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PAVEMENT DESIGN REPORT

The Gardens at North Carefree
El Paso County, Colorado

PREPARED FOR:

Covington Properties, LLC
13725 Struthers Road, Suite 201
Colorado Springs, CO 80921

JOB NO. 171800

May 12, 2020

Approved
By: Elizabeth Nijkamp
Date:05/19/2020
El Paso County Planning & Community Development

Respectfully Submitted,

RMG – Rocky Mountain Group

COLORADO LICENSED
GEOFF WEBSTER
5/12/20
45046
PROFESSIONAL ENGINEER

Geoff Webster, P.E.
Sr. Geotechnical Project Engineer

EPC: SF 195

TABLE OF CONTENTS

GENERAL SITE AND PROJECT DESCRIPTION

Location

The Gardens at North Carefree is located at the southeast intersection of Akers Drive and North Carefree Circle. The location of the site is shown on the Site Vicinity Map, Figure 1.

Existing Conditions

At the time of our field investigation, the proposed streets were close to grade and utility mains and services had been installed. Curb and gutter had not been installed.

Project Description

This Pavement Design Report was performed to determine the subsurface conditions present along the roadway alignments and to develop recommendations for the design and construction of the proposed flexible pavements.

The proposed streets included in this investigation are shown on Figure 2. The streets considered below are classified as Urban Local Residential as shown on Sheet 3 of 34 of *The Gardens at North Carefree* Construction Drawings (SF-195). Fallow Lane and Running Deer Way have 50-foot wide Right- of-Ways (ROW) and two 15-foot wide travel lanes. Vineyard Circle has a 45-foot ROW with two 15-foot wide travel lanes.

FIELD INVESTIGATION AND SUBSURFACE CONDITIONS

Drilling

The subsurface conditions on the site were investigated by drilling eight (8) exploratory test borings at maximum 500-foot spacing along the roadways. The approximate locations of the test borings are presented in the Test Boring Location Plan, Figure 2.

The test borings were advanced with a power-driven, continuous-flight auger drill rig to depths of about 5 to 10 feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. Representative bulk samples of subsurface materials were obtained from each boring at a depth of approximately 0 to 2 feet below the existing ground surface. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figures 4 through 7.

Subsurface Materials

The subsurface materials encountered in the test borings consisted primarily of silty and clayey sand. Combined bulk samples of the material classified as SM and SC according to the Unified Classification System. For pavement design, bulk samples of the soil were classified as A-2-4, A-4, and A-6 soil in

accordance with the American Association of State Highway and Transportation Officials (ASSHTO) classification system. This soil is suitable as subgrade material when prepared as recommended below.

Groundwater

Groundwater was not encountered in the test borings at the time of drilling. Groundwater is not expected to affect the construction of the pavements. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in precipitation and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

LABORATORY TESTING

Laboratory Testing

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis and Atterberg Limits tests were performed on selected samples to classify the soil and to develop pertinent engineering properties. Swell/Consolidation tests were performed to determine the expansive potential of the soil. A Summary of Laboratory Test Results is presented in Figure 8. Soil Classification Data are presented in Figures 9 and 10.

Swell/Consolidation tests were performed on A-6 soil with PI greater than 10. Laboratory testing indicates the subgrade soil exhibited a maximum swell potential of 1.1 percent, with an average swell potential of 0.73 percent. As this value is less than the 2 percent stipulated in the Engineering Criteria Manual, mitigative measures are not applicable. Swell test results are presented in Figures 11 and 12.

As A-6 soil represents the least favorable subgrade classification, California Bearing Ratio tests (CBR) were performed on a combined bulk sample of A-6 soil. The optimum moisture-density relationship was determined in accordance with ASTM D-698 (Standard Proctor compaction test). CBR tests were performed at varying densities with moisture content near optimum. At 95% of the maximum Standard Proctor Density, the CBR of the A-6 soil was 5.1. The Moisture-Density Relation Curve is presented in Figure 13. CBR Test Results are presented in Figures 14 and 15.

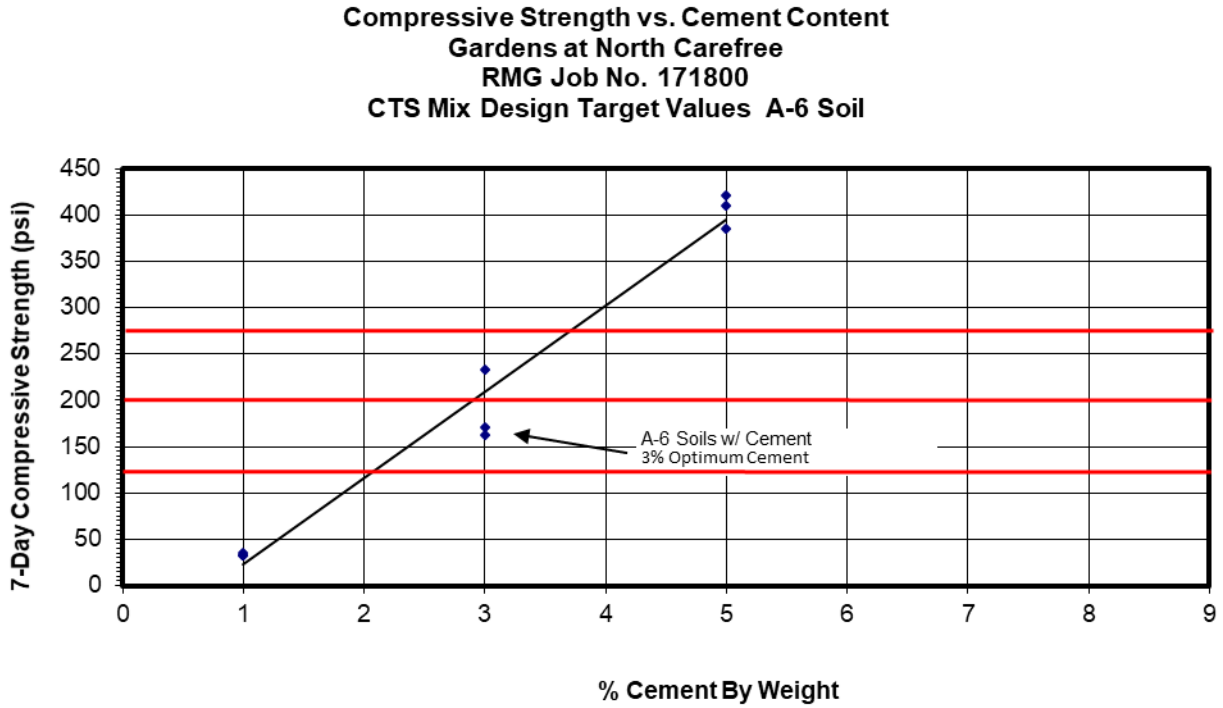
The developer intends to install a composite roadway section consisting of Hot Mix Asphalt over Cement-Treated Subgrade (CTS). RMG performed a CTS Mix Design for this composite section.

Specimens of soil composed of the A-6 subgrade materials and Portland cement were prepared by varying the “percent cement by weight” at target values of 1, 3, and 5 percent cement. Three specimens (pucks) were prepared for each target cement value, compacted to 95% of the maximum Standard Proctor density and cured in a saturated condition for 7-days. The compressive strength of each specimen was then determined upon completion of the 7-day curing process. The A-6 compressive strengths are presented in the table below:

A-6 Soil Compressive Strength Calculations

CTS Puck	Age/Day	Cap & Plate	Area of Sample	Dial Reading	Load LBF	Total Load	PSI
1A	7	2.12	12.566	40	404.7	406.8	32
1B	7	2.12	12.566	40	404.7	406.8	32
1C	7	2.12	12.566	44	445.1	447.3	36
3A	7	2.12	12.566	212	2144.8	2146.9	171
3B	7	2.12	12.566	289	2923.8	2925.9	233
3C	7	2.12	12.566	202	2043.6	2045.8	163
5A	7	2.12	12.566	509	5149.6	5151.7	410
5B	7	2.12	12.566	478	4835.9	4838.0	385
5C	7	2.12	12.566	523	5291.2	5293.3	421

The data values were then plotted as a function of "7-day Compressive Strength versus Percent Cement by Weight". In accordance with the El Paso County Engineering Criteria Manual, the target "percent cement by weight" was selected to obtain strengths in the lower Strength Coefficient (SC) categories (SC = 0.11, 125-200 psi; SC = 0.12, 200-275 psi). A target SC = 0.11 is used for CTS soil in the pavement design procedure presented below. Based upon an evaluation of the test data, a target range of 3.0 percent cement is recommended in all roadway sections to maintain strengths below the 275-psi threshold stipulated in the Engineering Criteria Manual. See CTS Graph below.



