ENTECH
ENGINEERING, INC.

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

October 27, 2022
Revised December 8, 2022

SR Land, LLC
20 Boulder Crescent, 1st Floor, Suite 100
Colorado Springs, Colorado 80921

Attn: Chaz Collins

Re: Pavement Recommendations - Revised
Sterling Ranch
Vollmer Road, Filing No. 2
El Paso County, Colorado
Entech Job No. 222053

Dear Mr. Collins:

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

Project Description

The project will consist of paving and widening of a portion of Vollmer Road, with acceleration and deceleration lanes for accessing Marksheffel Road at the Sterling Ranch Subdivision Filing No. 2 in El Paso County, Colorado. A Subsurface Soil Investigation and laboratory testing were performed to determine the pavement support characteristics on the soils. The general layout of the site is presented in the Test Boring Location Map in Figure 1.

Subgrade Conditions

A total of nine test borings were drilled along the roadway to depths of approximately 5 and 10 feet below the existing subgrade surface at the required sample frequency. The boring locations are shown from Figure No. 1.

The soils at the roadway subgrade depth consisted of native silty to slightly silty sand (Soil Type 1). The Test Boring Logs are presented in Appendix A. The pavement sections were determined using the Type 1 soil data. Sieve Analyses and Atterberg Limit testing were performed on subgrade soil samples obtained from the test borings for the purpose of classification. The percent passing the No. 200 sieve ranged from approximately 6 to 26 percent.

The Type 1 soil classified as A-1-b soils and A-2-4 soils, which commonly exhibit good pavement support characteristics. Groundwater was not encountered in the test borings. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack. Atterberg Limits testing resulted in liquid limits of no-value and plastic indexes of non-plastic. Swell/Consolidation testing was not required per classification testing. Mitigation for expansive soils is not required on this site.

California Bearing Ratio (CBR) testing was performed on a representative subgrade sample of the Type 1 materials from Test Boring No. 3 to determine the support characteristics of the subgrade soils for the roadway sections. The results of the CBR testing, are presented in Appendix B and summarized as follows:

Soil Type 1 – Silty Sand
R @ 90% = 71.0
R @ 95% = 74.0
Use R = 50.0 for design

Classification Testing	
Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	22.2
AASHTO Classification	A-1-b
Group Index	0
Unified Soils Classification	SM

Pavement Design

CBR testing was used to determine pavement sections for the roadways. Pavement sections were determined utilizing El Paso County Engineering Criteria Manual. Vollmer Road classifies as an urban minor arterial, which uses an 18K ESAL value of 1,971,000 for design purposes. County approval is required if recycled concrete is to be used. Pavement sections were determined for asphalt on basecourse and for asphalt on recycled concrete.

Design parameters used in the pavement analysis for the roadways are as follows:

Reliability	85%
Δpsi	2.5
Standard Deviation	0.45
"R" Value Subgrade (Soil Type 1)	50.0
Resilient Modulus (Soil Type 1)	13,168 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11
Recycled Concrete	0.09

The pavement design calculations are presented in Appendix C. Pavement section alternatives for the roadway sections are presented below. Any additional grading may result in subgrade soils with different support characteristics. The following pavement sections should be re-evaluated if additional grading is performed.

Pavement Sections – Urban Minor Arterial
ESAL = 1,971,000
Soil Type 1

Alternative	Asphalt (in)	Basecourse (in)	Recycled Concrete (in)
1. Asphalt Over Basecourse	5.0*	8.0*	-
2. Asphalt Over Recycled Concrete	5.0*	-	8.0

* Minimum sections required per El Paso County Criteria.

Full Depth asphalt is not allowed in unincorporated El Paso County. The proposed pavement thickness for additional lanes and roadway being added/connected to the existing road will meet the county's minimum pavement thickness or to match the existing pavement thickness, whichever is greater.

Roadway Construction - Asphalt on Recycled Concrete or Aggregate Basecourse Alternatives

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

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

Based on the soils encountered, subgrade soil problem areas, if any, will be identified at proof roll. We do not anticipate issues with the subgrade in regards to shallow water, frost susceptible soils, groundwater or drainage conditions, soluble sulfates, or cold weather construction.

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

We trust that this has provided you with the information you required. The pavement sections provided are based on general site soil types. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Stuart Wood
Geologist

Reviewed by:

COLORADO LICENSED
AUSTIN M NOSSOKOFF
53477
12-13-2022
PROFESSIONAL ENGINEER

Austin M. Nossokoff, P.E.

SW/am

Encl.
AAprojects/2022/222053 – pr -rev

TABLE

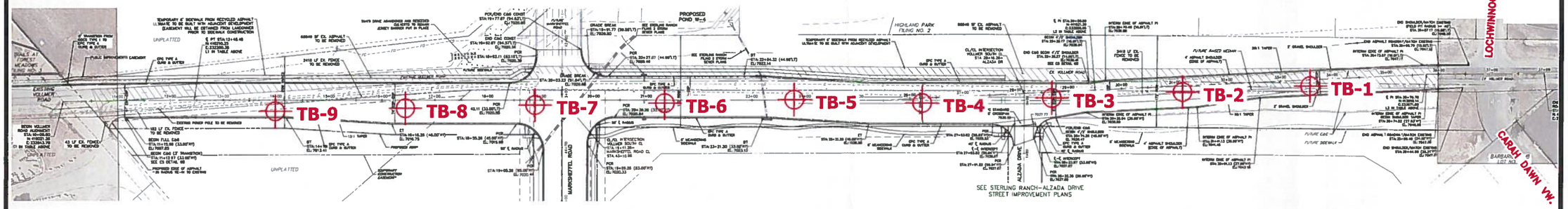
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT SR LAND CO.
PROJECT VOLLMER AND MARKSHEFFEL
JOB NO. 222053

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	AASHTO CLASS.	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1, CBR	3	0-3			22.2	NV	NP		A-1-b		SM	SAND, SILTY
1	1	1-2			8.1	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	2	1-2			6.0	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	3	1-2			25.7	NV	NP		A-2-4		SM	SAND, SILTY
1	4	1-2			7.1	NV	NP	<0.01	A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	5	1-2			9.5	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	6	1-2			25.3	NV	NP		A-1-b		SM	SAND, SLIGHTLY SILTY
1	7	1-2			23.3	NV	NP	<0.01	A-2-4		SM	SAND, SILTY
1	8	1-2			6.6	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	9	1-2			16.8	NV	NP		A-2-4		SM	SAND, SILTY
1	9	0-3			18.2						SM	SAND, SILTY
1	6	0-3			12.1						SM	SAND, SILTY

