

Architectural
Structural
Geotechnical



Materials Testing
Forensic
Civil/Planning

PAVEMENT DESIGN REPORT

**Skyline at Lorson Ranch, Filing No. 1
El Paso County, Colorado**

PREPARED FOR:

**Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO**

JOB NO. 188710

**September 8, 2022
Revised September 27, 2022**

Respectfully Submitted,

RMG – Rocky Mountain Group

A handwritten signature in blue ink, appearing to read 'J McElmeel', is written over a faint circular stamp.

**Jared McElmeel, E.I.
Geotechnical Staff Engineer**

Reviewed by,

RMG – Rocky Mountain Group

**Tony Munger, P.E.
Sr. Geotechnical Project Manager**

**APPROVED
Engineering Review**

09/29/2022 10:08:11 AM

dsdrice

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EPC Planning & Community
Development Department
Condition: For the Local
Residential roads, only
Option 1 may be used.



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GENERAL SITE AND PROJECT DESCRIPTION

Location

The site is generally located north and east of the intersection of Grayling Drive and Fountain Boulevard, in the southeast portion of El Paso County, Colorado. The location of the site is shown on the Site Vicinity Map, Figure 1.

Existing Site Conditions

At the time of our investigation, the project site was overlot graded, the roadways were rough graded and utilities had been installed. Curb and gutter had not been installed.

Project Description

The site is a continuation of the PUD Development Plan dated September 15, 2021. This pavement design includes the proposed streets Lamprey Drive, Garganey Drive, Sora Street, and Grayling Drive. Lamprey Drive, Garganey Drive, and Sora Street are classified as Urban Local Residential. Grayling Drive is classified as Urban Residential Collector.

FIELD INVESTIGATION AND LABORATORY TESTING

Drilling

The field exploration was conducted by drilling six borings at the locations shown on Figure 2.1. The borings were drilled on July 25, 2022 with a truck mounted drill rig powering 4-inch diameter, solid stem augers. Borings extended to 5 and 10 feet depth. The borings were logged by a representative of RMG. Samples of the subsurface materials were obtained with 2 ½ inch O.D. modified California samplers in accordance with ASTM D3550. Depths at which the samples were taken and the penetration resistance values are shown on the Test Boring Logs. Bulk samples were also obtained from each boring from a depth of about 0 to 2 feet in each boring and returned to our laboratory for review and testing. An explanation of Test Boring Logs is presented in Figure 3. Test Boring Logs are presented in Figures 4 through 6.

Laboratory Testing

Grain-size analyses and Atterberg limits tests were performed on the combined samples obtained from the borings for purposes of classification and obtaining pertinent engineering parameters. A moisture-density relationship curve and a California Bearing Ratio (CBR) test were performed on a composite bulk sample obtained from all ten Test Borings, TB-1 through TB-6. A Summary of Laboratory Test Results is presented in Figure 7. Soil Classification Data are presented in Figures 8 and 9. Denver Swell/Consolidation Test results are presented in Figures 10 through 12. The Moisture Density Relationship Curve is presented in Figure 13. The CBR Test Results are presented in Figures 14 and 15.

SUBSURFACE CONDITIONS

Subsurface Materials

The soil encountered in all the borings, TB-1 through TB-6, consisted of sandy clay and claystone. These soils classify as fine-grained soils, silts and clays (CL-CH) in accordance with the Unified Soil Classification System. For pavement design purposes, the soil classifies as A-7-6 in accordance with the American Association of State Highway and Transportation Officials (AASHTO) classification system.

A composite bulk sample from all of the Test Borings, A-7-6 soil, was tested to determine its moisture-density relationship curve in accordance with ASTM D698 (Standard Proctor compaction test). Maximum Dry Density proved to be 103.8 pcf at 18.7 percent moisture. A CBR test was performed in accordance with Appendix D.2.4 of the El Paso County Engineering Criteria Manual (EPCECM) at varying densities at moisture content near optimum. At 95% of the maximum Modified Proctor density, the CBR of the bulk sample was 1.7.

The developer intends to install a composite roadway section consisting of Hot Mix Asphalt over Aggregate Base Course (ABC).

Groundwater

Groundwater was not encountered in the test borings during field exploration. While groundwater is not expected to be a factor in pavement construction on this site, fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

PAVEMENT DESIGN

The following pavement design is based on the subsurface conditions encountered in the test borings and on the project characteristics previously described. If conditions are different from those described in this report or the project characteristics change, RMG should be retained to review our recommendations and adjust them, if necessary.

Pavement Design

This pavement design was prepared in accordance with the El Paso County Pavement Design Criteria Manual. Pavement design is based on A-7-6 soil as gathered from TB-1 through TB-6.

Street Classification – Urban Local Residential

- 1) Lamprey Drive, Sora Street, Garganey Drive
ESAL = 292,000 (Table D-2)

Serviceability Index = 2.0 (Table D-1)

2) Strength coefficients (Table D-3)

Asphalt (HMA): $a_1 = 0.44$

Aggregate Base Course: $a_2 = 0.11$

3) Subgrade

$M_r = \text{CBR} \times 1500 = 1.7 \times 1500 = 2,550 \text{ psi}$

4) Structural number (SN) = 3.65 (Flexible Pvm't Nomograph, Appendix A)

Structural number (SN) = 3.66 (Calculation, Flexible Pvm't Nomograph equation)

5) Composite HMA/ABC section

Minimum HMA thickness = $D_1 = 3.0$ inches (Table D-2)

ABC thickness = $D_2 = \{\text{SN} - (D_1 \times a_1)\} / a_2 = \{3.66 - (3.0 \times 0.44)\} / 0.11 = 21.3$ 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.*

$\text{SN} = (5.25 \times 0.44) + (12.5 \times 0.11) = 3.69 > 3.66$ (Min. SN required)

Use HMA thickness = 5.25 inches and ABC thickness = 12.5 inches

Street Classification – Urban Residential Collector

1) Grayling Drive

ESAL = 821,000 (Table D-2)

Serviceability Index = 2.5 (Table D-1)

2) Strength coefficients (Table D-3)

Asphalt (HMA): $a_1 = 0.44$

Aggregate Base Course: $a_2 = 0.11$

3) Subgrade

$M_r = \text{CBR} \times 1500 = 1.7 \times 1500 = 2,550 \text{ psi}$

4) Structural number (SN) = 4.50 (Flexible Pvm't Nomograph, Appendix A)

Structural number (SN) = 4.58 (Calculation, Flexible Pvm't Nomograph equation)

5) Composite HMA/ABC section

Minimum HMA thickness = $D_1 = 4.0$ inches (Table D-2)

ABC thickness = $D_2 = \{\text{SN} - (D_1 \times a_1)\} / a_2 = \{4.58 - (4.0 \times 0.44)\} / 0.11 = 25.6$ 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.

$$SN = (7.5 \times 0.44) + (12.0 \times 0.11) = 4.62 > 4.58 \text{ (Min. SN required)}$$

Use HMA thickness = 7.5 inches and ABC thickness = 12 inches

Pavement Thickness

Based on the design calculations, the recommended pavement sections are presented below and on Figure 2.2.

Option 2 base course thickness exceeds HMA thickness more than 2.5x

| Street | Sample | Required SN | HMA (in.) | ABC (in.) | Calculated SN | OK |
|--|----------|-------------|-----------|-----------|---------------|----|
| Lamprey Drive, Sora Street, Garganey Drive | Option 1 | 3.66 | 5.25 | 12.5 | 3.69 | Y |
| | Option 2 | 3.66 | 5.0 | 13.5 | 3.69 | Y |
| Grayling Drive | Option 1 | 4.58 | 7.5 | 12.0 | 4.62 | Y |
| | Option 2 | 4.58 | 7.0 | 14.0 | 4.62 | Y |

Pavement Materials

Pavement materials should be selected, prepared, and placed in accordance with the 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.

Expansive Soil Mitigation

The EPCECM notes that mitigation measures may be required for expansive soils, shallow ground water, subgrade instability, etc. Based on the AASHTO classification for the soils in this subdivision, the subgrade soils evaluated for this pavement design can be expected to be non-expansive. 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

All fill placed below pavements should be moisture conditioned and compacted in accordance with El Paso County *Standard Specifications Manual*. Prior to placement of the pavement section, the final subgrade should be scarified to a depth of 12 inches, adjusted to within 2 percent of the optimum moisture content and compacted to County specifications. The subgrade should then be proofrolled with a heavy, pneumatic tired vehicle. Areas which deform under wheel loads should be removed and replaced. Base course place atop prepared subgrade should be compacted to at least 95 percent of the maximum modified Proctor density (ASTM D1557).