PAVEMENT DESIGN

The discussion presented below is based on the subsurface conditions encountered in the test borings, laboratory test results and the project characteristics previously described. The conclusions and recommendations presented in this report should be verified by RMG during construction.

The pavement design was performed in accordance with the El Paso County Engineering Criteria Manual, Appendix D. Pavement design parameters and design calculations are presented below utilizing the CBR value for A-6 subgrade soil.

Street Classification – Urban Local Residential

1) Vineyard Circle, Fallow Lane, Running Deer Way
   ESAL = 292,000 (Table D-2)
   Serviceability Index = 2.0 (Table D-1)
   Reliability = 80% (Table D-1)

2) Strength coefficients (Table D-3)
   Asphalt (HMA): $a_1 = 0.44$
   Cement Treated Subgrade (CTS): $a_2 = 0.11$

3) Subgrade
   M_r = CBR x 1500 = 5.1 x 1500 = 7,650 psi

4) Structural number (SN) = 2.60 (1993 AASHTO Empirical Equation, Appendix A)

5) Composite asphalt/cement treated subgrade section
   Minimum HMA thickness = D_1 = 3 inches (Table D-2)
   CTS thickness = $D_2 = \{SN – (D_1 \times a_1)\} / a_2 = \{2.60 – (3 \times 0.44)\} / 0.11 = 11.6$ inches

6) In accordance with El Paso County ECM, Section D.4, Paragraph F, *The base course thickness selected cannot exceed 2.5 times the HMA thickness selected.*
   Therefore, try Asphalt thickness = 3.75 inches
   CTS thickness = $D_2 = \{SN – (D_1 \times a_1)\} / a_2 = \{2.60 – (3.75 \times 0.44)\} / 0.11 = 8.6$ inches
   Use HMA = 3.75 inches and CTS = 9 inches

   Check SN = (3.75 x 0.44) + (9 x 0.11) = 2.64 > 2.60 (Min. SN required) => OK

Pavement Thickness

Based on the soil types and the design calculations, the recommended pavement section is presented below and on Figure 2.1.

Recommended Pavement Section

Streets	HMA (in)	CTS (in)
Vineyard Circle, Fallow Lane, Running Deer Way	3.75	9.0

Pavement Materials

Pavement materials should be selected, prepared, and placed in accordance with El Paso County specifications and the *Pikes Peak Region Asphalt Paving Specifications*. Tests should be performed in accordance with the applicable procedures presented in the specifications.

Soil Mitigation

The PDCM notes that mitigation measures may be required for expansive soils, shallow ground water, subgrade instability, etc. Based on the AASHTO classification of the soils in the subdivision and laboratory swell testing, the subgrade soils evaluated for this pavement design will have nil to low expansive potential. Groundwater or wet and unstable soils were not encountered in the borings. Therefore, special mitigation measures do not appear to be necessary for subgrade preparation.

Subgrade Preparation

Subgrade for The Gardens at North Carefree shall be Cement Treated Subgrade (CTS) composed of a mixture of local soil, water, and Portland cement compacted at optimum moisture. Prior to CTS construction, the existing soil should be proof-rolled to a firm and unyielding condition. Areas that deform under wheel loads should be removed and replaced. The soil should then be scarified, pulverized, mixed with cement and water, compacted, finished and cured in lengths that allow the full roadway width to be completed in not more than 4 hours from the time that cement is exposed to water.

The quantity of cement shall be by weight as a percentage of the dry weight of the soil as specified herein (3% optimum), and should be applied uniformly on the soil to create a cement and water mixture for the full design width and depth. Mixing should be continuous until the mixture is at optimum moisture and ready for compacting and finishing. Compaction should begin within 30 minutes of mixing. CTS should be maintained in a moist condition during the curing process, and all traffic except for necessary construction equipment should be kept off the CTS for a minimum of 7 days.

CTS testing shall be in accordance with the El Paso County Engineering Criteria Manual. CTS compressive strength test results shall be submitted to the County prior to the placement of the asphalt, in part to confirm the requirement for micro fracturing (MF). Micro fracturing of the CTS shall be performed when 7-day compressive strength test results indicate CTS strength in excess of 275 psi. The subgrade should be kept in a moist cured condition for 48 to 72 hours before any micro fracturing is performed by a heavy (12-ton) steel drum vibratory roller operating at maximum amplitude. After satisfactory completion of micro fracturing, the subgrade should continue to be moist cured by sprinkling or other means.

Surface Drainage

Surface drainage is important for the satisfactory performance of pavement. Wetting of the subgrade soils or base course will cause a loss of strength that can result in pavement distress. Surface drainage should provide for efficient removal of storm-water runoff. Water should not pond on the pavement or at the edges of the pavement.

Subgrade Observations and Testing

The pavement thicknesses presented above assume pavement construction is completed in accordance with El Paso County specifications and the *Pikes Peak Region Asphalt Paving Specifications*. RMG should be present at the site during subgrade preparation, placement of fill, and construction of pavements to perform site observations and testing.

CLOSING

Our field exploration was conducted to provide geotechnical information for pavement thickness design. Variations in subsurface conditions not indicated by the borings may be encountered. This report has been prepared for **Covington Properties, LLC** for application as an aid in the design of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from exploratory borings and test pits, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

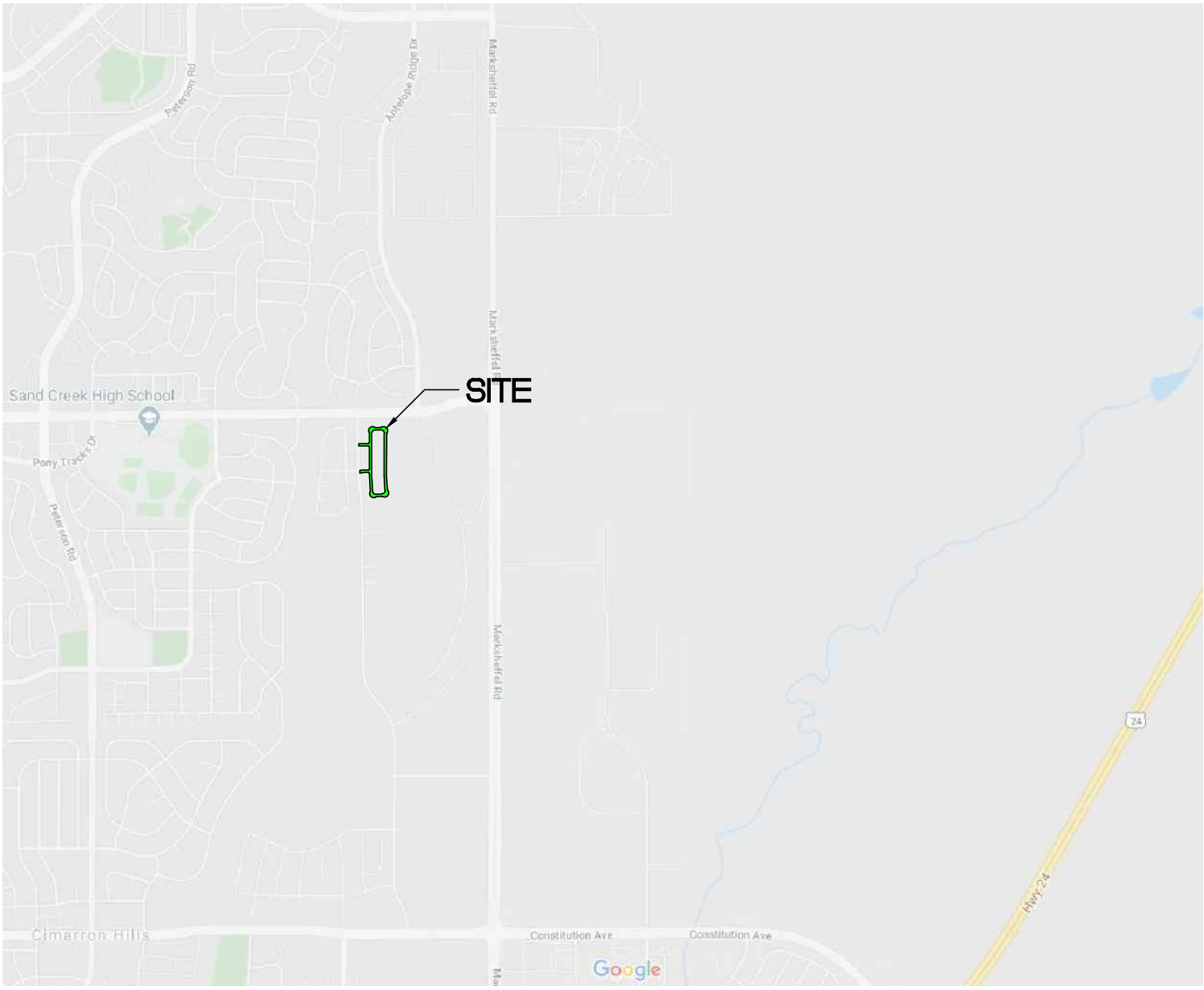
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG Engineers does not warrant the work of regulatory agencies or other third parties supplying information that may have been used during the preparation of this report. No warranty, express or implied is made. Any contractor reviewing this report for bidding purposes must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