FIGURE



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

REVISION	BY

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TEST BORING LOCATION MAP
STERLING RANCH–VOLLMER ROAD, F2
COLORADO SPRINGS, CO
FOR: SR LAND, LLC

DRAWN	JAC
CHECKED	DPS
DATE	10/25/22
SCALE	1"=200'
JOB NO.	222053
FIGURE No.	1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 10/11/2022
Job # 222053

REMARKS

DRY TO 5', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			19	3.3	1	SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
5			22	5.8	1	
10						
15						
20						

TEST BORING NO. 2
DATE DRILLED 10/11/2022
CLIENT SR LAND CO.
LOCATION VOLLMER AND MARKSHEFFEL

REMARKS

DRY TO 5', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			30	2.8	1	SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO MEDIUM DENSE, DRY TO MOIST
5			22	6.0	1	
10						
15						
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 10/11/2022
Job # 222053

REMARKS

DRY TO 10', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST		22	4.7	1
5			26	4.8	1
10			26	6.5	1
15					
20					

TEST BORING NO. 4
DATE DRILLED 10/11/2022
CLIENT SR LAND CO.
LOCATION VOLLMER AND MARKSHEFFEL

REMARKS

DRY TO 5', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST		22	7.4	1
5			24	7.4	1
10					
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

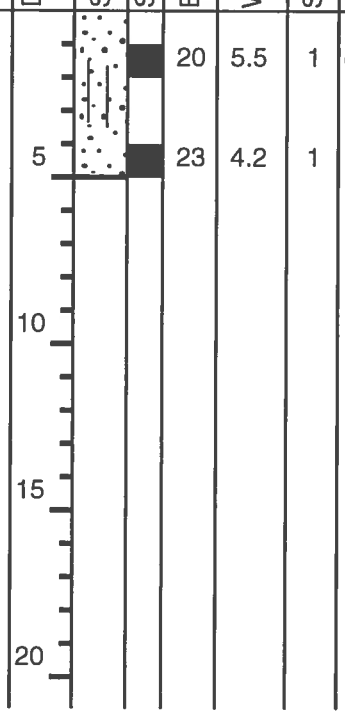
JOB NO.: 222053
FIG NO.: A- 2

TEST BORING NO. 5
DATE DRILLED 10/11/2022
Job # 222053

REMARKS

DRY TO 5', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST		20	5.5	1
5			23	4.2	1
10					
15					
20					

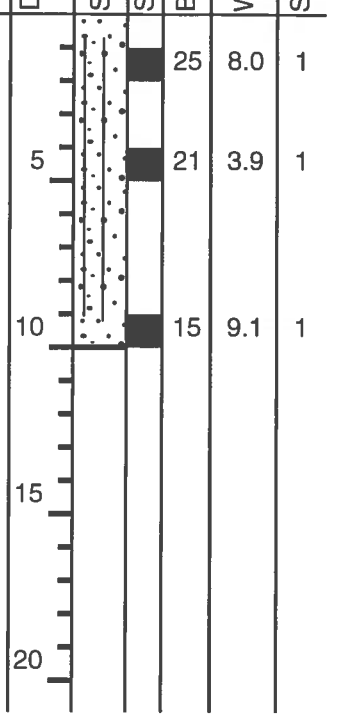


TEST BORING NO. 6
DATE DRILLED 10/11/2022
CLIENT SR LAND CO.
LOCATION VOLLMER AND MARKSHEFFEL

REMARKS

DRY TO 10', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST		25	8.0	1
5			21	3.9	1
10			15	9.1	1
15					
20					



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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: A- 3

TEST BORING NO. 7
DATE DRILLED 10/11/2022
Job # 222053

REMARKS

DRY TO 5', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			17	8.1	1
5			14	1.4	1
10					
15					
20					

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

TEST BORING NO. 8
DATE DRILLED 10/11/2022
CLIENT SR LAND CO.
LOCATION VOLLMER AND MARKSHEFFEL

REMARKS

DRY TO 5', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			19	5.3	1
5			22	6.2	1
10					
15					
20					

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

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		TS	10/25/22

JOB NO.: 222053
FIG NO.: A- 4

TEST BORING NO. 9
DATE DRILLED 10/11/2022
Job # 222053

REMARKS

DRY TO 10', 10/11/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST		20	14.3	1
5			17	4.2	1
10			16	4.1	1
15					
20					

TEST BORING NO.
DATE DRILLED
CLIENT SR LAND CO.
LOCATION VOLLMER AND MARKSHEFFEL

REMARKS

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

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TEST BORING LOG

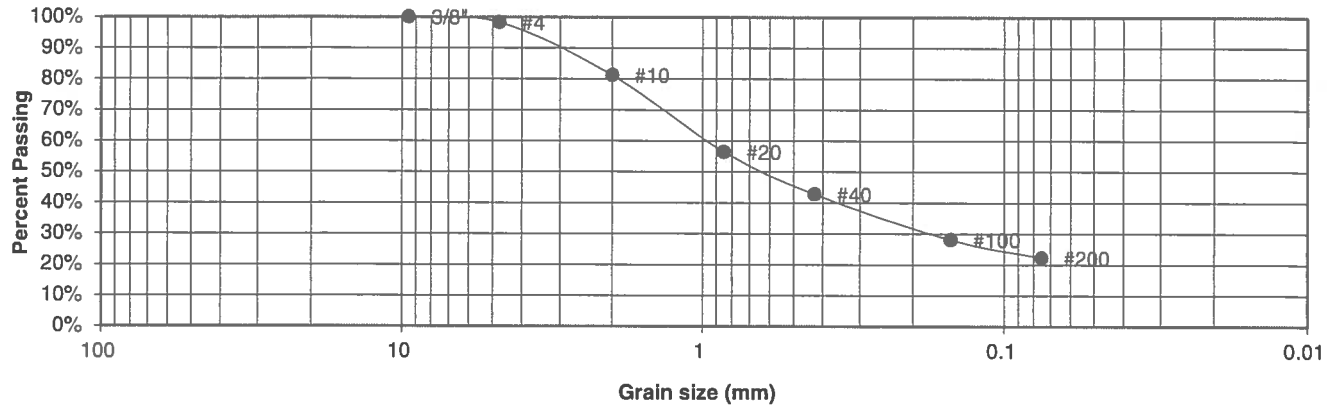
DRAWN:	DATE:	CHECKED:	DATE
		DS	10/25/22

JOB NO.: 222053
FIG NO.: A- 5

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1, CBR	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	3	JOB NO.	222053
DEPTH (FT)	0-3	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"	
3/8"	100.0%
4	98.3%
10	81.2%
20	56.5%
40	42.8%
100	28.1%
200	22.2%