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 which 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

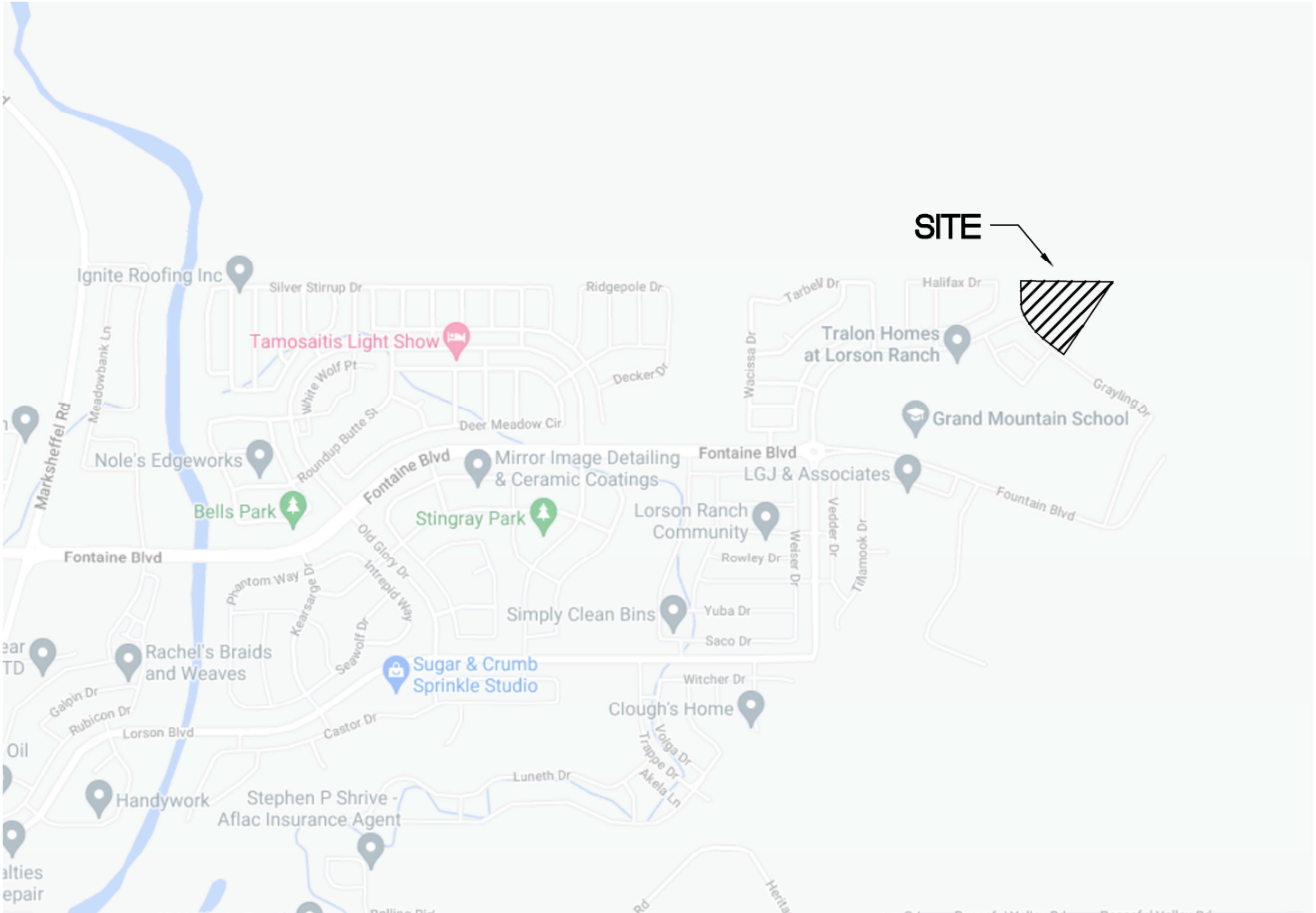
Our field exploration was conducted to provide geotechnical information for pavement thickness design. Variations in subsurface conditions not indicated by the borings may be encountered. This report has been prepared for **Landhuis Company** for application as an aid in the design of the proposed development 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 which 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



NOT TO SCALE

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SITE VICINITY MAP

SKYLINE AT LORSON RANCH
FILING NO. 1
EL PASO COUNTY, COLORADO
LANDHUIS COMPANY

JOB No. 188710

FIG No. 1

DATE 9-8-2022

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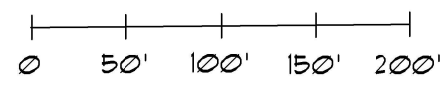
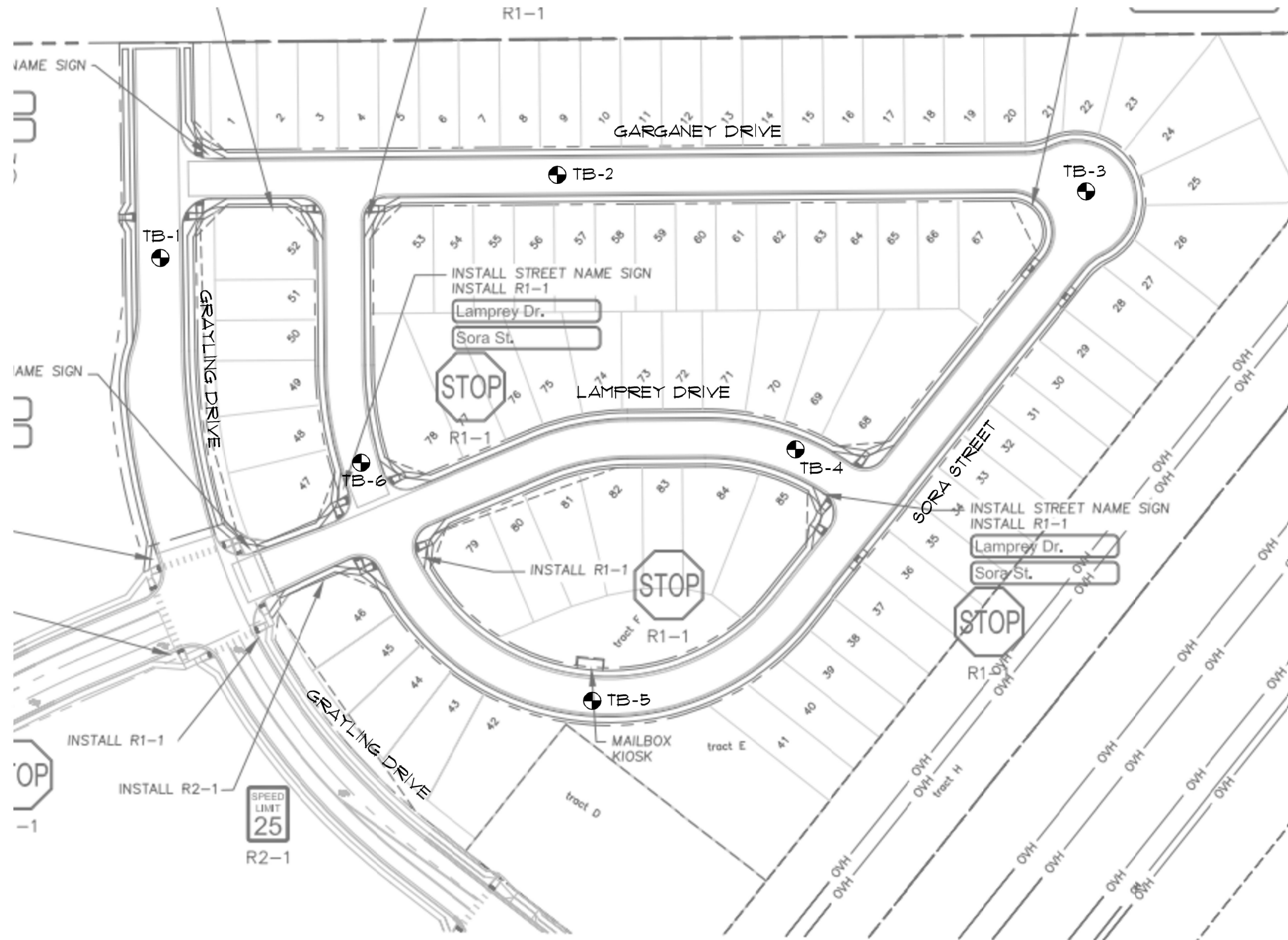


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SCALE: 1" = 100'

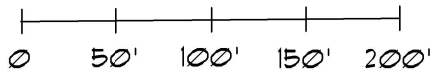
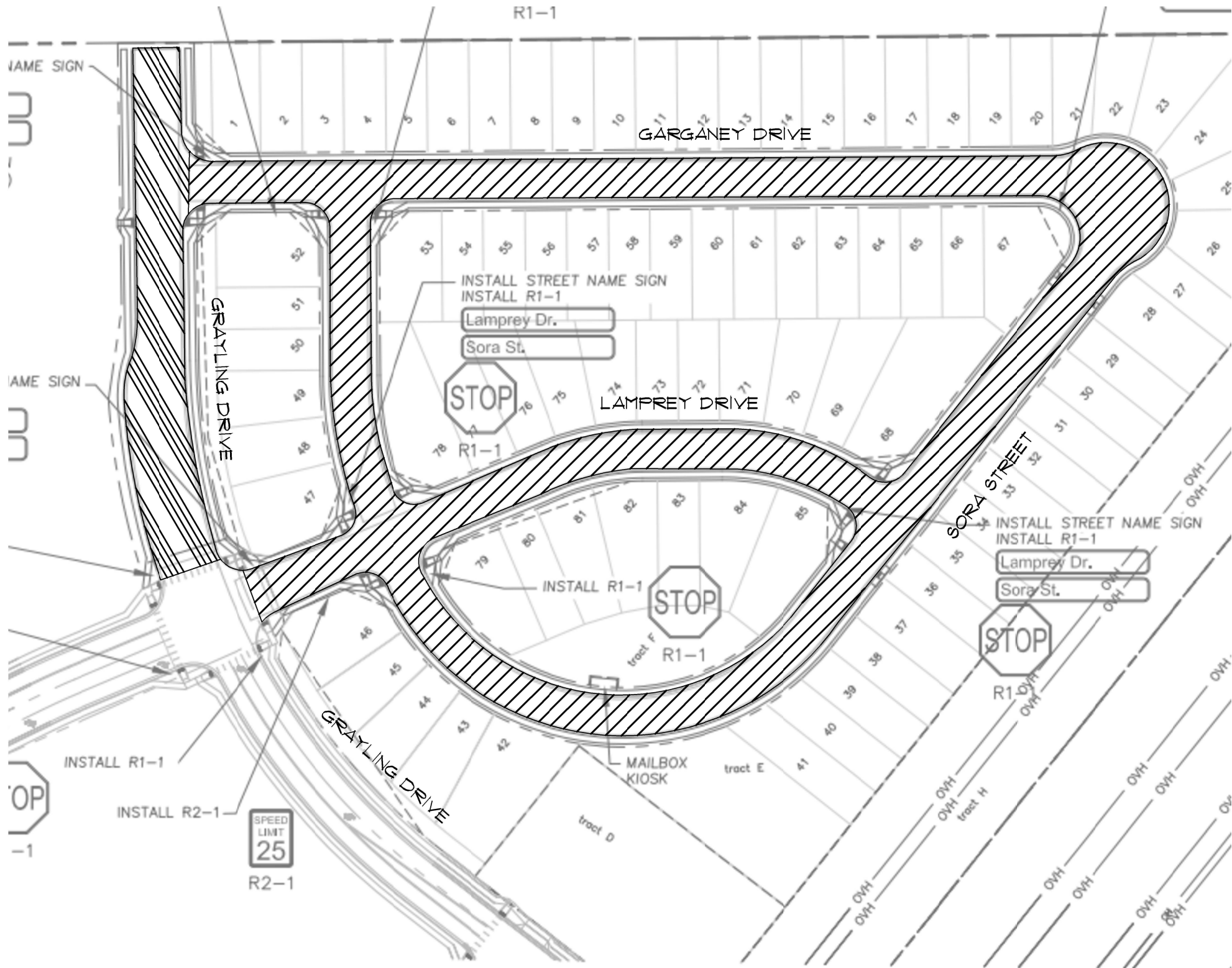
⊕ DENOTES APPROXIMATE LOCATION OF TEST BORINGS