This report is for the exclusive purpose of providing geotechnical information and pavement thickness design recommendations. The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this

report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES



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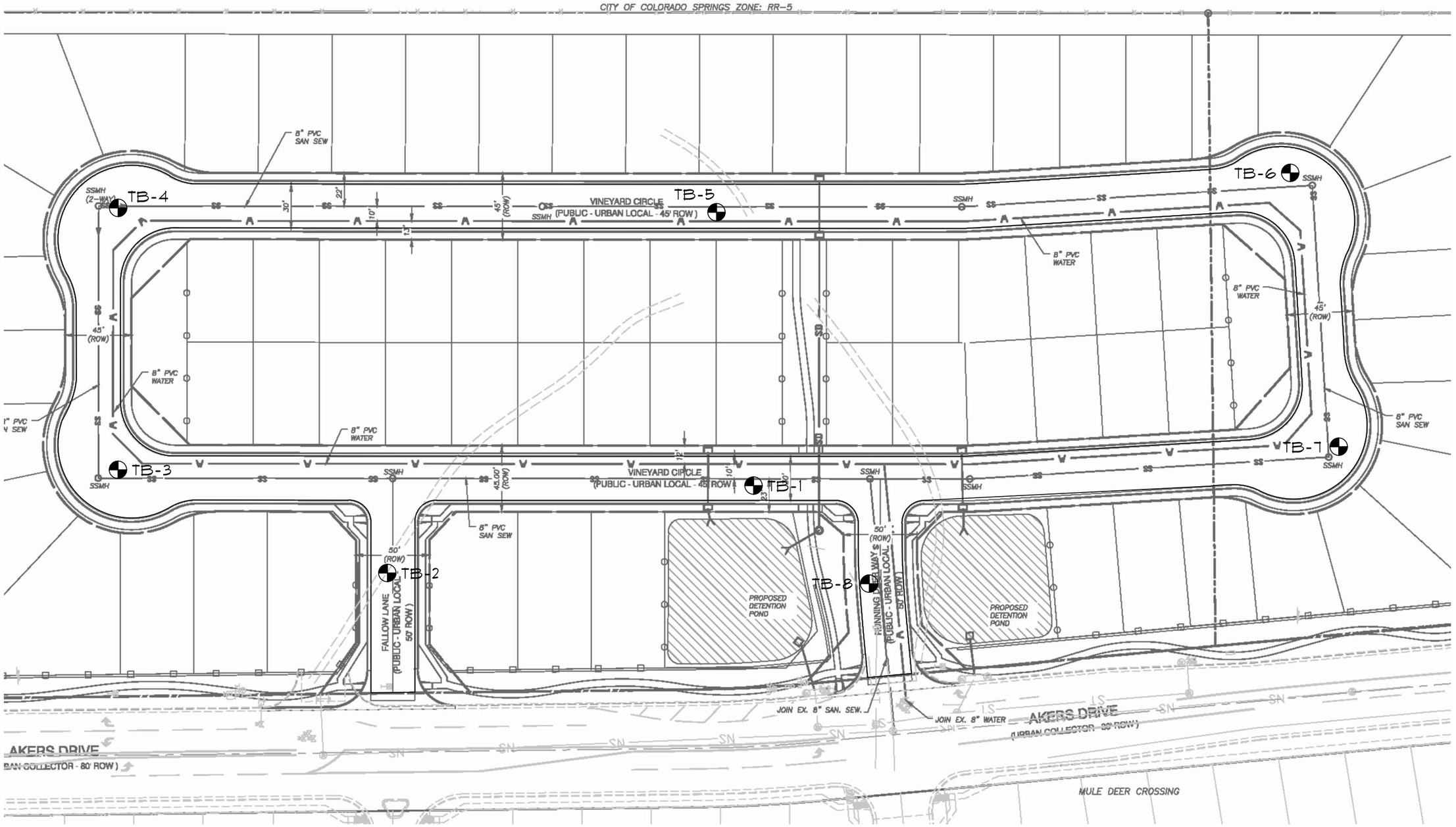
SITE VICINITY MAP

GARDENS AT NORTH CAREFREE
EL PASO COUNTY, COLORADO
COVINGTON PROPERTIES, LLC

JOB No. 171800

FIG No. 1

DATE 5/12/2020



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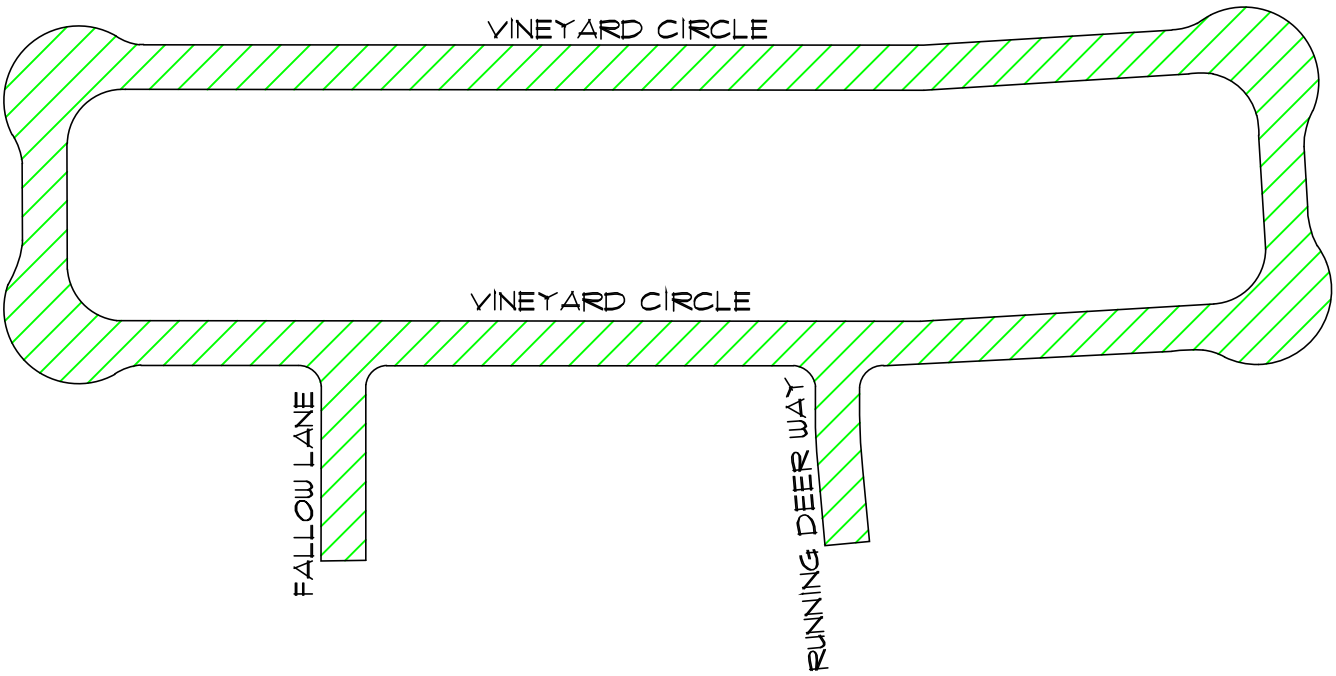
GARDENS AT NORTH CAREFREE
EL PASO COUNTY, COLORADO
COVINGTON PROPERTIES, LLC