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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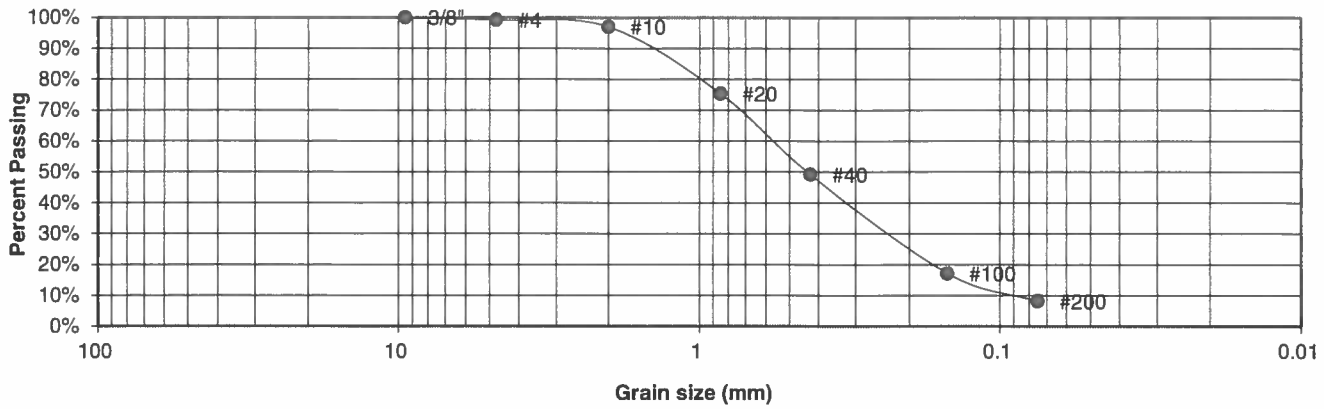
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-1

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	1	JOB NO.	222053
DEPTH (FT)	1-2	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"	
3/8"	100.0%
4	99.1%
10	97.0%
20	75.4%
40	49.2%
100	17.1%
200	8.1%

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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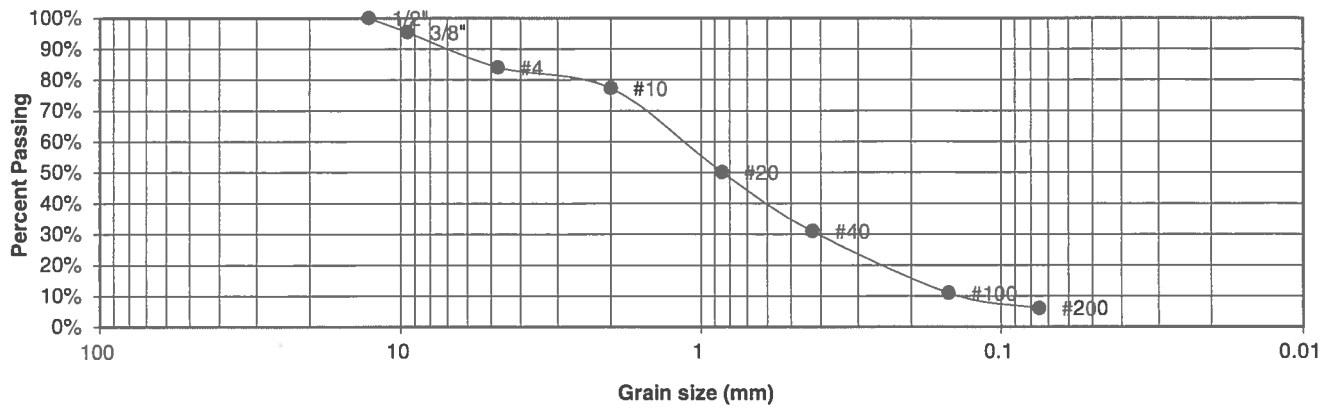
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-2

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	2	JOB NO.	222053
DEPTH (FT)	1-2	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"	95.4%
4	84.1%
10	77.2%
20	50.1%
40	31.0%
100	10.9%
200	6.0%

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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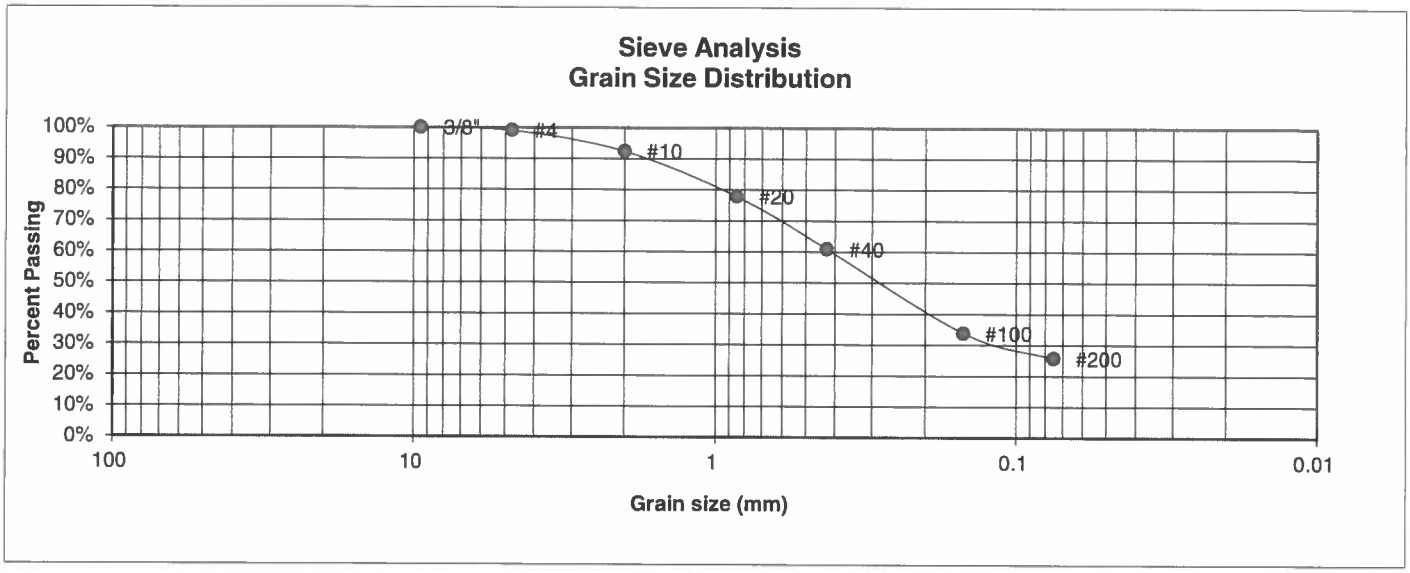
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-3

