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Resources
Conservation
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Construction,
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Subject: ENG - Phase II Soil Mechanics Report
Plum Creek Site 6
Hays County, Texas

Date: SEP 30 2014

To: John Mueller, P.E.
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File Code: 210-22
Job No: 7420

INTRODUCTION

The phase II Soil Mechanics Report is a summary of the test results from the site investigations to date. This report supplements the previous work presented in the Phase I Soil Mechanics Report, dated July 21st, 2014, and presents additional data gathered.

An additional fourteen undisturbed Shelby tube samples were submitted from the Plum Creek Site 6 embankment dam for soil mechanics testing. Nine of the undisturbed Shelby tube samples were taken from the longitudinal centerline of the existing embankment, four from the principal spillway alignment, and one from the downstream toe near the auxiliary spillway.

SOIL MECHANICS TESTING

Index Properties and Classification

Index data, classification based on the Unified Soil Classification System (USCS), dispersion data, and compaction test results are summarized in tabular form in Attachment 1. Undisturbed sample characteristics are summarized in Attachment 2 for the undisturbed samples along with photos of the extruded soil samples. Also, a borehole location map as developed by NRCS Texas Geologist, Bryan Moffatt, is shown in Attachment 3.

Embankment

Three bore holes were advanced 56 to 60 feet deep along the longitudinal centerline of the existing embankment structure. The nine undisturbed Shelby tube samples for the embankment and foundation provided seventeen soil samples for testing (F14 – 94 (2), F14-95, F14-96, F14-97(2), F14-98, F14-99, F14-100, F14-101A(2), F14-101B, F14-101C(2), F14-102A(2), and F14 - 102B). There was very little variation in the classification of the soil samples tested with the vast majority classifying as fat clay (CH). The Plasticity Index varied from 24 to 49 and the Liquid Limit varied from 45 to 72. One sample classified as lean clay (CL), two samples classified as gravelly fat clay, and the remainder of the samples classified as fat clay (CH).

Principal Spillway

One bore hole was advanced 26 feet along the centerline of the proposed principal spillway pipe. Four undisturbed Shelby tube samples for the principal spillway alignment provided eight soil samples (F14-104A(2), F14-104B(2), F14-105(2), F14-106, F14-107) for testing. These soil samples also demonstrated very little variation in their classification as predominately fat clay (CH) with plasticity index variation of 28 to 46 and liquid limits from 52 to 64. Two samples classified as a fat clay with sand (CH), one as sandy fat clay (CH), and the remainder classified as fat clay (CH).

Borrow

No borrow from the embankment section where the labyrinth weir will be placed has been tested to date. This data will be needed to specify the compaction requirements including the optimum moisture content and the percentage of the maximum dry density.

Shear Strength Testing

Triaxial shear tests with pore pressure measurement data along with unconsolidated undrained shear test data of the in-place existing embankment, downstream toe, and proposed principal spillway alignment are shown below and in Attachment 4.

The selection of failure criteria that was used included both maximum stress ratio and selected points for the triaxial shear tests with pore pressure measurement. The selection of the failure criteria that was used included both less than ten percent strain and selected points for the unconsolidated undrained shear tests.

| Sample No. | | γ_d # / ft ³ | w_{sat} % | USCS | LL | PI | CU' | | | | UU | |
|------------|---------|-----------------------------------|----------------|------|----|----|-------------|--------------------------|--------------|---------------------------|-------------|--------------------------|
| Field | Lab | | | | | | ϕ deg. | c (# / ft ²) | ϕ' deg. | c' (# / ft ²) | ϕ deg. | c (# / ft ²) |
| 1.1 | 14-94 | 102.7 | 22.4 | CH | 63 | 44 | 23 | 155 | 28 | 130 | 0 | 1440 |
| 2.1 | 14-97 | 103.5 | 21.5 | CH | 56 | 40 | 22.5 | 195 | 28 | 165 | 0 | 950 |
| 3.1 | 14-101A | 100.9 | 23.3 | CH | 58 | 42 | 21 | 185 | 25 | 110 | 0 | 1140 |
| 3.1 | 14-102A | 100.2 | 24.6 | CH | 72 | 49 | 28 | 325 | 44 | 0 | 0 | 1455 |
| 304.2 | 14-104A | 106.7 | 20.9 | CH | 52 | 35 | 20 | 375 | 28 | 165 | 0 | 1625 |
| 304.3 | 14-105 | 98.5 | 26.4 | CH | 64 | 46 | 20 | 320 | 28 | 80 | 0 | 1020 |

ENGINEERING ANALYSIS

The structure dimensions and elevations were provided by the as-built drawings and the abstract from the Supplemental Watershed Plan for the Environmental Assessment. The data provided is summarized in the following table:

| Description | Elevation | Width | Side Slope – Upstream | Side Slope – Downstream |
|-----------------------|-----------|-------|-----------------------|-------------------------|
| Top of Dam – Proposed | 643.4 | 14 | 2.5 | 2.5 |
| Auxiliary Spillway | 637.8 | | | |
| Normal Pool | 620.0 | | | |
| Lowest Gated Outlet | 612.65 | | | |

Seepage

No seepage has been documented in the existing structure and is unlikely to exceed the established phreatic surface for the pool of 620 feet elevation. Fracturing in the clay stone foundation materials are more likely to convey water than seepage through the existing compacted embankment. A downstream toe drain is planned for this rehabilitation.

Gradation of the proposed drainage materials is governed by the *National Engineering Handbook (NEH) Part 633, Chapter 26, Gradation Design of Sand and Gravel Filters*. All of the soil test data indicates that the soil will be classified as Category 1 with more than 85 percent passing the # 200 sieve per this standard. Permeability testing for undisturbed samples was accomplished for soil Samples F14-101C and F14-104B and indicated higher permeability than would typically be expected for soil classified as fat clay at the in-place densities and moisture content. See Attachment 5 for the setup parameters and test data associated with these tests and the results are listed below.

| Lab Sample Number | Degree of Compaction % Max. | Test w % Ref. to Opt. | Percent Sat. % | k Value cm/sec | k Value ft/day |
|-------------------|-----------------------------|-----------------------|----------------|-----------------------|-----------------------|
| F14- 101C | 94.9 | 0.0 | 68 | 8.75×10^{-6} | 2.48×10^{-2} |
| F14- 104B | 101.7 | 0.0 | 63 | 2.76×10^{-6} | 7.82×10^{-3} |

The proposed filter and drainfill foundation system along the downstream toe of the existing embankment will need to be prepared to base soil category 1 according to the *National Engineering Handbook, Part 633, Chapter 26, Gradation Design of Sand and Gravel Filters*. The fine filter material will need to be monitored closely due to the fine texture of the adjacent soils. Also, the high percentage of the clay portion of the soil will necessitate that a gradation will need to be manufactured similar to Texas Quality Products # 4 Industrial for the fine filter material and ASTM C-33 Coarse Aggregate # 89 for the coarse filter material. It is also noted that these material gradations will also necessitate some additional adjustments to meet the finer portion of the required gradations in order to meet the NEH Part 633, Chapter 26 standards.

Compaction

No Standard Proctor density test, ASTM-D698 Method A (minus #4 material), was performed on any of the soil samples tested. Currently there is no soil testing data that corroborates with the as-built drawing compaction specifications.

If you would like to discuss this report or if you need to request further testing, please contact me at (817) 509-3204.



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Attachments:

1. NRCS-ENG-354, Soil Mechanics Laboratory Test Data, 5 sheets
2. Undisturbed Sample Characteristics and Photos, 30 sheets
3. Borehole Location Map, 1 sheet
4. Shear Strength Soil Test Data, 30 sheets
5. Permeability Test Data, 9 sheets

cc: (electronically distributed)

John Hrebik, State Design Engineer, NRCS, Temple, TX
Shawn Higgins, Design Engineer, NRCS, Temple, TX
Stephen Reinsch, Co-Director, NDCSMC, NRCS, Lincoln, NE
Noller Herbert, Director, CED, NRCS, Washington, DC

Attachment 1

NRCS-ENG-354, Soil Mechanics Laboratory Test Data, 5 sheets

F10

| 6/5/14 | | TX Plum Creek Site 6 7420 Hays Co. Location and Description | WF-07 | | Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight | | | | | | | | | | | | | | | | | Atterberg Limits | | Unified Classification | Soluble Salts % | Natural Moisture (%) | Natural Dry Unit Weight (gm/cm ³) | Percent Saturation | Dispersion | | | Moisture-Density | | G _S | G _M | % Absorp-tion | pH | |
|-----------------|------------------|---|------------|-------------|---|----------|---------|---------|---------------|---------------|--------------|-------------|-------------|------------|------------|---------------|--------------|---------------|------------|----------------|------------|------------------|------|------------------------|-----------------|----------------------|---|--------------------|-------------------|------------|------|------------------|--------------------------|----------------|----------------|---------------|----|------------------|
| Lab. Sample No. | Field Sample No. | | Depth (ft) | Sample Type | Fines | | | | | Sand | | | | | | Gravel | | | | | | L.L. | P.I. | | | | | | Double Hydrometer | Crumb Test | | Pinhole | ASTM D698 | | | | | |
| | | | | | 0.002 mm | 0.005 mm | 0.02 mm | 0.05 mm | #200 0.074 mm | #140 0.105 mm | #60 0.250 mm | #40 0.42 mm | #20 0.84 mm | #10 2.0 mm | #4 4.76 mm | 3/8" 9.525 mm | 1/2" 12.7 mm | 3/4" 19.05 mm | 1" 25.4 mm | 1 1/2" 38.1 mm | 3" 76.2 mm | | | | | | | | | 1 Hr | 4 Hr | | Max γ _d (pcf) | | | | | w ₀ % |
| 1399 | 201.1 | Inside cut AS Approx. Sta. 5+00 | 0-2 | Undist. | 48 | 63 | 86 | 96 | 100 | | | | | | | | | | | | 58 | 36 | CH | | 16.4 | 1.55 | 61.2 | 5 | 1 | 1 | | | 2.65 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1400 | 201.2 | Inside cut AS Approx. Sta. 5+00 | 10-11 | Undist. | 54 | 76 | 96 | 99 | 100 | | | | | | | | | | | | 70 | 46 | CH | | 20.7 | 1.73 | 97.8 | 1 | 1 | 1 | | | 2.73 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1401 | 201.3 | Inside cut AS Approx. Sta. 5+00 | 30-35 | Small | 59 | 72 | 92 | 97 | 100 | | | | | | | | | | | | 63 | 41 | CH | <.5 | 22.6 | | | 11 | 1 | 1 | | | 2.72 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1402 | 202.1 | Inside cut AS Approx. Sta. 6+50 | 5-7 | Undist. | 54 | 68 | 93 | 100 | 100 | | | | | | | | | | | | 70 | 47 | CH | | 21.5 | 1.65 | 89.2 | 6 | 1 | 1 | | | 2.74 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1403 | 202.2 | Inside cut AS Approx. Sta. 6+50 | 10-11 | Undist. | 54 | 73 | 91 | 99 | 100 | | | | | | | | | | | | 70 | 47 | CH | | 22.4 | 1.64 | 92.0 | 5 | 1 | 1 | | | 2.73 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1404 | 202.3 | Inside cut AS Approx. Sta. 6+50 | 15-16 | Undist. | 35 | 75 | 96 | 100 | 100 | | | | | | | | | | | | 68 | 45 | CH | | 21.9 | 1.67 | 94.7 | 5 | 1 | 1 | | | 2.72 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1405 | 202.4 | Inside cut AS Approx. Sta. 6+50 | 19-20 | Small | 59 | 73 | 93 | 98 | 100 | | | | | | | | | | | | 59 | 36 | CH | 2.5 | 22.1 | | | 11 | 1 | 1 | | | 2.76 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1406 | 202.5 | Inside cut AS Approx. Sta. 6+50 | 20-20.5 | Undist. | 36 | 69 | 83 | 94 | 96 | | | | | | 100 | | | | | | 64 | 40 | CH | | 21.3 | 1.65 | 87.9 | 1 | 1 | 1 | | | 2.75 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1407 | 203.1 | Inside cut AS Approx. Sta. 8+00 | 17-19 | Small | 62 | 78 | 94 | 96 | 97 | - | - | - | - | 100 | | | | | | | 69 | 42 | CH | <.5 | 22.3 | | | 13 | 1 | 1 | | | 2.72 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1408 | 203.2 | Inside cut AS Approx. Sta. 8+00 | 24-25 | Small | 52 | 73 | 93 | 98 | 100 | | | | | | | | | | | | 63 | 39 | CH | 2.7 | 27.5 | | | 7 | 1 | 1 | | | 2.75 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 301.1 | Outlet Basin Left DS Approx. Sta. 15+00 CL Dam | 14-16 | Undist. | 54 | 56 | 93 | 96 | 99 | | | | | | 100 | | | | | | 77 | 53 | CH | | 28.6 | 1.53 | 99.1 | 7 | 1 | 1 | | | 2.74 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1410 | 803.1 | D. S. Berm Approx. Sta. 15+88 | 7-9.5 | Undist. | 43 | 63 | 82 | 86 | 87 | | | | | | 100 | | | | | | 52 | 30 | CH | | 22.9 | 1.62 | 93.8 | 6 | 1 | 1 | | | 2.68 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1411 | 802.1 | D. S. Berm Approx. Sta. 14+70 | 7-8.5 | Undist. | 47 | 66 | 90 | 92 | 94 | | | | | | 100 | | | | | | 59 | 43 | CH | | 28.0 | 1.51 | 96.4 | 6 | 1 | 1 | | | 2.69 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 6/5/14 | | TX Plum Creek Site 6 7420 Hays Co. Location and Description | WF-07 | | Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight | | | | | | | | | | | | | | | | | Atterberg Limits | | Unified Classification | Soluble Salts % | Natural Moisture (%) | Natural Dry Unit Weight (gm/cm ³) | Percent Saturation | Dispersion | | | | Moisture-Density | | G _S | G _M | % Absorp-tion | pH | |
|-----------------|------------------|---|------------|-------------|---|----------|---------|---------|---------------|---------------|--------------|-------------|-------------|------------|------------|---------------|--------------|---------------|------------|----------------|------------|------------------|------|------------------------|-----------------|----------------------|---|--------------------|-------------------|------------|------|---------|--------------------------|------------------|----------------|----------------|---------------|----|--|
| Lab. Sample No. | Field Sample No. | | Depth (ft) | Sample Type | Fines | | | | | Sand | | | | | | Gravel | | | | | | L.L. | P.I. | | | | | | Double Hydrometer | Crumb Test | | Pinhole | ASTM D698 | | | | | | |
| | | | | | 0.002 mm | 0.005 mm | 0.02 mm | 0.05 mm | #200 0.074 mm | #140 0.105 mm | #60 0.250 mm | #40 0.42 mm | #20 0.84 mm | #10 2.0 mm | #4 4.76 mm | 3/8" 9.525 mm | 1/2" 12.7 mm | 3/4" 19.05 mm | 1" 25.4 mm | 1 1/2" 38.1 mm | 3" 76.2 mm | | | | | | | | | 1 Hr | 4 Hr | | Max γ _d (pcf) | w ₀ % | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 104 A | 304.2 | Downstream Toe, Sta | 6.0 - 6.8 | Undist. | 36 | 45 | 59 | 63 | 67 | 68 | 70 | 72 | 73 | 74 | 82 | 89 | 96 | 100 | | | | 50 | 28 | CH | 2.6 | 21.0 | 1.71 | 99.2 | 11 | 1 | 1 | | | | 2.68 | | | | |
| 104 B | 304.2 | Downstream Toe, Sta | 5.0 - 5.8 | Undist. | 48 | 65 | 80 | 83 | 84 | - | - | - | - | 100 | | | | | | | 52 | 29 | CH | <.5 | 22.3 | 1.58 | 87.8 | 5 | 1 | 1 | | | | 2.64 | | | | | |
| 105 | 304.3 | Downstream Toe, Sta | 10 - 12 | Undist. | 53 | 72 | 86 | 96 | 97 | - | - | - | - | 100 | | | | | | | 60 | 37 | CH | 1.2 | 28.3 | 1.53 | 100.3 | 4 | 1 | 1 | | | | 2.69 | | | | | |
| 106 | 304.4 | Downstream Toe, Sta | 25 - 26.4 | Undist. | 49 | 67 | 89 | 94 | 97 | - | - | - | - | 100 | | | | | | | 59 | 31 | CH | <.5 | 19.0 | 1.58 | 72.6 | 12 | 1 | 1 | | | | 2.69 | | | | | |
| 107 | 900.1 | Downstream Toe, Sta | 0 - 2.5 | Undist. | 48 | 67 | 86 | 94 | 97 | - | - | - | - | 100 | | | | | | | 53 | 31 | CH | <.5 | 14.2 | 1.66 | 61.8 | 13 | 1 | 1 | | | | 2.68 | | | | | |

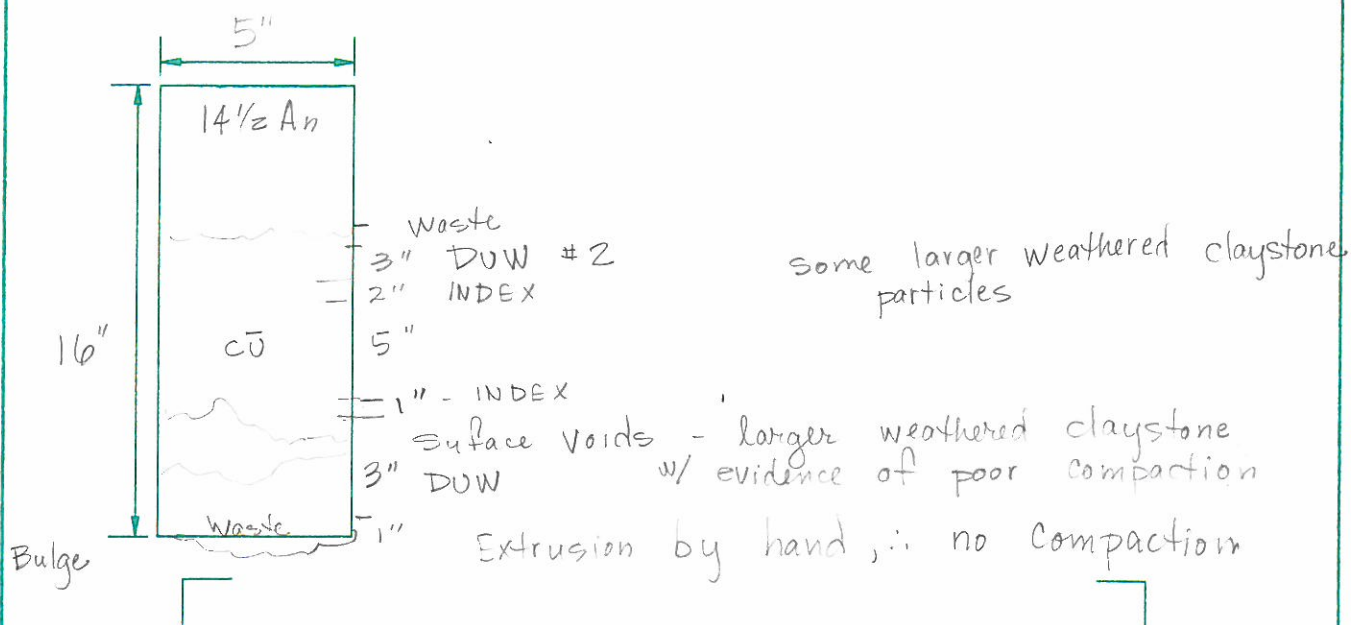
| 4/20/11 | | TEXAS (WF-07) <u>Location and Description</u> Plum Creek Site 6 (Hays County) | Sample Type | Depth ft. | Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight | | | | | | | | | | | | | | | | | Atterberg Limits | | Unified Classification | Crumb - 1 hr | Dispersion % | Moisture-Density Relationships □ Standard □ Modified | | | Undisturbed Sample Data | | G _s | Special Tests | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Lab. Sample No. | Field Number | | | | Fines | | | | | Sand | | | | | Gravel | | | | | | | L.L. | P.I. | | | | Curve No. | Max γ _d p.c.f. | w ₀ % | γ _d p.c.f. | w _N % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 0.002 mm | 0.005 mm | 0.02 mm | 0.05 mm | #200 0.074 mm | #140 0.105 mm | #60 0.250 mm | #40 0.42 mm | #20 0.84 mm | #10 2.0 mm | #4 4.76 mm | 3/8" 9.525 mm | 1/2" 12.7 mm | 3/4" 19.05 mm | 1" 25.4 mm | 1 1/2" 38.1 mm | 3" 76.2 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 14- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Attachment 2

Undisturbed Sample Characteristics and Photos, 30 sheets

UNDISTURBED SAMPLE CHARACTERISTICS

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|--|----------------|---------------------|-----------------------------|---------------------|--------------------------|---------------------------|--------------|
| PROJECT and STATE <u>Plum Creek #6, TX</u> | | | | | | | |
| TESTED AT <u>FW SML</u> | | DATE <u>6-12-14</u> | | JOB NO. <u>7420</u> | | BY <u>RB, SG & MH</u> | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| <u>Shelby</u> | <u>F14-94</u> | <u>1.1</u> | <u>15</u> | <u>17</u> | <u>± TO D Sta. 15+40</u> | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Cons. | Str. |
| <u>5" φ</u> | <u>tan</u> | <u>moist</u> | | | | <u>hard</u> | <u>Homog</u> |
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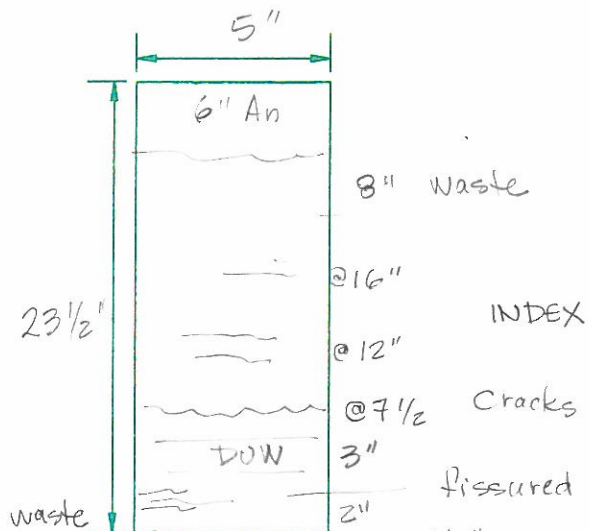


PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|-------------------------------------|------------------------|-------------------|-----------------------------|--------------|-----------------|---------------|----------|
| PROJECT and STATE Plum Creek #6, TX | | | | | | | |
| TESTED AT FWSML | | DATE | | JOB NO. 7420 | | BY RB, SG, MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | F14-95 | 1.2 | 45 | 47 | E TOD Sta 15+40 | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Cons. | Str. |
| 5" ϕ | Dark grey w/ tan seams | moist | | | | Very hard | fissured |
| | | | | | | | |
| | | | | | | | |



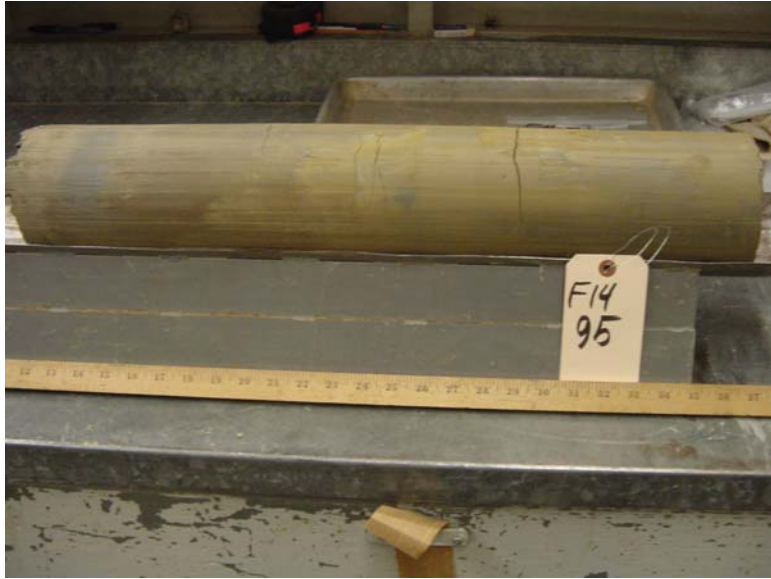
Refer to photos of fractures w/ gypsum crystals

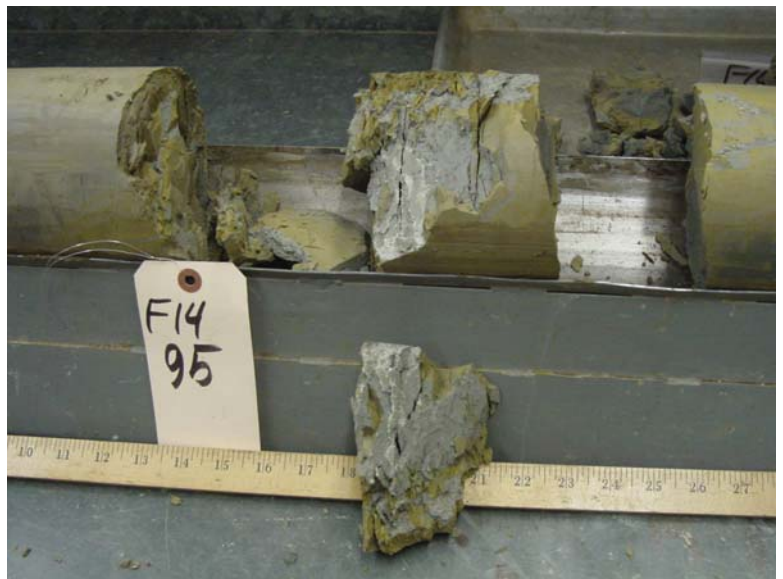
fissured w/ gypsum crystals; HCl reacted vigorously
1/2" compaction due to extrusion

weathered claystone prevented torque

* Not possible to trim for shear tests

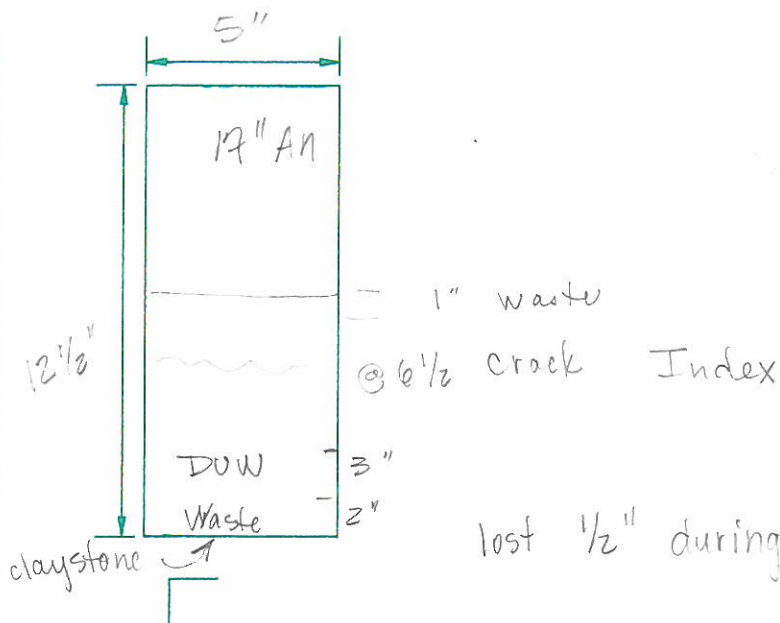
PHOTO





UNDISTURBED SAMPLE CHARACTERISTICS

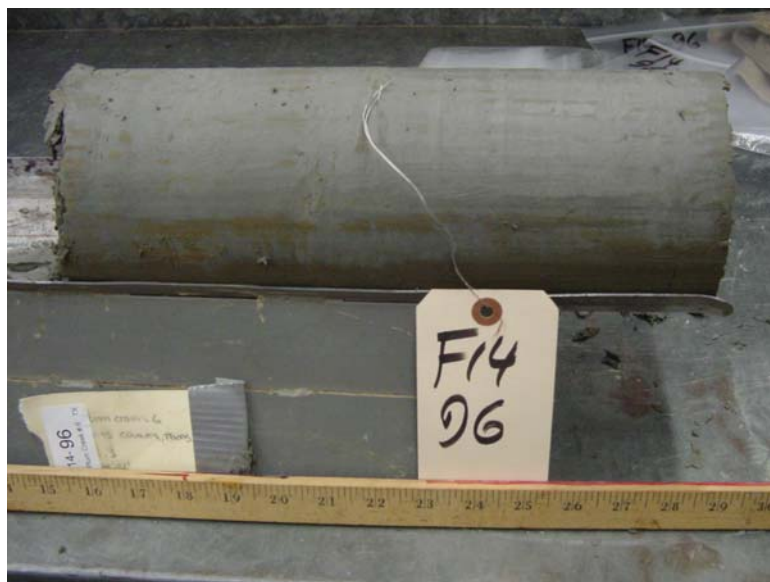
| | | | | | | | |
|-------------------------------------|----------------|-------------------|-----------------------------|--------------|-------------------|----------------|-------|
| PROJECT and STATE Plum Creek #6, TX | | | | | | | |
| TESTED AT FW SML | | DATE 6-12-14 | | JOB NO. 7420 | | BY RB, SG & MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | FI4-96 | 1.3 | 55 | 56 | ± TOD @ Sta 15+40 | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Cons | Str |
| 5"φ | Dark Grey | damp | | | | Very Hard | Homo. |
| | | | | | | | |
| | | | | | | | |



lost 1/2" during extrusion

easily sliced along laminar
failure planes ∴ slope stability
will be a block str.
and not prone to failure
in a curve

PHOTO

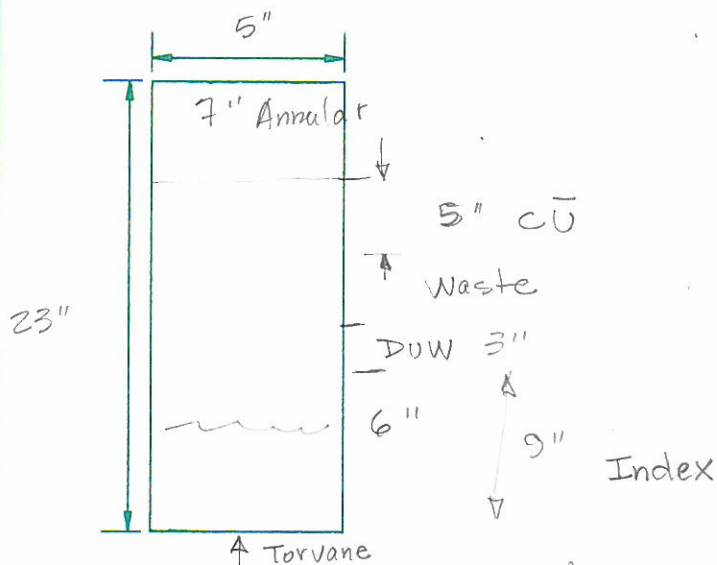


UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|----------------|-------------------|-----------------------------|--------------|--------------------------------------|---------------|-------------|
| PROJECT and STATE Plum Creek #6, Texas | | | | | | | |
| TESTED AT FW SML | | DATE 6-10-14 | | JOB NO. 7420 | | BY RB, SG, MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | F14-97 | 2.1 | 25 | 27 | Sta 14+40 ϕ - Embankment Zone I | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Consistency | Structure |
| 5" ϕ | Tan | Moist | | | | Hard | Homogeneous |
| | | | | | | | |
| | | | | | | | |