ENGINEER:	GW
DRAWN BY:	BG
CHECKED BY:	GW
ISSUED:	5-12-2020

TEST BORING LOCATION PLAN

SHEET No.
FIG-2



3.75" Hot Mix Asphalt over
9" Cement Treated Subgrade

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PAVEMENT DESIGN

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FIG No. 2.1

DATE 5/12/2020

SOILS DESCRIPTION


FILL: SAND, SILTY TO CLAYEY


SANDSTONE


SILTY SAND

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
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COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES


XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


FREE WATER TABLE


DEPTH AT WHICH BORING CAVED


BULK — DISTURBED BULK SAMPLE


AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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EXPLANATION OF TEST BORING LOGS

JOB No. 171800

FIGURE No. 3

DATE May 12, 2020

TEST BORING: **1** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, brown, loose to medium dense, moist				16	17.7
				40	12.9
	5				

TEST BORING: **2** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, brown, medium dense, moist				19	16.1
SAND, SILTY, light brown, loose, moist				17	8.6
	5				

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TEST BORING LOG

JOB No. 171800

FIGURE No. 4

DATE May 12, 2020

TEST BORING: **3** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, brown, loose to medium dense, moist				20	15.8
	5			12	14.0
SANDSTONE, SILTY, blue to gray, moist				10/0"	--

TEST BORING: **4** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, brown, medium dense, moist				28	17.3
	5			17	23.6

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TEST BORING LOG

JOB No. 171800

FIGURE No. 5

DATE Mary 12, 2020

TEST BORING: **5** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, light brown to brown, loose to medium dense, moist				23	17.8
				9	11.3
	5				

TEST BORING: **6** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY TO CLAYEY, brown to gray, medium dense, moist				19	18.7
				29	12.0
	5				
				20	18.8
	10				

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TEST BORING LOG

JOB No. 171800

FIGURE No. 6

DATE May 12, 2020

TEST BORING: **7** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, brown, moist					
SANDSTONE, SILTY, brown, very hard, moist				50/3"	8.9
				50/3"	--
	5				

TEST BORING: **8** ELEVATION (FT): DATE DRILLED: 2/11/20 NO GROUNDWATER ON 2/11/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, light brown to gray, medium hard to hard, moist					
				50/5"	19.7
				50/7"	18.3
	5				

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TEST BORING LOG

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FIGURE No. 7

DATE May 12, 2020

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.10 Sieve	% Retained No.40 Sieve	% Passing No. 200 Sieve	% Swell @ 100 psf	AASHTO Classification
1	2.0	17.7	98.2	37	12	5.8	18.6	35.9	1.1	A-6 (1)
1	2.1	17.7	107.9						0.4	
1	4.0	12.9								
2	2.0	16.1		33	5	10.5	26.1	33.5		A-2-4 (0)
2	4.0	8.6								
3	2.0	15.8		36	10	10.7	21.7	40.7		A-4 (1)
3	4.0	14.0								
4	2.0	17.3	108.5	40	15	11.9	23.2	42.8	1.1	A-6 (3)
4	2.1	17.3	102.5						0.3	
4	4.0	23.6								
5	2.0	17.8		36	10	5.4	19.2	39.3		A-4 (1)
5	4.0	11.3								
6	2.0	18.7		36	9	9.9	28.1	34.8		A-2-4 (0)
6	4.0	12.0								
6	9.0	18.8								
7	2.0	8.9		34	6	10.3	40.1	26.5		A-2-4 (0)
8	2.0	19.7		36	8	10.9	19.6	44.0		A-4 (1)
8	4.0	18.3								

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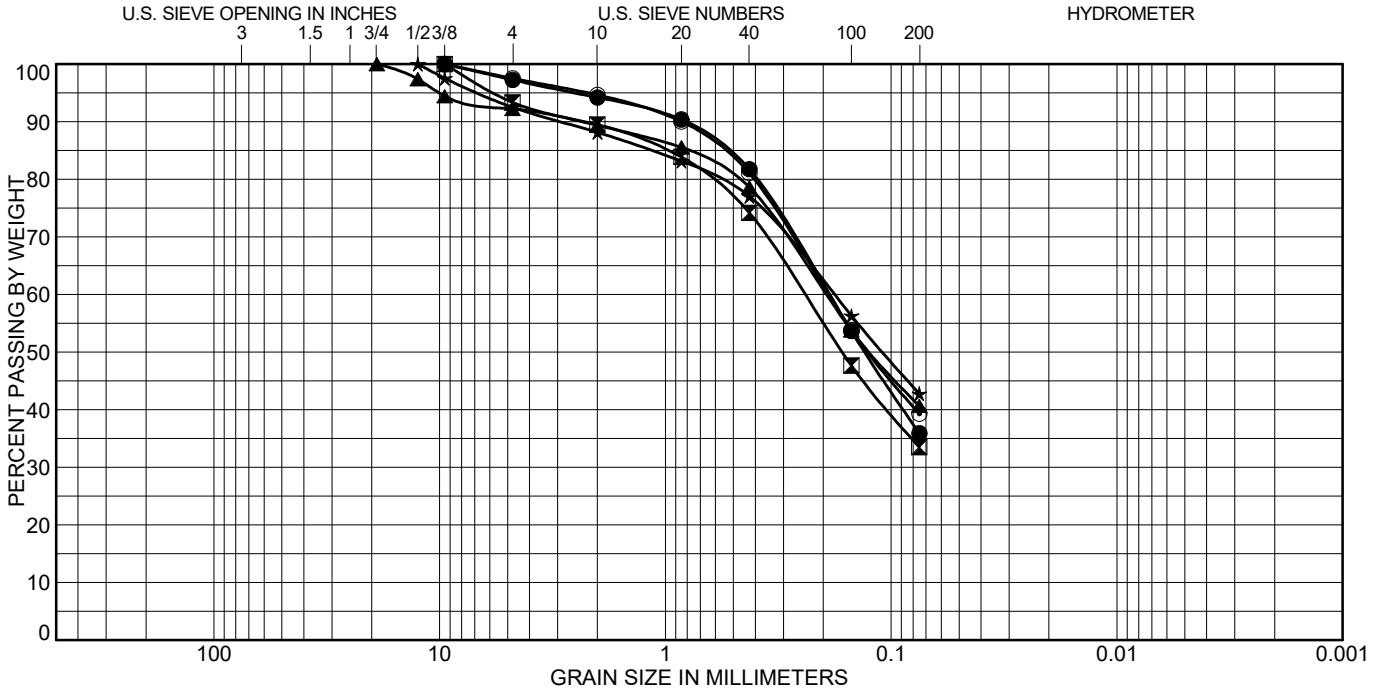
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 171800
FIGURE No. 8
PAGE 1 OF 1
DATE May 12, 2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	1	2.0	A-6 (1)	37	25	12		
⧓	2	2.0	A-2-4 (0)	33	28	5		
▲	3	2.0	A-4 (1)	36	26	10		
★	4	2.0	A-6 (3)	40	25	15		
⊙	5	2.0	A-4 (1)	36	26	10		

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	2.0	2.7	61.4	35.9	
⧓	2	2.0	6.7	59.8	33.5	
▲	3	2.0	7.8	51.6	40.7	
★	4	2.0	7.5	49.7	42.8	
⊙	5	2.0	2.5	58.2	39.3	

