October 2012







Feather River West Levee Project

Sutter Butte Flood Control Agency

Geotechnical Data Report

FINAL

URS

October 15, 2012

Mr. Chris Krivanec
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Re: Geotechnical Data Report
Segments 1 through 6

Dear Mr. Krivanec:

URS Corporation is pleased to submit this Geotechnical Data Report for the Feather River West Levee Project, Segments 1 through 6.

Please contact us if you have questions or require additional information. We appreciate this opportunity to be of service.

Sincerely,





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Robert K Green

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Final

GEOTECHNICAL DATA REPORT

Feather River West Levee Project

Contract 2696
October 2012

Prepared for:

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1.0 INTRODUCTION 1-1
1.1 Project Description 1-1
1.2 Project Limits 1-1
1.3 Purpose and Scope of Work 1-2
1.4 Authorization 1-2
1.5 Elevation Datum and Horizontal Coordinates 1-2
1.6 Report Organization 1-3

2.0 FIELD INVESTIGATION AND LABORATORY TESTS 2-1
2.1 Rationale for FRWL Explorations 2-1
2.2 Permitting and Utility Clearance 2-1
2.2.1 Biological and Cultural Clearance 2-1
2.2.2 Hazardous Materials 2-2
2.3 Field Exploration 2-2
2.3.1 Exploration Locations 2-2
2.3.2 Exploratory Borings 2-2
2.3.3 Cone Penetrometer Tests 2-2
2.3.4 Sampling and Classification 2-3
2.3.5 Backfilling and Cuttings Disposal 2-3
2.4 Laboratory Testing 2-4
2.4.1 Introduction 2-4
2.4.2 Moisture Content and Dry Density 2-4
2.4.3 Atterberg Limits 2-4
2.4.4 Grain Size Analysis 2-4
2.4.5 Consolidation 2-4
2.4.6 Triaxial Shear 2-4
2.4.7 Direct Shear 2-4
2.4.8 Compaction 2-5
2.4.9 Hydraulic Conductivity 2-5
2.5 Quality Assurance and Quality Control 2-5
2.5.1 Hammer Energy Measurements 2-5
2.5.2 Boring Logs 2-5
2.5.3 Cone Penetrometer Test Logs 2-6
2.5.4 Laboratory Tests 2-6

3.0 HISTORICAL FIELD INVESTIGATION AND LABORATORY TESTS 3-1
3.1 1947 USACE Flood Control Project 3-1
3.2 1957 Ben C. Gerwick Inc. 5th Street Bridge Investigation 3-1
3.3 1959 Reinhard W. Brandley Shanghai Bend Levee Cutoff Foundation Report 3-1
3.4 1965 USACE Bank Protection Project 3-1
3.5 1988 Wahler Associates Levee Investigation 3-1

3.6 1988 Von Geldern Engineering Company Levee Stabilization Investigation....3-1
3.7 1988 The Mark Group Levee Evaluation Investigation....3-2
3.8 1989 The Mark Group Levee Geotechnical Stability Assessment Investigation....3-2
3.9 1989 The Mark Group Shanghai Bend Levee Geotechnical Investigation....3-2
3.10 1991 USACE Marysville/Yuba City Levee Reconstruction Project....3-2
3.11 1997 USACE Star Bend Levee Reconstruction Investigation....3-2
3.12 1997 USACE PL84-99 Star Bend Investigation....3-2
3.13 1997 USACE Sacramento River Flood Control Project....3-2
3.14 1998 Gregg In Situ Inc. Shanghai Bend Site Investigation....3-3
3.15 1998 USACE Sacramento River Flood Control Project....3-3
3.16 1999 URS Greiner Woodward Clyde Additional Levee Site Investigation for Cut-off Levee at Shanghai Bend....3-3
3.17 1999 USACE PL 84-99 LD 1 Slurry Wall Investigation....3-3
3.18 2006 Kleinfelder Levee District 9 Geotechnical Investigation....3-3
3.19 2006 USACE Sutter County Feasibility Study....3-3
3.20 2006 and 2007 Blackburn Consulting Inc. Geotechnical Reports for Star Bend Setback Levee....3-3
3.21 2007 Taber 5th Street Bridge Investigation....3-4
3.22 2008 URS Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area....3-4
3.23 2010 URS Supplemental Geotechnical Data Report (P1GDR) Sutter Study Area....3-4
3.24 2011 Caltrans Emergency Scour Retrofit Feather River Bridge Investigation....3-4
3.25 2011 Dokken Engineering 5th Street Bridge Investigation....3-4
3.26 Other Pertinent Studies....3-4

4.0 LIMITATIONS....4-1

5.0 REFERENCES....5-1

Tables

Table 1 Summary of Reach Boundaries for FRWL
Table 2 Summary of FRWL Project Explorations
Table 3 Summary of Historical Explorations on FRWL
Table 4 Summary of Laboratory Tests

Figures

Figure 1	Project Location Map
Figure 2a	FRWL Project Plan Views – Figure Index
Figure 2b	FRWL Project Plan Views – Figure Legend
Figure 3	Plan View, Station 10+00 to Station 60+00
Figure 4	Plan View, Station 60+00 to Station 110+00
Figure 5	Plan View, Station 110+00 to Station 160+00
Figure 6	Plan View, Station 210+00 to Station 260+00
Figure 7	Plan View, Station 260+00 to Station 310+00
Figure 8	Plan View, Station 310+00 to Station 360+00
Figure 9	Plan View, Station 360+00 to Station 410+00
Figure 10	Plan View, Station 410+00 to Station 460+00
Figure 11	Plan View, Station 460+00 to Station 510+00
Figure 12	Plan View, Station 510+00 to Station 560+00
Figure 13	Plan View, Station 560+00 to Station 610+00
Figure 14	Plan View, Station 610+00 to Station 660+00
Figure 15	Plan View, Station 660+00 to Station 710+00
Figure 16	Plan View, Station 710+00 to Station 760+00
Figure 17	Plan View, Station 760+00 to Station 810+00
Figure 18	Plan View, Station 810+00 to Station 860+00
Figure 19	Plan View, Station 860+00 to Station 910+00
Figure 20	Plan View, Station 910+00 to Station 960+00
Figure 21	Plan View, Station 960+00 to Station 1010+00
Figure 22	Plan View, Station 1010+00 to Station 1060+00
Figure 23	Plan View, Station 1060+00 to Station 1110+00
Figure 24	Plan View, Station 1110+00 to Station 1160+00
Figure 25	Plan View, Station 1160+00 to Station 1210+00
Figure 26	Plan View, Station 1210+00 to Station 1260+00
Figure 27	Plan View, Station 1260+00 to Station 1310+00
Figure 28	Plan View, Station 210+00 to Station 260+00
Figure 29	Plan View, Station 1310+00 to Station 1360+00
Figure 30	Plan View, Station 1360+00 to Station 1410+00
Figure 31	Plan View, Station 1410+00 to Station 1460+00
Figure 32	Plan View, Station 1460+00 to Station 1510+00

Figures

Figure 33 Plan View, Station 1510+00 to Station 1560+00
Figure 34 Plan View, Station 1560+00 to Station 1610+00
Figure 35 Plan View, Station 1610+00 to Station 1660+00
Figure 36 Plan View, Station 1660+00 to Station 1710+00
Figure 37 Plan View, Station 1710+00 to Station 1760+00
Figure 38 Plan View, Station 1760+00 to Station 1810+00
Figure 39 Plan View, Station 1810+00 to Station 1860+00
Figure 40 Plan View, Station 1860+00 to Station 1910+00
Figure 41 Plan View, Station 1910+00 to Station 1960+00
Figure 42 Plan View, Station 1960+00 to Station 2010+00
Figure 43 Plan View, Station 2010+00 to Station 2060+00
Figure 44 Plan View, Station 2060+00 to Station 2110+00
Figure 45 Plan View, Station 2110+00 to Station 2160+00
Figure 46 Plan View, Station 2160+00 to Station 2210+00
Figure 47 Plan View, Station 2210+00 to Station 2260+00
Figure 48 Plan View, Station 2260+00 to Station 2310+00
Figure 49 Plan View, Station 2310+00 to Station 2360+00
Figure 50 Plan View, Station 2360+00 to Station 2372+17

Appendices

Appendix A Task Order 1 Boring Logs
Appendix B Task Order 1 Hammer Energy Measurement Information
Appendix C Task Order 1 Cone Penetrometer Test Logs
Appendix D Task Order 1 Pore Pressure Dissipation Test Results
Appendix E Task Order 1 Laboratory Test Results
Appendix F Task Order 2 and Task Order 4 Boring Logs
Appendix G Task Order 2 and Task Order 4 Hammer Energy Measurement Information
Appendix H Task Order 2 and Task Order 4 CPT Logs
Appendix I Task Order 2 and Task Order 4 Pore Pressure Dissipation Test Results
Appendix J Task Order 2 and Task Order 4 Laboratory Test Results
Appendix K Historical Report Information

Acronyms and Abbreviations

Term	Description
ASTM	ASTM International
BCI	Blackburn Consulting Incorporated
CPT	cone penetrometer test
DWR	California Department of Water Resources
FEMA	Federal Emergency Management Agency
FRWL	Feather River West Levee
FWLA	Fugro William Lettis & Associates
GDR	Geotechnical Data Report
GIS	geographic information systems
GPS	global positioning system
HDR	HDR Engineering Incorporated
HEM	helicopter-borne electromagnetic
LD	levee district
MA	maintenance area
NAVD88	North American Vertical Datum of 1988
QA/QC	quality assurance/quality control
SBFCA	Sutter Butte Flood Control Agency
SPT	standard penetration test
URS	URS Corporation
USA	Underground Services Alert
USACE	United States Army Corps of Engineers

1.0 INTRODUCTION

URS Corporation (URS) prepared this Geotechnical Data Report (GDR) in association with Blackburn Consulting Incorporated (BCI). URS and BCI are members of the Sutter Butte Flood Control Agency's (SBFCA's) Feather River West Levee (FRWL) Project design team, led by HDR Engineering Incorporated (HDR). This GDR presents geotechnical data used to prepare the Geotechnical Design Recommendations Report (GDRR) [URS, 2012] for the FRWL Project's 65 percent design of rehabilitation measures.

1.1 Project Description

The FRWL is part of the levee system protecting the Sutter Butte basin. The FRWL is bounded to the east by the Feather River, to the south by the Sutter Bypass, and to the west by Wadsworth Canal. The Sutter Butte basin contains orchards, cropland, and several cities and towns, including Yuba City (population approximately 60,000), Live Oak (population approximately 9,000), Gridley (population approximately 6,000), and Biggs (population approximately 2,000).

During past high water events along the Feather River, the FRWL has experienced performance issues, including a breach in 1955 that flooded Yuba City and the Sutter Butte basin. Studies performed by the United States Army Corps of Engineers (USACE), the California Department of Water Resources (DWR), and others have generated geotechnical data for the FRWL and indicated that portions of the FRWL need rehabilitation if they are to perform reliably in the future.

In 2007, the local levee districts joined with local cities and Sutter and Butte Counties to form SBFCA. SBFCA is a joint powers agency charged with improving flood protection within the Sutter Butte basin. SBFCA conceived and initiated the FRWL Project to rehabilitate the FRWL. The FRWL Project will rehabilitate its levees so they meet the FEMA standard for providing protection against a 100-year flood event, and so they meet California's standard for providing 200-year flood protection for urban areas. Project criteria and background information are discussed in the GDRR.

1.2 Project Limits

The FRWL is located along the right bank of the Feather River in Butte and Sutter Counties (see Figure 1). The FRWL is approximately 44 miles long, and extends from the Thermalito Afterbay in the north to its confluence with the Sutter Bypass in the south. The local agencies responsible for maintaining and operating these levees are:

- Maintenance Area 7 (MA 7)
- Maintenance Area 16 (MA 16)
- Levee District 9 (LD 9)
- Levee District 1 (LD 1)
- Maintenance Area 3 (MA 3)

HDR developed a unique centerline and levee stationing system for the FRWL Project. This stationing is independent of existing levee stationing systems used by DWR and local reclamation or flood-control districts. SBFCA stationing starts at Station 10+00 at the confluence with Sutter Bypass and runs northward, ending at Station 2372+17 at the Thermalito Afterbay (see Figures 3 through 50). The FRWL Project includes 41 reaches extending from Station 10+00, where Reach 1 begins, to Station 2368+00, where Reach 41 ends. Reach boundaries are summarized in Table 1. Geology and reach characterization are discussed in the GDRR.

1.3 Purpose and Scope of Work

The FRWL Project field investigation discussed in this GDR collected geotechnical information to supplement existing data. These new and existing data are used in the GDRR and support the FRWL Project's 65 percent design of rehabilitation measures.

URS and BCI completed the scope of work for this GDR, which entailed:

- Program management of all geotechnical activities.
- Reviewing existing information and summarizing pertinent geotechnical data in an inventory.
- Completing 93 exploratory borings and 89 cone penetrometer tests (CPTs) along the FRWL crest, waterside, landside toe, and landside field.
- Geotechnical laboratory testing on selected samples from explorations.
- Preparing this GDR.

1.4 Authorization

HDR authorized the work described in this GDR under FRWL Project Task Orders 1 (2010), 2 and 4 (2011 and 2012).

1.5 Elevation Datum and Horizontal Coordinates

This GDR provides elevation references in feet, and they are based on the North American Vertical Datum of 1988 (NAVD88). Survey data, elevations and horizontal coordinates are provided in the California State Plane Coordinate System.

1.6 Report Organization

Report organization is described in this section to help the reader locate project information. Locations of recent and historical explorations are shown on Figures 3 through 50 in this GDR, which correspond to the plan views of Plates A3 through A50 in the GDRR. The explorations are classified by color as defined on Figure 2B:

- Blue: Task Order 1 Boring or CPT. Data are in Appendices A through E.
- Green: Task Order 2 or 4 Boring or CPT. Data are in Appendices F through J.
- Orange: Historical Boring or CPT. Data are in Appendix K.

Tables 2 and 3 summarize recent and historical exploration information sorted by station, and show the relationship between the figures and appendices in this GDR. Table 4 summarizes recent laboratory tests sorted by station and shows where readers can locate test results in this GDR.

2.0 FIELD INVESTIGATION AND LABORATORY TESTS

URS and BCI performed FRWL Project field investigations between August 2010 and January 2012. During field investigations, 93 exploratory borings and 89 CPTs were completed along the FRWL's crest, waterside, landside toe, and landside field to depths ranging from 5 to 170 feet below ground surface. Table 2 summarizes these explorations.

2.1 Rationale for FRWL Explorations

Although existing geotechnical data about the FRWL was available, targeted supplemental subsurface explorations were completed during the FRWL field investigation to:

- Fill data gaps at a few locations on the levee crest.
- Generate additional subsurface data along the landside of the levee.
- Obtain data specifically targeted at locations that might control design decisions and design elements.

The companion GDRR (URS, 2012) describes the process for selecting exploration locations.

2.2 Permitting and Utility Clearance

Bender Rosenthal, Inc., an SBFCA consultant, obtained private property owner rights-of-entry. URS and BCI obtained the following public property permits prior the start of FRWL field investigation:

- California State Board of Reclamation Encroachment Permit
- Drilling permits from the Sutter and Butte County Environmental Health Departments
- Yuba City Encroachment Permit
- Sutter County Encroachment Permits

URS and BCI visually inspected each planned exploration location for the presence of overhead and underground utilities; they were then staked and marked with white paint. Underground Service Alert (USA) was contacted a minimum of 48 hours prior to the start of exploration activities. A USA ticket number (including clearance date, expiration date and call-back-to-extend date) was obtained for each planned exploration location and was documented in the project file.

Proximity to overhead utilities was evaluated at each exploration location to maintain at least 15 feet between the drill rig mast and any overhead utilities (i.e., power lines). Greater clearance was maintained in the presence of high-voltage overhead power lines.

2.2.1 Biological and Cultural Clearance

Other consultants retained by SBFCA obtained biological and cultural clearances prior to the start of field investigation. Constraints were provided to the geotechnical field exploration team for appropriate modification of the exploration plan.

2.2.2 Hazardous Materials

No hazardous materials were encountered during the execution of FRWL Project field investigation.

2.3 Field Exploration

2.3.1 Exploration Locations

URS and BCI performed exploratory borings and CPTs along the levee crest, waterside, landside toe, and landside field. A total of 52 explorations were on the levee crest, six were along the waterside, 88 were along the landside levee toe, and 36 were in the landside levee field. Planned boring locations were identified using a hand-held GPS unit and geographic information system (GIS) software. Where access constraints or utility conflicts occurred, the exploration was re-located as close as possible to the planned location. FRWL Project explorations are listed in Table 2 and shown on Figures 3 through 50. FRWL Project exploration logs are included in this GDR. Stick logs of FRWL Project explorations are in the GDRR.

2.3.2 Exploratory Borings

2.3.2.1 Auger and Mud-Rotary

Truck- and track-mounted auger and mud-rotary drill rigs were used for the FRWL Project borings. In accordance with USACE requirements, crest and waterside borings were cased through the levee fill. Hollow-stem auger drilling was typically performed down to groundwater then switched to mud-rotary. In some situations, mud-rotary borings were switched to hollow-stem auger drilling at-depth due to loss of circulation in gravel deposits. Appendix A contains logs of auger and mud-rotary borings performed under Task Order 1. Appendix F contains logs of auger and mud-rotary borings performed under Task Order 2 or Task Order 4.

2.3.2.2 Sonic

Particularly in the northern reaches, truck- and track-mounted sonic drill rigs were used for the FRWL Project borings to penetrate gravel layers. The sonic technique entailed using high-frequency vibration to continuously advance the drilling rod and an inner core barrel. The casing was then withdrawn and the 4-inch-diameter sample extracted and sealed in plastic bags. Depending on rig type, drilling runs ranged from 5 to 20 feet long. Sample recovery was generally good and more effective in gravels than auger or mud-rotary borings. Appendix F contains the sonic boring logs performed under Task Order 2 or Task Order 4.

2.3.3 Cone Penetrometer Tests

Truck- and track-mounted CPT rigs were used for the FRWL Project that pushed an instrumented cone-tipped probe into the ground while simultaneously recording resistance to penetration at the cone tip and along the friction sleeve. CPT explorations also included dissipation tests and soil sample collection in selected layers. CPT and dissipation testing

were performed in general accordance with ASTM D5778. Appendix C contains the logs of the CPTs performed under Task Order 1. Appendix H contains the logs of the CPTs performed under Task Order 2 or Task Order 4.

2.3.4 Sampling and Classification

A URS or BCI engineer or geologist logged borings by visually identifying and classifying the soils encountered in general accordance with ASTM D2488, and the Unified Soil Classification System (ASTM D2487). Appendices A and F have a soil classification legend at the front. Disturbed and relatively undisturbed samples of the subsurface materials were collected in general accordance with ASTM standards.

Disturbed soil samples were obtained from auger and mud-rotary borings in general accordance with ASTM D1586 using an unlined 2-inch-outside-diameter split-spoon drive sampler (i.e., standard penetration test). Where soil conditions dictated, samples were obtained with a 2.5-inch-outside-diameter split barrel drive sampler (i.e., modified California sampler) with liners. Disturbed soil samplers were driven 18 inches (unless otherwise noted) into undisturbed soil using an automatic safety hammer with a 140-pound weight and a 30-inch drop. Appendices B and G contain records of the automatic hammer's energy transfer efficiency. During sampler driving, the number of blows required to drive the sampler (i.e., its N value) for each of the three 6-inch intervals (or portion thereof) was recorded. Boring logs in Appendices A and F, and stick logs (in the GDRR) present field N values and corrected N_{60} values where appropriate.

Due to the sampler sizes used during field exploration, full recovery of cobbles and boulders was not possible. Therefore, information on the boring and stick logs regarding cobbles and boulders should not be considered complete. However, it could be expected that cobble and boulder sized material is present within the cleaner gravel layers identified.

Relatively undisturbed soil samples were also obtained from auger and mud-rotary borings in general accordance with ASTM D1587. Thin-wall, 3-inch outside diameter Shelby tubes were attached to a valved push-head assembly, lowered to the bottom of the cleaned borehole by drill rod and hydraulically pushed 24 inches (or portion thereof) into undisturbed soil.

Soil samples obtained from borings and CPTs were packaged and sealed in the field to reduce moisture loss and disturbance, and transported to the laboratory for testing as described below. Upon completion, soil classifications were evaluated. Appendix A presents selected test results on the boring logs. Appendix A also contains a key to the boring logs' terminology.

2.3.5 Backfilling and Cuttings Disposal

Following the completion of drilling, excavations were backfilled with cement-bentonite grout in accordance with Sutter and Butte County Environmental Health Department requirements. A subcontractor removed excess cuttings and drilling fluids from the site and disposed them.

2.4 Laboratory Testing

2.4.1 Introduction

Laboratory tests were performed on selected samples to help classify soils and evaluate the physical properties of these soils, which may affect the geotechnical aspects of project design and construction. The tests were performed to satisfy the objectives discussed in the GDRR. The laboratory tests performed are described below and are summarized in Table 4. Laboratory tests performed under Task Order 1 are in Appendix E. Laboratory tests performed under Task Order 2 or Task Order 4 are in Appendix J. Appendices E and J present raw data provided by the laboratory. The GDRR interprets these test results.

2.4.2 Moisture Content and Dry Density

Moisture content tests were performed to evaluate in situ moisture content of the studied profile. The tests were performed in general accordance with ASTM D2216. Dry density was evaluated in general accordance with ASTM D2937.

2.4.3 Atterberg Limits

Atterberg limits tests were performed in general accordance with ASTM D4318 to aid in soil classification and to evaluate the plasticity characteristics of the materials encountered.

2.4.4 Grain Size Analysis

Sieve and hydrometer analyses were performed in general accordance with ASTM D1140 and ASTM D422 to evaluate gradation of the materials encountered and to help classify soils.

2.4.5 Consolidation

Consolidation tests were performed in general accordance with ASTM D2435 on relatively undisturbed soil samples to evaluate the stress history and compressibility of fine-grained soils.

2.4.6 Triaxial Shear

Consolidated undrained triaxial shear tests with pore pressure measurements were performed on relatively undisturbed samples. Both total and effective strength envelopes were developed from these tests. Tests were performed in general accordance with ASTM D4767.

2.4.7 Direct Shear

Consolidated drained direct shear tests were performed on relatively undisturbed samples. Effective strength envelopes were developed from these tests. Tests were performed in general accordance with ASTM D3080.

2.4.8 Compaction

Maximum dry density and optimum moisture content tests were performed on bulk samples collected from auger borings to evaluate remolding criteria for select triaxial and direct shear tests. Tests were performed in general accordance with ASTM D698.

2.4.9 Hydraulic Conductivity

Hydraulic conductivity tests were performed on relatively undisturbed samples to evaluate permeability values compared to published correlations that use grain size distribution. Tests were performed in general accordance with ASTM D5084.

2.5 Quality Assurance and Quality Control

2.5.1 Hammer Energy Measurements

Measurements of the energy transfer from sample-driving hammers to sample rods were collected on the field exploration drill rigs. Automatic hammer systems were used for driven sampling (standard penetration test [SPT] and other driven sampler types). Hammer energy transfer calibration measurements were used to calculate each SPT's N value (see Appendices B and G).

SPT N values are sensitive to the energy efficiency of each specific SPT hammer used. To ensure collected N values are accurately normalized, the drilling subcontractor measured the amount of energy transferred from each SPT hammer system to the drill rod and then calculated the hammer's energy efficiency.

Hammer calibrations were conducted in accordance with ASTM D4633. Hammer energy efficiency measurements are also recorded on the gINT boring logs wherever a hammer was used. Appendix C presents hammer energy measurement reports, including details about sampler types (SPT and modified California), rod lengths, blows per minute, and energy transfer ratios.

2.5.2 Boring Logs

Quality assurance and control processes used during investigation and during development of this GDR are detailed below. Boring logs were created by:

- Entering field sampling details and soil descriptions on boring logs in general accordance with ASTM D2488, and the Unified Soil Classification System (ASTM D2487).
- Performing quality control checks on field logs (performed by the Field Investigation Manager and other URS geotechnical staff).
- Reviewing laboratory test results to gage conformance with field boring logs (performed by the Engineer).
- Wherever appropriate, refining field log soil classifications and descriptions based on laboratory test results.
- Reviewing updated gINT boring logs.

2.5.3 Cone Penetrometer Test Logs

QA/QC protocol for CPT logs consisted of calibrating and adjusting data interpretations based on recorded subsurface conditions in the boring. The CPT subcontractor was required to submit its own QA/QC plan before mobilization and start of field investigations. Before testing was started, CPT operators:

- Checked and recorded cone tolerances
- Properly saturated piezo-transducer cavity
- Ensured that a properly saturated piezo-element was installed on the cone
- Checked and recorded baseline readings with the cone in a zero-load position
- Recorded differential GPS readings
- Ensured the cone was vertical and rig was level

CPT measurements were conducted at 2-centimeter intervals in accordance with ASTM D 5778. CPT equipment is calibrated every 6 months.

CPT reports (in electronic and hard copy form) were checked to verify that CPT signature plots and pore pressure dissipation tests performed were present in both hard copy and electronic forms and included raw data.

2.5.4 Laboratory Tests

The laboratory testing facilities maintain independent American Association of State Highway and Transportation Officials Materials Reference Laboratory accreditation and USACE certification. Data received were reviewed by URS geotechnical staff and finalized laboratory reports incorporated comments, where necessary.

3.0 HISTORICAL FIELD INVESTIGATION AND LABORATORY TESTS

Multiple field investigations were previously performed on the FRWL. Past investigations included the completion of soil borings, CPTs, test pits, helicopter-borne electromagnetic (HEM) survey, ground-based resistivity survey, LiDAR survey, geomorphic mapping, and laboratory tests on soil samples. These investigations are summarized in this section. Appendix K provides more detailed information about previous field investigations along the FRWL. Table 3 summarizes historical explorations and classifies them by project number. Readers should use these project numbers to locate each historical item in Appendix K.

3.1 1947 USACE Flood Control Project

As part of this project, USACE performed two borings in Reaches 40 and 41. All explorations were performed on the levee crest (USACE, 1947).

3.2 1957 Ben C. Gerwick Inc. 5th Street Bridge Investigation

As part of this investigation, four borings were performed in Reach 16. Three explorations were performed in waterside fields and one was performed in a landside field (Gerwick Inc., 1957).

3.3 1959 Reinhard W. Brandley Shanghai Bend Levee Cutoff Foundation Report

As part of this investigation, five borings were performed in Reaches 12 and 13. Three explorations were performed on the levee crest and two were performed in waterside fields (Brandley, 1959).

3.4 1965 USACE Bank Protection Project

As part of this project, two borings were performed in Reach 11 in waterside fields (USACE, 1965).

3.5 1988 Wahler Associates Levee Investigation

As part of this investigation, ten borings were performed in Reach 15. Seven explorations were performed on the levee crest and three were performed in landside fields (Wahler, 1988).

3.6 1988 Von Geldern Engineering Company Levee Stabilization Investigation

As part of this investigation, four borings were performed in Reach 16 on the levee crest (Von Geldern Engineering Company, 1988).

3.7 1988 The Mark Group Levee Evaluation Investigation

As part of this investigation, 46 CPTs and 12 borings were performed in Reaches 1 through 13, 15 through 19, 21 through 25, 28 through 36, 39, and 40. A total of 55 explorations were performed on the levee crest and three were performed in waterside fields (The Mark Group, 1988).

3.8 1989 The Mark Group Levee Geotechnical Stability Assessment Investigation

As part of this investigation, 12 borings and 10 test pits were performed in Reaches 2, 5, 12, 15, 17, 19, 22, 30 and 32. A total of 55 explorations were performed on the levee crest and three were performed in waterside fields (The Mark Group, 1989).

3.9 1989 The Mark Group Shanghai Bend Levee Geotechnical Investigation

As part of this investigation, four borings were performed in Reach 12 in waterside fields (The Mark Group, 1989a).

3.10 1991 USACE Marysville/Yuba City Levee Reconstruction Project

As part of this investigation, 52 CPTs, 76 borings and 25 test pits were performed in Reaches 11, 13, 17, 20 and 21. A total of 30 explorations were performed on the levee crest; 110 were performed in landside fields; three were performed in waterside fields and 10 were performed at the landside toe of the levee. Additionally, two bulk samples were collected from landside fields (USACE, 1991).

3.11 1997 USACE Star Bend Levee Reconstruction Investigation

As part of this investigation, three borings and 22 CPTs were performed in Reach 7 and one CPT was performed in Reach 8 (USACE, 1997).

3.12 1997 USACE PL84-99 Star Bend Investigation

As part of this investigation, eight borings were performed in Reach 7. Four explorations were performed on the levee crest and were performed at the landside toe of the levee (USACE, 1997a).

3.13 1997 USACE Sacramento River Flood Control Project

As part of this project, three borings were performed in Reach 30 on the levee crest (USACE, 1997b).

3.14 1998 Gregg In Situ Inc. Shanghai Bend Site Investigation

As part of this investigation, five borings were performed in Reach 19. Four explorations were performed on the levee crest and one was performed in a landside field (Gregg In Situ Inc., 1998).

3.15 1998 USACE Sacramento River Flood Control Project

As part of this project, four borings were performed along the levee crest in Reaches 13 through 16 (USACE, 1998).

3.16 1999 URS Greiner Woodward Clyde Additional Levee Site Investigation for Cut-off Levee at Shanghai Bend

As part of this investigation, 12 CPTs and one boring were performed in Reach 19. Two explorations were performed on the levee crest; six were performed in landside fields; four were performed in waterside fields and one was performed at the waterside toe of the levee (URS Greiner Woodward Clyde, 1999).

3.17 1999 USACE PL 84-99 LD 1 Slurry Wall Investigation

As part of this investigation, 14 borings were performed on FRWL. Five explorations were performed on the levee crest; four were performed in landside fields; four were performed in waterside fields and one was performed at landside toe of the levee (USACE, 1999).

3.18 2006 Kleinfelder Levee District 9 Geotechnical Investigation

As part of this investigation, 76 borings, 52 CPT and 25 test pits were performed in Reaches 11, 13, 17, 20 and 21. A total of 14 explorations were performed on the levee crest; 123 were performed in landside fields; six were performed in waterside field, 10 were performed at the landside toe of the levee. Additionally, two bulk samples were collected from landside fields (Kleinfelder, 2006).

3.19 2006 USACE Sutter County Feasibility Study

As part of this study, 10 borings were performed in Reaches 17-19 and 21. All explorations were performed on the levee crest (USACE, 2006).

3.20 2006 and 2007 Blackburn Consulting Inc. Geotechnical Reports for Star Bend Setback Levee

As part of the initial investigation, 12 test pits, three CPTs and six borings were performed in Reaches 5, 6, 11, 14, 16 and 17 (Blackburn Consulting Inc., 2006). A supplemental investigation was performed in Reaches 5 through 7 that included seven borings, nine CPTs and nine test pits (Blackburn Consulting Inc., 2007).

3.21 2007 Taber 5th Street Bridge Investigation

As part of this investigation, one boring and one CPT were performed in Reach 16. One exploration was performed in a waterside field and one was performed in a landside field (Taber Consultants, 2007).

3.22 2008 URS Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area

As part of this investigation, 163 borings and 119 CPTs were performed in Reaches 1 through 40. The explorations were performed on the crest and at the waterside toe of the levee (URS, 2008).

3.23 2010 URS Supplemental Geotechnical Data Report (P1GDR) Sutter Study Area

As part of this investigation, 61 borings and 93 CPTs were performed in Reaches 2 through 5, 7 through 11, 13, 15 through 24, 31, 33 and 35 through 37. The explorations were performed on the crest and at the waterside toe of the levee (URS, 2010).

3.24 2011 Caltrans Emergency Scour Retrofit Feather River Bridge Investigation

As part of this investigation, three borings were performed in Reach 16. All explorations were performed in a waterside field (Caltrans, 2011).

3.25 2011 Dokken Engineering 5th Street Bridge Investigation

As part of this investigation, one CPT was performed in Reach 16. The exploration was performed on the crest/at the waterside toe of the levee (2011 Dokken).

3.26 Other Pertinent Studies

1957 Boring Logs and Tables. These USACE-generated boring logs includes 14 borings performed in Reaches 1, 2, 3 and 21. A total of 10 explorations were performed on the levee crest, two were performed in waterside fields, one was performed at the waterside toe of the levee, and one was performed in a landside field (DOC-2570: USACE).

1957 Yuba River Levee Foundation Soil Drilling Logs. These USACE-generated logs includes five borings performed in Reach 16. Three explorations were performed in waterside fields and three were performed at the landside toe of the levee (DOC-4092: USACE).

4.0 LIMITATIONS

This geotechnical data report, associated data collection and preparation have been performed in accordance with the standard of care commonly used as the state-of-practice in the engineering profession. Standard of care is defined as the ordinary diligence exercised by fellow practitioners in this area performing the same services under similar circumstances during the same period.

Discussions of subsurface conditions summarized in this report are based on subsurface soil and groundwater conditions at limited exploration locations. Variations in subsurface conditions may exist between exploration locations, and the project team may not be able disclose all adverse conditions in the levee and its foundation.

No warranty, express or implied, is made in the furnishing of this report, which is the result of geotechnical evaluation services. URS makes no warranty, express or implied, that actual encountered site and subsurface conditions will exactly conform to the conditions described herein, nor that interpretations and recommendations in this report will be sufficient for all construction planning aspects of the work. A sufficient number of additional explorations necessary to verify subsurface conditions should be performed rather than relying solely on the information presented in this report.

URS does not attest to the accuracy, completeness, or reliability of geotechnical borings and other subsurface data by others that are included or referenced in this report. In the preparation of this report, URS has relied upon data and information provided by others, including water surface elevations presented by others as representing specific events and/or governing profiles. URS has not performed independent validation or verification of data by others.

Data presented in this report are time-sensitive in that they apply only to locations and conditions existing at the time of the exploration or collection of the data. Data should not be applied to any other projects in or near the area of this study nor should they be applied at a future time without appropriate verification.

This report is for the use and benefit of HDR, SBFCA, and their consultants in connection with the execution of the FRWL Project. Use by any other party is at their own discretion and risk.

This report is a preliminary document describing work completed at the time of preparation and will be supplemented by subsequent reports as additional information becomes available. This report should not to be used as the sole basis for design, construction, remedial action, or major capital spending decisions.

5.0 REFERENCES

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TABLES

Table 1. Summary of Reach Boundaries for FRWL

FRWL Project Reach	SBFCA Begin Station	SBFCA End Station	Length (feet)
1	10+00	129+66	11,966
2	129+66	218+66	8,900
3	218+66	300+66	8,200
4	300+66	410+67	11,001
5	410+67	478+68	6,801
6	478+68	510+37	3,169
7	510+37	596+00	8,563
8	596+00	654+75	5,875
9	654+75	706+50	5,175
10	706+50	774+00	6,750
11	774+00	830+00	5,600
12	830+00	845+00	1,500
13	845+00	927+00	8,200
14	927+00	954+40	2,740
15	954+40	968+50	1,410
16	968+50	1080+00	11,150
17	1080+00	1130+86	5,086
18	1130+86	1213+85	8,299
19	1213+85	1297+83	8,398
20	1297+83	1374+33	7,650
21	1374+33	1433+83	5,950
22	1433+83	1503+83	7,000
23	1503+83	1609+37	10,554
24	1609+37	1623+86	1,449
25	1623+86	1674+37	5,051
26	1674+37	1707+11	3,274
27	1707+11	1721+60	1,449
28	1721+60	1769+31	4,771
29	1769+31	1813+33	4,402
30	1813+33	1902+00	8,867
31	1902+00	1958+00	5,600
32	1958+00	1989+00	3,100
33	1989+00	2122+00	13,300
34	2122+00	2182+00	6,000
35	2182+00	2224+00	4,200
36	2224+00	2259+00	3,500
37	2259+00	2290+00	3,100
38	2290+00	2303+00	1,300
39	2303+00	2319+00	1,600
40	2319+00	2359+00	4,000
41	2359+00	2368+00	900

Table 2. Summary of FRWL Project Explorations

SBFCA Station	Reach	Exploration ID	Location	Exploration Type	Completed Depth (ft)	Figure Number	Northing	Easting	Task Order	Appendix for Log
11+08	1	SM0003_009C	Landside Toe	CPT	50	3	2089119.26	6670521.08	2	H
29+08	1	SM0003_001C	Landside Toe	CPT	85	3	2089995.14	6671959.65	1	C
58+38	1	SM0003_002C	Landside Toe	CPT	85	3	2090962.83	6674499.05	1	C
64+97	1	SM0003_001B	Landside Toe	Boring	32	4	2090754.33	6675123.51	2	F
74+25	1	SM0003_003C	Landside Toe	CPT	121	4	2090680.83	6675914.03	1	C
92+17	1	SM0003_015C	Landside Toe	CPT	46	4	2091789.19	6677322.09	2	H
106+30	1	SM0003_004C	Landside Toe	CPT	92	4	2092685.59	6678386.52	1	C
126+00	1	SM0003_002B	Levee Waterside	Boring	51	5	2094266.86	6679522.9	2	F
159+73	2	SM0003_016C	Landside Field	CPT	60	5	2097506.47	6679929.98	2	H
171+47	2	SM0003_017C	Landside Field	CPT	60	6	2098623.98	6679830.58	2	H
190+80	2	SM0003_006C	Landside Toe	CPT	85	6	2100244.04	6678869.29	1	C
198+47	2	SM0003_007C	Landside Toe	CPT	90	6	2100657.14	6678249.27	1	C
198+74	2	SM0003_010C	Landside Field	CPT	60	6	2100600.12	6678157.29	2	H
212+98	2	SM0003_003B	Landside Field	Boring	52	7	2102070.7	6678089.55	2	F
235+00	3	SM0003_011C	Levee Crest	CPT	108	7	2104096.35	6678680.7	2	H
239+44	3	SM0003_008C	Landside Toe	CPT	85	7	2104552.7	6678684.22	1	C
240+07	3	SM0003_012C	Landside Field	CPT	85	7	2104637.15	6678643.16	2	H
255+02	3	SM0003_013C	Landside Toe	CPT	80	7	2105984.51	6679259.37	2	H
275+00	3	SM0003_014C	Levee Crest	CPT	90	8	2107937.93	6679394.44	2	H
280+00	3	SL0001_015C	Landside Field	CPT	70	8	2108475.15	6679280.99	2	H
306+35	4	SL0001_001C	Landside Toe	CPT	90	8	2111059.31	6679469.72	1	C
311+99	4	SL0001_016C	Levee Crest	CPT	100	9	2111618.20	6679460.38	2	H
318+83	4	SL0001_003B	Levee Waterside	Boring	50	9	2112299.63	6679413.28	2	F
351+09	4	SL0001_004B	Landside Field	Boring	40	9	2115326.80	6678539.17	2	F
359+02	4	SL0001_002C	Landside Toe	CPT	120	9	2116124.08	6678408.95	1	C
401+00	4	SL0001_042C	Landside Toe	CPT	37	10	2120221.11	6677580.00	2	H
437+98	5	SL0001_005B	Levee Waterside	Boring	53	11	2123747.47	6676932.88	2	F
461+00	5	SL0001_017C	Landside Field	CPT	80	12	2125892.72	6676054.40	2	H
468+46	5	SL0001_003C	Landside Toe	CPT	85	12	2126774.22	6676056.13	1	C
480+67	6	SL0001_006B	Landside Field	Boring	30	12	2127646.16	6675901.92	2	F
538+93	7	SL0001_004C	Landside Toe	CPT	89	13	2132319.12	6672516.17	1	C
545+02	7	SL0001_007B	Levee Waterside	Boring	51	13	2132923.82	6672364.16	2	F
551+00	7	SL0001_018C	Levee Crest	CPT	112	13	2133406.80	6672008.67	2	H
561+00	7	SL0001_019C	Levee Crest	CPT	113	14	2134334.14	6671644.45	2	H
570+00	7	SL0001_020C	Levee Crest	CPT	116	14	2135222.44	6671586.99	2	H
574+91	7	SL0001_001S	Levee Crest	Boring	130	14	2135713.44	6671594.22	2	F
580+00	7	SL0001_021C	Levee Crest	CPT	120	14	2136220.58	6671553.37	2	H

Table 2. Summary of FRWL Project Explorations

SBFCA Station	Reach	Exploration ID	Location	Exploration Type	Completed Depth (ft)	Figure Number	Northing	Easting	Task Order	Appendix for Log
590+00	7	SL0001_022C	Levee Crest	CPT	79	14	2137191.31	6671714.19	2	H
595+45	7	SL0001_008B	Levee Waterside	Boring	50	14	2137695.34	6671921.18	2	F
600+90	8	SL0001_023C	Landside Field	CPT	82	14	2138280.58	6671973.16	2	H
614+00	8	SL0001_024C	Landside Field	CPT	80	15	2139463.51	6671844.87	2	H
626+37	8	SL0001_005C	Landside Toe	CPT	70	15	2140726.03	6671942.81	1	C
634+00	8	SL0001_025C	Levee Crest	CPT	111	15	2141466.64	6672045.65	2	H
636+00	8	SL0001_009B	Landside Toe	Boring	77	15	2141656.88	6671928.15	2	F
647+00	8	SL0001_026C	Landside Toe	CPT	90	15	2142771.47	6672009.58	2	H
655+95	9	SL0001_027C	Landside Field	CPT	42	15	2143625.41	6672013.77	2	H
661+05	9	SL0001_028C	Landside Toe	CPT	80	16	2144138.96	6672062.90	2	H
665+84	9	SL0001_011B	Landside Field	Boring	87	16	2144618.92	6671968.30	2	F
674+00	9	SL0001_007C	Landside Toe	CPT	60	16	2145436.3	6671981.76	1	C
681+01	9	SL0001_038C	Levee Crest	CPT	104	16	2146141.45	6672032.59	2	H
693+02	9	SL0001_029C	Landside Toe	CPT	77	16	2147336.90	6671912.53	2	H
711+00	10	SL0001_030C	Levee Crest	CPT	104	17	2149119.05	6672148.92	2	H
720+71	10	SL0001_010B	Landside Field	Boring	90	17	2150101.23	6672343.18	2	F
734+85	10	SL0001_001B	Landside Toe	Boring	86	17	2151351.94	6672938.57	1	A
762+40	10	SL0001_012B	Landside Toe	Boring	52	18	2154114.76	6673338.29	2	F
791+00	11	SL0001_031C	Levee Crest	CPT	103	18	2156744.38	6673882.89	2	H
802+02	11	SL0001_032C	Levee Waterside	CPT	45	18	2157777.44	6674260.49	2	H
802+55	11	SL0001_043C	Landside Field	CPT	42	18	2157898.17	6674054.10	2	H
809+03	11	SL0001_008C	Landside Toe	CPT	60	18	2158448.43	6674473.38	1	C
818+00	11	SL0001_033C	Levee Crest	CPT	109	19	2159255.88	6674837.91	2	H
818+13	11	SL0001_012A	Levee Crest	Boring	26	19	2159267.80	6674841.70	2	F
827+86	11	SL0001_009C	Landside Toe	CPT	80	19	2160230.83	6675030.41	1	C
867+20	13	SL0001_002B	Landside Toe	Boring	80	20	2163559.13	6673391.89	1	A
889+00	13	SL0001_034C	Landside Toe	CPT	45	20	2165707.69	6672999.45	2	H
899+00	13	SL0001_035C	Landside Toe	CPT	50	20	2166703.74	6673089.79	2	H
906+84	13	SL0001_010C	Landside Toe	CPT	60	20	2167494.52	6673212.26	1	C
922+96	13	SL0001_036C	Landside Toe	CPT	45	21	2168991.18	6673845.70	2	H
939+85	14	SL0001_011C	Landside Toe	CPT	52	21	2170522.45	6674490.36	1	C
998+12	16	SL0001_012C	Landside Toe	CPT	60	22	2175969.51	6673515.37	1	C
1007+00	16	SL0001_039C	Levee Crest	CPT	125	22	2176671.64	6673016.17	2	H
1026+40	16	SL0001_040C	Levee Crest	CPT	120	23	2178470.77	6672423.77	2	H
1026+45	16	SL0001_041C	Landside Toe	CPT	92	23	2178498.35	6672356.48	2	H
1083+08	17	SL0001_037C	Landside Toe	CPT	40	24	2183243.09	6669855.25	2	H
1125+00	17	SL0001_011A	Landside Toe	Boring	57	25	2187151.03	6668542.25	2	F

