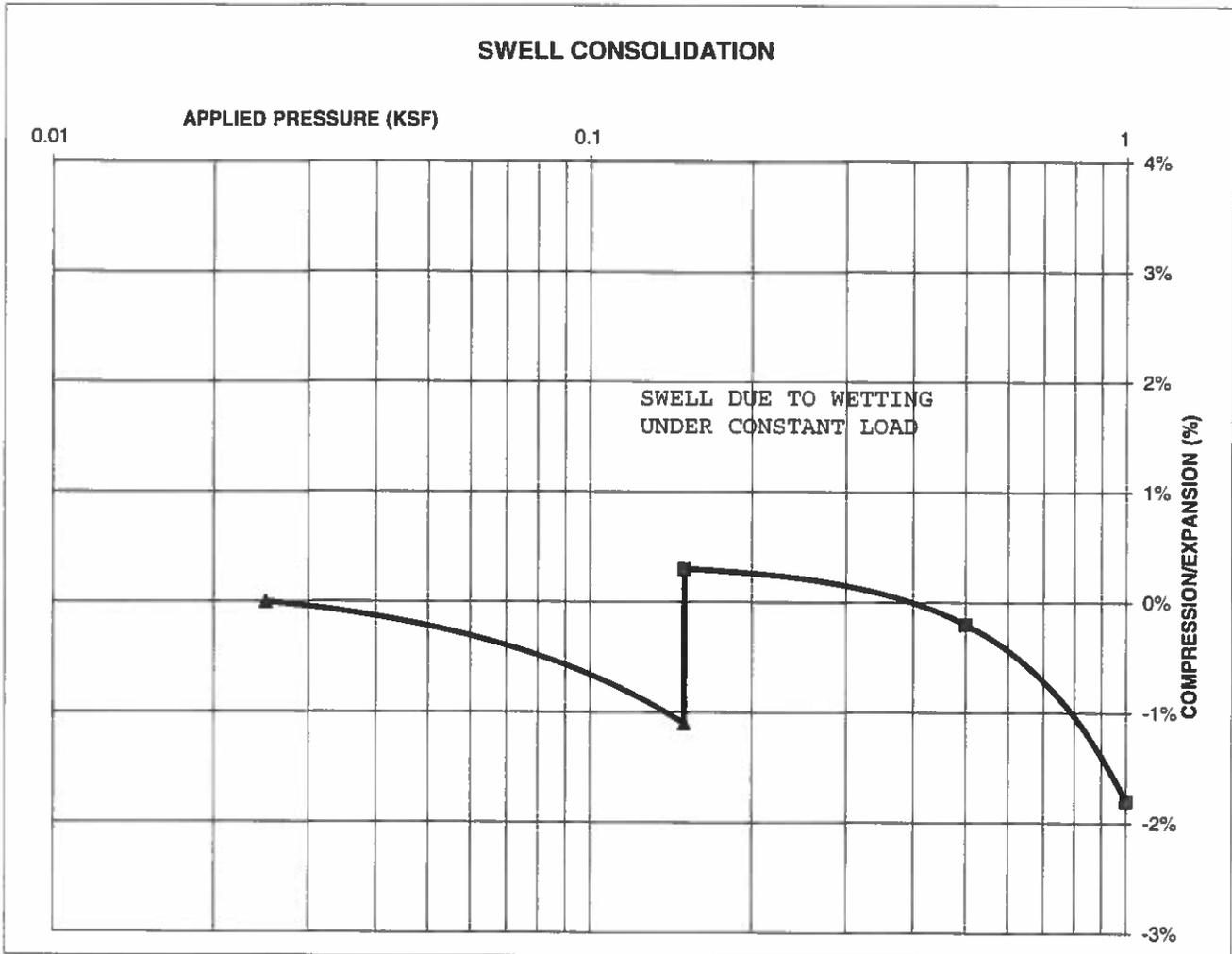
JOB NO.:  
 190014

FIG NO.:  
 B-36

**CONSOLIDATION TEST RESULTS**

TEST BORING #	20	DEPTH(ft)	1-2
DESCRIPTION	SM	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			111
NATURAL MOISTURE CONTENT			17.1%
SWELL/CONSOLIDATION (%)			1.4%

JOB NO. 190014  
CLIENT SR LAND, LLC  
PROJECT HOMESTEAD AT STERLING RANCH



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 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED: *[Signature]*