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SOIL CLASSIFICATION DATA

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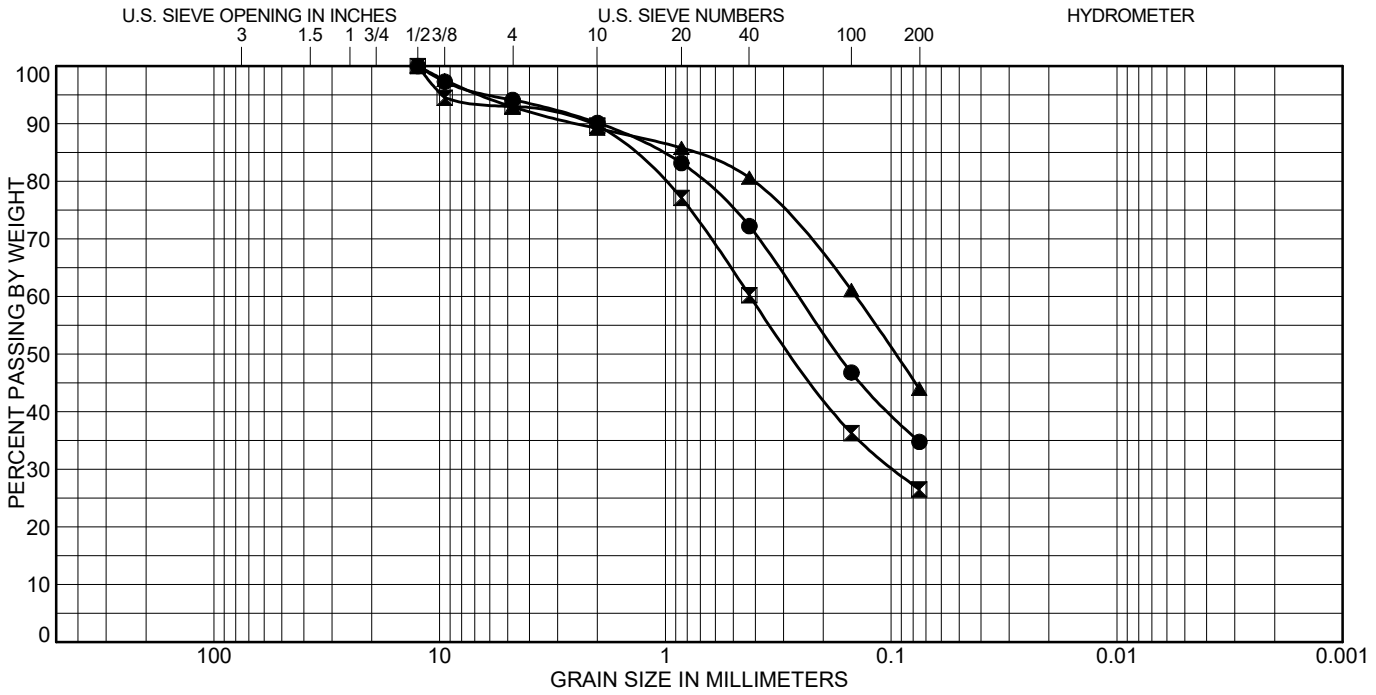
FIGURE No. 9

DATE May 12, 2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	6	2.0	A-2-4 (0)	36	27	9		
⧓	7	2.0	A-2-4 (0)	34	28	6		
▲	8	2.0	A-4 (1)	36	28	8		

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	6	2.0	5.9	59.4	34.8	
⧓	7	2.0	7.0	66.5	26.5	
▲	8	2.0	7.1	48.9	44.0	

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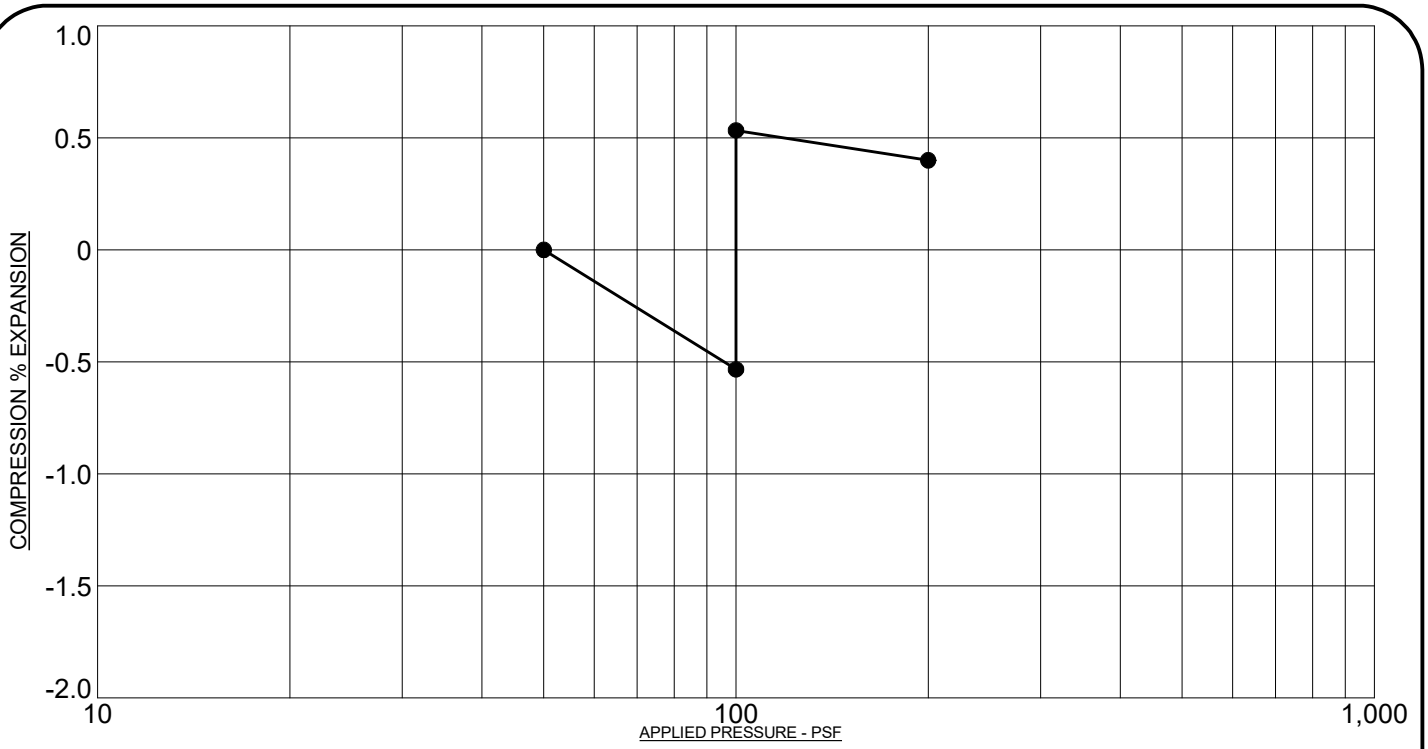
SOIL CLASSIFICATION DATA