Table 2. Summary of FRWL Project Explorations

SBFCA Station	Reach	Exploration ID	Location	Exploration Type	Completed Depth (ft)	Figure Number	Northing	Easting	Task Order	Appendix for Log
1146+00	18	SL0009_004A	Levee Crest	Boring	37	25	2189246.98	6668812.82	2	F
1146+17	18	SL0009_005A	Levee Crest	Boring	26	25	2189263.93	6668814.55	2	F
1163+75	18	SL0009_001B	Landside Toe	Boring	82	26	2191019.37	6668926.03	1	A
1190+00	18	SL0009_005C	Landside Field	CPT	80	26	2193634.90	6668997.07	2	H
1195+85	18	SL0009_001C	Landside Toe	CPT	53	26	2194216.11	6669134.51	1	C
1215+00	19	SL0009_006C	Levee Crest	CPT	70	27	2196059.31	6668772.50	2	H
1224+00	19	SL0009_007C	Levee Crest	CPT	70	27	2196928.26	6668550.34	2	H
1244+00	19	SL0009_004B	Levee Crest	Boring	132	27	2198409.39	6667234.78	2	F
1244+15	19	SL0009_006A	Levee Crest	Boring	27	27	2198424.10	6667230.12	2	F
1265+84	19	SL0009_002B	Levee Crest	Boring	86	28	2200512.5	6666651.53	1	A
1329+01	20	SL0009_008C	Landside Toe	CPT	40	29	2206791.32	6666865.18	2	H
1348+34	20	SL0009_002C	Landside Toe	CPT	55	29	2208689.83	6666568.05	1	C
1392+82	21	SL0009_003C	Landside Toe	CPT	70	30	2212820.33	6665126.33	1	C
1399+83	21	SL0009_009C	Landside Field	CPT	80	30	2213425.84	6664754.11	2	H
1405+05	21	SL0009_010C	Landside Field	CPT	35	30	2213909.68	6664570.29	2	H
1413+13	21	SL0009_011C	Landside Field	CPT	50	31	2214620.62	6664218.72	2	H
1423+81	21	SL0009_003B	Landside Toe	Boring	45	31	2215755.75	6664276.1	1	A
1429+45	21	SL0009_004C	Landside Toe	CPT	50	31	2216316.76	6664327.52	1	C
1476+77	22	SM0016_001C	Landside Toe	CPT	40	32	2221019.61	6664501.39	1	C
1483+06	22	SM0016_004C	Landside Field	CPT	31	32	2221656.98	6664502.95	2	H
1492+00	22	SM0016_005C	Levee Crest	CPT	55	32	2222530.54	6664699.50	2	H
1535+00	23	SM0016_006C	Levee Crest	CPT	75	33	2226686.51	6665693.64	2	H
1541+83	23	SM0016_003C	Landside Toe	CPT	70	33	2227345	6665507.18	1	C
1573+00	23	SM0016_007C	Levee Crest	CPT	66	34	2230297.18	6666269.70	2	H
1594+01	23	SM0016_010C	Landside Toe	CPT	21	34	2232249.06	6665603.64	2	H
1604+00	23	SM0016_011C	Landside Field	CPT	22	34	2233059.87	6665175.15	2	H
1622+01	24	SM0016_008C	Levee Crest	CPT	32	35	2234216.20	6664080.28	2	H
1622+02	24	SM0016_009C	Canal West Embankment	CPT	49	35	2234177.54	6663987.22	2	H
1698+85	26	SM0007_005C	Landside Toe	CPT	33	36	2241600.44	6665290.76	1	C
1815+00	30	SM0007_011B	Levee Crest	Boring	82	39	2252596.63	6666275.49	2	F
1842+85	30	SM0007_001C	Landside Toe	CPT	30	39	2255008.65	6665412.79	1	C
1883+02	30	SM0007_018A	Landside Toe	Boring	76	40	2257857.49	6662737.09	2	F
1891+58	30	SM0007_007A	West Levee Crest	Boring	87	40	2258429.25	6662105.99	2	F
1891+71	30	SM0007_012A	West Levee Crest	Boring	21	40	2258439.34	6662097.26	2	F
1892+00	30	SM0007_001S	Levee Crest	Boring	90	40	2258558.14	6662179.66	2	F
1892+14	30	SM0007_020A	Levee Crest	Boring	21	40	2258567.59	6662169.45	2	F
1906+90	31	SM0007_004A	Levee Crest	Boring	32	40	2259739.02	6661302.58	1	A

Table 2. Summary of FRWL Project Explorations

SBFCA Station	Reach	Exploration ID	Location	Exploration Type	Completed Depth (ft)	Figure Number	Northing	Easting	Task Order	Appendix for Log
1906+92	31	SM0007_003A	Landside Toe	Boring	30	40	2259681.42	6661193.87	1	A
1912+00	31	SM0007_012B	Levee Crest	Boring	62	41	2260187.74	6661060.38	2	F
1912+14	31	SM0007_013A	Levee Crest	Boring	15	41	2260199.78	6661053.81	2	F
1922+91	31	SM0007_001B	Landside Toe	Boring	60	41	2261186.77	6660618.41	1	A
1933+00	31	SM0007_013B	Levee Crest	Boring	67	41	2262196.64	6660540.60	2	F
1961+47	32	SM0007_019A	Landside Field	Boring	66	42	2264923.78	6660822.49	2	F
1965+80	32	SM0007_002B	Landside Toe	Boring	50	42	2264827.8	6661259.21	1	A
1970+98	32	SM0007_014B	Landside Field	Boring	62	42	2264998.66	6661772.33	2	F
1980+99	32	SM0007_015B	Landside Field	Boring	62	42	2265059.69	6662771.91	2	F
1994+00	33	SM0007_007C	Landside Toe	CPT	20	42	2264939.10	6663979.54	2	H
1999+47	33	SM0007_008C	Landside Toe	CPT	26	42	2265408.37	6664225.90	2	H
2011+00	33	SM0007_006S	Landside Toe	Boring	75	43	2266416.19	6664810.10	2	F
2020+85	33	SM0007_009C	Landside Toe	CPT	24	43	2267132.39	6665519.74	2	H
2030+80	33	SM0007_007S	Landside Toe	Boring	80	43	2267884.80	6666123.80	2	F
2041+00	33	SM0007_008A	Landside Toe	Boring	79	43	2268802.67	6666572.35	2	F
2051+99	33	SM0007_010C	Landside Toe	CPT	23	43	2269764.97	6667132.27	2	H
2057+02	33	SM0007_001A	Landside Toe	Boring	72	43	2270163.04	6667439.65	2	F
2063+84	33	SM0007_002C	Landside Toe	CPT	23	44	2270206.84	6667070.17	1	C
2076+90	33	SM0007_005A	Levee Crest	Boring	35	44	2270837.07	6666181.3	1	A
2091+01	33	SM0007_031S	Landside Toe	Boring	62	44	2272223.79	6665874.72	2	F
2103+27	33	SM0007_009A	Landside Toe	Boring	69	44	2273449.57	6665858.03	2	F
2112+05	33	SM0007_026S	Landside Toe	Boring	75	45	2273432.61	6665160.54	2	F
2113+89	33	SM0007_003C	Landside Toe	CPT	26	45	2273462.94	6664974.87	1	C
2116+95	33	SM0007_011C	Landside Toe	CPT	21	45	2273412.51	6664670.55	2	H
2122+11	34	SM0007_012C	Landside Toe	CPT	22	45	2273530.39	6664128.45	4	H
2131+98	34	SM0007_008S	Landside Field	Boring	90	45	2274536.76	6664017.71	4	F
2141+03	34	SM0007_009S	Landside Toe	Boring	75	45	2275292.13	6664415.58	4	F
2149+85	34	SM0007_004C	Landside Toe	CPT	27	45	2275634.97	6664798.25	1	C
2151+01	34	SM0007_010S	Landside Toe	Boring	70	45	2275750.46	6664776.69	4	F
2161+04	34	SM0007_025S	Landside Toe	Boring	85	46	2276642.22	6665109.14	4	F
2170+97	34	SM0007_011A	Landside Toe	Boring	75	46	2277082.76	6665495.43	4	F
2181+97	34	SM0007_012S	Landside Toe	Boring	70	46	2277770.69	6665232.84	2	F
2201+66	35	SM0007_013S	Landside Toe	Boring	80	46	2279352.10	6664691.60	2	F
2211+82	35	SM0007_004B	Landside Toe	Boring	38	47	2279741.44	6663803.95	1	A
2223+02	35	SM0007_027S	Landside Toe	Boring	80	47	2280852.53	6663592.92	2	F
2229+49	36	SM0007_028S	Landside Toe	Boring	45	47	2281499.84	6663582.89	2	F
2238+73	36	SM0007_029S	Landside Field	Boring	45	47	2281469.29	6662724.12	2	F

Table 2. Summary of FRWL Project Explorations

SBFCA Station	Reach	Exploration ID	Location	Exploration Type	Completed Depth (ft)	Figure Number	Northing	Easting	Task Order	Appendix for Log
2248+15	36	SM0007_032S	Landside Field	Boring	65	47	2282212.47	6662362.75	2	F
2248+20	36	SM0007_033S	Landside Field	Boring	43	47	2282212.40	6662356.73	2	F
2250+76	36	SM0007_005B	Landside Toe	Boring	50	47	2282521.3	6662254.22	1	A
2255+00	36	SM0007_030S	Landside Field	Boring	50	47	2282743.43	6661866.02	2	F
2262+19	37	SM0007_014S	Landside Toe	Boring	85	48	2283532.76	6661700.32	2	F
2270+03	37	SM0007_011S	Landside Field	Boring	95	48	2284311.34	6661557.60	2	F
2276+76	37	SM0007_006B	Landside Toe	Boring	32	48	2284989.34	6661687.82	1	A
2276+76	37	SM0007_006A	Levee Crest	Boring	40	48	2284992.45	6661728.65	1	A
2286+75	37	SM0007_006C	Landside Toe	CPT	12	48	2285958.26	6661461.68	1	C
2291+02	38	SM0007_010A	Landside Toe	Boring	42	48	2286405.46	6661653.85	2	F
2293+00	38	SM0007_002S	Levee Crest	Boring	147	48	2286312.65	6661877.95	2	F
2293+14	38	SM0007_014A	Levee Crest	Boring	10	48	2286312.92	6661892.01	2	F
2296+50	38	SM0007_015S	Landside Field	Boring	65	48	2286519.25	6662224.30	2	F
2300+00	38	SM0007_003S	Levee Crest	Boring	100	48	2286326.25	6662577.79	2	F
2300+16	38	SM0007_015A	Levee Crest	Boring	25	48	2286326.57	6662594.24	2	F
2301+53	38	SM0007_016S	Landside Toe	Boring	60	48	2286433.89	6662728.83	2	F
2319+51	40	SM0007_017S	Landside Toe	Boring	55	49	2287924.56	6662730.24	2	F
2324+00	40	SM0007_004S	Landside Edge of Crest	Boring	60	49	2288373.34	6662723.29	2	F
2333+64	40	SM0007_018S	Landside Field	Boring	170	49	2289336.97	6662666.85	2	F
2336+57	40	SM0007_008B	Landside Toe	Boring	43	49	2289719.35	6662734.46	1	A
2343+43	40	SM0007_005S	Landside Field	Boring	50	49	2290258.79	6662837.40	2	F
2343+43	40	SM0007_017B	Landside Field	Boring	34	49	2290258.79	6662837.40	2	F
2350+96	40	SM0007_019S	Landside Field	Boring	45	49	2291041.65	6663029.07	2	F
2355+37	40	SM0007_009B	Levee Crest	Boring	5	49	2291392.02	6663225.51	1	A
2358+47	40	SM0007_020S	Levee Crest	Boring	95	49	2291726.54	6663128.03	2	F
2358+49	40	SM0007_021S	Landside Toe	Boring	57	49	2291701.37	6663222.65	2	F
2358+64	40	SM0007_016A	Levee Crest	Boring	21	49	2291716.17	6663226.85	2	F
2360+00	41	SM0007_022S	Levee Crest	Boring	55	49	2291841.47	6663277.86	2	F
2362+54	41	SM0007_007H	Landside Toe	Boring	8	50	2292112.84	6663264.91	2	F
2362+69	41	SM0007_010B	Levee Crest	Boring	40	50	2292098.15	6663358.84	1	A
2364+97	41	SM0007_008H	Landside Toe	Boring	10	50	2292340.70	6663349.11	2	F
2365+01	41	SM0007_023S	Levee Crest	Boring	120	50	2292317.52	6663433.06	2	F
2365+16	41	SM0007_017A	Levee Crest	Boring	22	50	2291856.82	6663283.53	2	F
2368+00	41	SM0007_024S	Levee Crest	Boring	93	50	2292603.74	6663518.54	2	F

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
19+88	1	WM0003_001S	Boring	3	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
28+43	1	WM0003_006C	CPT	3	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
38+54	1	WM0003_007C	CPT	3	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
46+15	1	CF-88-66	CPT	3	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
48+53	1	WM0003_008B	Boring	3	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
58+53	1	WM0003_009C	CPT	3	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
73+83	1	WM0003_002S	Boring	4	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
73+86	1	WM0003_002C	CPT	4	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
83+72	1	WM0003_010C	CPT	4	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
96+28	1	CF-88-67	CPT	4	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
96+75	1	WM0003_011C	CPT	4	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
97+57	1	B-1	Boring	4	K	25	Caltrans. *Feather River Bridge (Widen). Log of Test Borings*. September 27, 1996.
97+73	1	B-6	Boring	4	K	25	Caltrans. *Feather River Bridge (Widen). Log of Test Borings*. September 27, 1996.
97+94	1	B-17	Boring	4	K	25	Caltrans. *Bridge Across Feather River at Nicolaus. Log of Test Borings*. June 1956.
97+94	1	B-18	Boring	4	K	25	Caltrans. *Bridge Across Feather River at Nicolaus. Log of Test Borings*. June 1956.
106+95	1	WM0003_012B	Boring	4	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
113+76	1	WM0003_013C	CPT	5	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
120+13	1	WM0003_003S	Boring	5	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
122+71	1	5F-73-CD1	Boring	5	K	25	USACE. *Boring Logs and Tables*. 1957.
129+80	2	WM0003_001H	Boring	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
129+88	2	WM0003_003C	CPT	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
130+13	2	WM0003_014C	CPT	5	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
132+86	2	WM0003_002H	Boring	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
133+00	2	WM0003_008C	CPT	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
138+50	2	5F-73-CD2	Boring	5	K	25	USACE. *Boring Logs and Tables*. 1957.
139+71	2	WM0003_003H	Boring	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
139+72	2	WM0003_001B	Boring	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
139+85	2	WM0003_012C	CPT	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
140+90	2	WM0003_015C	CPT	5	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
145+91	2	CF-88-68	CPT	5	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
146+31	2	WM0003_025C	CPT	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
146+33	2	WM0003_004H	Boring	5	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
151+60	2	WM0003_016B	Boring	5	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
156+50	2	2F-91-1A	Boring	5	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
156+53	2	2F-91-1	Boring	5	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
157+01	2	5F-73-CD3	Boring	5	K	25	USACE. *Boring Logs and Tables*. 1957.
160+17	2	WM0003_017C	CPT	6	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
163+81	2	WM0003_032C	CPT	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
169+95	2	2F-91-2	Boring	6	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
170+04	2	WM0003_004S	Boring	6	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
170+18	2	2F-91-2A	Boring	6	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
172+59	2	5F-73-CD4	Boring	6	K	25	USACE. *Boring Logs and Tables*. 1957.
178+76	2	WM0003_033C	CPT	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
181+06	2	WM0003_034C	CPT	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
181+18	2	WM0003_003A	Boring	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
181+18	2	WM0003_018C	CPT	6	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
181+20	2	WM0003_035C	CPT	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
184+81	2	5F-73-CD5	Boring	6	K	25	USACE. *Boring Logs and Tables*. 1957.
184+83	2	2F-91-3A	Boring	6	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
185+06	2	2F-91-3	Boring	6	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
191+06	2	WM0003_006H	Boring	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
191+09	2	WM0003_019C	CPT	6	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
194+28	2	WM0003_004C	CPT	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
201+93	2	2F-88-18A	Boring	6	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
201+95	2	2F-88-18	Boring	6	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
201+96	2	CF-88-69	CPT	6	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
201+98	2	2F-88-18B	Boring	6	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
202+01	2	WM0003_020B	Boring	6	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
204+35	2	WM0003_028C	CPT	6	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
204+40	2	5F-73-CD6	Boring	6	K	25	USACE. *Boring Logs and Tables* . 1957.
211+13	2	WM0003_021C	CPT	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
211+16	2	WM0003_002A	Boring	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
217+23	2	2F-91-4	Boring	7	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
217+25	2	2F-91-4A	Boring	7	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
219+81	3	WM0003_005C	CPT	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
219+82	3	WM0003_005S	Boring	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
220+55	3	5F-73-CD7	Boring	7	K	25	USACE. *Boring Logs and Tables* . 1957.
220+74	3	WM0003_004B	Boring	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
220+74	3	WM0003_005B	Boring	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
220+74	3	WM0003_007A	Boring	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
230+04	3	2F-91-5A	Boring	7	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
230+08	3	2F-91-5	Boring	7	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
230+68	3	WM0003_029C	CPT	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
230+72	3	WM0003_022C	CPT	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
233+85	3	CF-88-70	CPT	7	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
236+56	3	5F-73-CD8	Boring	7	K	25	USACE. *Boring Logs and Tables* . 1957.
239+80	3	WM0003_022B	Boring	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
239+87	3	WM0003_016C	CPT	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
239+88	3	WM0003_005H	Boring	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
246+50	3	WM0003_027C	CPT	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
246+73	3	2F-91-6A	Boring	7	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
246+74	3	2F-91-6	Boring	7	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
249+99	3	WM0003_023C	CPT	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
258+02	3	5F-73-CD9	Boring	7	K	25	USACE. *Boring Logs and Tables*. 1957.
258+57	3	WM0003_019C	CPT	7	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
258+89	3	WM0003_002B	Boring	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
258+97	3	WM0003_026C	CPT	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
259+61	3	WM0003_031C	CPT	7	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
261+68	3	2F-91-7	Boring	8	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
261+73	3	2F-91-7A	Boring	8	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
265+16	3	WM0003_001A	Boring	8	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
265+16	3	WM0003_024C	CPT	8	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
265+19	3	WM0003_020C	CPT	8	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
265+31	3	WM0003_003B	Boring	8	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
265+35	3	WM0003_030C	CPT	8	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
267+36	3	5F-73-CD10	Boring	8	K	25	USACE. *Boring Logs and Tables*. 1957.
269+17	3	WM0003_006S	Boring	8	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
278+13	3	2F-91-8A	Boring	8	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
278+23	3	2F-91-8	Boring	8	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
280+56	3	WL0001_020B	Boring	8	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
284+86	3	CF-88-1	CPT	8	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
289+36	3	WL0001_021C	CPT	8	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
299+37	3	WL0001_022C	CPT	8	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
306+34	4	WL0001_023C	CPT	8	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
318+42	4	WL0001_002S	Boring	9	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
326+88	4	WL0001_024C	CPT	9	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
332+80	4	CF-88-2	CPT	9	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
335+55	4	WL0001_119C	CPT	9	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
338+22	4	WL0001_025C	CPT	9	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
338+27	4	WL0001_025B	Boring	9	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
338+46	4	WL0001_007B	Boring	9	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
338+54	4	WL0001_005C	CPT	9	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
348+23	4	WL0001_026C	CPT	9	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
348+24	4	WL0001_006A	Boring	9	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
358+23	4	WL0001_027C	CPT	9	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
368+01	4	WL0001_003S	Boring	10	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
378+21	4	WL0001_028C	CPT	10	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
385+86	4	CF-88-3	CPT	10	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
388+29	4	WL0001_029C	CPT	10	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
396+52	4	WL0001_030C	CPT	10	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
408+13	4	WL0001_031B	Boring	10	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
408+17	4	WL0001_031C	CPT	10	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
410+59	4	WL0001_007C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
410+66	4	WL0001_010C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
417+09	5	WL0001_004C	CPT	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
417+11	5	WL0001_004S	Boring	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
420+05	5	WL0001_009B	Boring	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
420+11	5	WL0001_012C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
425+05	5	WL0001_118C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
427+30	5	WL0001_032C	CPT	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
427+35	5	WL0001_008C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
427+38	5	WL0001_008B	Boring	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
438+82	5	WL0001_014C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
438+87	5	WL0001_033B	Boring	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
438+89	5	WL0001_033C	CPT	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
439+18	5	WL0001_109C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
439+96	5	2F-88-12	Boring	11	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
439+96	5	CF-88-4	CPT	11	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
439+99	5	2F-88-12A	Boring	11	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
446+85	5	WL0001_011C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
447+24	5	WL0001_034C	CPT	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
455+62	5	WL0001_016C	CPT	11	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
457+27	5	WL0001_035C	CPT	11	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
462+15	5	CPT6-07	CPT	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
462+16	5	B7-07	Boring	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
466+26	5	WL0001_017C	CPT	12	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
466+28	5	WL0001_005S	Boring	12	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
473+36	5	WL0001_020C	CPT	12	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
475+48	5	B5-07	Boring	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
476+91	5	WL0001_059C	CPT	12	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
477+83	5	CPT5-07	CPT	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
478+65	5	WL0001_036C	CPT	12	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
479+47	6	B-1	Boring	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
480+93	6	CPT-1	CPT	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
483+16	6	TP06-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
483+70	6	CPT4-07	CPT	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
484+50	6	B4-07	Boring	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
485+25	6	WL0001_037C	CPT	12	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
486+00	6	TP08-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
487+44	6	B-6	Boring	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
488+29	6	B-3	Boring	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
489+08	6	TP07-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
490+73	6	B3-07	Boring	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
492+89	6	CPT8-07	CPT	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
492+92	6	TP05-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
493+36	6	WL0001_038C	CPT	12	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
493+94	6	CPT-2	CPT	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
493+94	6	B-4	Boring	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
495+66	6	TP04-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
497+24	6	B1-07	Boring	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
497+37	6	TP03-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
500+43	6	TP01-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
501+89	6	CPT3-07	CPT	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
501+98	6	B-5	Boring	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
502+04	6	WL0001_039B	Boring	12	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
503+93	6	TP02-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
504+82	6	B-2	Boring	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
505+14	6	CF-88-5	CPT	12	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
506+14	6	B2-07	Boring	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
508+22	6	WL0001_040C	CPT	12	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
508+35	6	TP09-07	Test Pit	12	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
509+50	6	CPT-3	CPT	12	K	19	Blackburn Consulting Inc. *Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. October 20, 2006.
511+31	7	CPT2-07	CPT	13	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
513+90	7	CPT10-07	CPT	13	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
515+74	7	WL0001_006C	CPT	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
515+80	7	WL0001_006S	Boring	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
517+03	7	WL0001_006B	Boring	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
517+16	7	WL0001_107C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
520+42	7	CPT9-07	CPT	13	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
523+67	7	B6-07	Boring	13	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
525+68	7	WL0001_041B	Boring	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
525+68	7	WL0001_041C	CPT	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
525+80	7	WL0001_005A	Boring	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
526+09	7	2F-97-19	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
526+41	7	CPT1-07	CPT	13	K	26	Blackburn Consulting Inc. *Addendum No. 1 to Geotechnical Report for Star Bend Setback Levee. Levee District No. 1. Sutter County, California*. November 16, 2007.
527+92	7	CPT-97-21	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
528+40	7	CPT-97-15	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
528+67	7	2F-97-1	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
529+15	7	CPT-97-20	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
529+95	7	2F-97-18	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
532+35	7	WL0001_042C	CPT	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
532+39	7	WL0001_086B	Boring	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
532+40	7	WL0001_086C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
532+77	7	WL0001_087C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
533+66	7	2F-97-2	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
535+39	7	2F-97-17	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
538+39	7	CPT-97-2	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
538+43	7	2F-97-3	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
538+46	7	CPT-97-1	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
538+71	7	CPT-97-10	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
538+72	7	CPT-97-3	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
538+86	7	WL0001_088C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
538+92	7	WL0001_084C	CPT	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
538+94	7	WL0001_088B	Boring	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
538+96	7	CPT-97-4	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
539+29	7	WL0001_089B	Boring	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
539+30	7	WL0001_089C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
539+35	7	CPT-97-11	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
539+39	7	CPT-97-5	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
540+90	7	CPT-97-14	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
540+91	7	2F-97-11	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
541+15	7	CPT-97-13	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
541+40	7	CPT-97-12	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
541+42	7	WL0001_090C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
541+65	7	CPT-97-16	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
541+94	7	WL0001_007S	Boring	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
543+35	7	CPT-97-7	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
543+39	7	CPT-97-6	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
543+41	7	2F-97-4	Boring	13	K	12	USACE. *PL84-99 Phase III, Relief Wells - LD1 Feather River at Star Bend*. February 1997.
543+51	7	CPT-97-9	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
543+89	7	WL0001_091C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
545+12	7	WL0001_092C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
545+99	7	WL0001_043C	CPT	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
546+37	7	WL0001_093C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
547+37	7	WL0001_094C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
550+08	7	CPT-97-18	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
554+27	7	CPT-97-17	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
554+56	7	WL0001_095B	Boring	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
554+60	7	WL0001_095C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
556+04	7	CPT-97-8	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
556+07	7	CPT-97-19	CPT	13	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
556+09	7	WL0001_085B	Boring	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
556+13	7	WL0001_085C	CPT	13	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
556+39	7	WL0001_096C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
557+08	7	WL0001_097C	CPT	13	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
562+30	7	CF-88-6	CPT	14	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
564+89	7	WL0001_044C	CPT	14	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
565+36	7	WL0001_099C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
565+39	7	WL0001_098C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
569+65	7	WL0001_018C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
569+73	7	WL0001_113C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
569+75	7	WL0001_005B	Boring	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
574+71	7	WL0001_100B	Boring	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
574+81	7	WL0001_100C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
574+89	7	WL0001_101C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
574+90	7	WL0001_004A	Boring	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
574+91	7	WL0001_045C	CPT	14	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
579+58	7	WL0001_039C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
579+61	7	WL0001_114C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
583+24	7	WL0001_115C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
584+89	7	WL0001_046C	CPT	14	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
584+91	7	WL0001_046B	Boring	14	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
594+96	7	WL0001_047C	CPT	14	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
595+70	7	WL0001_064C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
595+80	7	WL0001_116C	CPT	14	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
601+20	8	CPT-97-22	CPT	14	K	11	USACE. *Letter to Sutter County Public Works*. January 31, 1997.
604+34	8	2F-91-9	Boring	14	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
604+37	8	2F-91-9A	Boring	14	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
605+91	8	CF-88-7	CPT	14	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
606+36	8	WL0001_008S	Boring	14	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
616+28	8	WL0001_048C	CPT	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
621+43	8	2F-91-10	Boring	15	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
621+51	8	2F-91-10A	Boring	15	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
621+90	8	WL0001_061C	CPT	15	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
622+49	8	WL0001_110C	CPT	15	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
626+31	8	WL0001_049C	CPT	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
626+36	8	WL0001_049B	Boring	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
632+62	8	WL0001_117C	CPT	15	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
632+66	8	WL0001_074C	CPT	15	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
636+35	8	WL0001_050C	CPT	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
641+67	8	2F-91-11A	Boring	15	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
641+71	8	2F-91-11	Boring	15	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
649+58	8	WL0001_051C	CPT	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
655+29	9	WL0001_009S	Boring	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
655+36	9	WL0001_009C	CPT	15	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
665+25	9	WL0001_052C	CPT	16	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
667+14	9	2F-91-12	Boring	16	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
667+18	9	2F-91-12A	Boring	16	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
674+25	9	WL0001_053C	CPT	16	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
674+30	9	WL0001_053B	Boring	16	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
677+15	9	2F-88-11	Boring	16	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
677+15	9	CF-88-8	CPT	16	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
688+85	9	2F-91-13	Boring	16	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
688+90	9	2F-91-13A	Boring	16	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California* . 1991.
689+50	9	WL0001_054C	CPT	16	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
697+14	9	WL0001_055C	CPT	16	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
705+95	9	WL0001_010S	Boring	16	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
706+31	9	WL0001_111C	CPT	16	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
706+48	9	WL0001_004B	Boring	16	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
706+53	10	WL0001_079C	CPT	16	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
707+91	10	2F-91-14A	Boring	16	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
708+04	10	2F-91-14	Boring	16	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
715+91	10	WL0001_056C	CPT	17	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
715+95	10	WL0001_122C	CPT	17	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
725+83	10	WL0001_057C	CPT	17	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
731+05	10	2F-91-15A	Boring	17	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
731+08	10	2F-91-15	Boring	17	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
732+31	10	CF-88-9	CPT	17	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
735+88	10	WL0001_058C	CPT	17	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
745+77	10	WL0001_059B	Boring	17	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
754+09	10	WL0001_104C	CPT	17	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
754+19	10	WL0001_011S	Boring	17	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
754+21	10	WL0001_112C	CPT	17	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
755+43	10	2F-91-16A	Boring	17	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
755+44	10	2F-91-16	Boring	17	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
764+31	10	WL0001_060C	CPT	18	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
772+45	10	2F-91-17A	Boring	18	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
772+46	10	2F-91-17	Boring	18	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
774+59	11	WL0001_061B	Boring	18	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
784+28	11	WL0001_062C	CPT	18	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
784+39	11	WL0001_120C	CPT	18	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.

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SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
784+43	11	WL0001_121C	CPT	18	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
786+01	11	CF-88-10	CPT	18	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
792+00	11	2F-91-18A	Boring	18	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
792+03	11	2F-91-18	Boring	18	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
797+68	11	WL0001_012S	Boring	18	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
808+87	11	2F-07-01	Boring	18	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
812+47	11	B-18	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
816+55	11	B-19	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
817+19	11	2F-91-19A	Boring	19	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
817+21	11	2F-91-19	Boring	19	K	10	USACE. *Marysville/Yuba City Levee Reconstruction Project. Phase 2 Feather River. Sutter and Yuba Counties, California*. 1991.
817+70	11	WL0001_063C	CPT	19	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
819+11	11	2F 65-2	Boring	19	K	4	USACE. *Figure 50-4-4004. Sacramento River and Tributaries, California Bank Protection Project. Bank Protection*. July 23, 1965.
820+11	11	B-20	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
820+59	11	2F 65-1	Boring	19	K	4	USACE. *Figure 50-4-4004. Sacramento River and Tributaries, California Bank Protection Project. Bank Protection*. July 23, 1965.
827+54	11	WL0001_064B	Boring	19	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
832+25	12	2F-98-6	Boring	19	K	14	Gregg In Situ Inc. *Presentation of Cone Penetration Test Data. Site Investigation. Shanghai Bend. Yuba City, California*. November 16, 1998.
833+38	12	CPT-12	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
834+83	12	CPT-11	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
835+41	12	CPT-4	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
836+17	12	U3	Boring	19	K	3	Brandley. *Foundation Report. Shanghai Bend Levee Cutoff. West Bank-Feather River. Sutter County, California*. April 21, 1959.
836+82	12	WC-98-B2	Boring	19	K	14	Gregg In Situ Inc. *Presentation of Cone Penetration Test Data. Site Investigation. Shanghai Bend. Yuba City, California*. November 16, 1998.
837+61	12	WL0001_065C	CPT	19	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
837+82	12	U5	Boring	19	K	3	Brandley. *Foundation Report. Shanghai Bend Levee Cutoff. West Bank-Feather River. Sutter County, California*. April 21, 1959.
838+74	12	B4	Boring	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
838+76	12	CPT-6	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
838+80	12	CPT-7	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
838+81	12	B-4	Boring	19	K	9	The Mark Group. *Geotechnical Investigation Report. Shanghai Bend Levee Evaluation. Yuba City, California. Levee District No. 1 of Sutter County*. November 9, 1989.
839+01	12	CPT-5	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
839+07	12	CPT-3	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
839+34	12	B-2	Boring	19	K	9	The Mark Group. *Geotechnical Investigation Report. Shanghai Bend Levee Evaluation. Yuba City, California. Levee District No. 1 of Sutter County*. November 9, 1989.
839+34	12	U2	Boring	19	K	3	Brandley. *Foundation Report. Shanghai Bend Levee Cutoff. West Bank-Feather River. Sutter County, California*. April 21, 1959.
839+81	12	WC-98-B3	Boring	19	K	14	Gregg In Situ Inc. *Presentation of Cone Penetration Test Data. Site Investigation. Shanghai Bend. Yuba City, California*. November 16, 1998.
841+35	12	CPT-1	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
841+86	12	WC-98-B1	Boring	19	K	14	Gregg In Situ Inc. *Presentation of Cone Penetration Test Data. Site Investigation. Shanghai Bend. Yuba City, California*. November 16, 1998.
842+68	12	CPT-2	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California*. January 14, 1999.
842+71	12	2F-88-10A	Boring	19	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
842+74	12	2F-88-10	Boring	19	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
842+78	12	CF-88-11	CPT	19	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
842+82	12	4F-88-1	Test Pit	19	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.

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SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
842+83	12	4F-88-2	Test Pit	19	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
842+83	12	4F-88-3	Test Pit	19	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
842+87	12	4F-88-5	Test Pit	19	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
842+87	12	4F-88-4	Test Pit	19	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
843+10	12	CPT-10	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California* . January 14, 1999.
843+30	12	WL0001_066C	CPT	19	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
843+44	12	U1	Boring	19	K	3	Brandley. *Foundation Report. Shanghai Bend Levee Cutoff. West Bank-Feather River. Sutter County, California* . April 21, 1959.
843+72	12	CPT-9	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California* . January 14, 1999.
843+77	12	CPT-8	CPT	19	K	15	URS Greiner Woodward Clyde. *PL 84-99 Cost Shared Sacramento Basin No. 18. Feather River, Shanghai Bend, Sutter County, California* . January 14, 1999.
844+28	12	B-1	Boring	19	K	9	The Mark Group. *Geotechnical Investigation Report. Shanghai Bend Levee Evaluation. Yuba City, California. Levee District No. 1 of Sutter County* . November 9, 1989.
844+70	12	2F-98-5	Boring	19	K	14	Gregg In Situ Inc. *Presentation of Cone Penetration Test Data. Site Investigation. Shanghai Bend. Yuba City, California* . November 16, 1998.
844+85	12	B-3	Boring	19	K	9	The Mark Group. *Geotechnical Investigation Report. Shanghai Bend Levee Evaluation. Yuba City, California. Levee District No. 1 of Sutter County* . November 9, 1989.
845+20	13	U4	Boring	19	K	3	Brandley. *Foundation Report. Shanghai Bend Levee Cutoff. West Bank-Feather River. Sutter County, California* . April 21, 1959.
845+78	13	CPT-38	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
846+12	13	CPT-37	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
846+38	13	B-34	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
846+46	13	B-35	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
846+79	13	B-38	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
847+17	13	CPT-36	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
848+25	13	CPT-35	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
848+90	13	B-36	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
849+56	13	CPT-34	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.
850+53	13	B-37	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works* . December 13, 2006.

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SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
850+57	13	B-21	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
850+64	13	B-13	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
850+81	13	B-12	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
850+84	13	CPT-33	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
851+18	13	WL0001_013C	CPT	19	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
851+20	13	WL0001_013S	Boring	19	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
851+36	13	B-14	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
852+09	13	CPT-32	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
852+14	13	B-53	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
853+06	13	CPT-31	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
853+16	13	B-17	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
854+05	13	B-15	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
854+20	13	CPT-30	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
854+78	13	B-39	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
854+79	13	B-54	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
855+17	13	B-33	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
855+19	13	CPT-29	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
856+18	13	B-22	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
856+31	13	CPT-28	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
856+37	13	B-52	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
856+67	13	B-16	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
856+87	13	B-57	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
857+07	13	B-55	Boring	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
857+20	13	CPT-27	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
858+23	13	CPT-26	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
859+23	13	CPT-25	CPT	19	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
860+18	13	CPT-24	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
860+27	13	B-23	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
861+10	13	WL0001_067C	CPT	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
861+17	13	WL0001_067B	Boring	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
861+17	13	CPT-23	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
861+29	13	WL0001_003A	Boring	20	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
862+08	13	CPT-22	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
863+11	13	CPT-21	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
863+53	13	B-32	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
863+59	13	B-11	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
863+83	13	B-51	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
864+01	13	B-40	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
864+02	13	CPT-20	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
865+10	13	CPT-19	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
865+28	13	B-24	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
866+08	13	CPT-18	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
867+23	13	CPT-17	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
868+39	13	CPT-16	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
869+53	13	CPT-15	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
869+64	13	B-25	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
870+60	13	CPT-14	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
871+25	13	WL0001_068C	CPT	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
871+74	13	B-26	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
871+74	13	CPT-13	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
871+83	13	B-10	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
872+30	13	B-31	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
872+62	13	CPT-12	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
872+70	13	B-50	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
872+77	13	B-41	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
872+85	13	B-43	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+14	13	B-44	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+14	13	B-45	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+14	13	B-46	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+14	13	B-47	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+14	13	B-48	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+58	13	CPT-11	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
873+84	13	B-27	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
874+33	13	CPT-10	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
875+18	13	CPT-9	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
875+94	13	B-28	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
875+94	13	B-9	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
875+99	13	CPT-8	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+01	13	B-8	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+15	13	TP-5	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+64	13	B-7	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+64	13	TP-20	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+64	13	TP-23	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+64	13	TP-4	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+64	13	TP-6	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+73	13	TP-9	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+93	13	TP-21	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
876+95	13	CPT-7	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+07	13	TP-24	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+13	13	TP-3	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+34	13	B-1	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+34	13	B-3	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+34	13	TP-13	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+34	13	TP-15	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+34	13	TP-19	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+34	13	TP-22	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+45	13	TP-7	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+55	13	TP-25	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+60	13	TP-2	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+77	13	B-5	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
877+98	13	CPT-6	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	B-2	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	B-29	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	B-56	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	TP-1	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	TP-10	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	TP-12	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	TP-17	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+04	13	TP-18	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
878+18	13	TP-8	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+50	13	TP-11	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+66	13	B-4	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+75	13	TP-14	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+82	13	CPT-5	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
878+85	13	TP-16	Test Pit	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
879+42	13	B-6	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
879+53	13	CF-88-12	CPT	20	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
879+90	13	CPT-4	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
879+98	13	B-42	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
880+15	13	B-30	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
880+50	13	B-49	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
880+85	13	CPT-3	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
881+23	13	WL0001_069C	CPT	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
881+36	13	CPT-1	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
881+65	13	CPT-2	CPT	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
882+00	13	Bulk-1	-	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
882+95	13	Bulk-2	-	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
883+04	13	B-2	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
883+13	13	B-1	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
884+85	13	B-2	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
886+21	13	B-1	Boring	20	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
886+92	13	WL0001_014S	Boring	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
897+00	13	WL0001_070C	CPT	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
907+10	13	WL0001_071C	CPT	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
907+12	13	WL0001_071B	Boring	20	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
916+07	13	CF-88-13	CPT	21	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
916+89	13	WL0001_072C	CPT	21	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
923+23	13	2F-98-1	Boring	21	K	27	USACE. *Sacramento River Flood Control Project Phase II, Levee Reconstruction, Contract 3*. June 1998.
928+82	14	WL0001_015C	CPT	21	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
928+85	14	WL0001_015S	Boring	21	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
940+02	14	2F-07-02	Boring	21	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
948+92	14	WL0001_073C	CPT	21	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
953+73	14	2F-98-2	Boring	21	K	27	USACE. *Sacramento River Flood Control Project Phase II, Levee Reconstruction, Contract 3*. June 1998.
954+92	15	WL0001_103C	CPT	21	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
958+80	15	WL0001_108C	CPT	21	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
958+89	15	WL0001_003B	Boring	21	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
959+03	15	WL0001_074B	Boring	21	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
959+07	15	WL0001_105C	CPT	21	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
963+01	15	4F-88-6	Test Pit	22	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
963+03	15	4F-88-7	Test Pit	22	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
963+04	15	2F-88-9	Boring	22	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
963+04	15	CF-88-14	CPT	22	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
963+05	15	4F-88-8	Test Pit	22	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
963+06	15	4F-88-9	Test Pit	22	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
963+08	15	4F-88-10	Test Pit	22	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
963+08	15	2F-88-9A	Boring	22	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
963+73	15	2F-98-3	Boring	22	K	27	USACE. *Sacramento River Flood Control Project Phase II, Levee Reconstruction, Contract 3*. June 1998.
968+84	16	WL0001_075C	CPT	22	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
978+16	16	WL0001_016S	Boring	22	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
982+56	16	WL0001_076C	CPT	22	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
988+25	16	WL0001_077C	CPT	22	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
997+24	16	2F-07-03	Boring	22	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1000+89	16	CF-88-15	CPT	22	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1004+47	16	B-1	Boring	22	K	20	Taber Consultants. *5th Street Bridge over Feather River. Log of Test Borings*. August 2007.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1004+95	16	W-4	Boring	22	K	2	Ben C. Gerwick Inc. *Sutter and Yuba Counties. 5th Street Bridge Soil Profile*. January 30, 1957.
1005+60	16	W-3	Boring	22	K	2	Ben C. Gerwick Inc. *Sutter and Yuba Counties. 5th Street Bridge Soil Profile*. January 30, 1957.
1006+47	16	W-2	Boring	22	K	2	Ben C. Gerwick Inc. *Sutter and Yuba Counties. 5th Street Bridge Soil Profile*. January 30, 1957.
1007+59	16	DE-CPT-01	CPT	22	K	24	Dokken Engineering. *5th Street Bridge over Feather River. Yuba City, California*. May 2011.
1007+71	16	WL0001_002A	Boring	22	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1007+95	16	CPT-1	CPT	22	K	20	Taber Consultants. *5th Street Bridge over Feather River. Log of Test Borings*. August 2007.
1008+13	16	WL0001_078C	CPT	22	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1008+28	16	P-1	Boring	22	K	2	Ben C. Gerwick Inc. *Sutter and Yuba Counties. 5th Street Bridge Soil Profile*. January 30, 1957.
1008+38	16	DH-7	Boring	22	K	6	Von Geldern Engineering Company. *Letter to The Mark Group*. October 3, 1988.
1015+47	16	2F-1C-1R	Boring	23	K	25	*USACE. Yuba River Levee Foundation Soil Drilling Logs*. 1957.
1015+56	16	DH-6	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1015+83	16	2F-1C-1L	Boring	23	K	25	*USACE. Yuba River Levee Foundation Soil Drilling Logs*. 1957.
1017+73	16	2F-98-4	Boring	23	K	27	USACE. *Sacramento River Flood Control Project Phase II, Levee Reconstruction, Contract 3*. June 1998.
1017+82	16	2F-1C-2R	Boring	23	K	25	*USACE. Yuba River Levee Foundation Soil Drilling Logs*. 1957.
1018+37	16	WL0001_079B	Boring	23	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1019+43	16	2F-99-1	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1020+37	16	2F-1C-3R	Boring	23	K	25	USACE. *Yuba River Levee Foundation Soil Drilling Logs*. 1957.
1020+50	16	2F-1C-2L	Boring	23	K	25	USACE. *Yuba River Levee Foundation Soil Drilling Logs*. 1957.
1023+43	16	2F-99-2	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1025+51	16	Test Hole No. 20	Boring	23	K	25	Caltrans. *Feather River at Marysville Profile and Test Holes*. November 1941.
1025+74	16	Test Hole No. 23	Boring	23	K	25	Caltrans. *Feather River at Marysville Profile and Test Holes*. November 1941.
1026+99	16	Test Hole No. 1	Boring	23	K	25	Caltrans. *Feather River at Marysville Profile and Test Holes*. November 1941.
1026+99	16	RC-11-002	Boring	23	K	23	Caltrans. *Emergency Scour Retrofit. Feather River Bridge Log of Test Borings*. April 26, 2011.
1027+62	16	RC-11-003	Boring	23	K	23	Caltrans. *Emergency Scour Retrofit. Feather River Bridge Log of Test Borings*. April 26, 2011.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1028+20	16	RC-11-001	Boring	23	K	23	Caltrans. *Emergency Scour Retrofit. Feather River Bridge Log of Test Borings*. April 26, 2011.
1028+45	16	WL0001_017S	Boring	23	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1029+80	16	2F-98-4	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1035+06	16	DH-5	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1038+37	16	WL0001_080C	CPT	23	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1041+80	16	CF-88-16	CPT	23	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1045+59	16	WL0001_001A	Boring	23	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1045+66	16	WL0001_081B	Boring	23	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1045+67	16	WL0001_081C	CPT	23	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1046+19	16	DH-4C	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1046+31	16	DH-4A	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1046+32	16	DH-4D	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1046+46	16	DH-4B	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1052+00	16	2F-98-3	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1052+28	16	2F-99-3	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1052+99	16	DH-3B	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1053+05	16	DH-3A	Boring	23	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1055+29	16	2F-99-4	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1055+93	16	DH-2.2	Boring	23	K	6	Von Geldern Engineering Company. *Letter to The Mark Group*. October 3, 1988.
1058+38	16	WL0001_082C	CPT	23	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1058+39	16	DH-2.3	Boring	23	K	6	Von Geldern Engineering Company. *Letter to The Mark Group*. October 3, 1988.
1058+43	16	2F-99-5	Boring	23	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1060+71	16	DH-2.11	Boring	24	K	6	Von Geldern Engineering Company. *Letter to The Mark Group*. October 3, 1988.
1061+23	16	2F-99-6	Boring	24	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1064+24	16	2F-99-7	Boring	24	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1066+79	16	DH-2	Boring	24	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1069+33	16	WL0001_018S	Boring	24	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1074+12	16	2F-98-2	Boring	24	K	16	USACE. *PL84-99 Cost Shared/Added Sites Sacramento Basin No. 18. LD1 Slurry Wall*. 1999.
1075+59	16	DH-1	Boring	24	K	5	Wahler Associates. *Levee Investigation. Levee District No. 1. Right Bank Feather River Adjacent to Gilsizer Slough. Yuba City, California*. May 1988.
1078+99	16	WL0001_083C	CPT	24	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1087+35	17	2F-88-8A	Boring	24	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
1087+35	17	2F-88-8	Boring	24	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1087+35	17	CF-88-17	CPT	24	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1088+86	17	WL0001_001C	CPT	24	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1093+51	17	B-11	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1096+48	17	B-10	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1096+50	17	B-9	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1097+86	17	2F-07-04	Boring	24	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1098+83	17	B-6	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1099+26	17	B-7	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1099+63	17	B-5	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1101+67	17	B-8	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1102+28	17	B-4	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1102+77	17	B-3	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1103+46	17	B-1	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1103+73	17	B-2	Boring	24	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1108+45	17	2F-07-05	Boring	24	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1108+59	17	WL0001_002B	Boring	24	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1108+59	17	WL0001_106C	CPT	24	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1108+66	17	WL0001_003C	CPT	24	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1108+71	17	WL0001_002C	CPT	24	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1117+12	17	2F-07-06	Boring	25	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1124+86	17	WL0001_001B	Boring	25	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1135+58	18	WL0009_001S	Boring	25	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1135+60	18	WL0009_007A	Boring	25	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1135+63	18	WL0009_005C	CPT	25	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1143+05	18	WL0009_003H	Boring	25	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1143+06	18	WL0009_004C	CPT	25	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1143+18	18	WL0009_008C	CPT	25	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1144+05	18	CF-88-18	CPT	25	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1151+35	18	WL0009_009B	Boring	25	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1159+47	18	WL0009_010C	CPT	25	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1161+71	18	WL0009_001A	Boring	26	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1161+79	18	WL0009_002H	Boring	26	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1161+79	18	WL0009_032C	CPT	26	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1169+37	18	WL0009_002S	Boring	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1169+37	18	WL0009_002C	CPT	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1178+68	18	WL0009_006C	CPT	26	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1179+48	18	WL0009_011C	CPT	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1180+45	18	2F-07-7	Boring	26	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1188+43	18	CF-88-19	CPT	26	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1189+52	18	WL0009_012B	Boring	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1199+50	18	WL0009_013S	Boring	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1199+53	18	WL0009_009C	CPT	26	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1199+54	18	WL0009_013C	CPT	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1209+43	18	WL0009_014B	Boring	26	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1219+59	19	WL0009_015C	CPT	27	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1219+61	19	WL0009_015S	Boring	27	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1219+73	19	WL0009_002A	Boring	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1219+73	19	WL0009_012C	CPT	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1225+07	19	2F-07-8	Boring	27	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1227+33	19	WL0009_019C	CPT	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1229+81	19	WL0009_016B	Boring	27	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1238+42	19	WL0009_016C	CPT	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1238+43	19	WL0009_003S	Boring	27	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1238+48	19	WL0009_009A	Boring	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1242+06	19	WL0009_008A	Boring	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1242+11	19	WL0009_014C	CPT	27	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1244+57	19	2F-88-7B	Boring	27	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
1244+60	19	2F-88-7	Boring	27	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1244+60	19	CF-88-20	CPT	27	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1244+61	19	2F-88-7A	Boring	27	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
1248+60	19	WL0009_017B	Boring	27	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1258+64	19	WL0009_018S	Boring	27	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1268+74	19	WL0009_019B	Boring	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1272+88	19	2F-07-9	Boring	28	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.
1281+21	19	WL0009_020C	CPT	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1281+26	19	WL0009_020S	Boring	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1289+46	19	WL0009_004S	Boring	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1290+82	19	CF-88-21	CPT	28	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1291+49	19	WL0009_001H	Boring	28	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1291+49	19	WL0009_022C	CPT	28	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1293+16	19	WL0009_005A	Boring	28	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1293+25	19	WL0009_026C	CPT	28	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1295+01	19	WL0009_004A	Boring	28	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1295+07	19	WL0009_010A	Boring	28	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1298+70	20	WL0009_021C	CPT	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1303+12	20	WL0009_022B	Boring	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1308+75	20	WL0009_023C	CPT	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1308+80	20	WL0009_023B	Boring	28	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1315+32	20	CPT-5	CPT	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1315+42	20	CPT-2	CPT	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1318+73	20	WL0009_024C	CPT	29	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1319+11	20	B-2	Boring	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1319+17	20	B-1	Boring	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1324+16	20	CPT-1	CPT	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1324+21	20	CPT-4	CPT	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1328+71	20	WL0009_005S	Boring	29	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1328+99	20	CPT-6	CPT	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1329+11	20	CPT-3	CPT	29	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1338+87	20	WL0009_025C	CPT	29	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1338+93	20	WL0009_003A	Boring	29	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1339+20	20	WL0009_030C	CPT	29	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1347+63	20	WL0009_026B	Boring	29	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1358+72	20	WL0009_027C	CPT	29	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1361+87	20	WL0009_018C	CPT	30	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1362+31	20	CPT-7	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1362+76	20	CPT-14	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1368+49	20	WL0009_006S	Boring	30	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1368+79	20	CPT-8	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1368+98	20	CPT-13	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1375+21	21	B-4	Boring	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1375+27	21	B-3	Boring	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1377+19	21	WL0009_006A	Boring	30	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1377+27	21	5F4E-3	Boring	30	K	25	USACE. *Boring Logs and Tables*. 1957.
1377+37	21	5F4E-2	Boring	30	K	25	USACE. *Boring Logs and Tables*. 1957.
1378+54	21	WL0009_028C	CPT	30	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1378+56	21	WL0009_004H	Boring	30	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1379+52	21	5F4E-1	Boring	30	K	25	USACE. *Boring Logs and Tables*. 1957.
1380+08	21	5F4E-4	Boring	30	K	25	USACE. *Boring Logs and Tables*. 1957.
1381+18	21	CPT-12	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1381+20	21	CPT-9	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1386+55	21	CPT-10	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1386+64	21	2F-07-10	Boring	30	K	18	USACE. *Sutter County Feasibility Study Drilling Logs*. November 2006.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1386+76	21	CPT-11	CPT	30	K	17	Kleinfelder. *Letter to Sutter County Public Works*. December 13, 2006.
1388+71	21	WL0009_029C	CPT	30	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1398+56	21	WL0009_030B	Boring	30	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1408+57	21	WL0009_031C	CPT	30	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1412+84	21	WL0009_032B	Boring	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1417+91	21	CF-88-22	CPT	31	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1418+66	21	WL0009_017C	CPT	31	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1418+69	21	WL0009_033C	CPT	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1418+71	21	WL0009_005H	Boring	31	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1428+78	21	WL0009_007S	Boring	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1428+78	21	WL0009_007C	CPT	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1432+71	21	WM0016_003C	CPT	31	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1438+66	22	WL0009_034C	CPT	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1448+58	22	WL0009_001C	CPT	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1453+06	22	WL0009_001B	Boring	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1457+73	22	2F-88-6A	Boring	31	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
1457+74	22	2F-88-6	Boring	31	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1457+74	22	CF-88-23	CPT	31	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1458+78	22	WL0009_003C	CPT	31	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1463+34	22	WM0016_004C	CPT	32	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1468+85	22	WM0016_001A	Boring	32	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1468+87	22	WM0016_008C	CPT	32	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1472+35	22	WM0016_011C	CPT	32	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1477+41	22	WM0016_009C	CPT	32	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1484+79	22	WM0016_001S	Boring	32	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1498+80	22	WM0016_010C	CPT	32	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1508+37	23	CF-88-42	CPT	32	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1508+51	23	WM0016_011B	Boring	32	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1517+18	23	WM0016_012C	CPT	33	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