SKYLINE AT LORSON RANCH
FILING NO. 1
EL PASO COUNTY, COLORADO
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| | |
|-------------|----------|
| ENGINEER: | MM |
| DRAWN BY: | NM |
| CHECKED BY: | MM |
| ISSUED: | 9-8-2022 |

TEST BORING LAYOUT PLAN

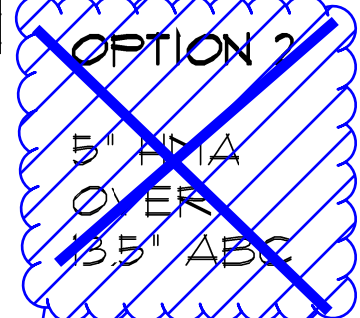
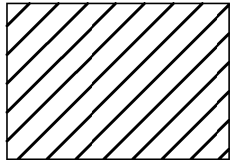
SHEET No. FIG-2.1



SCALE: 1" = 100'

OPTION 1

5.25" HMA
OVER
12.5" ABC



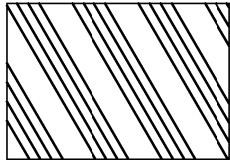
~~**OPTION 2**~~

~~5" HMA
OVER
3.5" ABC~~

Basecourse
thickness exceeds
HMA thickness by
more than 2.5 times.

OPTION 1

7.5" HMA
OVER
12" ABC



OPTION 2

7" HMA
OVER
14" ABC

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| | |
|-------------|----------|
| ENGINEER: | TM |
| DRAWN BY: | NM |
| CHECKED BY: | TM |
| ISSUED: | 9-8-2022 |

**PAVEMENT
RECOMMENDATIONS**

SHEET No.
FIG-2.2

SOILS DESCRIPTION



CLAYSTONE



SANDY CLAY

UNLESS NOTED OTHERWISE, ALL LABORATORY TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
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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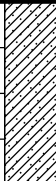



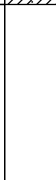



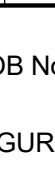

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EXPLANATION OF TEST BORING LOGS

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FIGURE No. 3

DATE Sep/08/2022

| TEST BORING: 1 DATE DRILLED: 7/25/22 NO GROUNDWATER ON 7/25/22 | DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % | TEST BORING: 2 DATE DRILLED: 7/25/22 NO GROUNDWATER ON 7/25/22 | DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|--|------------|---|--|---------------|-----------------|--|------------|---|---|---------------|-----------------|
| CLAY, SANDY, brown, with rust staining, very stiff, moist | 2.5 |  |  | 29 | 12.2 | CLAYSTONE, SANDY, dark brown, with rust staining, medium hard, moist | 2.5 |  |  | 50/11" | 16.9 |
| | 5.0 |  |  | 40 | 11.2 | | 5.0 |  |  | 50/10" | 14.6 |
| | | | | | | | 7.5 |  | | | |
| | | | | | | | 10.0 |  | | 50/11" | 14.5 |

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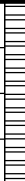







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TEST BORING LOG

JOB No. 188710

FIGURE No. 4

DATE Sep/08/2022

| TEST BORING: 3 DATE DRILLED: 7/25/22 NO GROUNDWATER ON 7/25/22 | DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % | TEST BORING: 4 DATE DRILLED: 7/25/22 NO GROUNDWATER ON 7/25/22 | DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|--|------------|---|---|---------------|-----------------|--|------------|---|---|---------------|-----------------|
| CLAYSTONE, SANDY, dark brown, with rust staining, medium hard, moist | 2.5 |  |  | 50/9" | 12.7 | CLAY, SANDY, dark brown, with rust staining, stiff to very stiff, moist | 2.5 |  |  | 19 | 16.8 |
| | 5.0 |  |  | 50/10" | 13.1 | | 5.0 |  |  | 13 | 15.0 |

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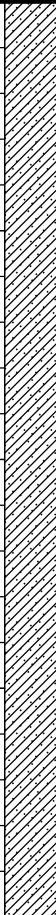

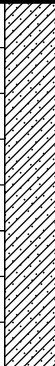

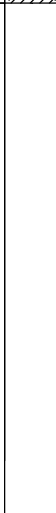




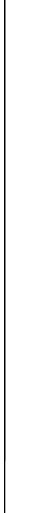



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TEST BORING LOG

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FIGURE No. 5

DATE Sep/08/2022

| TEST BORING: 5 DATE DRILLED: 7/25/22 NO GROUNDWATER ON 7/25/22 | DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % | TEST BORING: 6 DATE DRILLED: 7/25/22 NO GROUNDWATER ON 7/25/22 | DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|--|------------|---|---|---------------|-----------------|--|------------|---|---|---------------|-----------------|
| CLAY, SANDY, dark brown, with rust staining, stiff to very stiff, moist | 2.5 |  |  | 19 | 15.2 | CLAY, SANDY, dark brown, with rust staining, stiff, moist | 2.5 |  |  | 15 | 14.9 |
| | 5.0 |  |  | 19 | 14.4 | CLAYSTONE, SANDY, dark brown, with rust staining, medium hard, moist | 5.0 |  |  | 50/10" | 13.7 |
| | 7.5 |  | | | | | |  | | | |
| | 10.0 |  |  | 12 | 16.9 | | |  | | | |

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TEST BORING LOG

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FIGURE No. 6

DATE Sep/08/2022

| 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 | 12.2 | 100.8 | 41 | 28 | 0.0 | 0.9 | 86.2 | 0.0 | A-7-6 (23) |
| 1 | 4.0 | 11.2 | | | | | | | | |
| 2 | 2.0 | 16.9 | 107.3 | 50 | 40 | 2.8 | 5.6 | 84.8 | 0.9 | A-7-6 (34) |
| 2 | 4.0 | 14.6 | | | | | | | | |
| 2 | 9.0 | 14.5 | | | | | | | | |
| 3 | 2.0 | 12.7 | 111.2 | 50 | 42 | 1.4 | 3.2 | 89.9 | 0.2 | A-7-6 (38) |
| 3 | 4.0 | 13.1 | | | | | | | | |
| 4 | 2.0 | 16.8 | 95.9 | 45 | 30 | 1.1 | 2.4 | 86.1 | 0.2 | A-7-6 (26) |
| 4 | 4.0 | 15.0 | | | | | | | | |
| 5 | 2.0 | 15.2 | 108.8 | 41 | 30 | 1.2 | 1.8 | 86.2 | 0.0 | A-7-6 (25) |
| 5 | 4.0 | 14.4 | | | | | | | | |
| 5 | 9.0 | 16.9 | | | | | | | | |
| 6 | 2.0 | 14.9 | 109.1 | 49 | 34 | 1.8 | 3.4 | 86.9 | 0.2 | A-7-6 (30) |
| 6 | 4.0 | 13.7 | | | | | | | | |

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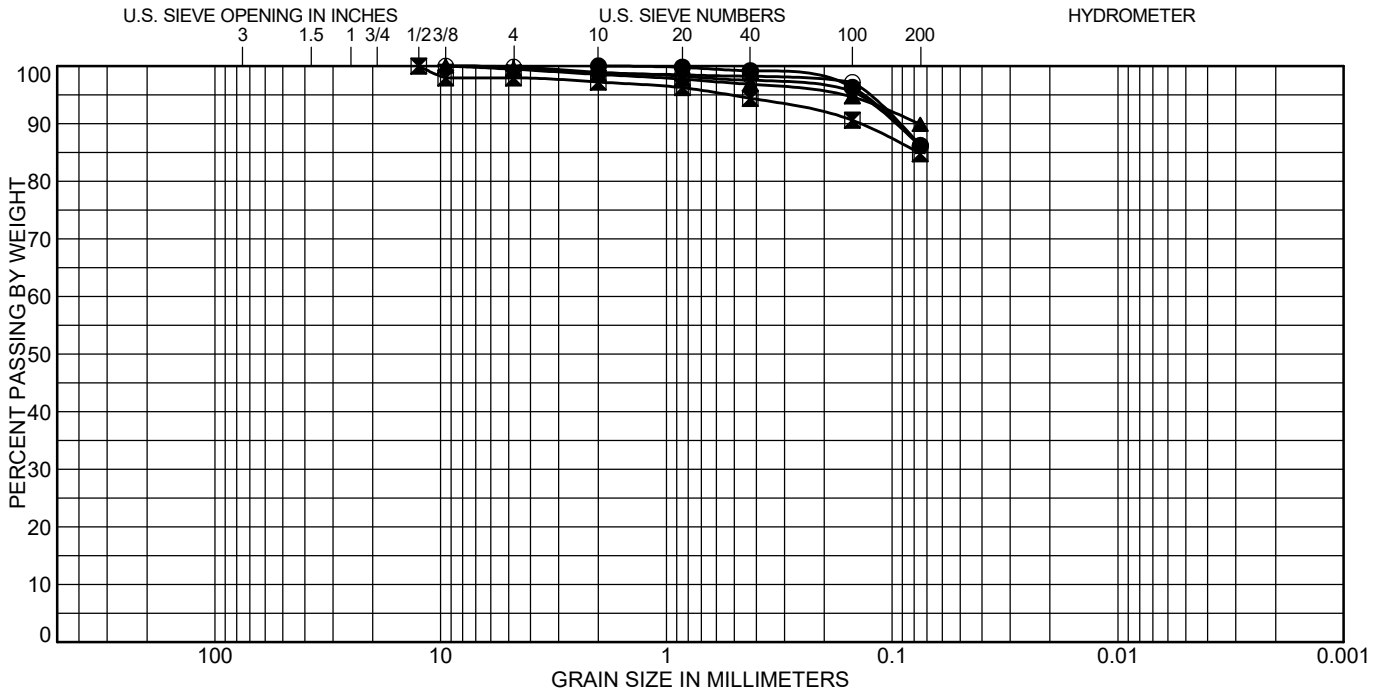
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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 188710
 FIGURE No. 7
 PAGE 1 OF 1
 DATE Sep/08/2022