JOB No. 171800

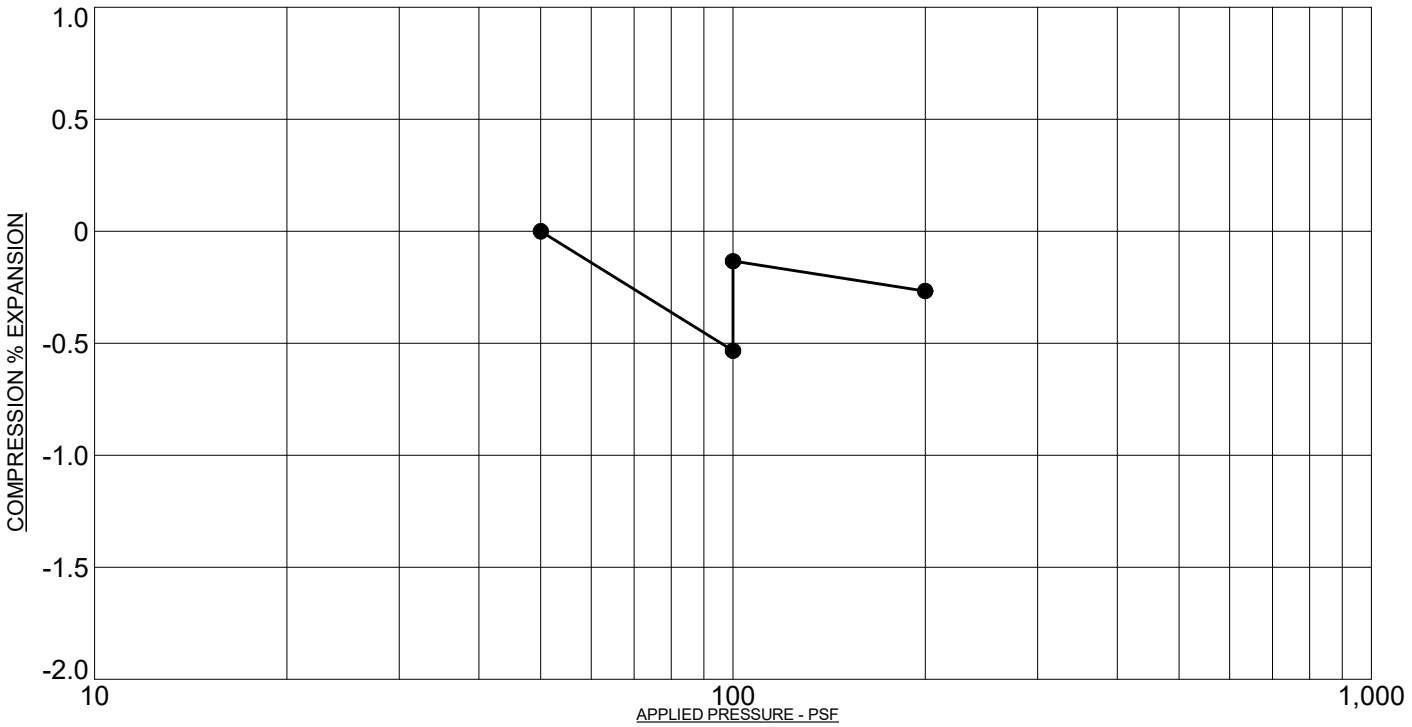
FIGURE No. 10

DATE May 12, 2020



PROJECT: **Gardens at North Carefree, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **1 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **98.2 PCF**
NATURAL MOISTURE CONTENT: **17.7%**
PERCENT SWELL/COMPRESSION: **1.1**



PROJECT: **Gardens at North Carefree, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **1 @ FT**
NATURAL DRY UNIT WEIGHT: **107.9 PCF**
NATURAL MOISTURE CONTENT: **17.7%**
PERCENT SWELL/COMPRESSION: **0.4**

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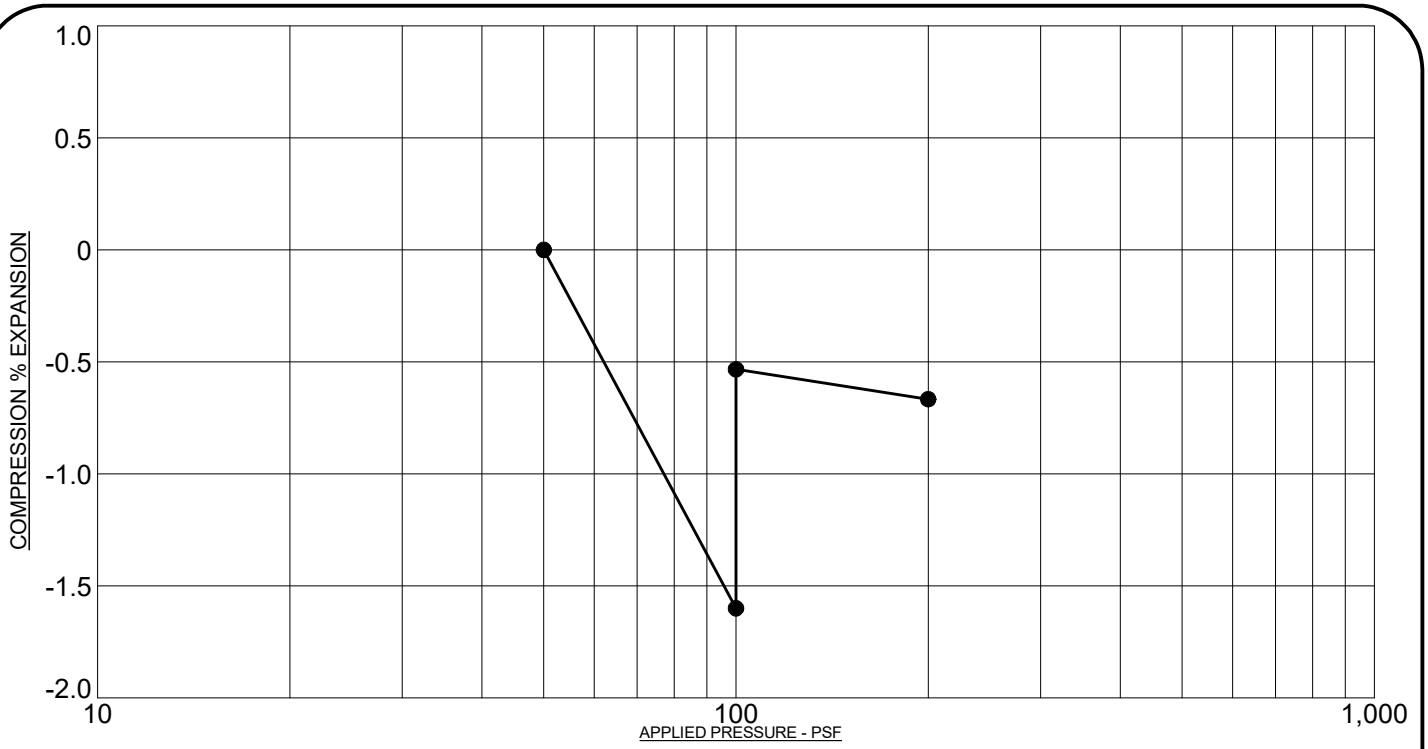
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 171800