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SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1528+75	23	WM0016_002S	Boring	33	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1528+75	23	WM0016_002C	CPT	33	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1541+12	23	WM0016_013C	CPT	33	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1548+69	23	WM0016_002B	Boring	33	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1548+83	23	WM0016_014B	Boring	33	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1558+91	23	WM0016_015C	CPT	33	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1564+64	23	CF-88-41	CPT	34	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1566+60	23	WM0016_016C	CPT	34	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1578+55	23	WM0016_003S	Boring	34	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1588+68	23	WM0016_017S	Boring	34	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1598+69	23	WM0016_018B	Boring	34	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1608+85	23	WM0016_019S	Boring	34	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1612+33	24	WM0016_006C	CPT	35	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1615+61	24	WM0016_020B	Boring	35	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1616+93	24	CF-88-40	CPT	35	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1628+73	25	WM0016_004S	Boring	35	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1638+72	25	WM0016_021B	Boring	35	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1645+84	25	WM0016_022S	Boring	35	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1658+64	25	WM0016_001B	Boring	35	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1668+72	25	WM0016_001C	CPT	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1668+98	25	CF-88-39	CPT	36	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1678+70	26	WM0007_001S	Boring	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1678+70	26	WM0007_001C	CPT	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1685+55	26	WM0007_017C	CPT	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1698+70	26	WM0007_018C	CPT	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1708+69	27	WM0007_019B	Boring	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1708+69	27	WM0007_019C	CPT	36	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1718+68	27	WM0007_020C	CPT	37	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1724+67	28	2F-88-5	Boring	37	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1724+67	28	CF-88-38	CPT	37	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
1727+72	28	WM0007_021C	CPT	37	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1732+21	28	WM0007_002S	Boring	37	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1738+62	28	WM0007_022C	CPT	37	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1748+64	28	WM0007_023C	CPT	37	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1761+05	28	WM0007_024B	Boring	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1768+25	28	WM0007_025C	CPT	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1776+40	29	CF-88-37	CPT	38	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
1777+62	29	WM0007_003S	Boring	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1788+01	29	WM0007_026B	Boring	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1792+88	29	WM0007_027S	Boring	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1797+98	29	WM0007_028B	Boring	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1808+01	29	WM0007_029S	Boring	38	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1818+15	30	2F-97-8	Boring	39	K	13	USACE. *Marysville/Yuba City Area, California. Sacramento River Flood Control Project Phase II, Levee Reconstruction Contract 3 (Sites 1, 2, 3, 8, 9, 10, 11 & 12)* . June 18, 1997.
1818+15	30	WM0007_030B	Boring	39	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1819+94	30	2F-88-4A	Boring	39	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
1819+94	30	2F-88-4	Boring	39	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
1819+94	30	CF-88-36	CPT	39	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California* . September 2, 1988.
1819+94	30	2F-88-4B	Boring	39	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California* . April 21, 1989.
1821+13	30	2F-97-9	Boring	39	K	13	USACE. *Marysville/Yuba City Area, California. Sacramento River Flood Control Project Phase II, Levee Reconstruction Contract 3 (Sites 1, 2, 3, 8, 9, 10, 11 & 12)* . June 18, 1997.
1824+31	30	2F-97-10	Boring	39	K	13	USACE. *Marysville/Yuba City Area, California. Sacramento River Flood Control Project Phase II, Levee Reconstruction Contract 3 (Sites 1, 2, 3, 8, 9, 10, 11 & 12)* . June 18, 1997.
1828+06	30	WM0007_004S	Boring	39	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1838+31	30	WM0007_031S	Boring	39	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1848+32	30	WM0007_032B	Boring	39	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.
1857+57	30	WM0007_033S	Boring	39	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area* . 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
1865+98	30	WM0007_034B	Boring	40	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1868+97	30	CF-88-35	CPT	40	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1877+75	30	WM0007_005S	Boring	40	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1888+00	30	WM0007_035S	Boring	40	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1897+37	30	WM0007_036B	Boring	40	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1897+45	30	WM0007_036S	Boring	40	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1907+37	31	WM0007_037S	Boring	40	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1916+88	31	CF-88-34	CPT	41	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1917+36	31	WM0007_038B	Boring	41	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1927+40	31	WM0007_006S	Boring	41	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1937+03	31	WM0007_003A	Boring	41	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1937+25	31	WM0007_039S	Boring	41	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1947+37	31	WM0007_040B	Boring	41	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1957+62	31	WM0007_041S	Boring	41	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1960+34	32	2F-88-3A	Boring	42	K	8	The Mark Group. *Geotechnical Stability Assessments of Levee Evaluations Sutter and Butte Counties, California*. April 21, 1989.
1960+36	32	2F-88-3	Boring	42	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1960+36	32	CF-88-33	CPT	42	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
1966+05	32	WM0007_042B	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1966+16	32	WM0007_042S	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1974+85	32	WM0007_007S	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1987+18	32	WM0007_043S	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1996+35	33	WM0007_004B	Boring	42	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
1996+90	33	WM0007_044B	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
1997+01	33	WM0007_044S	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2006+77	33	WM0007_045S	Boring	42	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2016+80	33	WM0007_005B	Boring	43	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2016+81	33	WM0007_046B	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2016+86	33	WM0007_046S	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
2019+98	33	CF-88-32	CPT	43	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2027+17	33	WM0007_008S	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2036+82	33	WM0007_047S	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2047+39	33	WM0007_048B	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2047+44	33	WM0007_048S	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2056+99	33	WM0007_049S	Boring	43	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2060+81	33	CF-88-31	CPT	44	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2066+82	33	WM0007_050B	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2066+94	33	WM0007_050S	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2076+95	33	WM0007_009S	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2077+00	33	WM0007_002C	CPT	44	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2086+93	33	WM0007_051S	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2096+90	33	WM0007_052B	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2096+99	33	WM0007_052S	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2106+56	33	WM0007_053S	Boring	44	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2106+60	33	CF-88-30	CPT	44	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2116+78	33	WM0007_054B	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2116+85	33	WM0007_054S	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2127+05	34	WM0007_010S	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2136+97	34	WM0007_055S	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2147+98	34	WM0007_056B	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2148+05	34	WM0007_056S	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2151+75	34	2F-88-2	Boring	45	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2151+75	34	CF-88-29	CPT	45	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2157+01	34	WM0007_057S	Boring	45	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2167+55	34	WM0007_058B	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2167+66	34	WM0007_058S	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2177+01	34	WM0007_011S	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2183+19	35	WM0007_001B	Boring	46	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
2186+10	35	WM0007_002A	Boring	46	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2186+11	35	WM0007_001A	Boring	46	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2187+00	35	WM0007_059S	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2196+46	35	WM0007_007B	Boring	46	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2197+04	35	WM0007_060B	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2197+16	35	WM0007_060S	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2203+96	35	CF-88-28	CPT	46	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2207+31	35	WM0007_061S	Boring	46	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2212+00	35	WM0007_062B	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2212+09	35	WM0007_062S	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2218+30	35	WM0007_063S	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2226+86	36	WM0007_012S	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2233+56	36	WM0007_064S	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2245+63	36	WM0007_065B	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2245+80	36	WM0007_065S	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2245+98	36	WM0007_003B	Boring	47	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2255+59	36	CF-88-27	CPT	47	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2258+11	36	WM0007_066S	Boring	47	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2266+61	37	WM0007_006B	Boring	48	K	22	URS. Supplemental Geotechnical Data Report (SGDR) Sutter Study Area. 2010.
2266+69	37	WM0007_067B	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2266+77	37	WM0007_067S	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2276+92	37	WM0007_013S	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2286+79	37	WM0007_068S	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2296+98	38	WM0007_069B	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2297+10	38	WM0007_069S	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2304+57	39	CF-88-26	CPT	48	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2306+89	39	WM0007_070S	Boring	48	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2316+72	39	WM0007_071B	Boring	49	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2316+83	39	WM0007_071S	Boring	49	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2326+86	40	WM0007_014S	Boring	49	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2336+67	40	WM0007_072S	Boring	49	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.

Table 3. Summary of Historical Explorations on FRWL

SBFCA Station	Reach	Exploration ID	Exploration Type	Figure Number	Appendix	Project Number	Source
2346+71	40	WM0007_073B	Boring	49	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2346+81	40	WM0007_073S	Boring	49	K	21	URS. *Phase 1 Geotechnical Data Report (P1GDR) Sutter Study Area*. 2008.
2355+64	40	CF-88-25	CPT	49	K	7	The Mark Group. *Geotechnical Report for Subsurface Explorations. Levee Evaluations Sutter and Butte. Counties. California*. September 2, 1988.
2358+91	40	SB-1	Boring	49	K	1	USACE. *Sacramento River, California, Flood Control Project. West Levee Feather River Sutter-Butte Canal Headgates General Plan and Profile*. May 30, 1947.
2359+03	41	AB-101	Boring	49	K	25	DWR. Thermalito Forebay and Afterbay. Exploration Locations and Surface Geology; Auger Bucket Locations; Soil Test Data and Summary Logs. August 9, 1965.
2359+51	41	AB-23	Boring	49	K	25	DWR. Thermalito Afterbay Drilling and Sampling Log. December 18, 1959.
2359+76	41	SB-2	Boring	49	K	1	USACE. *Sacramento River, California, Flood Control Project. West Levee Feather River Sutter-Butte Canal Headgates General Plan and Profile*. May 30, 1947.
2362+38	41	AB-96	Boring	50	K	25	DWR. Thermalito Forebay and Afterbay. Exploration Locations and Surface Geology; Auger Bucket Locations; Soil Test Data and Summary Logs. August 9, 1965.
2362+70	41	79-361	Boring	50	K	25	DWR. Drilling and Sampling Log. October 30, 1979.
2362+78	41	81A-C359SPT	Boring	50	K	25	DWR. Drill Hole Log. January 27, 1982.
2363+98	41	81A-C361SPT	Boring	50	K	25	DWR. Drill Hole Log. December 18, 1981.
2364+31	41	AB-92	Boring	50	K	25	DWR. Drill Hole Log. December 4, 1964.
2366+03	41	AB-97	Boring	50	K	25	DWR. Thermalito Forebay and Afterbay. Exploration Locations and Surface Geology; Auger Bucket Locations; Soil Test Data and Summary Logs. August 9, 1965.
2366+98	41	AB-60	Boring	50	K	25	DWR. Drilling and Sampling Log. March 20, 1964.
2370+50	41	81A-C366SPT	Boring	50	K	25	DWR. Drill Hole Log. December 18, 1981.

NOTES:

Caltrans	California Department of Transportation
CPT	Cone Penetration Test
DWR	California Department of Water Resources
SBFCA	Sutter Butte Flood Control Agency
USACE	United States Army Corp of Engineers

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
29+08	SM0003_001C	11.0-11.5			X								TO1	E
29+08	SM0003_001H	1.0-1.5	X	X									TO1	E
29+08	SM0003_001H	3.0-3.5			X								TO1	E
58+38	SM0003_002H	1.0-1.5	X	X									TO1	E
58+38	SM0003_002H	3.0-3.5			X		X						TO1	E
58+38	SM0003_002H	4.0-4.5	X	X									TO1	E
58+38	SM0003_002C	9.0-9.5					X						TO1	E
58+38	SM0003_002C	16.0-17.0			X		X						TO1	E
58+38	SM0003_002C	21.2-22.0			X		X						TO1	E
58+38	SM0003_002C	36.0-37.0			X								TO1	E
64+97	SM0003_001B	2.0-2.5	X	X	X	X	X						BCI	J
64+97	SM0003_001B	7.0-7.5	X	X	X		X						BCI	J
64+97	SM0003_001B	8.5-9.0	X		X		X						BCI	J
64+97	SM0003_001B	11.0-12.0	X		X		X						BCI	J
64+97	SM0003_001B	13.5-14.0			X		X						BCI	J
64+97	SM0003_001B	16.0-17.5	X		X		X		X				BCI	J
64+97	SM0003_001B	23.5-24.0	X		X		X						BCI	J
64+97	SM0003_001B	26.5-27.0	X	X	X						X		7	J
64+97	SM0003_001B	27.0-27.5			X								BCI	J
64+97	SM0003_001B	31.0-31.5			X								BCI	J
74+25	SM0003_003H	1.0-1.5	X	X									TO1	E
74+25	SM0003_003H	2.0-2.5			X								TO1	E
74+25	SM0003_003H	3.0-3.5			X		X						TO1	E
74+25	SM0003_003H	4.0-4.5	X	X									TO1	E
74+25	SM0003_003C	8.5-9.5			X		X						TO1	E
74+25	SM0003_003C	24.0-25.0			X		X						TO1	E
74+25	SM0003_003C	40.0-41.0			X		X						TO1	E
106+30	SM0003_004H	1.0-1.5	X	X									TO1	E
106+30	SM0003_004H	2.0-2.5			X								TO1	E
106+30	SM0003_004H	4.0-4.5	X	X									TO1	E
106+30	SM0003_004H	4.5-5.0			X		X						TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
106+30	SM0003_004C	17.0-18.0			X		X						TO1	E
106+30	SM0003_004C	24.0-25.0			X		X						TO1	E
106+30	SM0003_004C	43.5-44.0			X								TO1	E
126+00	SM0003_002B	2.0-2.5	X	X									BCI	J
126+00	SM0003_002B	6.5-7.0	X	X									BCI	J
126+00	SM0003_002B	8.5-9.0	X		X		X						BCI	J
126+00	SM0003_002B	11.0-11.5	X	X									BCI	J
126+00	SM0003_002B	13.0-13.5	X		X		X						BCI	J
126+00	SM0003_002B	15.0-15.5	X		X		X						BCI	J
126+00	SM0003_002B	19.5-20.0	X		X		X						BCI	J
126+00	SM0003_002B	24.0-24.5	X		X		X						BCI	J
126+00	SM0003_002B	32.5-33.0	X		X		X						BCI	J
126+00	SM0003_002B	42.5-43.0	X		X		X						BCI	J
126+00	SM0003_002B	49.0-49.5	X		X		X						BCI	J
212+98	SM0003_003B	14.4-14.9	X		X		X						7	J
212+98	SM0003_003B	25.5-26.0	X	X	X						X		7	J
212+98	SM0003_003B	36.5-37.0	X	X	X						X		7	J
212+98	SM0003_003B	2.0-2.5	X	X	X		X						BCI	J
212+98	SM0003_003B	3.5-4.0					X						BCI	J
212+98	SM0003_003B	5.5-7.0	X		X		X		X				BCI	J
212+98	SM0003_003B	11.5-12.0	X	X	X	X	X						BCI	J
212+98	SM0003_003B	16.0-16.5	X	X	X		X						BCI	J
212+98	SM0003_003B	20.5-22.0	X		X		X						BCI	J
212+98	SM0003_003B	25.5-27.0			X								BCI	J
212+98	SM0003_003B	31.0-31.5	X		X		X						BCI	J
212+98	SM0003_003B	36.0-36.5			X								BCI	J
212+98	SM0003_003B	41.0-41.5			X								BCI	J
212+98	SM0003_003B	51.0-51.5	X		X								BCI	J
239+44	SM0003_008H	1.0-1.5	X										TO1	E
239+44	SM0003_008H	2.0-3.0			X		X						TO1	E
239+44	SM0003_008H	4.0-4.5	X	X	X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
239+44	SM0003_008C	10.0-11.0			X		X						TO1	E
239+44	SM0003_008C	18.5-19.0			X								TO1	E
306+35	SL0001_001C	9.0-9.5			X		X						TO1	E
306+35	SL0001_001C	14.0-15.0			X		X						TO1	E
306+35	SL0001_001C	36.5-37.0			X								TO1	E
306+35	SL0001_001H	1.0-1.5	X	X									TO1	E
306+35	SL0001_001H	3.0-3.5			X		X						TO1	E
306+35	SL0001_001H	4.0-4.5	X	X									TO1	E
318+83	SL0001_003B	1.5-2.0	X	X	X								BCI	J
318+83	SL0001_003B	6.0-6.5	X	X	X								BCI	J
318+83	SL0001_003B	6.5-7.0	X	X	X								BCI	J
318+83	SL0001_003B	15.5-16.0	X	X	X		X						BCI	J
318+83	SL0001_003B	19.5-20.0	X		X		X						BCI	J
318+83	SL0001_003B	23.5-25.0	X		X		X		X				BCI	J
318+83	SL0001_003B	28.5-30.0	X		X		X						BCI	J
318+83	SL0001_003B	30.0-31.5					X						BCI	J
318+83	SL0001_003B	33.5-34.0	X		X		X						BCI	J
318+83	SL0001_003B	37.5-38.0	X	X	X								BCI	J
318+83	SL0001_003B	39.0-40.5					X						BCI	J
318+83	SL0001_003B	42.0-42.5	X		X		X						BCI	J
318+83	SL0001_003B	43.5-45.0					X						BCI	J
318+83	SL0001_003B	46.5-47.0	X		X		X						BCI	J
318+83	SL0001_003B	48.0-49.5			X								BCI	J
351+09	SL0001_004B	2.0-2.5	X	X	X		X						BCI	J
351+09	SL0001_004B	6.0-6.5	X	X	X		X						BCI	J
351+09	SL0001_004B	10.5-11.0	X		X		X						BCI	J
351+09	SL0001_004B	11.0-12.5			X								BCI	J
351+09	SL0001_004B	15.5-17.0			X								BCI	J
351+09	SL0001_004B	18.5-19.0	X		X		X						BCI	J
351+09	SL0001_004B	22.0-22.5			X								BCI	J
351+09	SL0001_004B	27.0-28.0	X		X	X	X						BCI	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
351+09	SL0001_004B	29.5-30.0	X		X		X						BCI	J
351+09	SL0001_004B	32.0-32.5	X	X	X		X						BCI	J
351+09	SL0001_004B	33.5-35.0	X		X		X						BCI	J
351+09	SL0001_004B	37.0-37.5	X		X		X						BCI	J
351+09	SL0001_004B	38.5-40.0	X		X								BCI	J
359+02	SL0001_002H	2.0-3.0			X								TO1	E
359+02	SL0001_002H	4.0-4.5	X	X									TO1	E
359+02	SL0001_002C	6.4-7.4			X		X						TO1	E
359+02	SL0001_002C	20.5-21.0			X		X						TO1	E
359+02	SL0001_002C	28.5-29.0			X		X						TO1	E
437+98	SL0001_005B	31.0-31.5	X	X	X						X		7	J
437+98	SL0001_005B	36.5-37.0	X	X	X						X		7	J
437+98	SL0001_005B	1.0-1.5	X	X									BCI	J
437+98	SL0001_005B	5.5-6.0	X	X									BCI	J
437+98	SL0001_005B	7.0-8.5	X		X								BCI	J
437+98	SL0001_005B	10.5-11.0	X	X									BCI	J
437+98	SL0001_005B	15.5-17.0	X		X		X		X				BCI	J
437+98	SL0001_005B	20.5-21.0	X		X		X						BCI	J
437+98	SL0001_005B	22.0-23.5	X		X		X						BCI	J
437+98	SL0001_005B	27.0-28.5	X		X		X						BCI	J
437+98	SL0001_005B	32.0-33.5					X						BCI	J
437+98	SL0001_005B	35.5-37.0			X								BCI	J
437+98	SL0001_005B	40.5-42.0	X		X		X						BCI	J
437+98	SL0001_005B	45.0-45.5	X	X	X		X						BCI	J
437+98	SL0001_005B	50.0-50.5	X		X		X						BCI	J
437+98	SL0001_005B	51.0-52.5	X		X		X						BCI	J
468+46	SL0001_003H	1.0-1.5	X	X									TO1	E
468+46	SL0001_003H	3.0-4.0			X		X						TO1	E
468+46	SL0001_003C	10.5-11.0			X		X						TO1	E
468+46	SL0001_003C	13.5-14.0			X		X						TO1	E
468+46	SL0001_003C	20.0-20.5					X						TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
468+46	SL0001_003C	20.5-21.0			X								TO1	E
468+46	SL0001_003C	35.5-36.0			X								TO1	E
480+67	SL0001_006B	1.0-1.5	X	X	X		X						BCI	J
480+67	SL0001_006B	6.0-7.5	X	X	X		X						BCI	J
480+67	SL0001_006B	8.5-9.0	X		X		X						BCI	J
480+67	SL0001_006B	11.0-12.0	X		X								BCI	J
480+67	SL0001_006B	12.0-12.5	X		X								BCI	J
480+67	SL0001_006B	13.0-13.5					X						BCI	J
480+67	SL0001_006B	15.5-16.0	X		X								BCI	J
480+67	SL0001_006B	17.0-17.5					X						BCI	J
480+67	SL0001_006B	21.5-22.0	X		X								BCI	J
480+67	SL0001_006B	26.5-27.0			X								BCI	J
538+93	SL0001_004C	8.0-9.0			X		X						TO1	E
538+93	SL0001_004C	17.5-18.0			X		X						TO1	E
538+93	SL0001_004C	41.0-42.0			X		X						TO1	E
538+93	SL0001_004H	3.0-3.5			X		X						TO1	E
538+93	SL0001_004H	4.0-4.5	X	X									TO1	E
545+02	SL0001_007B	37.5-38.0	X	X	X						X		7	J
545+02	SL0001_007B	42.0-42.5	X	X	X						X		7	J
545+02	SL0001_007B	1.0-1.5	X	X	X		X						BCI	J
545+02	SL0001_007B	3.0-3.5	X		X								BCI	J
545+02	SL0001_007B	6.0-6.5	X	X									BCI	J
545+02	SL0001_007B	7.5-8.0					X						BCI	J
545+02	SL0001_007B	10.5-11.0	X	X									BCI	J
545+02	SL0001_007B	14.5-15.0	X	X	X		X						BCI	J
545+02	SL0001_007B	18.5-20.0	X		X		X		X				BCI	J
545+02	SL0001_007B	23.5-24.0	X	X	X		X						BCI	J
545+02	SL0001_007B	27.5-28.0	X		X		X						BCI	J
545+02	SL0001_007B	32.0-32.5	X		X		X						BCI	J
545+02	SL0001_007B	37.0-37.5	X		X								BCI	J
545+02	SL0001_007B	41.5-42.0	X	X	X								BCI	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
545+02	SL0001_007B	48.5-49.0	X		X								BCI	J
574+91	SL0001_001S	115.0-116.0					X						9	J
595+45	SL0001_008B	2.0-2.5	X		X								BCI	J
595+45	SL0001_008B	6.0-6.5	X	X									BCI	J
595+45	SL0001_008B	10.5-11.0	X	X									BCI	J
595+45	SL0001_008B	15.0-15.5	X	X									BCI	J
595+45	SL0001_008B	19.5-20.5	X		X		X						BCI	J
595+45	SL0001_008B	23.5-25.0	X		X		X		X				BCI	J
595+45	SL0001_008B	28.5-29.0	X		X		X						BCI	J
595+45	SL0001_008B	33.0-33.5	X		X								BCI	J
595+45	SL0001_008B	37.5-38.0	X		X		X						BCI	J
595+45	SL0001_008B	42.0-42.5	X		X								BCI	J
600+90	SL0001_023C	0.0-2.0	X		X		X						3	J
600+90	SL0001_023C	4.0-4.5	X		X								3	J
600+90	SL0001_023C	4.5-5.0	X		X								3	J
600+90	SL0001_023C	6.5-7.5	X		X								3	J
600+90	SL0001_023C	9.0-10.0	X		X								3	J
614+00	SL0001_024C	30.0-30.5	X										3	J
626+37	SL0001_005C	26.0-27.0	X				X						TO1	E
626+37	SL0001_005C	40.0-41.0			X								TO1	E
626+37	SL0001_005H	4.0-5.0			X								TO1	E
636+00	SL0001_009B	5.0-7.0	X	X	X		X	X		X			2	J
636+00	SL0001_009B	21.0-21.5			X								2	J
636+00	SL0001_009B	27.5-29.5	X	X			X						2	J
636+00	SL0001_009B	31.0-31.5			X								2	J
636+00	SL0001_009B	40.0-41.5			X								2	J
665+84	SL0001_011B	3.0-4.0	X		X		X						5	J
665+84	SL0001_011B	11.0-12.0	X		X		X						5	J
665+84	SL0001_011B	20.0-21.5			X								5	J
665+84	SL0001_011B	35.0-36.5			X	X							5	J
674+00	SL0001_007C	34.0-35.0			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
674+00	SL0001_007C	44.0-45.0	X				X						TO1	E
674+00	SL0001_007H	4.0-5.0			X								TO1	E
693+02	SL0001_029C	4.0-4.5			X								4	J
693+02	SL0001_029C	24.0-25.0	X		X		X						4	J
720+71	SL0001_010B	5.5-6.0	X	X			X						4	J
720+71	SL0001_010B	15.5-16.0			X								4	J
720+71	SL0001_010B	32.5-34.0			X								4	J
720+71	SL0001_010B	63.0-63.5	X	X			X						4	J
734+85	SL0001_001B	3.5-4.0	X	X			X						TO1	E
734+85	SL0001_001B	8.0-8.5	X	X			X						TO1	E
734+85	SL0001_001B	10.0-11.5	X				X						TO1	E
734+85	SL0001_001B	14.0-15.5			X								TO1	E
734+85	SL0001_001B	26.5-28.0			X								TO1	E
734+85	SL0001_001B	44.0-45.5			X								TO1	E
734+85	SL0001_001B	67.0-68.5			X								TO1	E
762+40	SL0001_012B	3.0-3.5	X				X						5	J
762+40	SL0001_012B	7.0-7.5	X		X		X						5	J
762+40	SL0001_012B	22.0-23.5			X	X							5	J
762+40	SL0001_012B	35.0-36.5	X		X		X						5	J
791+00	SL0001_031C	27-28			X		X						1	J
809+03	SL0001_008H	1.0-2.0			X								TO1	E
809+03	SL0001_008H	4.0-5.0	X				X						TO1	E
809+03	SL0001_008C	12.0-13.0			X								TO1	E
809+03	SL0001_008C	22.0-23.0			X								TO1	E
818+13	SL0001_012A	6.0-12.0	X	X	X		X		X			X	6	J
818+13	SL0001_012A	19.0-21.0	X	X	X		X		X				6	J
818+13	SL0001_012A	24.0-26.0	X	X			X	X	X				6	J
827+86	SL0001_009H	4.0-5.0			X								TO1	E
827+86	SL0001_009C	10.0-11.0			X								TO1	E
827+86	SL0001_009C	26.0-27.0	X				X						TO1	E
827+86	SL0001_009C	44.0-45.0			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
867+20	SL0001_002B	2.5-4.0			X								TO1	E
867+20	SL0001_002B	15.0-16.5			X								TO1	E
867+20	SL0001_002B	32.5-34.0			X								TO1	E
867+20	SL0001_002B	40.0-41.5			X								TO1	E
867+20	SL0001_002B	68.0-68.5	X				X						TO1	E
867+20	SL0001_002B	73.0-74.5			X								TO1	E
889+00	SL0001_034C	4.0-4.5			X								3	J
889+00	SL0001_034C	24.0-25.0	X		X		X						3	J
899+00	SL0001_035C	8.0-8.5			X								3	J
906+84	SL0001_010H	4.0-5.0			X								TO1	E
906+84	SL0001_010C	21.0-22.0			X								TO1	E
939+85	SL0001_011H	4.0-5.0			X								TO1	E
939+85	SL0001_011C	20.0-21.0			X								TO1	E
939+85	SL0001_011C	24.0-25.0			X								TO1	E
998+12	SL0001_012H	4.0-5.0			X								TO1	E
998+12	SL0001_012C	14.0-15.0			X								TO1	E
998+12	SL0001_012C	40.0-41.0			X								TO1	E
1026+40	SL0001_040C	8.0-9.0			X		X						5	J
1026+40	SL0001_040C	12.0-13.0			X		X						5	J
1083+08	SL0001_037C	30.0-31.0	X										3	J
1125+00	SL0001_011A	6.0-6.5	X	X			X						2	J
1125+00	SL0001_011A	8.5-9.0			X								2	J
1125+00	SL0001_011A	18.5-19.0	X	X			X						2	J
1125+00	SL0001_011A	25.0-26.5			X								2	J
1125+00	SL0001_011A	31.0-31.5	X	X			X						2	J
1125+00	SL0001_011A	38.5-39.0			X								2	J
1146+00	SL0009_004A	5.5-6.0	X	X	X		X						2	J
1146+00	SL0009_004A	30.0-31.5	X		X								2	J
1146+17	SL0009_005A	0.0-5.0	X		X		X		X			X	6	J
1146+17	SL0009_005A	20.0-22.0	X		X		X	X	X				6	J
1146+17	SL0009_005A	5-10	X	X	X		X		X			X	8	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
1163+75	SL0009_001B	3.5-4.0	X	X			X						TO1	E
1163+75	SL0009_001B	6.0-6.5			X								TO1	E
1163+75	SL0009_001B	8.5-9.0			X								TO1	E
1163+75	SL0009_001B	13.5-14.0			X								TO1	E
1163+75	SL0009_001B	14.0-15.5			X								TO1	E
1163+75	SL0009_001B	28.0-29.0			X								TO1	E
1163+75	SL0009_001B	33.5-34.0	X				X						TO1	E
1163+75	SL0009_001B	38.5-39.0			X								TO1	E
1163+75	SL0009_001B	45.0-46.5			X								TO1	E
1163+75	SL0009_001B	55.0-56.5			X								TO1	E
1163+75	SL0009_001B	66.0-66.5	X				X						TO1	E
1190+00	SL0009_005C	4.0-4.5	X		X		X						4	J
1195+85	SL0009_001H	4.0-5.0			X								TO1	E
1195+85	SL0009_001H	5.0-6.0			X								TO1	E
1195+85	SL0009_001C	9.0-10.0			X								TO1	E
1195+85	SL0009_001C	36.0-37.0	X				X						TO1	E
1215+00	SL0009_006C	35-36			X		X						1	J
1215+00	SL0009_006C	39-40			X								1	J
1244+00	SL0009_004B	125-126.5	X		X		X						7	J
1244+00	SL0009_004B	8.5-9.0	X	X									2	J
1244+00	SL0009_004B	16.0-16.5	X	X									2	J
1244+00	SL0009_004B	18.5-19.0	X	X			X						2	J
1244+00	SL0009_004B	21.0-21.5	X	X									2	J
1244+00	SL0009_004B	23.0-23.5	X	X									2	J
1244+00	SL0009_004B	120.0-121.5			X								2	J
1244+00	SL0009_004B	130.0-131.5	X	X									2	J
1244+15	SL0009_006A	12.0-14.0	X				X	X					6	J
1244+15	SL0009_006A	15.0-17.0	X				X		X				6	J
1265+84	SL0009_002B	3.0-3.5	X	X			X						TO1	E
1265+84	SL0009_002B	8.0-8.5	X	X			X						TO1	E
1265+84	SL0009_002B	30.0-30.5			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
1265+84	SL0009_002B	40.0-41.0			X								TO1	E
1265+84	SL0009_002B	61.0-61.5			X								TO1	E
1265+84	SL0009_002B	78.5-79.0	X				X						TO1	E
1348+34	SL0009_002C	10.0-11.0			X								TO1	E
1348+34	SL0009_002C	19.0-20.0	X				X						TO1	E
1348+34	SL0009_002C	34.0-35.0			X								TO1	E
1348+34	SL0009_002H	4.0-5.0			X								TO1	E
1392+82	SL0009_003H	4.0-5.0	X				X						TO1	E
1392+82	SL0009_003C	15.0-16.0	X				X						TO1	E
1392+82	SL0009_003C	36.0-37.0			X								TO1	E
1399+83	SL0009_009C	2.0-2.5			X	X							3	J
1399+83	SL0009_009C	4.0-4.5			X	X							3	J
1399+83	SL0009_009C	20.0-21.0			X								3	J
1423+81	SL0009_003B	3.0-3.5	X	X	X	X							TO1	E
1423+81	SL0009_003B	24.5-25.0	X	X			X						TO1	E
1429+45	SL0009_004H	4.0-5.0			X								TO1	E
1429+45	SL0009_004C	14.0-15.0			X								TO1	E
1429+45	SL0009_004C	39.0-40.0			X								TO1	E
1476+77	SM0016_001H	4.0-5.0			X								TO1	E
1476+77	SM0016_001C	11.0-12.0			X								TO1	E
1476+77	SM0016_001C	20.0-21.0	X				X						TO1	E
1483+06	SM0016_004C	20.0-24.0	X				X						3	J
1492+00	SM0016_005C	30-31			X		X						1	J
1535+00	SM0016_006C	33-34			X		X						1	J
1541+83	SM0016_003C	16.0-17.0			X								TO1	E
1541+83	SM0016_003C	36.0-37.0	X				X						TO1	E
1541+83	SM0016_003H	4.0-5.0			X								TO1	E
1573+00	SM0016_007C	8.5-9.5					X						1	J
1573+00	SM0016_007C	30-31			X		X						1	J
1622+01	SM0016_008C	19.0-19.5	X		X								4	J
1698+85	SM0007_005H	0.0-5.0			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
1698+85	SM0007_005C	6.0-7.0			X								TO1	E
1698+85	SM0007_005C	8.0-9.0			X								TO1	E
1698+85	SM0007_005C	13.0-14.0			X								TO1	E
1698+85	SM0007_005C	19.5-20.5	X				X						TO1	E
1815+00	SM0007_011B	5.0-6.5			X								2	J
1815+00	SM0007_011B	17.5-19.0	X		X		X						2	J
1815+00	SM0007_011B	23.5-24.0			X								2	J
1815+00	SM0007_011B	20-21.5	X		X		X						7	J
1842+85	SM0007_001C	7.0-8.0			X								TO1	E
1842+85	SM0007_001C	13.0-14.0			X								TO1	E
1842+85	SM0007_001H	0.0-5.0			X								TO1	E
1883+02	SM0007_018A	3-3.5			X								7	J
1883+02	SM0007_018A	5.5-6	X		X		X						7	J
1883+02	SM0007_018A	20-21.5			X								7	J
1883+02	SM0007_018A	25-26.5			X								7	J
1883+02	SM0007_018A	40-42			X	X							7	J
1883+02	SM0007_018A	60.5-61	X		X		X						7	J
1891+58	SM0007_007A	5.5-6.0	X	X	X		X						4	J
1891+58	SM0007_007A	8.0-8.5			X	X							4	J
1891+58	SM0007_007A	13.0-13.5	X	X									4	J
1891+58	SM0007_007A	13.5-14.0	X	X									4	J
1891+58	SM0007_007A	20.0-21.5			X	X							4	J
1891+58	SM0007_007A	22.5-24.0			X	X							4	J
1891+58	SM0007_007A	37.5-39.0			X								4	J
1891+58	SM0007_007A	75-76.5	X		X		X						7	J
1891+71	SM0007_012A	5.0-10.0	X	X	X		X		X			X	6	J
1891+71	SM0007_012A	14.0-16.0	X	X	X		X	X					6	J
1891+71	SM0007_012A	19.0-21.0	X		X		X						6	J
1892+00	SM0007_001S	6.0-7.0	X		X		X						4	J
1892+00	SM0007_001S	10.0-11.0			X	X							4	J
1892+00	SM0007_001S	12.0-13.0	X		X		X						7	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
1892+00	SM0007_001S	18.0-19.0	X				X						4	J
1892+00	SM0007_001S	22.0-23.0			X	X							4	J
1892+00	SM0007_001S	70.0-71.0	X				X						4	J
1892+14	SM0007_020A	5.0-10.0	X	X	X		X		X			X	6	J
1892+14	SM0007_020A	19.0-21.0	X	X	X		X	X	X				6	J
1892+14	SM0007_020A	14.5-15.0	X	X							X		7	J
1906+90	SM0007_004A	5.5-6.0	X	X			X						TO1	E
1906+90	SM0007_004A	13.0-13.5	X	X			X						TO1	E
1906+90	SM0007_004A	20.0-21.5			X								TO1	E
1906+90	SM0007_004A	27.5-29.0			X								TO1	E
1906+92	SM0007_003A	4.6-5.7	X	X			X	X	X				TO1	E
1906+92	SM0007_003A	13.0-13.5	X	X			X						TO1	E
1906+92	SM0007_003A	18.5-20.0			X	X							TO1	E
1906+92	SM0007_003A	21.5-22.0			X								TO1	E
1906+92	SM0007_003A	26.5-27.0			X								TO1	E
1912+00	SM0007_012B	6.0-6.5	X	X			X						2	J
1912+00	SM0007_012B	18.5-19.0			X								2	J
1912+00	SM0007_012B	20.0-21.5			X								2	J
1912+00	SM0007_012B	30.0-31.5			X								2	J
1912+00	SM0007_012B	40.0-41.5			X								2	J
1912+00	SM0007_012B	61-61.5	X		X		X						7	J
1912+14	SM0007_013A	1.0-5.0	X	X			X		X			X	6	J
1912+14	SM0007_013A	13.0-15.0	X	X	X		X	X		X			6	J
1922+91	SM0007_001B	8.0-9.5	X	X			X						TO1	E
1922+91	SM0007_001B	10.25-10.5	X	X			X	X					TO1	E
1922+91	SM0007_001B	16.0-18.0	X	X			X		X				TO1	E
1922+91	SM0007_001B	17.2-17.3	X	X				X					TO1	E
1922+91	SM0007_001B	19.0-19.5	X	X			X						TO1	E
1922+91	SM0007_001B	23.5-25.0			X	X							TO1	E
1922+91	SM0007_001B	26.5-26.7	X	X			X	X					TO1	E
1922+91	SM0007_001B	31.0-32.5			X	X							TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
1922+91	SM0007_001B	38.5-40.0			X								TO1	E
1922+91	SM0007_001B	41.0-42.5			X								TO1	E
1922+91	SM0007_001B	46.5-47.0	X				X						TO1	E
1933+00	SM0007_013B	30-31.5	X		X		X						7	J
1933+00	SM0007_013B	5.0-7.0	X	X	X		X		X				2	J
1933+00	SM0007_013B	11.0-11.5	X	X									2	J
1933+00	SM0007_013B	16.0-16.5	X	X									2	J
1933+00	SM0007_013B	17.5-19.5	X	X	X		X	X	X				2	J
1933+00	SM0007_013B	21.0-21.5			X								2	J
1933+00	SM0007_013B	41.0-41.5			X								2	J
1961+47	SM0007_019A	10.75-11.5	X		X		X						7	J
1961+47	SM0007_019A	16-16.5			X								7	J
1961+47	SM0007_019A	25-27			X								7	J
1961+47	SM0007_019A	55.5-56	X		X		X						7	J
1961+47	SM0007_019A	61-61.5			X								7	J
1965+80	SM0007_002B	5.0-5.5	X	X									TO1	E
1965+80	SM0007_002B	5.5-6.0	X	X			X						TO1	E
1965+80	SM0007_002B	6.5-8.5	X	X			X		X				TO1	E
1965+80	SM0007_002B	7.66-7.72	X	X				X					TO1	E
1965+80	SM0007_002B	11.0-12.5			X								TO1	E
1965+80	SM0007_002B	27.5-29.0			X								TO1	E
1965+80	SM0007_002B	35.0-36.5			X								TO1	E
1965+80	SM0007_002B	42.5-44.0			X								TO1	E
1965+80	SM0007_002B	45.0-46.5	X		X		X						TO1	E
1970+98	SM0007_014B	38-38.5	X		X		X						7	J
1970+98	SM0007_014B	6.0-6.5	X	X									2	J
1970+98	SM0007_014B	10.0-12.0	X	X	X		X	X		X			2	J
1970+98	SM0007_014B	20.0-21.5			X								2	J
1970+98	SM0007_014B	38.5-39.0	X	X									2	J
1980+99	SM0007_015B	38.0-38.5			X								3	J
1980+99	SM0007_015B	38.8-39.0	X	X									3	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
1980+99	SM0007_015B	41.0-41.5			X								6	J
1980+99	SM0007_015B	46.0-46.5			X								6	J
1994+00	SL0001_007C	5.0-5.5			X								5	J
1994+00	SL0001_007C	14.0-15.0			X								5	J
1999+47	SL0001_008C	15.0-16.0			X								5	J
2011+00	SM0007_006S	4.0-5.0			X	X							5	J
2011+00	SM0007_006S	10.0-11.0			X								5	J
2011+00	SM0007_006S	12.0-13.0			X	X							5	J
2011+00	SM0007_006S	23.0-24.0			X								5	J
2011+00	SM0007_006S	63.0-64.0			X								5	J
2011+00	SM0007_006S	67.0-68.0			X								5	J
2011+00	SM0007_006S	69.0-70.0			X								5	J
2011+00	SM0007_006S	72.0-73.0	X				X						5	J
2030+80	SM0007_007S	44.0-45.0	X		X		X						5	J
2030+80	SM0007_007S	71.0-72.0	X		X		X						5	J
2041+00	SM0007_008A	5.5-6.0			X								4	J
2041+00	SM0007_008A	41.0-41.5	X	X									4	J
2041+00	SM0007_008A	72.5-74.0	X				X						4	J
2057+02	SM0007_001A	3.0-3.5			X								4	J
2057+02	SM0007_001A	5.5-6.0			X								4	J
2057+02	SM0007_001A	6.0-6.5			X								4	J
2057+02	SM0007_001A	10.0-11.5	X		X	X							4	J
2057+02	SM0007_001A	15.0-16.5			X								4	J
2057+02	SM0007_001A	65.0-66.5			X								4	J
2057+02	SM0007_001A	70.0-71.5	X		X		X						4	J
2063+84	SM0007_002H	4.0-5.0			X								TO1	E
2063+84	SM0007_002C	15.0-16.0			X								TO1	E
2063+84	SM0007_002C	20.0-21.0			X								TO1	E
2076+90	SM0007_005A	9.5-11.0			X								TO1	E
2076+90	SM0007_005A	29.0-29.5			X								TO1	E
2076+90	SM0007_005A	32.0-32.5			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2091+01	SM0007_031S	3.0-4.0			X								5	J
2091+01	SM0007_031S	14.0-15.0			X								5	J
2091+01	SM0007_031S	17.0-18.0			X								5	J
2091+01	SM0007_031S	27.0-28.0			X	X							5	J
2091+01	SM0007_031S	54.0-55.0	X		X		X						5	J
2103+27	SM0007_009A	5.5-6.0			X	X							4	J
2103+27	SM0007_009A	10.9-11.4	X	X	X		X		X				4	J
2103+27	SM0007_009A	15.5-16.0	X		X								4	J
2103+27	SM0007_009A	17.5-19.0			X								4	J
2103+27	SM0007_009A	26.5-28.0			X								4	J
2103+27	SM0007_009A	53.0-54.0	X		X		X						4	J
2103+27	SM0007_009A	58.5-59.0	X	X	X								4	J
2112+05	SM0007_026S	9-9.5	X		X		X						7	J
2112+05	SM0007_026S	23.5-24.5			X								7	J
2112+05	SM0007_026S	31-32			X								7	J
2112+05	SM0007_026S	41-42			X								7	J
2112+05	SM0007_026S	47-48			X		X						7	J
2112+05	SM0007_026S	60.5-61			X								7	J
2113+89	SM0007_003H	4.0-5.0			X								TO1	E
2113+89	SM0007_003C	9.0-10.0			X								TO1	E
2113+89	SM0007_003C	15.0-16.0			X								TO1	E
2131+98	SM0007_008S	4.0-5.0			X	X							5	J
2131+98	SM0007_008S	11.0-12.0			X	X							5	J
2131+98	SM0007_008S	15.0-16.0			X								5	J
2131+98	SM0007_008S	18.0-19.0			X								5	J
2131+98	SM0007_008S	77.0-78.0	X		X		X						5	J
2141+03	SM0007_009S	4.0-5.0			X	X							5	J
2141+03	SM0007_009S	12.0-13.0			X	X							5	J
2141+03	SM0007_009S	27.0-28.0	X		X		X						5	J
2141+03	SM0007_009S	69.0-70.0	X				X						5	J
2149+85	SM0007_004C	7.0-8.0			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2149+85	SM0007_004H	0.0-5.0			X								TO1	E
2151+01	SM0007_010S	4.0-5.0			X	X							5	J
2151+01	SM0007_010S	59.0-60.0	X		X		X						5	J
2161+04	SM0007_025S	3.0-3.5			X	X							5	J
2161+04	SM0007_025S	9.0-10.0			X								5	J
2161+04	SM0007_025S	17.0-18.0			X								5	J
2161+04	SM0007_025S	71.0-72.0	X		X		X						5	J
2161+04	SM0007_025S	76.0-77.0			X								5	J
2170+97	SM0007_011A	10-11.5			X								7	J
2170+97	SM0007_011A	25-26.5			X								7	J
2170+97	SM0007_011A	65-66.5			X								7	J
2170+97	SM0007_011A	70-71.5	X		X		X						7	J
2181+97	SM0007_012S	48.0-49.0	X		X		X						5	J
2181+97	SM0007_012S	56.0-57.0	X		X		X						5	J
2201+66	SM0007_013S	4.0-5.0			X	X							5	J
2201+66	SM0007_013S	17.0-18.0			X								5	J
2201+66	SM0007_013S	42.0-43.0			X								5	J
2201+66	SM0007_013S	44.0-45.0	X				X						5	J
2201+66	SM0007_013S	56.0-57.0	X				X						5	J
2211+82	SM0007_004B	4.0-5.5			X								TO1	E
2211+82	SM0007_004B	14.2-14.5	X	X			X	X					TO1	E
2211+82	SM0007_004B	15.0-16.0			X								TO1	E
2211+82	SM0007_004B	30.0-31.5			X								TO1	E
2223+02	SM0007_027S	9-10	X		X		X						7	J
2223+02	SM0007_027S	22-23			X								7	J
2223+02	SM0007_027S	32-33			X								7	J
2223+02	SM0007_027S	44-45			X								7	J
2223+02	SM0007_027S	56.5-57.5	X		X		X						7	J
2223+02	SM0007_027S	64-64.5			X								7	J
2223+02	SM0007_027S	68-69			X								7	J
2229+49	SM0007_028S	10-11	X		X		X						7	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2229+49	SM0007_028S	18-19			X								7	J
2229+49	SM0007_028S	35.5-36.5	X		X		X						7	J
2229+49	SM0007_028S	37.5-38.5	X		X		X						7	J
2229+49	SM0007_028S	39.5-40	X		X		X						7	J
2238+73	SM0007_029S	8-9	X		X		X						7	J
2238+73	SM0007_029S	19-20			X								7	J
2238+73	SM0007_029S	35-36	X		X		X						7	J
2238+73	SM0007_029S	40.5-41.5			X								7	J
2238+73	SM0007_029S	44.5-45			X								7	J
2248+15	SM0007_032S	37.5-38.5			X		X						9	J
2250+76	SM0007_005B	5.0-5.5	X	X	X								TO1	E
2250+76	SM0007_005B	22.5-24.0			X								TO1	E
2250+76	SM0007_005B	35.0-36.5	X		X		X						TO1	E
2250+76	SM0007_005B	45.0-46.5			X								TO1	E
2255+00	SM0007_030S	6-7	X		X								7	J
2255+00	SM0007_030S	16-17			X								7	J
2255+00	SM0007_030S	23-24			X								7	J
2255+00	SM0007_030S	34-35	X		X		X						7	J
2255+00	SM0007_030S	40.5-41.5			X								7	J
2262+19	SM0007_014S	5.0-6.0			X								5	J
2262+19	SM0007_014S	33.0-34.0	X				X						5	J
2262+19	SM0007_014S	36.0-37.0			X								5	J
2262+19	SM0007_014S	57.0-58.0	X		X		X						5	J
2270+03	SM0007_011S	6-6.5	X		X		X						7	J
2270+03	SM0007_011S	32-33			X								7	J
2270+03	SM0007_011S	36-36.5	X		X		X						7	J
2270+03	SM0007_011S	59.25-60			X								7	J
2270+03	SM0007_011S	64-65			X		X						7	J
2276+76	SM0007_006B	5.0-5.5			X								TO1	E
2276+76	SM0007_006B	15.0-15.5			X								TO1	E
2276+76	SM0007_006B	19.5-21.0			X								TO1	E