| | | | | | | |
|---------|--------|------|--------|--------|------|--------------|
| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
| | coarse | fine | coarse | medium | fine | |

| Test Boring | Depth (ft) | Classification | LL | PL | PI |
|-------------|------------|------------------------|----|----|----|
| ● 1 | 2.0 | LEAN CLAY(CL) | 41 | 13 | 28 |
| ☒ 2 | 2.0 | FAT CLAY with SAND(CH) | 50 | 10 | 40 |
| ▲ 3 | 2.0 | FAT CLAY(CH) | 50 | 8 | 42 |
| ★ 4 | 2.0 | LEAN CLAY(CL) | 45 | 15 | 30 |
| ⊙ 5 | 2.0 | LEAN CLAY(CL) | 41 | 11 | 30 |

| Test Boring | Depth (ft) | %Gravel | %Sand | %Silt | %Clay |
|-------------|------------|---------|-------|-------|-------|
| ● 1 | 2.0 | 0.0 | 13.8 | 86.2 | |
| ☒ 2 | 2.0 | 2.1 | 13.2 | 84.8 | |
| ▲ 3 | 2.0 | 0.6 | 9.6 | 89.9 | |
| ★ 4 | 2.0 | 0.1 | 13.8 | 86.1 | |
| ⊙ 5 | 2.0 | 0.2 | 13.6 | 86.2 | |

ROCKY MOUNTAIN GROUP

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RMG

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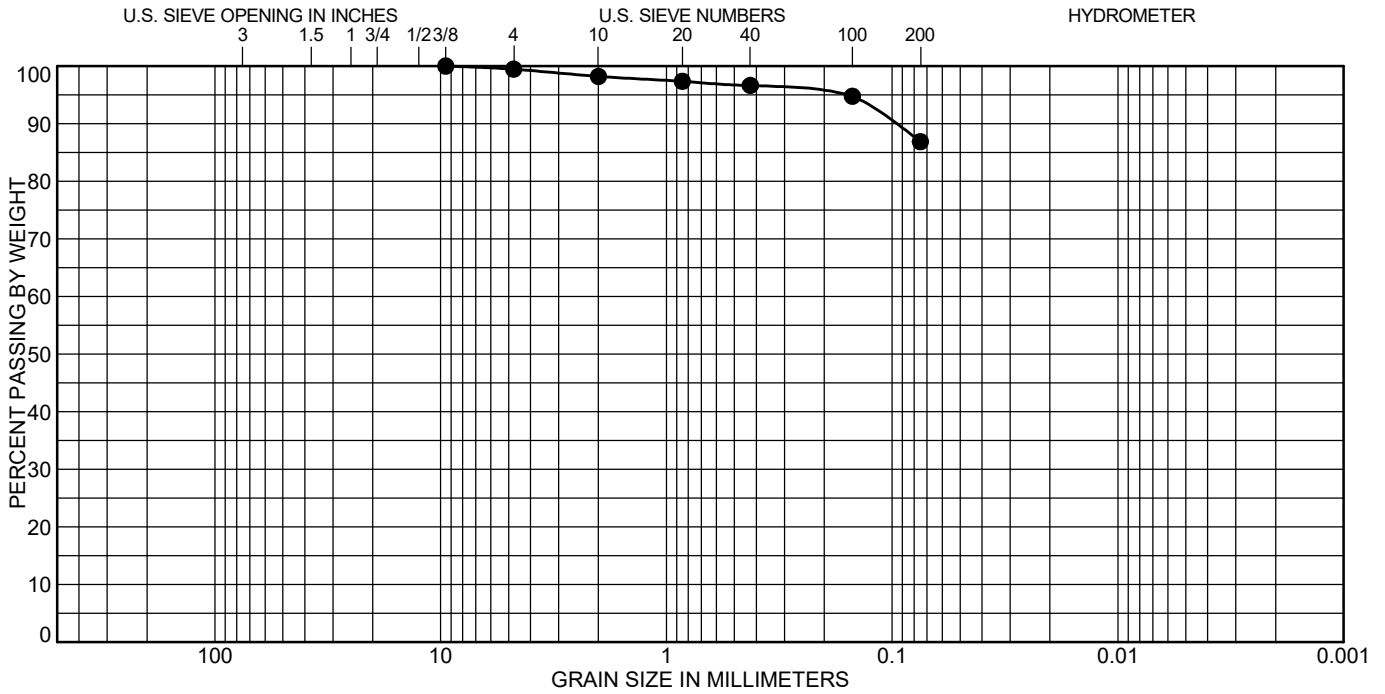
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SOIL CLASSIFICATION DATA

JOB No. 188710

FIGURE No. 8

DATE Sep/08/2022



| | | | | | | |
|---------|--------|------|--------|--------|------|--------------|
| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
| | coarse | fine | coarse | medium | fine | |

| Test Boring | Depth (ft) | Classification | LL | PL | PI |
|-------------|------------|----------------|----|----|----|
| ● 6 | 2.0 | LEAN CLAY(CL) | 49 | 15 | 34 |
| | | | | | |
| | | | | | |

| Test Boring | Depth (ft) | %Gravel | %Sand | %Silt | %Clay |
|-------------|------------|---------|-------|-------|-------|
| ● 6 | 2.0 | 0.5 | 12.6 | 86.9 | |
| | | | | | |
| | | | | | |

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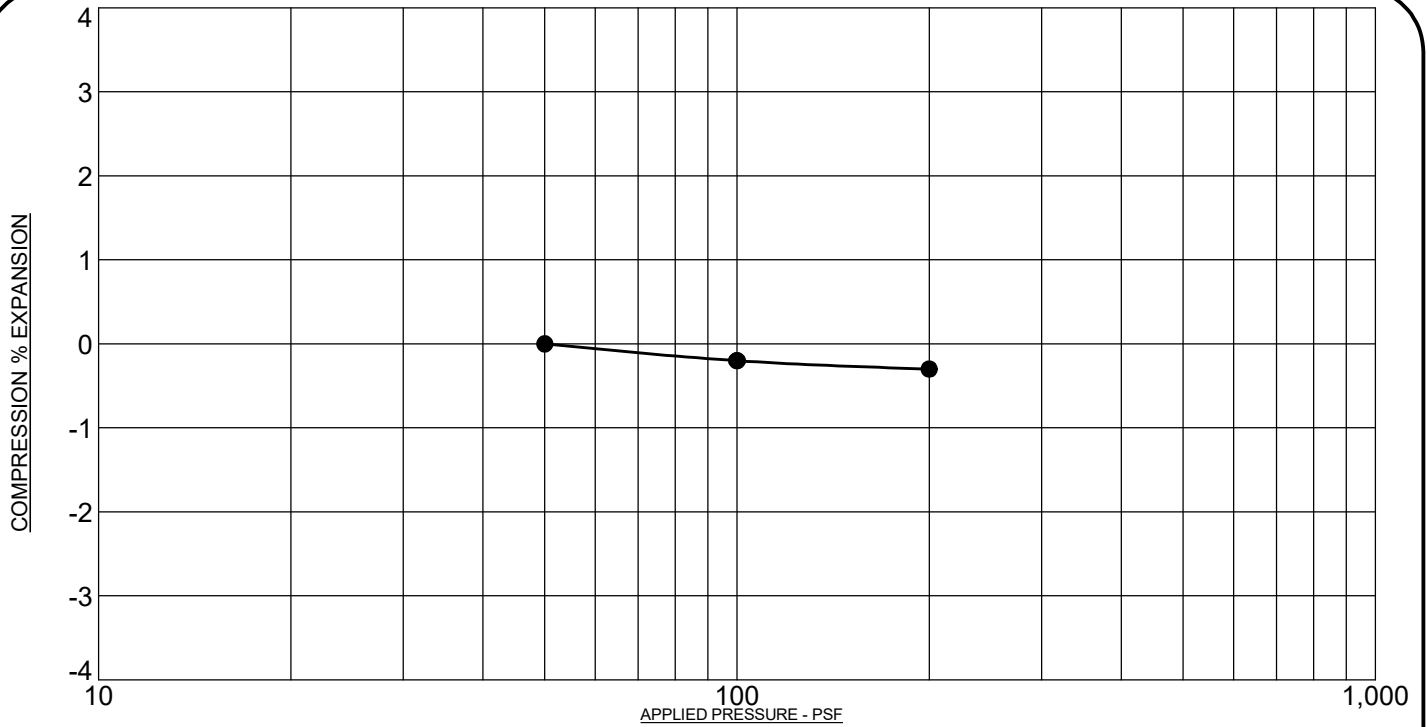
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SOIL CLASSIFICATION DATA