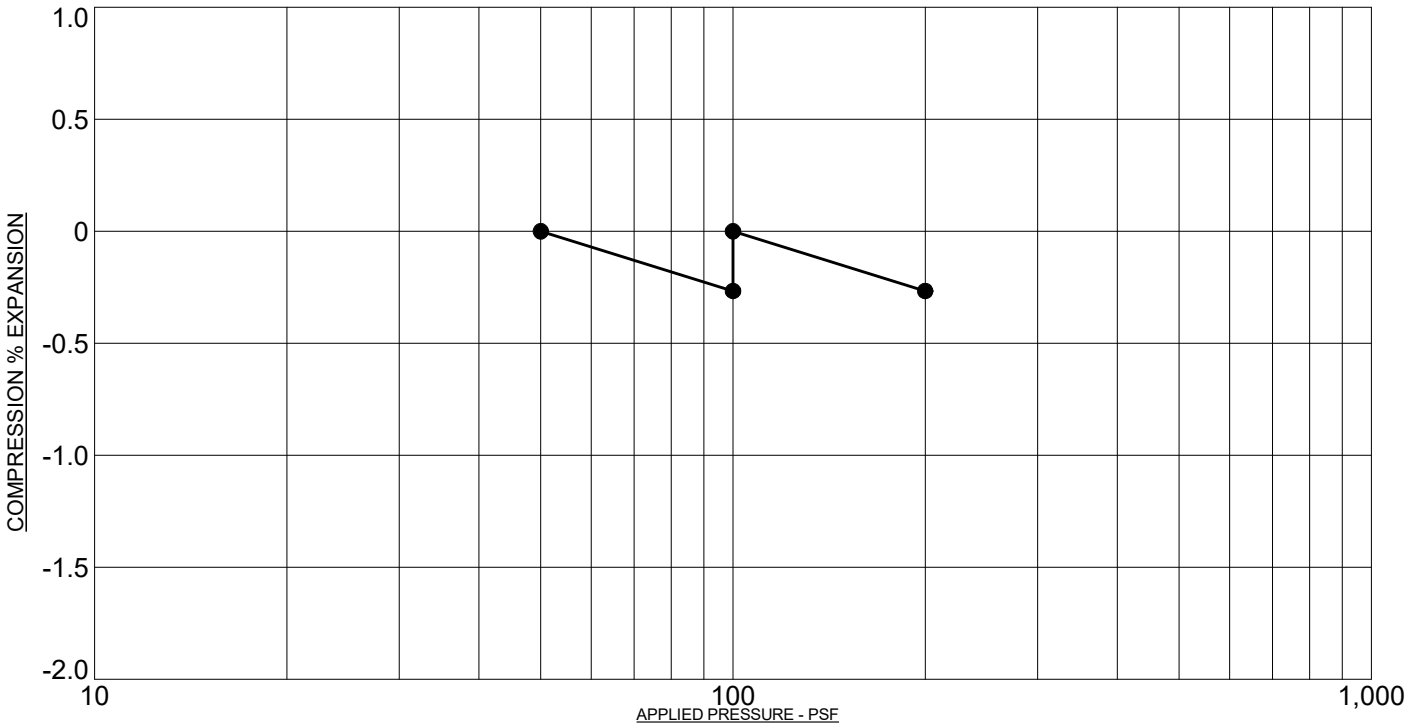
FIGURE No. 11

DATE May 12, 2020



PROJECT: **Gardens at North Carefree, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **4 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **108.5 PCF**
NATURAL MOISTURE CONTENT: **17.3%**
PERCENT SWELL/COMPRESSION: **1.1**



PROJECT: **Gardens at North Carefree, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **4 @ FT**
NATURAL DRY UNIT WEIGHT: **102.5 PCF**
NATURAL MOISTURE CONTENT: **17.3%**
PERCENT SWELL/COMPRESSION: **0.3**

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SWELL/CONSOLIDATION TEST RESULTS

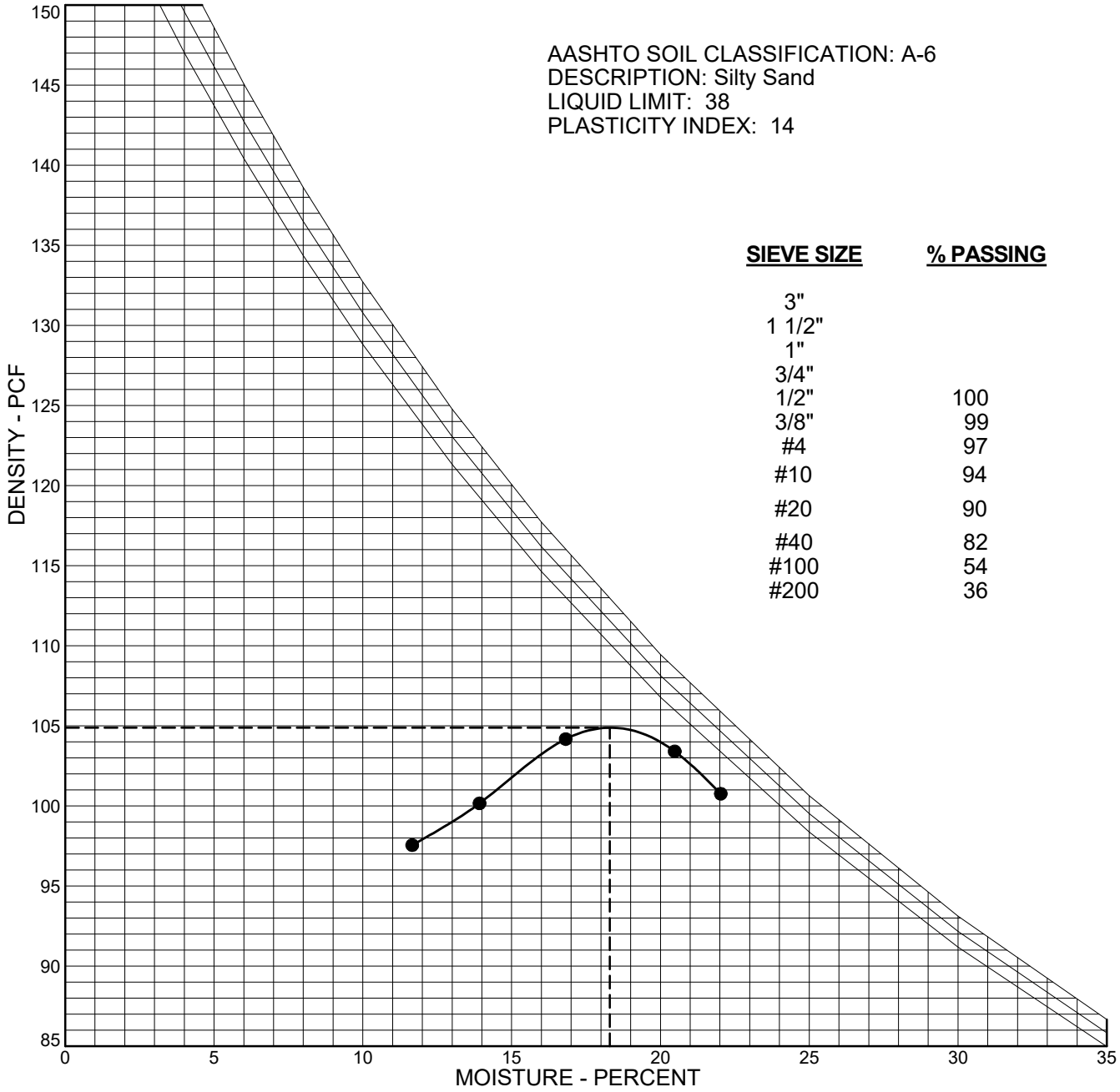
JOB No. 171800

FIGURE No. 12

DATE May 12, 2020

CLIENT: **Covington Properties, LLC** SAMPLE NUMBER: **A-6 PROCTOR Pvm't Design**

PROJECT: Gardens at North Carefree, El Paso County, Colorado



AASHTO SOIL CLASSIFICATION: A-6
DESCRIPTION: Silty Sand
LIQUID LIMIT: 38
PLASTICITY INDEX: 14

SIEVE SIZE	% PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	100
3/8"	99
#4	97
#10	94
#20	90
#40	82
#100	54
#200	36

DESIGNATION **AASHTO 698A**
MAX. DRY DENSITY **104.8 pcf**
OPTIMUM MOISTURE **18.3 %**
FRACTION USED **#4**
MOLD VOLUME **0.0332 cu.ft.**

NOTE:
ZERO AIR VOIDS CURVES PLOTTED FOR:
Gs = 2.60
Gs = 2.65
Gs = 2.70

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MOISTURE-DENSITY RELATION CURVE