Geonor H-60

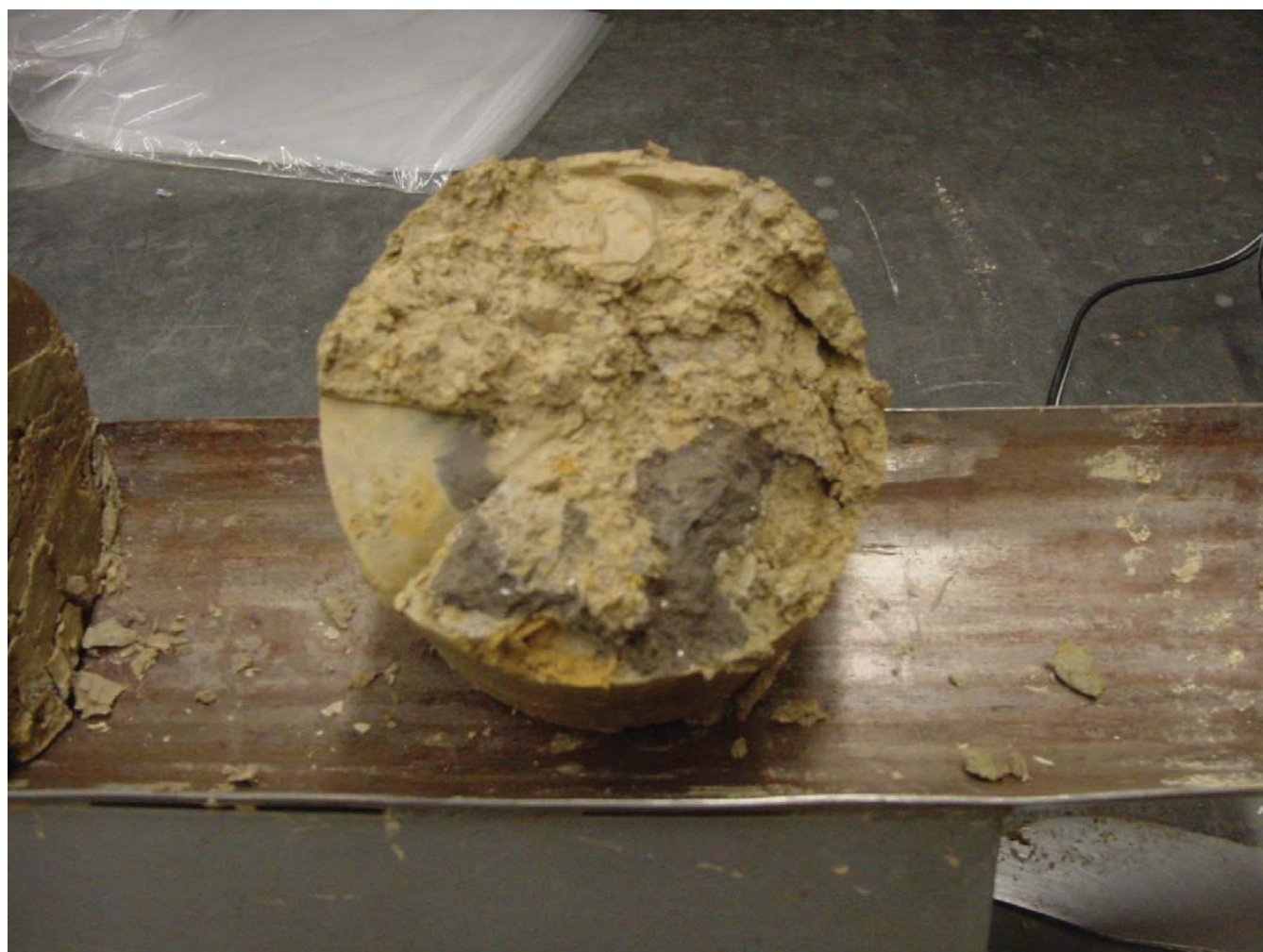
Torvane 102 kPa



Some motiling
w/ brown and gray
soil, but homogeneous

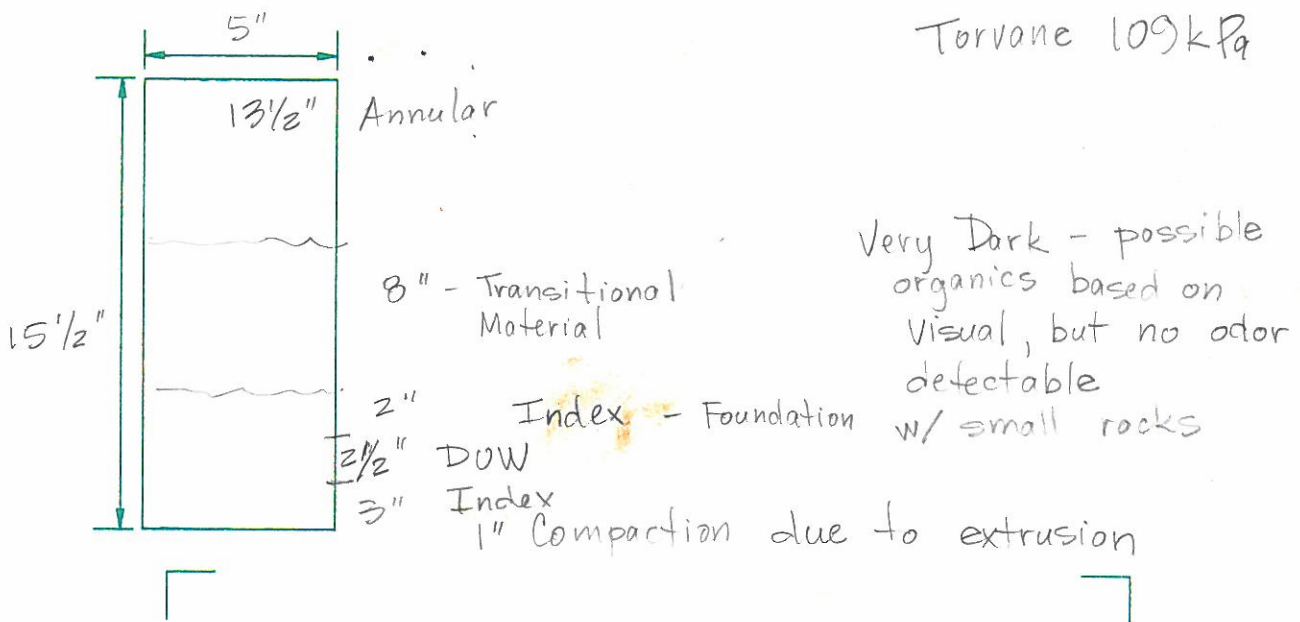
No compaction of sample during extrusion

PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|----------------|-------------------|-----------------------------|--------------|-----------------|----------------|------|
| PROJECT and STATE Plum Creek #6, Texas | | | | | | | |
| TESTED AT FW SML | | DATE 6-10-14 | | JOB NO. 7420 | | BY RB, SG & MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | F14-98 | 2.2 | 35 | 37 | Sta 14+40 E - | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Consistency | Str. |
| 5"φ | Black | Moist | | | | Hard | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |



PHOTO



PLUM CREEK 6

HAYS COUNTY, TEXAS

2.2

35-37

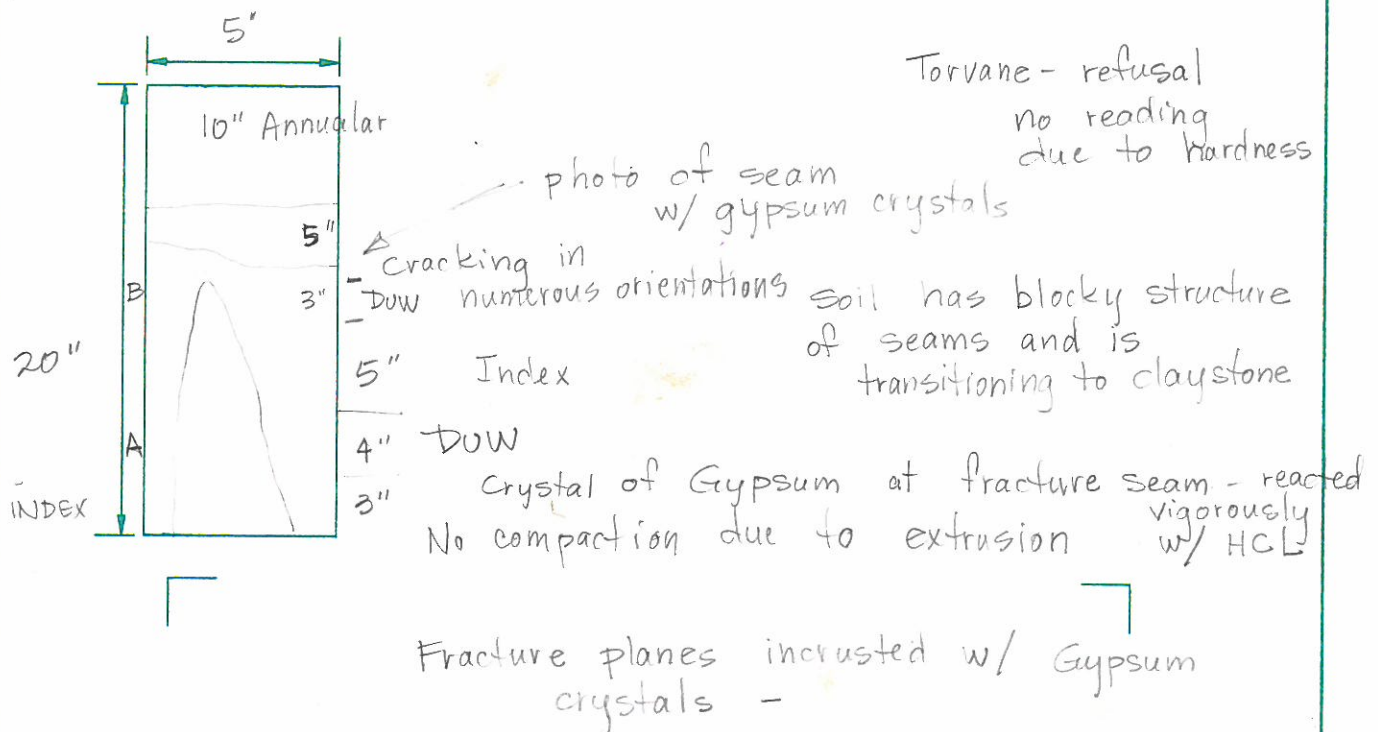
F14-98

7420 Plum Creek #6 TX

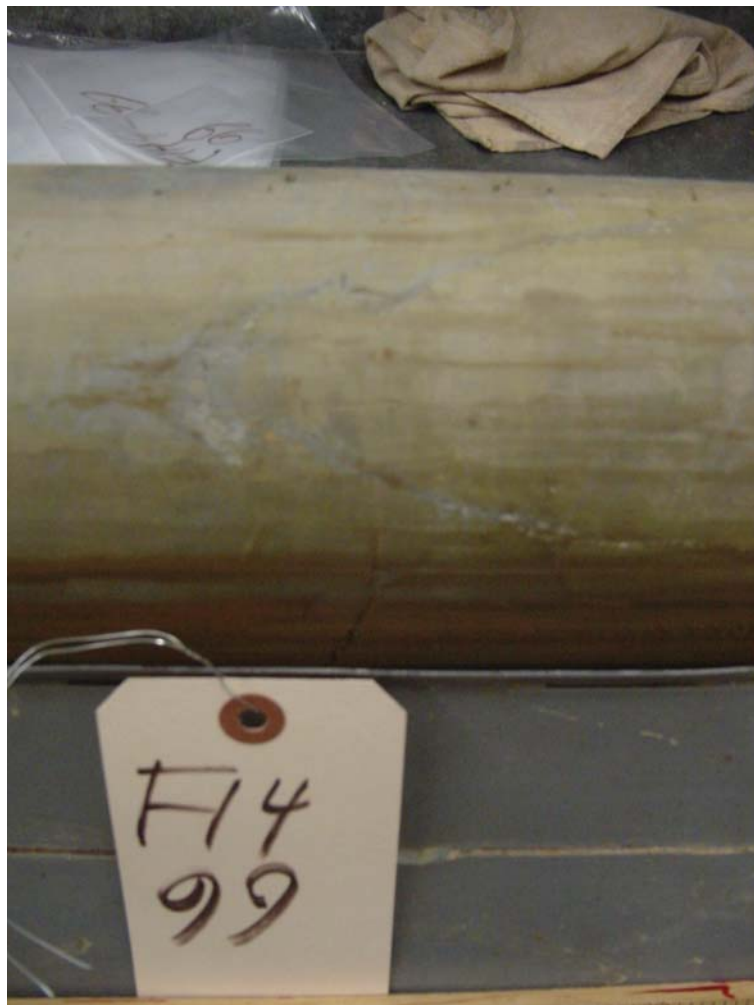
F14
98

F14

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------|--|--|--|----------------|--|--|--|----------------------|--|--|--|-----------------------------|--|--|--|-----------------|--|--|--|-----------|--|--|--|------------------------------|--|--|--|------------|--|--|--|
| PROJECT and STATE | | | | | | | | Plum Creek #6, Texas | | | | | | | | | | | | | | | | | | | | | | | |
| TESTED AT | | | | FW3ML | | | | DATE | | | | 6-10-14 | | | | JOB NO. | | | | 7420 | | | | BY | | | | RB, SG, MH | | | |
| TYPE OF SAMPLE | | | | LABORATORY NO. | | | | FIELD SAMPLE NO. | | | | DEPTH (FT.) | | | | SAMPLE LOCATION | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | FROM TO | | | | | | | | | | | | | | | | | | | |
| Shelby | | | | F14-99 | | | | 2.3 | | | | 45 47 | | | | Sta 14+40 ± ToD | | | | | | | | | | | | | | | |
| CORE SECTION | | | | COLOR | | | | RELATIVE MOISTURE | | | | CONSISTENCY OR REL. DENSITY | | | | TEXTURE | | | | | | | | VISUAL CLASSIFICATION SYMBOL | | | | | | | |
| 5"φ | | | | Grey | | | | Moist | | | | | | | | | | | | Very Hard | | | | CH- | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



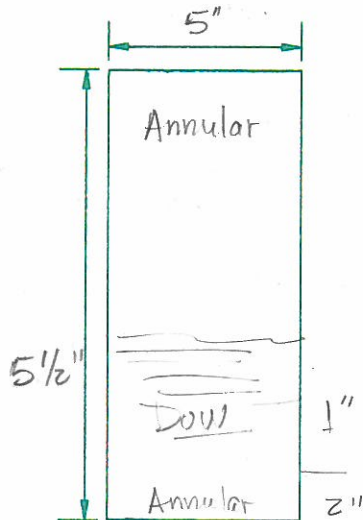
PHOTO





UNDISTURBED SAMPLE CHARACTERISTICS

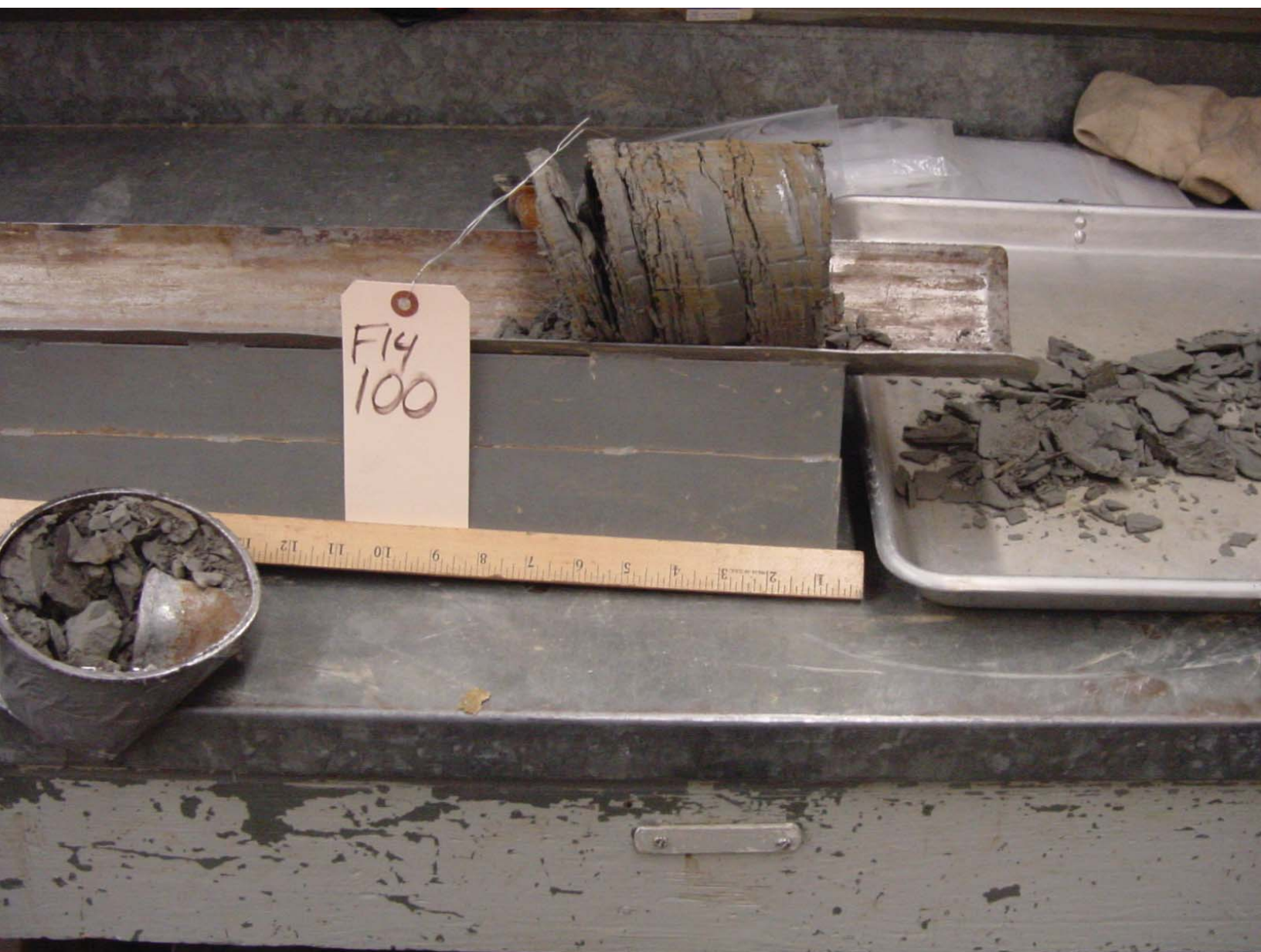
| | | | | | | | |
|--|------------------|---------------------|-----------------------------|---------------------|-------------------------|----------------------|------------------------------|
| PROJECT and STATE <u>Plum Creek #6</u> | | | | | | | |
| TESTED AT <u>FW SML</u> | | DATE <u>6-11-14</u> | | JOB NO. <u>7420</u> | | BY <u>RB, SG, MH</u> | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| <u>Shelby</u> | <u>F14-100</u> | <u>2.4</u> | <u>55</u> | <u>55.7</u> | <u>& Str. @ Sta</u> | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | | VISUAL CLASSIFICATION SYMBOL |
| <u>5" φ</u> | <u>Dark Grey</u> | <u>dry</u> | | | <u>Very Hard</u> | <u>Fissured</u> | <u>Claystone</u> |
| | | | | | | | |
| | | | | | | | |



Laminar Fissures

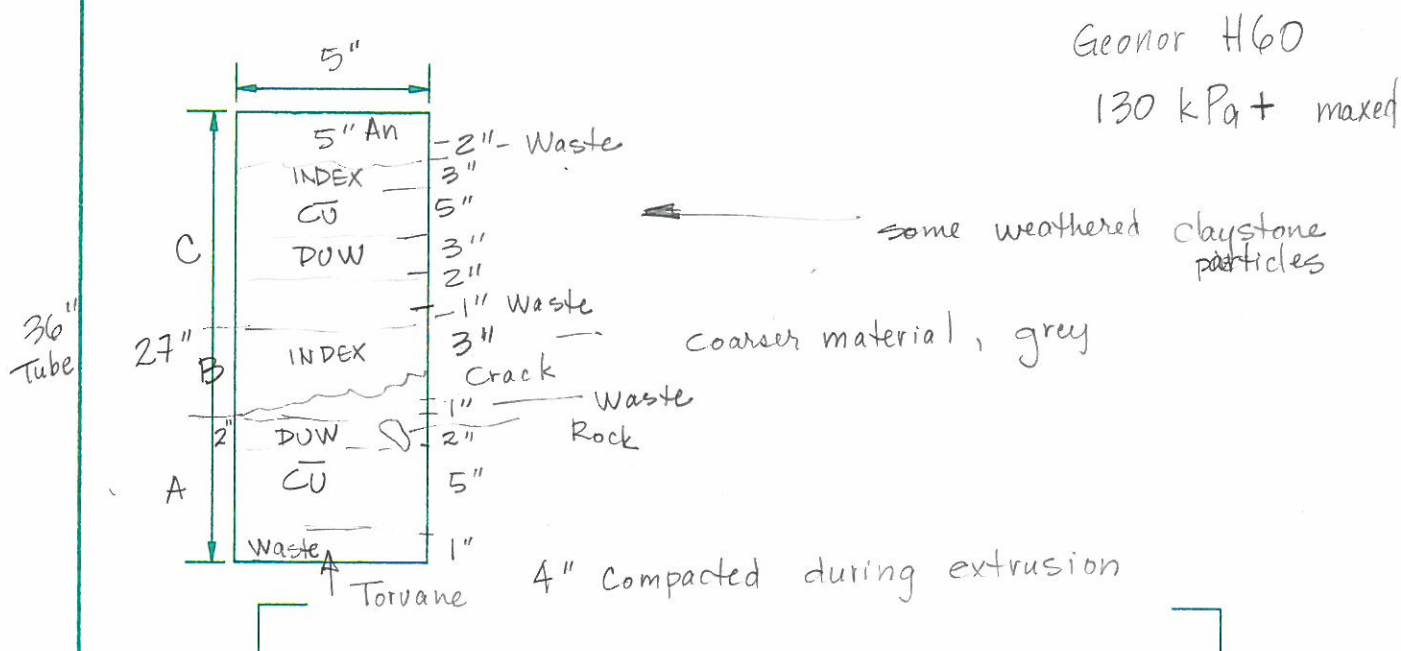
Taco-end piece cut off w/ bandsaw

PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|----------------|---------------------|-----------------------------|---------------------|--------------------------|----------------------------|-------------------------|
| PROJECT and STATE Plum Creek #6, TX | | | | | | | |
| TESTED AT FW SML | | DATE 6-11-14 | | JOB NO. 7420 | | BY RB, SG, & MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | FI4-101 | 3.1 | 20 | 23 | ☒ ToD @ Sta 13+40 | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Cons. | Str. |
| 5" Φ | Tan | Moist | | | | Hard | Evidence of |
| | | | | | | | lit Construction |
| | | | | | | | |

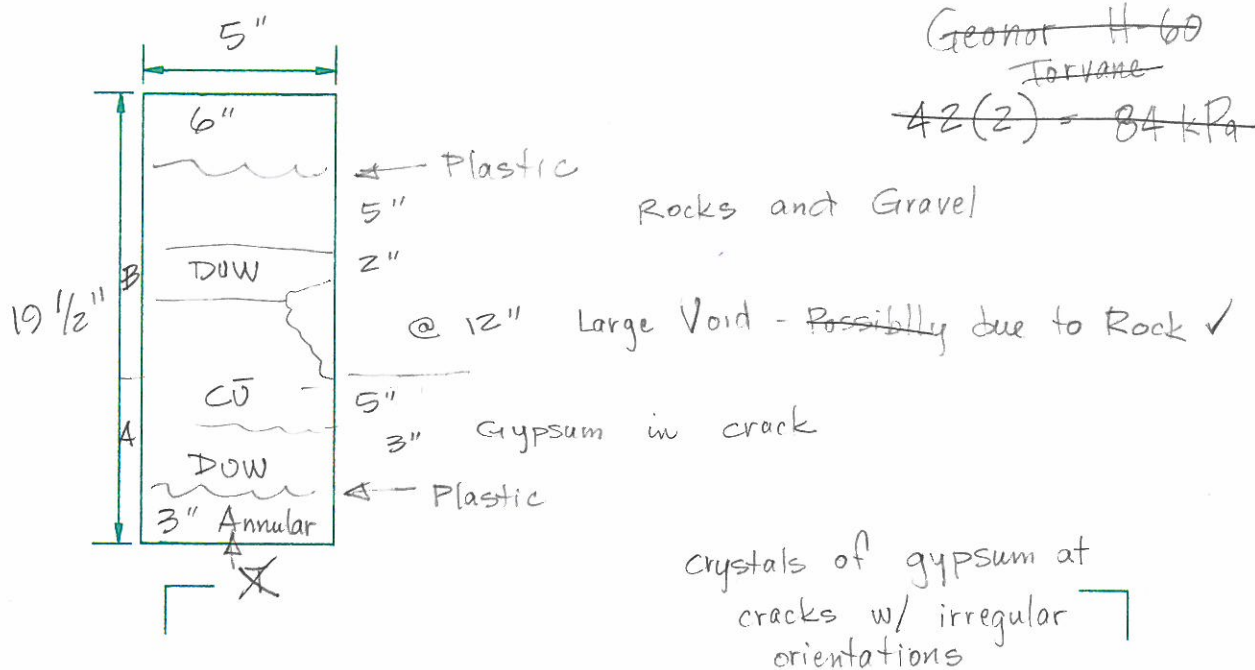


PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|---------------------------------|-------------------|-------------------|-----------------------------|--------------|------------------|---------------|------------------------------|
| PROJECT and STATE Plum Creek #6 | | | | | | | |
| TESTED AT FW SML | | DATE 6-11-14 | | JOB NO. 7420 | | BY RB, SG, MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | F/4-102 | 3.2 | 40 | 42 | E TO D Sta 13+40 | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | | VISUAL CLASSIFICATION SYMBOL |
| 5" ϕ | Tan to Light Grey | Moist | | | Hard | | |
| | | | | | | | |
| | | | | | | | |

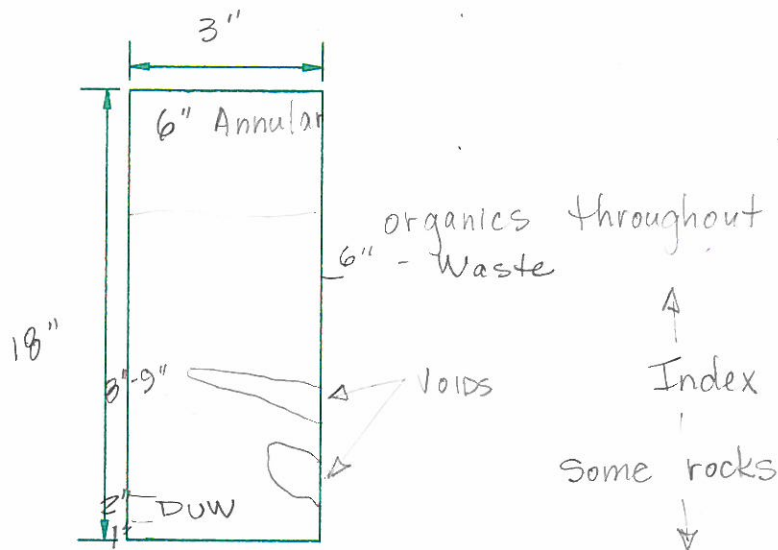


PHOTO

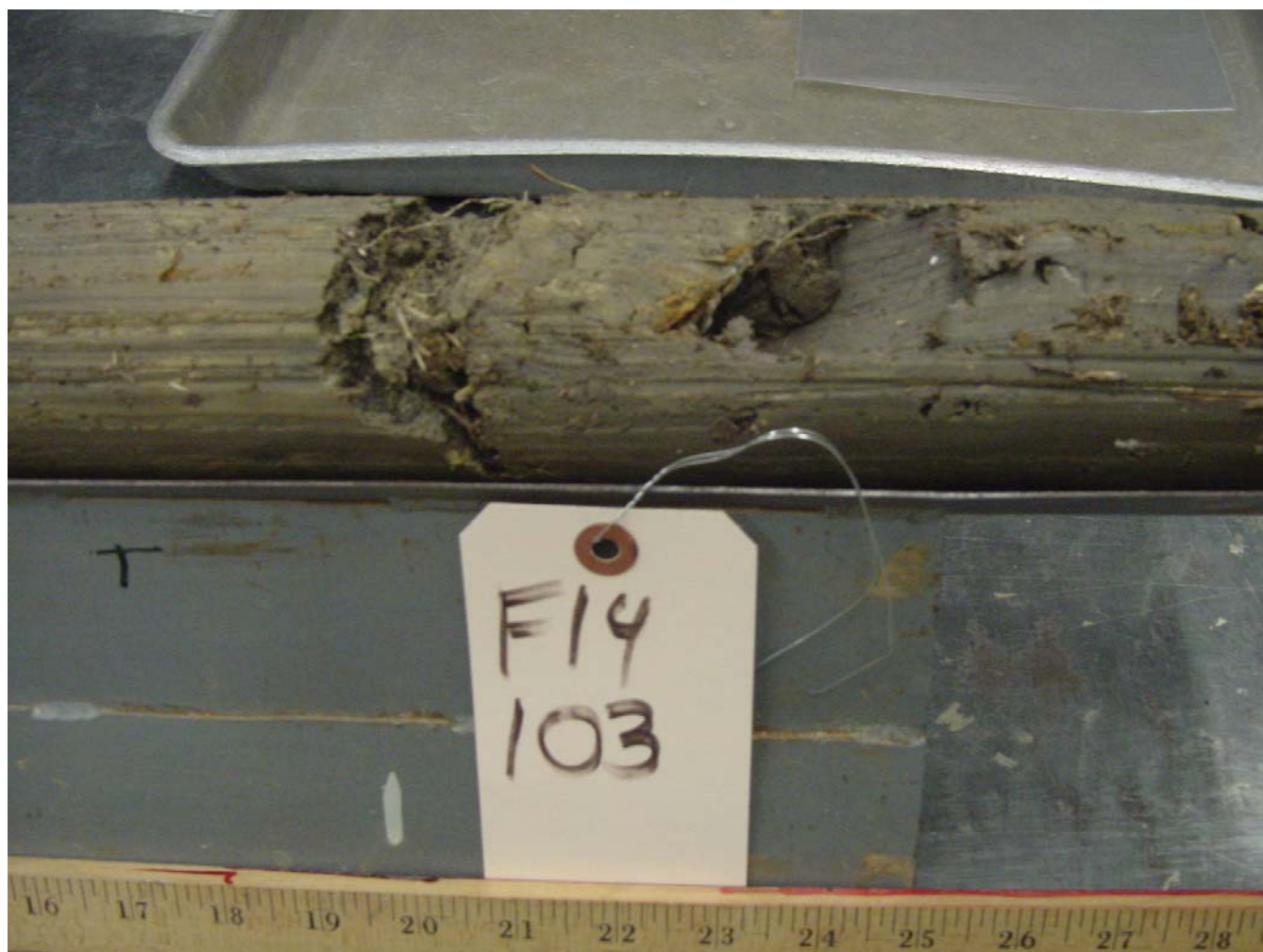


UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|----------------------|---------------------|-----------------------------|---------------------|--------------------|----------------------|------------------------------|
| PROJECT and STATE <i>Plum Creek #6, TX</i> | | | | | | | |
| TESTED AT <i>FW SML</i> | | DATE <i>6-10-14</i> | | JOB NO. <i>7420</i> | | BY <i>RB, SG, MH</i> | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| <i>Shelby</i> | <i>FI4-103</i> | <i>304.1</i> | <i>0</i> | <i>2</i> | <i>P.S. outlet</i> | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | | VISUAL CLASSIFICATION SYMBOL |
| <i>3" ϕ</i> | <i>Grey to Black</i> | <i>moist</i> | | | <i>soft</i> | | <i>OH</i> |
| | | | | | | | |
| | | | | | | | |

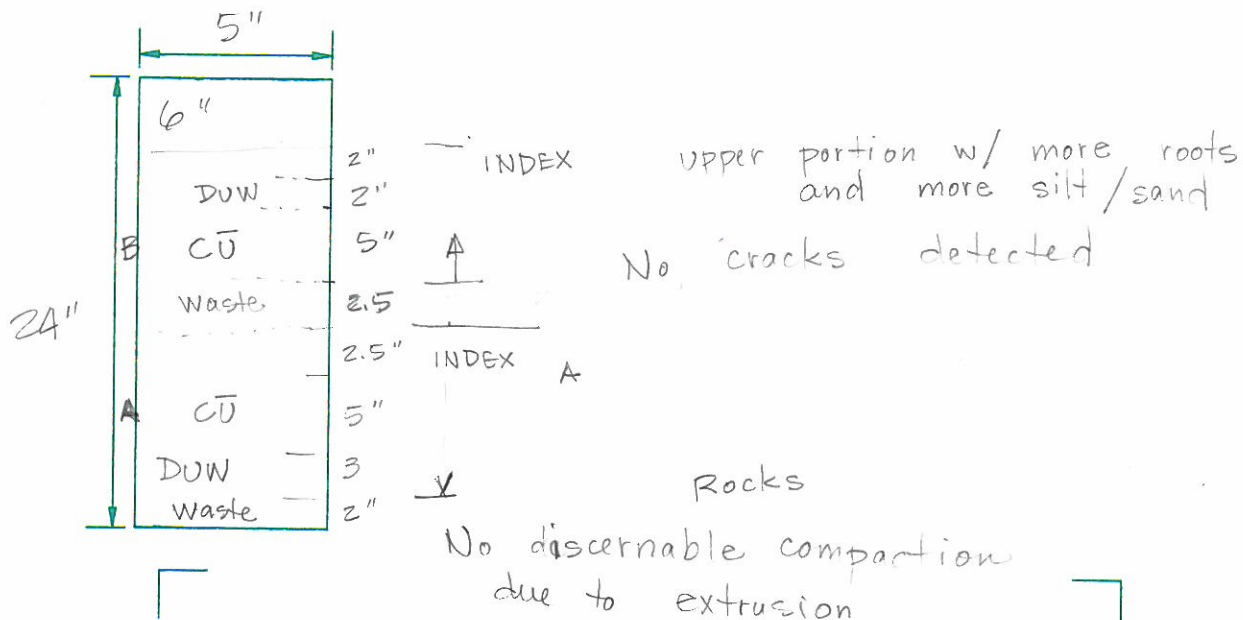


PHOTO

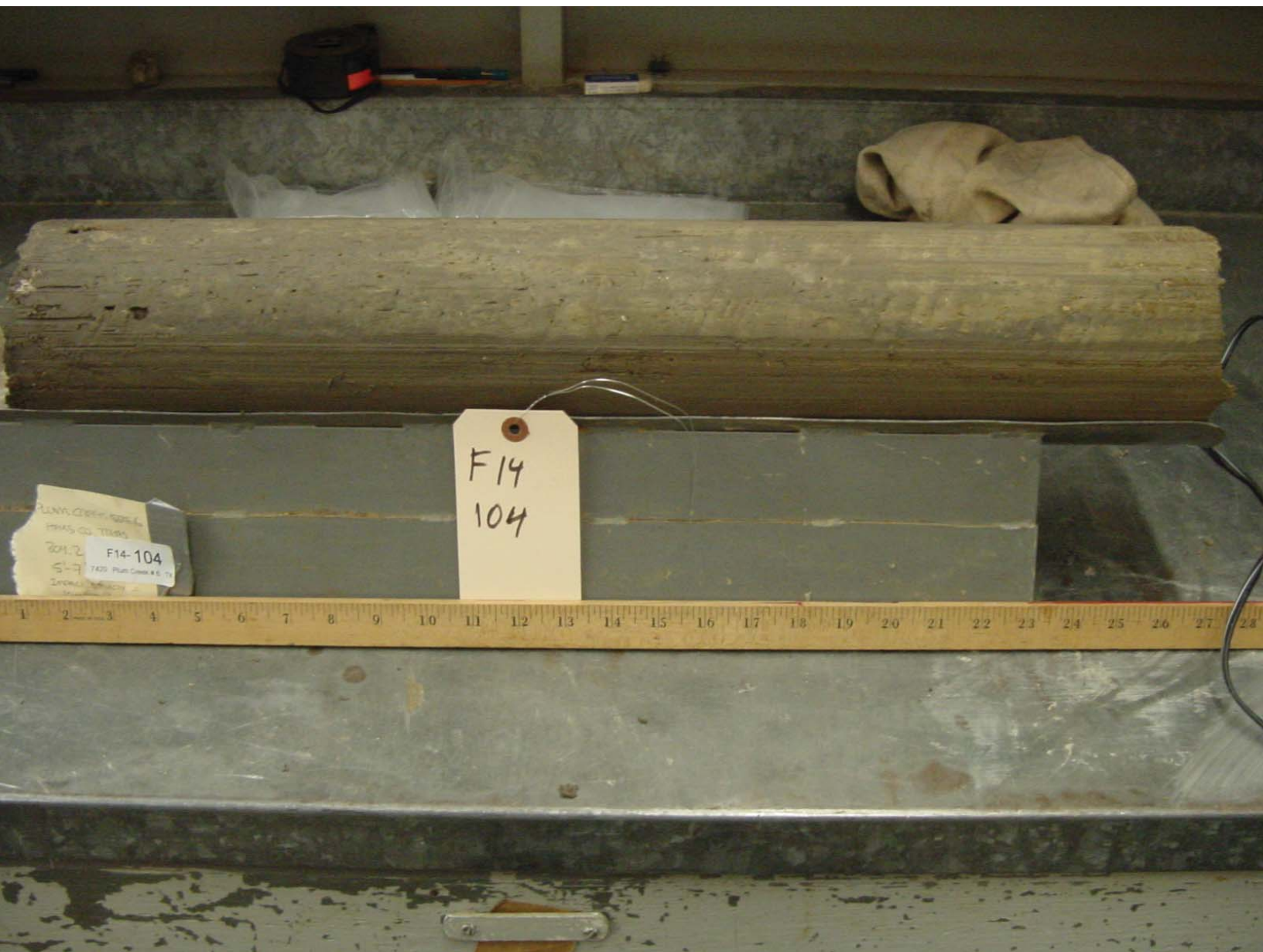


UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|----------------|---------------------|-----------------------------|---------------------|----------------------------|---------------------------|------------------------------|
| PROJECT and STATE <u>Plum Creek #6, TX</u> | | | | | | | |
| TESTED AT <u>FW SML</u> | | DATE <u>6-11-14</u> | | JOB NO. <u>7420</u> | | BY <u>RB, SG & MH</u> | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| <u>Shelby</u> | <u>F14-104</u> | <u>304.2</u> | <u>5</u> | <u>7</u> | <u>Downstream Toe, Sta</u> | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | TEXTURE | Consistency | Str | VISUAL CLASSIFICATION SYMBOL |
| <u>5" ϕ</u> | <u>Grey</u> | <u>Moist</u> | | | <u>hard</u> | <u>Homogeneous</u> | <u>CH-MH</u> |
| | | | | | | <u>Some mottling</u> | |
| | | | | | | <u>and small rocks</u> | |