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	3	JOB NO.	222053
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.1%
10	92.4%
20	77.9%
40	60.9%
100	33.8%
200	25.7%

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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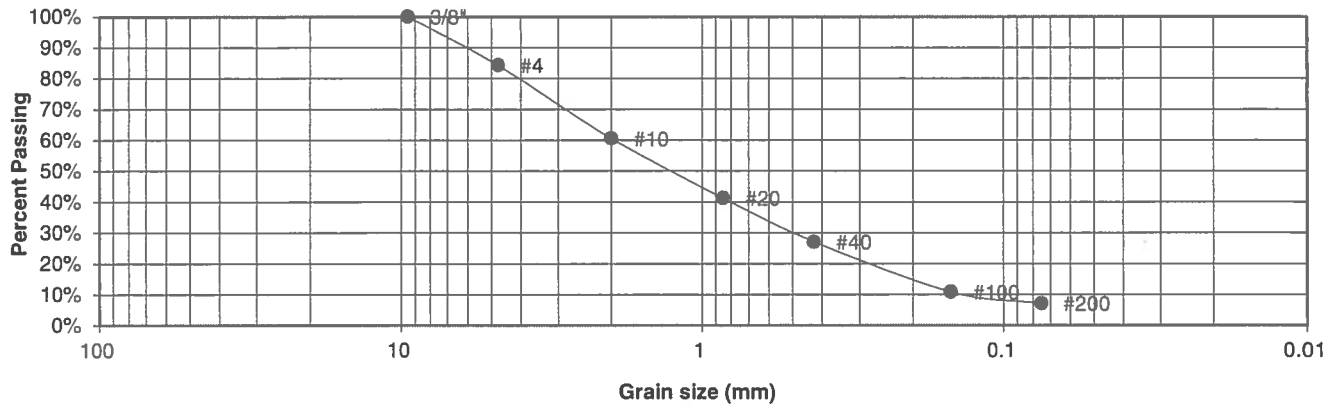
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-4

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	4	JOB NO.	222053
DEPTH (FT)	1-2	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"	
3/8"	100.0%
4	84.3%
10	60.5%
20	41.3%
40	27.1%
100	10.8%
200	7.1%

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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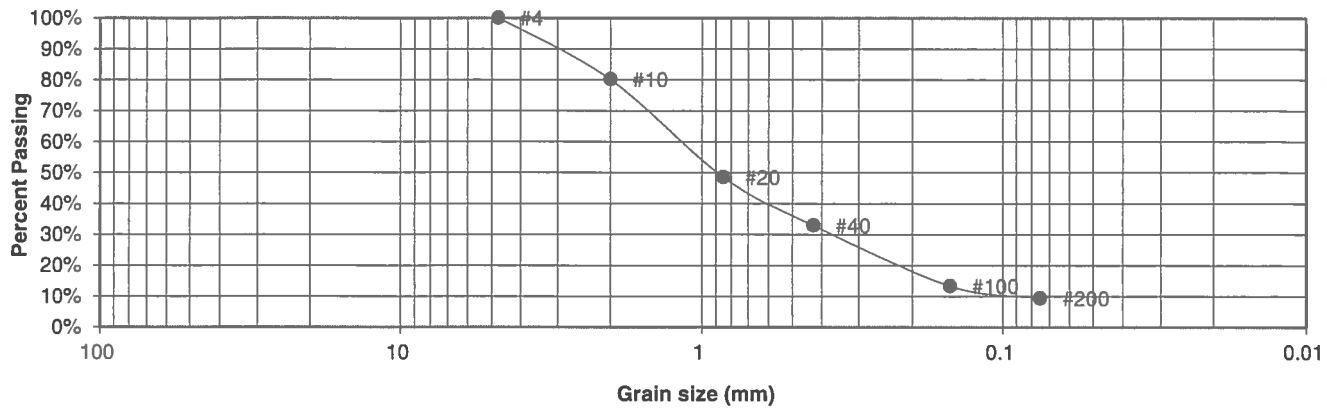
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-5

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	5	JOB NO.	222053
DEPTH (FT)	1-2	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"	
3/8"	
4	100.0%
10	80.2%
20	48.5%
40	33.0%
100	13.4%
200	9.5%

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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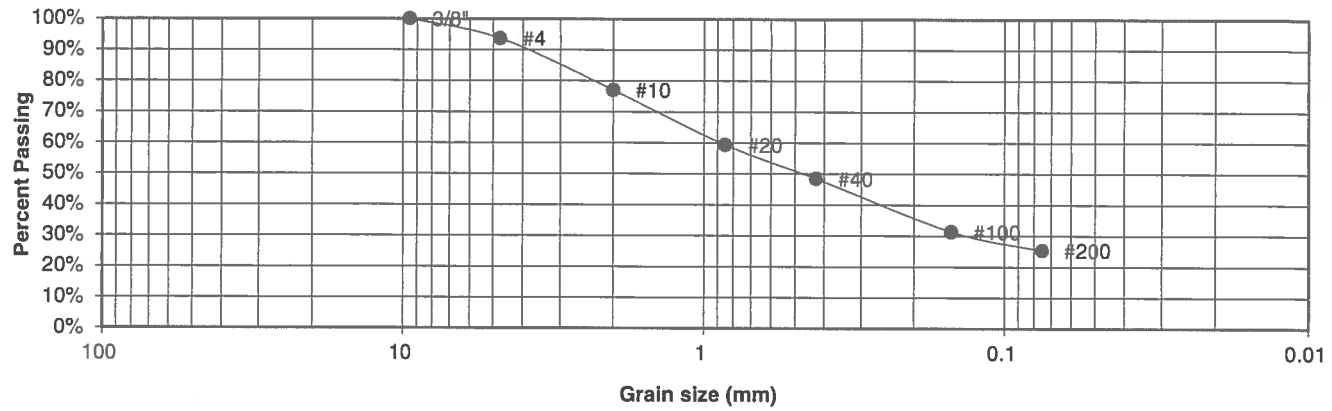
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-6

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	6	JOB NO.	222053
DEPTH (FT)	1-2	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"	
3/8"	100.0%
4	93.7%
10	77.0%
20	59.3%
40	48.5%
100	31.4%
200	25.3%