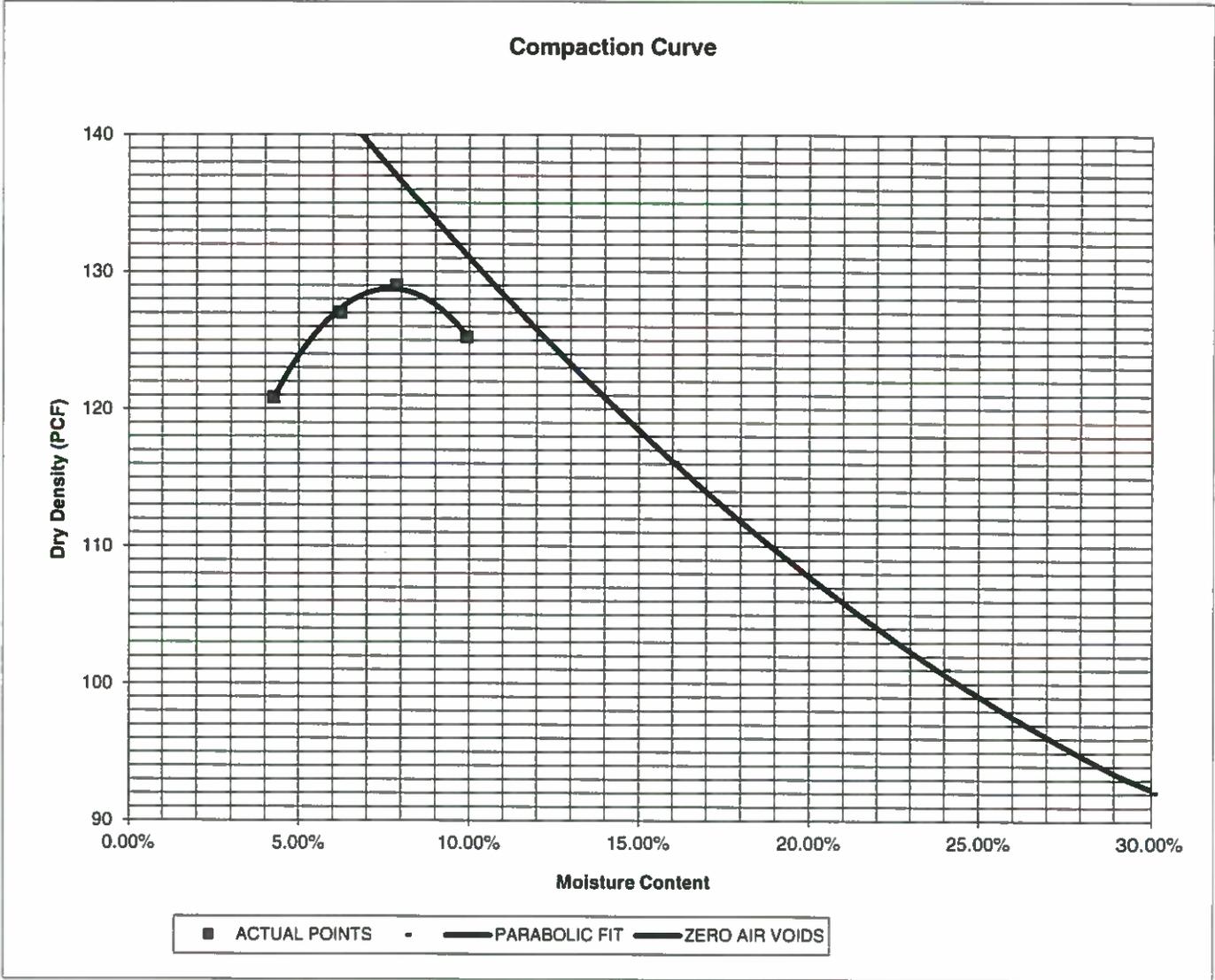
DATE  
 1/2/20

JOB NO:  
 190014

FIG NO:  
 8-37

<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH	<b>CLIENT</b>	SR LAND, LLC
<b>SAMPLE LOCATION</b>	TB-4 @ 0-3'	<b>JOB NO.</b>	190014
<b>SOIL DESCRIPTION</b>	SAND, CLAYEY, BROWN	<b>DATE</b>	12/04/19

<b>IDENTIFICATION</b>	SC	<b>COMPACTION TEST #</b>	1
<b>TEST DESIGNATION / METHOD</b>	ASTM D-1557-A	<b>TEST BY</b>	BL
<b>MAXIMUM DRY DENSITY (PCF)</b>	129	<b>OPTIMUM MOISTURE</b>	7.8%



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COLORADO SPRINGS, COLORADO 80907

**MOISTURE DENSITY RELATION**

DRAWN:

DATE:

CHECKED: *h*

DATE: 1/13/20

JOB NO.:

190014

FIG NO.:

8-38

**CBR TEST LOAD DATA**

JOB NO: 190014  
 CLIENT: SR LAND, LLC  
 PROJECT: HOMESTEAD AT STERLING RANCH  
 SOIL TYPE: 1, CBR #1

PISTON		PISTON					
DIAMETER (cm)		AREA (in <sup>2</sup> )					
4.958		2.99250919					
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)	
	(LBS)	(PSI)	(LBS)	(PSI)	(LBS)	(PSI)	
0.000	0	0.00	0	0.00	0	0.00	
0.025	60	20.05	96	32.08	65	21.72	
0.050	85	28.40	175	58.48	235	78.53	
0.075	108	36.09	263	87.89	361	120.63	
0.100	128	42.77	321	107.27	520	173.77	
0.125	143	47.79	393	131.33	619	206.85	
0.150	153	51.13	442	147.70	747	249.62	
0.175	165	55.14	504	168.42	836	279.36	
0.200	177	59.15	557	186.13	939	313.78	
0.300	208	69.51	703	234.92	1308	437.09	
0.400	235	78.53	818	273.35	1605	536.34	
0.500	265	88.55	939	313.78	1884	629.57	

**FINAL MOISTURE CONTENT**

	MOLD # 1	MOLD # 2	MOLD # 3
<u>CAN #</u>	102	119	100
<u>WT. CAN</u>	9.36	9.35	9.41
<u>WT. CAN+WET</u>	211.33	243.54	245.09
<u>WT. CAN+DRY</u>	185.14	217.61	219.02
<u>WT. H2O</u>	26.19	25.93	26.07
<u>WT. DRY SOIL</u>	175.78	208.26	209.61
<u>MOISTURE CONTENT</u>	14.90%	12.45%	12.44%