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2276+76	SM0007_006A	10.5-11.0			X								TO1	E
2276+76	SM0007_006A	23.0-24.5			X								TO1	E
2276+76	SM0007_006A	28.5-30.0			X								TO1	E
2276+76	SM0007_006A	32.0-33.0			X								TO1	E
2286+75	SM0007_006C	7.0-8.0			X								TO1	E
2286+75	SM0007_006C	10.5-11.5			X								TO1	E
2286+75	SM0007_006H	0.0-5.0			X								TO1	E
2291+02	SM0007_010A	5.5-6.0			X	X							3	J
2291+02	SM0007_010A	6.0-6.5	X	X			X						3	J
2291+02	SM0007_010A	7.5-8.5	X	X									3	J
2291+02	SM0007_010A	3.0-3.5			X								4	J
2291+02	SM0007_010A	11.0-11.5			X								4	J
2291+02	SM0007_010A	27.0-27.5			X								4	J
2291+02	SM0007_010A	35.5-36.0			X								4	J
2293+00	SM0007_002S	4.5-5.0			X								4	J
2293+00	SM0007_002S	10.0-11.0	X		X		X						4	J
2293+00	SM0007_002S	17.0-18.0			X								4	J
2293+00	SM0007_002S	20.0-21.0			X	X							4	J
2293+00	SM0007_002S	25.0-26.0			X	X							4	J
2293+00	SM0007_002S	34.0-35.0			X								4	J
2293+00	SM0007_002S	63.0-64.0			X								4	J
2293+00	SM0007_002S	65.0-66.0			X								4	J
2293+00	SM0007_002S	66.0-67.0			X								4	J
2293+00	SM0007_002S	67.0-68.0			X								4	J
2293+00	SM0007_002S	72.0-73.0	X		X		X						4	J
2293+14	SM0007_014A	5-10	X	X	X		X		X			X	8	J
2296+50	SM0007_015S	29.0-30.0			X								5	J
2296+50	SM0007_015S	34.0-35.0			X								5	J
2296+50	SM0007_015S	39.0-40.0			X								5	J
2296+50	SM0007_015S	60.0-61.0	X		X		X						5	J
2296+50	SM0007_015S	63.0-64.0			X								5	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2300+00	SM0007_003S	5.0-6.0	X				X						4	J
2300+00	SM0007_003S	9.0-10.0			X	X							4	J
2300+00	SM0007_003S	20.0-21.0			X	X							7	J
2300+00	SM0007_003S	25.0-26.0	X		X		X						4	J
2300+00	SM0007_003S	31.0-32.0			X	X							4	J
2300+00	SM0007_003S	33.0-34.0			X								4	J
2300+00	SM0007_003S	35.0-36.0			X								4	J
2300+00	SM0007_003S	40.0-41.0			X								4	J
2300+00	SM0007_003S	62.0-63.0	X		X		X						4	J
2300+16	SM0007_015A	5.0-10.0	X	X	X		X		X			X	6	J
2300+16	SM0007_015A	23.0-25.0	X		X								6	J
2300+16	SM0007_015A	14.5-15.0	X	X	X						X		7	J
2301+53	SM0007_016S	6.0-7.0			X								5	J
2301+53	SM0007_016S	37.0-38.0			X								5	J
2301+53	SM0007_016S	46.0-47.0	X		X		X						5	J
2301+53	SM0007_016S	57.0-58.0			X								5	J
2319+51	SM0007_017S	30.0-31.0			X	X							5	J
2324+00	SM0007_004S	5.0-6.0			X								4	J
2324+00	SM0007_004S	21.0-22.0			X								4	J
2324+00	SM0007_004S	26.0-27.0	X		X		X						4	J
2324+00	SM0007_004S	28.0-29.0			X								4	J
2324+00	SM0007_004S	48.0-49.0	X		X		X						4	J
2324+00	SM0007_004S	54.0-55.0			X	X							4	J
2333+64	SM0007_018S	22.0-23.0			X								5	J
2333+64	SM0007_018S	33.0-34.0			X								5	J
2333+64	SM0007_018S	37.0-38.0	X				X						5	J
2333+64	SM0007_018S	58.0-59.0	X		X		X						5	J
2336+57	SM0007_008B	2.5-4.0			X								TO1	E
2336+57	SM0007_008B	12.5-14.0			X								TO1	E
2336+57	SM0007_008B	17.5-19.0			X								TO1	E
2336+57	SM0007_008B	22.3-24.0			X								TO1	E

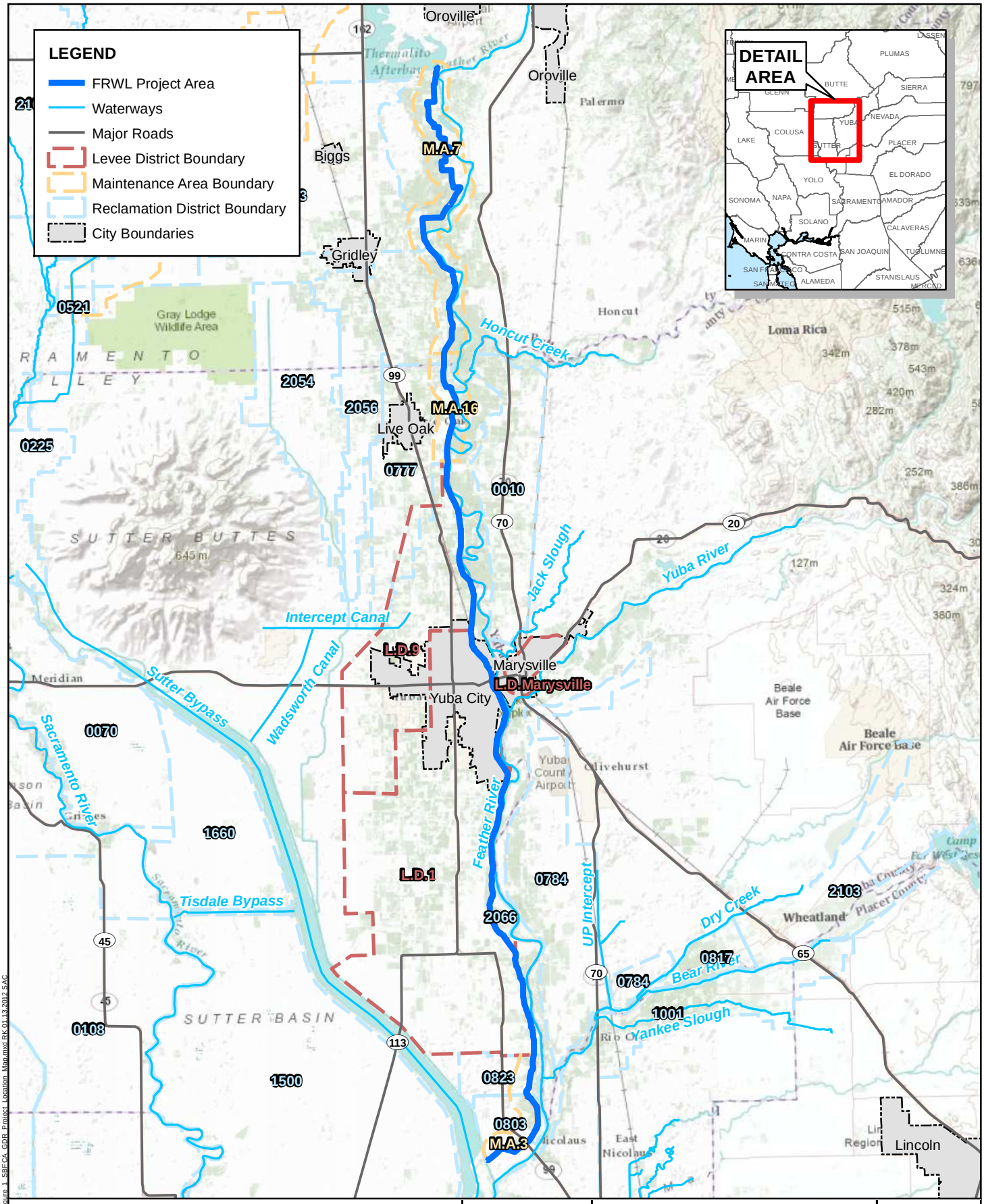
Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2336+57	SM0007_008B	30.0-31.5			X								TO1	E
2336+57	SM0007_008B	40.0-41.5			X								TO1	E
2343+43	SM0007_005S	41.0-42.0			X								4	J
2343+43	SM0007_017B	5.0-5.5			X								4	J
2343+43	SM0007_017B	13.5-14.0			X								4	J
2343+43	SM0007_017B	20.0-21.5			X								4	J
2343+43	SM0007_017B	25.0-26.5	X				X						4	J
2350+96	SM0007_019S	14.0-15.0			X	X							5	J
2350+96	SM0007_019S	19.0-20.0			X								5	J
2350+96	SM0007_019S	29.0-30.0			X								5	J
2355+37	SM0007_009B	1.5-5			X								TO1	E
2358+47	SM0007_020S	6.0-7.0	X		X		X						5	J
2358+47	SM0007_020S	13.0-14.0	X		X		X						5	J
2358+47	SM0007_020S	19.0-20.0	X		X		X						5	J
2358+47	SM0007_020S	34.0-35.0	X		X		X						5	J
2358+47	SM0007_020S	60.0-61.0	X		X		X						5	J
2358+49	SM0007_021S	8.0-9.0			X								5	J
2358+49	SM0007_021S	25.0-26.0			X	X							5	J
2358+49	SM0007_021S	11.0-12.0			X	X							6	J
2358+64	SM0007_016A	10.0-11.5	X	X	X		X	X					6	J
2358+64	SM0007_016A	18.5-20.5	X	X	X		X		X				6	J
2360+00	SM0007_022S	6.0-7.0	X		X		X						5	J
2360+00	SM0007_022S	17.0-18.0	X		X		X						5	J
2360+00	SM0007_022S	23.0-24.0	X		X		X						5	J
2360+00	SM0007_022S	30.0-31.0	X				X						5	J
2360+00	SM0007_022S	37.0-38.0			X								5	J
2362+54	SM0007_007H	7.0-8.0	X		X		X						5	J
2362+69	SM0007_010B	5.5-6.0	X	X			X						TO1	E
2362+69	SM0007_010B	15.5-16.0	X	X			X						TO1	E
2362+69	SM0007_010B	20.5-21.0	X	X			X						TO1	E
2364+97	SM0007_008H	3.0-4.0	X		X		X						5	J

Table 4. Summary of Laboratory Tests

Station	Exploration	Sample Depth (ft)	Moisture Content	Dry Density	Sieve Analysis (includes gradation or #200 wash)	Hydrometer Analysis	Atterberg Limits	Consol-idation	Triaxial Test (ICU)	Direct Shear	Hydraulic Conductivity	Compaction	Lab Test Schedule	Data in Appendix
2364+97	SM0007_008H	8.0-9.0	X		X		X						5	J
2365+01	SM0007_023S	5.0-6.0	X		X		X						5	J
2365+01	SM0007_023S	10.0-11.0			X	X							5	J
2365+01	SM0007_023S	16.0-17.0	X				X						5	J
2365+01	SM0007_023S	22.0-23.0			X								5	J
2365+01	SM0007_023S	27.0-28.0	X		X		X						5	J
2365+01	SM0007_023S	32.0-33.0			X								5	J
2365+01	SM0007_023S	62.0-63.0	X		X		X						5	J
2365+01	SM0007_023S	67.0-68.0			X								5	J
2365+01	SM0007_023S	77.0-78.0	X		X		X						5	J
2365+01	SM0007_023S	82.0-83.0			X								5	J
2365+16	SM0007_017A	20.0-22.0	X	X	X		X	X	X				6	J
2368+00	SM0007_024S	10.0-11.0	X		X		X						5	J
2368+00	SM0007_024S	19.0-20.0	X				X						5	J
2368+00	SM0007_024S	24.0-25.0			X	X							5	J
2368+00	SM0007_024S	27.0-28.0			X								5	J
2368+00	SM0007_024S	41.0-42.0	X		X		X						5	J
2368+00	SM0007_024S	46.0-47.0			X								5	J
2368+00	SM0007_024S	66.0-67.0			X								5	J
2368+00	SM0007_024S	71.0-72.0			X								5	J
2368+00	SM0007_024S	76.0-77.0	X				X						5	J
2368+00	SM0007_024S	81.0-82.0			X								5	J

FIGURES


LEGEND
FRWL Project Area
Waterways
Major Roads
Levee District Boundary
Maintenance Area Boundary
Reclamation District Boundary
City Boundaries
DETAIL AREA
Oroville
Palermo
Biggs
Gridley
Gray Lodge Wildlife Area
Honcut
Honcut Creek
Loma Rica
Live Oak
Marysville
Yuba City
Meridian
Beale Air Force Base
Olivehurst
Wheatland
Lincoln
East Nicolaus
Intercept Canal
Wadsworth Canal
Jack Slough
Yuba River
Sutter Bypass
Sacramento River
Feather River
Tisdale Bypass
UP Intercept
Dry Creek
Bear River
Yankee Slough
SUTTER BUTTES
SUTTER BASIN
M.A.7
M.A.16
M.A.3
L.D.9
L.D.Marysville
L.D.1
0521
2054
2056
0225
0777
0010
0070
1660
0784
2066
0108
1500
0823
0803
2103
0817
1001
Thermalito Afterbay
Oroville Airport
Yuba County Airport
Camp Beale
PLUMAS
SIERRA
BUTTE
GLENN
NEVADA
YUBA
COLUSA
SUTTER
PLACER
LAKE
YOLO
EL DORADO
SONOMA
NAPA
SACRAMENTO
AMADOR
SOLANO
CALAVERAS
MARIN
CONTRA COSTA
SAN JOAQUIN
TUOLUMNE
SAN FRANCISCO
ALAMEDA
STANISLAUS
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N
0
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5
Miles
Sutter Butte Flood Control Agency
URS
in association with:
blackburn consulting
Project Location Map
Feather River West Levee Project
Geotechnical Data Report
Figure 1

INDEX LEGEND

- FRWL Project Limits
- Levee
- Waterway
- 2 — Plan Frame Width and Figure Number
- County Boundary
- Levee District Boundary
- Maintenance Area Boundary
- Reclamation District Boundary

DETAIL AREA



Yuba River
Feather River
Jack Slough
Honcut Creek
Dry Creek
Bear River
Yankee Slough
Best Slough
Up Intercept
Gilsizer Slough
East Side Canal
Live Oak
Wheatland
Oroville
Palermo
Biggs
Gridley
YUBA CO.
BUTTE CO.
SUTTER CO.
COLUSA CO.
GLENN CO.
L.D.1
L.D.9
L.D.10
RD 2103
RD 0777
RD 2056
RD 2054
RD 0833
RD 0784
RD 1001
RD 0823
RD 1660
RD 0070
RD 0824
RD 2106
RD 0825
M.A. 2
M.A. 3
M.A. 4
M.A. 5
M.A. 6
M.A. 7
M.A. 8
M.A. 9
M.A. 10
M.A. 11
M.A. 12
M.A. 13
M.A. 14
M.A. 15
M.A. 16
M.A. 17
M.A. 18
M.A. 19
M.A. 20
M.A. 21
M.A. 22
M.A. 23
M.A. 24
M.A. 25
M.A. 26
M.A. 27
M.A. 28
M.A. 29
M.A. 30
M.A. 31
M.A. 32
M.A. 33
M.A. 34
M.A. 35
M.A. 36
M.A. 37
M.A. 38
M.A. 39
M.A. 40
M.A. 41
M.A. 42
M.A. 43
M.A. 44
M.A. 45
M.A. 46
M.A. 47
M.A. 48
M.A. 49
M.A. 50
L.P. Marysville
West Intercept Canal
East Intercept Canal
Wadsworth Canal
Sutter Bypass
Tisdale Bypass
Sacramento River
Cherokee Canal
Butte Creek

N

0 7,000 14,000
Feet
1 inch = 7,000 feet

FRWL Project Plan Views
Figure Index

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency
FEATHER RIVER WEST LEVEE PROJECT

Figure 2A

EXPLORATIONS & LEVEE FEATURES

- SBFCA TO1 FRWL Project Boring
- SBFCA TO1 FRWL Project CPT
- SBFCA TO2 & TO4 FRWL Project Boring
- SBFCA TO2 & TO4 FRWL Project CPT
- Historical Boring
- Historical CPT
- Levee Miles
- Canal
- SBFCA FRWL Project Levee Stationing
- Reach
- Levee District Boundary
- Maintenance Area Boundary
- Reclamation District Boundary

DOCUMENTED HISTORICAL LEVEE DISTRESS

- Boil
- Cracking
- Sinkhole
- Area of Concern
- Boil
- Breach, Levee Failure
- Erosion
- Seepage
- Sinkhole
- Slope Instability

EXISTING IMPROVEMENT MEASURE, KNOWN OR REPORTED

- Berm
- Ditch
- Levee Raise
- Levee Raise and Widening
- Levee Reconstruction
- Relief Well
- Revetment
- Riprap
- Seepage Interceptor System
- Slurry Cutoff Wall
- Toe Drain
- Waterside Slope Repair

ASSIGNMENT OF BORING ID NUMBER FOR FRWL PROJECT

SX**** _###Y

- "S" for SBFCA
- "W" for DWR

Local District Category
- "R" for Reclamation District
- "L" for Levee District
- "M" for Maintenance Area
- "C" for County of Local Maintenance Agency
- "S" for State. For areas not within any of the above districts or areas
- "P" for Private. Non-State and doesn't fit into any of the above categories.

Local District Number/Special Designation
Use "0" at font if it is less than 4 digits. If "S", "C" or "P" is used in the Local District Category, a four character abbreviation describing the river or channel where the levee is located will be used here.

Exploration Number
Use 001 through 999

Underscore
"_" as a Separator

Hole Type Code
- "A" for Auger (Hollow Stem)
- "B" for Boring (Mud Rotary)
- "C" for CPT
- "H" for Hand-Auger
- "S" for Sonic
- "M" for Monitoring Well
- "T" for Test Pit
- "K" for Bucket Auger
- "V" for Vane Shear Exploration

*Historical borings identified in this report have their own numbering system.

SURFICIAL GEOLOGY LEGEND (Source: DWR, 2010a)

Surfical Geology was mapped at 1:20,000.

Geologic contact; dashed where approximate, dotted where concealed, queried where uncertain; solid contacts within 30' of line shown on map.

- W 1911 — Water bodies, circa 1911
- W 1937 — Water bodies, circa 1937
- BP — Borrow pits present in 1937

GEOLOGIC UNITS*

Historical
- L — Levee; Culturally deposited
- SP — Spoils pile; Artificial fill, circa 1937
- DT — Dredge tailings; Spoils material from gold dredge operations
- Rob — Overbank deposits; sand, silt, and clay; deposited during high-stage water flow, overtopping channel banks
- Rcs — Crevasse splay deposits; Fine to coarse sand, with minor lenses of clay deposited from breaching of natural or artifical levees
- Rdf — Distributary fan deposits; Sand, silt and clay
- Rdc — Distributary channel deposits; Distributary channel deposits, trace gravel, sand, silt, and clay; channelized flow conducting sediment to floodplain
- Rofc — Overflow channels; Vertically stratified sand, silt and clay in channels occupiedwhen high-stage water overtops channel banks
- Rsl — Slough deposits; Sand, silt and clay, fining upward facies, low-energy channel deposit
- Rcu — Crevasse splay deposits; Cut off channel (chute); occurs on insides of meander bends within the river channel; on flood plain – entrenchment of overflow channels into hydraulic mining debris
- Rch — Channel deposits; Sorted sands and silts; fining upward (Rch 1911: channels as shown on historic topo)
  - Rb — Channel bar deposits; fine gravel, sand, and silt deposited in or along channel lateral margins
  - Rms — Channel meander scroll deposits; Sand, silt and clay from lateral channel migration
- Ra — Alluvial deposits, undifferentiated; sand, silt, and minor lenses of fine gravel

Holocene
- Hob — Overbank deposits; sand, silt, and clay; deposited during high-stage water flow, overtopping channel banks
- Hcs — Crevasse splay deposits; Fine to coarse sand, with minor lenses of clay deposited from breaching of natural or artifical levees
- Hdf — Distributary fan deposits; Sand, silt and clay
- Hofc — Overflow channels; Vertically stratified sand, silt and clay in channels occupied when high-stage water overtops channel banks
- Ha — Alluvial deposits undifferentiated; Sand, silt, and minor lenses of gravel; under cultivation in 1937
- Hch — Channel deposits; Sorted sands and silts; fining upward
  - Hb — Channel bar deposits; Fine gravel, sand, and silt deposited in or along channel lateral margins
  - Hms — Channel meander scroll deposits; Sand, silt and clay from lateral channel migration
- Hdc — Distributary channel deposits, sand, silt, and clay
- Hsl — Slough deposits; sand, silt and clay, fining upward facies, low-energy channel deposit
- Hfy — Alluvial fan deposits; Well graded gravel, sand, silt and clay; volcanic lithologies
- Qa — Alluvial deposits undifferentiated; Sand, silt, and minor lenses of fine gravel, under urbanization in 1937
- Qn — Basin deposits; Fine sand, silt and clay, dark yellow to dark yellowish brown, under cultivation in 1937
- Hms — Marsh deposits; Silt and clay, likely organic-rich; perennially or seasonally submerged

Pleistocene
- Qmu — Modesto Formation; upper member; Unconsolidated gravel, sand, silt, and clay
- Qml — Modesto Formation; lower member; Unconsolidated to semi-consolidated gravel, sand, silt and clay
- Qru — Riverbank Formation; upper member; Semi-consolidated to consolidated gravel, sand, silt and minor clay
- Qrl — Riverbank Formation; lower member; Consolidated gravel, sand, silt, and clay, generally associated with strong duripan soil horizon

Pliocene / Pleistocene
- QTm — Tuff breccia; Volcanic tuff breccia (andesitic and rhyolitic) from Sutter Buttes, latest Pliocene

FRWL Project Plan Views
Figure Legend

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency
FEATHER RIVER WEST LEVEE PROJECT

Figure 2B

I:\Projects\SBFCA\ArcMaps\SBFCA_GDR_Mapbook_Legend.mxd RK 10/10/2012 SAC



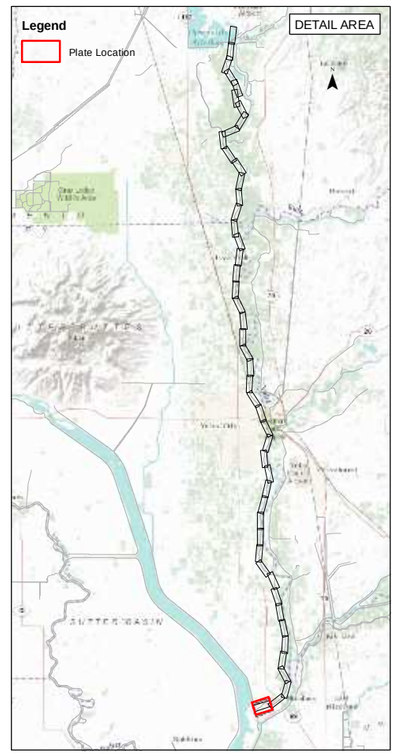
N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 10+00 to Station 60+00

URS

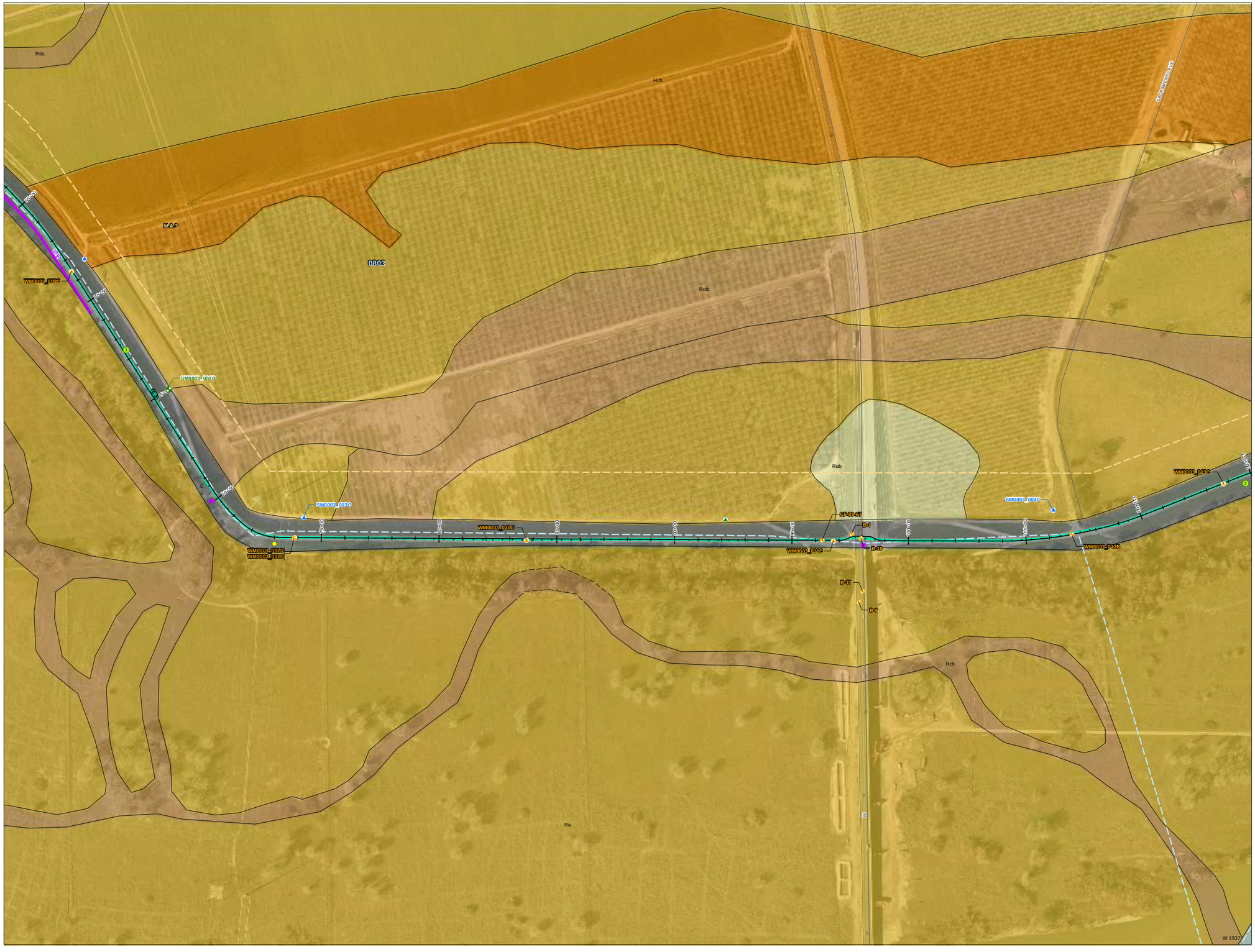
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 3

L:\Projects\SBFCA\Maps\SBFCA_GDR_Multipack.mxd RK 30 Oct 2012 SJC



0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 60+00 to Station 110+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 4

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 30 Oct 2012 10:4C



0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 110+00 to Station 160+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

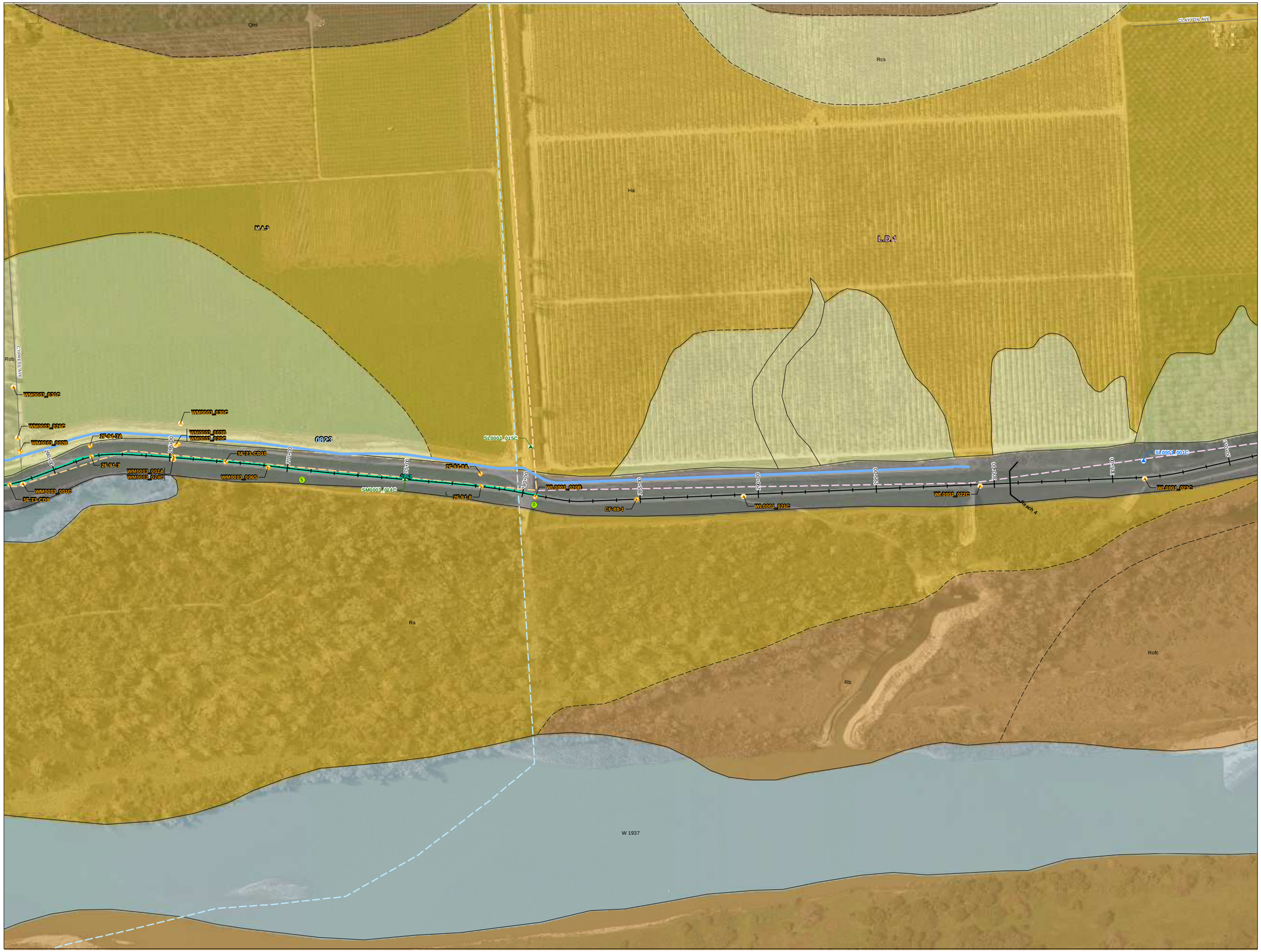
FEATHER RIVER WEST LEVEE PROJECT

Figure 5

I:\Projects\SBFCA\Maps\SBFCA_GDR_Mapbook.mxd RK 10 Oct 2012 SAC


Ha
Ra
Rofc
Rdc
W 1937
0802
0823
SM0003_010C
1992
SM0003_007C
1986
WM0003_020B
2F-01-1A
GF-01-CD1
2F-01-1B
5F-73-CD6
WM0003_020C
2F-01-1A
WM0003_006H
WM0003_006C
SM0003_006C
WM0003_006G
WM0003_019C
WM0003_002A
WM0003_021C
SM0003_003B
WM0003_017C
WM0003_032C
WM0003_033C
WM0003_035C
2F-01-2A
WM0003_033C
1997
2F-01-3
5F-73-CD5
WM0003_003A
WM0003_018C
2F-01-2
WM0003_004S
5F-73-CD4
1993
1997
1997
1997


Qmf
Rdc
Ha
Rob
Ra
W.A.F.
0823
W 1937
Cache Creek
Cache Creek
Feather River
Feather River
Feather River



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 260+00 to Station 310+00

URS

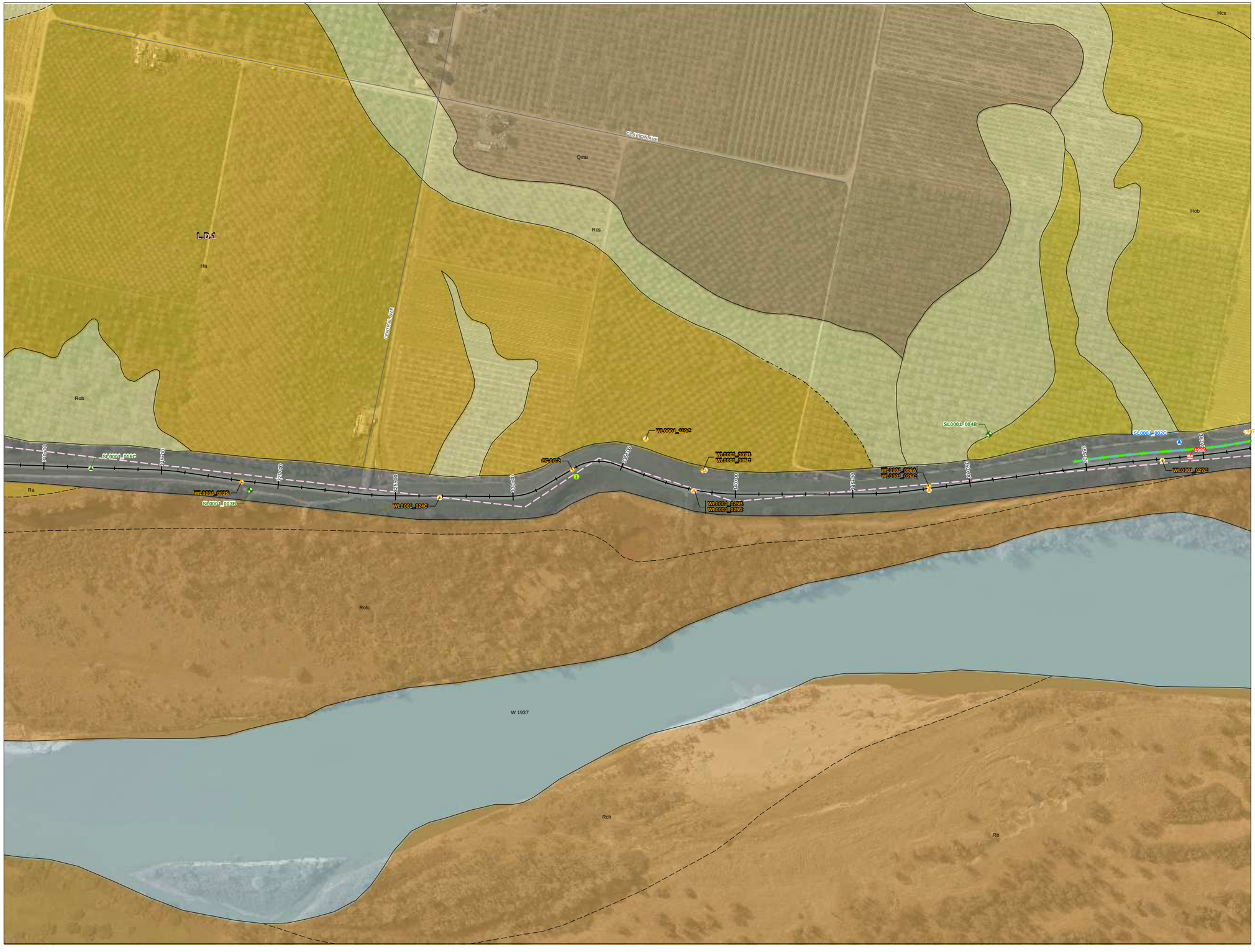
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 8