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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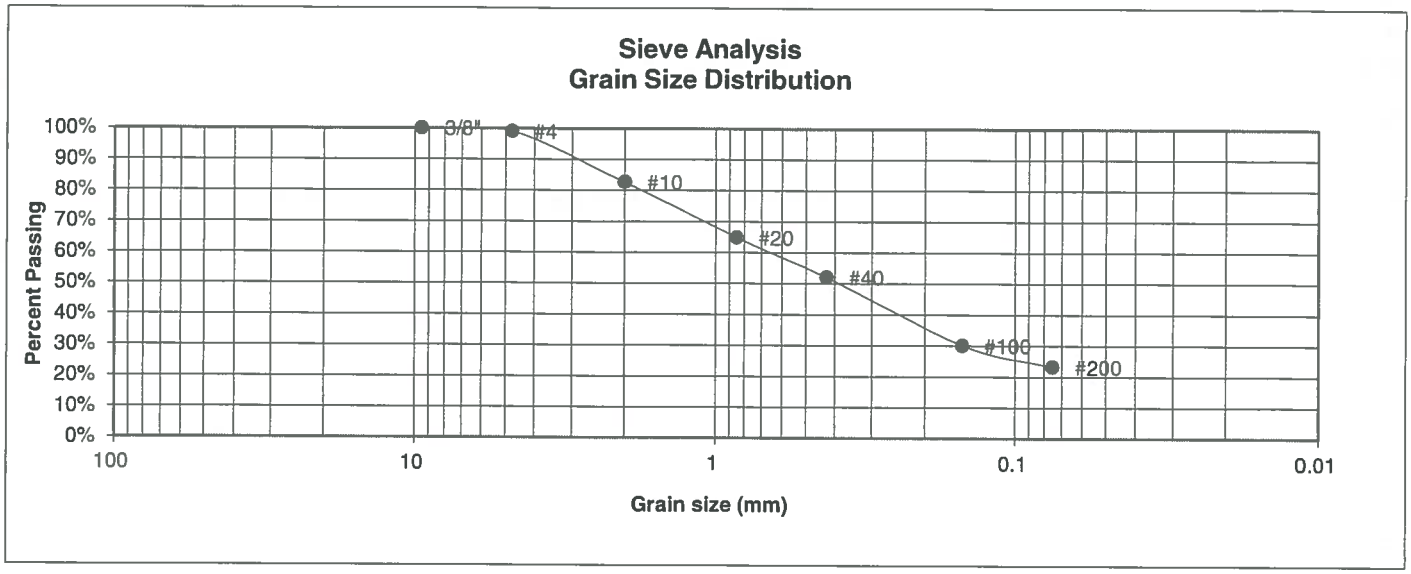
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/28/22

JOB NO.: 222053
FIG NO.: B-7

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	7	JOB NO.	222053
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	82.7%
20	64.9%
40	52.1%
100	30.1%
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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COLORADO SPRINGS, COLORADO 80907

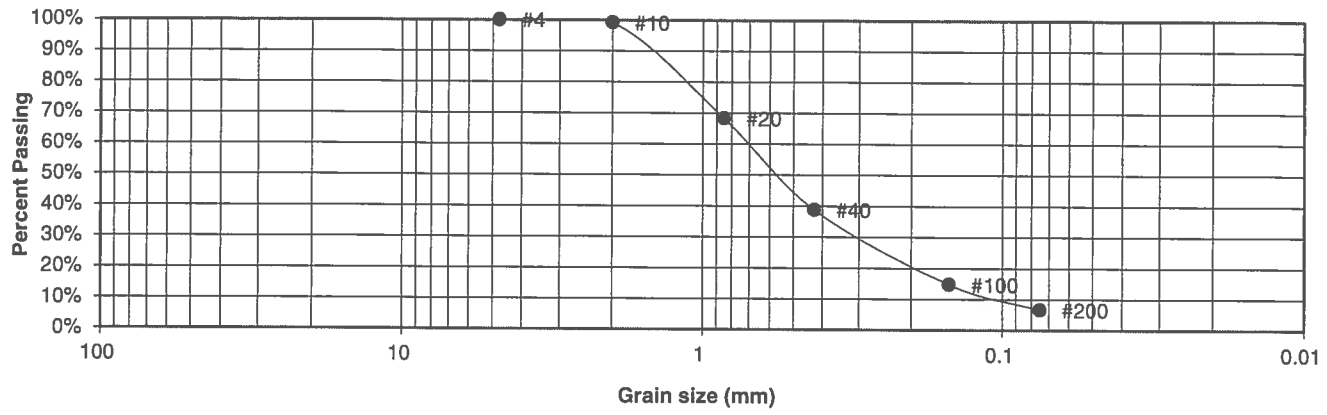
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-8

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	8	JOB NO.	222053
DEPTH (FT)	1-2	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"	
3/8"	
4	100.0%
10	99.1%
20	68.3%
40	38.8%
100	14.8%
200	6.6%

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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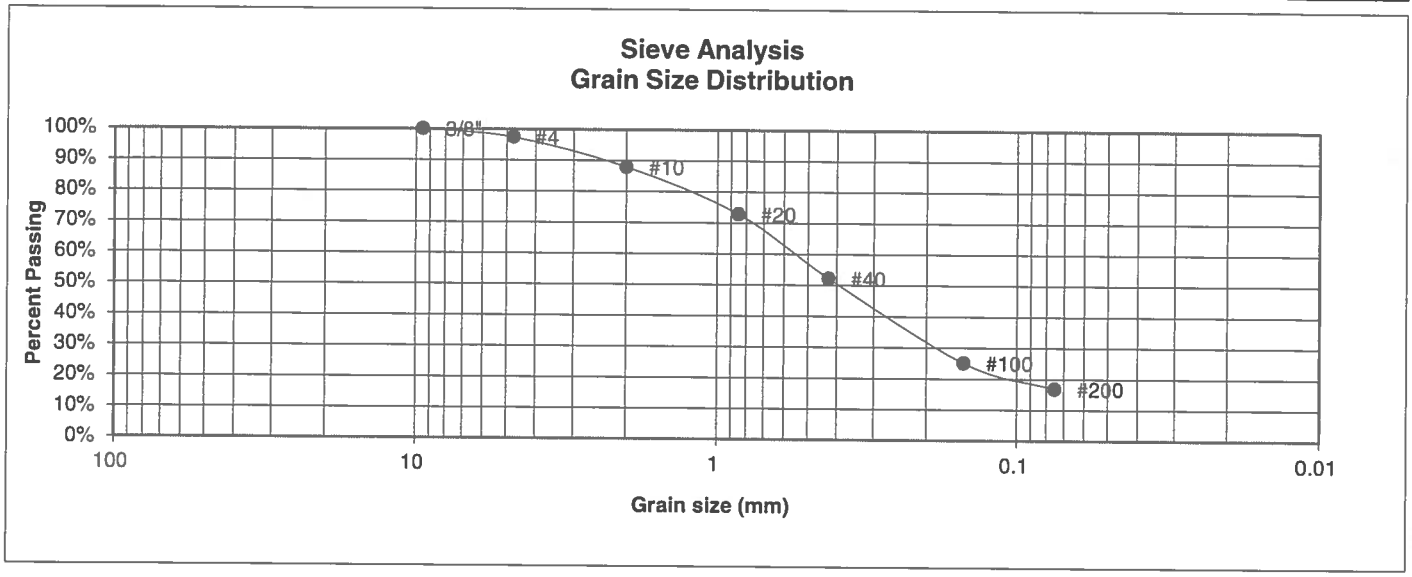
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-9