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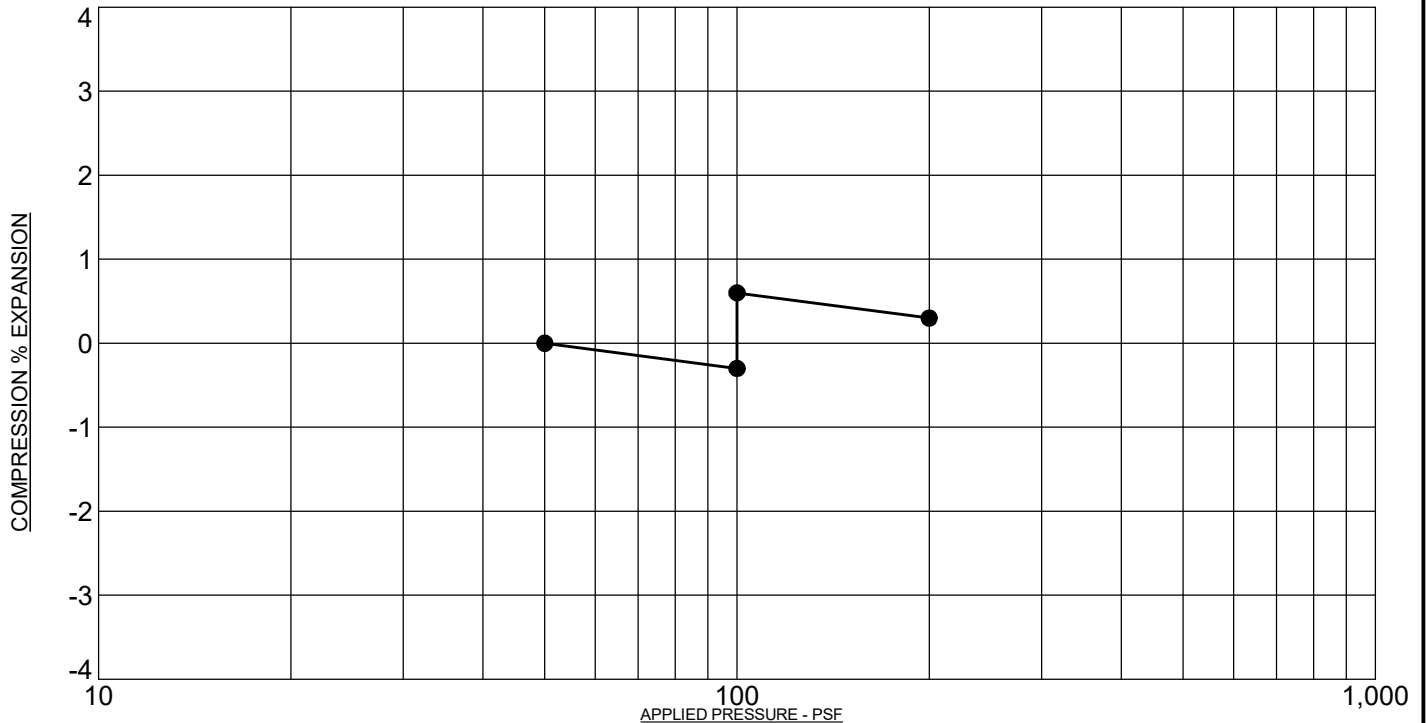
FIGURE No. 9

DATE Sep/08/2022



PROJECT: Grayling Dr El Paso County, Colorado
 RMG SOIL TYPE:
 SAMPLE DESCRIPTION: CLAY, SANDY
 NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: 1 @ 2 FT
 NATURAL DRY UNIT WEIGHT: 107.8 PCF
 NATURAL MOISTURE CONTENT: 12.2%
 PERCENT SWELL/COMPRESSION: 0.0



PROJECT: Grayling Dr El Paso County, Colorado
 RMG SOIL TYPE:
 SAMPLE DESCRIPTION: CLAYSTONE, SANDY
 NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: 2 @ 2 FT
 NATURAL DRY UNIT WEIGHT: 107.3 PCF
 NATURAL MOISTURE CONTENT: 16.9%
 PERCENT SWELL/COMPRESSION: 0.9

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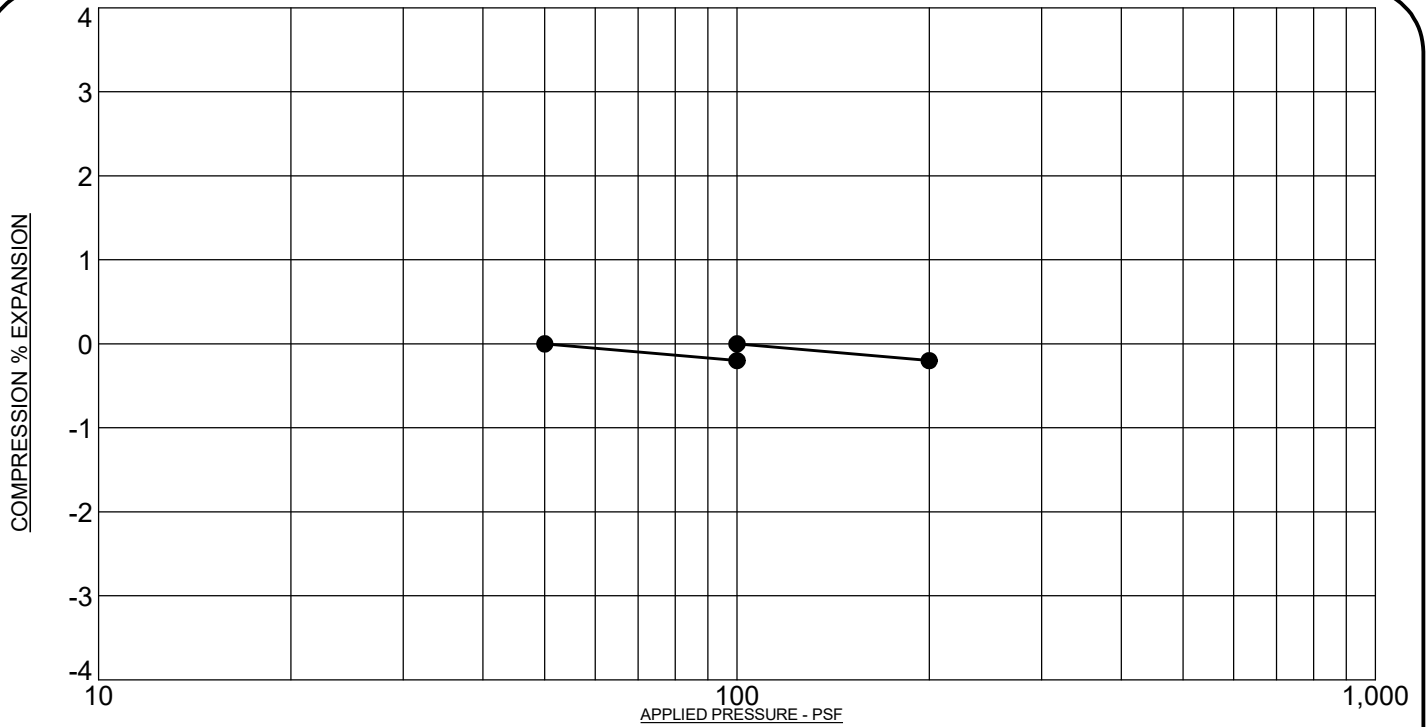
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SWELL/CONSOLIDATION TEST RESULTS

JOB No. 188710

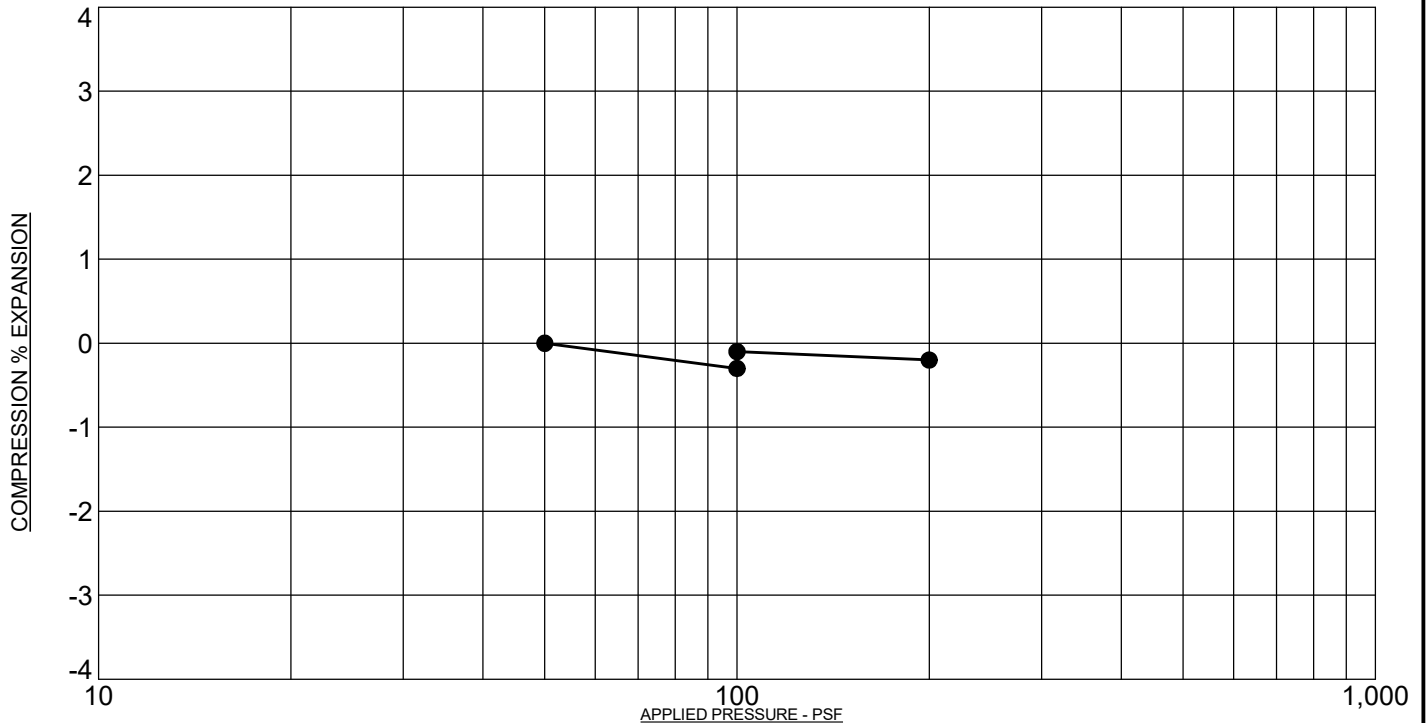
FIGURE No. 10

DATE Sep/08/2022



PROJECT: Grayling Dr El Paso County, Colorado
 RMG SOIL TYPE:
 SAMPLE DESCRIPTION: CLAYSTONE, SANDY
 NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: 3 @ 2 FT
 NATURAL DRY UNIT WEIGHT: 111.2 PCF
 NATURAL MOISTURE CONTENT: 12.7%
 PERCENT SWELL/COMPRESSION: 0.2