L:\Projects\SBFCA\Maps\SBFCA_GDR_Multiple.mxd RK 30 Oct 2012 SAC



NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 310+00 to Station 360+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 9

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N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 360+00 to Station 410+00

URS

Geotechnical Data Report

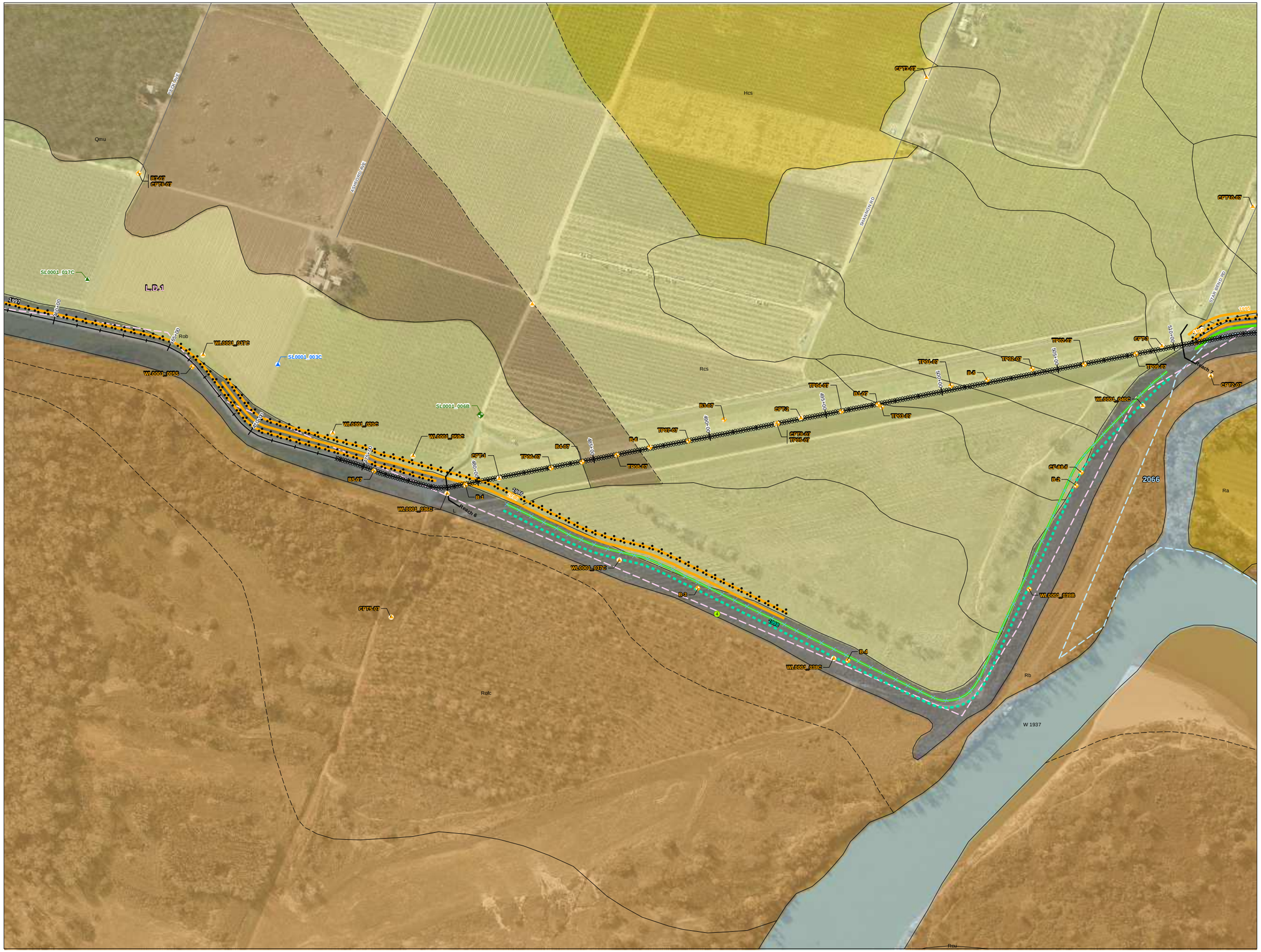
Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 10

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\mxd\RK 10 Oct 2012 2AC


L.D.1
PARISH ROAD
W.N.W. 0+00
E.W. 0+00
E.W. 100+00
Qimu
Rcs
Rob
Rb
Rofc
W 1937
WL0001_007C
WL0001_006C
WL0001_005C
WL0001_004C
WL0001_004B
WL0001_003C
WL0001_003B
WL0001_002C
WL0001_008B
WL0001_008C
WL0001_009C
WL0001_010C
WL0001_011C
WL0001_012C
WL0001_013C
WL0001_014C
WL0001_015C
WL0001_016C
WL0001_017C
WL0001_018C
WL0001_019C
WL0001_020C
WL0001_021C
WL0001_022C
WL0001_023C
WL0001_024C
WL0001_025C
WL0001_026C
WL0001_027C
WL0001_028C
WL0001_029C
WL0001_030C
WL0001_031C
WL0001_032C
WL0001_033C
SL0001_005B
SL0001_017C
SF-98-12
SF-98-4
SF-98-12A
1997
1997
1997



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 460+00 to Station 510+00

URS

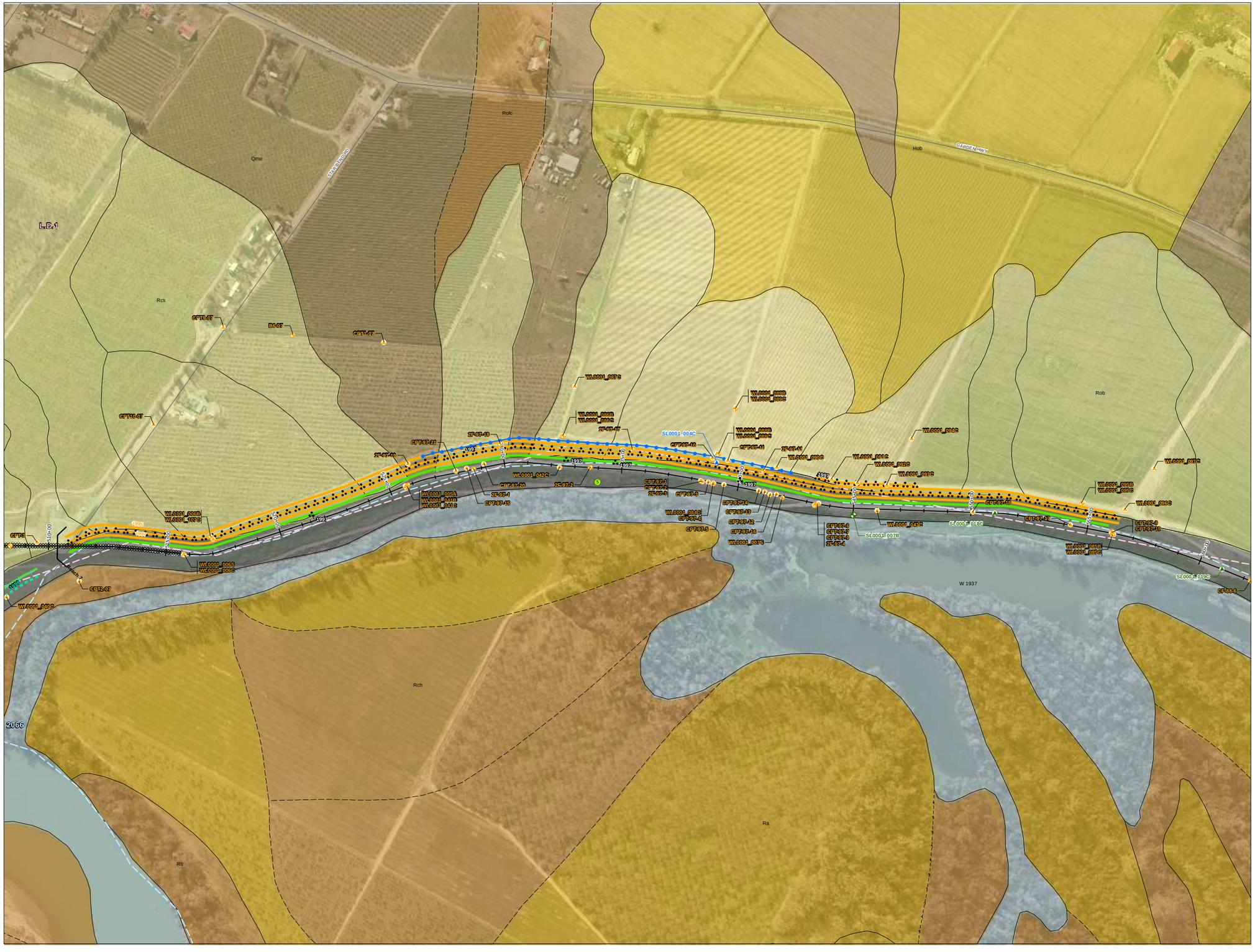
Geotechnical Data Report

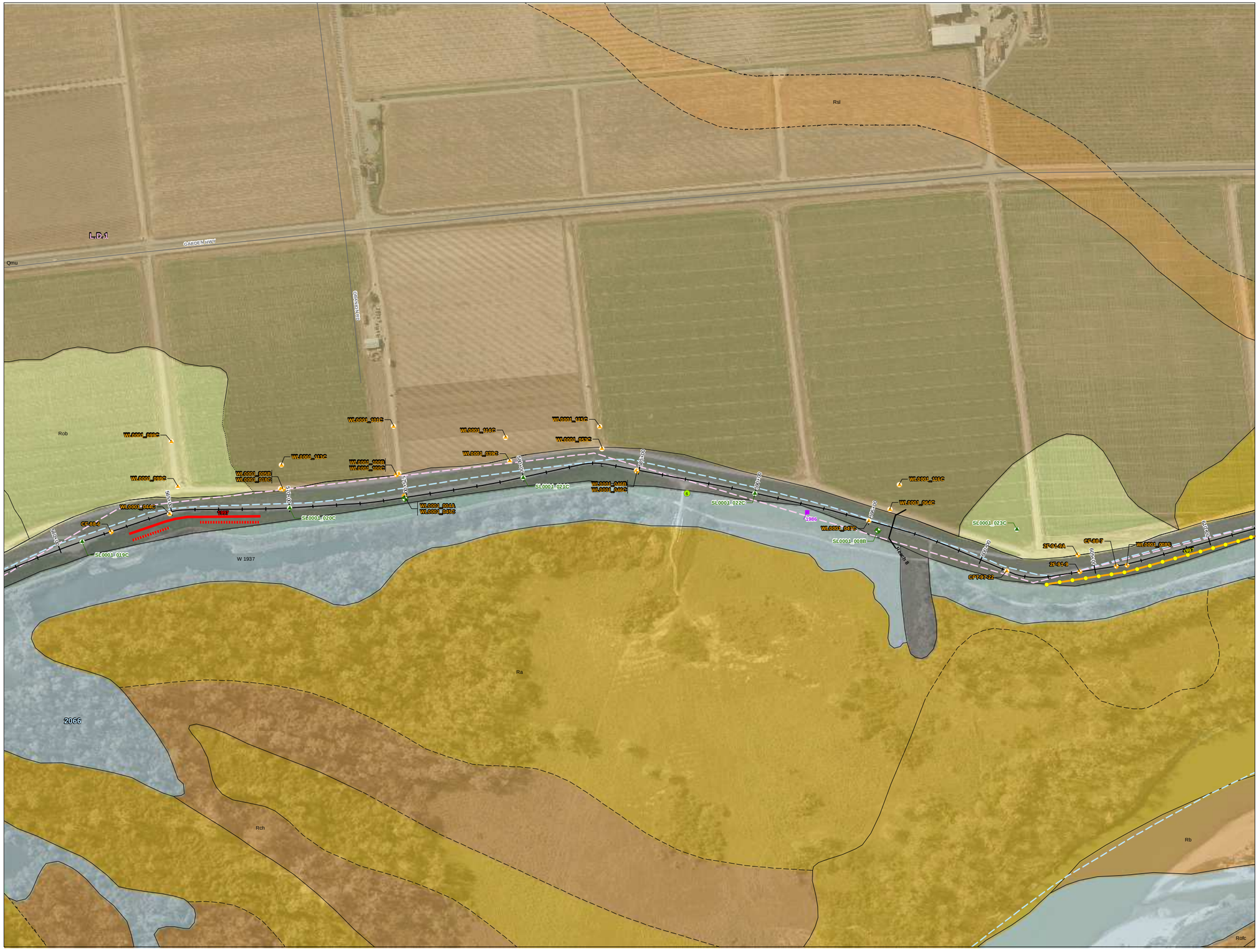
Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 12

L:\Projects\SBFCA\Maps\SB\FCA_GDR_Multipack.mxd Rle 10 Oct 2012 SAC


Qmu
Rolc
Hob
Rcs
Rob
Rch
Ra
Rb
W 1937
L.D.1
SEAN MOORE RD
GARDEN HWY
2066
CPT3-07
CPT4-07
CPT5-07
CPT2-07
CPT3
WL0001_007C
WL0001_008B
WL0001_008C
WL0001_007B
WL0001_008A
WL0001_011B
WL0001_001B
WL0001_004C
WL0001_005C
WL0001_006C
WL0001_002C
WL0001_003C
WL0001_007A
WL0001_008B
WL0001_008C
WL0001_004C
SL0001_004C
SL0001_007B
SL0001_010C
SL0001_011C
SF-07-10
SF-07-11
SF-07-12
SF-07-13
SF-07-14
SF-07-15
SF-07-16
SF-07-17
SF-07-18
SF-07-19
SF-07-20
SF-07-21
SF-07-1
SF-07-2
SF-07-3
SF-07-4
SF-07-5
SF-07-6
SF-07-7
SF-07-8
SF-07-9
CPT07-10
CPT07-11
CPT07-12
CPT07-13
CPT07-14
CPT07-15
CPT07-16
CPT07-17
CPT07-18
CPT07-19
CPT07-20
CPT07-21
CPT07-1
CPT07-2
CPT07-3
CPT07-4
CPT07-5
CPT07-6
CPT07-7
CPT07-8
CPT07-9
CPT07-11
CPT07-12
CPT07-13
CPT07-14
CPT07-15
CPT07-16
CPT07-17
CPT07-18
CPT07-19
1997
1997
1997


L.D.1
GARDEN HWY
GARDEN RD
Qmu
Rsl
Rob
Ra
Rch
Rb
Rofc
2066
W 1937
1986
WL0001_111C
WL0001_112C
WL0001_113C
WL0001_114C
WL0001_115C
WL0001_005B
WL0001_018C
WL0001_004A
WL0001_043B
WL0001_044C
WL0001_045B
WL0001_046C
WL0001_047C
WL0001_048C
WL0001_049C
WL0001_050C
WL0001_051C
WL0001_052C
WL0001_053C
WL0001_054C
WL0001_055C
WL0001_056C
WL0001_057C
WL0001_058C
WL0001_059C
WL0001_060C
WL0001_061C
WL0001_062C
WL0001_063C
WL0001_064C
WL0001_065C
WL0001_066C
WL0001_067C
WL0001_068C
WL0001_069C
WL0001_070C
WL0001_071C
WL0001_072C
WL0001_073C
WL0001_074C
WL0001_075C
WL0001_076C
WL0001_077C
WL0001_078C
WL0001_079C
WL0001_080C
WL0001_081C
WL0001_082C
WL0001_083C
WL0001_084C
WL0001_085C
WL0001_086C
WL0001_087C
WL0001_088C
WL0001_089C
WL0001_090C
WL0001_091C
WL0001_092C
WL0001_093C
WL0001_094C
WL0001_095C
WL0001_096C
WL0001_097C
WL0001_098C
WL0001_099C
WL0001_100C
WL0001_101C
WL0001_102C
WL0001_103C
WL0001_104C
WL0001_105C
WL0001_106C
WL0001_107C
WL0001_108C
WL0001_109C
WL0001_110C
SL0001_019C
SL0001_020C
SL0001_021C
SL0001_022C
SL0001_023C
SL0001_008B
CF-88-4
CF-88-5
CF-88-6
CF-88-7
CF-88-8
CF-88-9
CF-88-10
CF-88-11
CF-88-12
CF-88-13
CF-88-14
CF-88-15
CF-88-16
CF-88-17
CF-88-18
CF-88-19
CF-88-20
CF-88-21
CF-88-22
ZF-88-1A
ZF-88-1B
ZF-88-1C
ZF-88-1D
ZF-88-1E
ZF-88-1F
ZF-88-1G
ZF-88-1H
ZF-88-1I
ZF-88-1J
ZF-88-1K
ZF-88-1L
ZF-88-1M
ZF-88-1N
ZF-88-1O
ZF-88-1P
ZF-88-1Q
ZF-88-1R
ZF-88-1S
ZF-88-1T
ZF-88-1U
ZF-88-1V
ZF-88-1W
ZF-88-1X
ZF-88-1Y
ZF-88-1Z
ZF-88-2A
ZF-88-2B
ZF-88-2C
ZF-88-2D
ZF-88-2E
ZF-88-2F
ZF-88-2G
ZF-88-2H
ZF-88-2I
ZF-88-2J
ZF-88-2K
ZF-88-2L
ZF-88-2M
ZF-88-2N
ZF-88-2O
ZF-88-2P
ZF-88-2Q
ZF-88-2R
ZF-88-2S
ZF-88-2T
ZF-88-2U
ZF-88-2V
ZF-88-2W
ZF-88-2X
ZF-88-2Y
ZF-88-2Z
ZF-88-3A
ZF-88-3B
ZF-88-3C
ZF-88-3D
ZF-88-3E
ZF-88-3F
ZF-88-3G
ZF-88-3H
ZF-88-3I
ZF-88-3J
ZF-88-3K
ZF-88-3L
ZF-88-3M
ZF-88-3N
ZF-88-3O
ZF-88-3P
ZF-88-3Q
ZF-88-3R
ZF-88-3S
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ZF-88-3Y
ZF-88-3Z



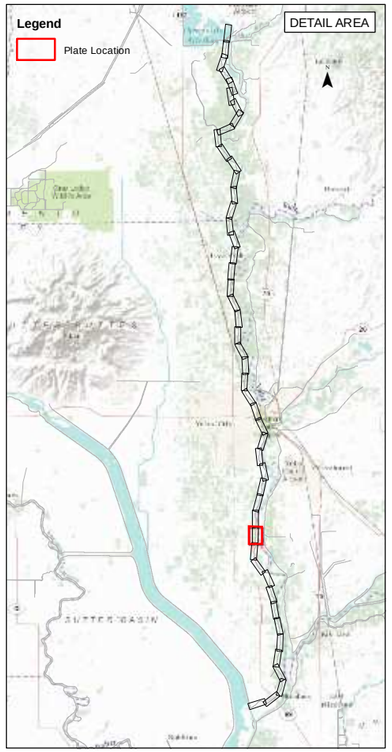
N

0 100 200

Feet

NOTES:

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2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 610+00 to Station 660+00

URS

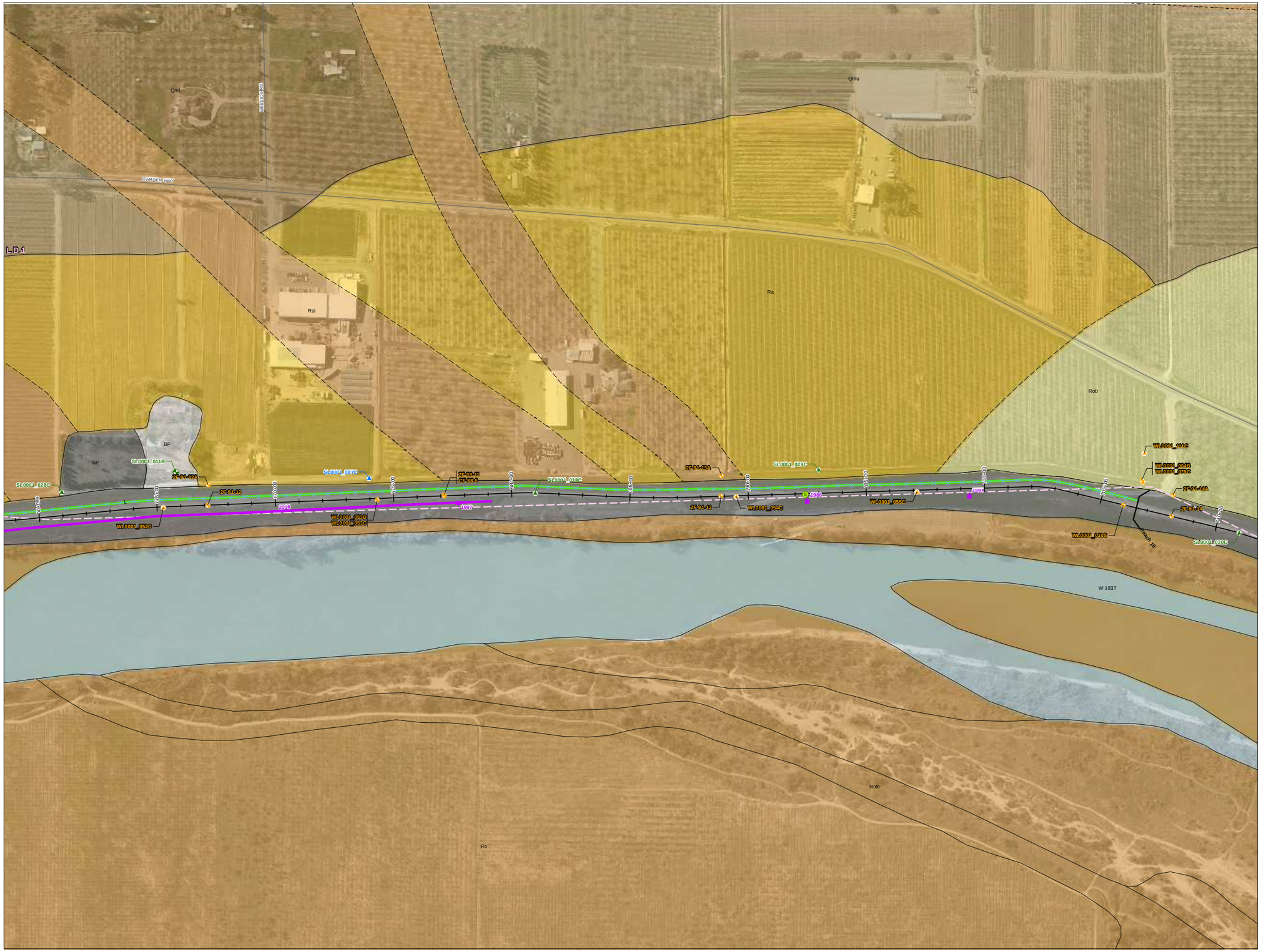
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 15

L:\Projects\SBFCA\Maps\SBFCA_GDR_Mxdwork.mxd RK 30 Oct 2012 SAC



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 660+00 to Station 710+00

URS

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Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 16

L:\Projects\SBFCA\ArcMaps\SBFCA_GDR_Maps\mxd\RK 30 Oct 2012 2AC

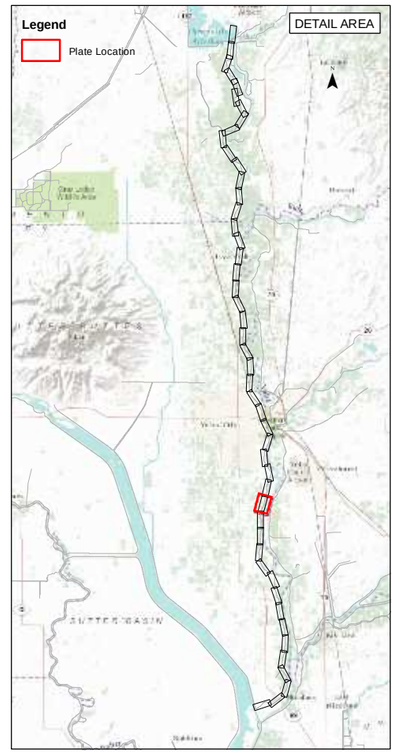


N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 710+00 to Station 760+00

URS

Geotechnical Data Report

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FEATHER RIVER WEST LEVEE PROJECT

Figure 17

L:\Projects\SBFCA\ArcMaps\SBFCA_GDR_MapBook.mxd RK 10 Oct 2012 16:42

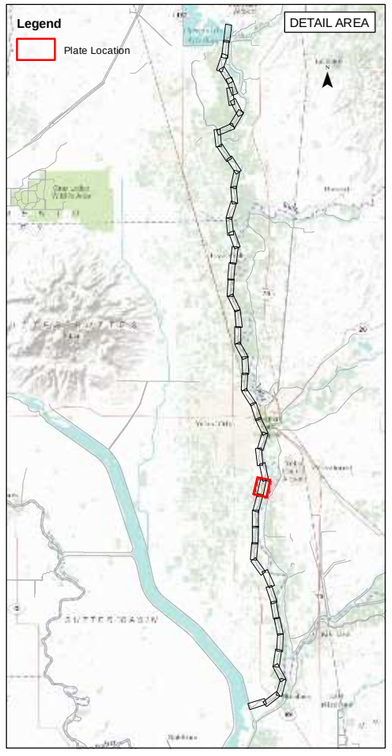


N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 760+00 to Station 810+00

URS

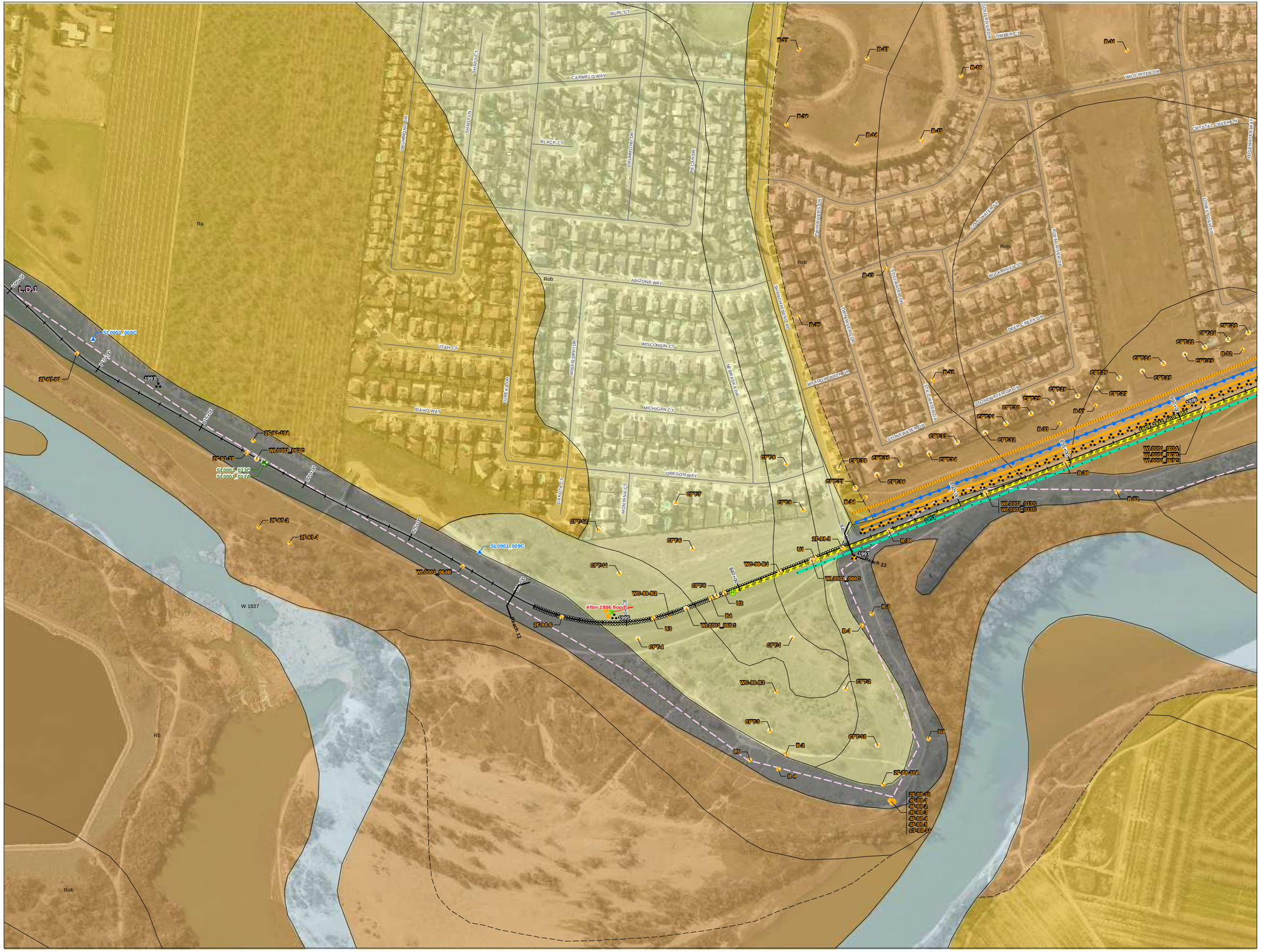
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 18

L:\Projects\SBFCA\Arcmap\SBFCA_GDR_Mapbook.mxd RK 30 Oct 2012 10:42



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 810+00 to Station 860+00

URS

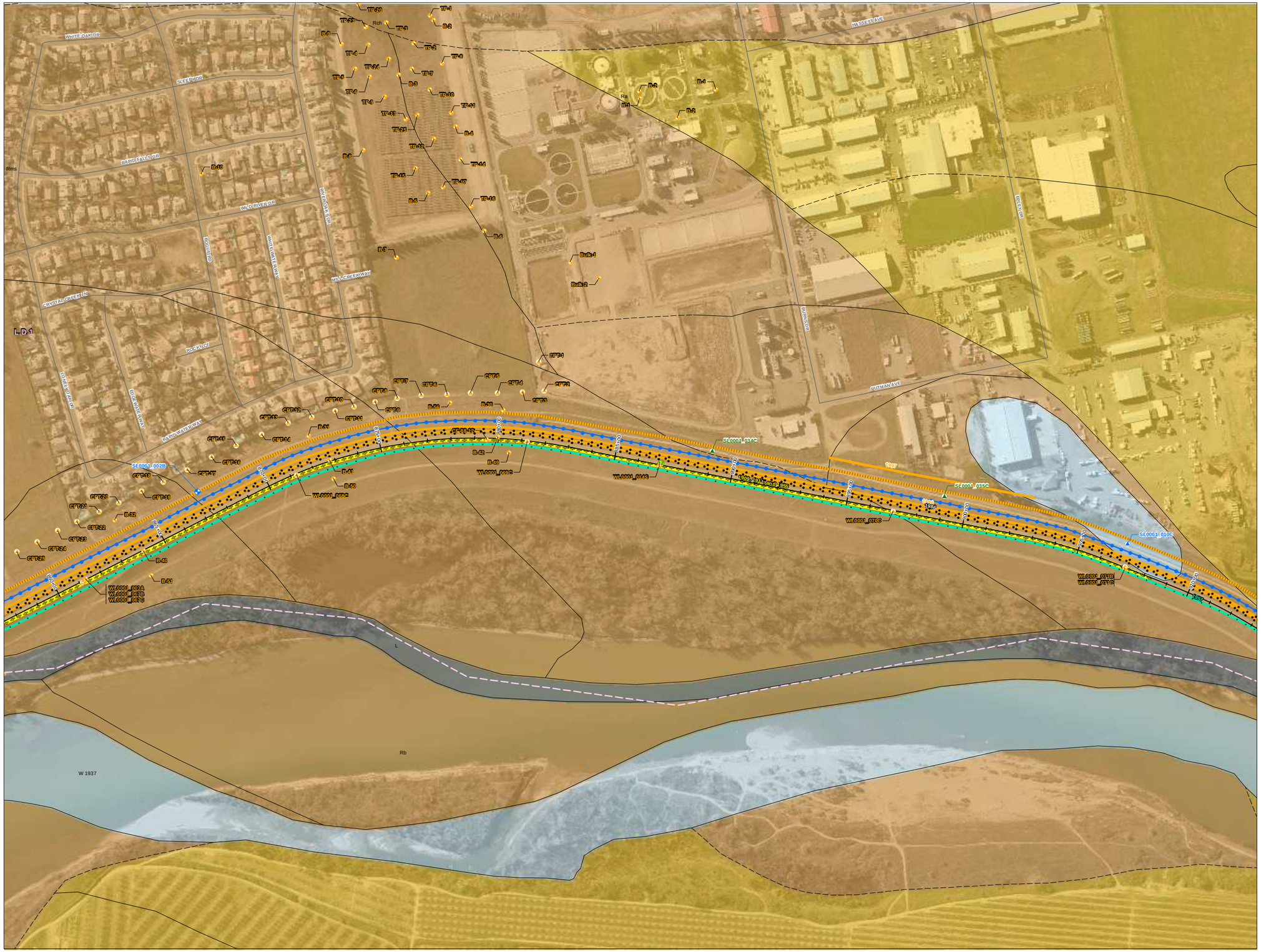
Geotechnical Data Report

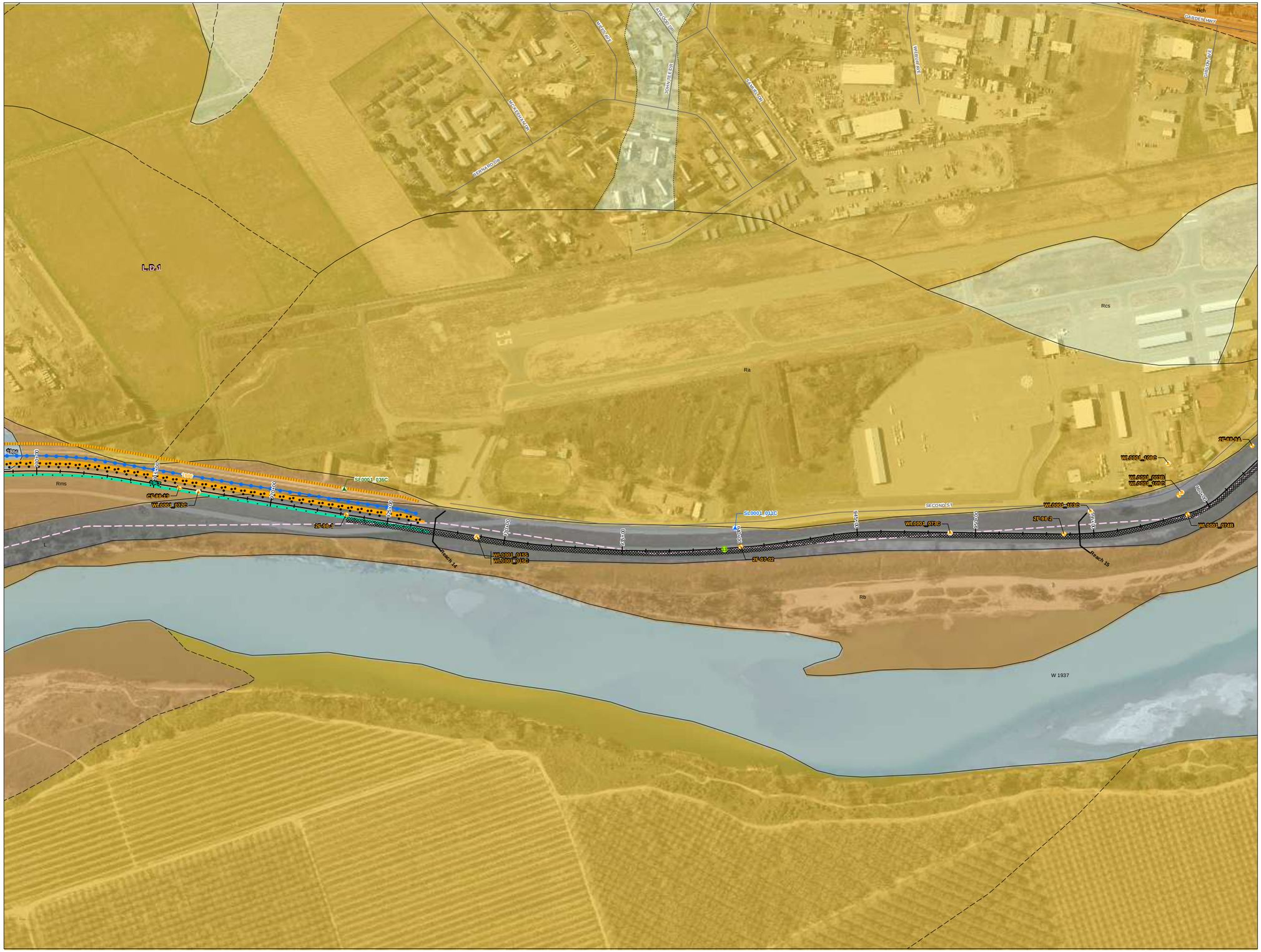
Sutter Butte Flood Control Agency

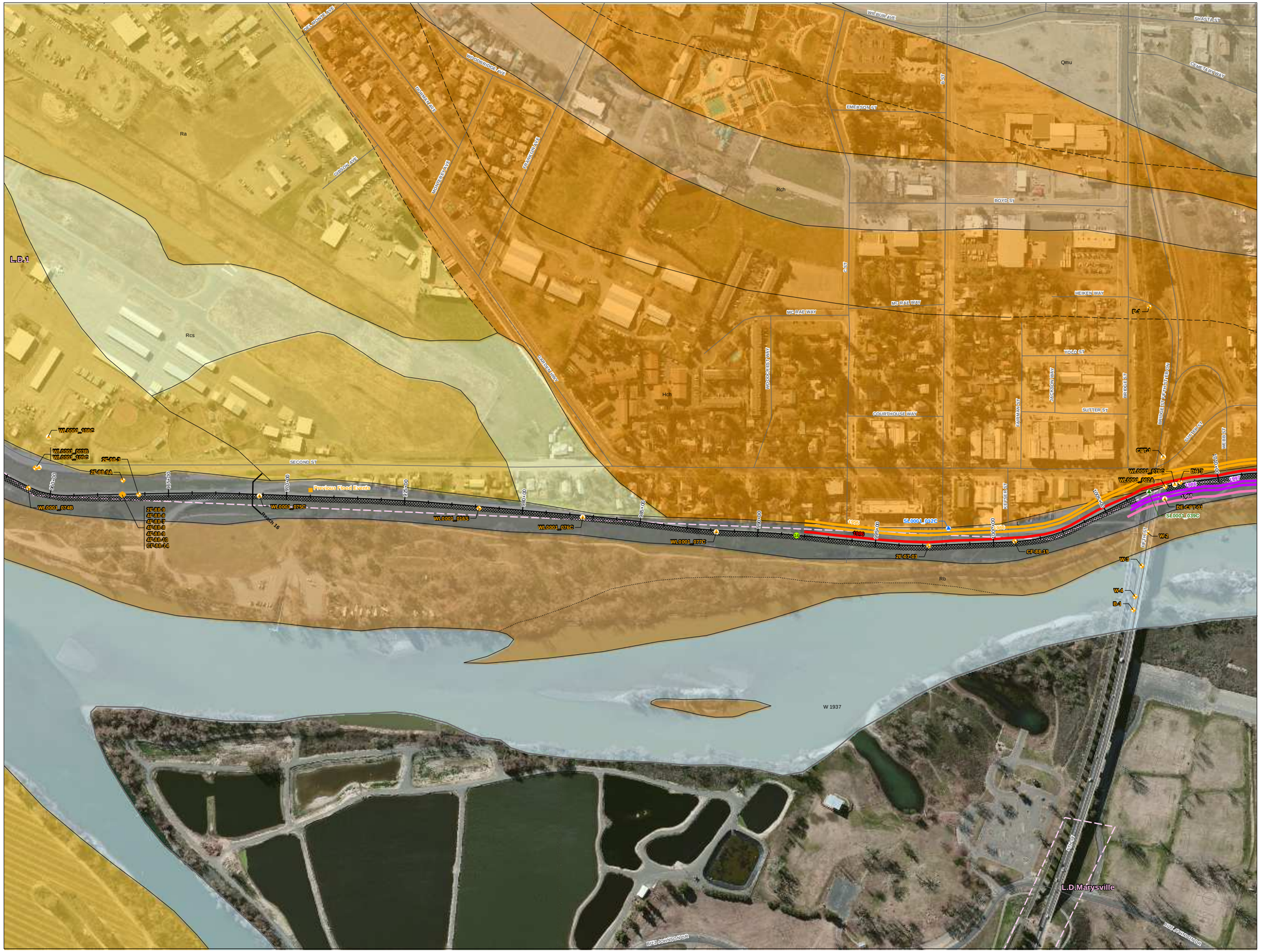
FEATHER RIVER WEST LEVEE PROJECT

Figure 19

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 10 Oct 2012 10:42


WHITE OAK DR
SLEEPY DR
RAPID FALLS DR
WILD RUN BAR
RIVER OAKS EST
LAKELAND
WHITE WATER WAY
MILK CREEK WAY
CRYSTAL CREEK LN
ROCKY CT
HONEY WATER
RIVER WALK WAY
RAPIDS WATER WAY
HASSETT AVE
BUTTE DR
HUMAN AVE
L.D.1
Rms
Rch
Ra
Rb
W 1937
L
SL0001_034C
SL0001_035C
SL0001_010C
SL0001_002B
WL0001_069C
WL0001_070C
WL0001_071C
WL0001_072C
WL0001_001A
WL0001_007B
WL0001_007B
1986
1987
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2021
2022
2023
2024
2025


L.D.1
Rms
Ra
Rb
Rcs
Hch
W 1937
MERIDIAN RD
MC LEAN AVE
STEWART DR
JOHN BELL DR
SAMUEL DR
WILLIAM AVE
GARDEN HWY
JESSE AVE
SECOND ST
Reach 14
Reach 15
SE0001_036C
SE0001_011C
2F-08.4
2F-08.3
2F-07.02
2F-08.2
2F-08.1A
WL0001_072C
WL0001_073C
WL0001_074B
WL0001_075B
WL0001_076B
WL0001_077B
WL0001_078B
WL0001_079B
WL0001_080B
WL0001_081B
WL0001_082B
WL0001_083B
WL0001_084B
WL0001_085B
WL0001_086B
WL0001_087B
WL0001_088B
WL0001_089B
WL0001_090B
WL0001_091B
WL0001_092B
WL0001_093B
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WL0001_095B
WL0001_096B
WL0001_097B
WL0001_098B
WL0001_099B
WL0001_100B
WL0001_101B
WL0001_102B
WL0001_103B
WL0001_104B
WL0001_105B
WL0001_106B
WL0001_107B
WL0001_108B
WL0001_109B
WL0001_110B
WL0001_111B
WL0001_112B
WL0001_113B



N

0 100 200
Feet

NOTES:

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FRWL Project Plan Views
FRWL Project: Station 960+00 to Station 1010+00