JOB No. 171800

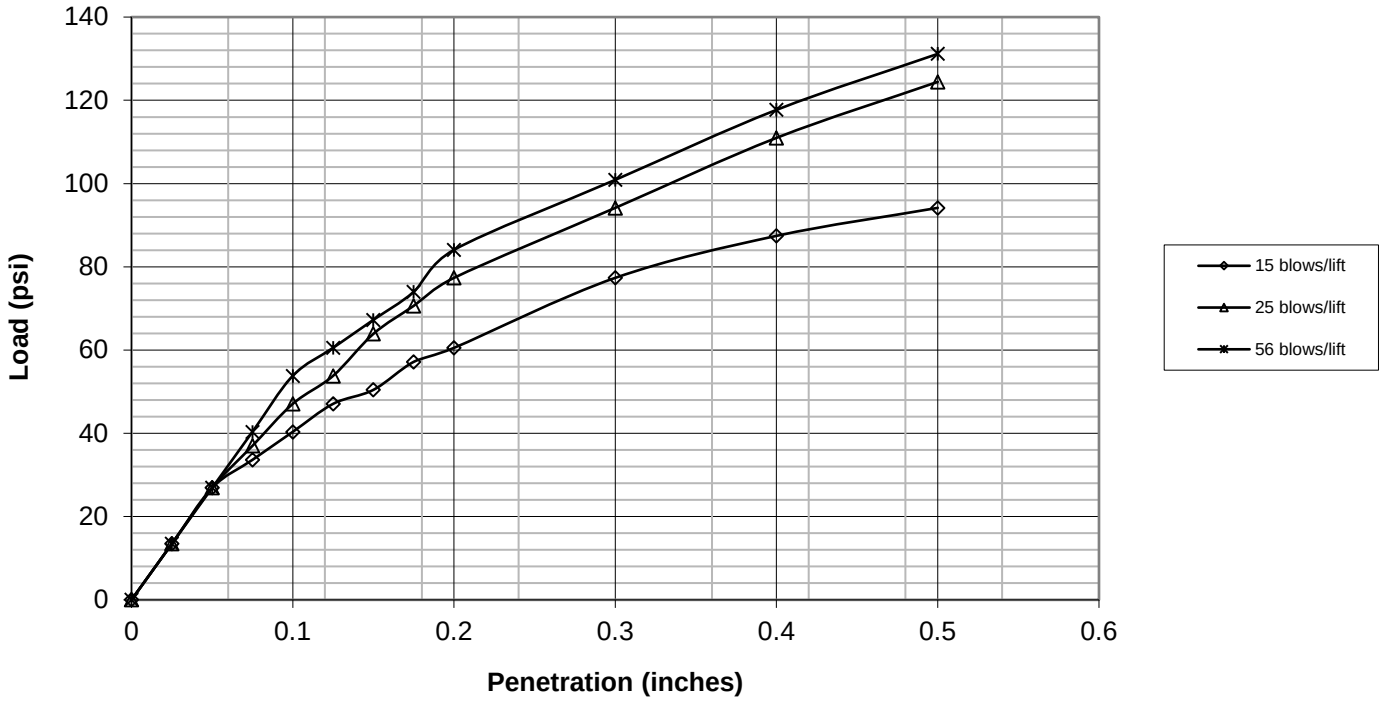
FIGURE No. 13

DATE May 12, 2020

CALIFORNIA BEARING RATIO TEST RESULTS

PROJECT: Gardens at North Carefree - Covington
JOB NUMBER: 171800 TEST DATE: 3/13/2020
AASHTO A-6
SAMPLE NUMBER: CBR
SAMPLE LOCATION: Combined Bulk Sample
SOIL DESCRIPTION: Silty Sand

	15 blows/lift	25 blows/lift	56 blows/lift
Penetration (in)	Load (psi)	Load (psi)	Load (psi)
0.000	0.0	0.0	0.0
0.025	13.5	13.5	13.5
0.050	26.9	26.9	26.9
0.075	33.6	37.0	40.4
0.100	40.4	47.1	53.8
0.125	47.1	53.8	60.5
0.150	50.4	63.9	67.3
0.175	57.2	70.6	74.0
0.200	60.5	77.3	84.1
0.300	77.3	94.2	100.9
0.400	87.4	111.0	117.7
0.500	94.2	124.4	131.2



	15 blows/lift	25 blows/lift	56 blows/lift
Corrected Penetration (in)	Corrected Load (psi)	Corrected Load (psi)	Corrected Load (psi)
0.1	4.0	4.7	5.4
0.2	4.0	5.2	5.6

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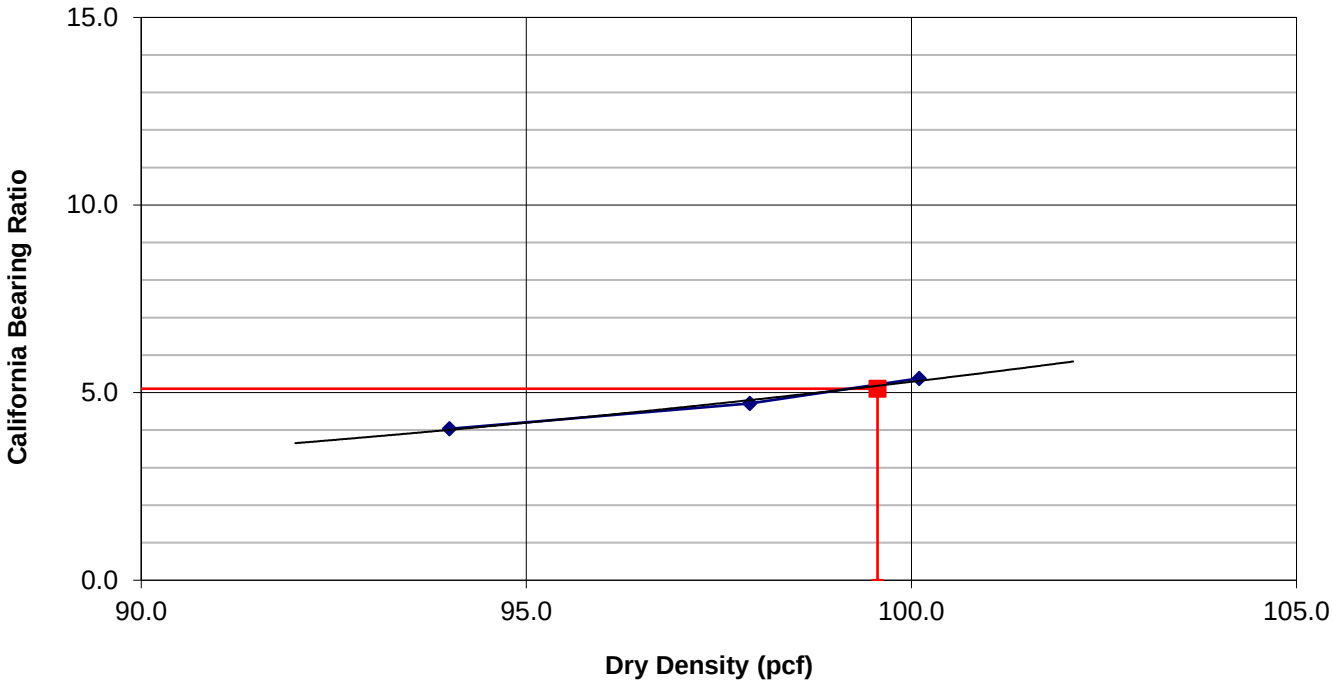
Figure No. 14

CALIFORNIA BEARING RATIO TEST RESULTS

PROJECT:	Gardens at North Carefree - Covington
JOB NUMBER:	171800
TEST DATE:	3/13/2020
AASHTO CLASSIFICATION:	A-6
SAMPLE NUMBER:	CBR
SAMPLE LOCATION:	Combined Bulk Sample
SOIL DESCRIPTION:	Silty Sand

	15 blows/lift	25 blows/lift	56 blows/lift
Corrected California Bearing Ratio	4.0	4.7	5.4
Dry Density (pcf)	94.0	97.9	100.1
Percent Compaction	90	93	96
Percent Moisture After Soaking	29.7	29.4	27.2
Percent Expansion/Compression	0.5	0.5	0.3
Surcharge Weight (lbs)	12.60	12.60	12.60



California Bearing Ratio	**5.1**
Dry Density (pcf)	104.8
Percent Compaction	95.00%
Target Dry Density	99.6
Compaction Test Method	ASTM D-698
Condition of sample	Soaked

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Figure No. 15

APPENDIX A

AASHTO Structural Number

1993 AASHTO Empirical Equation for Flexible Pavements

Equation Solver | Variable Descriptions and Typical Values | Precautions

Type in data in the grey boxes and click the calculate button to see the output. To make additional calculations, change the desired input data and click the calculate button again. Click on the text descriptions of the input or output variables for more information.

INPUT

1. Loading

Total Design ESALs (W_{18}): 292000

2. Reliability

Reliability Level in percent (R): 80

Combined Standard Error (S_0): 0.45

3. Serviceability

Initial Serviceability Index (p_i): 4.2

Terminal Serviceability Index (p_t): 2

4. Layer Parameters

Number of Base Layers: 0

	a	m	M_R	Min. Depth
Surface	0.44	1.0	N/A	0
Subgrade	N/A	N/A	7650	N/A

OUTPUT

1. Calculation Parameters

Standard Normal Deviate (z_R): -0.841

ΔPSI: 2.2

Design Structural Number (SN): 2.595

2. Layer Depths (to the nearest 1/2 inch)

Surface: 6

Total SN based on layer depths: 2.64

See Solution Details

Comments

Calculate