PROJECT: Grayling Dr El Paso County, Colorado
 RMG SOIL TYPE:
 SAMPLE DESCRIPTION: CLAY, SANDY
 NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: 4 @ 2 FT
 NATURAL DRY UNIT WEIGHT: 95.9 PCF
 NATURAL MOISTURE CONTENT: 16.8%
 PERCENT SWELL/COMPRESSION: 0.2

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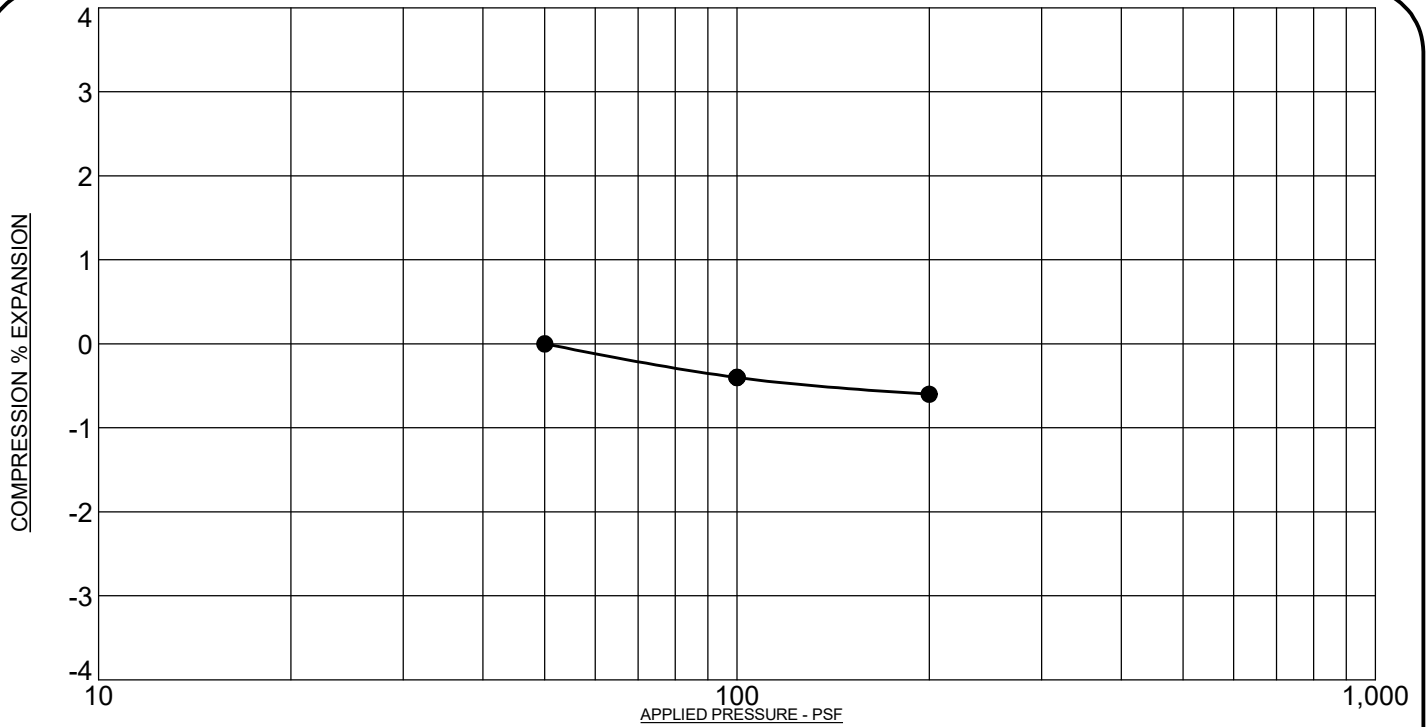
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SWELL/CONSOLIDATION TEST RESULTS

JOB No. 188710

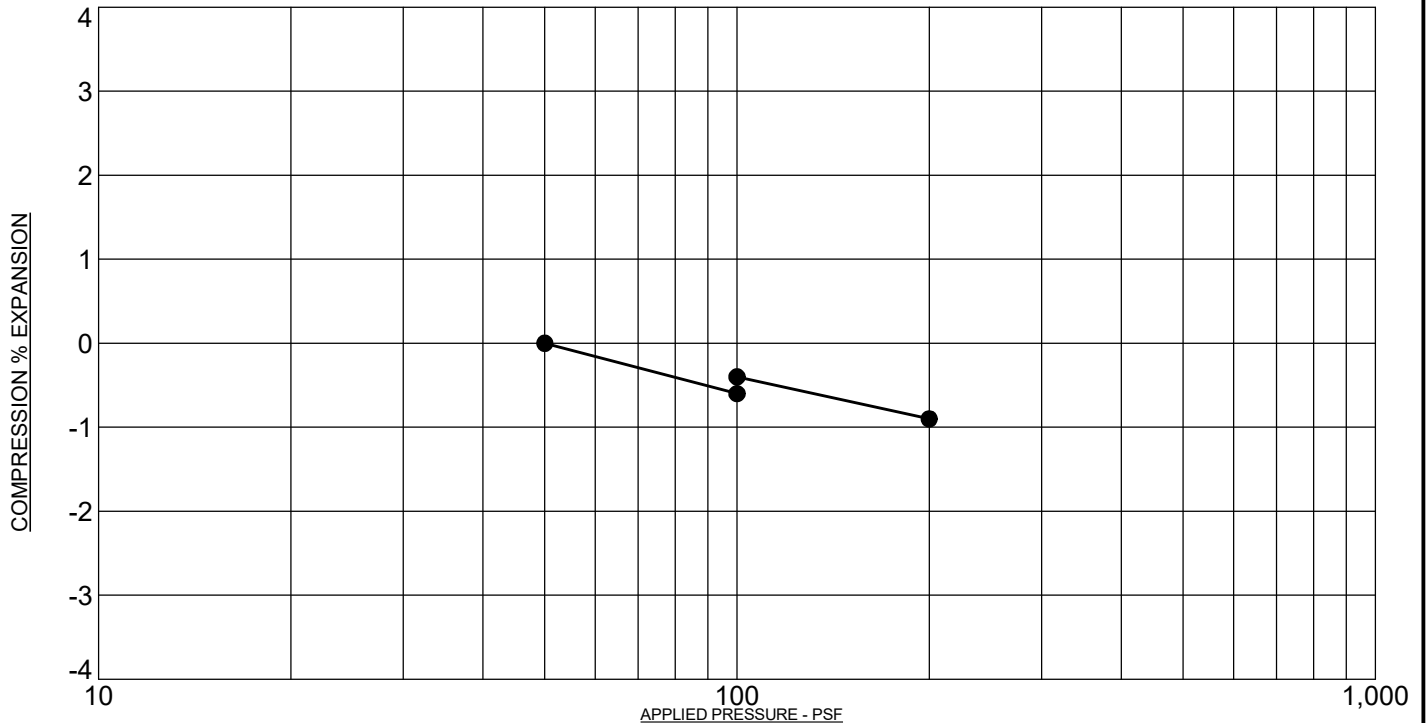
FIGURE No. 11

DATE Sep/08/2022



PROJECT: Grayling Dr El Paso County, Colorado
 RMG SOIL TYPE:
 SAMPLE DESCRIPTION: CLAY, SANDY
 NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: 5 @ 2 FT
 NATURAL DRY UNIT WEIGHT: 108.8 PCF
 NATURAL MOISTURE CONTENT: 15.2%
 PERCENT SWELL/COMPRESSION: 0.0



PROJECT: Grayling Dr El Paso County, Colorado
 RMG SOIL TYPE:
 SAMPLE DESCRIPTION: CLAY, SANDY
 NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: 6 @ 2 FT
 NATURAL DRY UNIT WEIGHT: 109.1 PCF
 NATURAL MOISTURE CONTENT: 14.9%
 PERCENT SWELL/COMPRESSION: 0.2

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SWELL/CONSOLIDATION TEST RESULTS