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	9	JOB NO.	222053
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.4%
10	87.9%
20	72.9%
40	52.2%
100	25.1%
200	16.8%

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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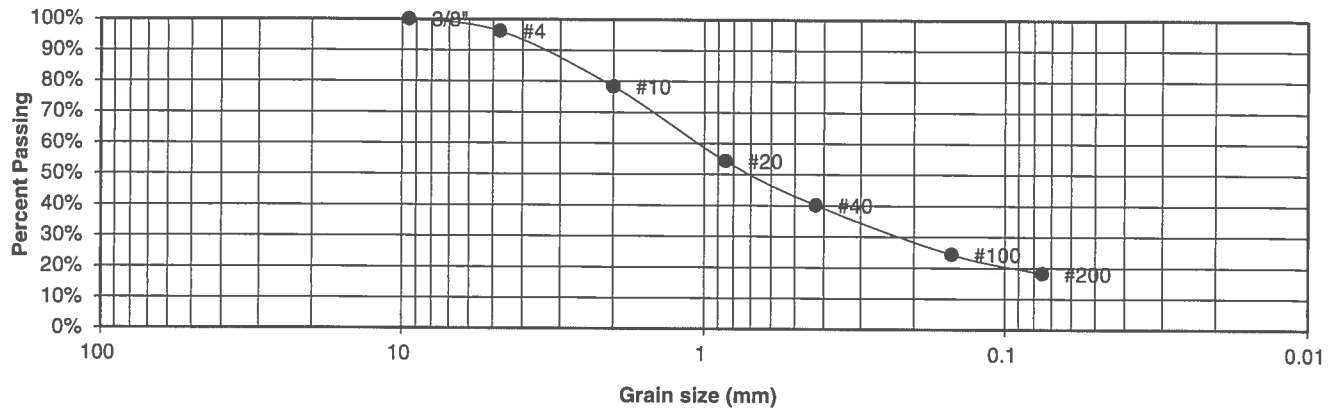
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-10

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	9	JOB NO.	222053
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION		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	96.1%
10	78.4%
20	54.3%
40	40.2%
100	24.3%
200	18.2%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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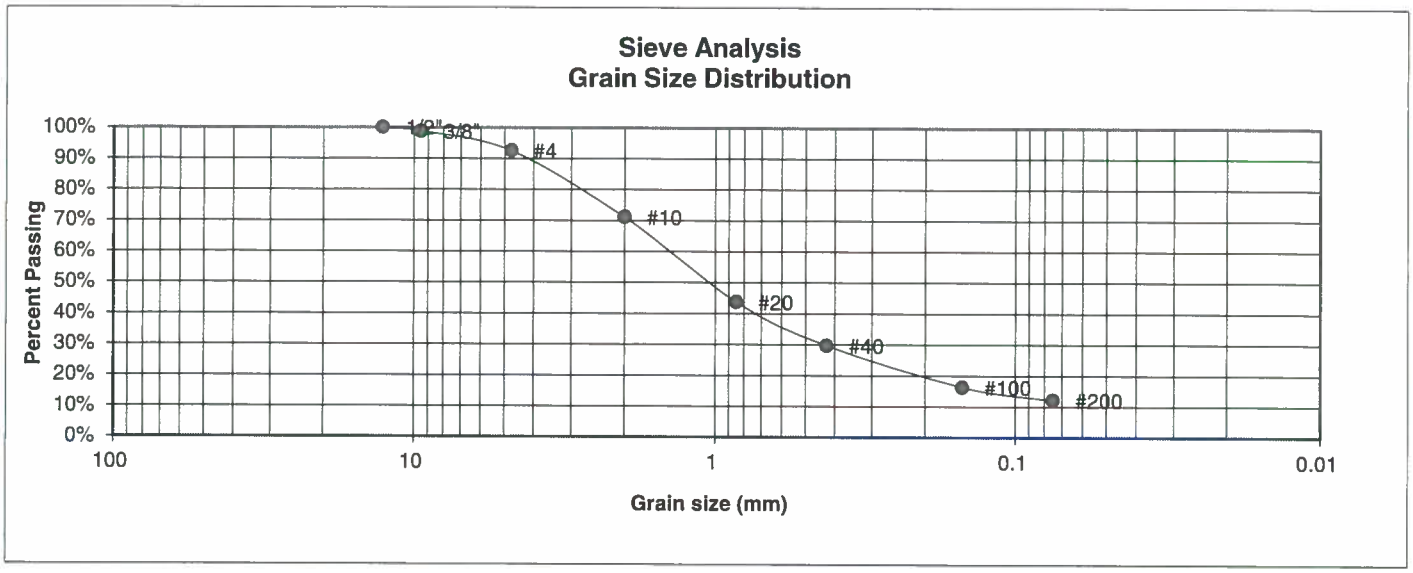
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-11

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND CO.
SOIL TYPE #	1	PROJECT	VOLLMER AND MARKSHEFFEL
TEST BORING #	6	JOB NO.	222053
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION		GROUP INDEX	



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.8%
4	92.5%
10	71.1%
20	43.7%
40	29.7%
100	16.3%
200	12.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-M

CLIENT	SR LAND CO.	JOB NO.	222053
PROJECT	VOLLMER AND MARKSHEFFEL	DATE	10/18/2022
LOCATION	VOLLMER AND MARKSHEFFEL	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-4	1-2	1	SM	<0.01
TB-7	1-2	1	SM	<0.01