<u>WET DENSITY (PCF)</u>	119.0	127.6	130.5
<u>DRY DENSITY (PCF)</u>	110.4	118.4	121.1

BEARING RATIO 4.28 10.73 17.38

90% OF DRY DENSITY 116.1

95% OF DRY DENSITY 122.6

<u>BEARING RATIO AT 90% OF MAX</u>	8.90 ~ R VALUE	22
<u>BEARING RATIO AT 95% OF MAX</u>	20.93 ~ R VALUE	71



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**CBR TEST DATA**

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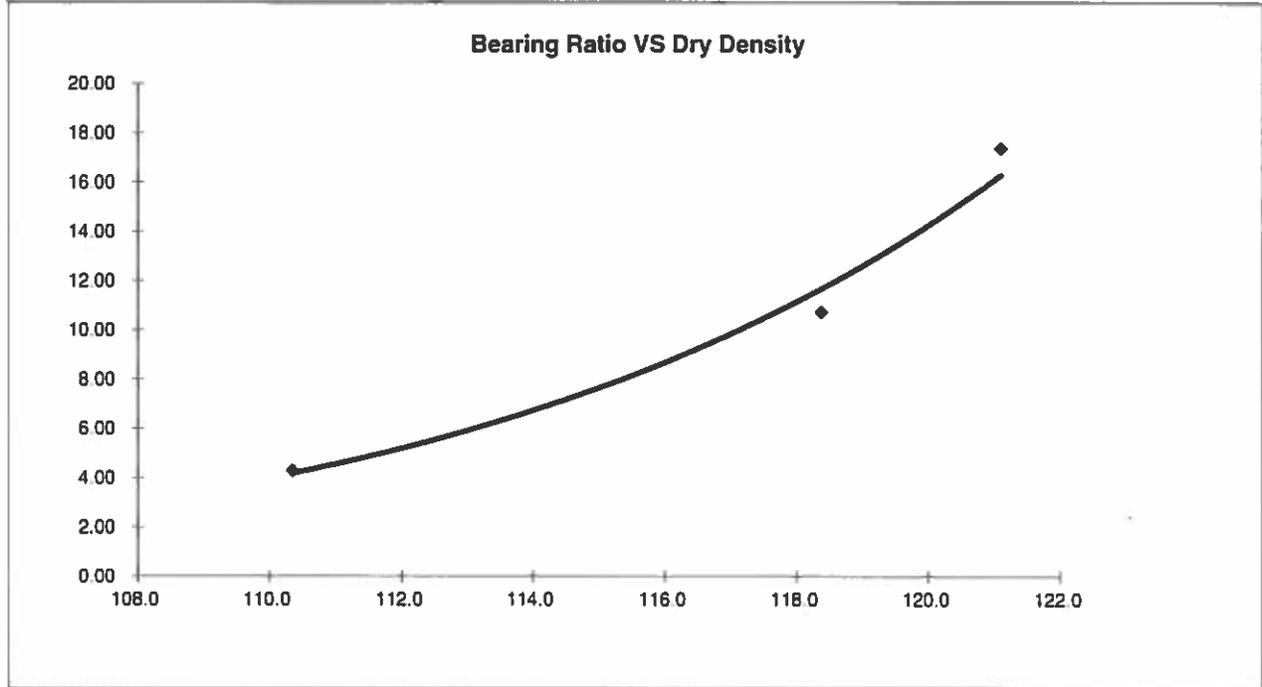
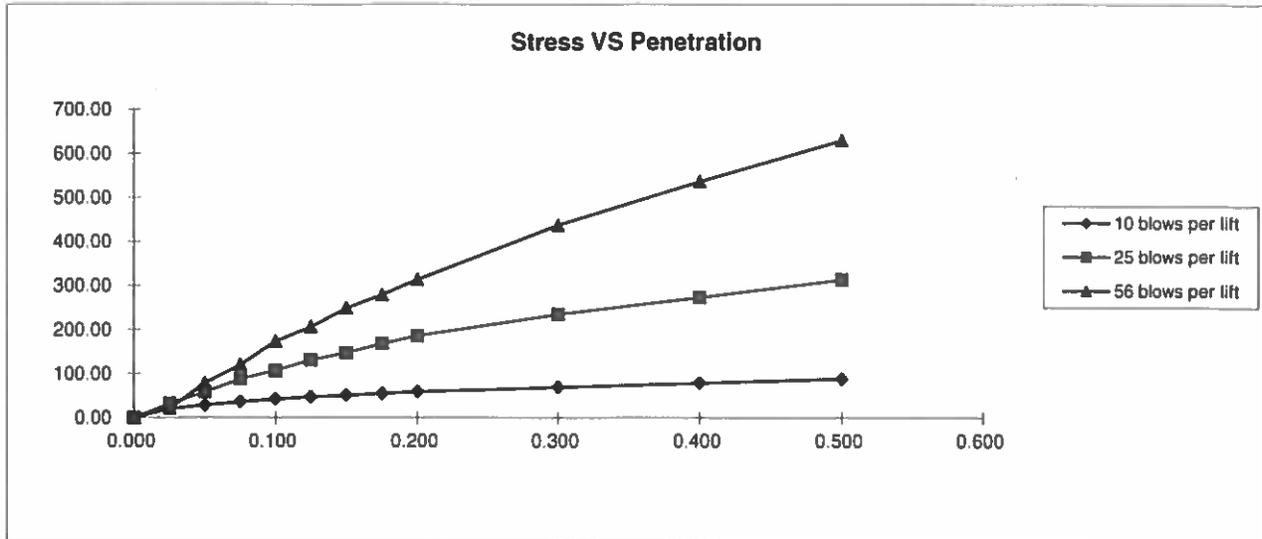
DATE

1/13/10

JOB NO:  
 190014

FIG NO:

B-39



<b>BEARING RATIO AT 90% OF MAX</b>	8.90 ~ R VALUE	22.00
<b>BEARING RATIO AT 95% OF MAX</b>	20.93 ~ R VALUE	71.00

JOB NO: 190014  
 SOIL TYPE: 1, CBR #1



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 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