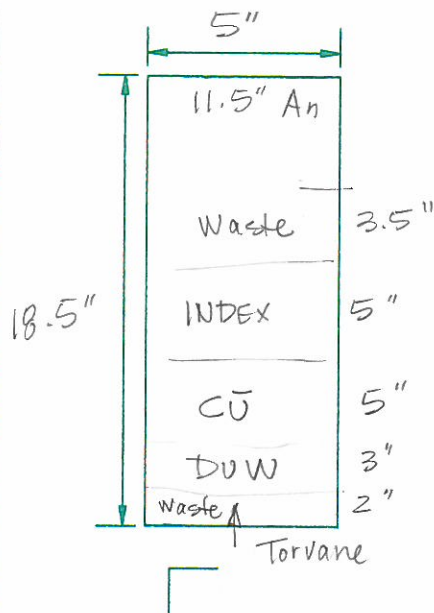


PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|-----------------|---------------------|-----------------------------|---------------------|-----------------------------|--------------------------|-------------------------------------|
| PROJECT and STATE <i>Plum Creek #6, TX</i> | | | | | | | |
| TESTED AT <i>FW SML</i> | | DATE <i>6-11-14</i> | | JOB NO. <i>7420</i> | | BY <i>RB,SG & MH</i> | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| <i>Shelby</i> | <i>F14-105</i> | <i>304.3</i> | <i>10</i> | <i>12</i> | <i>Downstream PS Outlet</i> | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Consistency | Str |
| <i>5"φ</i> | <i>Grey-Tan</i> | <i>Moist</i> | | | | <i>Hard</i> | <i>Homogeneous w/ some mottling</i> |
| | | | | | | | |
| | | | | | | | |



Geonor H-60
Torvane 78(2)
156 kPa

No apparent cracks

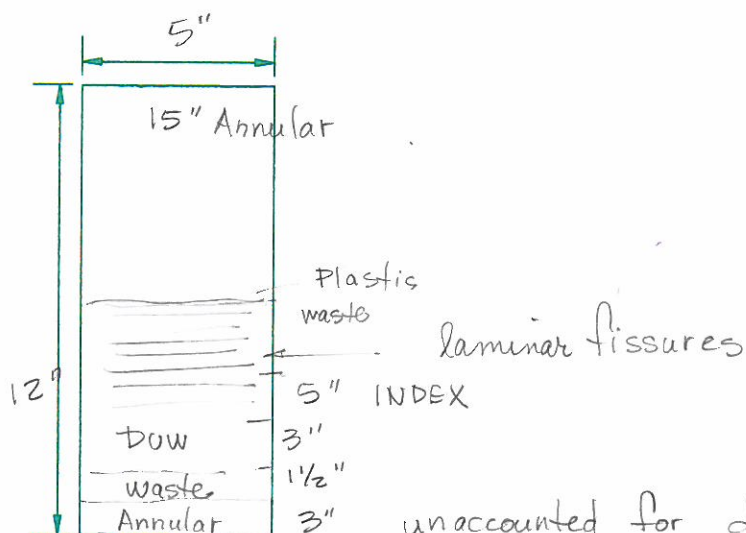
No indication of compaction from extrusion

PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|-------------------|----------------|-------------------|-----------------------------|-----------------|------------------------|-----------|----------|
| PROJECT and STATE | | | | | | | |
| TESTED AT | | DATE 6-11-14 | | JOB NO. 7420 | | BY | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | F14-106 | 304.4 | 25 26.4 | | Downstream P.S. Outlet | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Cons. | Str. |
| 5" ϕ | dark Grey | damp | | | | Very Hard | Fissured |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |



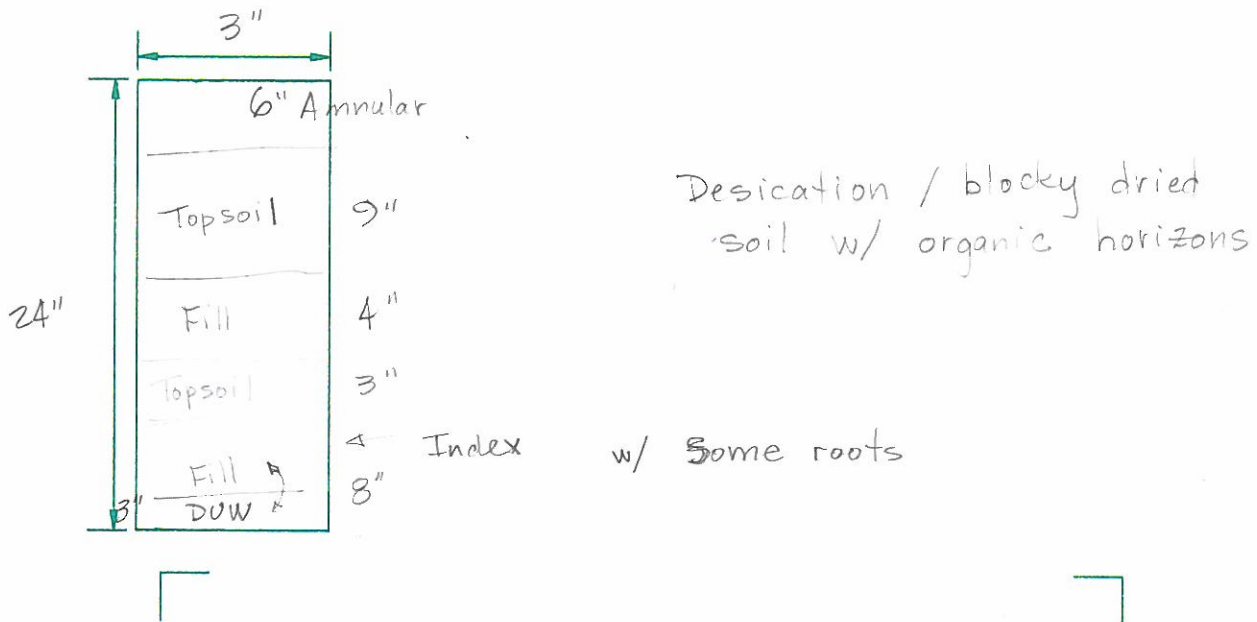
unaccounted for during extrusion -
sample must of had voids
between fissured at extraction
of shelby or during shipping.

PHOTO



UNDISTURBED SAMPLE CHARACTERISTICS

| | | | | | | | |
|--|----------------|-------------------|-----------------------------|--------------|----------------------|----------------|------------|
| PROJECT and STATE Plum Creek #6, Texas | | | | | | | |
| TESTED AT FW SML | | DATE 6-10-14 | | JOB NO. 7420 | | BY RB, SG & MH | |
| TYPE OF SAMPLE | LABORATORY NO. | FIELD SAMPLE NO. | DEPTH (FT.) FROM TO | | SAMPLE LOCATION | | |
| Shelby | FI4-107 | 900.1 | 0 2.5 | | Downstream PS Outlet | | |
| CORE SECTION | COLOR | RELATIVE MOISTURE | CONSISTENCY OR REL. DENSITY | | TEXTURE | Consistency | Str. |
| 3"φ | Tan to Black | dry | | | | firm to soft | Stratified |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |



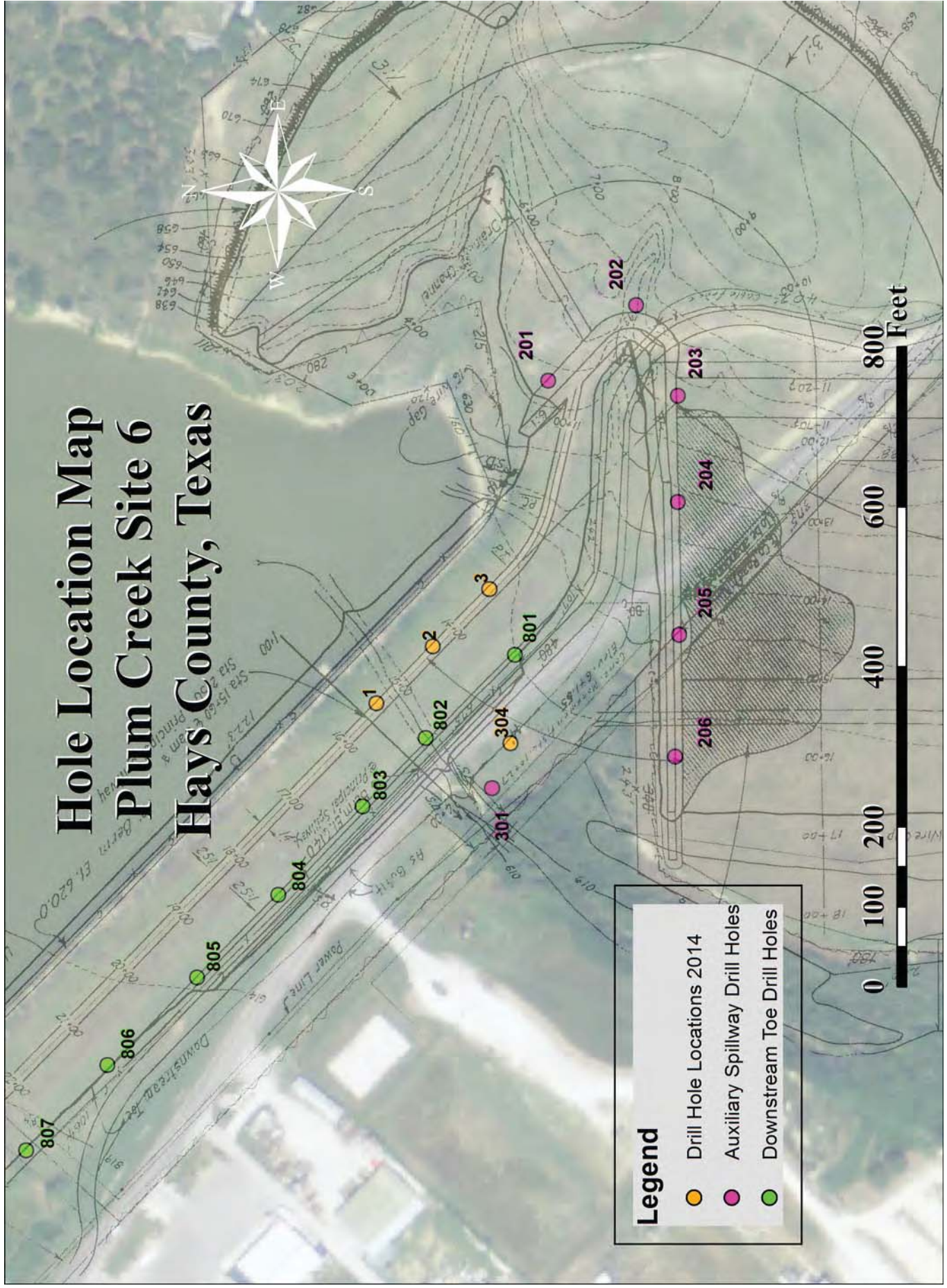
PHOTO



Attachment 3

Borehole Location Map, 1 sheet

Hole Location Map Plum Creek Site 6 Hays County, Texas



Attachment 4

Shear Strength Soil Test Data, 30 sheets

Mohr Circle Program

SITE NAME: **Plum Creek 6**
STATE: **Texas**
SAMPLE NO: **14-1057**

Total Strength Parameters:

Zero Cohesion:

| | |
|------|--------------|
| PHI: | 23.2 degrees |
| C: | 157 psf |

23.2 degrees
1.09 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☒ Maximum Stress Ratio
☐ Max. Pore Pressure
☐ <= 15% Strain
☐ Selected Points

Effective Strength Parameters:

| | |
|--------|--------------|
| PHI' : | 28.2 degrees |
| C' : | 237 psf |

28.2 degrees
1.65 psi

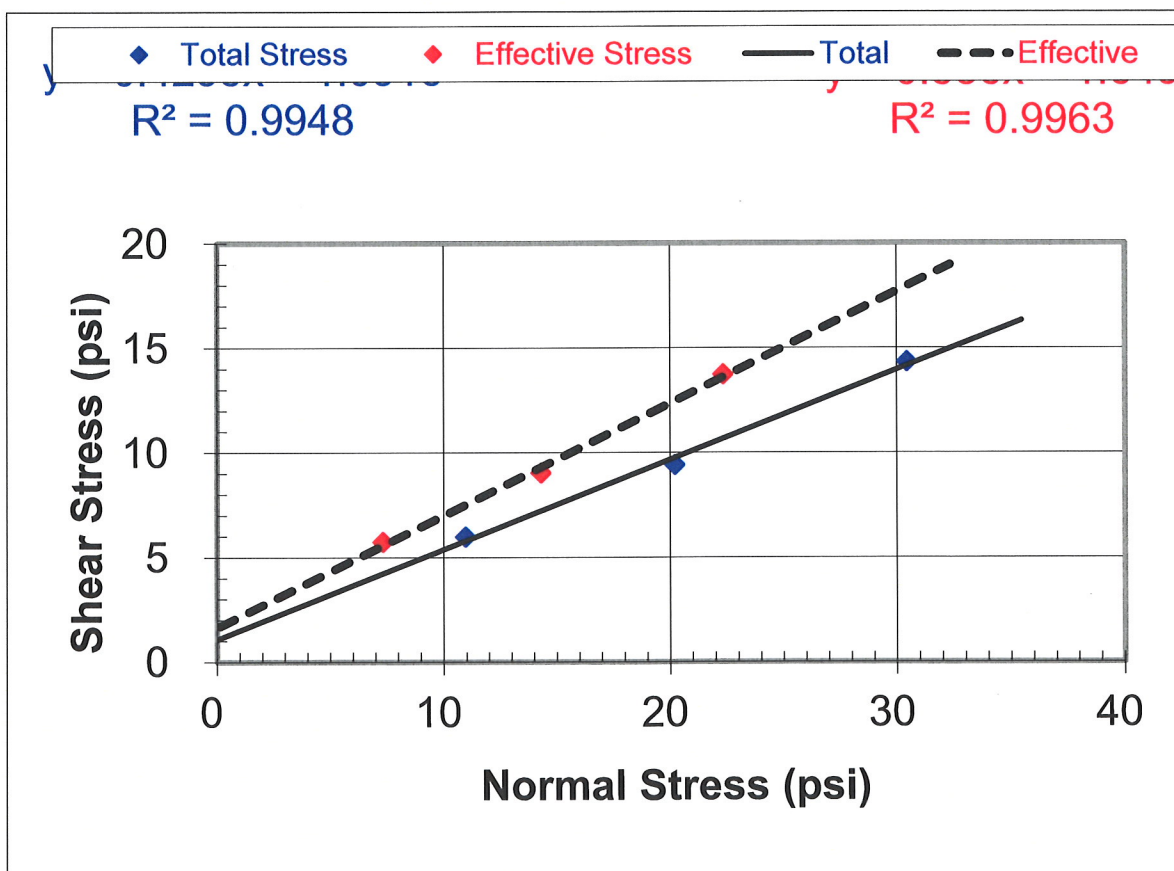
Slope y=

Stress path analysis for Effective:

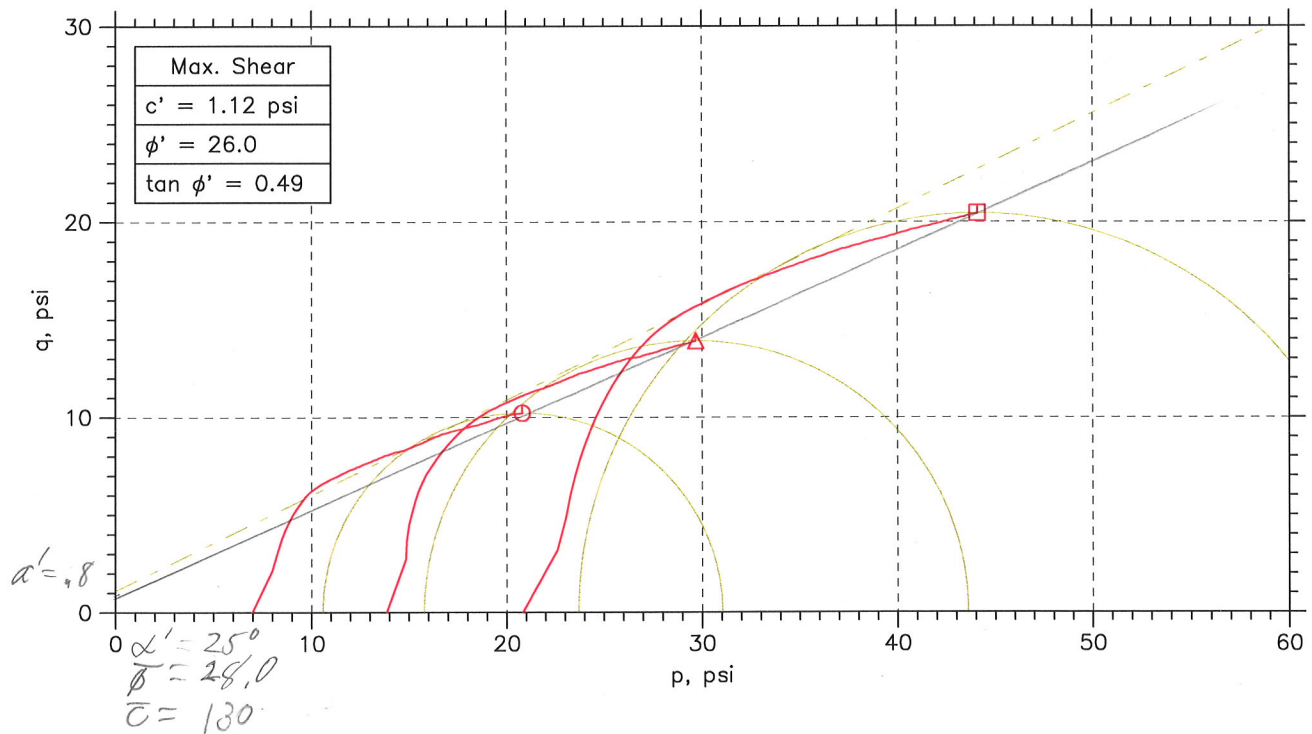
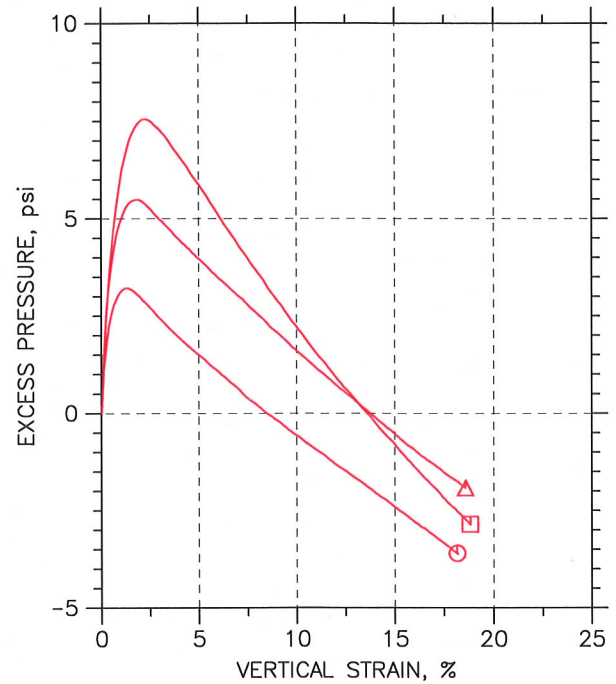
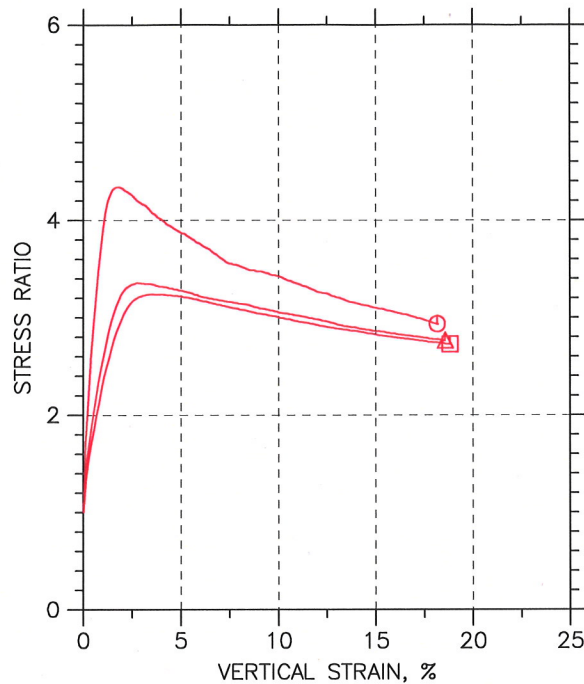
PHI' : degrees
c' : psf

(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 13 | 3.1 | 1.8 |
| 14 | 20.5 | 5.1 | 2.7 |
| 21 | 31.2 | 6.9 | 3.6 |



CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|------------|----------|-------|-----------|-----------|------------|------------|-------------------|
| ○ | 14-1057 | 1 | N/A | SKK | 8/6/14 | SKK | | 14-1057-07eng.dat |
| △ | 14-1057 | 2 | N/A | SKK | 8/6/14 | SKK | | 14-1057-14eng.dat |
| □ | 14-1057 | 3 | N/A | SKK | 8/6/14 | SKK | | 14-1057-21eng.dat |



Project: PLUM CREEK SITE #6

Location: TX

Project No.: 14-1057

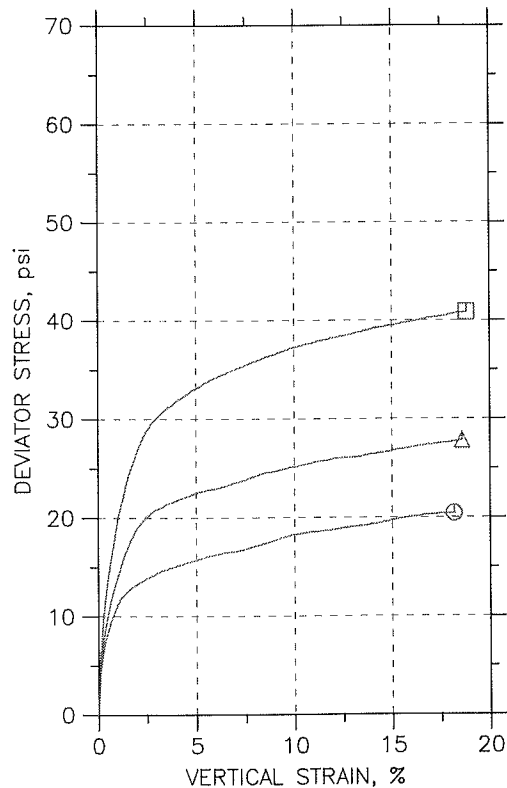
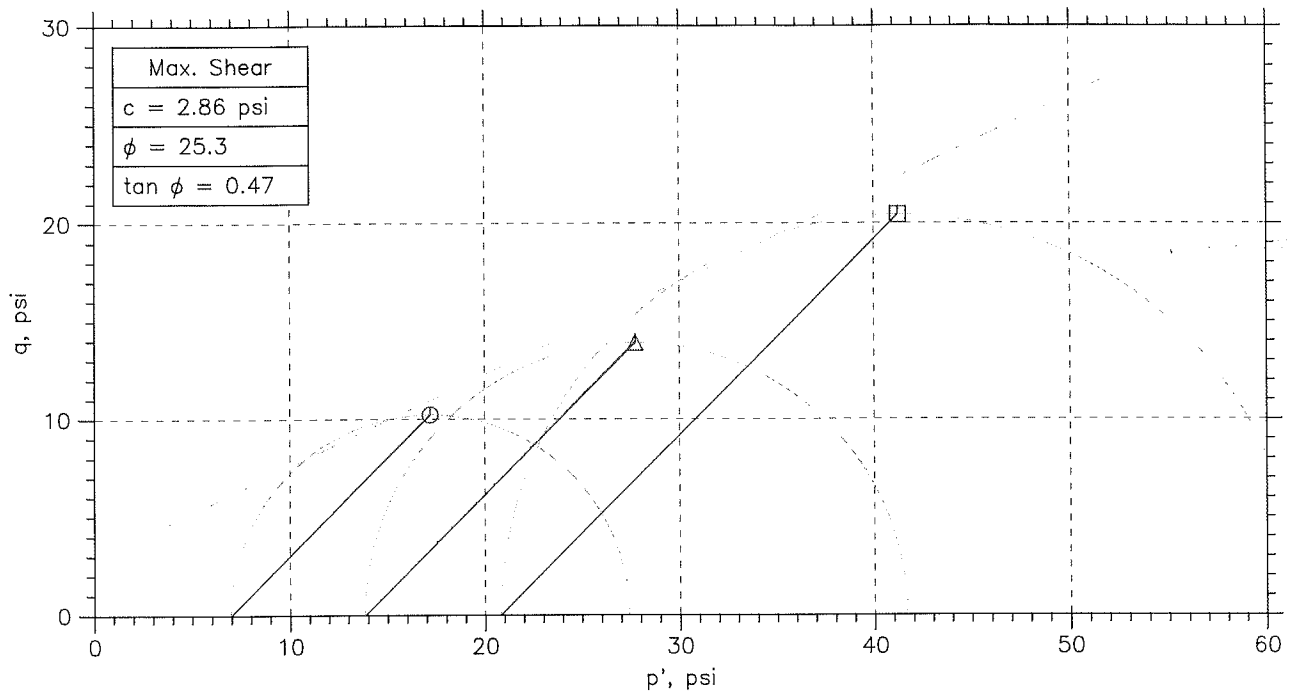
Boring No.: F14-94

Sample Type: CORE

Description: F14-94

Remarks:

CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | | | | |
|--------------|-----------------------------|---------|---------|-------|
| Symbol | ⊙ | △ | □ | |
| Sample No. | 14-1057 | 14-1057 | 14-1057 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Initial | Diameter, in | 1.4 | 1.399 | 1.393 |
| | Height, in | 3.022 | 3.026 | 3.03 |
| | Water Content, % | 22.4 | 22.2 | 22.7 |
| | Dry Density, pcf | 102.7 | 102.5 | 103. |
| | Saturation, % | 93.9 | 92.4 | 95.7 |
| | Void Ratio | 0.648 | 0.651 | 0.643 |
| Before Shear | Water Content, % | 25.6 | 24.8 | 24.6 |
| | Dry Density, pcf | 99.86 | 101.2 | 101.5 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.694 | 0.672 | 0.666 |
| | Back Press., psi | 100 | 100.2 | 100.2 |
| | Ver. Eff. Cons. Stress, psi | 6.972 | 13.85 | 20.82 |
| | Shear Strength, psi | 10.22 | 13.91 | 20.43 |
| | Strain at Failure, % | 18.2 | 18.6 | 18.8 |
| | Strain Rate, %/min | 0.06 | 0.06 | 0.06 |
| | B-Value | 0.00 | 0.00 | 0.00 |
| | Measured Specific Gravity | 2.71 | 2.71 | 2.71 |
| | Liquid Limit | --- | --- | --- |
| | Plastic Limit | --- | --- | --- |

| | | | | | |
|---|-----------------------------|--|--|--|--|
| Natural Resources Conservation Service | Project: PLUM CREEK SITE #6 | <div style="border: 1px dashed black; width: 40px; height: 80px; margin: 0 auto;"></div> | <div style="border: 1px dashed black; width: 40px; height: 80px; margin: 0 auto;"></div> | <div style="border: 1px dashed black; width: 40px; height: 80px; margin: 0 auto;"></div> | <div style="border: 1px dashed black; width: 40px; height: 80px; margin: 0 auto;"></div> |
| | Location: TX | | | | |
| | Project No.: 14-1057 | | | | |
| | Boring No.: F14-94 | | | | |
| | Sample Type: CORE | | | | |
| | Description: F14-94 | | | | |
| Remarks: | | | | | |

Mohr Circle Program

SITE NAME: **Plum Creek Site #6**
STATE: **Texas**
SAMPLE NO: **14-1057 UU**

Total Strength Parameters:

Zero Cohesion:

PHI: ~~5.3~~ degrees
C: ~~1090~~ psf

5.3 degrees
7.57 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☐ Maximum Stress Ratio
☐ Max. Pore Pressure
☒ <= 10 % Strain
☒ Selected Points

Effective Strength Parameters:

PHI': ~~5.3~~ degrees
C': ~~1090~~ psf

5.3 degrees
7.57 psi

Slope y=

$\phi = 0^\circ$
 $C = 1440$ psf

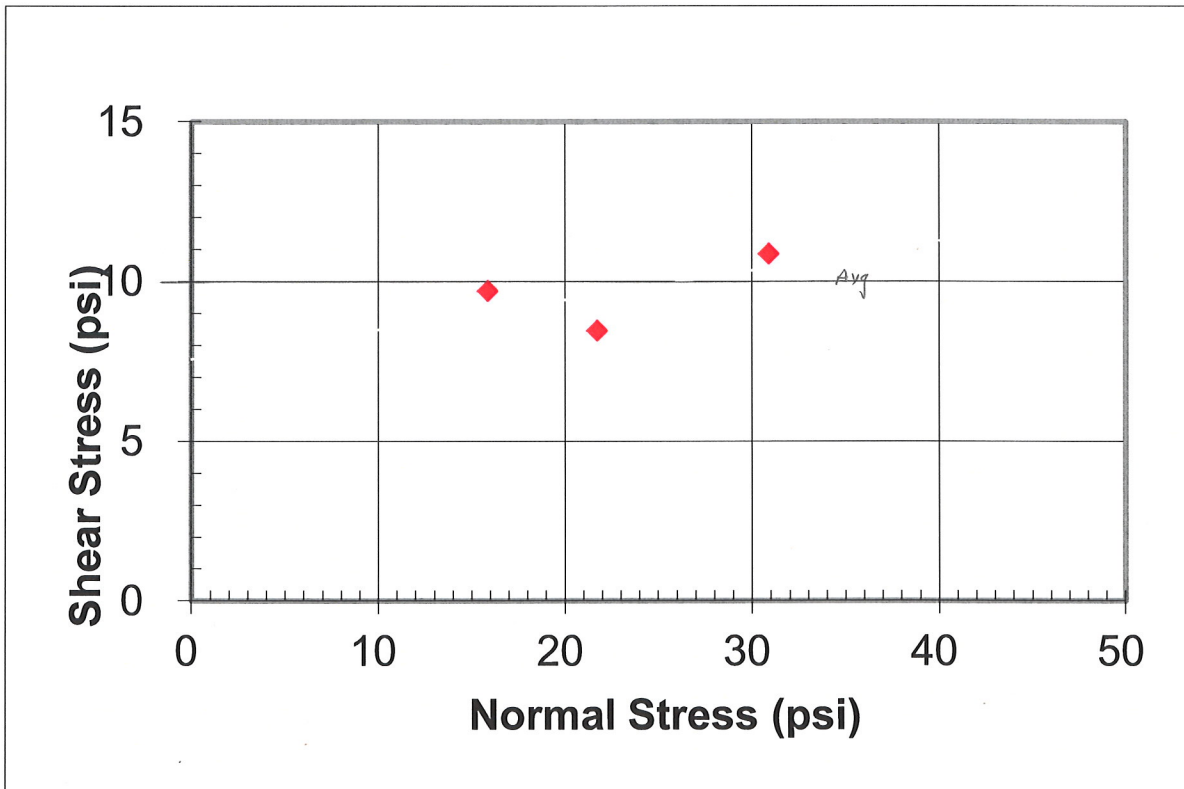
Stress path analysis for Effective:

Alpha': 5.3 degrees
a': 7.54 psi

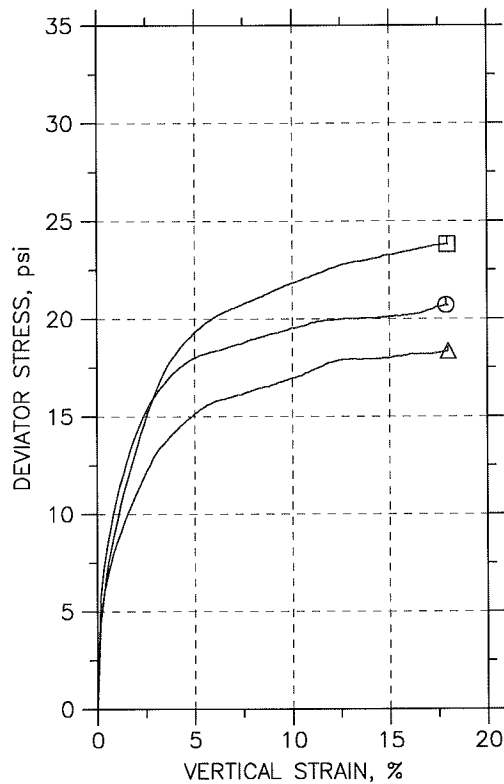
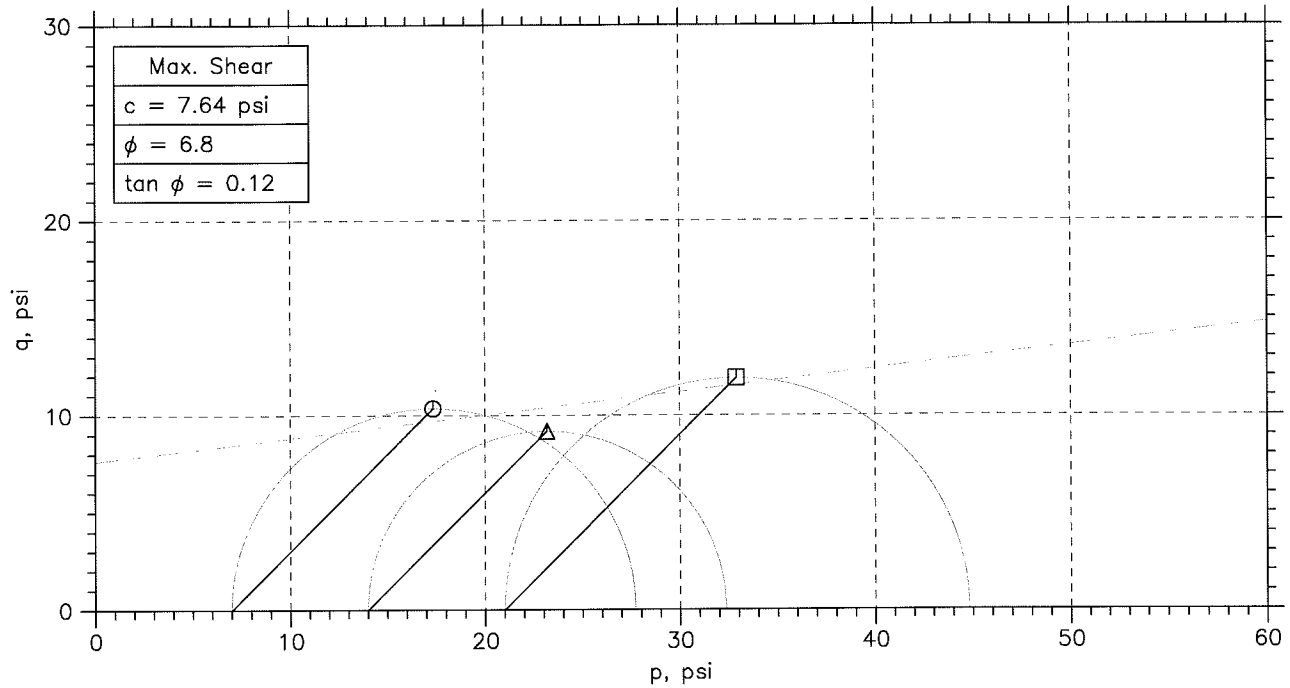
(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 19.5 | 0.001 | 10.0 |
| 14 | 17.0 | 0.001 | 10.0 |
| 21 | 21.8 | 0.001 | 10.0 |

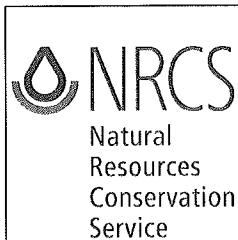
Backpressure Saturated UU - $\phi = 0^\circ$



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ⊙ | △ | □ | |
|---------------------------|---------|---------|---------|--|
| Sample No. | 14-1057 | 14-1057 | 14-1057 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Tested by | SKK | SKK | SKK | |
| Test Date | 9/3/14 | 9/3/14 | 9/3/14 | |
| Checked by | SKK | SKK | SKK | |
| Check Date | | | | |
| Diameter, in | 1.4 | 1.399 | 1.394 | |
| Height, in | 3.02 | 3.02 | 3.026 | |
| Water Content, % | 21.4 | 21.4 | 21.7 | |
| Dry Density, pcf | 105.2 | 104.8 | 105.3 | |
| Saturation, % | 95.2 | 94.4 | 96.9 | |
| Void Ratio | 0.608 | 0.614 | 0.606 | |
| Confining Stress, psi | 7 | 14 | 21 | |
| Undrained Strength, psi | 10.35 | 9.171 | 11.9 | |
| Max. Dev. Stress, psi | 20.7 | 18.34 | 23.8 | |
| Strain at Failure, % | 17.9 | 18 | 18 | |
| Strain Rate, %/min | 1 | 1 | 1 | |
| Measured Specific Gravity | 2.71 | 2.71 | 2.71 | |
| Liquid Limit | --- | --- | --- | |
| Plastic Limit | --- | --- | --- | |
| Plasticity Index | --- | --- | --- | |



Project: PLUM CREEK SITE #6

Location: TX

Project No.: 14-1057

Boring No.: F14-94

Sample Type: CORE

Description: F14-94

Remarks:

Phase calculations based on start and end of test.