QC BLANK PASS

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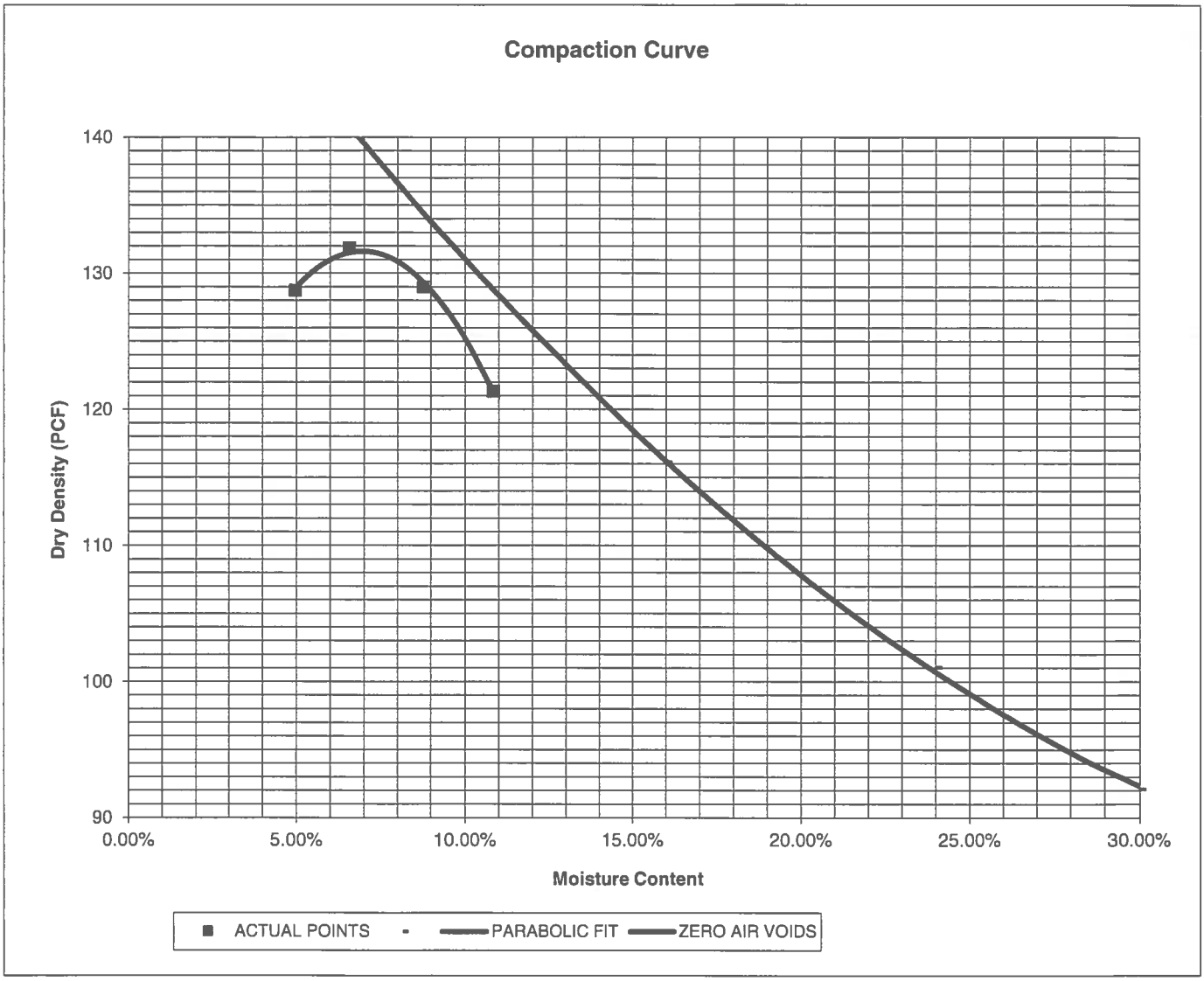
LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-13

PROJECT	VOLLMER AND MARKSHEFFEL	CLIENT	SR LAND CO.
SAMPLE LOCATION	TB-3 @ 0-3'	JOB NO.	222053
SOIL DESCRIPTION	SAND, SILTY, TAN	DATE	10/14/22

IDENTIFICATION	SM	COMPACTION TEST #	1, SOIL TYPE #1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	AL
MAXIMUM DRY DENSITY (PCF)	131.7	OPTIMUM MOISTURE	6.9%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B-14

CBR TEST LOAD DATA

JOB NO: 222053
CLIENT: SR LAND CO.
PROJECT: VOLLMER AND MARKSHEFFEL
SOIL TYPE: 1, CBR #1

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

PENETRATION DEPTH (INCHES)	*10 BLOWS* MOLD # 1 LOAD(LBS) (LBS)	STRESS (PSI)	*25 BLOWS* MOLD # 2 LOAD(LBS) (LBS)	STRESS (PSI)	*56 BLOWS* MOLD # 3 LOAD(LBS) (LBS)	STRESS (PSI)
0.000	0	0.00	0	0.00	0	0.00
0.025	156	52.13	312	104.26	570	190.48
0.050	292	97.58	583	194.82	1125	375.94
0.075	445	148.70	891	297.74	1460	487.88
0.100	542	181.12	1085	362.57	1681	561.74
0.125	636	212.53	1272	425.06	2522	842.77
0.150	795	265.66	1591	531.66	2784	930.32
0.175	915	305.76	1830	611.53	2939	982.12
0.200	1016	339.51	2032	679.03	3476	1161.57
0.300	1213	405.35	2425	810.36	5556	1856.64
0.400	1429	477.53	2859	955.39	6000	2005.01
0.500	1785	596.49	3010	1005.84		

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	303	117	347
WT. CAN	8.47	8.43	8.59
WT. CAN+WET	158.21	163.85	123.27
WT. CAN+DRY	142.22	156.97	114.73
WT. H20	15.99	6.88	8.54
WT. DRY SOIL	133.75	148.54	106.14
MOISTURE CONTENT	11.96%	4.63%	8.05%