JOB No. 188710

FIGURE No. 12

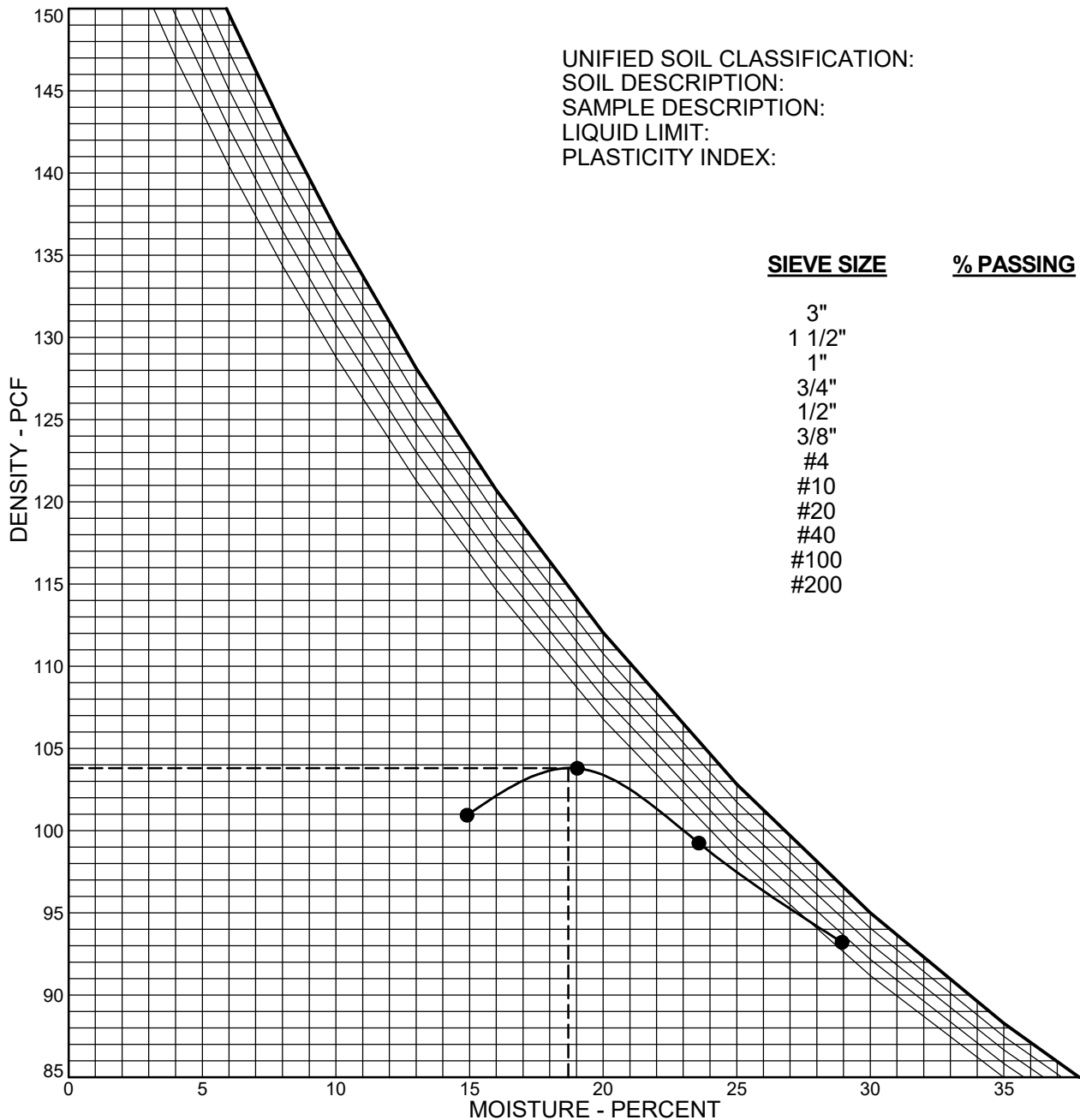
DATE Sep/08/2022

CLIENT: Landhuis Company

SAMPLE NUMBER: A-7-6 Soil

PROJECT: Skyline at Lorson Ranch, Filing No. 1, El Paso County, Colorado

UNIFIED SOIL CLASSIFICATION:
SOIL DESCRIPTION:
SAMPLE DESCRIPTION:
LIQUID LIMIT:
PLASTICITY INDEX:



DESIGNATION **ASTM D-698A**
MAX. DRY DENSITY **103.8 pcf**
OPTIMUM MOISTURE **18.7 %**
FRACTION USED **#4**
MOLD VOLUME **0.0333 cu.ft.**

NOTE: ZERO AIR VOIDS CURVES PLOTTED FOR:
Gs = 2.60
Gs = 2.65
Gs = 2.70
Gs = 2.75
Gs = 2.80

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MOISTURE-DENSITY RELATION CURVE

JOB No. 188710

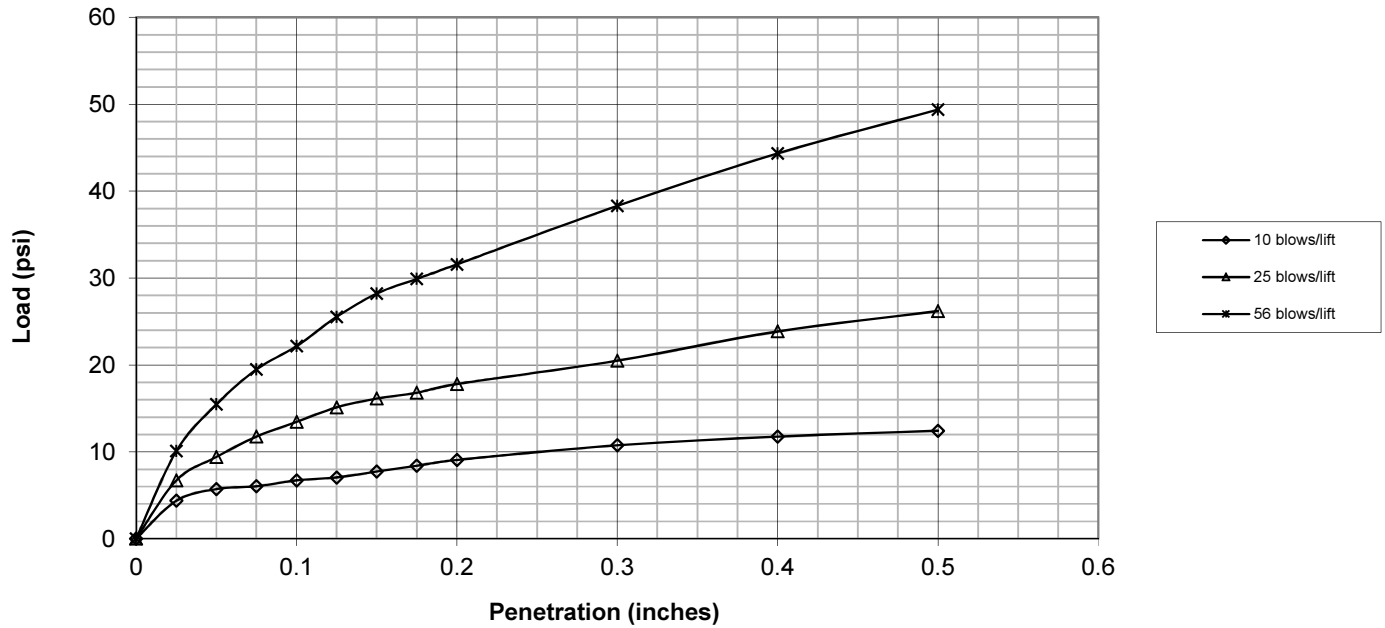
FIGURE No. 13

DATE Sep/08/2022

CALIFORNIA BEARING RATIO TEST RESULTS

Project: Skyline at Lorson Ranch, Filing No. 1
 Job No.: 188710
 AASHTO Classification: A-7-6
 Sample Number: CBR
 Sample Location: Combined Bulk Sample
 Soil Description: Sandy Clay

| Penetration (in) | 10 blows/lift | 25 blows/lift | 56 blows/lift |
|---------------------|---------------|---------------|---------------|
| | Load (psi) | Load (psi) | Load (psi) |
| 0.000 | 0.0 | 0.0 | 0.0 |
| 0.025 | 4.4 | 6.7 | 10.1 |
| 0.050 | 5.7 | 9.4 | 15.5 |
| 0.075 | 6.0 | 11.8 | 19.5 |
| 0.100 | 6.7 | 13.4 | 22.2 |
| 0.125 | 7.1 | 15.1 | 25.5 |
| 0.150 | 7.7 | 16.1 | 28.2 |
| 0.175 | 8.4 | 16.8 | 29.9 |
| 0.200 | 9.1 | 17.8 | 31.6 |
| 0.300 | 10.7 | 20.5 | 38.3 |
| 0.400 | 11.8 | 23.9 | 44.3 |
| 0.500 | 12.4 | 26.2 | 49.4 |



| | Corrected Penetration (in) | Corrected Load (psi) |
|---------------|----------------------------------|-------------------------|
| 10 blows/lift | 0.100 | 0.7 |
| 25 blows/lift | 0.100 | 1.3 |
| 56 blows/lift | 0.100 | 2.2 |