Mohr Circle Program

SITE NAME: **Plum Creek 6**
STATE: **Texas**
SAMPLE NO: **14-1058**

$\phi = 22.5^\circ$
 $c = 195 \text{ psf}$
 $\bar{\phi} = 28.0^\circ$
 $\bar{c} = 165 \text{ psf}$

Total Strength Parameters:

Zero Cohesion:

PHI: **22.4** degrees

22.4 degrees

C: **194** psf

1.35 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☒ Maximum Stress Ratio
☐ Max. Pore Pressure
☐ <= 15% Strain
☐ Selected Points

Effective Strength Parameters:

PHI': **28.7** degrees

28.7 degrees

C': **246** psf

1.71 psi

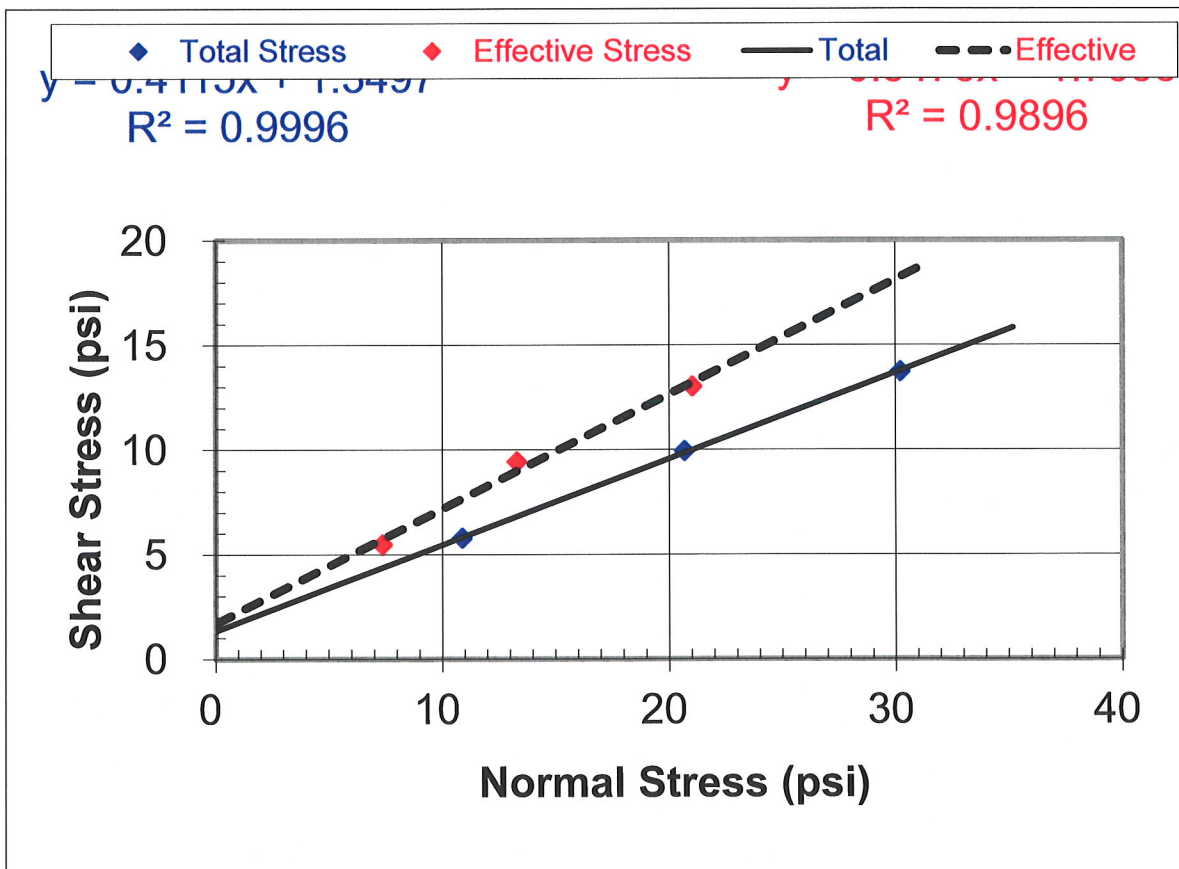
Slope y=

Stress path analysis for Effective:

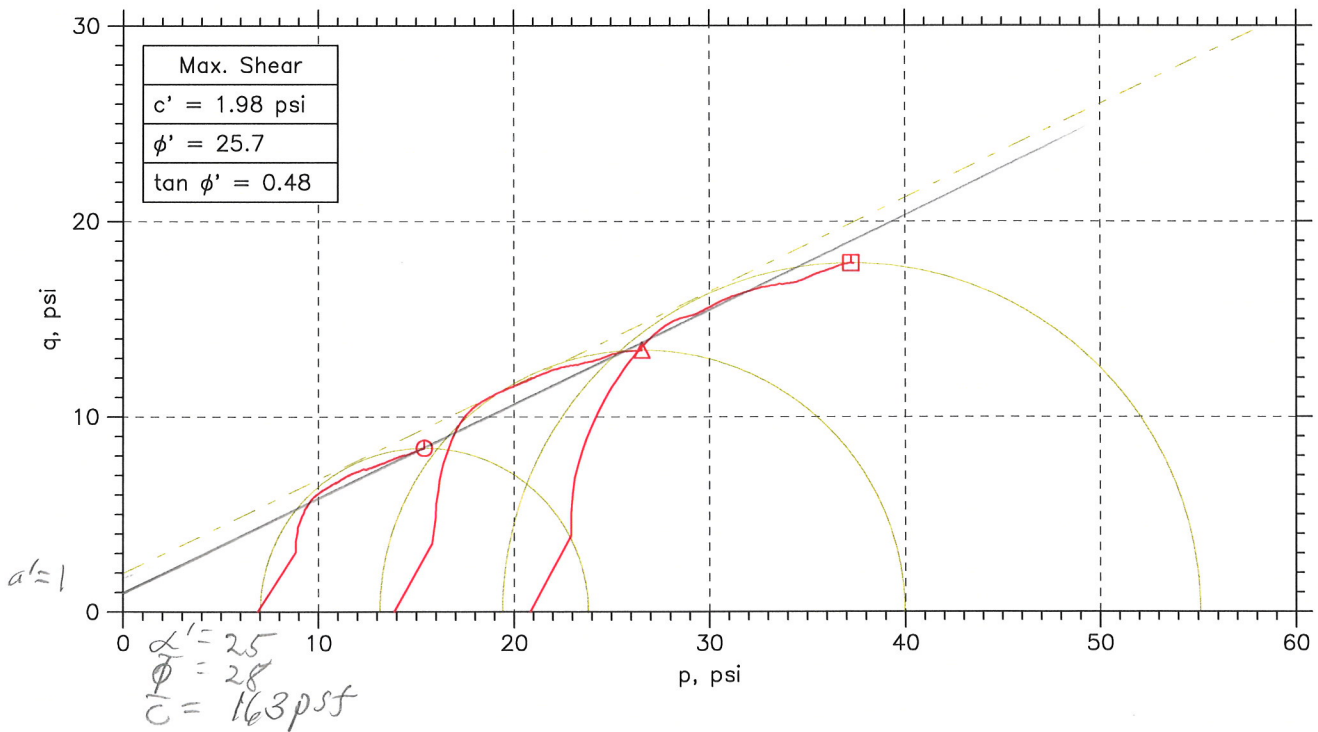
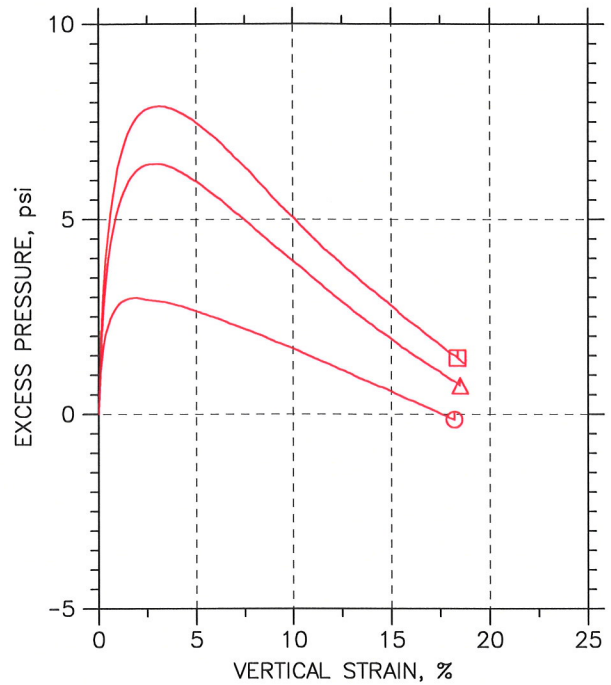
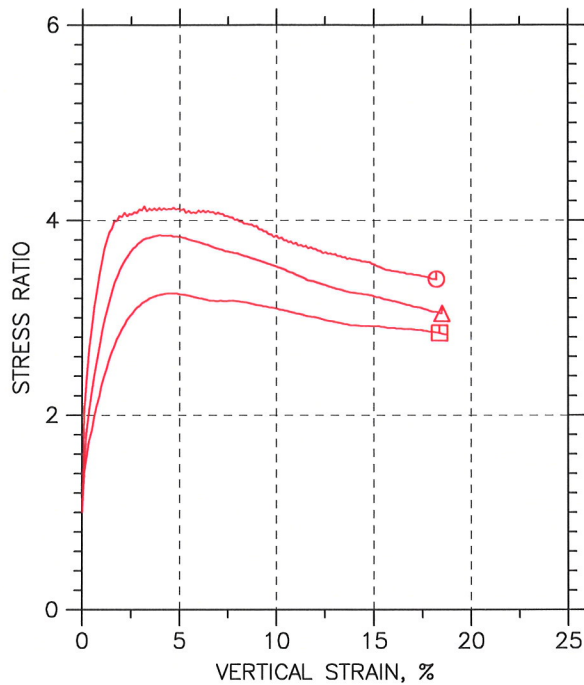
PHI': **28** degrees
c': **165** psf

(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 12.5 | 2.9 | 3.2 |
| 14 | 21.5 | 6.3 | 3.9 |
| 21 | 29.7 | 7.7 | 4.5 |



CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|------------|----------|-------|-----------|-----------|------------|------------|-------------------|
| ○ | 14-1058 | 1 | N/A | SKK | 8/8/14 | SKK | | 14-1058-07eng.dat |
| △ | 14-1058 | 2 | N/A | SKK | 8/8/14 | SKK | | 14-1058-14eng.dat |
| □ | 14-1058 | 3 | N/A | SKK | 8/8/14 | SKK | | 14-1058-21eng.dat |
| | | | | | | | | |



Project: PLUM CREEK SITE #6

Location: TX

Project No.: 14-1058

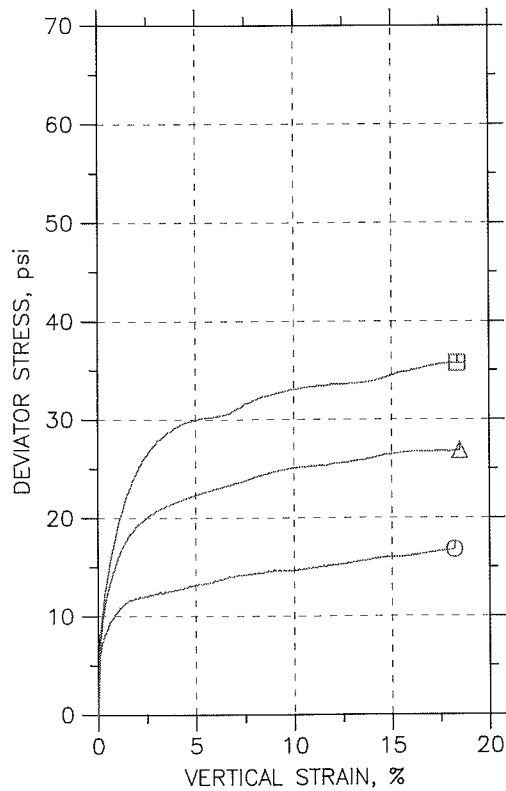
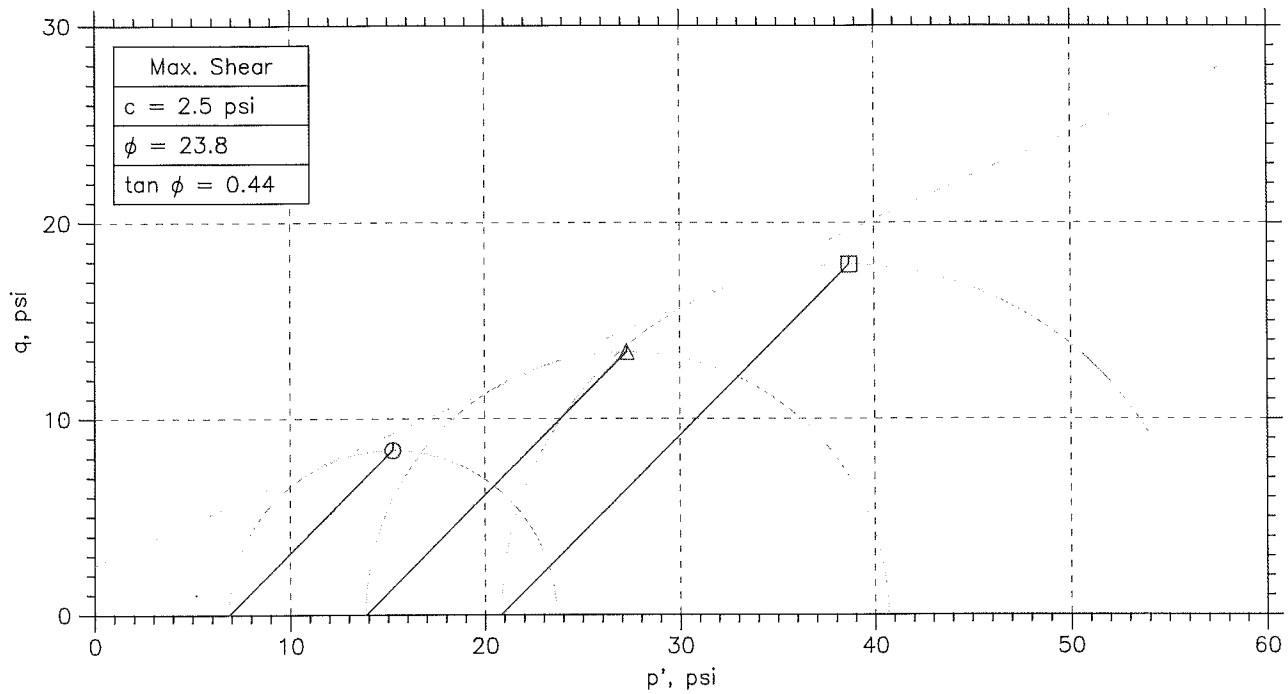
Boring No.: F14-97

Sample Type: CORE

Description: F14-97

Remarks:

CONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ○ | △ | □ | |
|-----------------------------|------------------|---------|---------|-------|
| Sample No. | 14-1058 | 14-1058 | 14-1058 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Initial | Diameter, in | 1.39 | 1.4 | 1.396 |
| | Height, in | 3.025 | 3.021 | 3.027 |
| | Water Content, % | 21.4 | 21.4 | 21.6 |
| | Dry Density, pcf | 103.4 | 103.2 | 103.9 |
| | Saturation, % | 91.2 | 90.8 | 93.2 |
| | Void Ratio | 0.636 | 0.639 | 0.628 |
| Before Shear | Water Content, % | 24.7 | 23.5 | 23.0 |
| | Dry Density, pcf | 101.4 | 103.3 | 104.2 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.668 | 0.638 | 0.624 |
| | Back Press., psi | 100.1 | 100.1 | 100.2 |
| Ver. Eff. Cons. Stress, psi | | 6.867 | 13.86 | 20.84 |
| Shear Strength, psi | | 8.396 | 13.42 | 17.86 |
| Strain at Failure, % | | 18.2 | 18.5 | 18.4 |
| Strain Rate, %/min | | 0.06 | 0.06 | 0.06 |
| B-Value | | 0.00 | 0.00 | 0.00 |
| Measured Specific Gravity | | 2.71 | 2.71 | 2.71 |
| Liquid Limit | | --- | --- | --- |
| Plastic Limit | | --- | --- | --- |



Project: PLUM CREEK SITE #6

Location: TX

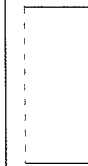
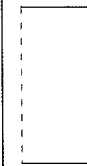
Project No.: 14-1058

Boring No.: F14-97

Sample Type: CORE

Description: F14-97

Remarks:



Mohr Circle Program

SITE NAME: **Plum Creek Site #6**
STATE: **Texas**
SAMPLE NO: **14-1058 UU**

Total Strength Parameters:

Zero Cohesion:

PHI: ~~-5.9~~ degrees
C: ~~661~~ psf

5.9 degrees
4.59 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☐ Maximum Stress Ratio
☐ Max. Pore Pressure
☒ <= 10 % Strain
☐ Selected Points

Effective Strength Parameters:

PHI': ~~-5.9~~ degrees
C': ~~661~~ psf

5.9 degrees
4.59 psi

Slope y=

Stress path analysis for Effective:

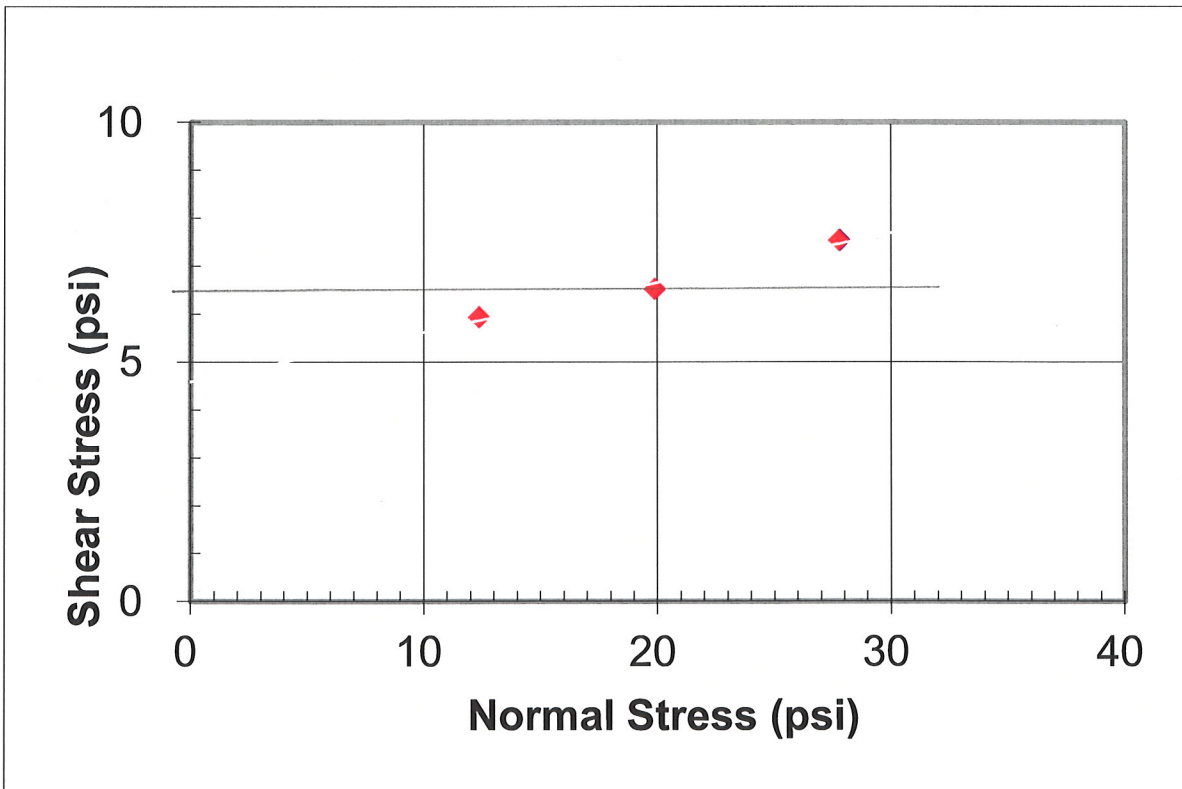
Alpha': 5.9 degrees
a': 4.57 psi

$\phi = 0^\circ$
 $c = 950$ psf

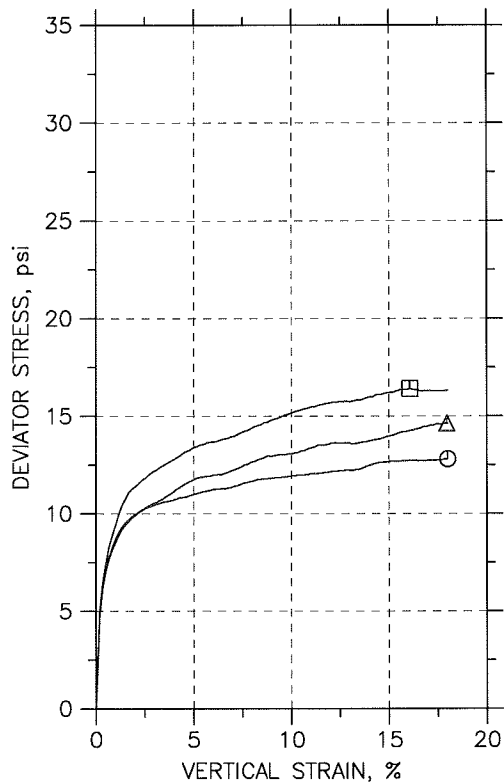
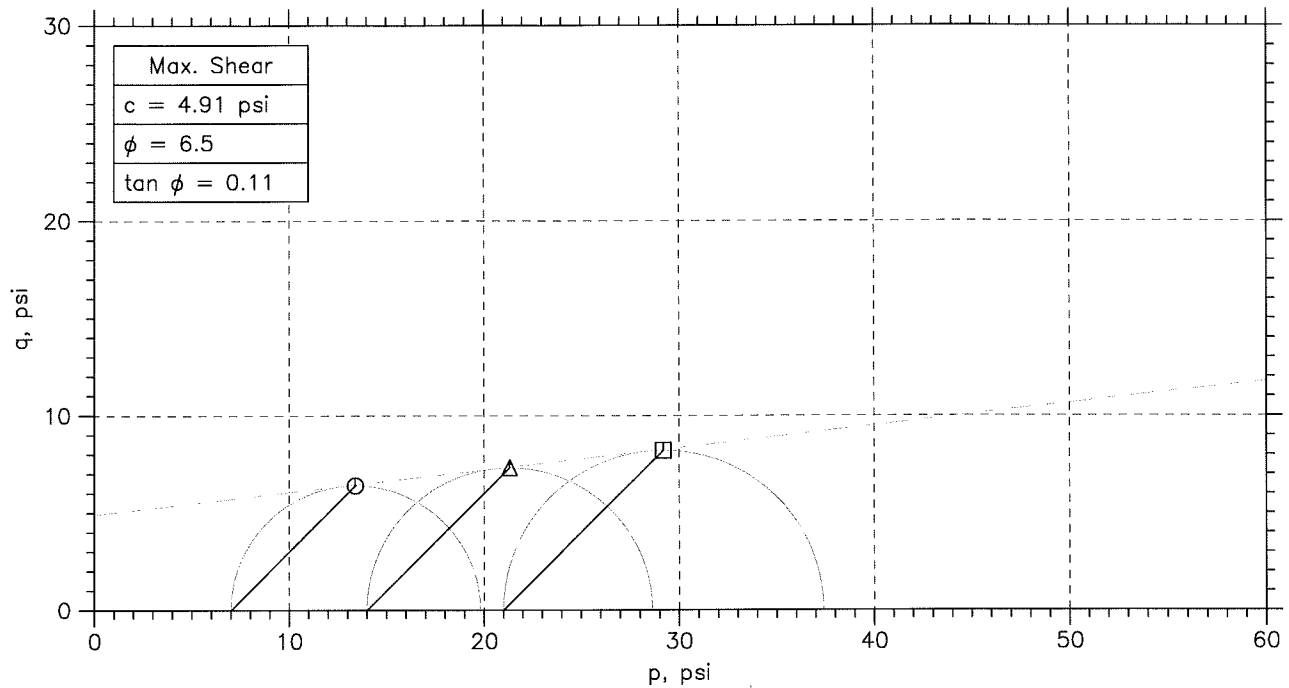
(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 11.9 | 0.001 | 10.0 |
| 14 | 13.1 | 0.001 | 10.0 |
| 21 | 15.2 | 0.001 | 10.0 |

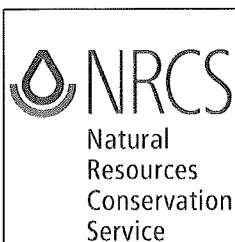
Backpressure Saturated UU - $\phi = 0^\circ$



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ⊙ | Δ | □ | |
|---------------------------|---------|---------|---------|--|
| Sample No. | 14-1058 | 14-1058 | 14-1058 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Tested by | SKK | SKK | SKK | |
| Test Date | 9/4/14 | 9/4/14 | 9/4/14 | |
| Checked by | SKK | SKK | SKK | |
| Check Date | | | | |
| Diameter, in | 1.395 | 1.393 | 1.396 | |
| Height, in | 3.023 | 3.027 | 3.025 | |
| Water Content, % | 20.5 | 20.9 | 20.1 | |
| Dry Density, pcf | 104.4 | 103.8 | 105.9 | |
| Saturation, % | 89.8 | 89.7 | 91.1 | |
| Void Ratio | 0.62 | 0.63 | 0.597 | |
| Confining Stress, psi | 7 | 14 | 21 | |
| Undrained Strength, psi | 6.401 | 7.318 | 8.203 | |
| Max. Dev. Stress, psi | 12.8 | 14.64 | 16.41 | |
| Strain at Failure, % | 18 | 18 | 16.1 | |
| Strain Rate, %/min | 1 | 1 | 1 | |
| Measured Specific Gravity | 2.71 | 2.71 | 2.71 | |
| Liquid Limit | --- | --- | --- | |
| Plastic Limit | --- | --- | --- | |
| Plasticity Index | --- | --- | --- | |



Project: PLUM CREEK SITE #6

Location: TX

Project No.: 14-1058

Boring No.: F14-97

Sample Type: CORE

Description: F14-97

Remarks:

Phase calculations based on start and end of test.