WET DENSITY (PCF)	127.2	134.9	142.9
DRY DENSITY (PCF)	119.0	126.2	133.7

BEARING RATIO	18.11	36.26	56.17

90% OF DRY DENSITY	120.3
95% OF DRY DENSITY	127.0

BEARING RATIO AT 90% OF MAX	21.55	~ R VALUE	71
BEARING RATIO AT 95% OF MAX	38.50	~ R VALUE	74

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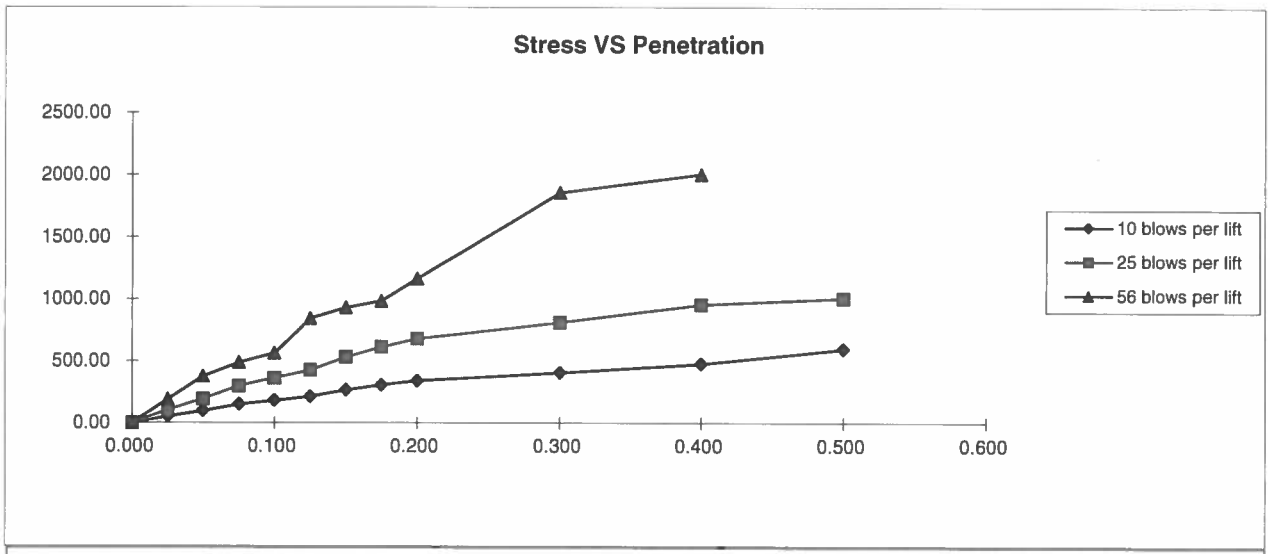
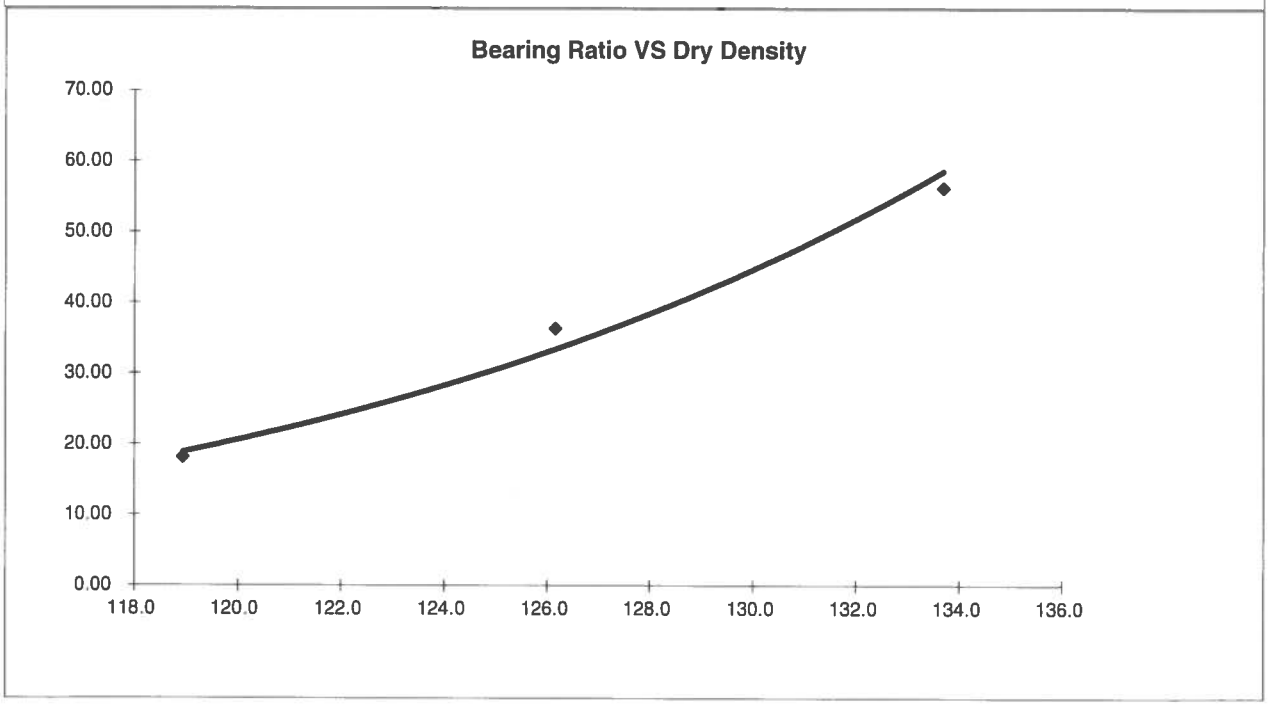
CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
		TDS	10/28/22

JOB NO.: 222053
FIG NO.: B-5





BEARING RATIO AT 90% OF MAX	21.55	~ R VALUE	71.00
BEARING RATIO AT 95% OF MAX	38.50	~ R VALUE	74.00

JOB NO: 222053
SOIL TYPE: 1, CBR #1

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COLORADO SPRINGS, COLORADO 80907

CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/25/22

JOB NO.: 222053
FIG NO.: B - 16

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC VOLLMER ROAD SOIL TYPE1
URBAN MINOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	1,971,000
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	85
Reliability (z-statistic)	Z_R =	-1.04
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 2.87

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
6.29	6.29	0.0

Job No. 222053
Fig. No. C-1

DESIGN CALCULATIONS

AGGREGATE BASE COURSE

DESIGN DATA

SR LAND, LLC VOLLMER ROAD SOIL TYPE1
URBAN MINOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 1,971,000
Hveem Stabilometer (R Value) Results:	R = 50
Weighted Structural Number (WSN):	WSN = 2.87

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

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

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

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 6.5 inches of Full Depth Asphalt
Use 6.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE

Asphalt Thickness (t) = [5] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 6.1 inches of Aggregate
Aggregate Base Course = 8.0 inches

RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 8.0 inche of Aggregate Base Course

Job No. 222053
Fig. No. C-2

DESIGN CALCULATIONS

RECYCLED CONCRETE

DESIGN DATA

SR LAND, LLC - SOIL TYPE 1
URBAN MINOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 1,971,000
Hveem Stabilometer (R Value) Results:	R = 50
Weighted Structural Number (WSN):	WSN = 2.87

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.09 Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Recycled Concrete (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 6.5 inches of Full Depth Asphalt
Use 6.5 inches Full Depth

FOR ASPHALT + RECYCLED CONCRETE

Asphalt Thickness (t) = [5] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 7.4 inches of Recycled Concrete
Recycled Concrete, use 8.0 inches

RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 8.0 inches of Recycled Concrete, or

Job No. 220053
Figure No. C-3