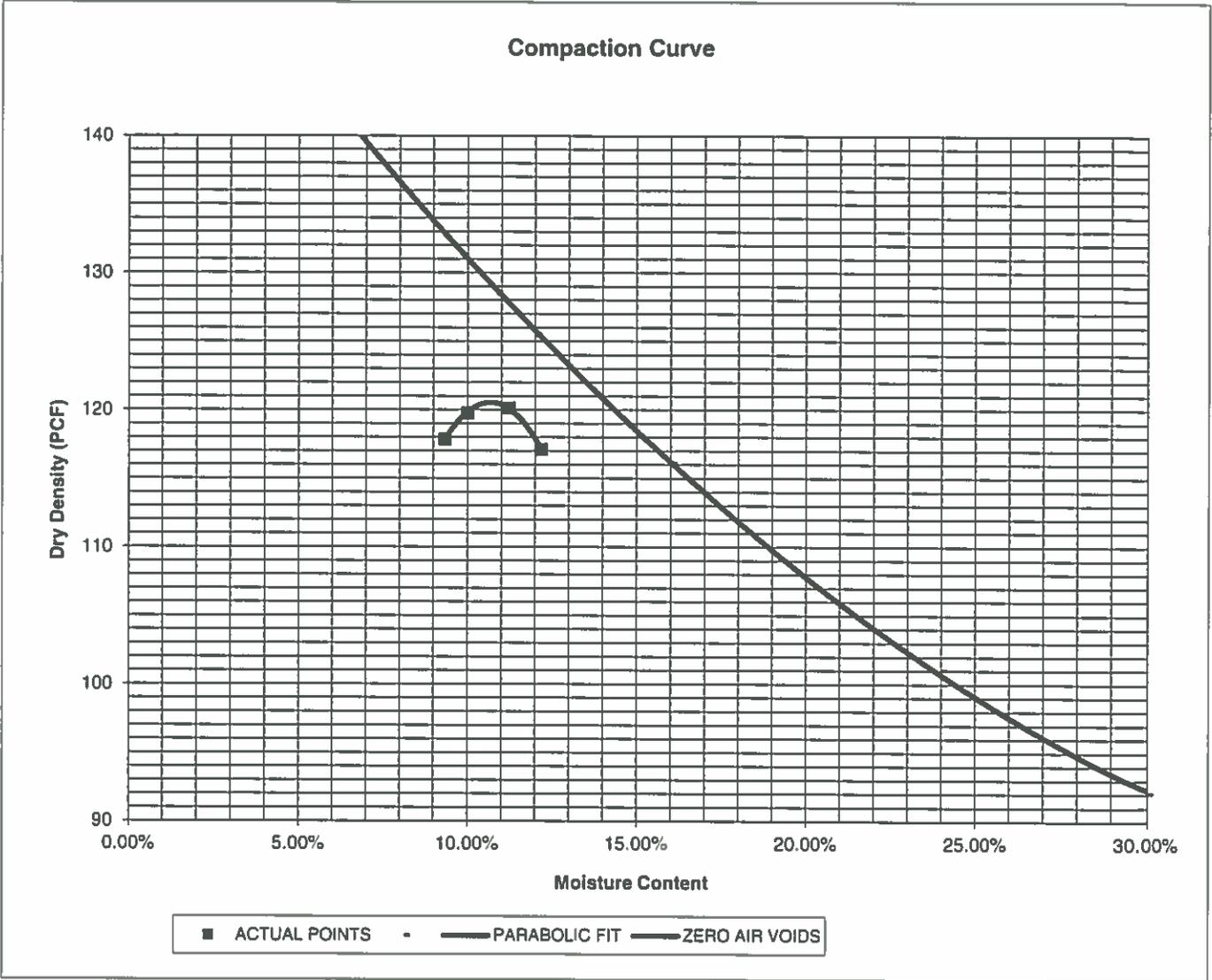
**CALIFORNIA BEARING RATIO**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 1/12/20
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JOB NO: 190014  
 FIG NO: 8-40

<b>PROJECT</b>	HOMESTEAD AT STERLING RANCH	<b>CLIENT</b>	SR LAND, LLC
<b>SAMPLE LOCATION</b>	TB-8 @ 0-3'	<b>JOB NO.</b>	190014
<b>SOIL DESCRIPTION</b>	SAND, VERY CLAYEY, BROWN	<b>DATE</b>	12/04/19

<b>IDENTIFICATION</b>	SC	<b>COMPACTION TEST #</b>	2
<b>TEST DESIGNATION / METHOD</b>	ASTM D-698-A	<b>TEST BY</b>	BL
<b>MAXIMUM DRY DENSITY (PCF)</b>	120.6	<b>OPTIMUM MOISTURE</b>	10.8%



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**MOISTURE DENSITY RELATION**

DRAWN:

DATE:

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*[Signature]*  
DATE: 1/13/20