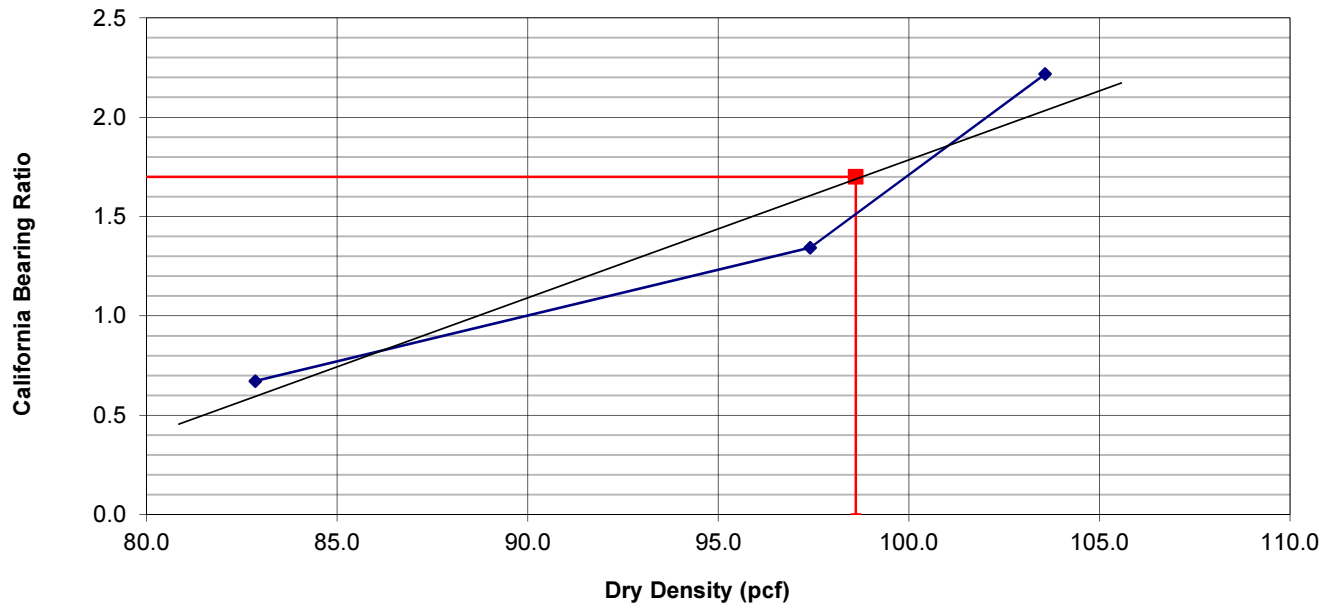


Figure No. 14

CALIFORNIA BEARING RATIO TEST RESULTS

Project: Skyline at Lorson Ranch, Filing No. 1
 Job No.: 188710
 AASHTO Classification" A-7-6
 Sample Number: CBR
 Sample Location: Combined Bulk Sample
 Soil Description: Sandy Clay

| | 10 blows/lift | 25 blows/lift | 56 blows/lift |
|---|---------------|---------------|---------------|
| Corrected California Bearing Ratio | 0.7 | 1.3 | 2.2 |
| Dry Density (pcf) | 82.9 | 97.4 | 103.6 |
| Percent Compaction | 80 | 94 | 100 |
| Percent Moisture After Soaking | 38.1 | 34.8 | 31.0 |
| Percent Expansion (+) / Compression (-) | 2.5% | 3.8% | 3.1% |
| Surcharge Weight (lbs) | 12.60 | 12.60 | 12.60 |



| | |
|---------------------------------|------------|
| California Bearing Ratio | 1.7 |
| Dry Density (pcf) | 103.8 |
| Percent Compaction | 95% |
| Target Dry Density | 98.6 |
| Compaction Test Method | ASTM D-698 |
| Condition of sample | Soaked |

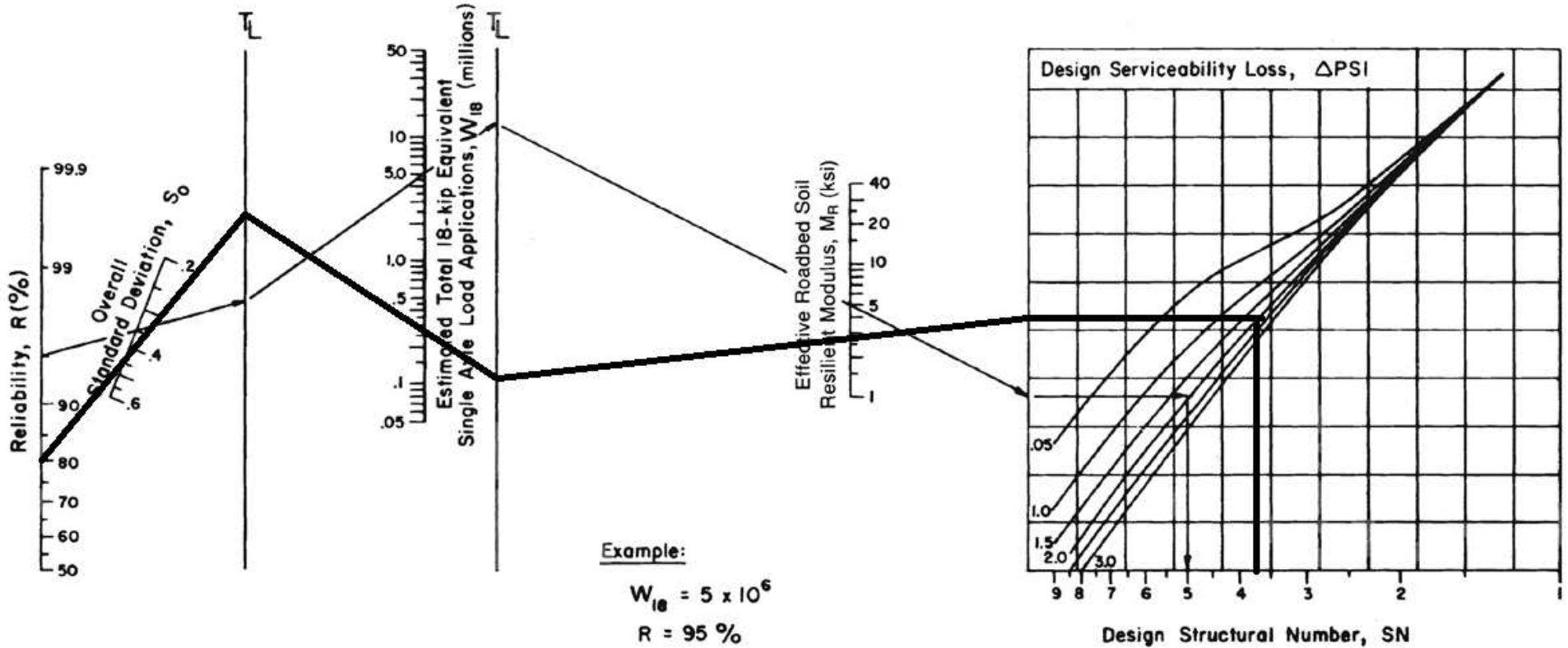


Figure No. 15

APPENDIX A

NOMOGRAPH SOLVES:

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



Example:

$W_{18} = 5 \times 10^6$

$R = 95 \%$

$S_o = 0.35$

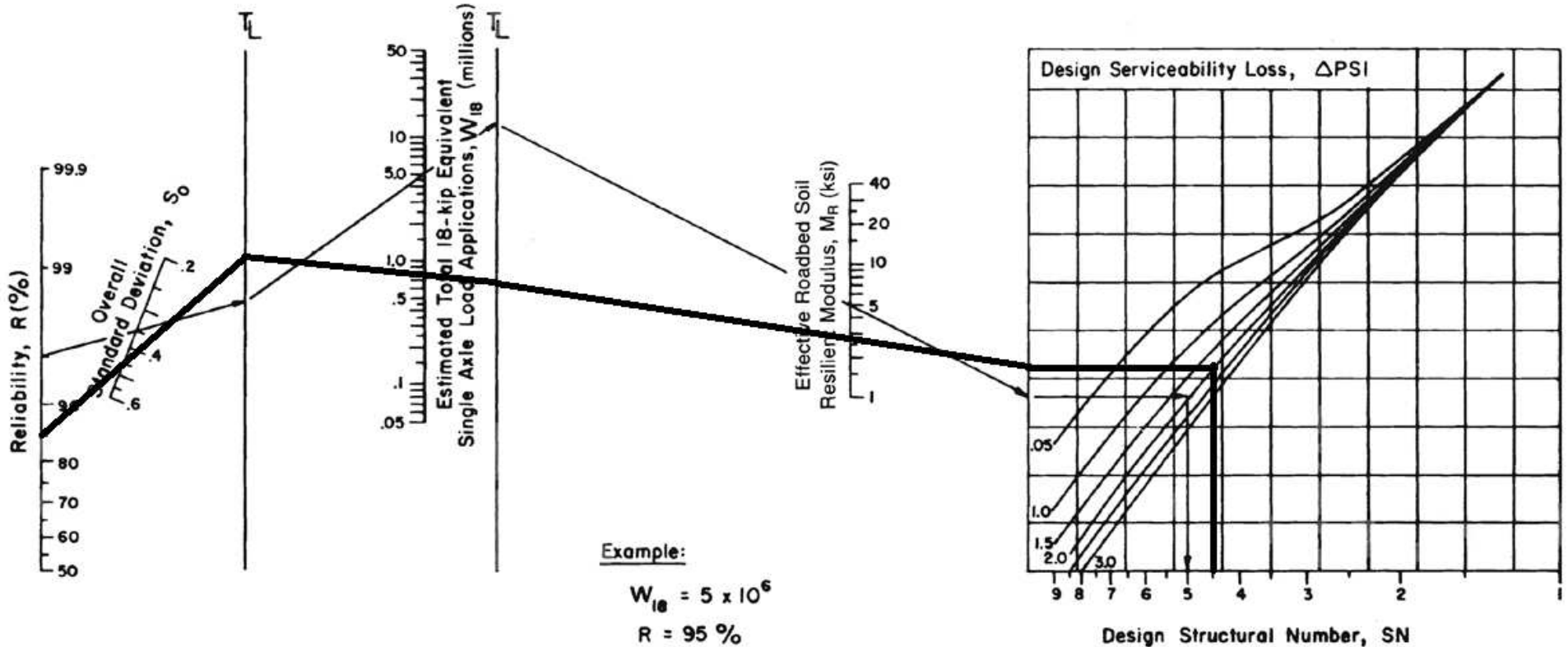
$M_R = 5000$ psi

$\Delta PSI = 1.9$

Solution: $SN = 5.0$

NOMOGRAPH SOLVES:

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



Example:

- $W_{18} = 5 \times 10^6$
- $R = 95 \%$
- $S_o = 0.35$
- $M_R = 5000 \text{ psi}$
- $\Delta \text{PSI} = 1.9$
- Solution: $SN = 5.0$**