Mohr Circle Program

SITE NAME: **Plum Creek 6**
STATE: **Texas**
SAMPLE NO: **14-1059**

Total Strength Parameters:

Zero Cohesion:

PHI: **21.2** degrees
C: **185** psf

21.2 degrees
1.28 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☒ Maximum Stress Ratio
☐ Max. Pore Pressure
☐ <= 15% Strain
☐ Selected Points

Effective Strength Parameters:

PHI': **26.9** degrees
C': **194** psf

26.9 degrees
1.35 psi

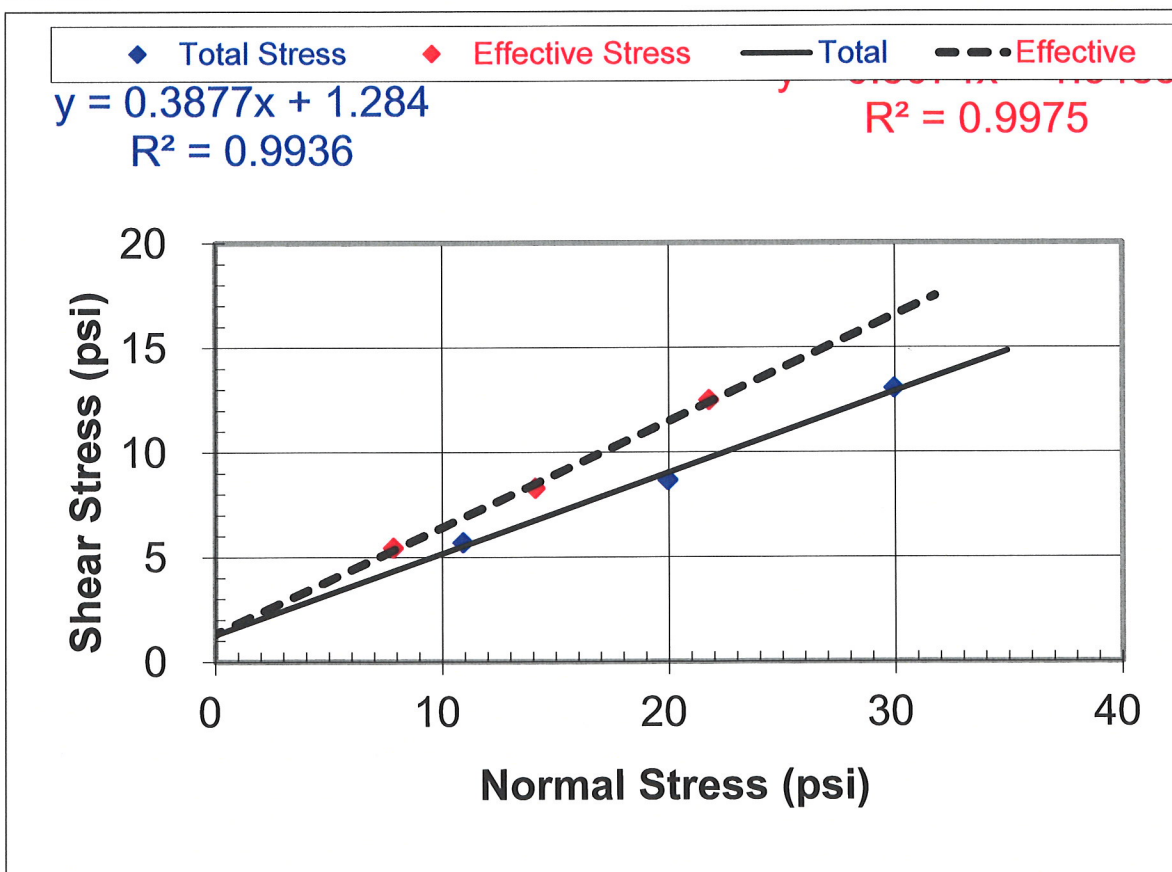
Slope y=

Stress path analysis for Effective:

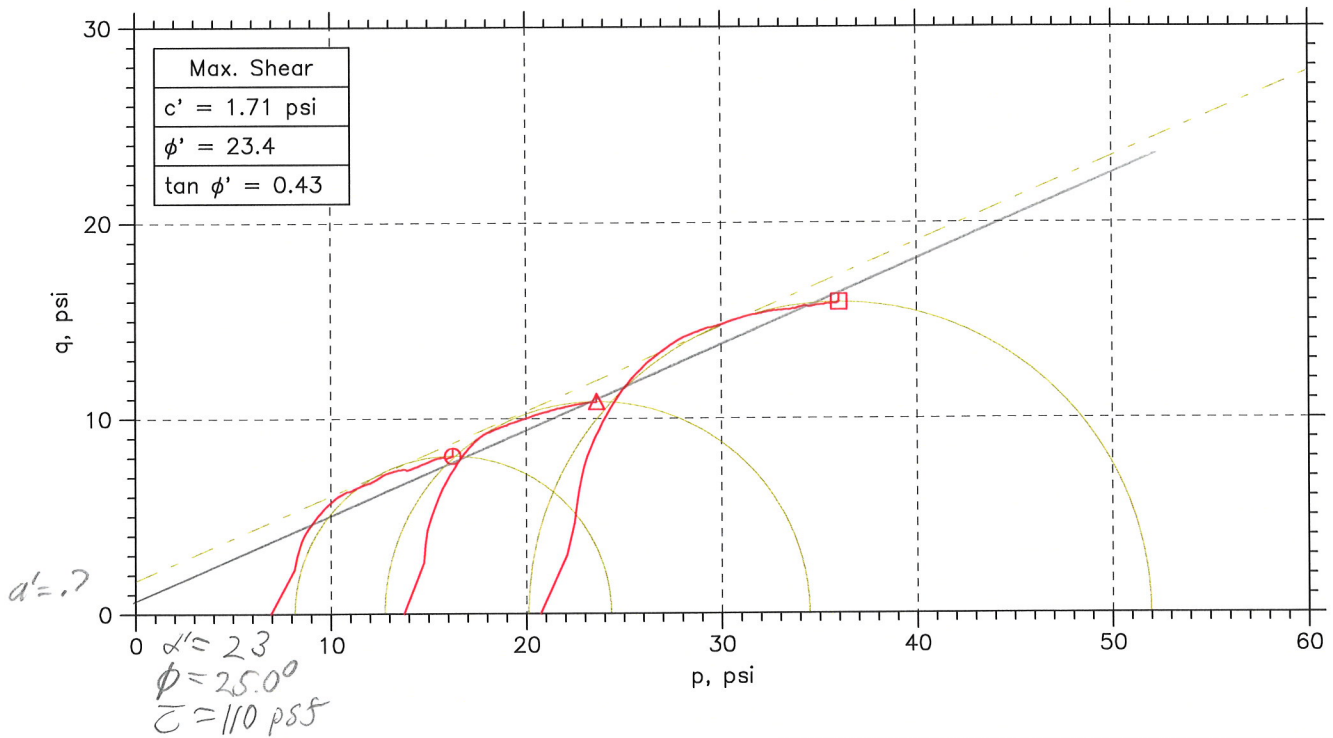
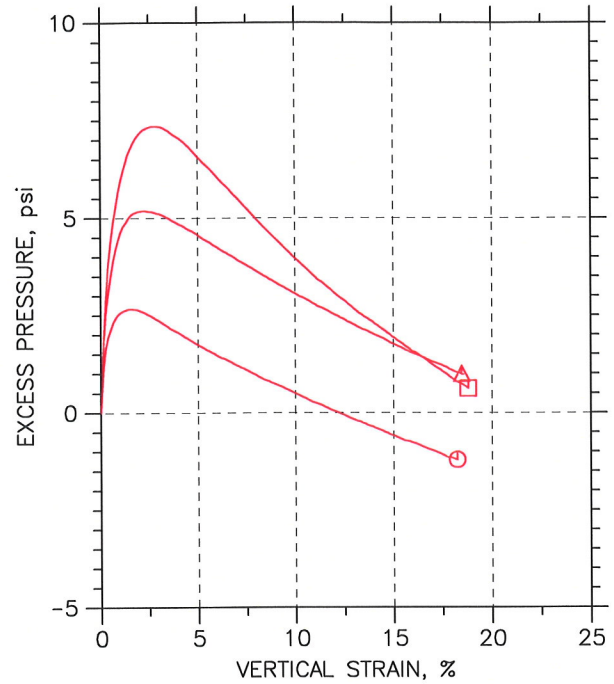
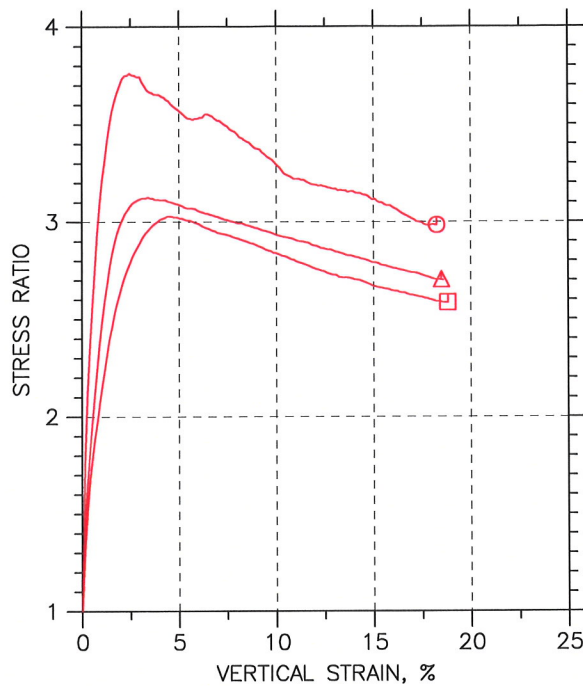
PHI': **25** degrees
c': **110** psf

(All inputed values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 12.2 | 2.5 | 2.4 |
| 14 | 18.6 | 5 | 3.4 |
| 21 | 28 | 6.9 | 4.4 |



CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|------------|----------|-------|-----------|-----------|------------|------------|-------------------|
| ○ | 14-1059 | 1 | N/A | SKK | 8/12/14 | SKK | | 14-1059-07eng.dat |
| △ | 14-1059 | 2 | N/A | SKK | 8/12/14 | SKK | | 14-1059-14eng.dat |
| □ | 14-1059 | 3 | N/A | SKK | 8/12/14 | SKK | | 14-1059-21eng.dat |



Project: PLUM CREEK SITE #6 DAM Location: TX

Project No.: 14-1059

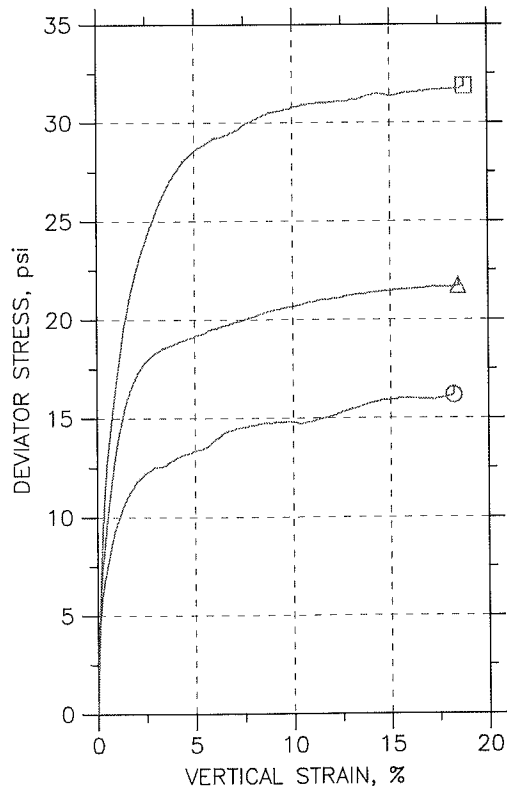
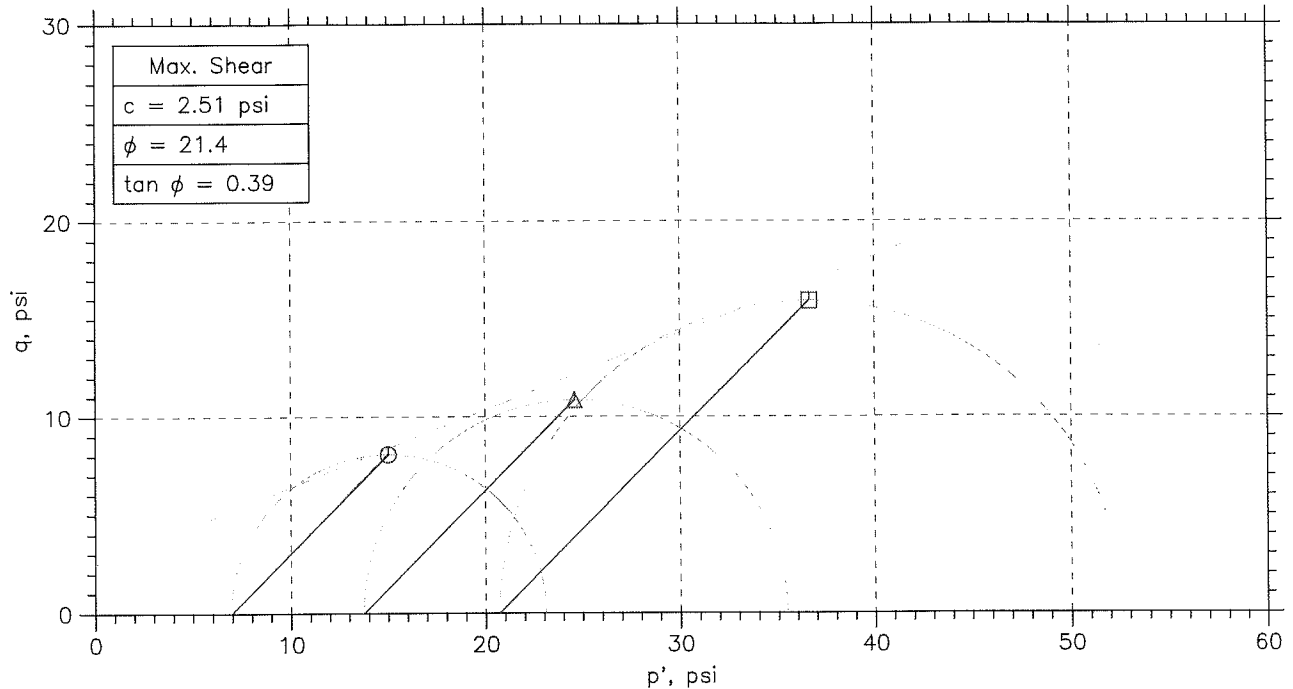
Boring No.: F14-101A

Sample Type: CORE


Description: F14-101A

Remarks:

CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | | | | |
|--------------|-----------------------------|---------|---------|-------|
| Symbol | ○ | △ | □ | |
| Sample No. | 14-1059 | 14-1059 | 14-1059 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Initial | Diameter, in | 1.398 | 1.397 | 1.394 |
| | Height, in | 3.027 | 3.03 | 3.024 |
| | Water Content, % | 22.9 | 23.7 | 23.4 |
| | Dry Density, pcf | 101.3 | 100.4 | 101. |
| | Saturation, % | 92.3 | 93.1 | 93.6 |
| | Void Ratio | 0.676 | 0.691 | 0.681 |
| Before Shear | Water Content, % | 26.4 | 26.1 | 25.1 |
| | Dry Density, pcf | 98.77 | 99.24 | 100.9 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.719 | 0.711 | 0.683 |
| | Back Press., psi | 100.1 | 100.3 | 100.3 |
| | Ver. Eff. Cons. Stress, psi | 6.94 | 13.74 | 20.72 |
| | Shear Strength, psi | 8.083 | 10.86 | 15.92 |
| | Strain at Failure, % | 18.2 | 18.5 | 18.8 |
| | Strain Rate, %/min | 0.06 | 0.06 | 0.06 |
| | B-Value | 0.00 | 0.00 | 0.00 |
| | Measured Specific Gravity | 2.72 | 2.72 | 2.72 |
| | Liquid Limit | --- | --- | --- |
| | Plastic Limit | --- | --- | --- |

| | | | | | |
|--|---------------------------------|--|--|--|---|
|  NRCS Natural Resources Conservation Service | Project: PLUM CREEK SITE #6 DAM | | | | <div></div> <div></div> <div></div> <div></div> |
| | Location: TX | | | | |
| | Project No.: 14-1059 | | | | |
| | Boring No.: F14-101A | | | | |
| | Sample Type: CORE | | | | |
| | Description: F14-101A | | | | |
| Remarks: | | | | | |

Mohr Circle Program

SITE NAME: **Plum Creek Site #6**

STATE: **Texas**

SAMPLE NO: **14-1059 UU**

Total Strength Parameters:

Zero Cohesion:

PHI: ~~-7.3~~ degrees
C: ~~1469~~ psf

-7.3 degrees
10.20 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☐ Maximum Stress Ratio
☐ Max. Pore Pressure
☒ <= 10 % Strain
☐ Selected Points

Effective Strength Parameters:

PHI': ~~-7.3~~ degrees
C': ~~1469~~ psf

-7.3 degrees
10.20 psi

Slope y=

Stress path analysis for Effective:

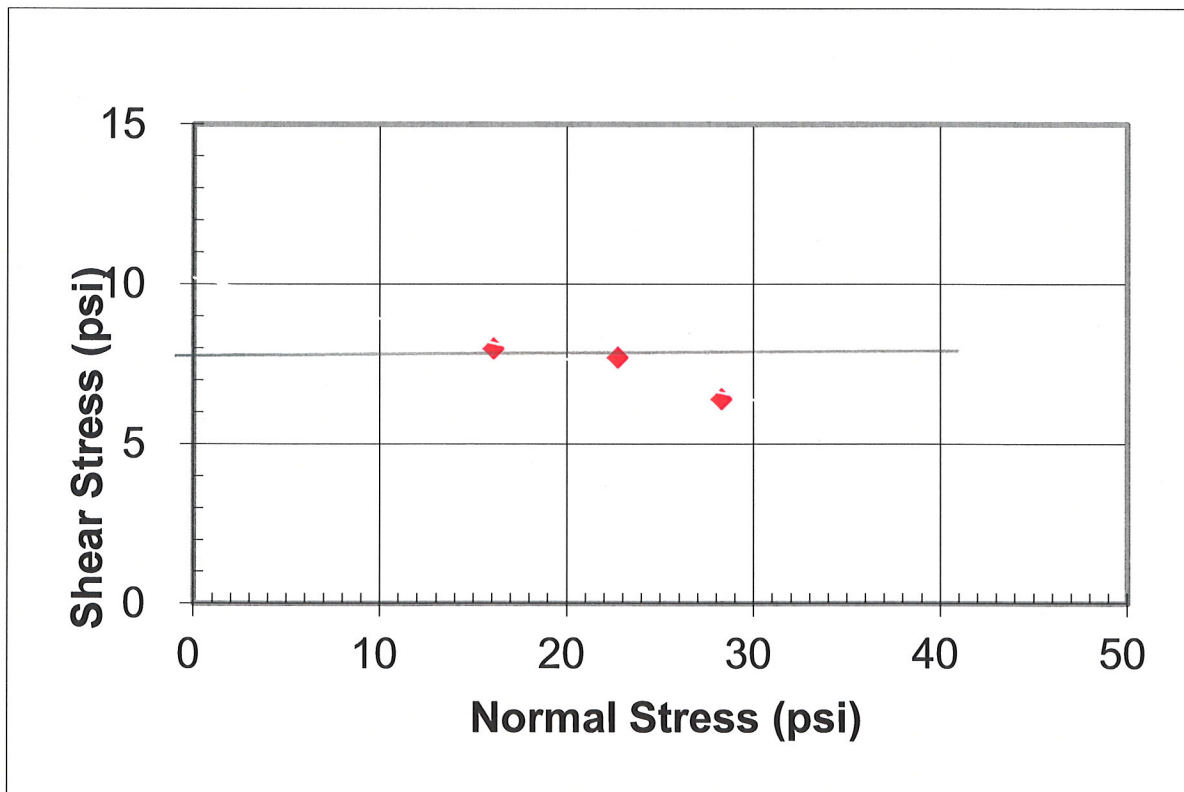
$\phi = 0^\circ$
 $c = 11.38 \text{ psf}$

Alpha': -7.2 degrees
a': 10.12 psi

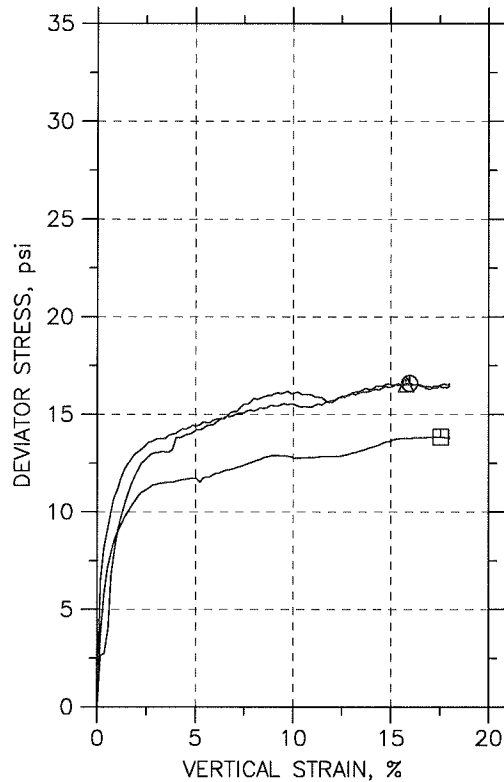
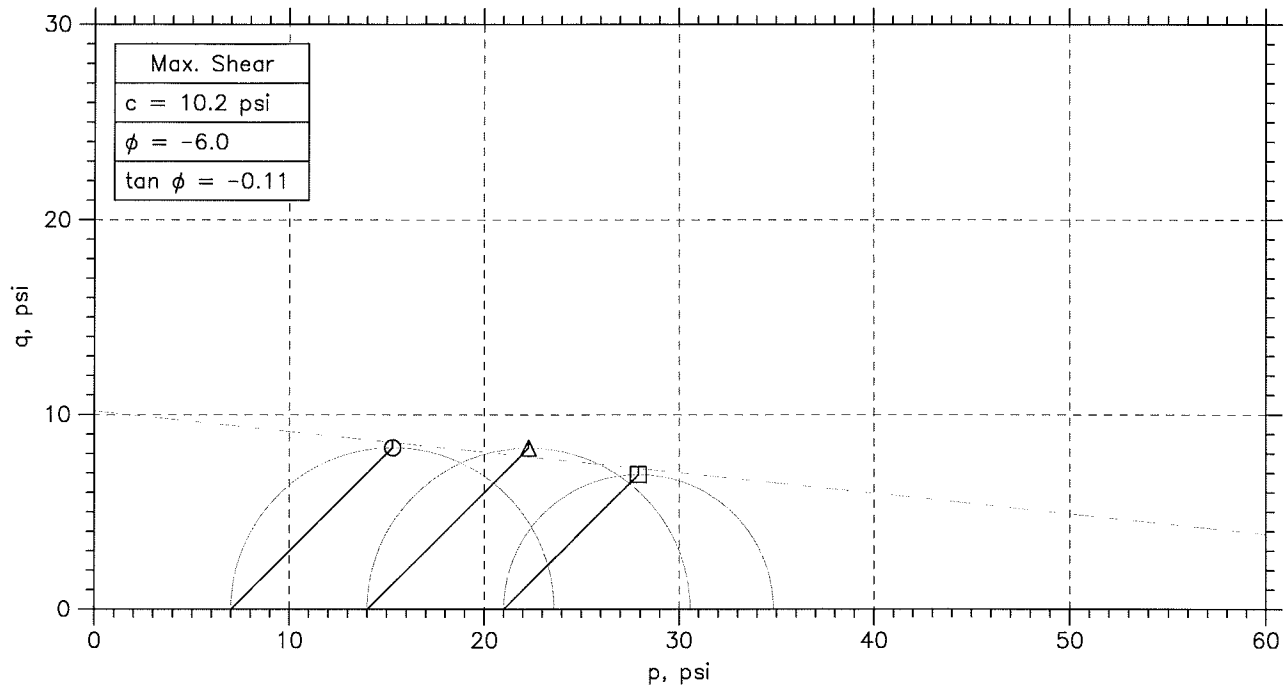
(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 16.1 | 0.001 | 10.0 |
| 14 | 15.5 | 0.001 | 10.0 |
| 21 | 12.9 | 0.001 | 10.0 |

Backpressure Saturated UU - $\phi = 0^\circ$



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ⊙ | △ | □ | |
|---------------------------|---------|---------|---------|--|
| Sample No. | 14-1059 | 14-1059 | 14-1059 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Tested by | SKK | SKK | SKK | |
| Test Date | 9/5/14 | 9/5/14 | 9/5/14 | |
| Checked by | SKK | SKK | SKK | |
| Check Date | | | | |
| Diameter, in | 1.39 | 1.398 | 1.398 | |
| Height, in | 3.022 | 3.022 | 3.029 | |
| Water Content, % | 23.4 | 23.1 | 21.7 | |
| Dry Density, pcf | 101.5 | 101.4 | 103.3 | |
| Saturation, % | 94.7 | 92.9 | 91.5 | |
| Void Ratio | 0.672 | 0.675 | 0.644 | |
| Confining Stress, psi | 7 | 14 | 21 | |
| Undrained Strength, psi | 8.3 | 8.284 | 6.922 | |
| Max. Dev. Stress, psi | 16.6 | 16.57 | 13.84 | |
| Strain at Failure, % | 16 | 15.8 | 17.5 | |
| Strain Rate, %/min | 1 | 1 | 1 | |
| Measured Specific Gravity | 2.72 | 2.72 | 2.72 | |
| Liquid Limit | --- | --- | --- | |
| Plastic Limit | --- | --- | --- | |
| Plasticity Index | --- | --- | --- | |



Project: PLUM CREEK SITE #6 DAM

Location: TX

Project No.: 14-1059

Boring No.: F14-101A

Sample Type: CORE

Description: F14-101A

Remarks:

Phase calculations based on start and end of test.

Mohr Circle Program

$\phi = 28.00$
 $C = 325 \text{ psf}$
 $\bar{\phi} = 44.00$
 $\bar{C} = 0$

SITE NAME: Plum Creek 6
STATE: Texas
SAMPLE NO: 14-1061

Total Strength Parameters:

Zero Cohesion:

| | |
|------|--------------|
| PHI: | 28.2 degrees |
| C: | 324 psf |

28.2 degrees
2.25 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
- ☐ Maximum Stress Ratio
- ☐ Max. Pore Pressure
- ☐ <= 15% Strain
- ☒ Selected Points

Effective Strength Parameters:

| | |
|-------|--------------|
| PHI': | 45.3 degrees |
| C': | 225 psf |

45.3 degrees
1.56 psi

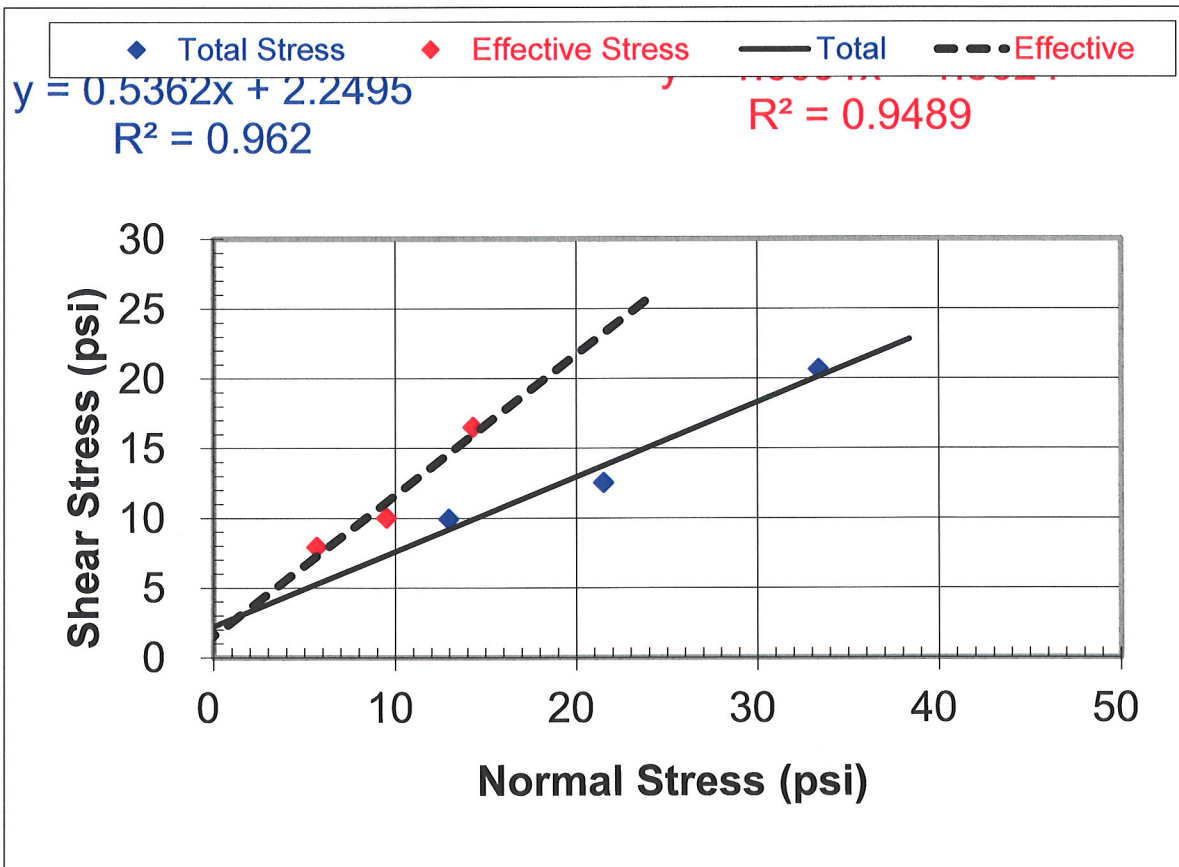
Slope y=

Stress path analysis for Effective:

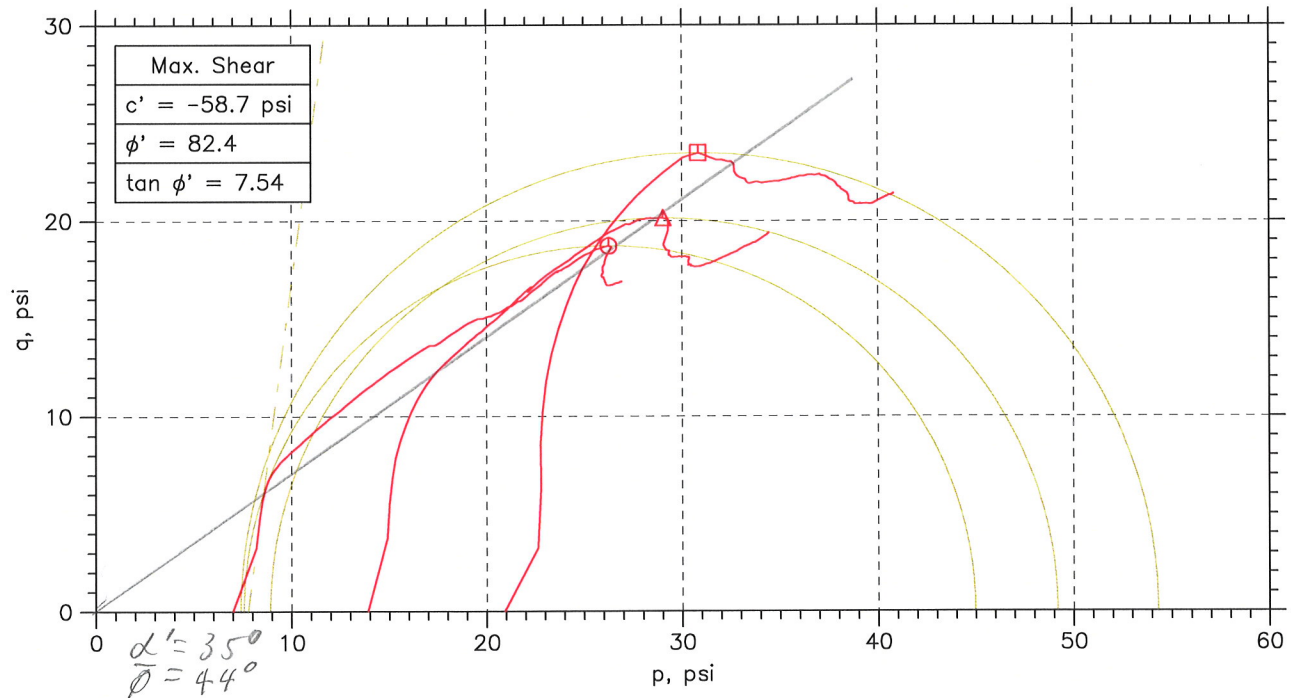
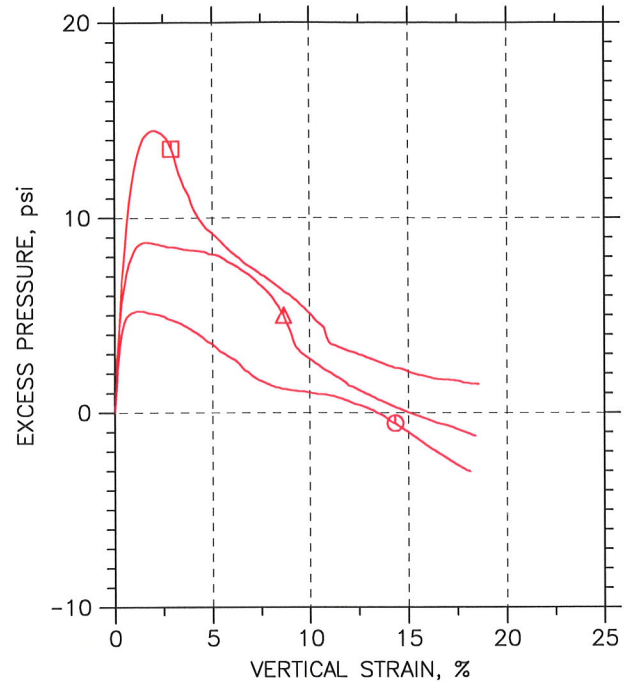
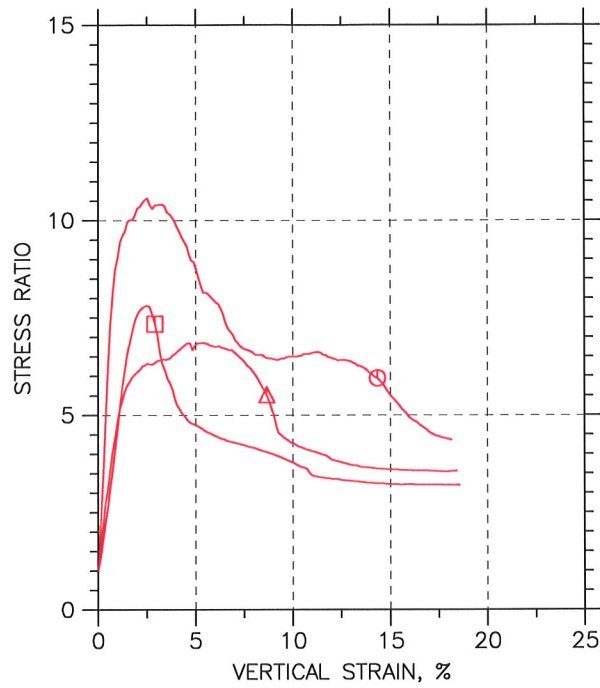
PHI': 44 degrees
c': 0 psf

(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 22.5 | 4.6 | 3.3 |
| 14 | 28.4 | 8.6 | 2.5 |
| 21 | 46.9 | 13.5 | 2.9 |



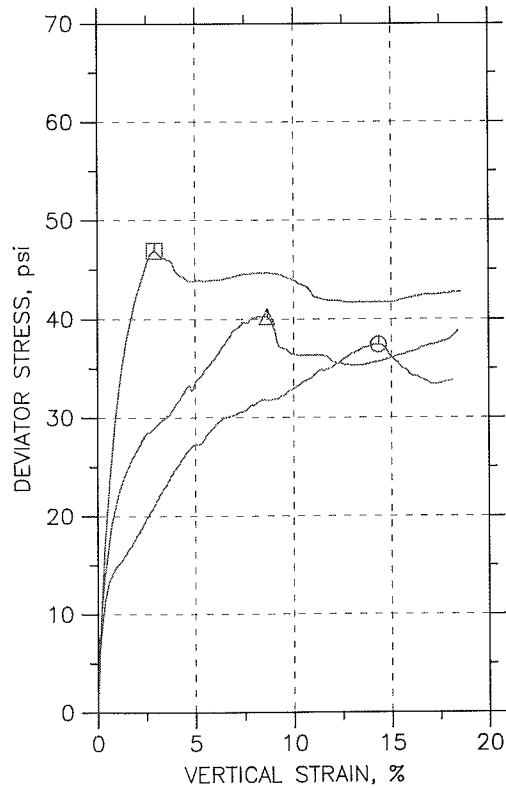
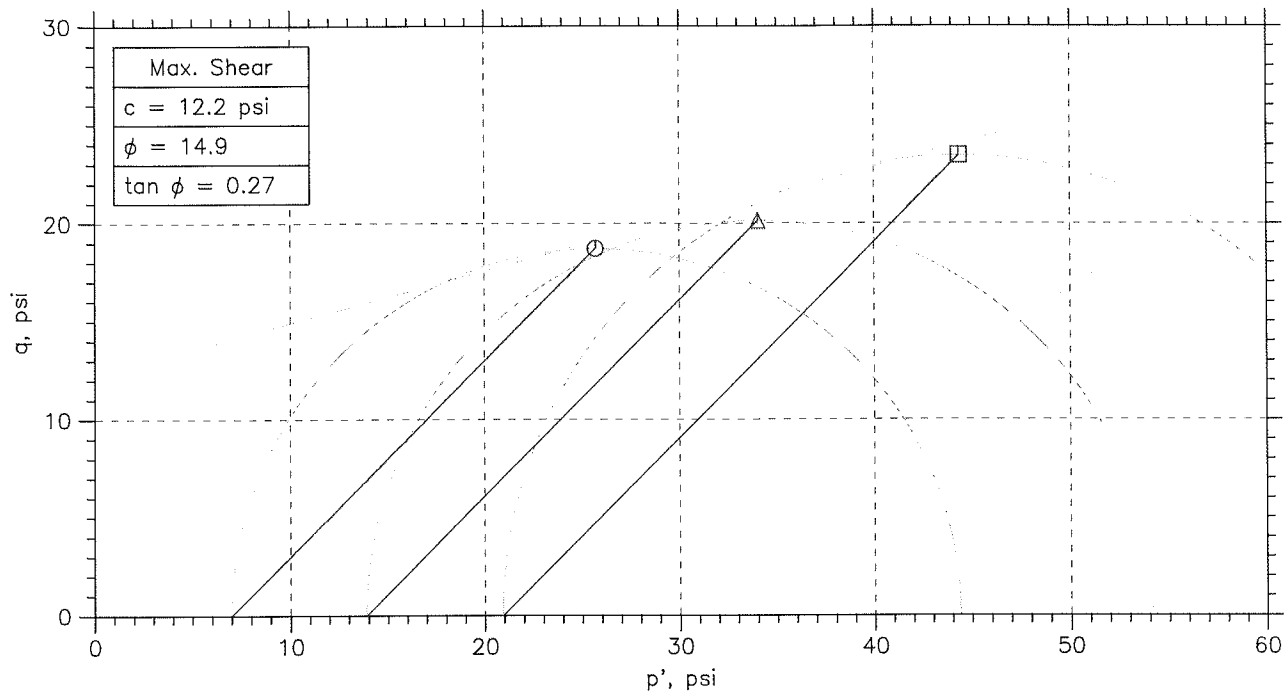
CONSOLIDATED UNDRAINED TRIAXIAL TEST




| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|------------|----------|-------|-----------|-----------|------------|------------|-------------------|
| ○ | 14-1061 | 1 | N/A | SKK | 8/14/14 | SKK | | 14-1061-07eng.dat |
| △ | 14-1061 | 2 | N/A | SKK | 8/14/14 | SKK | | 14-1061-14eng.dat |
| □ | 14-1061 | 3 | N/A | SKK | 8/14/14 | SKK | | 14-1061-21eng.dat |

| | | | | |
|---|--------------------------------|--|-------------------|----------------------|
| Natural Resources Conservation Service | Project: PLUM CREEK SITE 6 DAM | | Location: TX | Project No.: 14-1061 |
| | Boring No.: F14-102A | | Sample Type: CORE | |
| | Description: F14-102A | | | |
| | Remarks: | | | |

CONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ⊙ | Δ | □ | |
|--------------|-----------------------------|---------|---------|-------|
| Sample No. | 14-1061 | 14-1061 | 14-1061 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Initial | Diameter, in | 1.4 | 1.397 | 1.4 |
| | Height, in | 3.016 | 3.005 | 3.022 |
| | Water Content, % | 24.4 | 24.9 | 24.5 |
| | Dry Density, pcf | 100.5 | 99.45 | 100.6 |
| | Saturation, % | 95.5 | 95.2 | 96.2 |
| Before Shear | Void Ratio | 0.697 | 0.714 | 0.695 |
| | Water Content, % | 26.8 | 27.3 | 26.0 |
| | Dry Density, pcf | 98.49 | 97.66 | 99.65 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.73 | 0.745 | 0.71 |
| Before Shear | Back Press., psi | 100 | 100.1 | 100.1 |
| | Ver. Eff. Cons. Stress, psi | 7.004 | 13.9 | 20.93 |
| | Shear Strength, psi | 18.7 | 20.13 | 23.45 |
| | Strain at Failure, % | 14.3 | 8.66 | 2.91 |
| | Strain Rate, %/min | 0.06 | 0.06 | 0.06 |
| Before Shear | B-Value | 0.00 | 0.00 | 0.00 |
| | Measured Specific Gravity | 2.73 | 2.73 | 2.73 |
| | Liquid Limit | --- | --- | --- |
| | Plastic Limit | --- | --- | --- |
| | | | | |

| | | | | | |
|---|--------------------------------|---|---|---|---|
|  Natural Resources Conservation Service | Project: PLUM CREEK SITE 6 DAM | <div></div> <div></div> <div></div> <div></div> | <div></div> <div></div> <div></div> <div></div> | <div></div> <div></div> <div></div> <div></div> | <div></div> <div></div> <div></div> <div></div> |
| | Location: TX | | | | |
| | Project No.: 14-1061 | | | | |
| | Boring No.: F14-102A | | | | |
| | Sample Type: CORE | | | | |
| | Description: F14-102A | | | | |
| Remarks: | | | | | |

SITE NAME: **Plum Creek Site #6**
STATE: **Texas**
SAMPLE NO: **14-1061 UU**

Total Strength Parameters:

Zero Cohesion:

PHI: ~~4.2~~ degrees
C: ~~1085~~ psf

4.2 degrees
7.53 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☐ Maximum Stress Ratio
☐ Max. Pore Pressure
☒ <= 10 % Strain
☐ Selected Points

Effective Strength Parameters:

PHI': 4.2 degrees
C': 1085 psf

4.2 degrees
7.53 psi

Slope y=

Stress path analysis for Effective:

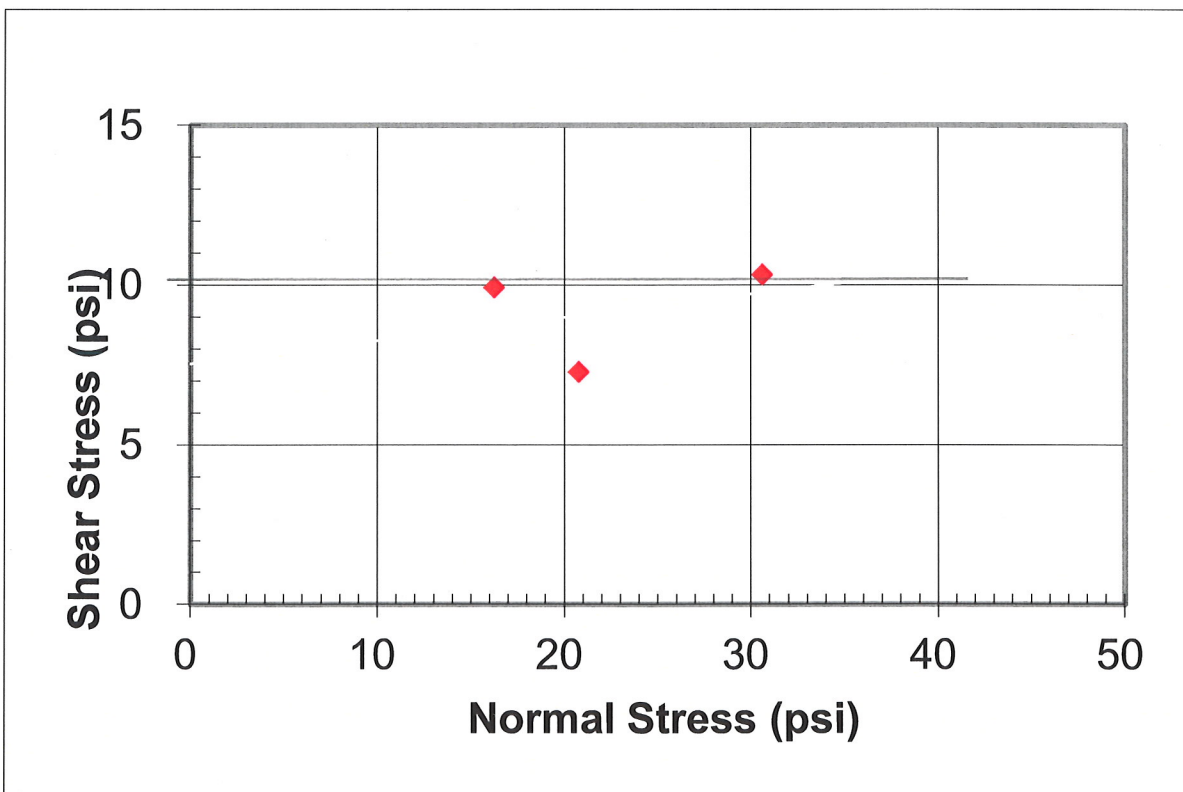
Alpha': 4.2 degrees
a': 7.51 psi

$\phi = 0^\circ$
 $c = 1454 \text{ psf}$

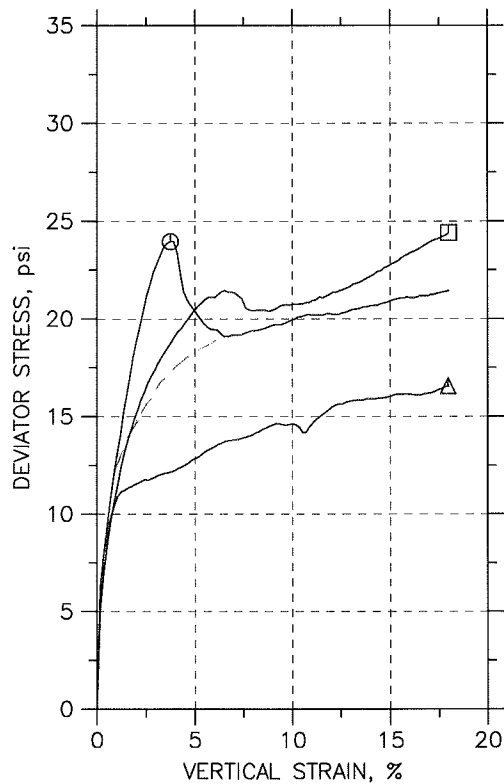
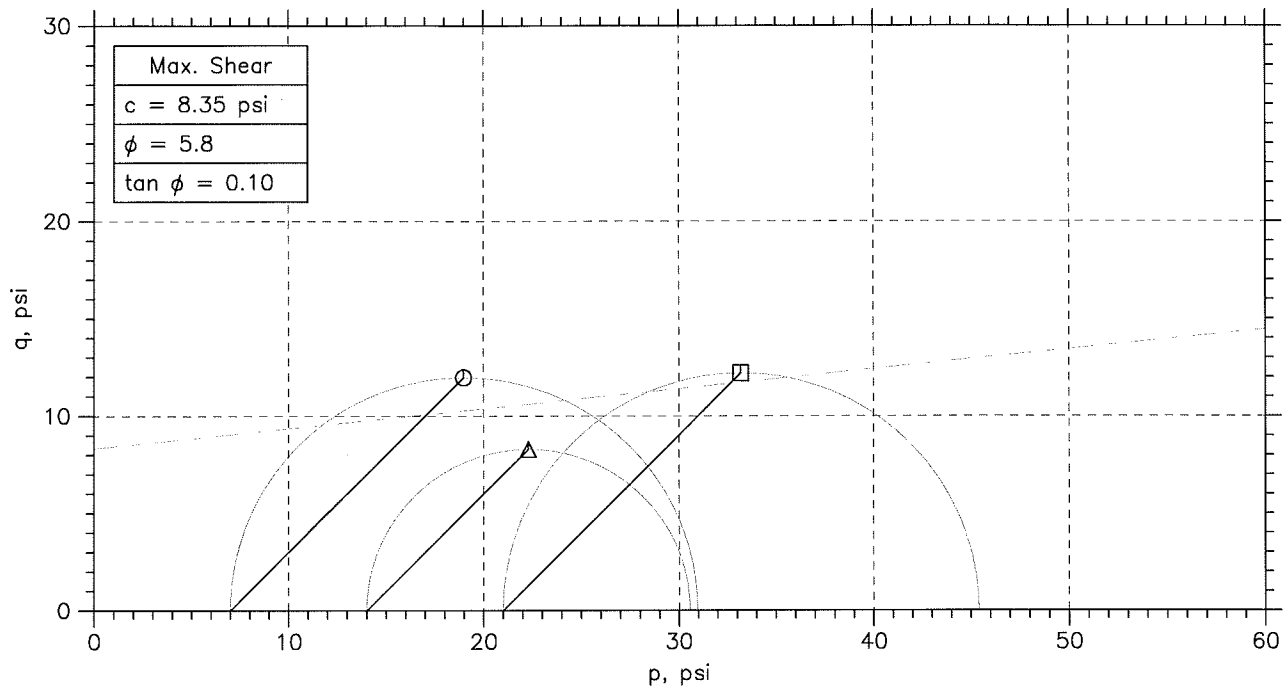
(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 19.9 | 0.001 | 10.0 |
| 14 | 14.6 | 0.001 | 10.0 |
| 21 | 20.7 | 0.001 | 10.0 |

Backpressure Saturated UU - $\phi = 0^\circ$



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ○ | △ | □ | |
|---------------------------|---------|---------|---------|--|
| Sample No. | 14-1061 | 14-1061 | 14-1061 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Tested by | SKK | SKK | SKK | |
| Test Date | 9/9/14 | 9/9/14 | 9/9/14 | |
| Checked by | SKK | SKK | SKK | |
| Check Date | | | | |
| Diameter, in | 1.399 | 1.403 | 1.4 | |
| Height, in | 3.026 | 3.027 | 3.029 | |
| Water Content, % | 24.0 | 24.8 | 24.1 | |
| Dry Density, pcf | 100.1 | 99.16 | 100.8 | |
| Saturation, % | 93.2 | 94.1 | 95.0 | |
| Void Ratio | 0.702 | 0.719 | 0.691 | |
| Confining Stress, psi | 7 | 14 | 21 | |
| Undrained Strength, psi | 11.98 | 8.284 | 12.2 | |
| Max. Dev. Stress, psi | 23.96 | 16.57 | 24.4 | |
| Strain at Failure, % | 3.74 | 18 | 18 | |
| Strain Rate, %/min | 1 | 1 | 1 | |
| Measured Specific Gravity | 2.73 | 2.73 | 2.73 | |
| Liquid Limit | --- | --- | --- | |
| Plastic Limit | --- | --- | --- | |
| Plasticity Index | --- | --- | --- | |



Project: PLUM CREEK SITE 6 DAM

Location: TX

Project No.: 14-1061

Boring No.: F14-102A

Sample Type: CORE

Description: F14-102A

Remarks: *Bad Test*

Phase calculations based on start and end of test.

Mohr Circle Program

9/2/2014
1:02 PM

$\phi = 20.0^\circ$
 $C = 375 \text{ psf}$
 $\bar{\phi} = 28.0^\circ$
 $\bar{C} = 165 \text{ psf}$

SITE NAME: Plum Creek 6

STATE: Texas

SAMPLE NO: 14-1062

Total Strength Parameters:

Zero Cohesion:

PHI: 20.1 degrees

20.1 degrees

C: 376 psf

2.61 psi

Slope y=

Failure Criterion:

☐ Maximum Dev. Stress

☒ Maximum Stress Ratio

☐ Max. Pore Pressure

☐ <= 15% Strain

☐ Selected Points

Effective Strength Parameters:

PHI': 26.0 degrees

26.0 degrees

C': 473 psf

3.29 psi

Slope y=

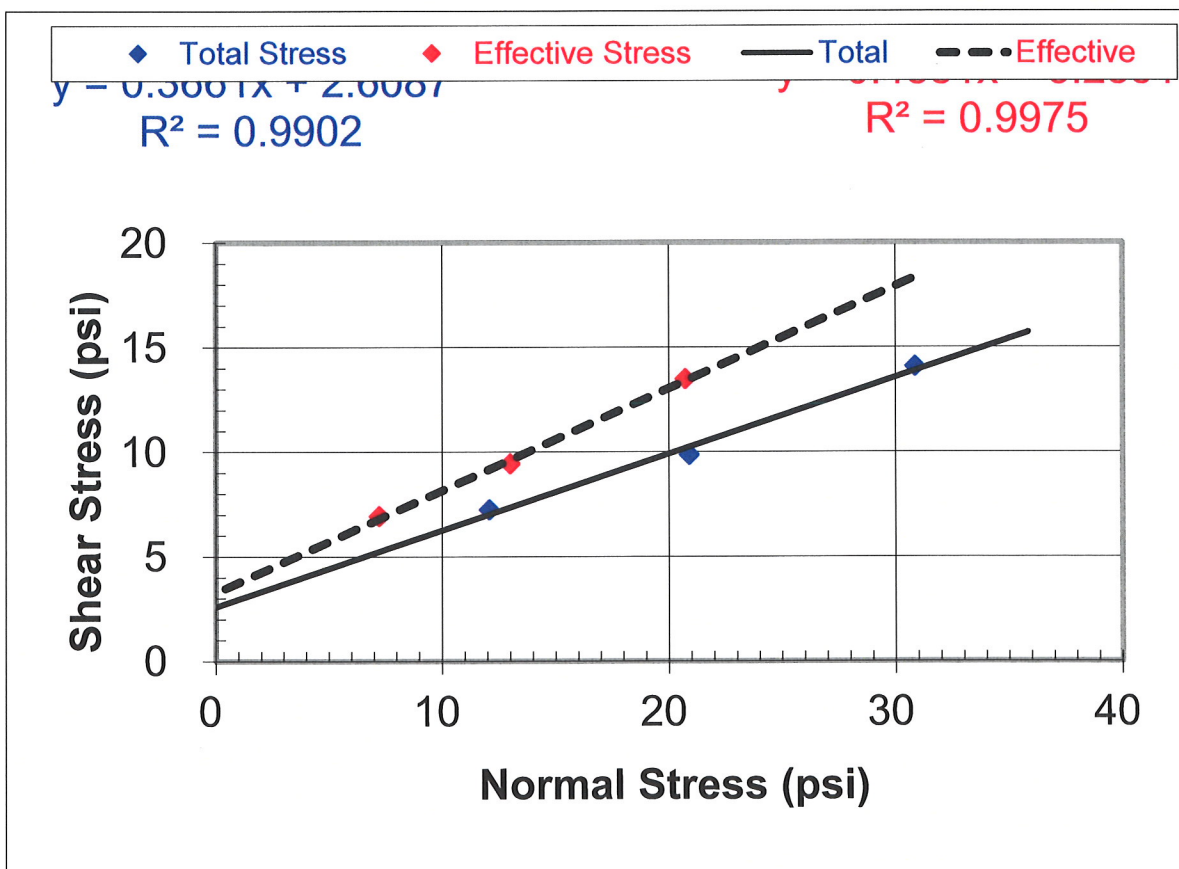
Stress path analysis for Effective:

PHI': 28.0 degrees

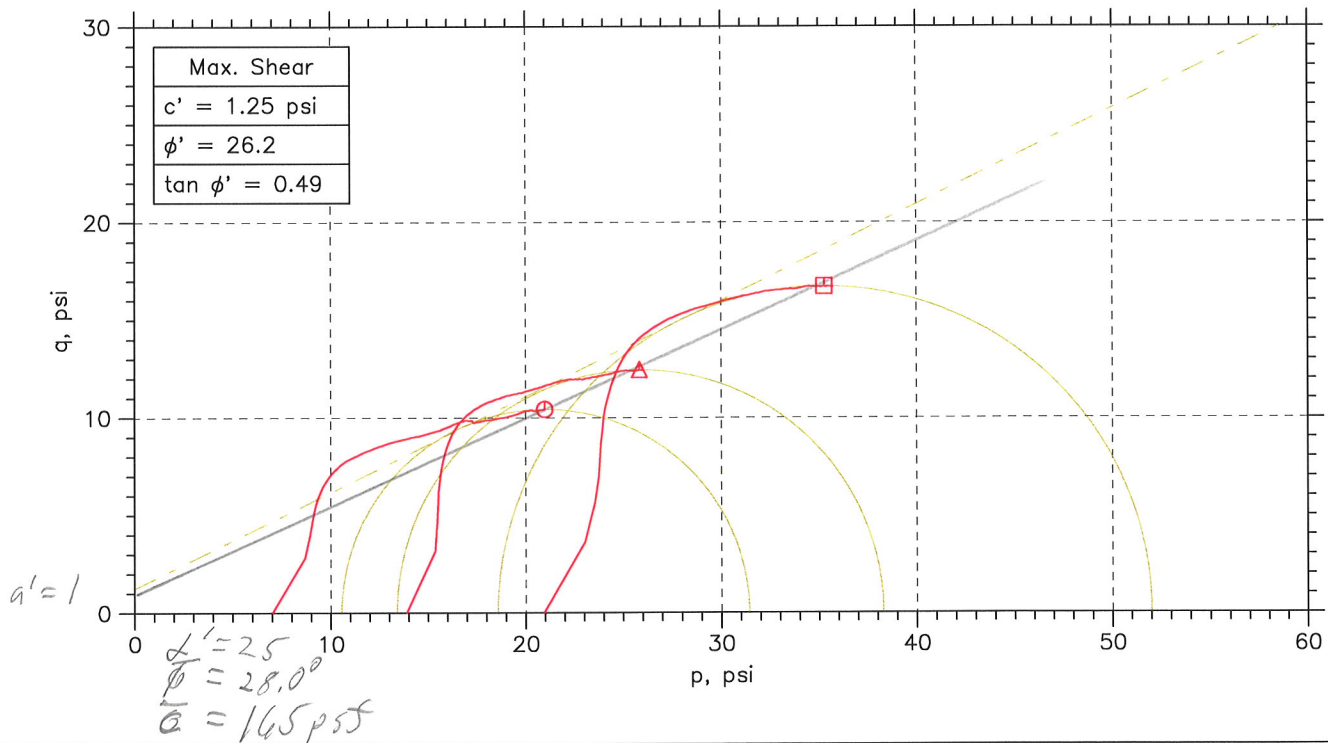
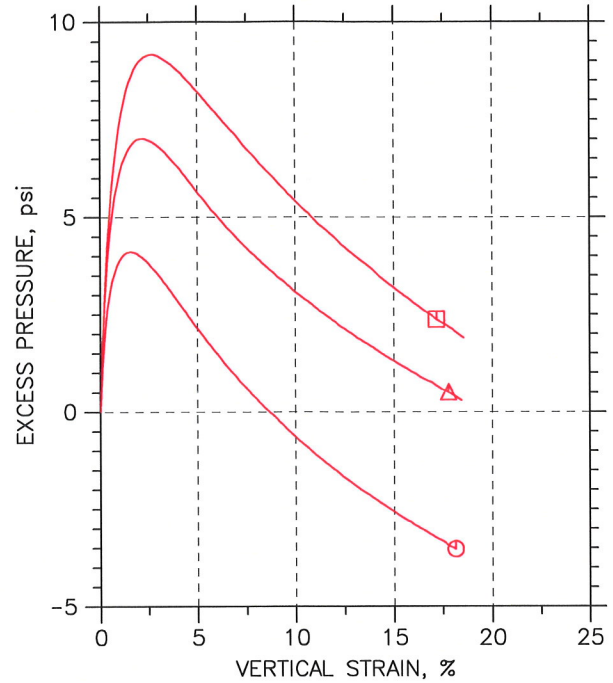
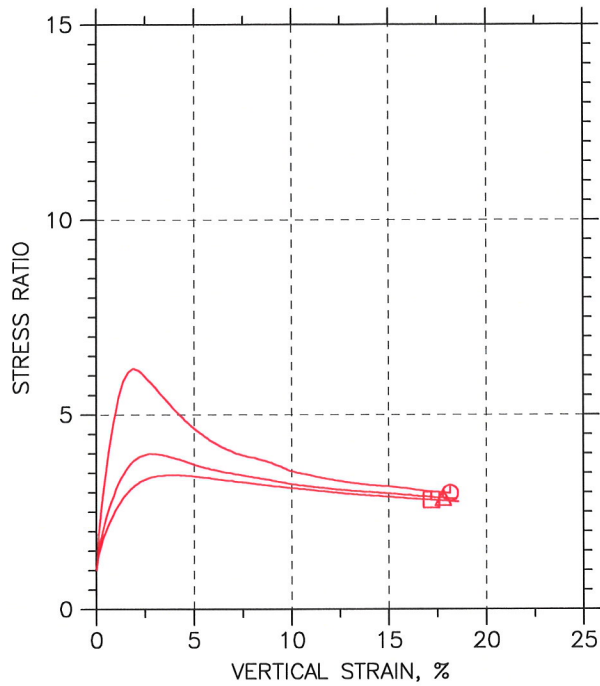
c': 165 psf

(All inputed values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 15.4 | 4.1 | 1.9 |
| 14 | 21 | 6.9 | 2.8 |
| 21 | 30 | 8.7 | 4.2 |



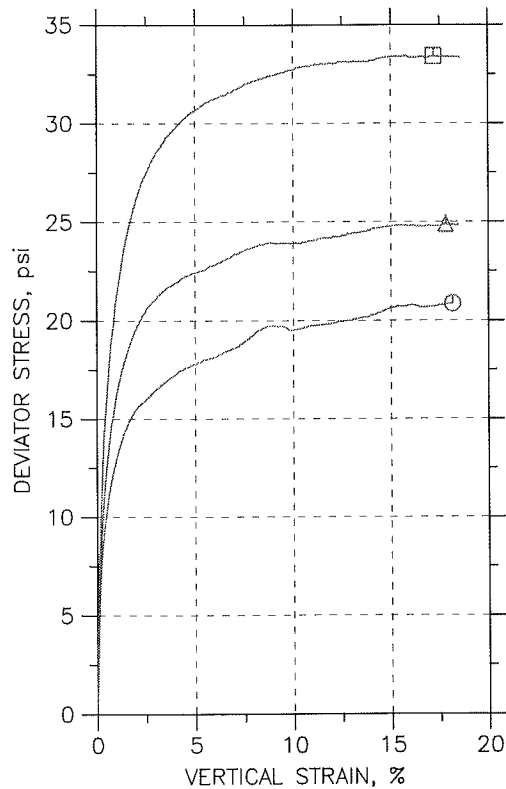
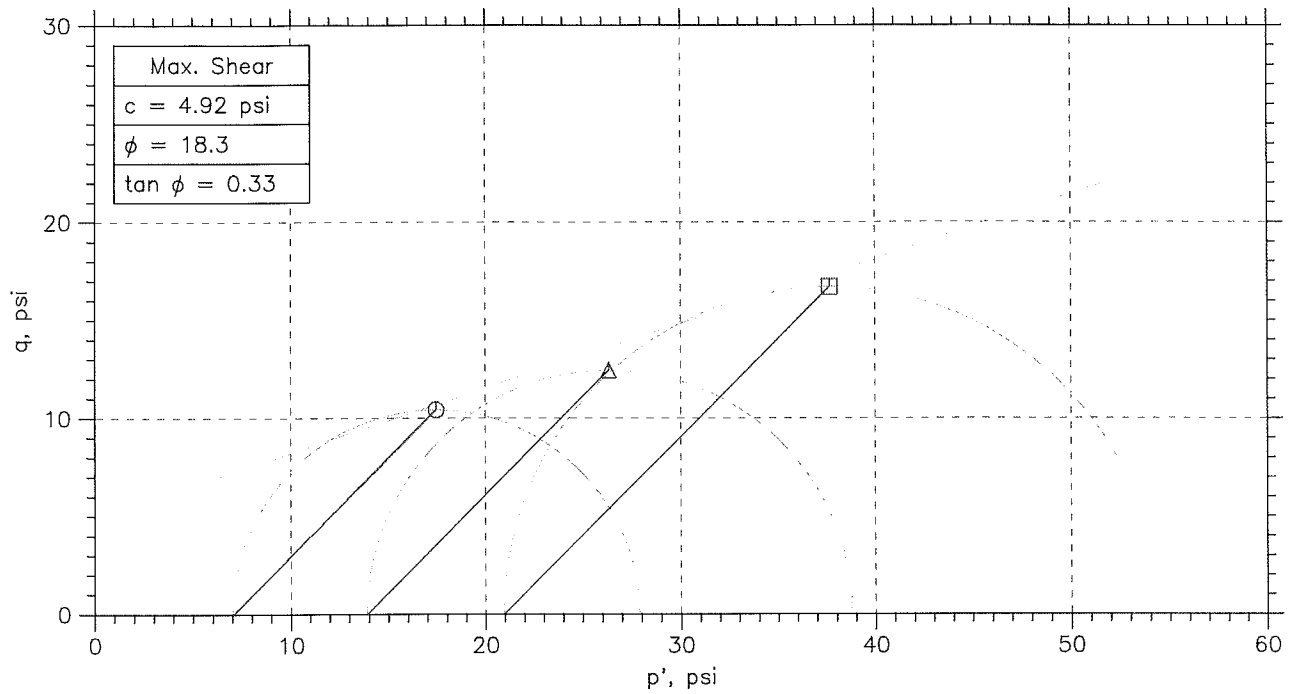
CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|------------|----------|-------|-----------|-----------|------------|------------|-------------------|
| ○ | 14-1062 | 1 | N/A | SKK | 8/15/14 | SKK | | 14-1062-07eng.dat |
| △ | 14-1062 | 2 | N/A | SKK | 8/15/14 | SKK | | 14-1062-14eng.dat |
| □ | 14-1062 | 3 | N/A | SKK | 8/15/14 | SKK | | 14-1062-21eng.dat |

| | | | |
|---|--|-------------------|----------------------|
| Natural Resources Conservation Service | Project: PLUM CREEK SITE #6 DAM Location: TX | | Project No.: 14-1062 |
| | Boring No.: F14-104A | Sample Type: CORE | |
| | Description: F14-104A | | |
| | Remarks: | | |

CONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ○ | △ | □ | |
|--------------|-----------------------------|---------|---------|-------|
| Sample No. | 14-1062 | 14-1062 | 14-1062 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Initial | Diameter, in | 1.399 | 1.396 | 1.397 |
| | Height, in | 3.017 | 3.02 | 3.02 |
| | Water Content, % | 20.7 | 21.2 | 20.8 |
| | Dry Density, pcf | 107.2 | 105.4 | 107.4 |
| | Saturation, % | 97.1 | 94.9 | 98.2 |
| Before Shear | Void Ratio | 0.578 | 0.605 | 0.575 |
| | Water Content, % | 22.7 | 22.5 | 21.6 |
| | Dry Density, pcf | 104.8 | 105.1 | 106.8 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.614 | 0.609 | 0.584 |
| | Back Press., psi | 99.97 | 100.1 | 100 |
| | Ver. Eff. Cons. Stress, psi | 7.029 | 13.9 | 20.95 |
| | Shear Strength, psi | 10.43 | 12.44 | 16.71 |
| | Strain at Failure, % | 18.2 | 17.8 | 17.2 |
| | Strain Rate, %/min | 0.06 | 0.06 | 0.06 |
| | B-Value | 0.00 | 0.00 | 0.00 |
| | Measured Specific Gravity | 2.71 | 2.71 | 2.71 |
| | Liquid Limit | --- | --- | --- |
| | Plastic Limit | --- | --- | --- |



Project: PLUM CREEK SITE #6 DAM

Location: TX

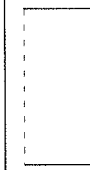
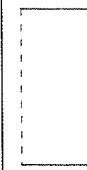
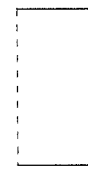
Project No.: 14-1062

Boring No.: F14-104A

Sample Type: CORE

Description: F14-104A

Remarks:



Mohr Circle Program

SITE NAME: **Plum Creek Site #6**
STATE: **Texas**
SAMPLE NO: **14-1062 UU**

Total Strength Parameters:

Zero Cohesion:

PHI: ~~4.9~~ degrees
C: ~~1317~~ psf

4.9 degrees
9.15 psi

Slope y=

Failure Criterion:

- ☐ Maximum Dev. Stress
☐ Maximum Stress Ratio
☐ Max. Pore Pressure
☒ <= 10 % Strain
☐ Selected Points

Effective Strength Parameters:

PHI': ~~4.9~~ degrees
C': ~~1317~~ psf

4.9 degrees
9.15 psi

Slope y=

$\phi = 0^\circ$

Stress path analysis for Effective:

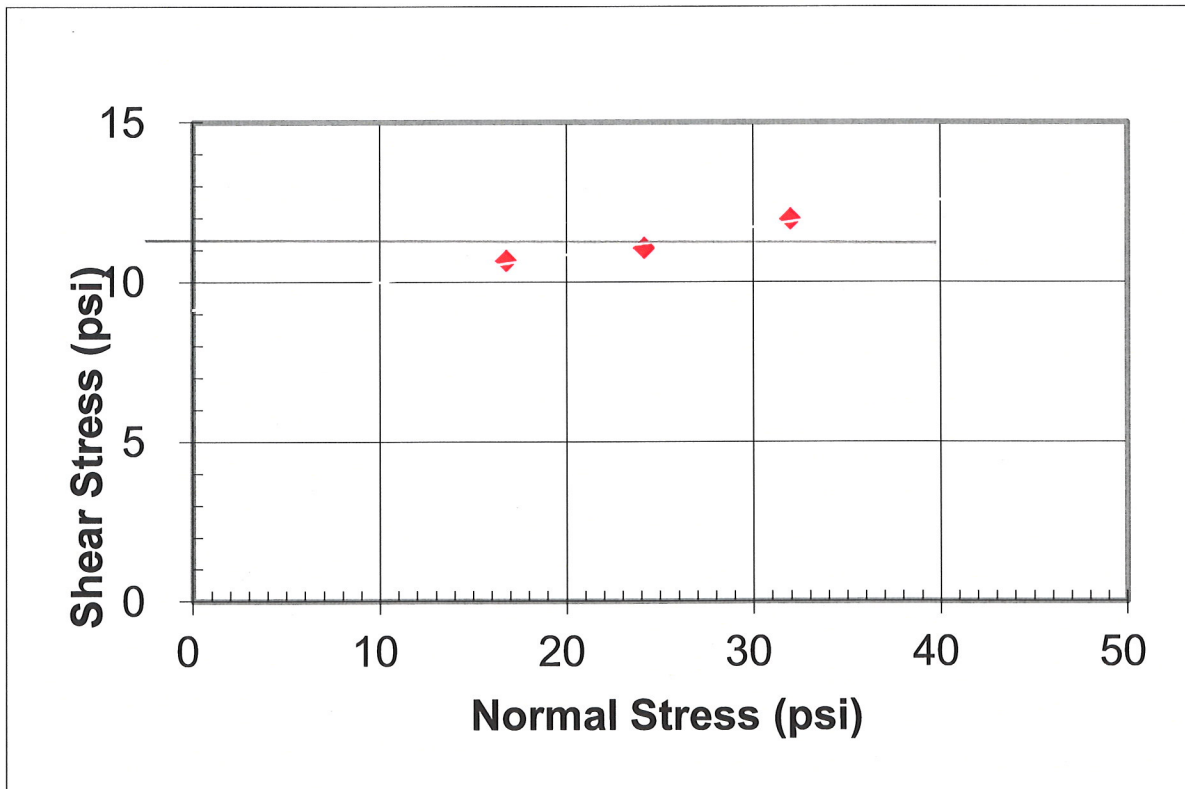
Alpha': 4.9 degrees
a': 9.11 psi

$C = 1623 \text{ psf}$

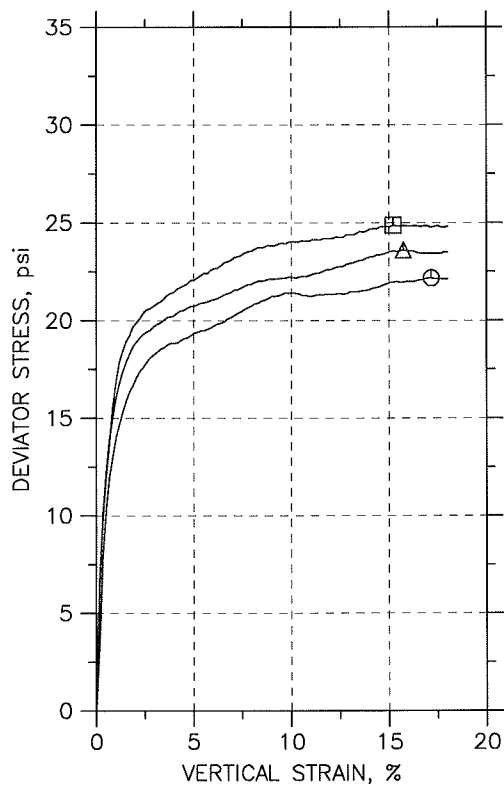
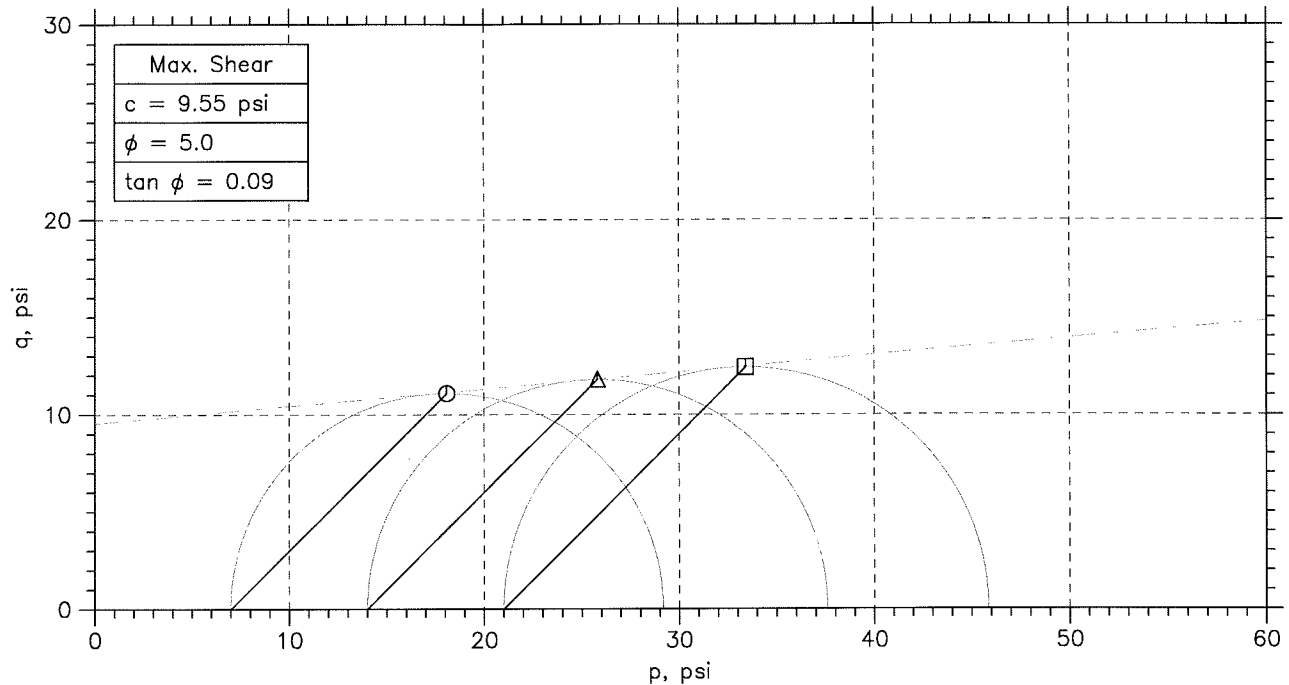
(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 21.4 | 0.001 | 10.0 |
| 14 | 22.2 | 0.001 | 10.0 |
| 21 | 24.0 | 0.001 | 10.0 |

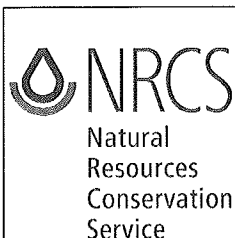
Backpressure Saturated UU - $\phi = 0^\circ$



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ○ | △ | □ | |
|---------------------------|---------|---------|---------|--|
| Sample No. | 14-1062 | 14-1062 | 14-1062 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Tested by | SKK | SKK | SKK | |
| Test Date | 9/9/14 | 9/9/14 | 9/9/14 | |
| Checked by | SKK | SKK | SKK | |
| Check Date | | | | |
| Diameter, in | 1.395 | 1.398 | 1.394 | |
| Height, in | 3.02 | 3.018 | 3.021 | |
| Water Content, % | 20.6 | 20.2 | 20.2 | |
| Dry Density, pcf | 107.7 | 107.9 | 108.7 | |
| Saturation, % | 98.1 | 96.3 | 98.1 | |
| Void Ratio | 0.57 | 0.568 | 0.556 | |
| Confining Stress, psi | 7 | 14 | 21 | |
| Undrained Strength, psi | 11.09 | 11.8 | 12.43 | |
| Max. Dev. Stress, psi | 22.17 | 23.59 | 24.86 | |
| Strain at Failure, % | 17.2 | 15.7 | 15.2 | |
| Strain Rate, %/min | 1 | 1 | 1 | |
| Measured Specific Gravity | 2.71 | 2.71 | 2.71 | |
| Liquid Limit | --- | --- | --- | |
| Plastic Limit | --- | --- | --- | |
| Plasticity Index | --- | --- | --- | |



Project: PLUM CREEK SITE #6 DAM

Location: TX

Project No.: 14-1062

Boring No.: F14-104A

Sample Type: CORE

Description: F14-104A

Remarks:

Phase calculations based on start and end of test.

Mohr Circle Program

SITE NAME: Plum Creek 6

STATE: Texas

SAMPLE NO: 14-1064

Total Strength Parameters:

Zero Cohesion:

PHI: 19.8 degrees

19.8 degrees

C: 319 psf

2.22 psi

Slope y=

Failure Criterion:

☐ Maximum Dev. Stress

☒ Maximum Stress Ratio

☐ Max. Pore Pressure

☐ <= 15% Strain

☐ Selected Points

Effective Strength Parameters:

PHI': 25.1 degrees

25.1 degrees

C': 356 psf

2.47 psi

Slope y=

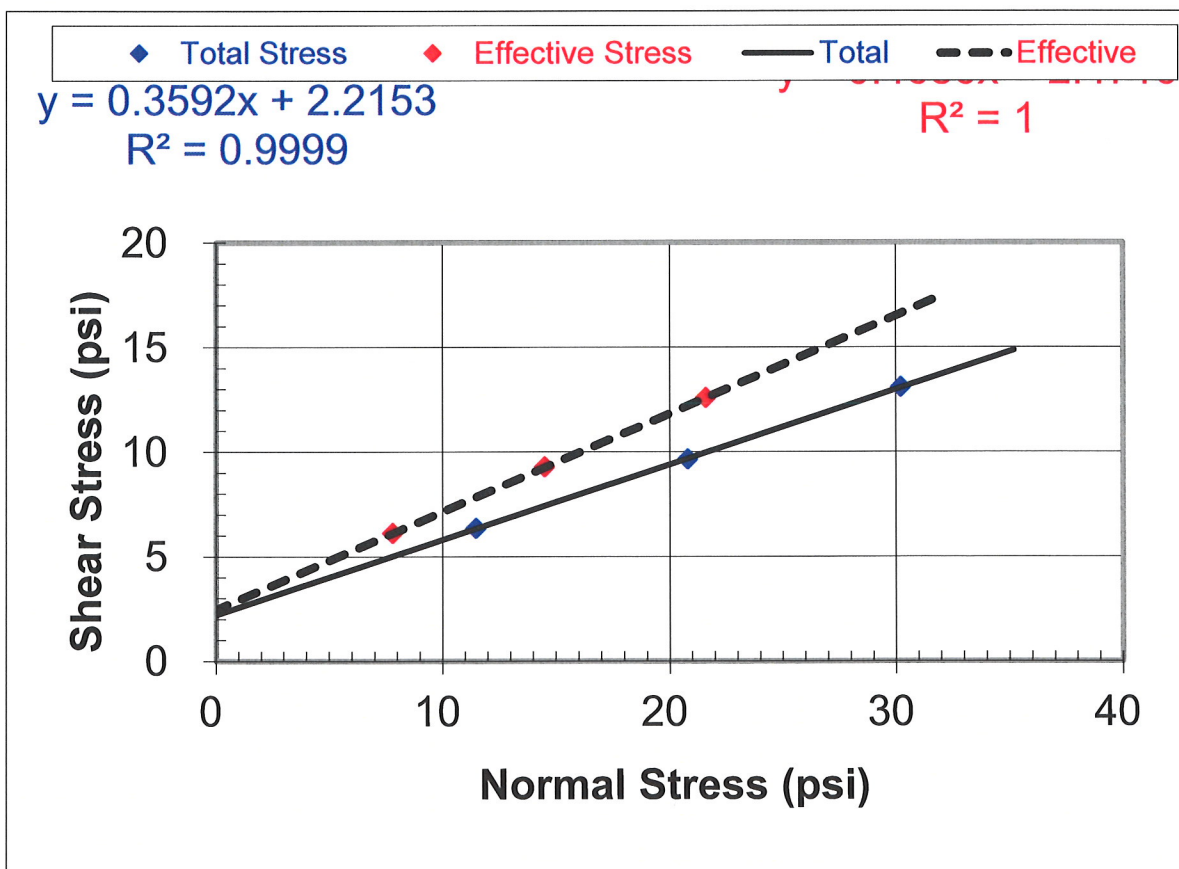
Stress path analysis for Effective:

PHI': 28.0 degrees

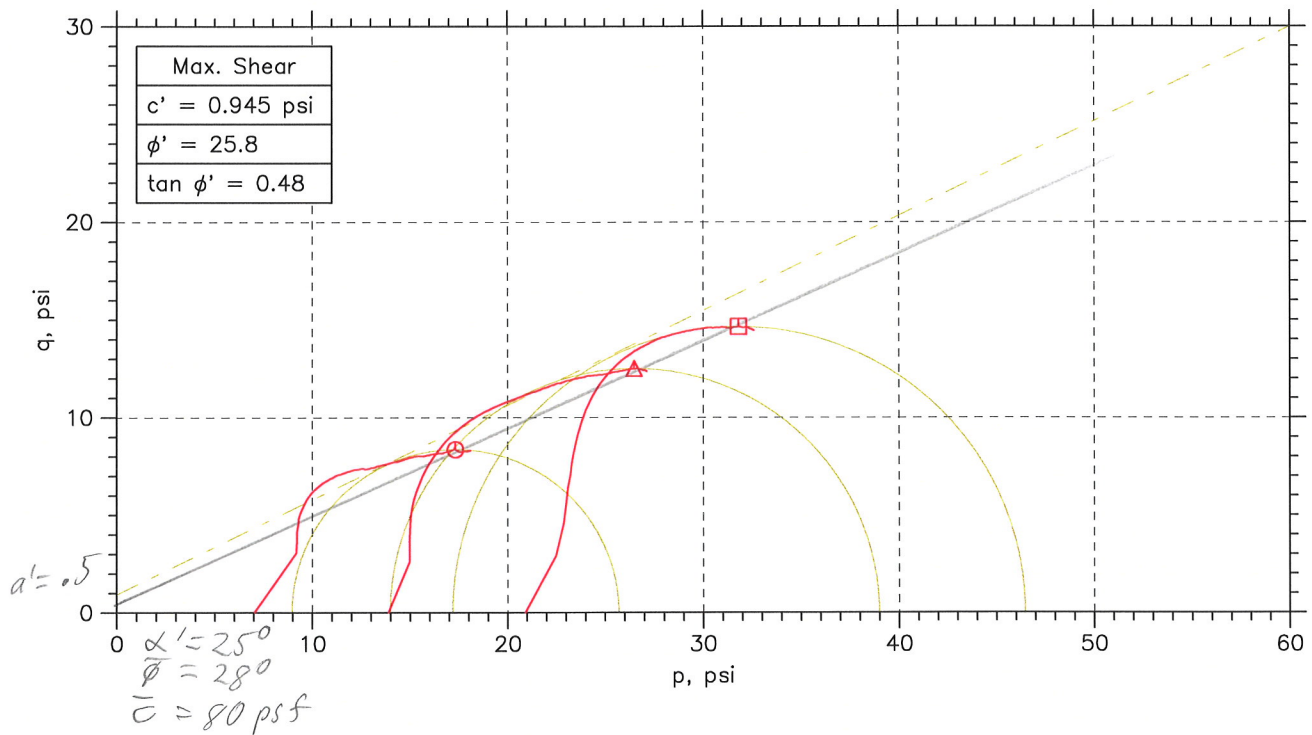
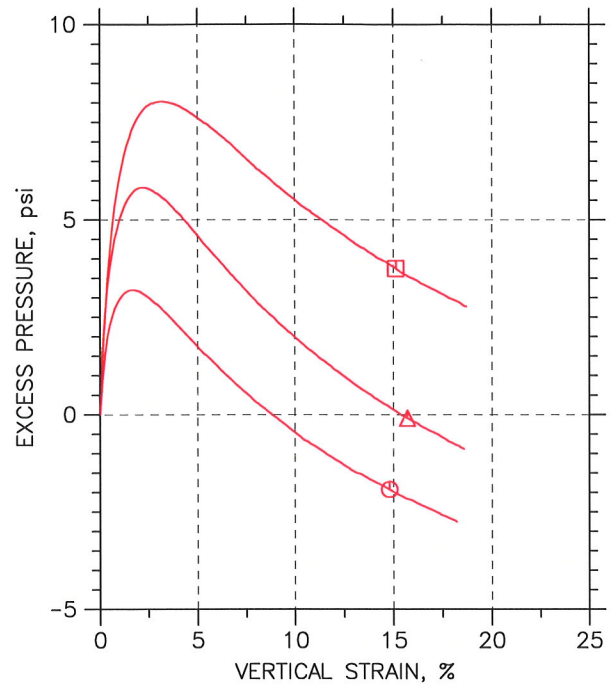
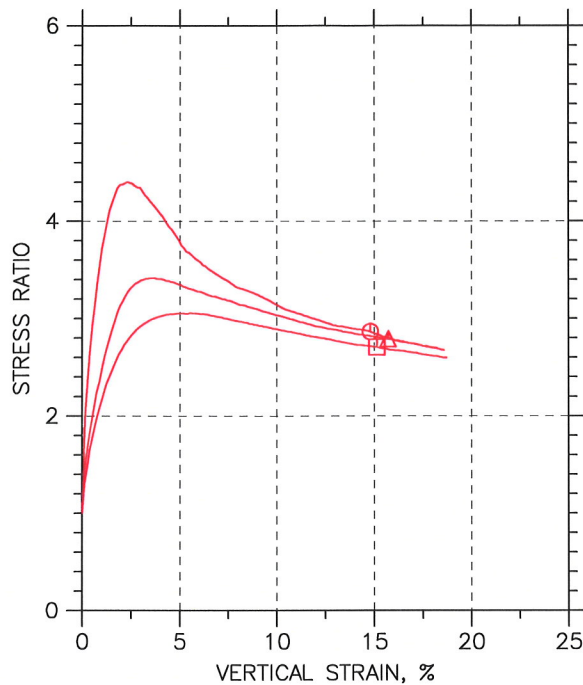
c': 80 psf

(All inputted values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 13.5 | 3.1 | 2.3 |
| 14 | 20.5 | 5.4 | 3.6 |
| 21 | 27.8 | 7.4 | 5.6 |



CONSOLIDATED UNDRAINED TRIAXIAL TEST



| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|------------|----------|-------|-----------|-----------|------------|------------|-------------------|
| ○ | 14-1064 | 1 | N/A | SKK | 8/20/14 | SKK | | 14-1064-07eng.dat |
| △ | 14-1064 | 2 | N/A | SKK | 8/20/14 | SKK | | 14-1064-14eng.dat |
| □ | 14-1064 | 3 | N/A | SKK | 8/20/14 | SKK | | 14-1064-21eng.dat |



Project: PLUM CREEK SITE #6 DAM Location: TX

Project No.: 14-1064

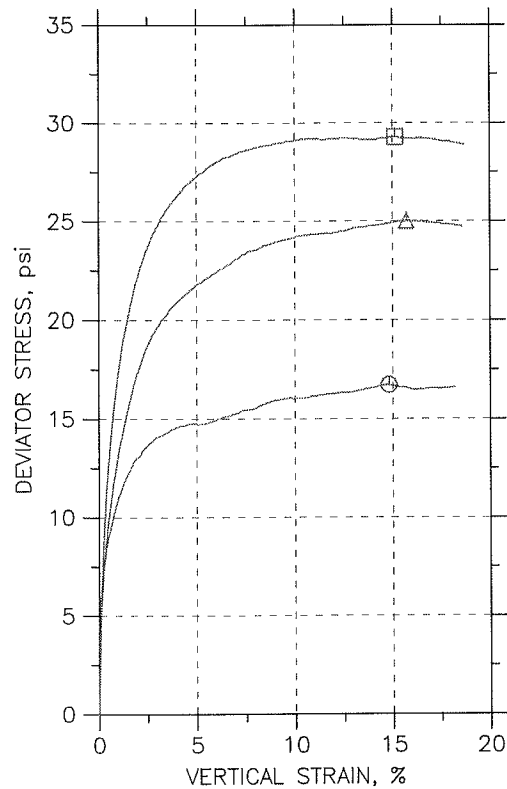
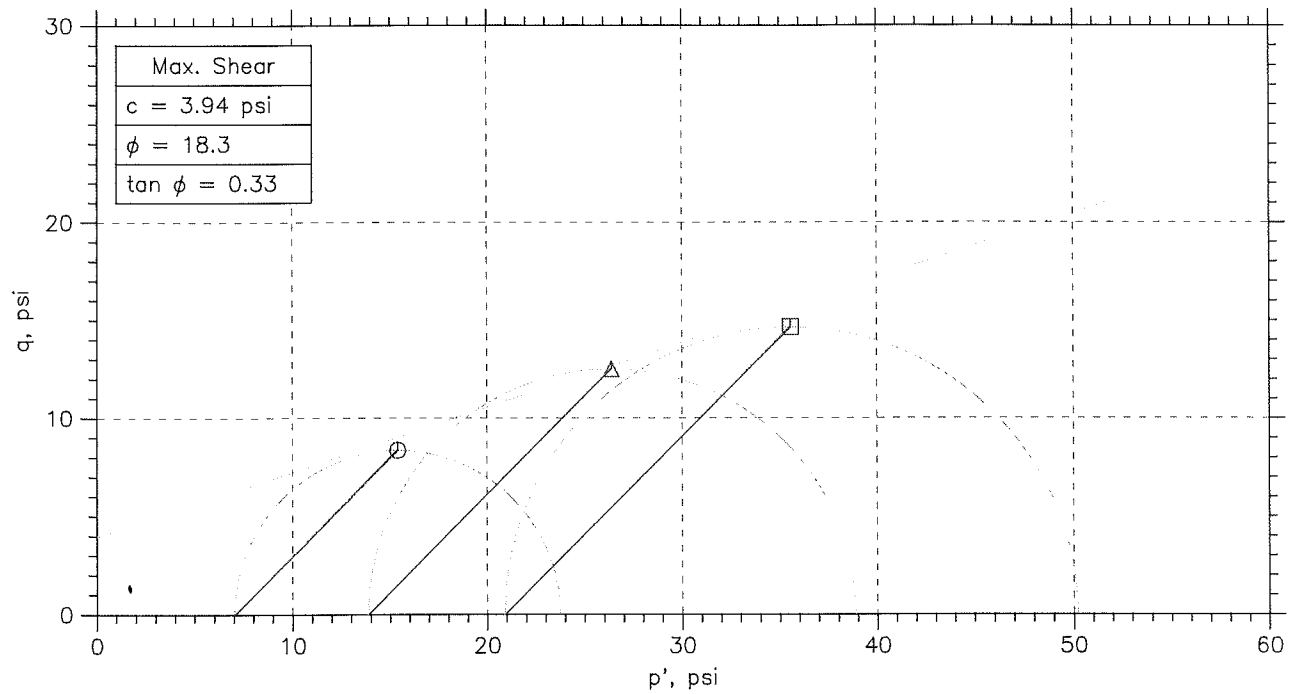
Boring No.: F14-105

Sample Type: CORE

Description: F14-105

Remarks:

CONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ⊙ | △ | □ | |
|-----------------------------|------------------|---------|---------|-------|
| Sample No. | 14-1064 | 14-1064 | 14-1064 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Initial | Diameter, in | 1.397 | 1.392 | 1.398 |
| | Height, in | 3.024 | 3.023 | 3.019 |
| | Water Content, % | 26.2 | 27.5 | 25.5 |
| | Dry Density, pcf | 98.78 | 96.88 | 99.75 |
| | Saturation, % | 98.7 | 99.0 | 98.1 |
| Before Shear | Void Ratio | 0.725 | 0.759 | 0.709 |
| | Water Content, % | 28.2 | 28.7 | 25.8 |
| | Dry Density, pcf | 96.3 | 95.52 | 100.1 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.77 | 0.784 | 0.703 |
| | Back Press., psi | 99.96 | 100.1 | 100.1 |
| Ver. Eff. Cons. Stress, psi | | 7.037 | 13.88 | 20.92 |
| Shear Strength, psi | | 8.358 | 12.51 | 14.64 |
| Strain at Failure, % | | 14.8 | 15.7 | 15.1 |
| Strain Rate, %/min | | 0.06 | 0.06 | 0.06 |
| B-Value | | 0.00 | 0.00 | 0.00 |
| Measured Specific Gravity | | 2.73 | 2.73 | 2.73 |
| Liquid Limit | | --- | --- | --- |
| Plastic Limit | | --- | --- | --- |



Project: PLUM CREEK SITE #6 DAM

Location: TX

Project No.: 14-1064

Boring No.: F14-105

Sample Type: CORE

Description: F14-105

Remarks:



Mohr Circle Program

SITE NAME: **Plum Creek Site #6**
STATE: **Texas**
SAMPLE NO: **14-1064 UU**

Total Strength Parameters:

Zero Cohesion:

| | |
|------|-------------------------|
| PHI: | -2.6 degrees |
| C: | 1163 psf |

-2.6 degrees
8.08 psi

| |
|----------|
| Slope y= |
|----------|

Failure Criterion:

- ☐ Maximum Dev. Stress
☐ Maximum Stress Ratio
☐ Max. Pore Pressure
☒ <= 10 % Strain
☐ Selected Points

Effective Strength Parameters:

| | |
|--------|-------------------------|
| PHI' : | -2.6 degrees |
| C' : | 1163 psf |

-2.6 degrees
8.08 psi

| |
|----------|
| Slope y= |
|----------|

$\phi = 0^\circ$

$c = 1022$ psf

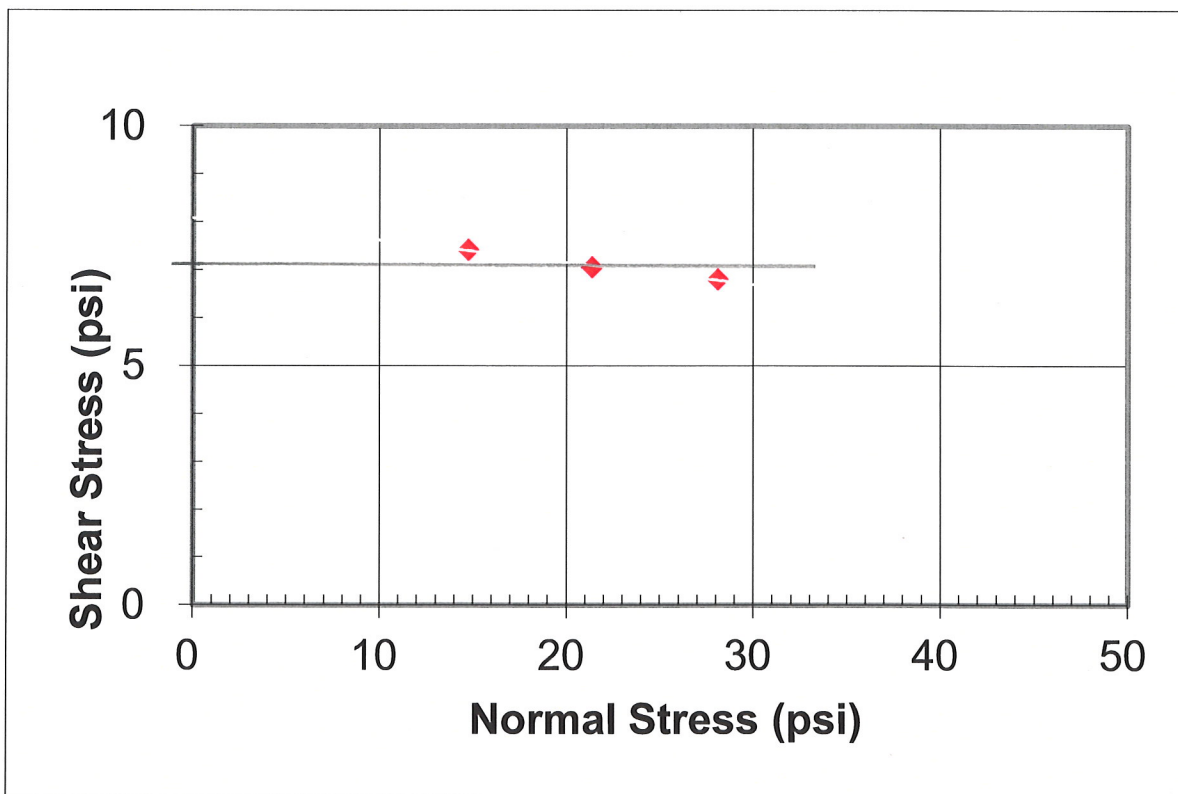
Stress path analysis for Effective:

Alpha' : **-2.6 degrees**
a' : **8.07 psi**

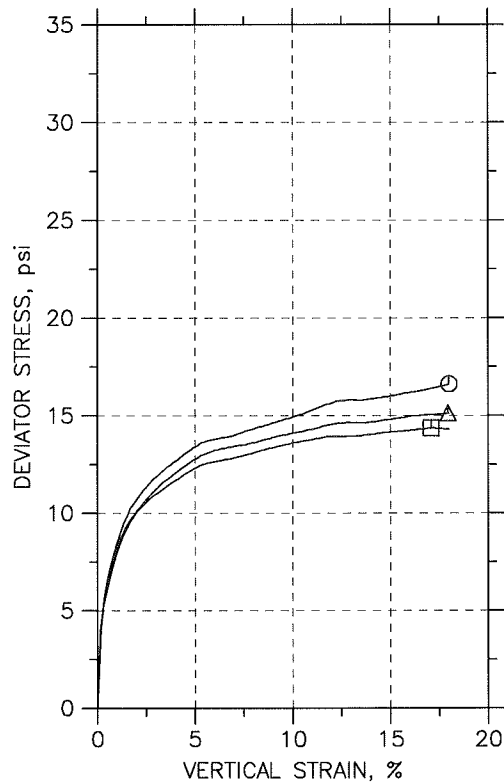
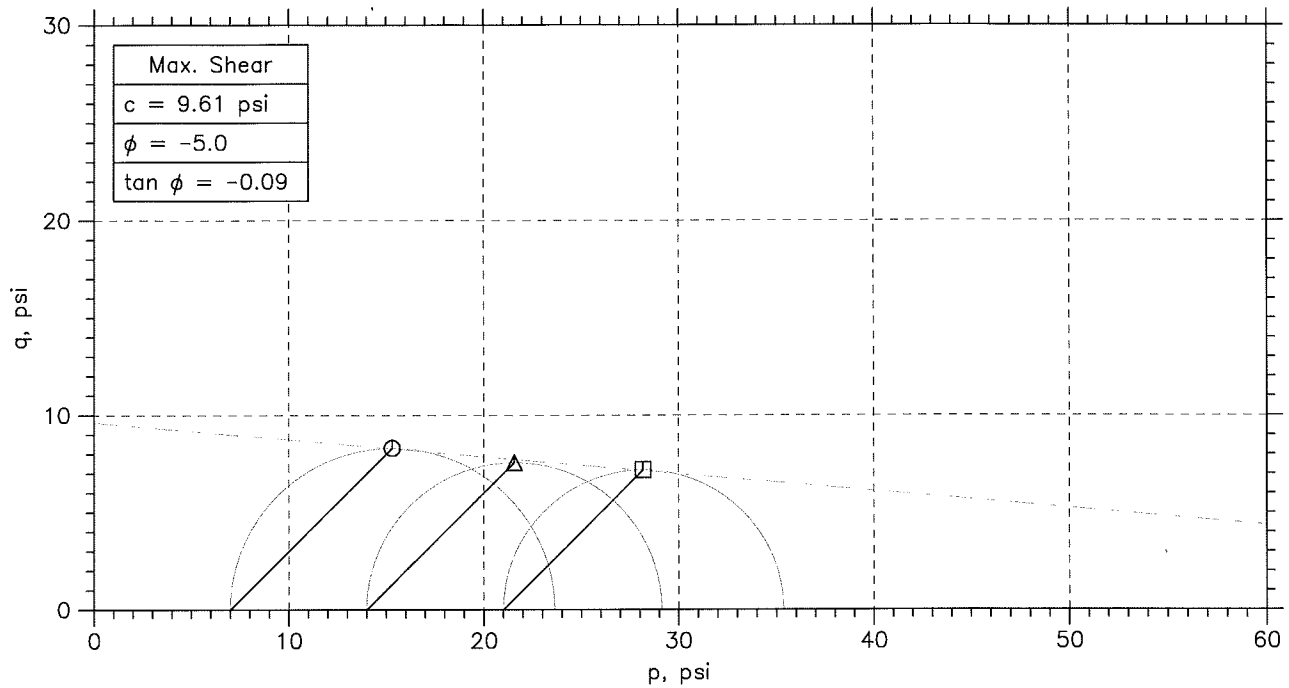
(All inputed values in the chart are in psi)

| CELL PRESSURE | DEVIATOR STRESS AT FAILURE | PORE PRESSURE AT FAILURE | PERCENT STRAIN (Optional Entry) |
|---------------|-------------------------------|-----------------------------|------------------------------------|
| 7 | 14.9 | 0.001 | 10.0 |
| 14 | 14.1 | 0.001 | 10.0 |
| 21 | 13.6 | 0.001 | 10.0 |

Backpressure Saturated UU - $\phi = 0^\circ$



UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



| Symbol | ○ | △ | □ | |
|---------------------------|---------|---------|---------|--|
| Sample No. | 14-1064 | 14-1064 | 14-1064 | |
| Test No. | 1 | 2 | 3 | |
| Depth | N/A | N/A | N/A | |
| Tested by | SKK | SKK | SKK | |
| Test Date | 9/10/14 | 9/10/14 | 9/10/14 | |
| Checked by | SKK | SKK | SKK | |
| Check Date | | | | |
| Diameter, in | 1.398 | 1.39 | 1.394 | |
| Height, in | 3.022 | 3.025 | 3.021 | |
| Water Content, % | 26.3 | 27.1 | 26.6 | |
| Dry Density, pcf | 98.51 | 97.76 | 98.8 | |
| Saturation, % | 98.3 | 99.7 | 100.2 | |
| Void Ratio | 0.73 | 0.743 | 0.725 | |
| Confining Stress, psi | 7 | 14 | 21 | |
| Undrained Strength, psi | 8.306 | 7.564 | 7.18 | |
| Max. Dev. Stress, psi | 16.61 | 15.13 | 14.36 | |
| Strain at Failure, % | 18 | 18 | 17.1 | |
| Strain Rate, %/min | 1 | 1 | 1 | |
| Measured Specific Gravity | 2.73 | 2.73 | 2.73 | |
| Liquid Limit | --- | --- | --- | |
| Plastic Limit | --- | --- | --- | |
| Plasticity Index | --- | --- | --- | |



Project: PLUM CREEK SITE #6 DAM

Location: TX

Project No.: 14-1064

Boring No.: F14-105

Sample Type: CORE

Description: F14-105

Remarks:

Phase calculations based on start and end of test.

Attachment 5

Permeability Test Data, 9 sheets

WORK ASSIGNMENT SHEET

FY: 14

Work Assignment No.: 113

Assigned by: RM

Date: 7/14/14

Target Date: 8/14/14

DAM

OPERATION: Permeability 2.8-inch or 4.0-inch Undisturbed

LTS Entry:

Work Completed by: LSM

Date: 9-9-14

Fund: WRHB

Type: Rehab

Recorded by: _____

Date: _____

Plum Creek Site #6 Dam , TX

Flexwall permeability test.

Criteria:

REGULATED

These tests will be run only if the requested shear testing on samples 14-1059 and 1062 are completed.
NO Index on these samples - same as 1059 and 1062 - respectively.

Route sheet along with samples to perm run at the completion of shear testing.

REGULATED.

Page 1

uf 8/22

14-1060 (Cores)

Gs = 2.71

γ_d = _____

ω_o = _____

| | | |
|--|---|----------------|
| | | |
| | k= <u>8.749×10^{-6}</u> | Day: <u>15</u> |
| | | |
| | k= _____ | Day: _____ |
| | | |
| | k= _____ | Day: _____ |
| | | |
| | | |
| | | |
| | | |

uf 8/22

14-1063 (Cores)

Gs = 2.68

γ_d = _____

ω_o = _____

| | | |
|--|---|----------------|
| | | |
| | k= <u>2.760×10^{-6}</u> | Day: <u>15</u> |
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| 4/20/11 | | TEXAS (WF-07) <u>Location and Description</u> Plum Creek Site 6 (Hays County) | Sample Type | Depth ft. | Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight | | | | | | | | | | | | | | | | | | Atterberg Limits | | Unified Classification | Crumb - 1 hr | Dispersion % | Moisture-Density Relationships <input type="checkbox"/> Standard <input type="checkbox"/> Modified | | | Undisturbed Sample Data | | G _s | Special Tests | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 14- | | | | 0.002 mm | 0.005 mm | 0.02 mm | 0.05 mm | #200 0.074 mm | #140 0.105 mm | #60 0.250 mm | #40 0.42 mm | #20 0.84 mm | #10 2.0 mm | #4 4.76 mm | 3/8" 9.525 mm | 1/2" 12.7 mm | 3/4" 19.05 mm | 1" 25.4 mm | 1 1/2" 38.1 mm | 3" 76.2 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Permeability Test Data

Project: Plum Creek site #6 Dam
State: TX.
Lab No: 14-1060

Test Conditions: 4.0" Core
Additional Information:

Specific Gravity (Gs): 2.71
Maximum Dry Density: 94.9 pcf
Optimum Moisture: 22.5 percent
Perm Cell No.: 1
Additive Type and Rate: lbs/sq.ft. of
Initial Average Diameter of Specimen: 3.850 inches
Initial Average Height of Specimen: 3.355 inches
Initial Moist Weight of Specimen: 1191.14 gms.