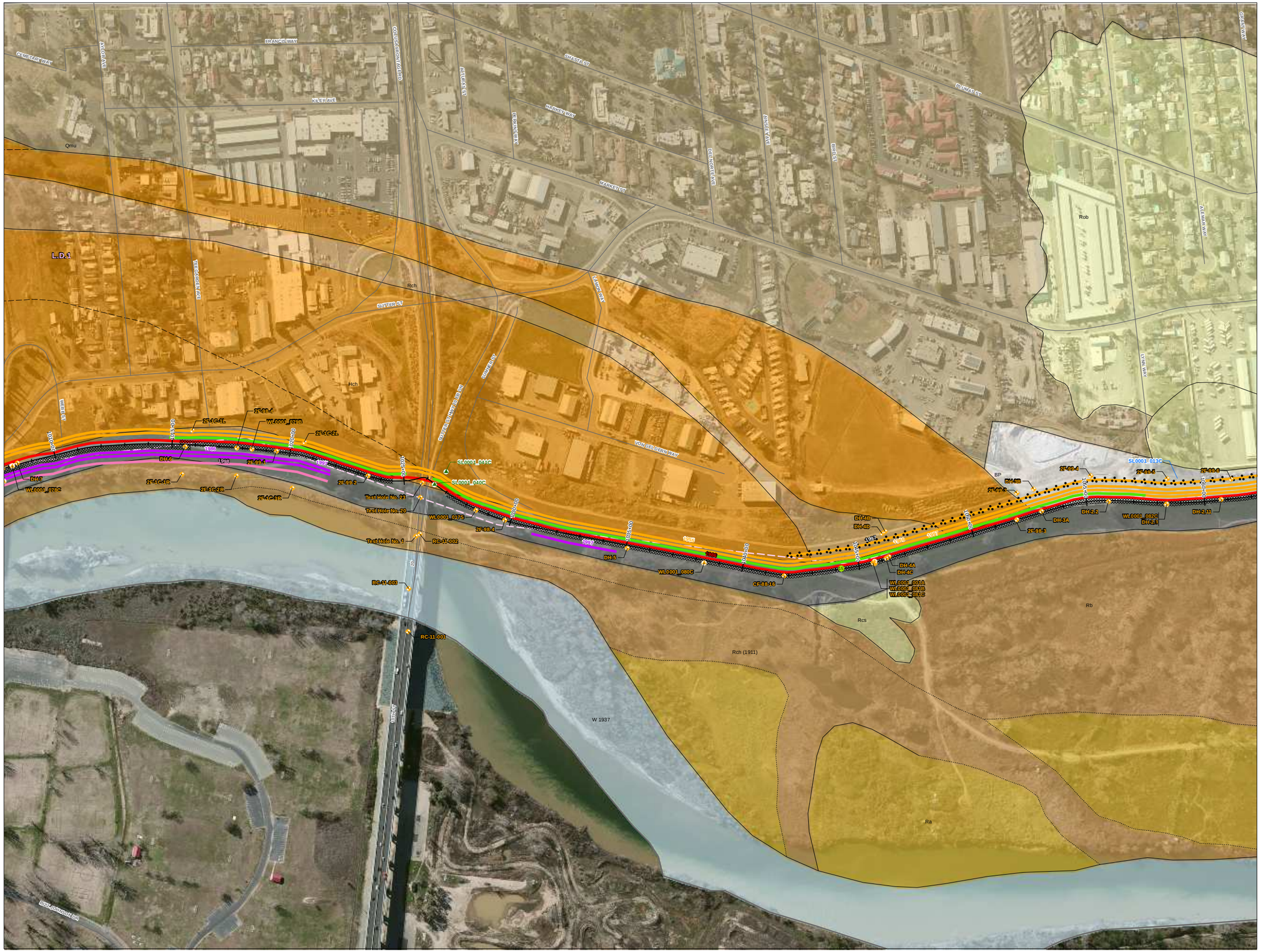
URS

Geotechnical Data Report

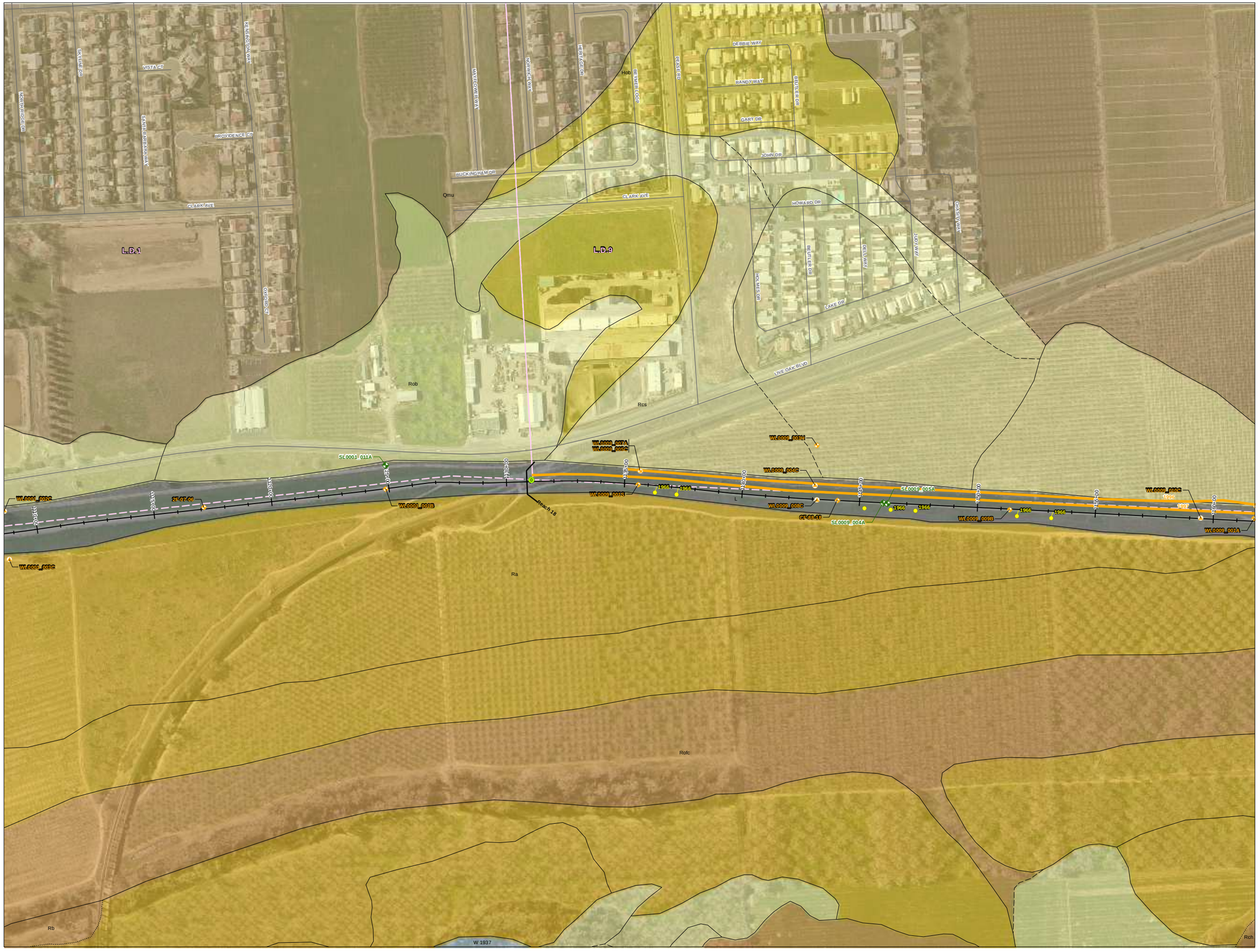
Sutter Butte Flood Control Agency
FEATHER RIVER WEST LEVEE PROJECT

Figure 22

L:\Projects\SBFCA\ArcMap\SBFCA_GDR_Maps\xxx.mxd Rik 10 Oct 2012 8:42


L.D.1
Qmu
Rch
Hch
Rob
Rcs
Rb
Rch (1911)
W 1937
Ra
FRANCIS WAY
KLEIN AVE
ATKINS CT
COLLEGE FRONT RD
CHASE AVE
HARNETT WAY
FRANKLIN AVE
DELANGE AVE
BURT ST
FURMAS ST
MANHEIM CT
ALEMAR WAY
GRANT LEE WAY
TERRACE DR AVE
HEIDE ST
SUTTER ST
LARKIN WAY
SUNSET AVE
CALIFORNIA WATER SERVICE DR
MONTELEREY WAY
LYNN WAY
BP
DH-4B
DH-4A
DH-4C
DH-4D
DH-5.2
DH-5.1A
DH-2.01
DH-2.1
DH-5
Test Hole No. 23
Test Hole No. 20
Test Hole No. 9
RC-11-002
RC-11-003
RC-11-001
SL0001_011C
SL0001_010C
SL0001_013C
WL0001_078C
WL0001_077B
WL0001_079S
WL0001_080C
WL0001_082C
WL0001_R04A
WL0001_R04B
WL0001_R04C
ZF-98-4
ZF-98-3
ZF-98-2
ZF-98-1
ZF-98-16
ZF-98-6
ZF-14-4L
ZF-14-4
ZF-14-4R
ZF-14-3R
ZF-14-5R
ZF-14-6L
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
6200
6400
6600
6800
7000
7200
7400
7600
7800
8000
8200
8400
8600
8800


L_D.1
PLUMAS ST
PLUMAS CT
MARKET ST
Qmu
Rob
Ra
Rb
Rch (1911)
W 1937
Rolfc
Reach 11
B-4
B-5
B-6
B-7
B-10
B-11
SL0001_037C
2F-98-6A
WL0001_001C
2F-98-6
2F-98-6
WL0001_002C
2F-98-2
DH-1
WL0001_018S
DH-2
DH-2.5
DH-2.11
2F-98-4
SL0001_013C
2F-98-5
2F-98-7
2F-97-04
2F-97-05
WL0001_003C
WL0001_102C
WL0001_002S
WL0001_003S
1937
1955
1956
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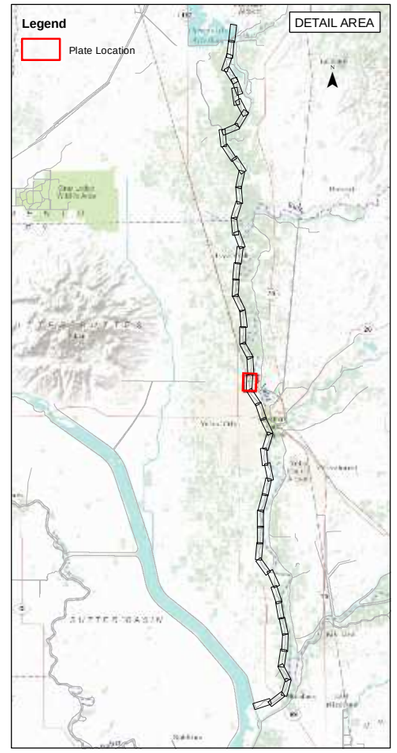


N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views
FRWL Project: Station 1110+00 to Station 1160+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency
FEATHER RIVER WEST LEVEE PROJECT

Figure 25

L:\Projects\SBFCA\Maps\SBFCA_GDR_Mapbook.mxd Rev. 10 Oct 2012 SAC



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1160+00 to Station 1210+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 26

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 30 Oct 2012 12AC



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1210+00 to Station 1260+00

URS

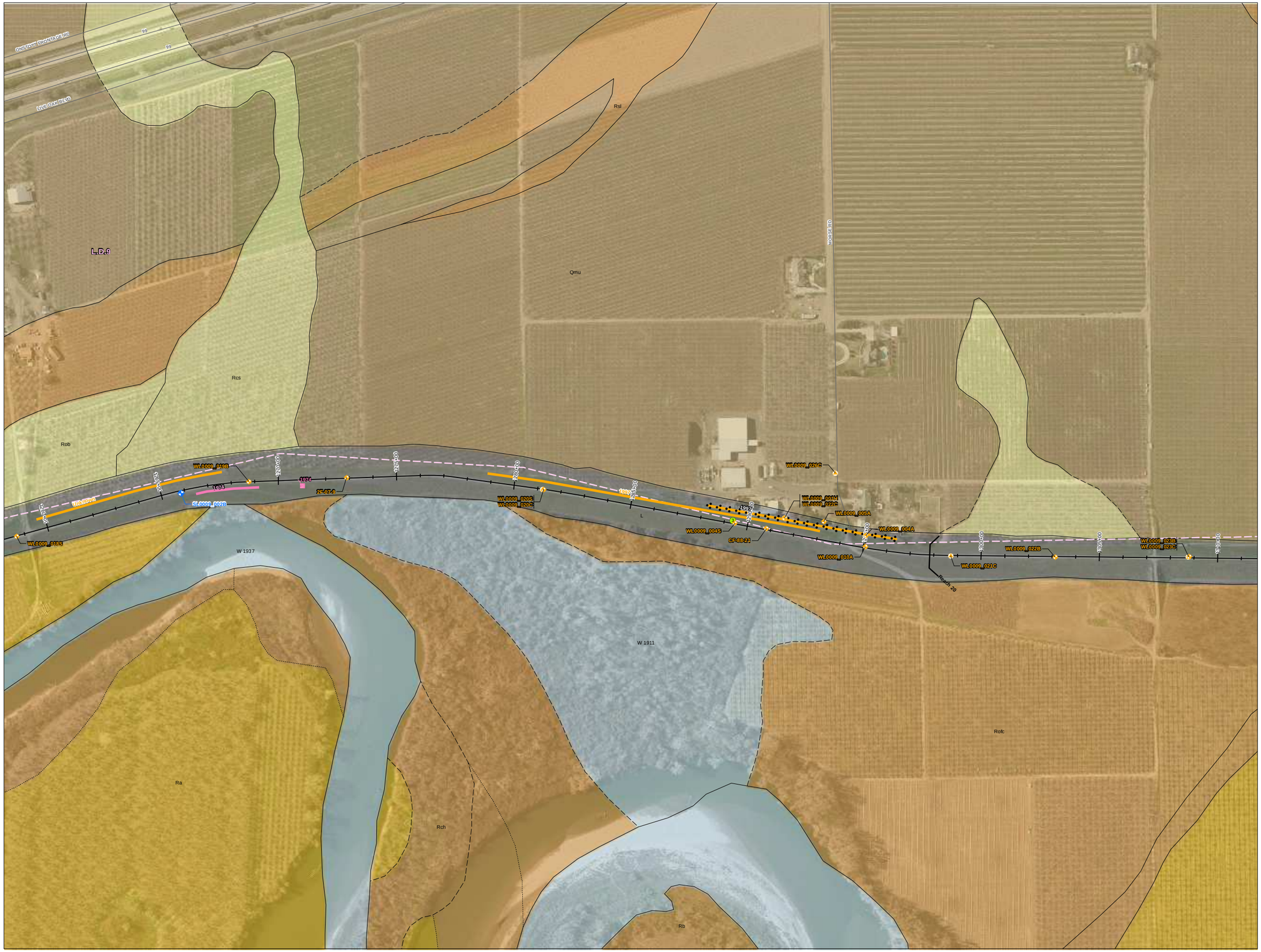
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 27

L:\Projects\SBFCA\Arc\Main\SBFCA_GDR_Map\xxxx.mxd tbk 10 Oct 2012 SAC


ONEMILE FRONTAGE RD
99'
99'
LEVEE CREST
L.D.9
Rsl
Qmu
Rcs
Rob
WL0009_018B
WL0009_018S
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
6+00
6+50
7+00
7+50
8+00
8+50
9+00
9+50
10+00
10+50
11+00
11+50
12+00
12+50
13+00
13+50
14+00
14+50
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17+50
18+00
18+50
19+00
19+50
20+00
20+50

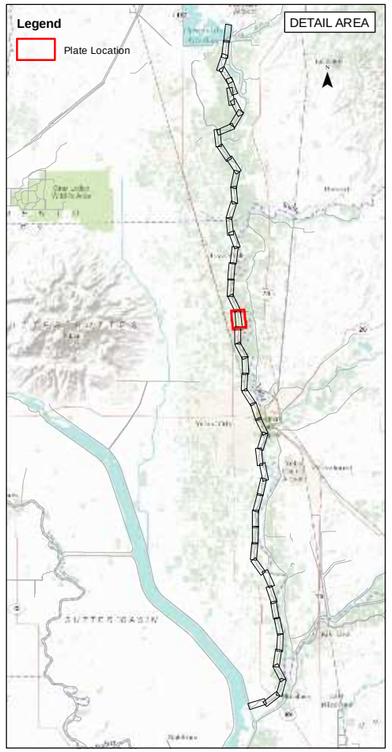


NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)

N

0 100 200
Feet



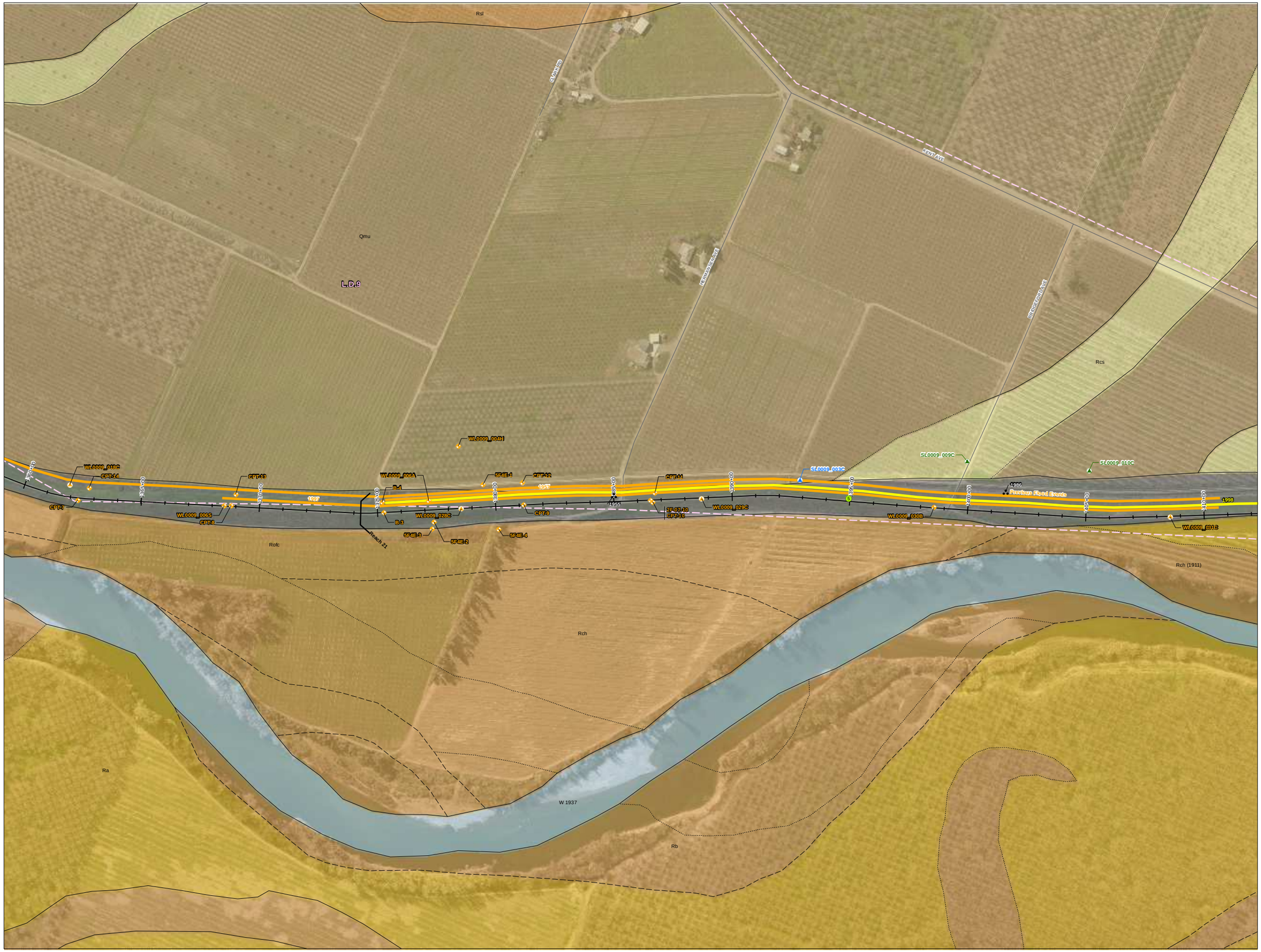
FRWL Project Plan Views
FRWL Project: Station 1310+00 to Station 1360+00

URS Geotechnical Data Report

Sutter Butte Flood Control Agency
FEATHER RIVER WEST LEVEE PROJECT

Figure 29

L:\Projects\SBFCA\Vicinity\SBFCA_GDR_Mapbook.mxd RK 10 Oct 2012 SJC



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1360+00 to Station 1410+00

URS

Geotechnical Data Report

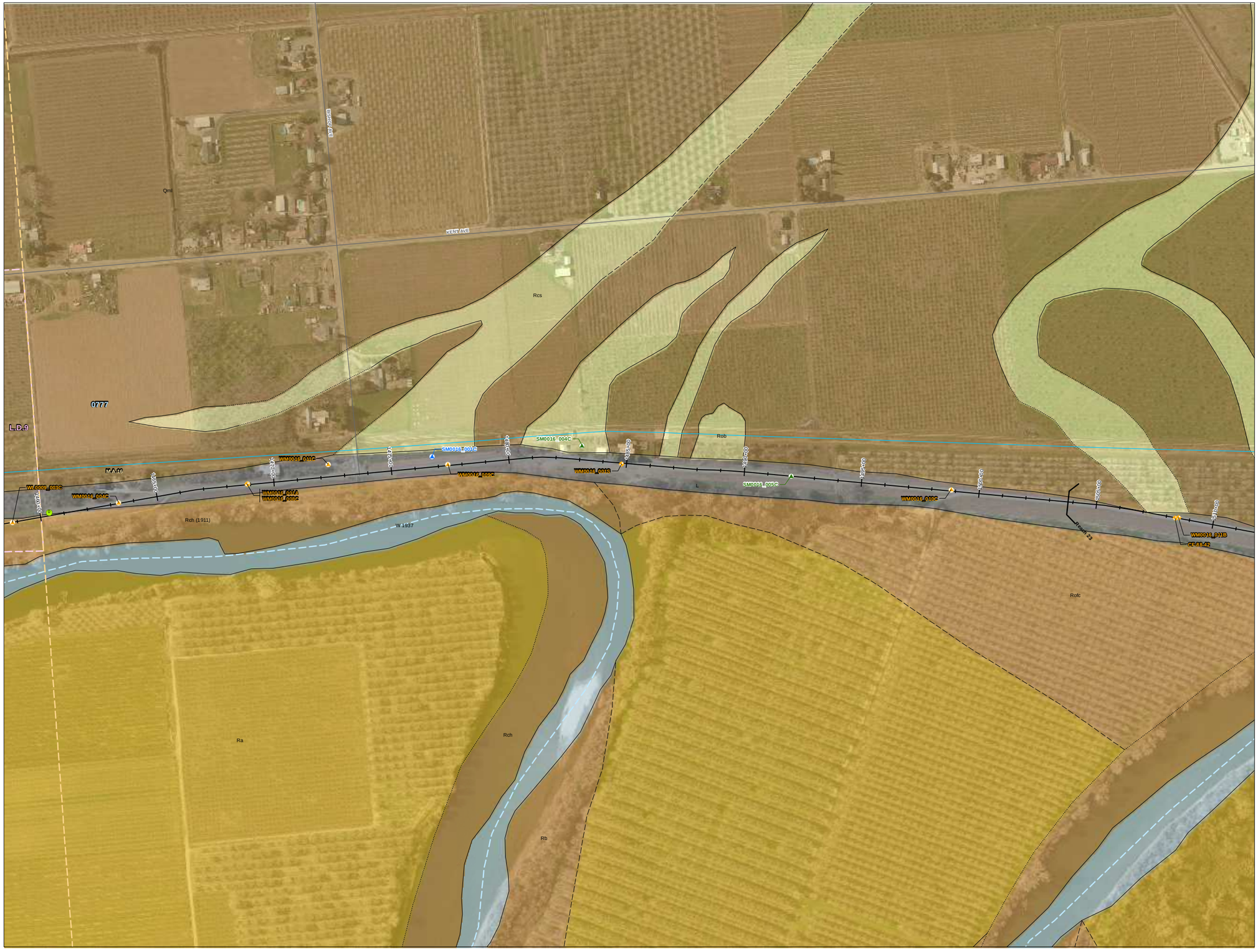
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FEATHER RIVER WEST LEVEE PROJECT

Figure 30

L:\Projects\SBFCA\vMaps\SBFCA_GDR_Mapbook.mxd RK 10 Oct 2012 8AC


Qmu
Qml
Rcs
Rch (1911)
Rch
Rob
Rofc
Ra
W 1937
L.D.9
GRIFFIN AVE
WILLOW OAKS
PEASE AVE
KENT AVE
0777
MA-18
WL0009_009H
SL0009_011C
WL0009_017C
SL0009_008B
SL0009_004B
WL0009_034C
WL0009_001C
WL0009_032B
WL0009_033C
WL0009_009C
WL0009_008B
WL0009_003C
CF-58-22
CF-58-C
Pedestrian Flood Protection Levee
1410+00
1420+00
1430+00
1440+00
1450+00
1460+00
1470+00
1480+00
1490+00
1500+00
1510+00
1520+00
1530+00
1540+00
1550+00
1560+00
1570+00
1580+00
1590+00
1600+00
1610+00
1620+00
1630+00
1640+00
1650+00
1660+00
1670+00
1680+00
1690+00
1700+00
1710+00
1720+00
1730+00
1740+00
1750+00
1760+00
1770+00
1780+00
1790+00
1800+00



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1460+00 to Station 1510+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 32

L:\Projects\SBFCA\vMaps\SBFCA_GDR_Maplocs.mxd RK 10 Oct 2012 16:42



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1510+00 to Station 1560+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 33

L:\Projects\SBFCA\Maps\SBFCA_GDR_MultiWork.mxd RK 30 Oct 2012 SJC



0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1560+00 to Station 1610+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 34

L:\Projects\SBFCA\Maps\SBFCA_GDR_Mxds\xxx.mxd RK 10 Oct 2012 SAC



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1610+00 to Station 1660+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 35

L:\Projects\SBFCA\Maps\SBFCA_GDR_Mapbook.mxd Rx 10 Oct 2012 SJC



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1660+00 to Station 1710+00

URS

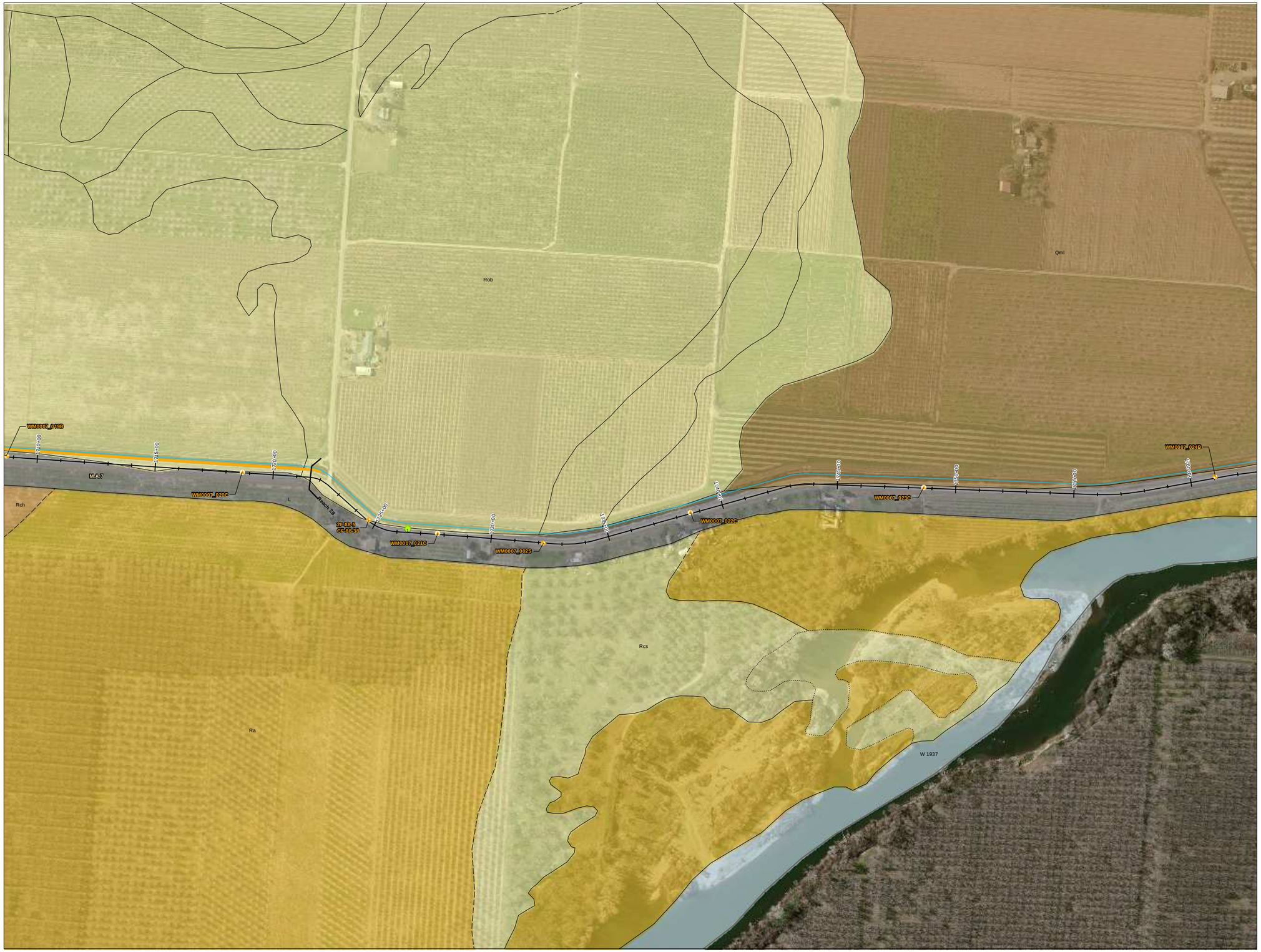
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 36

L:\Projects\SBFCA\Maps\SBFCA_GDR_MapBook.mxd Rev. 10 Oct 2012 SJC



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1710+00 to Station 1760+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 37

L:\Projects\SBFCA\Arc\Main\SBFCA_GDR_Map\xxx.mxd tbk 10 Oct 2012 SAC



NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)

N

0 100 200

Feet



FRWL Project Plan Views

FRWL Project: Station 1760+00 to Station 1810+00

URS

Geotechnical Data Report

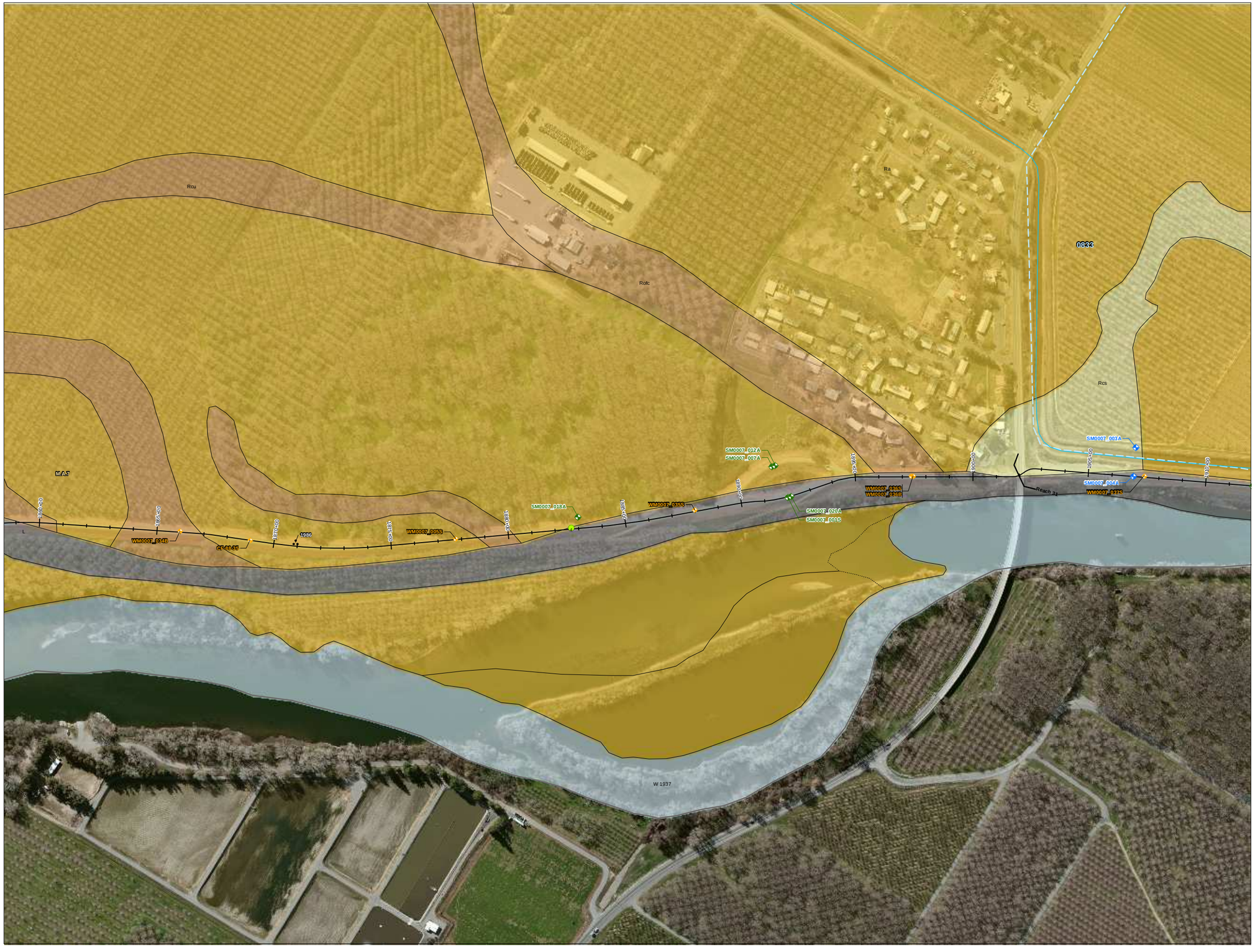
Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 38

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 30 Oct 2012 12:42


WM0007_033S
WM0007_032S
WM0007_031S
SM0007_011B
SM0007_001C
2F-07-4
2F-07-4A
2F-07-4B
2F-07-5
2F-07-5A
2F-07-5B
2F-07-6
2F-07-10
1886
Rob
Rolc
Rcu
Rch
Ra
M.A.T.
W 1937
1810+00
1823+00
1833+00
1843+00
1853+00
1863+00
1873+00
1883+00
1893+00
1903+00
1913+00
1923+00
1933+00
1943+00
1953+00
1963+00
1973+00
1983+00
1993+00
2003+00
2013+00
2023+00
2033+00
2043+00
2053+00
2063+00
2073+00
2083+00
2093+00
2103+00
2113+00
2123+00
2133+00
2143+00
2153+00
2163+00
2173+00
2183+00
2193+00
2203+00
2213+00



0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views
FRWL Project: Station 1860+00 to Station 1910+00

URS Geotechnical Data Report

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FEATHER RIVER WEST LEVEE PROJECT

Figure 40

L:\Projects\SBFCA\vMaps\SBFCA_GDR_Map4xx4.mxd RK 10 Oct 2012 2AC



N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1910+00 to Station 1960+00

URS

Geotechnical Data Report

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FEATHER RIVER WEST LEVEE PROJECT

Figure 41

L:\Projects\SBFCA\vMaps\SBFCA_GDR_Maps\mxd\mxd RK 10 Oct 2012 SAC



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 1960+00 to Station 2010+00

URS

Geotechnical Data Report

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FEATHER RIVER WEST LEVEE PROJECT

Figure 42

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 10 Oct 2012 12:42



NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 2010+00 to Station 2060+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 43

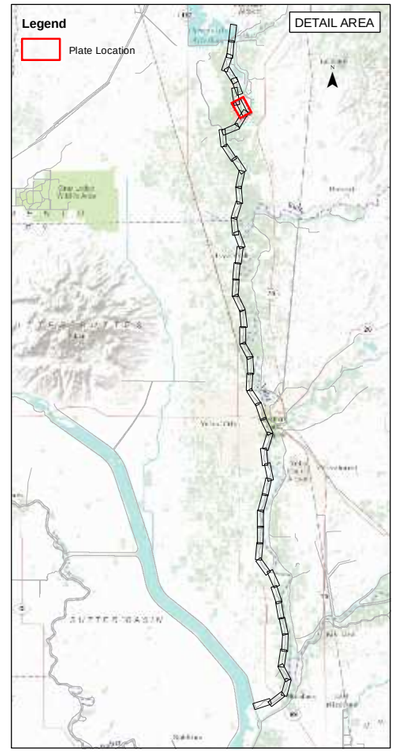
L:\Projects\SBFCA\Maps\SBFCA_GDR_Mapbook.mxd RK 10 Oct 2012 SJC



0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 2060+00 to Station 2110+00

URS

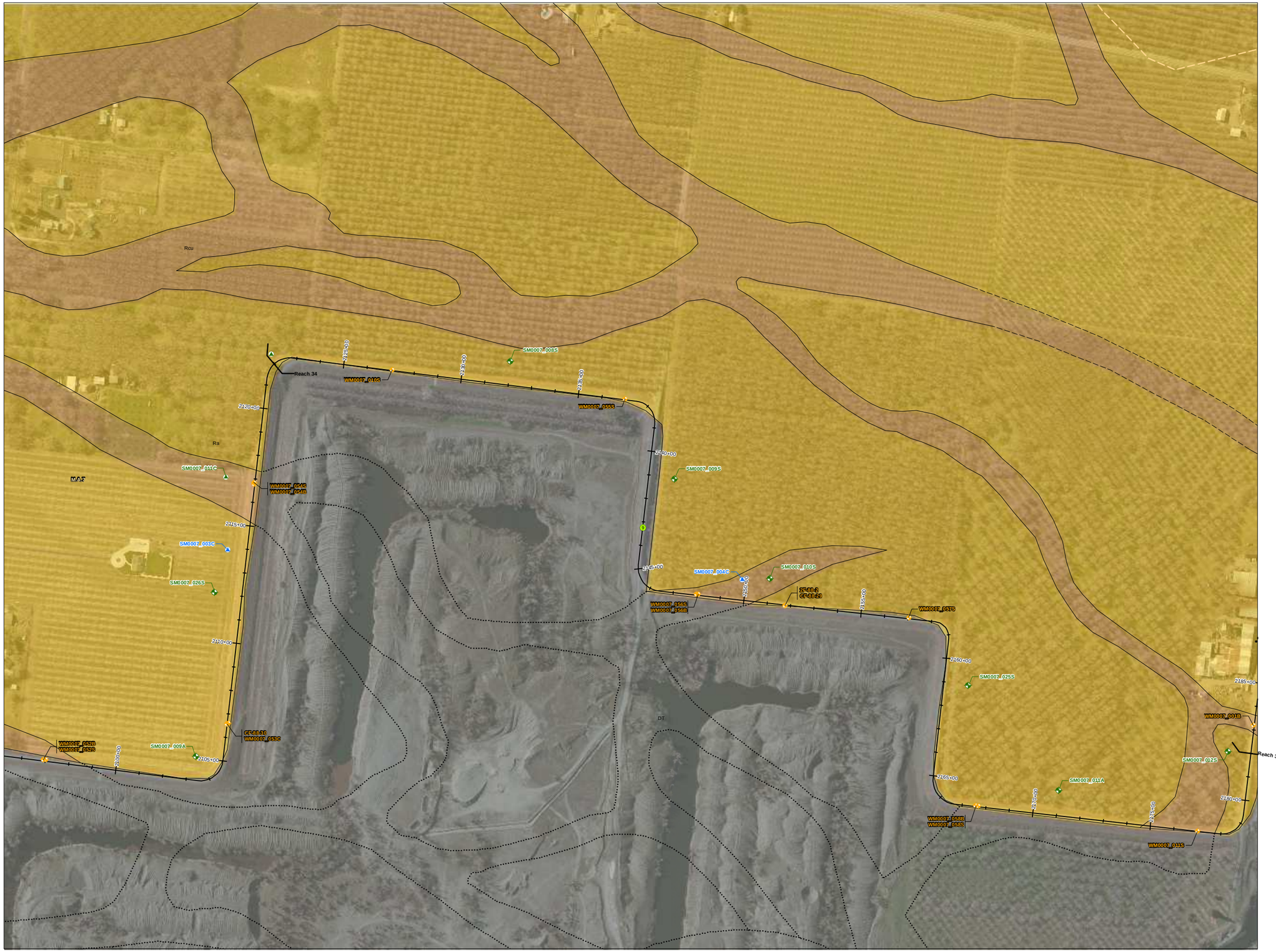
Geotechnical Data Report

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FEATHER RIVER WEST LEVEE PROJECT

Figure 44

I:\Projects\SBFCA\Arc\Maps\SBFCA_GDR_Mapbook.mxd RK 10 Oct 2012 SJC



FRWL Project Plan Views

FRWL Project: Station 2110+00 to Station 2160+00

URS

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FEATHER RIVER WEST LEVEE PROJECT

Figure 45

L:\Projects\SBFCA\Arc\Maps\SBFCA_GDR_Mapbook.mxd RK 30 Oct 2012 SJC

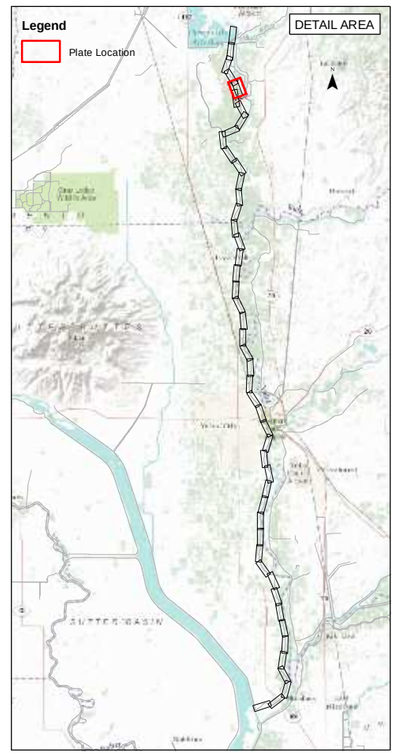


N

0 100 200
Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 2160+00 to Station 2210+00

URS

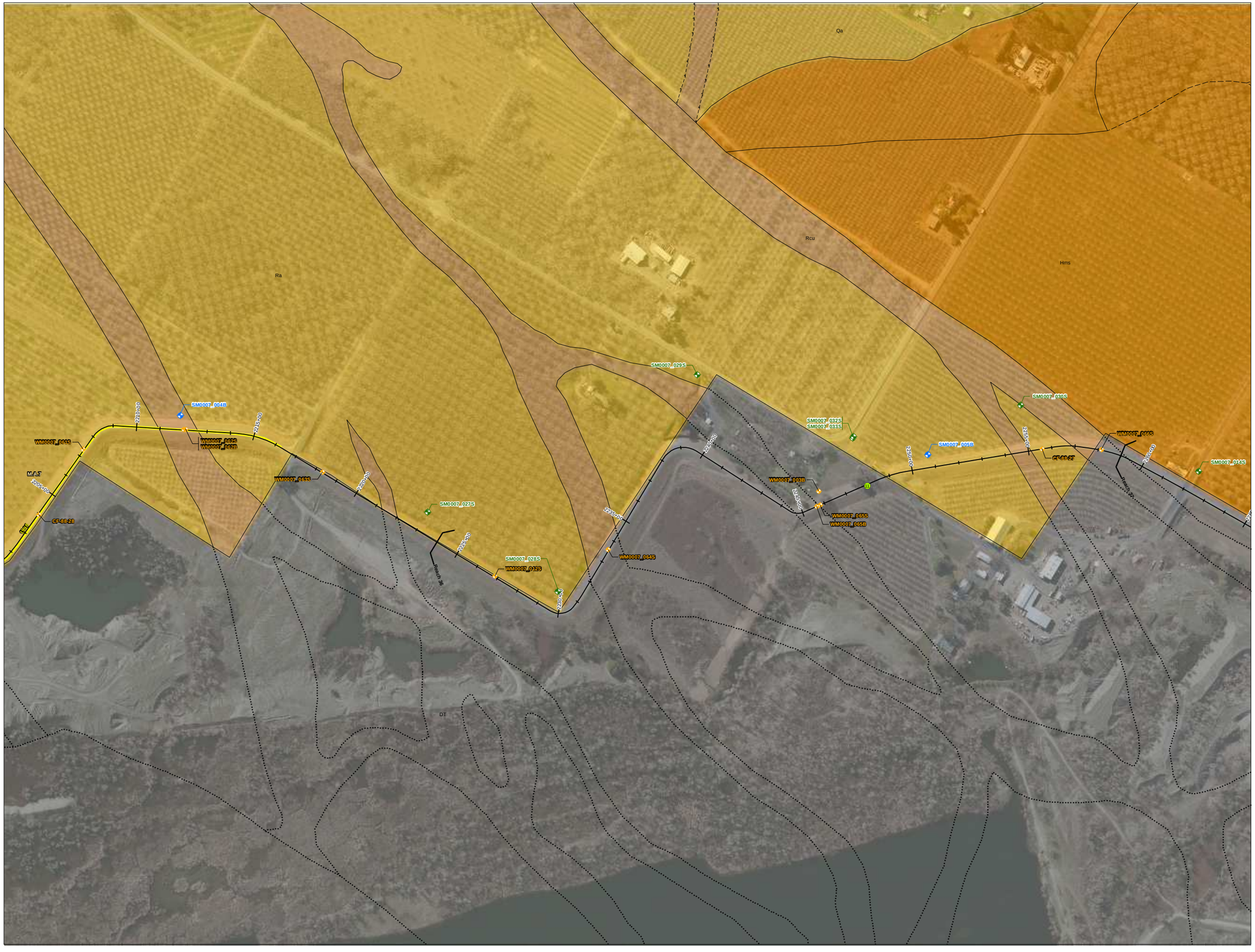
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 46

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\mxd\RK 10 Oct 2012 2AC



NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 2210+00 to Station 2260+00