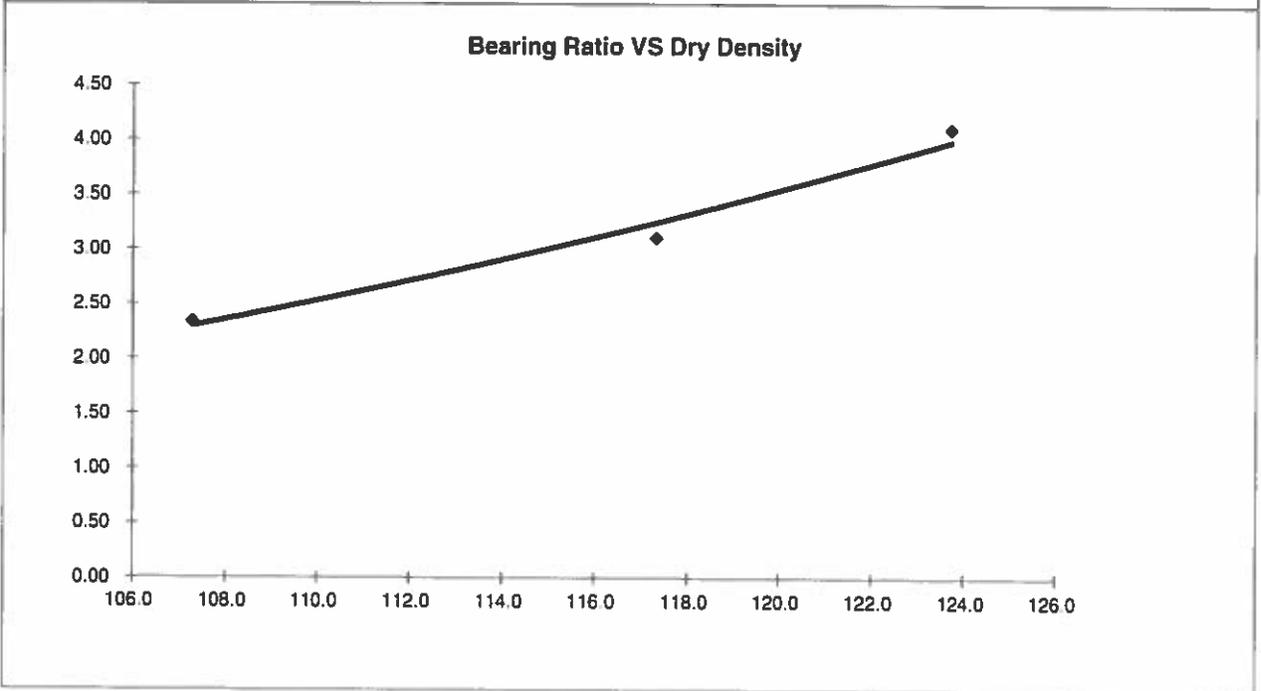
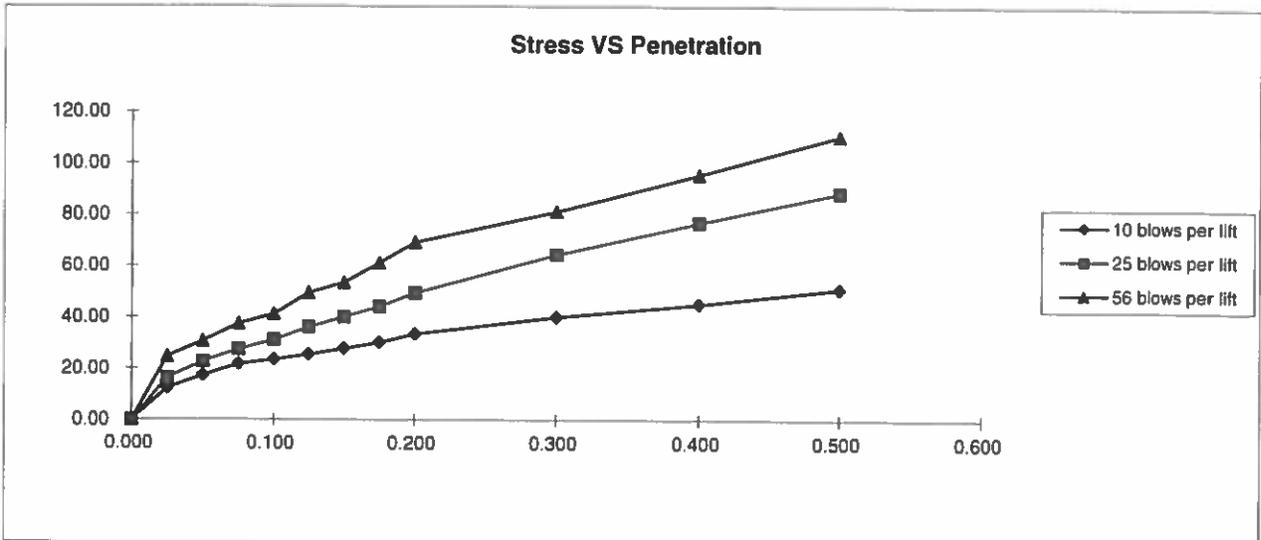
JOB NO.:

190014

FIG NO.:

B-41





BEARING RATIO AT 90% OF MAX	2.44 - R VALUE	6.00
BEARING RATIO AT 95% OF MAX	2.90 - R VALUE	6.00

JOB NO: 190014  
 SOIL TYPE: 2, CBR #2



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 COLORADO SPRINGS, COLORADO 80907

### CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED: *W*

DATE: 1/13/20

JOB NO:  
 190014

FIG NO:  
 B-43



## **APPENDIX C: Pavement Design Calculations**

## FLEXIBLE PAVEMENT DESIGN

### DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL LOW-VOLUME  
SOIL TYPE I

*Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL ( $W_{18}$ ) =	36,500
Hveem Stabilometer (R Value) Results:	R =	40
Standard Deviation	$S_o$ =	0.45
Loss in Serviceability	$\Delta$ psi =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	9497

Weighted Structural Number (WSN): ➔ WSN = 1.67

### 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
4.56	4.56	0.0

Job No. 190014  
Fig. No. C-1

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                         URBAN LOCAL LOW-VOLUME  
                         SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 36,500
Hveem Stabilometer (R Value) Results:	R = 40
Weighted Structural Number (WSN):	WSN = 1.67

### 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)

$$D_1 = (WSN)/C_1 = 3.8 \text{ inches of Full Depth Asphalt}$$

Use 5.0 inches Full Depth

### FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) =  inches

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 3.2 \text{ inches of Aggregate}$$

Base Course, use 4.0 inches

### RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Aggregate Base Course, or
2. 5.0 inches of Full Depth Asphalt

Job No. 190014  
Fig. No. C-2

# FLEXIBLE PAVEMENT DESIGN

## DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL LOW-VOLUME  
SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL ( $W_{18}$ ) =	36,500
Hveem Stabilometer (R Value) Results:	R =	40
Standard Deviation	$S_o$ =	0.45
Loss in Serviceability	$\Delta psi$ =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	9497

Weighted Structural Number (WSN): ➔ WSN = 1.67

## 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

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

Left	Right	Difference
4.56	4.56	0.0

Job No. 190014  
Fig. No. C-3

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                         URBAN LOCAL LOW-VOLUME  
                         SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 36,500
Hveem Stabilometer (R Value) Results:	R = 40
Weighted Structural Number (WSN):	WSN = 1.67

### DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

$C_1 = 0.44$  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)

$$D_1 = (WSN)/C_1 = 3.8 \text{ inches of Full Depth Asphalt}$$

Use 5.0 inches Full Depth

### FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

$$\text{Asphalt Thickness } (t) = \boxed{3} \text{ inches}$$

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 3.2 \text{ inches of Recycled Concrete}$$

Base Course, use 4.0 inches

### RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Recycled Concrete Base Course, or
2. 5.0 inches of Full Depth Asphalt

Job No. 190014

Fig. No. C-4

# FLEXIBLE PAVEMENT DESIGN

## DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL LOW-VOLUME  
SOIL TYPE 2

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL ( $W_{18}$ ) =	36,500
Hveem Stabilometer (R Value) Results:	R =	6
Standard Deviation	$S_o$ =	0.45
Loss in Serviceability	$\Delta psi$ =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	3126

Weighted Structural Number (WSN): ➔ WSN = 2.55

## 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. 190014  
Fig. No. C-5

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                         URBAN LOCAL LOW-VOLUME  
                         SOIL TYPE 2

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	6
Weighted Structural Number (WSN):	WSN =	2.57

### 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)

$D_1 = (WSN)/C_1 = 5.8$  inches of Full Depth Asphalt  
Use 6.0 inches Full Depth

### FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) =  inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 7.3$  inches of Aggregate  
Base Course, use 8.0 inches

### RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8.0 inches of Aggregate Base Course, or
2. 6.0 inches of Full Depth Asphalt

Job No. 190014  
Fig. No. C-6

## FLEXIBLE PAVEMENT DESIGN

### DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL LOW-VOLUME  
SOIL TYPE 2

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL ( $W_{18}$ ) =	36,500
Hveem Stabilometer (R Value) Results:	R =	6
Standard Deviation	$S_o$ =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	3126

Weighted Structural Number (WSN): ➔ WSN = 2.55

### 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
4.56	4.56	0.0

Job No. 190014

Fig. No. c-7

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL LOW-VOLUME  
SOIL TYPE 2

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 36,500
Hveem Stabilometer (R Value) Results:	R = 6
Weighted Structural Number (WSN):	WSN = 2.57

### DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

$C_1 = 0.44$  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)

$$D_1 = (WSN)/C_1 = 5.8 \text{ inches of Full Depth Asphalt}$$

Use 6.0 inches Full Depth

### FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

$$\text{Asphalt Thickness (t)} = \boxed{4} \text{ inches}$$

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 7.3 \text{ inches of Recycled Concrete}$$

Base Course, use 8.0 inches

### RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8.0 inches of Recycled Concrete Base Course, or
2. 6.0 inches of Full Depth Asphalt