End Area: 11.642 sq. inches
Volume of Specimen: 39.058 cubic inches
Moist Unit Weight: 116.18 pcf
3.8095 (multiplication factor to convert gms/cubic inch to pcf)

Initial Cell Burette Reading Before Backpressure: 3.00
Cell Burette Reading After Backpressure: 11.40
Cell Pressure After Backpressure: 103.0 psi
Cell Burette After Equalization: 14.00
Cell Pressure After Equalization: 105.0 psi

Gradient
Pressure
Diff.:
(psi)

Average Permeability (k) for each run:

| | | Date/time: Start | End | Total per Each Run: | Total Elapsed Time: |
|----------|------------------|---------------------|-----------------|------------------------|------------------------|
| 1st Run | 2.374E-05 cm/sec | 8/25/14 7:00 AM | 8/25/14 9:40 AM | 2.67 hrs. | 2.67 hrs. |
| 2nd Run | 1.723E-05 cm/sec | 8/25/14 9:40 AM | 8/26/14 9:00 AM | 23.33 hrs. | 26.00 hrs. |
| 3rd Run | 1.311E-05 cm/sec | 8/26/14 9:00 AM | 8/27/14 9:35 AM | 24.58 hrs. | 50.58 hrs. |
| 4th Run | 1.173E-05 cm/sec | 8/27/14 9:35 AM | 8/28/14 8:20 AM | 22.75 hrs. | 73.33 hrs. |
| 5th Run | 1.155E-05 cm/sec | 8/28/14 8:20 AM | 8/29/14 8:05 AM | 23.75 hrs. | 97.08 hrs. |
| 6th Run | 1.182E-05 cm/sec | 8/29/14 8:05 AM | 9/2/14 11:05 AM | 99.00 hrs. | 196.08 hrs. |
| 7th Run | 1.027E-05 cm/sec | 9/2/14 11:05 AM | 9/3/14 9:15 AM | 22.17 hrs. | 218.25 hrs. |
| 8th Run | 9.663E-06 cm/sec | 9/3/14 9:15 AM | 9/4/14 9:45 AM | 24.50 hrs. | 242.75 hrs. |
| 9th Run | 9.573E-06 cm/sec | 9/4/14 9:45 AM | 9/5/14 8:30 AM | 22.75 hrs. | 265.50 hrs. |
| 10th Run | 8.746E-06 cm/sec | 9/5/14 8:30 AM | 9/8/14 9:44 AM | 73.23 hrs. | 338.73 hrs. |
| 11th Run | cm/sec | | | hrs. | hrs. |
| 12th Run | cm/sec | | | hrs. | hrs. |
| 13th Run | cm/sec | | | hrs. | hrs. |
| 14th Run | cm/sec | | | hrs. | hrs. |
| 15th Run | cm/sec | | | hrs. | hrs. |
| 16th Run | cm/sec | | | hrs. | hrs. |
| 17th Run | cm/sec | | | hrs. | hrs. |
| 18th Run | cm/sec | | | hrs. | hrs. |

Note:

Ambient Water Temperature (nearest 0.5 deg): 22.5 deg.Celsius

Recorded Permeability: 8.749E-06 cm/sec

-Start and End Times based on the start and end of each days run.
-Elapsed Time based on the accumulation of each run whether continuous or not.
-Average Permeability is based on four readings within parameters.

Final Cell Pressure for the Recorded Perm: 105.0 psi
Final Base Pressure for the Recorded Perm: 100.0 psi
Final Gradient Pressure Difference: psi

(Use only the External Burette for the Cell Reading)

Initial Cell Burette Reading Before Backpressure: 3.00
Final Cell Burette Reading After Cell is Tore Down: 11.40
Cell Burette Reading for Recorded Perm Result:
Final Cell Burette Reading for Recorded Perm Result: 15.70
Estimated Correction for Compressed Water: 6.78
Estimated Initial/Final Cell Burette Reading: 17.32
Estimated Consolidation at the End of the Test: 5.92

Final Moist Weight of Specimen+Container: 1428.18 gms.
Final Dry Weight of Specimen+Container: 1158.26 gms.
Weight of Container: 185.69 gms.
Weight of Water: 269.92 gms.
Weight of Dry Specimen: 972.57 gms.

Initial Dry Density: 94.86 pcf
Percent of Maximum Dry Density: 100.00 %
Initial Percent Moisture in Ref. to Optimum: 0.00 %

Estimated Final Volume Change of Burette: 1.283 cubic inches
Estimated Final Volume of the Specimen: 37.775 cubic inches

Final Dry Density: 94.86 pcf
Percent of Maximum Dry Density: 100.00 %
Final Percent Moisture in Ref. to Optimum: 5.28 %

Estimated Final Dry Density: 98.08 pcf
Percent of Maximum Dry Density: 103.40 %

Initial Water Content: 22.47 percent
Final Water Content: 27.75 percent
Saturated Moisture: 28.88 percent
Initial Percent Saturated: 77.81 %
Final Percent Saturated: 96.10 %

Note: The Specimen is not directly measured to achieve the Final Dry Density, but is measured from the Difference in Volume of the Cell Burette to achieve an Estimated Final Dry Density. This Volume is assumed to be the Volume during the test for the Recorded Perm Result. Rebound of the Specimen may occur when the pressure is released.

Note: Initial and Final Densities are considered to be the same unless the Cell Burette Volume is monitored.

Final Measured Average Diameter of Specimen: inches
Final Measured Average Height of Specimen: inches

Checked by: LLS

Permeability vs. Time

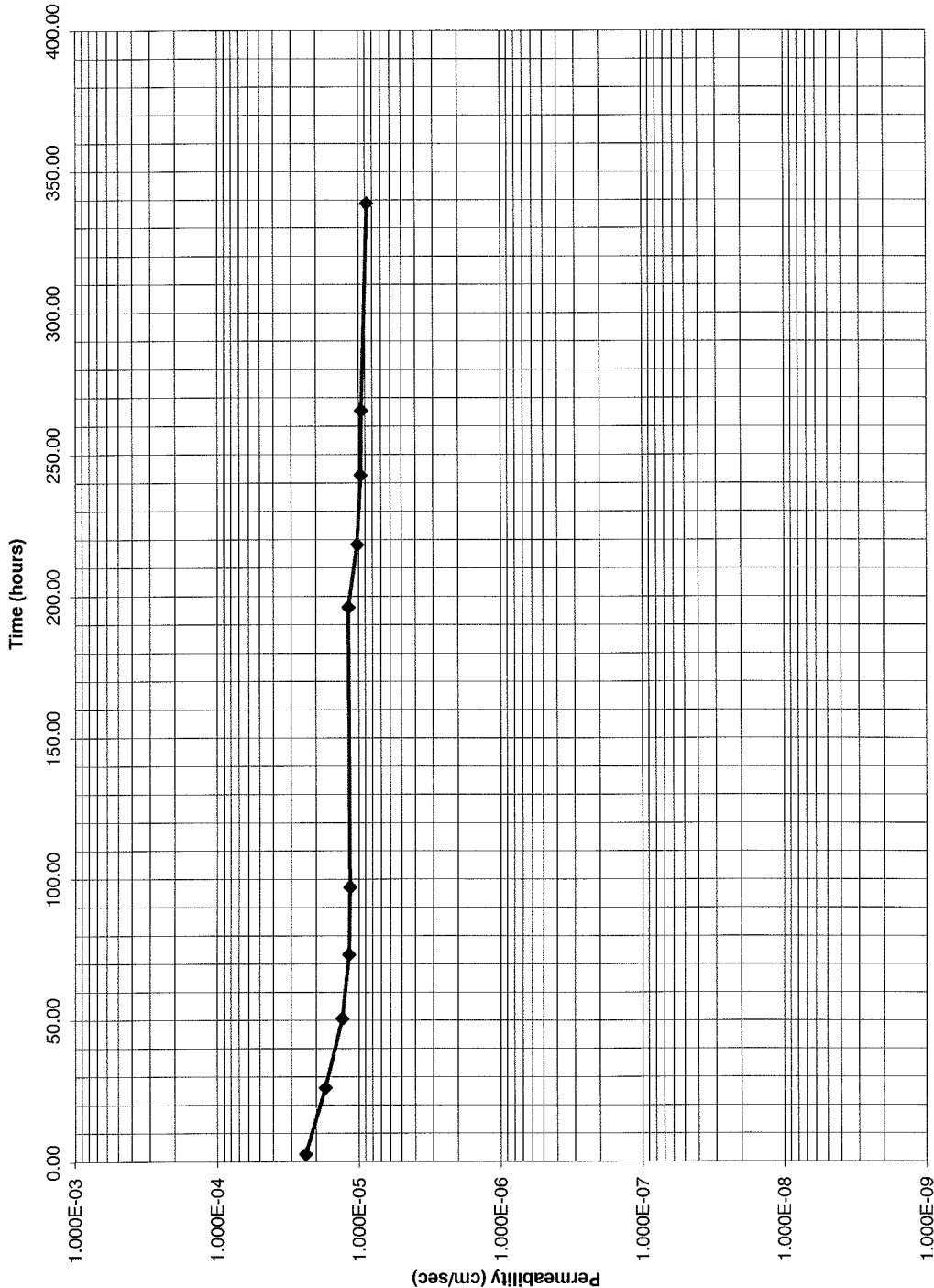
Project:
Plum Creek site #6 Dam

State: TX.

Lab No: 14-1060

Test Conditions:
4.0" Core

Total for all Runs



| Permeability Rate: | Elapsed Time: | |
|--------------------|---------------|----------|
| 2.374E-05 cm/sec | 2.67 hrs. | 1st Run |
| 1.723E-05 cm/sec | 26.00 hrs. | 2nd Run |
| 1.311E-05 cm/sec | 50.58 hrs. | 3rd Run |
| 1.173E-05 cm/sec | 73.33 hrs. | 4th Run |
| 1.155E-05 cm/sec | 97.08 hrs. | 5th Run |
| 1.182E-05 cm/sec | 196.08 hrs. | 6th Run |
| 1.027E-05 cm/sec | 218.25 hrs. | 7th Run |
| 9.663E-06 cm/sec | 242.75 hrs. | 8th Run |
| 9.573E-06 cm/sec | 265.50 hrs. | 9th Run |
| 8.746E-06 cm/sec | 338.73 hrs. | 10th Run |
| cm/sec | hrs. | 11th Run |
| cm/sec | hrs. | 12th Run |
| cm/sec | hrs. | 13th Run |
| cm/sec | hrs. | 14th Run |
| cm/sec | hrs. | 15th Run |
| cm/sec | hrs. | 16th Run |
| cm/sec | hrs. | 17th Run |
| cm/sec | hrs. | 18th Run |

Perm Cell No.: 1

Project: Plum Creek site #6 Dam
 State: TX.
 Lab No: 14-1060
 Test Conditions: 4.0" Core
 Additional Information:

Perm Cell No.: 1
 Initial Average Diameter of Specimen: 3.850 inches
 Initial Average Height of Specimen: 3.355 inches
 Cross-Sectional End Area of the Specimen: 11.642 sq. inches
 10th Run
 Cell Pressure: 105.0 psi
 Base Pressure: 100.0 psi
 Gradient Pressure Difference: psi
 Initial Cell Burette Reading for this Run: 15.70 (used to determine Swink or Swell Potential)
 Ambient Water Temperature (nearest 0.5 deg): 22.5 deg.Celcius 0.942 Correction Factor (R_T)
 Is the Large Burette being Used? YES (yes or no)
 Calibrated Area of the Inlet Burette: 0.195610 sq. cm
 Calibrated Area of the Outlet Burette: 0.195880 sq. cm
 Calibrated Area of the Large Inlet Burette: 3.429780 sq. cm
 Calibrated Area of the Large Outlet Burette: 3.434870 sq. cm
 Day of Run (ie Day 1, Day 2, Day 3 etc.): DAY 15
 Date/time for the entire run (exact format needed): 9/5/14 8:30 AM Start
 9/9/14 12:06 PM 9/8/14 9:44 AM End (At the Last Recorded Reading for this Run)

Total Running Time per Run: 73.23 hrs.
 Start and End Times based on the start and end of each days run.

Readings:

| | 1st | 2nd | 3rd | 4th | note: |
|---|-----------|-----------|--|-----------|--|
| Initial Cell Burette Reading of Inlet: | 0.70 | 0.82 | 0.94 | 1.06 | After the 4th Reading, the 1st Readings are replaced by the 2nd Readings and so forth. Then the new 4th Readings can be inputed. |
| Initial Cell Burette Reading of Outlet: | 9.40 | 9.28 | 9.16 | 9.04 | |
| Final Cell Burette Reading of Inlet: | 0.82 | 0.94 | 1.06 | 1.17 | |
| Final Cell Burette Reading of Outlet: | 9.28 | 9.16 | 9.04 | 8.93 | |
| Time Between Readings (min.): | 10 | 10 | 10 | 10 | |
| Total Elapsed Time (min): | 10 | 20 | 30 | 40 | |
| Cross-Sectional Area of the Input Burette a_{in} (sq. cm): | 3.429780 | 3.429780 | 3.429780 | 3.429780 | |
| Cross-Sectional Area of the Outlet Burette a_{out} (sq. cm): | 3.434870 | 3.434870 | 3.434870 | 3.434870 | |
| Length of Specimen L (cm): | 8.522 | 8.522 | 8.522 | 8.522 | |
| Cross-Sectional End Area of Specimen A (sq. cm): | 75.107 | 75.107 | 75.107 | 75.107 | |
| Time elapsed between determinations t (sec): | 600 | 600 | 600 | 600 | |
| Head loss across the specimen at time t_1 (cm): | 44.4100 | 43.1839 | 41.9578 | 40.7318 | |
| Head loss across the specimen at time t_2 h_2 (cm): | 43.1839 | 41.9578 | 40.7318 | 39.6078 | |
| Falling Head Permeability K (cm/sec): | 9.086E-06 | 9.347E-06 | 9.625E-06 | 9.081E-06 | |
| Corrected Falling Head Permeability K (cm/sec): (corrected for temperature at 20 deg. Celcius) | 8.559E-06 | 8.805E-06 | 9.066E-06 | 8.554E-06 | |
| Average K : | 9.285E-06 | cm/sec | (See Equation 3 of ASTM D 5084-90 for Computation of K) | | |
| Average Corrected K : | 8.746E-06 | cm/sec | (Average Corrected K = Average K x RT) | | |
| Ratio of K to the Average K : | 0.979 | 1.007 | 1.037 | 0.978 | |

Ratio of K should be between 0.75 and 1.25 if Average $K > 1.0 \times 10^{-8}$ cm/sec.
 Ratio of K should be between 0.50 and 1.50 if Average $K < 1.0 \times 10^{-8}$ cm/sec.
 Also the plot of K vs. Time shows no significant upward or downward trend.

| | 2.104 | 2.104 | 2.104 | 1.929 | Total: |
|-------------------------|-------|-------|-------|-------|----------------|
| Volume of Inflow (ml): | 2.104 | 2.104 | 2.104 | 1.929 | 8.241 |
| Volume of Outflow (ml): | 1.000 | 1.000 | 1.000 | 1.000 | 4.000 |
| Outflow / Inflow: | | | | | Average: 1.000 |

Ratio of Outflow/Inflow should be between 0.75 and 1.25.

| | 1.2261 | 1.2261 | 1.2261 | 1.1239 |
|---|--------|--------|--------|--------|
| Head Loss/Gain between time t and t_2 (cm): | 2.84% | 2.92% | 3.01% | 2.84% |
| Ratio of Head Loss Initial to Final for each Reading: | 0.97 | 0.94 | 0.92 | 0.89 |
| Head Loss as compared to the Initial Head: | | | | |

For soft compressible specimens may need to keep initial final head loss $< \pm 5\%$.
 Head Loss should not be less than 0.75 of the initial head.

| | 5.211 | 5.068 | 4.924 | 4.780 |
|---|-------|------------------|--------|-------------------------|
| Initial Hydraulic Gradient: | 5.068 | 4.924 | 4.780 | 4.648 |
| Final Hydraulic Gradient: | | | | |
| ASTM Suggested Maximum Hydraulic Gradients: | 2 | for K rates of | 1.E-03 | cm/sec to 1.E-04 cm/sec |
| | 5 | for K rates of | 1.E-04 | cm/sec to 1.E-05 cm/sec |
| | 10 | for K rates of | 1.E-05 | cm/sec to 1.E-06 cm/sec |
| | 20 | for K rates of | 1.E-06 | cm/sec to 1.E-07 cm/sec |
| | 30 | for K rates of | 1.E-07 | cm/sec or less |

For soft compressible specimens may need to use an hydraulic gradient less then 10.

Project: Plum Creek Site #6 Dam
State: TX
Lab No: 14-1063
Test Conditions: 4.0" core
Additional Information:

Specific Gravity (Gs): 2.68
Maximum Dry Density: 101.7 pcf
Optimum Moisture: 20.6 percent
Perm Cell No.: 2
Additive Type and Rate: lbs/sq.ft. of
Initial Average Diameter of Specimen: 3.821 inches
Initial Average Height of Specimen: 4.002 inches
Initial Moist Weight of Specimen: 1477.14 gms.

End Area: 11.467 sq. inches
Volume of Specimen: 45.890 cubic inches
Moist Unit Weight: 122.62 pcf
3.8095 (multiplication factor to convert gms/cubic inch to pcf)

Initial Cell Burette Reading Before Backpressure: 3.00
Cell Burette Reading After Backpressure: 13.30
Cell Pressure After Backpressure: 103.0 psi
Cell Burette After Equalization: 14.30
Cell Pressure After Equalization: 105.0 psi

Gradient
Pressure
Diff.:
(psi)

Average Permeability (k) for each run:

| | | Date/time: Start | End | Total per Each Run: | Total Elapsed Time: |
|----------|------------------|---------------------|------------------|------------------------|------------------------|
| 1st Run | 6.961E-06 cm/sec | 8/25/14 7:00 AM | 8/25/14 10:00 AM | 3.00 hrs. | 3.00 hrs. |
| 2nd Run | 4.861E-06 cm/sec | 8/25/14 10:00 AM | 8/26/14 9:30 AM | 23.50 hrs. | 26.50 hrs. |
| 3rd Run | 4.930E-06 cm/sec | 8/26/14 9:30 AM | 8/27/14 10:15 AM | 24.75 hrs. | 51.25 hrs. |
| 4th Run | 4.483E-06 cm/sec | 8/27/14 10:15 AM | 8/28/14 8:45 AM | 22.50 hrs. | 73.75 hrs. |
| 5th Run | 4.328E-06 cm/sec | 8/28/14 8:45 AM | 8/29/14 8:30 AM | 23.75 hrs. | 97.50 hrs. |
| 6th Run | 3.435E-06 cm/sec | 8/29/14 8:30 AM | 9/2/14 10:00 AM | 97.50 hrs. | 195.00 hrs. |
| 7th Run | 3.191E-06 cm/sec | 9/2/14 10:00 AM | 9/3/14 9:15 AM | 23.25 hrs. | 218.25 hrs. |
| 8th Run | 3.310E-06 cm/sec | 9/3/14 9:15 AM | 9/4/14 9:45 AM | 24.50 hrs. | 242.75 hrs. |
| 9th Run | 3.091E-06 cm/sec | 9/4/14 9:45 AM | 9/5/14 8:20 AM | 22.58 hrs. | 265.33 hrs. |
| 10th Run | 2.760E-06 cm/sec | 9/5/14 8:20 AM | 9/8/14 9:44 AM | 73.40 hrs. | 338.73 hrs. |
| 11th Run | cm/sec | | | hrs. | hrs. |
| 12th Run | cm/sec | | | hrs. | hrs. |
| 13th Run | cm/sec | | | hrs. | hrs. |
| 14th Run | cm/sec | | | hrs. | hrs. |
| 15th Run | cm/sec | | | hrs. | hrs. |
| 16th Run | cm/sec | | | hrs. | hrs. |
| 17th Run | cm/sec | | | hrs. | hrs. |
| 18th Run | cm/sec | | | hrs. | hrs. |

Note:

-Start and End Times based on the start and end of each days run.
-Elapsed Time based on the accumulation of each run whether continuous or not.
-Average Permeability is based on four readings within parameters.

Ambient Water Temperature (nearest 0.5 deg): 22.5 deg.Celsius

Recorded Permeability: 2.760E-06 cm/sec

Final Cell Pressure for the Recorded Perm: 105.0 psi
Final Base Pressure for the Recorded Perm: 100.0 psi
Final Gradient Pressure Difference: psi

(Use only the External Burette for the Cell Reading)

Final Moist Weight of Specimen+Container: 1698.77 gms.
Final Dry Weight of Specimen+Container: 1401.90 gms.
Weight of Container: 176.72 gms.
Weight of Water: 296.87 gms.
Weight of Dry Specimen: 1225.18 gms.

Initial Cell Burette Reading Before Backpressure: 3.00
Final Cell Burette Reading After Cell is Tore Down: 10.90
Cell Burette Reading for Recorded Perm Result: 7.90
Final Cell Burette Reading for Recorded Perm Result: 14.90
Estimated Correction for Compressed Water: 6.97
Estimated Initial/Final Cell Burette Reading: 7.93
Estimated Consolidation at the End of the Test: -2.97

Initial Dry Density: 101.71 pcf
Percent of Maximum Dry Density: 100.00 %
Initial Percent Moisture in Ref. to Optimum: 0.00 %

Estimated Final Volume Change of Burette: -0.626 cubic inches
Estimated Final Volume of the Specimen: 46.517 cubic inches

Final Dry Density: 101.71 pcf
Percent of Maximum Dry Density: 100.00 %
Final Percent Moisture in Ref. to Optimum: 3.66 %

Estimated Final Dry Density: 100.34 pcf
Percent of Maximum Dry Density: 98.65 %

Initial Water Content: 20.57 percent
Final Water Content: 24.23 percent
Saturated Moisture: 24.04 percent
Initial Percent Saturated: 85.55 %
Final Percent Saturated: 100.79 %

Note: The Specimen is not directly measured to achieve the Final Dry Density, but is measured from the Difference in Volume of the Cell Burette to achieve an Estimated Final Dry Density. This Volume is assumed to be the Volume during the test for the Recorded Perm Result. Rebound of the Specimen may occur when the pressure is released.

Note: Initial and Final Densities are considered to be the same unless the Cell Burette Volume is monitored.

Final Measured Average Diameter of Specimen: inches
Final Measured Average Height of Specimen: inches

Checked by: LLS

Permeability vs. Time

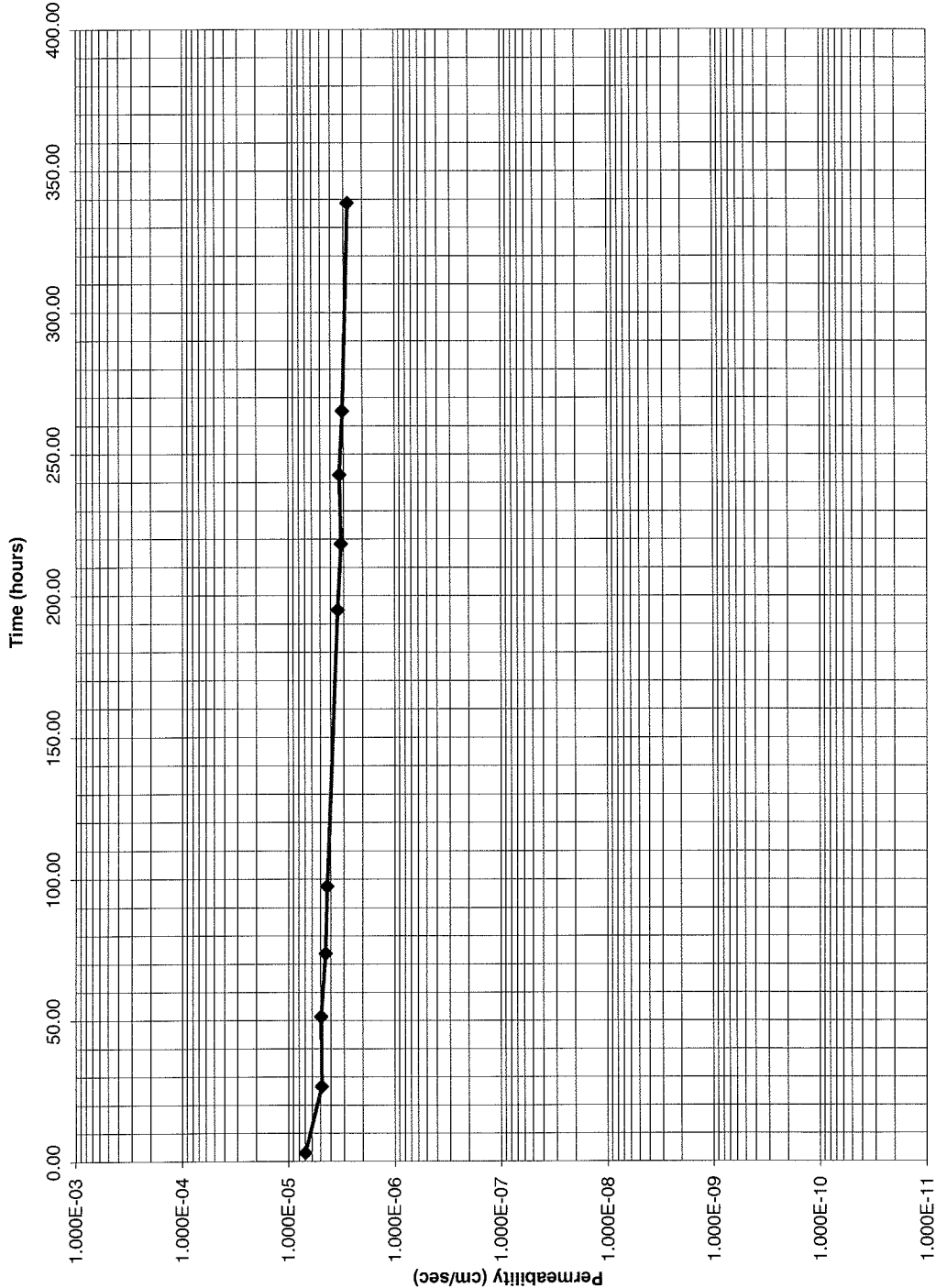
Project:
Plum Creek Site #6 Dam

State: TX

Lab No: 14-1063

Test Conditions:
4.0" core

Total for all Runs



| Permeability Rate: | Elapsed Time: | |
|--------------------|---------------|----------|
| 6.961E-06 cm/sec | 3.00 hrs. | 1st Run |
| 4.861E-06 cm/sec | 26.50 hrs. | 2nd Run |
| 4.930E-06 cm/sec | 51.25 hrs. | 3rd Run |
| 4.483E-06 cm/sec | 73.75 hrs. | 4th Run |
| 4.328E-06 cm/sec | 97.50 hrs. | 5th Run |
| 3.435E-06 cm/sec | 195.00 hrs. | 6th Run |
| 3.191E-06 cm/sec | 218.25 hrs. | 7th Run |
| 3.310E-06 cm/sec | 242.75 hrs. | 8th Run |
| 3.091E-06 cm/sec | 265.33 hrs. | 9th Run |
| 2.760E-06 cm/sec | 338.73 hrs. | 10th Run |
| cm/sec | hrs. | 11th Run |
| cm/sec | hrs. | 12th Run |
| cm/sec | hrs. | 13th Run |
| cm/sec | hrs. | 14th Run |
| cm/sec | hrs. | 15th Run |
| cm/sec | hrs. | 16th Run |
| cm/sec | hrs. | 17th Run |
| cm/sec | hrs. | 18th Run |

Perm Cell No.: 2

Project: 10th Run Plum Creek Site #6 Dam
 State: TX
 Lab No: 14-1063
 Test Conditions: 4.0" core
 Additional Information:

Perm Cell No.: 2
 Initial Average Diameter of Specimen: 3.821 inches
 Initial Average Height of Specimen: 4.002 inches
 Cross-Sectional End Area of the Specimen: 11.467 sq. inches
 10th Run
 Cell Pressure: 105.0 psi
 Base Pressure: 100.0 psi
 Gradient Pressure Difference: psi
 Initial Cell Burette Reading for this Run: 14.90 (used to determine Swink or Swell Potential)
 Ambient Water Temperature (nearest 0.5 deg): 22.5 deg. Celcius 0.942 Correction Factor (R_T)
 Is the Large Burette being Used? YES (yes or no)
 Calibrated Area of the Inlet Burette: 0.194530 sq. cm
 Calibrated Area of the Outlet Burette: 0.181350 sq. cm
 Calibrated Area of the Large Inlet Burette: 3.664200 sq. cm
 Calibrated Area of the Large Outlet Burette: 3.048070 sq. cm
 Day of Run (ie Day 1, Day 2, Day 3 etc.): DAY 15
 Date/time for the entire run (exact format needed): 9/5/14 8:20 AM Start
 9/9/14 12:21 PM 9/8/14 9:44 AM End (At the Last Recorded Reading for this Run)
 Total Running Time per Run: 73.40 hrs.

Start and End Times based on the start and end of each days run.

Readings:

| | 1st | 2nd | 3rd | 4th | note: |
|---|-----------|---|-----------|-----------|--|
| Initial Cell Burette Reading of Inlet: | 0.18 | 0.22 | 0.25 | 0.28 | After the 4th Reading, the 1st Readings are replaced by the 2nd Readings and so forth. Then the new 4th Readings can be inputed. |
| Initial Cell Burette Reading of Outlet: | 9.76 | 9.72 | 9.68 | 9.64 | |
| Final Cell Burette Reading of Inlet: | 0.22 | 0.25 | 0.28 | 0.32 | |
| Final Cell Burette Reading of Outlet: | 9.72 | 9.68 | 9.64 | 9.60 | |
| Time Between Readings (min.): | 10 | 10 | 10 | 10 | |
| Total Elapsed Time (min): | 10 | 20 | 30 | 40 | |
| Cross-Sectional Area of the Input Burette a_{in} (sq. cm): | 3.664200 | 3.664200 | 3.664200 | 3.664200 | |
| Cross-Sectional Area of the Outlet Burette a_{out} (sq. cm): | 3.048070 | 3.048070 | 3.048070 | 3.048070 | |
| Length of Specimen L (cm): | 10.165 | 10.165 | 10.165 | 10.165 | |
| Cross-Sectional End Area of Specimen A (sq. cm): | 73.980 | 73.980 | 73.980 | 73.980 | |
| Time elapsed between determinations t (sec): | 600 | 600 | 600 | 600 | |
| Head loss across the specimen at time t_1 h_1 (cm): | 52.8933 | 52.4671 | 52.0923 | 51.7175 | |
| Head loss across the specimen at time t_2 h_2 (cm): | 52.4671 | 52.0923 | 51.7175 | 51.2913 | |
| Falling Head Permeability K (cm/sec): | 3.083E-06 | 2.732E-06 | 2.751E-06 | 3.153E-06 | |
| Corrected Falling Head Permeability K (cm/sec): (corrected for temperature at 20 deg. Celcius) | 2.904E-06 | 2.573E-06 | 2.592E-06 | 2.970E-06 | |
| Average K : | 2.930E-06 | cm/sec (See Equation 3 of ASTM D 5084-90 for Computation of K) | | | |
| Average Corrected K : | 2.760E-06 | cm/sec (Average Corrected K = Average K x R_T) | | | |
| Ratio of K to the Average K : | 1.052 | 0.932 | 0.939 | 1.076 | |

Ratio of K should be between 0.75 and 1.25 if Average $K > 1.0 \times 10^{-8}$ cm/sec.

Ratio of K should be between 0.50 and 1.50 if Average $K < 1.0 \times 10^{-8}$ cm/sec.

Also the plot of K vs. Time shows no significant upward or downward trend.

| | 0.753 | 0.565 | 0.565 | 0.753 | Total: |
|-------------------------|-------|-------|-------|-------|----------------|
| Volume of Inflow (ml): | 0.753 | 0.565 | 0.565 | 0.753 | 2.637 |
| Volume of Outflow (ml): | 0.672 | 0.672 | 0.672 | 0.672 | 2.689 |
| Outflow / Inflow: | 0.892 | 1.190 | 1.190 | 0.892 | Average: 1.020 |

Ratio of Outflow/Inflow should be between 0.75 and 1.25.

| | 0.4262 | 0.3748 | 0.3748 | 0.4262 |
|---|--------|--------|--------|--------|
| Head Loss/Gain between time t and t_2 (cm): | 0.4262 | 0.3748 | 0.3748 | 0.4262 |
| Ratio of Head Loss Initial to Final for each Reading: | 0.81% | 0.72% | 0.72% | 0.83% |
| Head Loss as compared to the Initial Head: | 0.99 | 0.98 | 0.98 | 0.97 |

For soft compressible specimens may need to keep initial final head loss $< \pm 5\%$.

Head Loss should not be less than 0.75 of the initial head.

| | 5.203 | 5.162 | 5.125 | 5.088 |
|---|-------|------------------|--------|-------------------------|
| Initial Hydraulic Gradient: | 5.203 | 5.162 | 5.125 | 5.088 |
| Final Hydraulic Gradient: | 5.162 | 5.125 | 5.088 | 5.046 |
| ASTM Suggested Maximum Hydraulic Gradients: | 2 | for K rates of | 1.E-03 | cm/sec to 1.E-04 cm/sec |
| | 5 | for K rates of | 1.E-04 | cm/sec to 1.E-05 cm/sec |
| | 10 | for K rates of | 1.E-05 | cm/sec to 1.E-06 cm/sec |
| | 20 | for K rates of | 1.E-06 | cm/sec to 1.E-07 cm/sec |
| | 30 | for K rates of | 1.E-07 | cm/sec or less |

For soft compressible specimens may need to use an hydraulic gradient less then 10.