URS

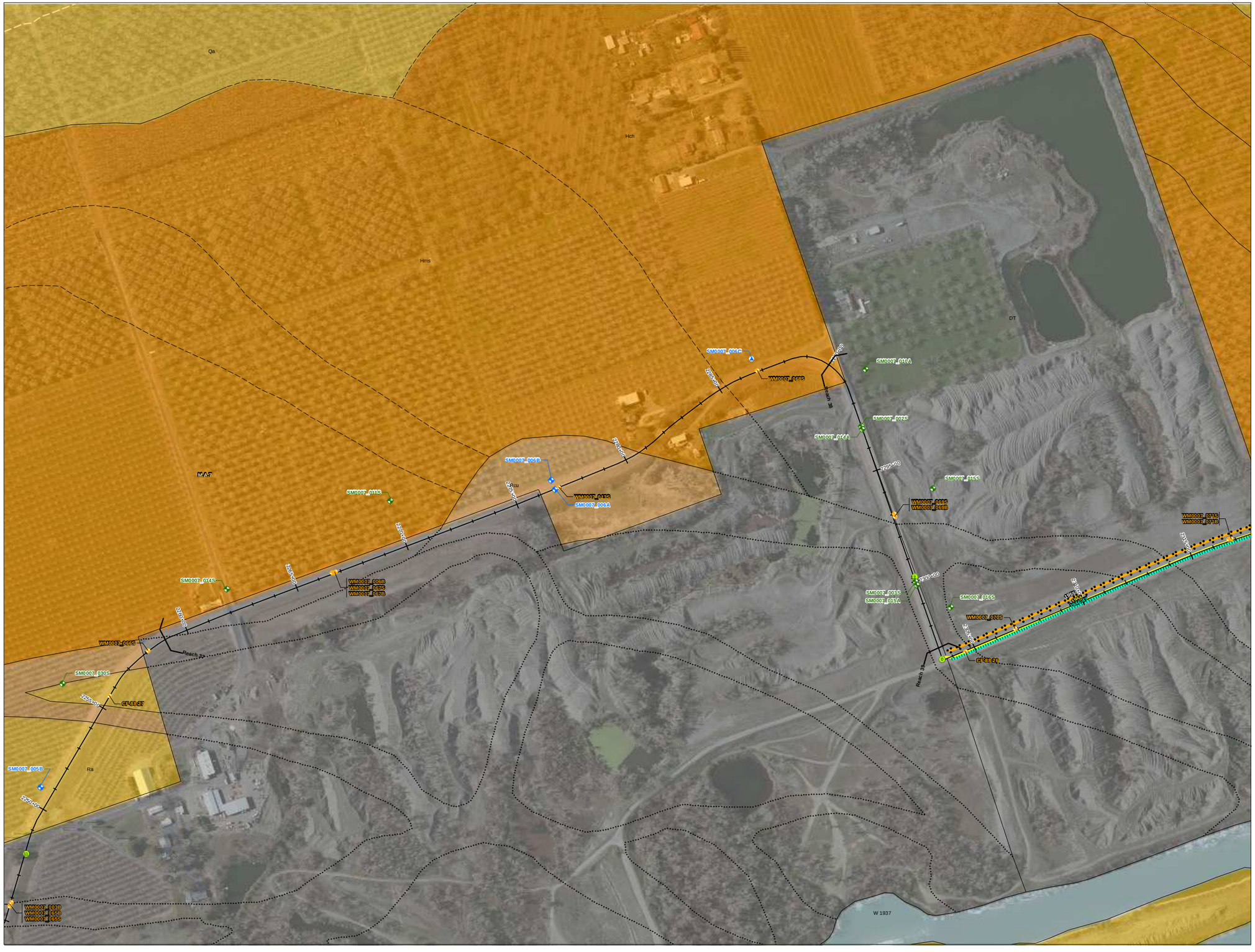
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 47

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 30 Oct 2012 2AC



N

0 100 200

Feet

NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 2260+00 to Station 2310+00

URS

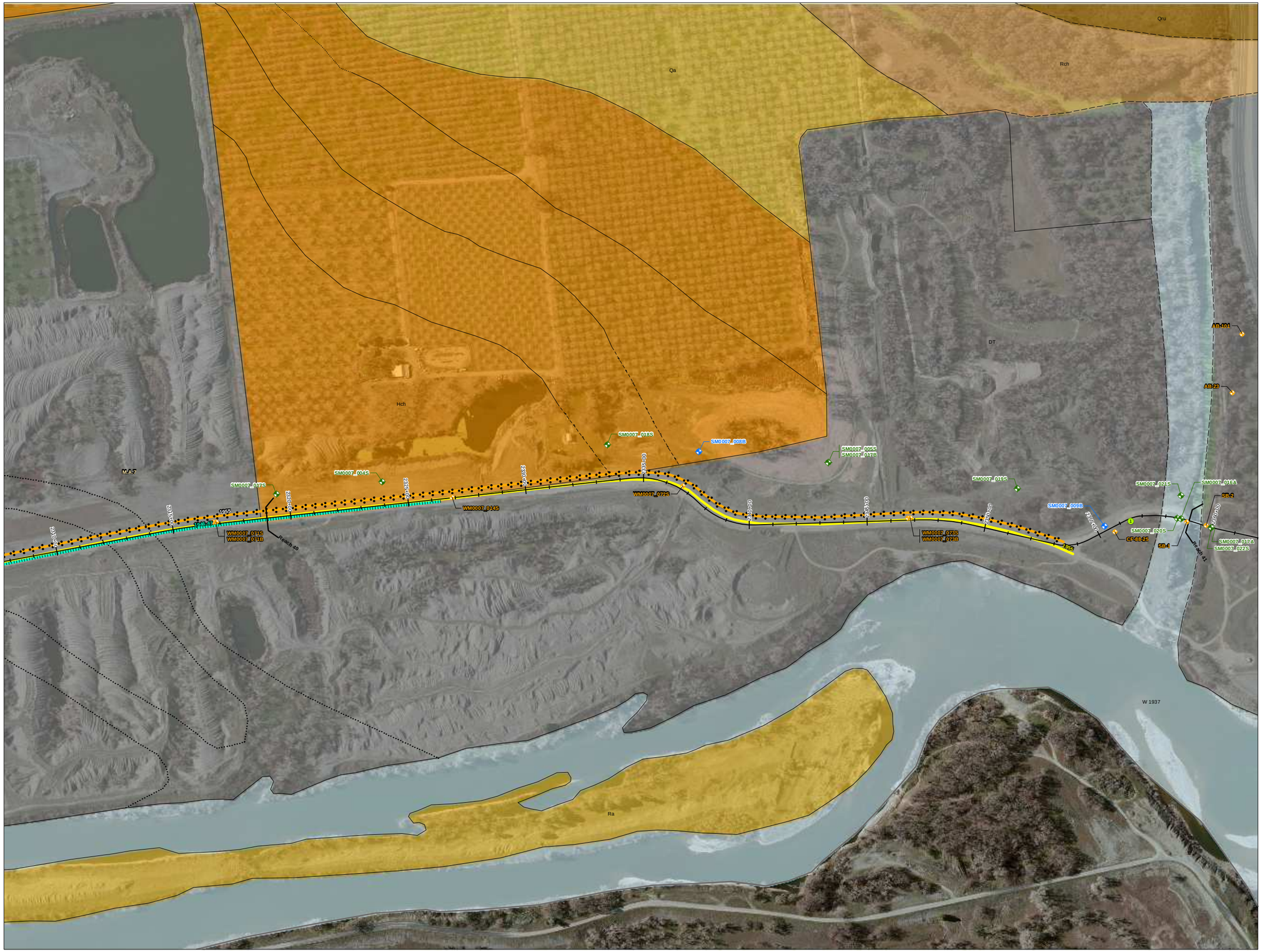
Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 48

L:\Projects\SBFCA\Maps\SBFCA_GDR_Maps\xxx.mxd RK 10 Oct 2012 14:C





NOTES:

1. This is a color figure. Black and white reproductions should not be relied upon as data will be lost.
2. Surficial geology was mapped at 1:20,000 scale. (Source: DWR, 2010a)



FRWL Project Plan Views

FRWL Project: Station 2310+00 to Station 2360+00

URS

Geotechnical Data Report

Sutter Butte Flood Control Agency

FEATHER RIVER WEST LEVEE PROJECT

Figure 49

L:\Projects\SBFCA\Maps\SBFCA_GDR_Mapbook.mxd Rev. 10 Oct 2012 SAC


Rch
DT
W 1937
AB-01
AB-02
AB-03
AB-04
AB-05
AB-06
AB-07
AB-08
AB-09
AB-10
AB-11
AB-12
AB-13
AB-14
AB-15
AB-16
AB-17
AB-18
AB-19
AB-20
AB-21
AB-22
AB-23
AB-24
AB-25
AB-26
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AB-32
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AB-35
AB-36
AB-37
AB-38
AB-39
AB-40

APPENDIX A

Task Order 1
Boring Logs

GROUP SYMBOLS AND NAMES

Graphic	Group Names	Graphic	Group Names	Graphic	Group Names
	Lean Clay (CL)		Lean Clay with Sand (CL)		Lean Clay with Gravel (CL)
	Sandy Lean Clay (CL)		Fat Clay (CH)		Fat Clay with Sand (CH)
	Fat Clay with Gravel (CH)		Sandy Fat Clay (CH)		Silty Clay (CL-ML)
	Silty Clay with Sand (CL-ML)		Sandy Silty Clay (CL-ML)		Clayey Silt (ML/CL)
	Silt (ML)		Silt with Sand (ML)		Sandy Silt (ML)
	Elastic Silt (MH)		Sandy Elastic Silt (MH)		Poorly Graded Sand (SP)
	Poorly Graded Sand with Gravel (SP)		Poorly Graded Sand with Clay (SP-SC)		Poorly Graded Sand with Clay and Gravel (SP-SC)
	Poorly Graded Sand with Silt (SP-SM)		Poorly Graded Sand with Silt and Gravel (SP-SM)		Well-Graded Sand (SW)
	Well-Graded Sand with Gravel (SW)		Well-Graded Sand with Clay (SW-SC)		Well-Graded Sand with Clay and Gravel (SW-SC)
	Well-Graded Sand with Silt (SW-SM)		Well-Graded Sand with Silt and Gravel (SW-SM)		Clayey Sand (SC)
	Clayey Sand with Gravel (SC)		Silty Clayey Sand (SC-SM)		Silty Sand (SM)
	Silty Sand with Gravel (SM)		Poorly Graded Gravel (GP)		Poorly Graded Gravel with Sand (GP)
	Poorly Graded Gravel with Clay (GP-GC)		Poorly Graded Gravel with Clay and Sand (GP-GC)		Poorly Graded Gravel with Silt (GP-GM)
	Poorly Graded Gravel with Silt and Sand (GP-GM)		Well-Graded Gravel (GW)		Well-Graded Gravel with Sand (GW)
	Well-Graded Gravel with Clay (GW-GC)		Well-Graded Gravel with Clay and Sand (GW-GC)		Well-Graded Gravel with Silt (GW-GM)
	Well-Graded Gravel with Silt and Sand (GW-GM)		Clayey Gravel (GC)		Clayey Gravel with Sand (GC)
	Silty Clayey Gravel (GC-GM)		Silty Gravel (GM)		Silty Gravel with Sand (GM)

Note: Soils were classified in the field in general accordance with ASTM D2488-06, Standard Practice for Description and Identification of Soils (Visual Manual Procedure). Where laboratory testing was performed, classifications were modified in general accordance with ASTM D2487-06, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

Borderline symbols, two group symbols separated by a slash, may be used in field visual classification when (1) percentage of fines is estimated to be between 45% and 55%, (2) percentages of sand and gravel are estimated to be about the same, (3) soil could be either well graded or poorly graded, (4) soil could be either a silt or a clay, or (5) fine-grained soil has properties indicating that it is at the boundary between low and high plasticity. Refer to DWR Soil and Rock Logging, Classification, and Presentation Manual for guidelines in the use of borderline symbols.

FIELD AND LABORATORY TESTS

AL	Atterberg Limits - Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02 & T 90-00)
CCRS	One Dimensional Consolidation Controlled-Strain (ASTM D 4186)
CDDS	Consolidated Drained Direct Shear
CL	Collapse Potential (ASTM D 5333-03)
CN	Consolidation (ASTM D 2435-04)
CP	Relative Compaction (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CRSC	Constant Rate of Strain Consolidation
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
CUDS	Consolidated Undrained Direct Simple (ASTM D 6528-07)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
FWK	Hydraulic Conductivity Flexible Wall Permeameter (ASTM D 5084)
HD	Hydrometer (ASTM)
N_{60}	$N_{60}(ASTM)=N_m*(Eri/60)$
OC	Organic Content (ASTM D 2974-07)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PE	Permeability (CTM 220 - 05)
PM	Pressure Meter
PP	Pocket Penetrometer
RV	R-Value (CTM 301 - 00)
SCUDSS	Special Consolidated Undrained Direct Simple Shear (ASTM D 6528)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression (ASTM D 2166-06)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223 - 96 [2004])
WC	Water Content (ASTM D 2216-05)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test
- Standard California
- Modified California
- Shelby Tube
- Punch Core
- Sonic Core
- Dry Core
- Bag Sample
- Vane Shear
- Tricone Bit
- NSD — Non Sample Drilling

WATER LEVEL SYMBOLS

- First water encountered during drilling
- Water level measured after drilling
- Static water level reading (short-term)
- Static water leavel reading (long-term)

SBFCA PAGE1 DYNAMIC NO WELL GRAPHICS SBFCA FRWL.GPJ SUTTERBUTTELIBRARY01272012.GLB 2/21/12

SUTTER BUTTE FLOOD CONTROL AGENCY

SBFCA Feather River West Levee

BORING LOG LEGEND

CONSISTENCY OF COHESIVE SOILS (AASHTO 1988)		
Descriptor	**Pocket Penetrometer (tsf)**	**Torvane (tsf)**
Very Soft	< 0.25	< 0.12
Soft	0.25 - 0.50	0.12 - 0.25
Medium Stiff	0.50 - 1.0	0.25 - 0.50
Stiff	1.0 - 2.0	0.50 - 1.0
Very Stiff	2.0 - 4.0	1.0 - 2.0
Hard	> 4.0	> 2.0

APPARENT DENSITY OF COHESIONLESS SOILS (ASTM 6066-96 (2004))	
Descriptor	**SPT N(60) - Value (blows / foot)**
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE (ASTM D 2488-06)	
Descriptor	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

SOIL PARTICLE SIZE (ASTM D 2488-06)		
Descriptor		**Size**
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

DRY STRENGTH OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
None	Dry specimen crumbles into powder with mere pressure of handling.
Low	Dry specimen crumbles into powder with some finger pressure.
Medium	Dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	Dry specimen cannot be broken with finger pressure; will break into pieces between thumb and a hard surface.
Very High	Dry specimen cannot be broken between thumb and a hard surface.

DILATANCY OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear, or disappears slowly, upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

TOUGHNESS OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

CEMENTATION (ASTM D 2488-06)	
Descriptor	**Criteria**
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure.

SBFCA Feather River West Levee

BORING LOG LEGEND

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/30/10	9/30/10	50.4 ft	NAVD 88	86.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Precision		Tony Young	John Perez	2 ft
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
HSA, Mud Rotary		CME75 TMR		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4.5" ID HSA, 3-7/8" Tricone Drag Bit		Hex Rod 1.25"		Mehrzad Maghsoudlou
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** HSA, 8.25"		**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
MCal(2.5"), SPT(1.375")		Marl, automatic, 140 lbs / 30-inch drop		74%
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite slurry			23.5 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
50	0		[LEVEE FILL] LEAN CLAY (CL); medium stiff; dark brown (10YR 3/3); moist; 100% low plasticity, no dilatancy fines.		1A 1B	83	4 7 5								1A_0.5-1.0 1B_1.0-1.5
FILL	1														
	2		LEAN CLAY (CL); medium stiff; dark brown (10YR 3/3); moist; 100% low plasticity, no dilatancy fines.		2	33	[12] 2 3 5	10							2_1.5-3.0
	3		At 3 feet brown (10YR 4/3).		3A 3B	83	[8] 5 9 18			17	36	19			3A_3.5-4.0 3B_4.0-4.5
45	4														
	5				4A 4B	83	[27] 14 57		>4.5P						4A_5-5.5 4B_5.5-6
	6		At 5.5 feet hard.		5A 5B 5C	94	50 [107] 7								5A_6-6.5 5B_6.5-7 5C_7-7.5
	7														
	8		SILT (ML); very stiff; brown (10YR 4/3); moist; 100% low plasticity, slow dilatancy fines.		6A 6B 6C	94	18 27 [45]		3.5P	32	37	9			6A_7.5-8 6B_8-8.5 6C_8.5-9
	9						7 15 23								
40	10		ELASTIC SILT (MH); very stiff; brown (10YR 4/3); moist; 100% high plasticity, no dilatancy fines.		7	100	[38] 6 8	25		32	50	21			7_10-11.5
	11														
	12		SANDY LEAN CLAY (CL); very stiff; brown (10YR 4/3); moist; 62% low plasticity, slow dilatancy fines; 38% fine sand.		8A 8B 8C	100	12 [20] 6								8A_11.5-12 8B_12-12.5 8C_12.5-13
	13						16 24								
	14						[40]								
	15				9	94	6 8 14	27	4.0P				62	PA	9_14-15.5
35	16						[22]								
	17				10	78	6 9 10	23							10_16.5-18
	18						[19]								
	19		Poorly Graded SAND with Silt (SP-SM); medium dense; dark grayish brown (10YR 4/2); moist; 92% medium		11	67	5	26							11_19-20.5
	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,151,351.94 **Easting:** 6,672,938.57
Latitude: 39.06894 **Longitude:** -121.60807
Levee Station or Milepost: 734+85 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
30	20		sand; 8% no plasticity fines.	X	11	67	10 11 [21]	26							
	21														
	22			X	12	67	4 7 7 [14]	17	0.75P						12_21.5-23
	23														
	24			X	13		3 3 3 [6]	7	0.5P						13_24-25.5
25	25		At 25 feet loose.												
	26														
	27			X	14	89	1 1 2 [3]	4					8	PA	14_26.5-28
	28		At 27.5 feet very loose.												
	29			X	15	83	2 3 8 [11]	14							15_29-30.5
20	30		At 30 feet medium dense.												
	31														
	32			X	16	100	13 24 37 [61]	75							16_31.5-33
	33		At 32.5 feet very dense.												
	34		SANDY SILT (ML); medium dense; very dark greenish gray (10BG 3/1); moist; 75% no plasticity, rapid dilatancy fines; 25% fine sand.	X	17	72	6 10 12 [22]	27							17_34-35.5
15	35														
	36														
	37		SILT (ML); medium dense; very dark greenish gray (10BG 3/1); moist; 92% no plasticity, rapid dilatancy fines; 8% fine sand.	X	18	56	6 11 13 [24]	30							18_36.5-38
	38														
	39			X	19	56	6 18 26 [44]	54	>4.5P						19_39-40.5
10	40		At 40 feet very dense.												
	41														
	42		At 42 feet dense.	X	20	50	4 11 20 [31]	38							20_41.5-43
	43														
	44			X	21	100	4	27					92	PA	21_44-45.5
	45		At 44.5 feet medium dense.												

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,151,351.94 **Easting:** 6,672,938.57
Latitude: 39.06894 **Longitude:** -121.60807
Levee Station or Milepost: 734+85 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001B
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
5	45			X	21	100	9 13 [22]	27					92	PA	
	46														
	47			X	22	100	6 11 13 [24]	30							22_46.5-48
	48														
	49		Poorly Graded SAND with Silt (SP-SM); very dense; very dark greenish gray (10BG 3/1); wet; 90% medium sand; 10% no plasticity fines.	X	23	56	10 18 28 [46]	57							23_49-50.5
0	50														
	51														
	52		SILT (ML); medium dense; very dark greenish gray (10BG 3/1); moist; 90% no plasticity, rapid dilatancy fines; 10% fine sand.	X	24	81	2 7 14 [21]	26							24_51.5-53
	53														
	54			X	25A 25B	72	10 13 18 [31]		2.0P						25A_54.5-55 25B_55-55.5
-5	55														
	56														
	57			X	26	67	4 5 10 [15]	19	0.75P						26_56.5-58
	58														
	59			X		0	7 9 17 [26]								No Recovery
-10	60														
	61														
	62			X		0	1 0 0 [0]	0							No Recovery
	63		At 72.5 feet very loose.												
	64		Poorly Graded SAND with Silt (SP-SM); very dense; very dark greenish gray (10BG 3/1); wet; 95% medium sand; 5% no plasticity fines.	X	27	89	8 25 31 [56]	69							27_64-65.5
-15	65														
	66														
	67			X	28	89	34 24 50/6" [74/12"]						5	PA	28_67-68.5
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,151,351.94 **Easting:** 6,672,938.57
Latitude: 39.06894 **Longitude:** -121.60807
Levee Station or Milepost: 734+85 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001B
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
-20	70														
	71														
	72														
	73														
	74		Well-Graded GRAVEL with Sand (GW); 70% fine to coarse gravel; 30% fine sand.												Soil identified from cuttings. No sample retained.
-25	75														
	76														
	77														
	78														
	79														
-30	80														
	81														
	82														
	83		LEAN CLAY (CL); brown (10YR 4/3); 90% low plasticity fines; 10% fine sand.												Soil identified from cuttings. No sample retained.
-35	84														
	85														
	86		End of boring at 86'. Backfilled with cement bentonite slurry. 32-47 lb. bags cement, 190 gallons water, 20 lb. bentonite.												
	87														
	88														
	89														
-40	90														
	91														
	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: **Northing:** 2,151,351.94 **Easting:** 6,672,938.57
Latitude: 39.06894 **Longitude:** -121.60807
Levee Station or Milepost: 734+85 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/1/10	10/1/10	54.5 ft	NAVD 88	80.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	0 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA, 3-7/8" Tricone Drag Bit	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	HSA, 8.25", 25' & 50'	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite slurry	21 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		CLAYEY SAND (SC); very dense; very dark grayish brown (10YR 3/2); moist; 75% fine to medium sand; 25% medium plasticity fines.		1A 1B	75	17 50/6" [50/6"]								1A_0.0-0.5 1B_0.5-1.0
	1														
	2														
	3		SILTY SAND (SM); medium dense; very dark grayish brown (10YR 3/2); moist; 78% fine to medium sand; 22% no plasticity fines.		2	56	3 5 4 [9]	11					22	PA	2_2.5-4
50	4														
	5				3	83	1 2 3 [5]	6							3_5-6.5
	6		At 6 feet loose.												
	7														
	8				4A 4B	67	3 2 3 [5]								4A_8-8.5 4B_8.5-9
45	9														
	10		Poorly Graded SAND (SP); loose; very dark grayish brown (10YR 3/2); moist; 95% fine to medium sand; 5% no plasticity fines.		5	94	3 3 4 [7]	9							5_10-11.5
	11														
	12														
	13				6	33	5 3 4 [7]	9							6_12.5-14 Piece of plastic at bottom of shoe
40	14														
	15				7	100	8 4 5 [9]	11					5	PA	7_15-16.5
	16		At 16 feet medium dense.												
	17														
	18		At 18 feet loose.		8	22	4 3 4 [7]	9							8_12.5-19 Piece of plastic at bottom of shoe
	19														
35	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,163,559.13 **Easting:** 6,673,391.89
Latitude: 39.10246 **Longitude:** -121.60628
Levee Station or Milepost: 867+20 **Levee Mile:** 0
Levee Segment Reach 13
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_002B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		At 20 feet same as above except very loose; wet.		9	56	2 1 2 [3]	4							9_20-21.5
	21														
	22														
	23		At 22.5 feet same as above except medium dense; dark greenish gray (10BG 4/1).		10	67	3 4 12 [16]	20							10_22.5-24
30	24														
	25				11	56	3 4 6 [10]	12							11_25-26.5 Switched to mud.
	26														
	27														
	28				12	61	6 6 7 [13]	16							12_27.5-29
	29														
25	30					0	7 4 6 [10]	12							No Recovery
	31														
	32														
	33		Poorly Graded SAND with Clay (SP-SC); 92% fine sand; 8% low plasticity fines.		13	72	5 6 8 [14]	17					8	PA	13_32.5-34
	34														
20	35				14	56	8 7 15 [22]	27							14_35-36.5
	36														
	37		Well-Graded GRAVEL with Sand (GW); very dense; very dark greenish gray (10BG 3/1); wet; 90% fine to coarse gravel; 5% sand; 5% no plasticity fines; some gravel pieces are broken off larger clasts of cobble size.		15	17	17 35 26 [61]	75							15_37.5-39
	38														
	39														
15	40				16	22	12 19 22 [41]	51					5	PA	16_40-41.5 Broken rock in shoe.
	41														
	42														
	43				17	56	14 30 50 [80]	99							17_42.5-44
	44														Lost about 150 gallons of
10	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,163,559.13 **Easting:** 6,673,391.89
Latitude: 39.10246 **Longitude:** -121.60628
Levee Station or Milepost: 867+20 **Levee Mile:** 0
Levee Segment Reach 13
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_002B
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45				18	67	35 27 40 [67]	83							circulation. 18_45-46.5
	46														
	47														
	48														Lost 100 gallons of circulation.
	49														
5	50				19	44	39 50/3" [50/3"]								19_49-50.5 Extended casing (HSA) to50'. Lost 150 gallons of circulation.
	51														
	52														
	53														
	54		At 54 feet medium dense.		20	17	7 5 6 [11]	14							20_53-54.5 Lost 100 gallons of circulation.
0	55														
	56		At 56 feet dense.		21	11	4 5 21 [26]	32							21_55.5-57 Rock in shoe.
	57														
	58														
	59														
-5	60		SILTY SAND (SM); dense; very dark greenish gray (10BG 3/1); moist; 60% fine sand; 40% no plasticity fines.		22	44	15 16 17 [33]	41							22_60-61.5
	61														
	62														
	63				23A 23B	100	16 17 21 [38]	47							23A_62.5-63.5 23B_63.5-64
	64		FAT CLAY (CH); very dark greenish gray (10BG 3/1); moist; 100% high plasticity, no dilatancy fines.												
-10	65				24	94	8 10 13 [23]	28							24-65-66.5
	66														
	67														
	68		SILT (ML); 100% no plasticity, slow dilatancy fines.		25A 25B 25C	100	14 16 19 [35]		3.5P	34	36	10			25A_67.5-68 25B_68-68.5 25C_68.5-69
-15	69														
	70														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,163,559.13 **Easting:** 6,673,391.89
Latitude: 39.10246 **Longitude:** -121.60628
Levee Station or Milepost: 867+20 **Levee Mile:** 0
Levee Segment Reach 13
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_002B
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70		SILTY SAND (SM); dense; dark greenish gray (10BG 4/1); moist; 80% fine to medium sand; 20% no plasticity fines.		26	44	8 9 18 [27]								26_71-71.5
	71														
	72														
	73				27	67	12 15 17 [32]	39							27_73-74.5
	74												20	PA	
-20	75					0	26 25 21 [46]	57							No Recovery Rock in shoe.
	76		At 75.5 feet very dense.												
	77														
	78														
	79				28A 28B	67	15 16 26 [42]	52							28A_78.5-79.5 28B_79.5-80
-25	80		LEAN CLAY (CL); very dark greenish gray (10BG 3/1); moist; 100% medium plasticity, no dilatancy fines.												
	81		End of boring at 80'. Backfilled with cement bentonite slurry. 34-47 lb. bags cement, 178 gallons water, 41 lb. bentonite.												
	82														
	83														
	84														
-30	85														
	86														
	87														
	88														
	89														
-35	90														
	91														
	92														
	93														
	94														
-40	95														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,163,559.13 **Easting:** 6,673,391.89
Latitude: 39.10246 **Longitude:** -121.60628
Levee Station or Milepost: 867+20 **Levee Mile:** 0
Levee Segment Reach 13
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_002B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/8/10	10/8/10	66.4 ft	NAVD 88	81.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	2 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA, 3-7/8" Tricone Drag Bit	NRod 94mm	Sheri Janowski

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	4.5" ID HSA, 31.5'	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
StdCal(2.5"), MCal(2.5")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Neat cement grout to surface	26.4 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
FILL	0		[LEVEE FILL] CLAYEY SAND (SC); hard; dark brown (10YR 3/3); moist; 55% fine sand; 45% low plasticity, rapid dilatancy fines; trace subangular gravel; no cementation.		1	89	13 11 9 [20]		>4.5P						1_0.0-2.0
65	2		LEAN CLAY (CL); hard; dark brown (10YR 3/3); moist; 90% low to medium plasticity, slow dilatancy fines; 10% fine sand.		2	67	5 5 5 [10]		>4.5P	16	29	13			2_3.0-4.0
	5		SANDY SILT (ML); dark brown (10YR 3/3); moist; 55% no plasticity, rapid dilatancy fines; 45% fine sand; weak cementation.		3	100	8 16 38 [54]								3_5.0-7.0
60	7		SILTY SAND (SM); brown (10YR 5/3); moist; 53% fine sand; 47% no plasticity fines; no to weak cementation; trace clay nodules.		4	100	50 40 50/5" [90/11"]						47	PA	4_8.0-9.0 Fines decreasing with depth.
	9		At 9 feet fine decreasing with depth.												
	10		Poorly Graded SAND with Silt (SP-SM); brown (10YR 5/3); moist; 94% fine sand; 6% no plasticity fines; no cementation; micaceous.		5	100	3 4 5 [9]								5_10.0-12.0
55	12				6	100	5 5 6 [11]						6	PA	6_13.0-14.0
	15				7	100	5 4 6 [10]								7_15.0-17.0 Coarsening with depth.
50	16		At 16.2 feet medium grained, 2-inch thick wet zone.												
	18		At 17.5 feet (10YR 4/3).		8	100	3 3 6 [9]								8_18.0-19.0
	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,191,019.37 **Easting:** 6,668,926.03
Latitude: 39.17791 **Longitude:** -121.62162
Levee Station or Milepost: 1163+75 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_001B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
45	21		Poorly Graded SAND with Gravel (SP); grayish brown (2.5Y 5/2); moist; 75% fine to medium sand; 20% fine to coarse, subangular gravel; 5% fines; no cementation.		9	78	6 8 17 [25]								9_20.0-22.0
	22		Poorly Graded SAND with Clay (SP-SC); brown (10YR 5/3); moist; 92% fine sand; 6% low plasticity fines; 2% fine gravel; no cementation; micaceous; trace coarse sand clasts.												
	23				10	89	5 8 11 [19]								10_23.0-24.0
	24														
	25				11	100	9 11 15 [26]								11_25.0-27.0
40	26		At 25.5 feet gray (2.5Y 6/1).												
	27														
	28		At 28 feet gray (2.5Y 5/1); wet.		12	89	5 7 11 [18]						6	PA	12_28.0-29.0
	29														
	30				13	100	5 13 18 [31]								13_30.0-32.0
35	31														
	32		At 31.5 feet 10% subrounded to subangular gravel (not bagged).												Switch to mud rotary. Use HSA as casing.
	33		SILT (ML); very stiff; brown (10YR 5/3); 90% low plasticity fines; 10% fine sand.		14A 14B	72	17 21 26 [47]		3.25P	18	38	11			14A_33.0-34.0 14B_33.0-34.0
	34														
	35				15	78	9 13 19 [32]		2.0P						15_35.0-37.0
30	36														
	37														
	38				16A 16B	67	8 11 18 [29]		3.25P						16A_38.0-39.0 16B
	39		SANDY SILT (ML); yellowish brown (10YR 5/4); moist; 60% no to low plasticity, rapid dilatancy fines; 40% fine sand; no cementation.												
	40				17	89	6 5 5 [10]								17_40.0-42.0
25	41														
	42		Poorly Graded SAND with Clay (SP-SC); dark gray (2.5Y 4/1); wet; 93% medium sand; 7% low plasticity fines; no cementation.												
	43				18	94	7 8 10 [18]								18_43.0-44.0
	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,191,019.37 **Easting:** 6,668,926.03
Latitude: 39.17791 **Longitude:** -121.62162
Levee Station or Milepost: 1163+75 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_001B
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		At 45 feet micaceous.		19	100	5 4 8 [12]						7	PA	19_45.0-46.5
20	46														
	47														
	48				20	83	9 11 14 [25]								20_47.5-49.0
	49														
	50				21	72	8 11 13 [24]								21_50.0-51.5
15	51														
	52		Poorly Graded GRAVEL with Sand (GP); dark gray (2.5Y 4/1); wet; 55% fine to coarse, subangular gravel; 45% medium sand; gravel of mixed origin; no cementation; cobbles inferred due to blow counts and not able to advance sampler.												Rig chatter
	53				22	33	50								22_52.5-53.0
	54														
	55				23	78	25 24 28 [52]						9	PA	23_55.0-56.5
10	56														
	57														
	58				24		50/5" [REF]								24_57.5-58.0
	59														
	60				25	100	33 17 18 [35]		2.75P						25_60.75-61.5
	61		SANDY SILTY CLAY (CL/ML); very stiff to hard; very dark greenish gray (10G 3/1); moist; 70% low plasticity, slow dilatancy fines; 30% fine sand.												
5	62														
	63				26A 26B	100	29 50/5"		>4.5P						26A_63.0-63.5 26B_62.5-63.0
	64		SANDY LEAN CLAY (CL); hard; very dark greenish gray (10G 3/1); moist; 70% medium plasticity, slow dilatancy fines; 30% fine sand.				[50/ 5"]								
	65				27A 27B	83	21 34 42 [76]		>4.5P	20	35	18			27A_66.0-66.5 27B_65.5-66.0
0	66														
	67														
	68		CLAYEY SAND (SC); hard; very dark greenish gray (10G 3/1); moist; 60% fine sand; 40% low plasticity, rapid dilatancy fines; no cementation.												
	69														
	70														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,191,019.37 **Easting:** 6,668,926.03
Latitude: 39.17791 **Longitude:** -121.62162
Levee Station or Milepost: 1163+75 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_001B
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70														
	71				28	83	22 50		>4.5P						28_70.5-71.0
-5	72														
	73														
	74		Poorly Graded SAND with Gravel (SP-SC); very dark greenish gray (10G 3/1); moist; 90% medium sand; 10% low plasticity, rapid dilatancy fines; weak cementation; micaceous.												
	75														
	76		From 75.5 to 76.5 feet more fines then rest of sample, fine sand.		29	83	13 26 38								29_76.0-76.5
-10	77						[64]								
	78														
	79		CLAYEY SAND (SC); hard; very dark greenish gray (10G 3/1); moist; 60% fine sand; 40% low plasticity, rapid dilatancy fines; no cementation.												
	80														
	81				30	100	17 26 43								30_80.0-81.5
-15	82						[69]								
	83		End of boring at 81.5'. Backfilled with cement bentonite slurry. 8-47 lb. bags cement, 80 gallons water, 5% bentonite, tremie grout to surface.												
	84														
	85														
	86														
-20	87														
	88														
	89														
	90														
	91														
-25	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: **Northing:** 2,191,019.37 **Easting:** 6,668,926.03
Latitude: 39.17791 **Longitude:** -121.62162
Levee Station or Milepost: 1163+75 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_001B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/12/10	8/12/10	87.9 ft	NAVD 88	86.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	22 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA, 3-7/8" Tricone Drag Bit	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	HSA, 8.25", 50'	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite slurry	46.5 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road Gravels.												
	1		[LEVEE FILL] SILT (ML); very stiff; dark yellowish brown (10YR 4/4); moist; 100% low plasticity, no dilatancy fines.		1A 1B	67	8 17 18 [35]								1A_0.5-1.0 1B_1.0-1.5
	2														
85	3				2A 2B	67	6 5 7 [12]		2.0P	15	24	1			2A_3.0-3.5 2B_3.5-4.0
	4														
	5				3A 3B	89	6 7 9 [16]		2.5P						3A_5.5-6.0 3B_6.0-6.5
	6														
	7														
80	8		[LEVEE FILL] SILT with Sand (ML); stiff; dark yellowish brown (10YR 4/4); moist; 80% low plasticity, no dilatancy fines; 20% fine sand.		4A 4B	78	3 2 4 [6]		1.0P	32	40	8			4A_8.0-8.5 4B_8.5-9.0
	9														
	10				5A 5B	89	4 6 11 [17]								5A_10.5-11.0 5B_11.0-11.5
	11														
	12				6A 6B	72	5 7 8 [15]		2.0P						6A_12.5-13.0 6B_13.0-13.5
75	13														
	14														
	15		At 15 feet hard.		7A 7B	78	6 10 12 [22]		4.5P						7A_15.0-15.5 7B_15.5-16.0
	16														
	17				8A 8B	100	8 7 10 [17]		3.0P 3.5P						8A_17.5-18.0 8B_18.0-18.5
70	18		At 18 feet very stiff.												
	19														
	20				9A	78	2		2.0P						9A_20.0-20.5

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee Crest **County:** Sutter
Coordinates: Northing: 2,200,512.50 **Easting:** 6,666,651.53
Latitude: 39.20400 **Longitude:** -121.62951
Levee Station or Milepost: 1265+84 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_002B
Sheet 1 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20				9B	78	3		2.0P						9B_20.5-21.0
FILL	21				9A		7		2.0P						
	22				9B		[10]		2.0P						
65	23		[LEVEE FILL] SILT with Sand (ML); hard; dark yellowish brown (10YR 4/4); moist; 80% low plasticity, no dilatancy fines; 20% fine sand.		10A	89	7		>4.5P						10A_22.5-23.0
	24				10B		19		>4.5P						10B_23.0-23.5
	25						18								
	26				11A	78	[37]								11A_25.0-25.5
	27				11B		8								11B_25.5-26.0
60	28				12A	56	17		>4.5P						12A_27.5-28.0
	29		SANDY SILT (ML); dark brown (10YR 3/3); moist; 62% medium plasticity, rapid dilatancy fines; 38% fine sand.		12B		19		>4.5P						12B_28.0-28.5
	30				13A	94	[36]								13A_30.0-30.5
	31				13B		11								13B_30.5-31.0
	32						50/6"								
55	33		Poorly Graded SAND with Silt (SP-SM); dense; very dark grayish brown (2.5Y 3/2); 92% fine to medium, subangular sand; 8% no plasticity fines.		14A		[50/6"]								14A_32.5-33.0
	34				14B		5		2.0P				62	PA	14B_33.0-33.5
	35						13		2.0P						
	36				15	44	16	38							13A_30.0-30.5
	37						[29]								13B_30.5-31.0
50	38				16	44	21	38							15_34.5-36.0
	39						25								
	40				17	67	29	57					8	PA	16_37.0-38.5
	41		At 40.5 feet very dense.				[54]								17_39.5-41.0
	42				18	56	8	41							
45	43		At 42.5 feet dense.				15								18_42.0-43.5
	44						16								
	45				19	39	[31]	42							19_44.5-46.0

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Sutter
Coordinates: Northing: 2,200,512.50 **Easting:** 6,666,651.53
Latitude: 39.20400 **Longitude:** -121.62951
Levee Station or Milepost: 1265+84 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_002B
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45		At 45 feet trace organics. Odorous layer is 3-inches thick.	X	19	39	17 17 [34]	42							
	46														
	47		At 46.5 feet, groundwater.	X	20	39	14 20 20 [40]	49							20_47.0-48.5
40	48														
	49														
	50														Switched over to mud at 50'.
	51			X	21	78	5 13 36 [49]	60							21_51.0-52.5
	52		At 51.5 feet very dense.												
35	53														
	54														
	55		SILTY SAND (SM); medium dense; very dark gray (2.5Y 3/1); wet; 70% fine sand; 30% no plasticity, rapid dilatancy fines.	X	22	39	5 5 6 [11]	14							22_55.0-56.5
	56														
	57														
30	58														
	59														
	60														
	61		Well-Graded SAND with Silt and Gravel (SW-SM); very dense; very dark gray (2.5Y 3/1); wet; 60% medium sand; 31% fine gravel; 9% no plasticity fines.	X	23	67	22 36 50/6" [86/12"]						9	PA	23_60.0-61.5
	62														
25	63														At 63 feet drill chattering. Difficult drilling.
	64														
	65			X	24	50	50/6" [REF]								24_65.0-65.5
	66														
	67														
20	68														
	69														
	70														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Sutter
Coordinates: Northing: 2,200,512.50 **Easting:** 6,666,651.53
Latitude: 39.20400 **Longitude:** -121.62951
Levee Station or Milepost: 1265+84 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_002B
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														
	71														
	72														
15	73														
	74														
	75														
	76		LEAN CLAY with Sand (CL); hard; very dark gray (2.5Y 3/1); moist; 85% medium to high plasticity fines; 15% fine sand.	X	25	44	9 16 20 [36]	44	>4.5P						25_75.0-76.5
	77														
10	78		At 78 feet very stiff, light olive brown (2.5Y 5/3).	X	26A 26B	67	13 22 35 [57]	70	2.5P	19	39	17			26A_78.0-78.5 26B_78.5-79.0
	79														
	80		At 80 feet hard, very dark gray (2.5Y 3/1).	X	27A 27B	67	23 36 50/6" [86/12"]		>4.5P						27A_80.0-80.5 27B_80.5-81.0
	81														
	82														
5	83														
	84														
	85			X	28	100	24 50/5" [50/5"]		>4.5P						28_85.0-86.0
	86		End of boring at 86'. Backfilled with cement bentonite slurry. 14-47 lb. bags cement, 70 gallons water, 5% bentonite.												
	87														
0	88														
	89														
	90														
	91														
	92														
-5	93														
	94														
	95														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Sutter
Coordinates: Northing: 2,200,512.50 **Easting:** 6,666,651.53
Latitude: 39.20400 **Longitude:** -121.62951
Levee Station or Milepost: 1265+84 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_002B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/7/10 **DATE COMPLETED**	**GROUND ELEVATION** 78.6 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 45.0 ft
DRILLING CONTRACTOR Precision	**DRILLER'S NAME** Tony Young **HELPER'S NAME** John Perez	**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA	**DRILL RIG MAKE AND MODEL** CME75 TMR	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" ID HSA	**DRILLING ROD TYPE AND DIAMETER** Hex Rod 1.25"	**FIELD LOGGER** Mehrzad Maghsoudlou
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH**	**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S) MCal(2.5"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop	**HAMMER EFFICIENCY** 74%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite slurry	**GROUNDWATER READING: DURING DRILLING** NA	**AFTER DRILLING (DATE-TIME)** NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); loose; dark brown (10YR 3/3); dry; 56% fine to medium sand; 44% medium plasticity fines.		1A 1B	78	7 13 12 [25]								1A_0.5-1.0 1B_1.0-1.5
	1														
	2														
75	3		At 3 feet becomes moist.		2A 2B	78	7 6 6 [12]						44	PA	2A_3-3.5 2B_3.5-4
	4														
	5				3	72	3 4 4 [8]	10							3_5-6.5
	6														
	7				4A 4B	78	4 4 4 [8]								4A_7-7.5 4B_7.5-8
70	8														
	9				5	67	3 4 4 [8]	10							5_9.5-10.5
	10		Poorly Graded SAND with Silt (SP-SM); loose to medium dense; very dark brown (10YR 2/2); 90% fine to medium sand; 10% no plasticity fines.												
	11														
	12				6	78	3 4 8 [12]	15							6_11.5-13
	13														
65	14				7	83	4 6 7 [13]	16							7_14-15.5
	15														
	16														
	17		At 17 feet coarse sand.		8	78	4 8 7 [15]	19							8_16.5-18
	18														
60	19				9	89	3	22							9_19-20.5
	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,215,755.75 **Easting:** 6,664,276.10
Latitude: 39.24588 **Longitude:** -121.63767
Levee Station or Milepost: 1423+81 **Levee Mile:**
Levee Segment Reach 21
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_003B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		At 20 feet few gravels.		9	89	7 11 [18]	22							
	21														
	22		SILT (ML); medium dense; brown (10YR 5/3); moist; 100% low plasticity, slow dilatancy fines.		10	78	5 5 10 [15]	19							10_21.5-23
55	23														
	24				11A 11B	89	7 11 14 [25]		3.5P	35	48	18			11A_24.5-25 11B_25-25.5
	25														
	26														
	27				12A 12B 12C	100	9 13 20 [33]		3.0P						12A_26.5-27 12B_27-27.5 12C_27.5-28
	28				13	100	3 5 5 [10]	12							13_28-29.5
50	29														
	30														
	31				13A 13B	89	6 16 27 [43]		>4.5P						13A_31-31.5 13B_31.5-32
	32														
	33				14A 14B	89	15 24 30 [54]		>4.5P						14A_33.5-34 14B_34-34.5
45	34														
	35														
	36														
	37		Poorly Graded SAND with Silt (SP-SM); dark gray (10YR 4/1); 90% fine to medium sand; 10% no plasticity fines.												
	38				15A 15B	89	8 12 18 [30]								15A_38-38.5 15B_38.5-39
40	39														
	40				16	72	5 11 14 [25]	31							16_40-41.5
	41														
	42														
	43														
35	44				17	50	3 8 10	22							17_43.5-45
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,215,755.75 **Easting:** 6,664,276.10
Latitude: 39.24588 **Longitude:** -121.63767
Levee Station or Milepost: 1423+81 **Levee Mile:**
Levee Segment Reach 21
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_003B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	45						[18]				
	46		End of boring at 45'. Backfilled with cement bentonite slurry. 11-47 lb. bags cement, 70 gallons water, 12 lb. bentonite								
	47										
	48										
30	49										
	50										
	51										
	52										
	53										
25	54										
	55										
	56										
	57										
	58										
20	59										
	60										
	61										
	62										
	63										
15	64										
	65										
	66										
	67										
	68										
10	69										
	70										