Job No. 190014

Fig. No. C-8

## FLEXIBLE PAVEMENT DESIGN

### DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL  
SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL ( $W_{18}$ ) =	292,000
Hveem Stabilometer (R Value) Results:	R =	40
Standard Deviation	$S_o$ =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	9497

Weighted Structural Number (WSN): ➔ WSN = 2.36

### DESIGN TABLES AND EQUATIONS

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

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

$$k = M_R / 19.4$$

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
5.47	5.47	0.0

Job No. 190014

Fig. No. C-9

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                          URBAN LOCAL  
                          SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 292,000
Hveem Stabilometer (R Value) Results:	R = 40
Weighted Structural Number (WSN):	WSN = 2.36

### 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)

$$D_1 = (WSN)/C_1 = 5.4 \text{ inches of Full Depth Asphalt}$$

Use 6.0 inches Full Depth

### FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) =  inches

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 5.4 \text{ inches of Aggregate}$$

Base Course, use 8.0 inches

### RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8.0 inches of Aggregate Base Course, or
2. 6.0 inches of Full Depth Asphalt

Job No. 190014

Fig. No. C-16

## FLEXIBLE PAVEMENT DESIGN

### DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
 URBAN LOCAL  
 SOIL TYPE I

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL ( $W_{18}$ ) =	292,000
Hveem Stabilometer (R Value) Results:	R =	40
Standard Deviation	$S_o$ =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	9497

Weighted Structural Number (WSN): ➔ WSN = 2.36

### 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
5.47	5.47	0.0

Job No. 190014

Fig. No. 11

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                         URBAN LOCAL  
                         SOIL TYPE 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):            ESAL = 292,000  
Hveem Stabilometer (R Value) Results:                                        R = 40  
Weighted Structural Number (WSN):                                                WSN = 2.36

### DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

$C_1 = 0.44$  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)

$D_1 = (WSN)/C_1 = 5.4$  inches of Full Depth Asphalt  
Use 6.0 inches Full Depth

### FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

Asphalt Thickness (t) =  inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 5.4$  inches of Recycled Concrete  
Base Course, use 8.0 inches

### RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8.0 inches of Recycled Concrete Base Course, or
2. 6.0 inches of Full Depth Asphalt

Job No. 190014

Fig. No. C-12

# FLEXIBLE PAVEMENT DESIGN

## DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
 URBAN LOCAL  
 SOIL TYPE 2

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	$\Delta psi$ =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	$Z_R$ =	-0.84
Soil Resilient Modulus	$M_R$ =	3126

Weighted Structural Number (WSN): WSN = 3.50

## 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

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

Left	Right	Difference
5.47	5.47	0.0

Job No. 190014  
 Fig. No. C-13

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                          URBAN LOCAL  
                          SOIL TYPE 2

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 292,000
Hveem Stabilometer (R Value) Results:	R = 6
Weighted Structural Number (WSN):	WSN = 3.50

### 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)

$D_1 = (WSN)/C_1 = 7.9$  inches of Full Depth Asphalt  
Use 8.0 inches Full Depth

### FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) =  inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 11.8$  inches of Aggregate  
Base Course, use 12.0 inches

### RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 12.0 inches of Aggregate Base Course, or
2. 8.0 inches of Full Depth Asphalt

Job No. 190014

Fig. No. C-14

## FLEXIBLE PAVEMENT DESIGN

### DESIGN DATA

HOMESTEAD AT STERLING RANCH F2  
URBAN LOCAL  
SOIL TYPE 2

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 ( $W_{18}$ ) =	292,000
R =	6
$S_o$ =	0.45
$\Delta\psi$ =	2.2
Reliability =	80
$Z_R$ =	-0.84
$M_R$ =	3126

Weighted Structural Number (WSN): ➔ WSN = 3.50

### 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
5.47	5.47	0.0

Job No. 190014

Fig. No. C-15

## DESIGN CALCULATIONS

DESIGN DATA    HOMESTEAD AT STERLING RANCH F2  
                         URBAN LOCAL  
                         SOIL TYPE 2

Equivalent (18 kip) Single Axle Load Applications (ESAL):            ESAL = 292,000  
Hveem Stabilometer (R Value) Results:                                            R = 6  
Weighted Structural Number (WSN):                                                WSN = 3.50

### 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)

$D_1 = (WSN)/C_1 = 7.9$  inches of Full Depth Asphalt  
Use 8.0 inches Full Depth

### FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

Asphalt Thickness (t) =  inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 11.8$  inches of Recycled Concrete  
Base Course, use 12.0 inches

### RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 12.0 inches of Recycled Concrete Base Course, or
2. 8.0 inches of Full Depth Asphalt

Job No. 190014

Fig. No. 6-16