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: **Northing:** 2,215,755.75 **Easting:** 6,664,276.10
Latitude: 39.24588 **Longitude:** -121.63767
Levee Station or Milepost: 1423+81 **Levee Mile:**
Levee Segment Reach 21
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_003B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/11/10	8/11/10	108.5 ft	NAVD 88	31.5 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Precision		Tony Young	John Perez	10 ft
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
HSA		CME75 TMR		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4.5" ID HSA		Hex Rod 1.25"		Mehrzad Maghsoudlou
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** NA		**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
MCal(2.5"), SPT(1.375")		Marl, automatic, 140 lbs / 30-inch drop		74%
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			30 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road Gravels.												
	1		[LEVEE FILL] LEAN CLAY with Sand (CL); hard; very dark grayish brown (10YR 3/2); moist; 80% medium plasticity, no dilatancy fines; 20% sand.		1	83	34 30 35 [65]		>4.5P						1_1.0-1.5
	2														
105	3				2A 2B	78	7 12 20 [32]		>4.5P						2A_3.0-3.5 2B_3.5-4.0
	4														
	5				3A 3B	89	5 11 17 [28]			20	31	10			3A_5.5-6.0 3B_6.0-6.5
	6														
	7														
100	8				4A 4B	78	5 14 12 [26]		4.0P						4A_8.0-8.5 4B_8.5-9.0
FILL	9														
	10		LEAN CLAY with Sand (CL); hard; very dark grayish brown (10YR 3/2); moist; 80% medium plasticity, no dilatancy fines; 20% sand.		5A 5B	78	6 12 15 [27]								5A_10.5-11.0 5B_11.0-11.5
	11														
	12														
95	13				6A 6B	100	7 15 22 [37]			25	43	19			6A_13.0-13.5 6B_13.5-14.0
	14														
	15				7A 7B	89	5 17 34 [51]		4.0P						7A_15.5-16.0 7B_16.0-16.5
	16														
	17														
90	18		Poorly Graded SAND with Silt (SP-SM); medium dense; dark brown (10YR 3/3); moist; 94% fine to medium, angular to subangular sand; 6% no plasticity fines.		8A 8B	94	4 11 8 [19]								8A_18.0-18.5 8B_18.5-19.0
	19														
	20														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,259,739.02 **Easting:** 6,661,302.58
Latitude: 39.36667 **Longitude:** -121.64757
Levee Station or Milepost: 1906+90 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21			X	9	78	3 4 6 [10]	12					6	PA	9_20.0-21.5
	22														
	23			X	10	78	7 9 17 [26]	32							10_22.5-24.0
85	24		At 23.5 feet dense.												
	25														
	26		Well-Graded GRAVEL with Silt and Sand (GW-GM); dense to very dense; moist; 70% fine to coarse, rounded gravel; 18% sand; 12% no plasticity fines.	X		0	14 14 14 [28]	35							No Recovery
	27														
	28			X	11	56	15 32 50 [82]	101					12	PA	11_27.5-29.0
80	29														
	30		At 30 feet, groundwater.												
	31			X	12	44	30 50/5" [50/5"]								12_30.0-31.5
	32		End of boring at 31.5'. Backfilled with cement bentonite grout. 11-47 lb. bags cement, 70 gallons water, 5% bentonite												
	33														
75	34														
	35														
	36														
	37														
	38														
70	39														
	40														
	41														
	42														
	43														
65	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,259,739.02 **Easting:** 6,661,302.58
Latitude: 39.36667 **Longitude:** -121.64757
Levee Station or Milepost: 1906+90 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/22/10	9/22/10	103.0 ft	NAVD 88	30.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	NA	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	Not encountered during drilling	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		FAT CLAY with Sand (CH); very stiff; very dark grayish brown (10YR 3/2); dry; 80% medium plasticity, no dilatancy fines; 20% fine sand.		1A 1B	78	7 16 18		3.5P						1A_0.5-1.0 1B_1.0-1.5
	1														
	2				2	17	[34] 10 12 10	27							2_1.5-3.0
100	3														
	4				3A 3B	83	[22] 5 6 8		2.0P						3A_3.5-4.0 3B_4.0-4.5
	5				4		[14]								4_4.5-7.0 200 lb
	6														
	7				5	67	2 1 1 [2]	2							5_7-8.5
95	8														
	9								0.5P						No Recovery Started at 200 psi increased to 1500 psi at bottom. Tube crushed at bottom.
	10		SILT with Sand (ML); very dense; brown (10YR 4/3); moist; 74% no plasticity, slow dilatancy fines; 26% fine sand.												
	11				6	100	11 21 22	53							6_11.0-12.5
	12														
90	13				7A 7B 7C	89	[43] 5 16 22		3.5P	30	43	14			7A_12.5-13.0 7B_13.0-13.5 7C_13.5-14
	14						[38]								
	15				8	100	4 9 12	26							8_14.5-16
	16		At 15.5 feet medium dense.				[21]								
	17				9A 9B 9C	94	8 12 17								9A_16.5-17 9B_17-17.5 9C_17.5-
85	18						[29]								
	19				10	100	4 7 9	20					74	PA	10_18.5-20
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,259,681.42 **Easting:** 6,661,193.87
Latitude: 39.36651 **Longitude:** -121.64796
Levee Station or Milepost: 1906+92 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003A
Sheet 1 of 2

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20						[16]								
	21														
	22		SILTY SAND (SM); brown (10YR 4/3); moist; 54% fine to medium sand; 46% no plasticity fines.		11A 11B 11C	89	6 8 12						46	PA	11A_21-21.5 11B_21.5-22 11C_22-22.5
80	23						[20]								
	24		Poorly Graded GRAVEL (GP); very dense; moist; 57% fine to coarse, rounded gravel; 39% medium sand; 4% no plasticity fines.		12A 12B	67	14 24 50/5"								12A_24-24.5 12B_24.5-25
	25						[74/ 11"]								
	26		At 26 feet gravel size decreases.		13A 13B	72	23 42 43						4	PA	13A_26.5-27 13B_27-27.5
75	28						[85]								
	29		At 29 feet sampling rod reinserted encountered bottom at 25 feet due to caving.		14	94	15 29 43	89							14_28.5-30
	30						[72]								
	31		Boring terminated at 30'. Backfilled with cement bentonite grout. 16-47 lb. bags cement, 75 gallons water, 30 lb. bentonite												
	32														
70	33														
	34														
	35														
	36														
	37														
65	38														
	39														
	40														
	41														
	42														
60	43														
	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: **Northing:** 2,259,681.42 **Easting:** 6,661,193.87
Latitude: 39.36651 **Longitude:** -121.64796
Levee Station or Milepost: 1906+92 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/22/10	9/23/10	97.3 ft	NAVD 88	60.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA, 3-7/8" Tricone Drag Bit	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	HSA, 8.25", 33'	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite slurry	21.8 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY (CL); hard; dark yellowish brown (10YR 4/4); moist; 95% medium plasticity, no dilatancy fines; 5% fine sand.		1A 1B	67	3 10 14 [24]								1A_0.5-1.0 1B_1.0-1.5
95	2				2		6 7 10 [17]	21	>4.5P						2_2.0-3.5
	4				3A 3B	78	9 13 16 [29]								3A_4.0-4.5 3B_4.5-5.0
	6				4	100	4 6 7 [13]	16	>4.5P						4_6-7.5
90	8		At 8 feet trace roots.		5A 5B	72	3 5 12 [17]		>4.5P	21	34	15			5A_8.5-9.0 5B_9.0-9.5
	9				6	63									6_9.0-11.5 700 psi
	12				7A 7B	72	6 9 10 [19]		2.0P						7A_12-12.5 7B_12.5-13
85	13		At 12.5 feet very stiff.												
	14				8	67	1 2 2 [4]	5							8_14-15.5
	16		SILT (ML); medium dense; very dark grayish brown (10YR 3/2); moist; 89% no plasticity, slow dilatancy fines; 11% fine sand.		9	93									9_15.5-18
80	18				10A 10B	78	4 4 7 [11]		3.0P	37	37	8			10A_18.5-19 10B_19-19.5
	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,261,186.77 **Easting:** 6,660,618.41
Latitude: 39.37065 **Longitude:** -121.64997
Levee Station or Milepost: 1922+91 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21			X	11	67	4 4 7 [11]	14							11_20.5-22
75	22														Hole clean, no heave
	23														
	24			X	12	44	2 4 7 [11]	14					89	PA	12_23.5-25
	25														No heave
	26														
70	27				13	83									13_26-28.5 26-27.5 400 lb. 27.5-28.5 100 lb.
	28														No heave
	29		SANDY SILT (ML); medium dense; dark olive brown (2.5Y 3/3); 61% medium plasticity fines; 39% fine sand.	X	14A 14B	78	7 10 15 [25]								14A_29-19.5 14B_29.5-30
	30														Hole stable, no heave
	31														
65	32			X	15	72	6 10 14 [24]	30					61	PA	15_31-32.5
	33														Switching to mud
	34			X	16	72	6 7 12 [19]	23							16_33.5-35
	35														
	36														
	37			X	17	17	6 10 24 [34]	42							17_36-37.5
60	38		Well-Graded SAND with Gravel (SW); wet; 80% fine to coarse sand; 20% fine gravel.												
	39			X	18	28	44 50/3" [50/3"]						52	PA	18_38.5-40
	40		SANDY SILT (ML/SM); very dense; wet; 52% low plasticity fines; 45% fine to coarse sand; 3% fine gravel, max. 3/4 in..												difficult drilling
	41		Well-Graded GRAVEL with Silt and Sand (GW-GM); wet; 53% fine to coarse, subrounded gravel; 39% sand; 8% no plasticity fines.	X	19	44	36 47 50/5" [97/11"]						8	PA	19_41-42.5
55	42														
	43		SILT (ML); hard; olive brown (2.5Y 4/3); moist; 95% medium plasticity, slow dilatancy fines; 5% fine sand.												
	44			X	20	44	15 17 18	43							20_43.5-45
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,261,186.77 **Easting:** 6,660,618.41
Latitude: 39.37065 **Longitude:** -121.64997
Levee Station or Milepost: 1922+91 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45						[35]								
	46				21A 21B	83	13 23 38		4.0P	41	43	13			21A_46.5-47 21B_47-47.5
50	47														
	48						[61]								
	49				22	44	19 50/6"								22_49-49.5
	50						[50/ 6"]								
	51				23A 23B	78	25 32 50/5"								23A_51.5-52 23B_52-52.3
45	52														
	53						[82/ 11"]								
	54		CLAYEY SAND (SC); very dense; olive brown (2.5Y 4/3); moist; 55% medium plasticity fines; 45% fine sand.		24A 24B	89	15 32 50/5"								24A_54-54.5 24B_54.5-55
	55						[82/ 11"]								
	56				25A 25B	78	14 25 33								25A_56.5-57 25B_57-57.5
40	57														
	58						[58]								
	59				26A 26B	72	14 23 32								26A_59-59.5 26B_59.5-60
	60						[55]								
	61		End of boring at 60'. Backfilled with cement bentonite slurry. 13-47 lb. bags cement, 100 gallons water, 20 lb. bentonite												
	62														
35	63														
	64														
	65														
	66														
	67														
30	68														
	69														
	70														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: **Northing:** 2,261,186.77 **Easting:** 6,660,618.41
Latitude: 39.37065 **Longitude:** -121.64997
Levee Station or Milepost: 1922+91 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/29/10 **DATE COMPLETED** 10/6/10	**GROUND ELEVATION** 88.9 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 50.0 ft
DRILLING CONTRACTOR Precision	**DRILLER'S NAME** Tony Young **HELPER'S NAME** John Perez	**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA, Mud Rotary	**DRILL RIG MAKE AND MODEL** CME75 TMR	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" ID HSA, 3-7/8" Tricone Drag Bit	**DRILLING ROD TYPE AND DIAMETER** Hex Rod 1.25"	**FIELD LOGGER** Mehrzad Maghsoudlou
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** HSA, 8.25", 48'	**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S) MCal(2.5"), Shelby(2.87"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop	**HAMMER EFFICIENCY** 74%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite slurry	**GROUNDWATER READING: DURING DRILLING** 8 ft	**AFTER DRILLING (DATE-TIME)** NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); dark grayish brown (10YR 4/2); moist; 70% fine sand; 30% no plasticity fines.		1A 1B 1C	89	5 6 5 [11]								1A_0-0.5 1B_0.5-1.0 1C_1.0-1.5
	1														
	2				2A 2B	72	1 4 4 [8]								2A_2-2.5 2B_2.5-3
	3		SANDY LEAN CLAY (CL/SC); SANDY CLAY (CL/SC); loose; very dark grayish brown (10YR 3/2); 50% fine sand; 50% medium plasticity fines.			0	2 2 2 [4]	5							
85	4														
	5		CLAYEY SILT (ML/CL); soft; dark grayish brown (10YR 4/2); wet; 95% medium plasticity, no dilatancy fines; 5% fine sand.		3A 3B	78	1 2 1 [3]		0.5P						3A_5-5.5 3B_5.5-6
	6														
	7				4	100					51 45	14 16			4_6-8.5 200 psi NP NP
	8		Poorly Graded SAND (SP); very loose; very dark grayish brown (2.5Y 3/2); 95% fine sand; 5% no plasticity fines.												
80	9				5	94	0 0 1 [1]	1							5_8.5-10
	10														Switching to mud rotary at 10'.
	11				6	50	1 1 1 [2]	2					5	PA	6_11-12.5
	12														
	13		Well-Graded GRAVEL with Sand (GW); dense; olive gray (5Y 4/2); wet; 70% fine to coarse gravel; 30% medium to coarse sand; some gravels are fragments of larger pieces.												Rod shaking.
75	14					0	15 14 13 [27]	33							Few gravels in shoe.
	15														
	16				7	44	12 16 10 [26]	32							7_16-17.5
	17														
	18														
70	19														Difficult drilling, rod shaking.
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,264,827.80 **Easting:** 6,661,259.21
Latitude: 39.38064 **Longitude:** -121.64766
Levee Station or Milepost: 1965+80 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002B
Sheet 1 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20						1 4 19 [23]	28							No Recovery
	21														
	22														
	23														8_0-1.0 Bulk sample from berm between borehole and levee.
65	24														
	25						17 50/4" [50/4"]								9_25-26.5
	26		At 26 feet very dense.		9	22									
	27														
	28				10	50	28 32 40 [72]	89					1	PA	10_27.5-29
60	29														
	30						16 50/4" [50/4"]								No Recovery
	31				0	0									
	32														
	33														
55	34														
	35		SANDY SILT (ML); medium dense; dark yellowish brown (10YR 3/4); wet; 58% low plasticity, slow dilatancy fines; 42% fine sand.		11	78	10 8 15 [23]	28					58	PA	11_35-36.5
	36														
	37														
	38		Poorly Graded SAND (SP); dense; dark yellowish brown (10YR 4/4); wet; 97% fine to medium sand; 3% low plasticity, slow dilatancy fines.		12	94	34 18 18 [36]	44							12_37.5_39
50	39														
	40		At 40 feet 2-inch thick clay seam.		13	67	18 13 14 [27]	33							13_40-41.5
	41														
	42														
	43				14	89	36 19 23 [42]	52					3	PA	14_42.5-44
45	44		At 43.5 feet very dense.												
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,264,827.80 **Easting:** 6,661,259.21
Latitude: 39.38064 **Longitude:** -121.64766
Levee Station or Milepost: 1965+80 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		SANDY LEAN CLAY (CL); hard; dark yellowish brown (10YR 4/4); moist; 66% medium plasticity, no dilatancy fines; 34% fine sand.		15	89	16 50/3" [50/3"]		>4.5P	32	35	14	66	PA	15_45-46.5
	46														
	47														
	48														
40	49				16A 16B	72	12 35 31 [66]	81							16A_48.5-49.5 16B_49.5-50
	50		SILTY SAND (SM); very dense; dark grayish brown (10YR 4/2); 75% fine sand; 25% no plasticity fines.												
	51		End of boring at 50'. Backfilled with cement bentonite slurry. 8-47 lb. bags cement, 80 gallons water, 17 lb. bentonite												
	52														
	53														
35	54														
	55														
	56														
	57														
	58														
30	59														
	60														
	61														
	62														
	63														
25	64														
	65														
	66														
	67														
	68														
20	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,264,827.80 **Easting:** 6,661,259.21
Latitude: 39.38064 **Longitude:** -121.64766
Levee Station or Milepost: 1965+80 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002B
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/13/10	8/13/10	118.4 ft	NAVD 88	34.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	21.5 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	NA	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	Not encountered during drilling	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Subangular sand; Road Gravels.												
	1		[LEVEE FILL] SILTY SAND (SM); very dark grayish brown (10YR 3/2); moist; 70% fine sand; 30% no plasticity, rapid dilatancy fines.		1A 1B	78	8 13 14								1A_0.5-1.0 1B_1.0-1.5
	2						[27]								
	3					0	30 50/3"								No Recovery
115	4		[LEVEE FILL] SILTY SAND with Gravel (SM); very dark grayish brown (10YR 3/2); moist; 50% fine sand; 30% gravel; 20% medium plasticity fines; with interbedded zones of sandy silt and cobbles.				[50/ 3"]								
	5					0	50/5"								No Recovery
	6						[REF]								
	7		At 6.5 feet zones with increased gravel.												Chattering. Difficult drilling
	8					0	40 50/45								No Recovery
110	9						[50/ 45"]								
	10				2								60	PA	2_9.5-11.0 Bulk sample
	11				3	17	23 40 50/4"								3_12.0-12.5
	12														Only shoe sample
	13						[90/ 10"]								
105	14														
	15														
	16		[LEVEE FILL] CLAYEY SAND (SC/SC); very dark grayish brown (10YR 3/2); moist; 54% medium plasticity, slow dilatancy fines; 46% fine sand.			0	50								No Recovery
	17														
	18				4	17	40 50/4"								4_18.5-19.0
100	19														Only shoe sample. Sample contained
	20		At 19.5 feet gravel and cobble pockets.				[50/								

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,270,837.07 **Easting:** 6,666,181.30
Latitude: 39.39709 **Longitude:** -121.63016
Levee Station or Milepost: 2076+90 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
FILL	20					0	4" 20 50/5"								no gravel. Drill chattering No Recovery
	21														
	22		CLAYEY SAND (SC/SC); very dark grayish brown (10YR 3/2); moist; 54% medium plasticity, slow dilatancy fines; 46% fine sand.				[50/ 5"]								
95	23		At 23 feet intersepted cobble in shoe.		5	17	54 63 52	142							5_22.0-23.5 Drill chattering. Over-driving to recover sample.
	24		At 24.5 feet gravel and cobble pockets.				[115]								
	25					0	19 38 39	95							No Recovery
	26														
	27						[77]								
90	28														
	29				6A 6B	100	6 8 11						54	PA	6A_29.0-29.5 6B_29.5-30.0
	30						[19]								
	31				7A 7B	100	5 9 25	42					7	PA	7A_31.5-32.0 7B_32.0-32.5
85	32		Well-Graded GRAVEL with Silt and Sand (GW-GM); 60% gravel; 33% sand; 7% no plasticity fines.				[34]								
	33														
	34														
	35		End of boring at 34.5'. Tremmie backfilled with cement bentonite slurry. 14-47 lb. bags cement, 70 gallons water, 5% bentonite												
	36														
	37														
80	38														
	39														
	40														
	41														
	42														
75	43														
	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,270,837.07 **Easting:** 6,666,181.30
Latitude: 39.39709 **Longitude:** -121.63016
Levee Station or Milepost: 2076+90 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005A
Sheet 2 of 2

SBFCA Feather River West Levee

DATE STARTED 10/6/10 **DATE COMPLETED** 10/7/10	**GROUND ELEVATION** 109.8 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 38.0 ft
DRILLING CONTRACTOR Precision	**DRILLER'S NAME** Tony Young **HELPER'S NAME** John Perez	**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA, Mud Rotary	**DRILL RIG MAKE AND MODEL** CME75 TMR	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" ID HSA, 3-7/8" Tricone Drag Bit	**DRILLING ROD TYPE AND DIAMETER** Hex Rod 1.25"	**FIELD LOGGER** Mehrzad Maghsoudlou
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** HSA, 8.25", 37'	**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S) MCal(2.5"), Shelby(2.87"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop	**HAMMER EFFICIENCY** 74%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite slurry	**GROUNDWATER READING: DURING DRILLING** 22 ft	**AFTER DRILLING (DATE-TIME)** NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); medium dense; very dark grayish brown (10YR 3/2); moist; 59% no plasticity, slow dilatancy fines; 41% fine sand.		1A 1B 1C	89	9 12 20								1A_0.0-0.5 1B_0.5-1.0 1C_1.0-1.5
	1														
	2				2A 2B	78	[32] / 7 11 17								2A_2.0-2.5 2B_2.5-3.0
	3						[28]								
	4				3	78	2 6 8	17					59	PA	3_4-5.5
105	5														
	6				4A 4B	78	[14] / 9 13 16								4A_6-6.5 4B_6.5-7
	7						[29]								
	8				5	78	16 10 6	20							5_8-9.5
100	9														
	10						[16]								
	11				6A 6B		3 4 2 [6]	7							6A_10.5-11.5 6B_11.5-12
	12		At 12 feet loose.		7										7_12-14.5 400 psi
	13														
	14														
95	15		SILTY SAND (SM); loose; dark grayish brown (10YR 4/2); 52% fine sand; 48% no plasticity fines.		8A 8B	94	1 3 5 [8]	10					48	PA	8A_14.5-15 8B_15-16
	16														
	17				9	100	2 1 3 [4]	5							9_17-18.5
	18														
	19		Well-Graded GRAVEL with Clay and Sand (GW-GC); very dense; brown (10YR 4/3); wet; 70% fine to coarse												
90	20				10	44	24	64							10_19.5-21

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,279,741.44 **Easting:** 6,663,803.95
Latitude: 39.42156 **Longitude:** -121.63844
Levee Station or Milepost: 2211+82 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20		gravel; 23% fine to coarse sand; 7% low plasticity fines.												
	21				10	44	31 21	64							
							[52]								
	22														
	23				11		6 32 50/2.5"								11_22-23.5
	24						[82/ 8.5"]								
85	25														
	26														
	27														
	28														
	29														
80	30														
	31				12	50	9 18 40	72					7	PA	12_30-31.5
	32						[58]								Difficult drilling. Rig bouncing and chattering
	33						33								No Recovery
	34					0	50/5"								Rock in shoe
75	35						[50/ 5"]								
	36														Engine repeatedly shuts down from bit getting stuck in cobbles.
	37														Switched to mud at 37'.
	38														
	39		End of boring at 38'. Backfilled with cement bentonite slurry. 14-47 lb. bags cement, 85 gallons water, 12 lb. bentonite												
70	40														
	41														
	42														
	43														
	44														
65	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,279,741.44 **Easting:** 6,663,803.95
Latitude: 39.42156 **Longitude:** -121.63844
Levee Station or Milepost: 2211+82 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004B
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/27/10	**DATE COMPLETED** 9/28/10	**GROUND ELEVATION** 113.2 ft	**ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 50.0 ft
DRILLING CONTRACTOR Precision		**DRILLER'S NAME** Tony Young	**HELPER'S NAME** John Perez	**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA, Mud Rotary		**DRILL RIG MAKE AND MODEL** CME75 TMR		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" ID HSA, 3-7/8" Tricone Drag Bit		**DRILLING ROD TYPE AND DIAMETER** Hex Rod 1.25"		**FIELD LOGGER** Mehrzad Maghsoudlou
X VERTICAL ☐ **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** HSA, 8.25", 30'		**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S) MCal(2.5"), SPT(1.375")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop		**HAMMER EFFICIENCY** 74%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite slurry		**GROUNDWATER READING:**	**DURING DRILLING** 16.5 ft	**AFTER DRILLING (DATE-TIME)** NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		CLAYEY SAND (SC); medium dense; very dark grayish brown (10YR 3/2); moist; 63% fine sand; 37% medium plasticity fines.		1A 1B	78	5 5 5 [10]								1A_0.5-1.0 1B_1.0-1.5
	1														
	2														
110	3				2	39	4 4 5 [9]	11							2_2.5-4
	4														
	5				3A 3B 3C	89	5 5 34 [39]						37	PA	3A_5-5.5 3B_5.5-6.0 3C_6-6.5 Rock in shoe.
	6														
	7		Well-Graded GRAVEL with Silt and Sand (GW-GM); very dense; moist; 70% fine to coarse gravel; 24% fine to medium sand; 6% no plasticity fines.												
105	8				4	33	15 50								4_7.5-9
	9														
	10					0	6/50								Difficult drilling, chattering No Recovery Rock in shoe
	11						[REF]								
	12														Water added into auger as lubricant
100	13					0	50/2.5" [REF]								No Recovery
	14														
	15		At 14.5 feet cuttings contain gravel, cobble fragments.		5	50	50/5" [REF]								Rig bouncing, shutting down engine 5_15-16.5
	16														
	17														
95	18				6	27	30 50/5" [50/5"]								6_17.5-19
	19														
	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: **Northing:** 2,282,521.30 **Easting:** 6,662,254.22
Latitude: 39.42921 **Longitude:** -121.64389
Levee Station or Milepost: 2250+76 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20			X	7	67	15 41 42 [83]	102							7_20-21.5
	21														
	22														
	23			X	8	100	50								8_22.5-24
90	24												6	PA	
	25			X		0	50/4"								No Recovery
	26						[REF]								
	27														
	28		At 28 feet dense.	X	9	22	6 10 21	38							9_27.5-29
85	29						[31]								
	30			X		78	2 7 43	62							Switched to mud at 30'. Sample discarded, highly contaminated with sand matrix washed from above.
	31		At 31 feet very dense.				[50]								
	32														
	33			X	10	33	19 50/3"								10_32.5-34 Rock in shoe.
80	34						[50/ 3"]								
	35		LEAN CLAY with Sand (CL); hard; brown (10YR 4/3); moist; 74% low plasticity fines; 26% fine to medium sand.	X	11	72	13 12 14	32	>4.5P	36	48	24	74	PA	Difficult drilling, chattering 11_35-36.5
	36														
	37						[26]								
	38			X	11A 11B	83	17 21 50		>4.5P						11A_38-38.5 11B_38.5-39
75	39		Poorly Graded SAND with Silt (SP-SM); very dense; dark brown (10YR 3/3); moist; 90% fine to medium sand; 10% no plasticity fines.				[71]								
	40		Well-Graded GRAVEL with Clay (GW-GC); very dense; wet; 75% fine to coarse gravel; 15% fine to medium sand; 10% medium plasticity fines.	X	12	33	32 50								12_40-41.5
	41														
	42														
	43			X	13	50	50								13_42.5-43
70	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,282,521.30 **Easting:** 6,662,254.22
Latitude: 39.42921 **Longitude:** -121.64389
Levee Station or Milepost: 2250+76 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45				13	67	50						10	PA	13_45-46.5
	46														
	47														
65	48					0	50		>4.5P						No Recovery
	49														
	50		End of boring at 50'. Backfilled with cement bentonite slurry. 11-47 lb. bags cement, 73 gallons water, 14 lb. bentonite												
	51														
	52														
60	53														
	54														
	55														
	56														
	57														
55	58														
	59														
	60														
	61														
	62														
50	63														
	64														
	65														
	66														
	67														
45	68														
	69														
	70														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: **Northing:** 2,282,521.30 **Easting:** 6,662,254.22
Latitude: 39.42921 **Longitude:** -121.64389
Levee Station or Milepost: 2250+76 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/16/10	8/16/10	132.5 ft	NAVD 88	40.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	23 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	NA	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	33.5 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road Gravels.												
	1		[LEVEE FILL] SANDY SILT (ML); dense; very dark brown (7.5YR 2.5/2); moist; 59% no plasticity fines; 41% fine sand.		1A 1B	83	10 15 19 [34]		>4.5P						1A_0.5-1.0 1B_1.0-1.5
	2														
130	3				2	22	11 17 16 [33]	41							From 2 to 3 feet chattering and shaking. 2_2.5-4.0
	4		At 3.5 feet intercepted gravel in shoe.												
	5				3	33	13 12 9 [21]								3_6.0-6.5
	6														
125	7														
	8		At 8 feet medium dense.		4	100	4 6 6 [12]	15							4_7.5-9.0
	9														
	10				5A 5B	94	4 9 16 [25]						59	PA	5A_10.5-11.0 5B_11.0-11.5
	11														
120	12														
	13				6	94	7 9 12 [21]	26							6_12.5-14.0
	14														
	15		At 15 feet sand content is about 70%.		7A 7B	89	7 12 17 [29]								7A_15.5-16.0 7B_16.0-16.5
	16														
115	17														
	18				8	94	5 9 9 [18]	22							8_18.0-19.5
	19														
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,284,992.45 **Easting:** 6,661,728.65
Latitude: 39.43600 **Longitude:** -121.64572
Levee Station or Milepost: 2276+76 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006A
Sheet 1 of 2

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21				9A 9B	89	4 7 10 [17]								9A_21.0-21.5 9B_21.5-22.0
	22														
110	23		FILL SILT with Sand (ML); medium dense; dark olive brown (2.5Y 3/3); 77% no plasticity fines; 23% fine sand.		10	100	4 4 6 [10]	12					77	PA	10_23.0-24.5
	24														
	25														
	26				11A 11B		2 5 6 [11]								11A_26.0-26.5 11B_26.5-27.0
105	27														
	28														
	29		Poorly Graded SAND with Silt (SP-SM); medium dense; very dark gray (5YR 3/1); moist; 94% medium sand; 6% no plasticity fines.		12	89	4 6 6 [12]	15					6	PA	12_28.5-30.0
	30														
	31				13A 13B	78	11 16 17 [33]						3	PA	13A_31.5-32.0 13B_32.0-32.5
100	32		Well-Graded GRAVEL with Sand (GW); very dense; moist; 70% fine to coarse gravel; 30% medium to coarse sand.												
	33		At 33 feet 3-inch long intercepted piece of gravel.												Difficult drilling, chattering
	34		At 33.5 feet groundwater.		14		18 50/6" [50/6"]								14_33.5-34.5
	35														
	36		At 36 feet cuttings contain cobble fragments up to 4 inches.												
	37														
95	38														
	39														
	40		End of boring at 40'. Backfilled with cement bentonite grout. 14-47 lb. bags cement, 105 gallons water, 5% bentonite												
	41														
	42														
90	43														
	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: **Northing:** 2,284,992.45 **Easting:** 6,661,728.65
Latitude: 39.43600 **Longitude:** -121.64572
Levee Station or Milepost: 2276+76 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/24/10	9/27/10	117.2 ft	NAVD 88	32.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Precision		Tony Young	John Perez	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
HSA, Mud Rotary		CME75 TMR		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4.5" ID HSA, 3-7/8" Tricone Drag Bit		Hex Rod 1.25"		Mehrzad Maghsoudlou
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** HSA, 8.25", 16.5'		**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S) MCal(2.5"), SPT(1.375")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop		**HAMMER EFFICIENCY** 74%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite slurry		**GROUNDWATER READING: DURING DRILLING** 12.5 ft		**AFTER DRILLING (DATE-TIME)** NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); loose; very dark grayish brown (10YR 3/2); moist; 61% no plasticity fines; 39% fine sand.		1A 1B	72	4 6 8 [14]								1A_0.5-1.0 1B_1.0-1.5
115	2														
	3				2	56	4 3 3 [6]	7							2_2.5-4.0
	4				3A 3B	72	3 3 2 [5]						61	PA	3A_5-5.5 3B_5.5-6
	5														
	6														
110	7		At 7 feet very loose.		4	67	1 1 2 [3]	4							4_7-8.5
	8														
	9				5	100	3 2 2 [4]	5							5_9-10.5
	10		At 9.5 feet loose.												
	11		Poorly Graded SAND (SP); loose; very dark brown (10YR 2/2); moist; 98% fine to coarse sand; 2% no plasticity fines.		6A 6B	67	4 6 6 [12]								6A_11-11.5 6B_11.5-12
105	12														
	13				7	56	2 4 3 [7]	9							7_13-14.5 No heave noted at 13 ft
	14														
	15				8A 8B	89	3 4 5 [9]						2	PA	8A_15-15.5 8B_15.5-16
	16														
	17		Well-Graded GRAVEL with Silt and Sand (GW-GM); dense; moist; 57% fine to coarse gravel; 36% medium to coarse sand; 7% no plasticity fines.		9	39	11 18 17 [35]	43							Switched to mud rotary at 16.5 ft 9_17-18.5
100	18														
	19														
	20				10	44	15								10_19.5-21

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,284,989.34 **Easting:** 6,661,687.82
Latitude: 39.43599 **Longitude:** -121.64586
Levee Station or Milepost: 2276+76 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		At 20 feet very dense.	X	10	44	27 50/3"						7	PA	
	21						[77/ 9"]								
95	22			X	11	39	17 36 50/6"								11_22-23.5
	23														
	24						[86/ 12"]								Difficult drilling. Lost about 60 gallons of drilling fluid into bore hole. 12_24.5-26
	25			X	12	17	2 3 50/5"								
	26						[53/ 11"]								From 26 to 27 feet difficult drilling. Rig bouncing.
90	27			X	13	17	30 50/6"								13_27-28.5
	28		At 27.5 feet intercepted rock in shoe. Size of original clast unknown.												
	29						[50/ 6"]								
	30			X	14	11	36 50/6"								14_29.5-31
	31		At 30 feet intercepted rock in shoe. Size of original clast unknown.												
	32		At 31.5 feet clay clumps with gravel in cuttings..				[50/ 6"]								Difficult drilling. Rig bouncing. Engine stops running.
85	33		End of boring at 32'. Backfilled with cement bentonite slurry. 9-47 lb. bags cement, 45 gallons water, 15 lb. bentonite												
	34														
	35														
	36														
80	37														
	38														
	39														
	40														
	41														
75	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,284,989.34 **Easting:** 6,661,687.82
Latitude: 39.43599 **Longitude:** -121.64586
Levee Station or Milepost: 2276+76 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006B
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/23/10	**DATE COMPLETED** 9/24/10	**GROUND ELEVATION** 115.4 ft	**ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 43.0 ft
DRILLING CONTRACTOR Precision		**DRILLER'S NAME** Tony Young	**HELPER'S NAME** John Perez		**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA, Mud Rotary		**DRILL RIG MAKE AND MODEL** CME75 TMR			**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" ID HSA, 3-7/8" Tricone Drag Bit		**DRILLING ROD TYPE AND DIAMETER** Hex Rod 1.25"			**FIELD LOGGER** Mehrzad Maghsoudlou
☒ **VERTICAL** ☐ **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** HSA, 8.25", 16.5'			**FIELD LOG REVIEWER** MARK PALMER
SAMPLER TYPE(S) MCal(2.5"), SPT(1.375")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop			**HAMMER EFFICIENCY** 74%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite slurry		**GROUNDWATER READING:**	**DURING DRILLING** 11 ft	**AFTER DRILLING (DATE-TIME)** NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
115	0		Well-Graded GRAVEL with Sand (GW); dry; 60% fine to coarse, angular gravel; 40% fine to coarse sand.		1	22	30 30 26 [56]								1_0.0-0.5
	1														
	2														
	3		At 2.5 feet cuttings contained a 5" cobble.		2	39	21 8 6 [14]	17					14	PA	2_2.5-4
	4		SILTY SAND (SM); medium dense; dark yellowish brown (10YR 4/4); moist; 86% fine to medium sand; 14% no plasticity fines.												
	5														
110	6		Poorly Graded SAND with Silt (SP-SM); loose to medium dense; dark grayish brown (10YR 4/2); moist; 80% fine to medium sand; 10% fine gravel; 10% no plasticity fines.		3	33	19 4 3 [7]	9							3_5-6.5
	7														
	8				4	33	5 4 6 [10]	12							4_7.5-9
	9														
	10														
105	11				5	56	4 5 6 [11]	14							5_10-11.5
	12		Well-Graded SAND with Clay and Gravel (SW-SC); medium dense to dense; brown (10YR 4/3); wet; 80% fine to coarse sand; 11% fine, subangular gravel; 9% fines.												
	13				6	67	7 7 5 [12]	15					9	PA	6_12.5-14
	14														
	15														
100	16				7	67	10 13 14 [27]	33							7_15-16.5
	17														Switched to mud.
	18		At 17.5 feet 80% sand; 12% fines; 8% gravel.		8	56	14 15 16 [31]	38					12	PA	8_17.5-19
	19														
	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,289,719.35 **Easting:** 6,662,734.46
Latitude: 39.44897 **Longitude:** -121.64209
Levee Station or Milepost: 2336+57 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
95	20		Poorly Graded GRAVEL with Sand (GP); olive brown (2.5Y 4/4); wet; 70% fine, subrounded gravel; 20% medium to coarse sand; 5% fines.	X	9	44	12 16 16 [32]	39							9_20_21.5
	21														
	22														
	23		CLAYEY SAND (SC); olive brown (2.5Y 4/4); wet; 73% fine to coarse sand; 14% fine to coarse, subrounded gravel; 13% medium plasticity fines.	X	10	39	8 12 17 [29]	36					13	PA	10_22.3-24
	24														
90	25		CLAYEY SAND (SC); medium dense; olive brown (2.5Y 4/4); wet; 55% fine sand; 35% medium plasticity fines; 10% fine gravel.	X	11	17	12 12 14 [26]	32							11_25-26.5
	26														
	27														
	28		At 28 feet medium dense.	X	12	44	7 10 11 [21]	26							12_27.5-29
	29														
85	30		Well-Graded GRAVEL with Clay and Sand (GW-GC); dense; olive brown (2.5Y 4/4); wet; 58% fine to coarse gravel; 36% fine to coarse sand; 6% no plasticity fines. At 31 feet very dense.	X	13		6 14 27 [41]	51					6	PA	13_30-31.5
	31														
	32		CLAYEY SAND (SC); medium dense; olive brown (2.5Y 4/4); wet; 55% fine sand; 35% medium plasticity fines; 10% fine gravel.	X	14	50	4 4 5 [9]	11							Grinding and chattering. 14_32.5-34
	33														
	34														
80	35			X		0	8 9 7 [16]	20							
	36														
	37														
	38		Well-Graded GRAVEL with Clay and Sand (GW-GC); olive brown (2.5Y 4/4); wet; 75% fine to coarse, subangular to angular gravel; 15% fine to coarse sand; 10% medium plasticity fines; interbedded zones with more sand.	X	15	44	20 33 24 [57]	70							15_37.5-39
	39														
75	40			X	16	33	15 30 20 [50]	62					29	PA	16_40-41.5
	41														
	42														Difficult drilling. Grinding and chattering at 2000 psi. Rig bouncing.
	43														
	44		Refusal at 43'. Backfilled with cement bentonite slurry. 9-47 lb. bags cement, 70 gallons water, 20 lb. bentonite												
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Butte
Coordinates: Northing: 2,289,719.35 **Easting:** 6,662,734.46
Latitude: 39.44897 **Longitude:** -121.64209
Levee Station or Milepost: 2336+57 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008B
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 8/17/10	**DATE COMPLETED** 8/17/10	**GROUND ELEVATION** 139.0 ft	**ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 5.0 ft	
DRILLING CONTRACTOR Precision		**DRILLER'S NAME** Tony Young	**HELPER'S NAME** John Perez	**TOTAL DEPTH OF FILL** 5 ft	
DRILLING METHOD HSA		**DRILL RIG MAKE AND MODEL** CME75 TMR		**CONSULTANT COMPANY** URS Corporation	
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" ID HSA		**DRILLING ROD TYPE AND DIAMETER** Hex Rod 1.25"		**FIELD LOGGER** Mehrzad Maghsoudlou	
☒ **VERTICAL** ☐ **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** NA		**FIELD LOG REVIEWER** MARK PALMER	
SAMPLER TYPE(S) Bag, MCal(2.5")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Marl, automatic, 140 lbs / 30-inch drop		**HAMMER EFFICIENCY** 74%	
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout		**GROUNDWATER READING: DURING DRILLING** Not encountered during drilling		**AFTER DRILLING (DATE-TIME)** NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road Gravels.				18								1A_0.5-1.0
	1		[LEVEE FILL] Poorly Graded GRAVEL with Cobbles or Boulders (GP); About 30% well-rounded cobbles or boulders; 99% rounded gravel; 1% no plasticity fines.		1A 1B	78	25 25								1B_1.0-1.5
	2						[50]								2_1.5-5.0 Bulk sample
	3				2								1	PA	
135 FILL	4														
	5		Refusal at 5'. Backfilled with cement bentonite grout. 2-47 lb. bags cement, 10 gallons water, 5% bentonite												
	6														
	7														
	8														
130	9														
	10														
	11														
	12														
	13														
125	14														
	15														
	16														
	17														
	18														
120	19														
	20														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,291,392.02 **Easting:** 6,663,225.51
Latitude: 39.45355 **Longitude:** -121.64033
Levee Station or Milepost: 2355+37 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009B
Sheet 1 of 1

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/16/10	8/16/10	139.1 ft	NAVD 88	40.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Precision	Tony Young	John Perez	18 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	CME75 TMR	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" ID HSA, 3-7/8" Tricone Drag Bit	Hex Rod 1.25"	Mehrzad Maghsoudlou

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	HSA, 8.25", 27'	MARK PALMER

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	74%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	25.5 ft	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] LEAN CLAY (CL); very stiff; dark reddish brown (5YR 3/2); moist; 90% high plasticity, no dilatancy fines; 10% fine sand.			0	11 8 9 [17]		3.0P						
	1														
	2														
	3				1	56	2 4 4 [8]	10							1_2.5-4.0
135	4														
	5				2A 2B	78	7 10 0 [10]		1.5P	17	31	12			2A_5.5-6.0 2B_6.0-6.5
	6		At 5.5 feet medium stiff.												
	7														
	8				3	100	3 4 6 [10]	12							3_7.5-9.0
130	9														
	10				4A 4B	100	7 19 22 [41]		4.0P >4.5P						4A_10.5-11.0 4B_11.0-11.5
	11		At 11 feet hard.												
	12														
	13		[LEVEE FILL] SANDY LEAN CLAY (CL); very stiff; dark reddish gray (2.5YR 3/1); 65% medium plasticity, no dilatancy fines; 35% fine to medium sand.		5	89	7 11 13 [24]	30							5_12.5-14.0
125	14														
	15				6A 6B	100	5 12 14 [26]		3.5P	17	31 32	14 15			6A_15.5-16.0 6B_16.0-16.5
FILL	16														
	17														
	18		LEAN CLAY (CL); dark brown (7.5YR 3/3); 100% high plasticity, no dilatancy fines.		7	89	3 2 4 [6]	7							7_17.5-19.0
120	19														
	20														

Final Report Version

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,292,098.15 **Easting:** 6,663,358.84
Latitude: 39.45549 **Longitude:** -121.63984
Levee Station or Milepost: 2362+69 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20						4 12 16								
	21				8A 8B	83			3.5P	16					8A_20.5-21.0 8B_21.0-22.0
	22						[28]								
	23				9	100	7 13 19	39							9_22.5-24.0
115	24						[32]								
	25						4 15 36								
	26		At 25.5 feet, groundwater.		10A 10B				>4.5P						10A_25.5-26.0 10B_26.0-27.0 Sample 10B has gravel at bottom. Switched ot mud at 26.5'.
	27						[51]								
	28		COBBLES At 27 feet gravels and cobbles. Chattering and grinding. Difficult to drill. Gravel caves in losing circulation (about 75 gallons).												
110	29														
	30														
	31														
	32														
	33														
105	34														
	35														
	36														
	37														
	38														
100	39														
	40														
	41		Refusal at 40'. Backfilled with cement bentonite grout. 15-47 lb. bags cement, 85 gallons water, 5% bentonite												
	42														
	43														
95	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee Crest **County:** Butte
Coordinates: Northing: 2,292,098.15 **Easting:** 6,663,358.84
Latitude: 39.45549 **Longitude:** -121.63984
Levee Station or Milepost: 2362+69 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010B
Sheet 2 of 2

SBFCA Feather River West Levee

APPENDIX B

Task Order 1
Hammer Energy Measurement Information

Abe Construction Services, Inc.

2230 Lariat Lane, Walnut Creek, CA 94596
PHONE: 925-944-6363 FAX: 925-476-1588
EMAIL: SA@AbeEngineering.com

September 7, 2010

Rob Trojan
URS Corporation
2870 Gateway Oaks Dr, Suite 300
Sacramento, CA 95833

Re: SPT Hammer Energy Measurements
URS Job No. 17326463.0204012B- Work Authorization No. 001
Feather River West Levee-
Precision Sampling Drill Rig CME 75
Yuba City, CA
August 12, 2010

Job No. 10076

Dear Sir,

This report presents the results of SPT (Standard Penetration Test) energy measurements obtained for Precision Sampling CME75 Drill Rig during SPT sampling for the project referenced above on August 12, 2010. Dynamic measurements were made with a PDA (Pile Driving Analyzer) during SPT sampling at depths ranging from 12 ft to 65 ft. The objective of the dynamic measurements was to determine the energy transfer ratio (ETR) or efficiency of the SPT systems, which is used to normalize the SPT N values to a standard efficiency of 60% (N_{60}).

DYNAMIC TESTING AND FIELD DETAILS

Drill Rig and SPT Hammer Description

The SPT samples were taken with Hex rod and NW rod and a split spoon sampler using a CME automatic hammer which has a 140 lb ram, a 30-inch nominal drop heights, and theoretical potential energy of 350 ft-lbs. Further details regarding the SPT equipment are beyond the scope of this report and should be obtained from the driller.

Dynamic Test Instrumentation

Dynamic measurements of strain and acceleration were taken on a 2-ft long section of NW rod, which was attached to the top of the sample rod string just below the hammer. The rod section was instrumented with two strain bridges and two piezoresistive accelerometers. By averaging the measurements taken from opposite sides of the rod, the effects of non-uniform hammer impacts to the recorded signals were minimized.

Strain and acceleration signals were conditioned and converted to force and velocity records by a PAK Model, Pile Driving Analyzer® (PDA). This dynamic testing equipment is the same equipment that is routinely used for conventional pile driving analysis. The dynamic force and velocity records were the basis of the computed energy results presented in this report. In the field the force and velocity records from the PDA were viewed on a graphic LCD screen to evaluate data quality. A representative sample of the force and velocity records was also digitally stored on disc for back up.

Calculation of Energy Transfer

The energy transferred to the instrumented rod section was computed from the dynamic force and velocity records by the EFV method, which uses both the force and velocity records to calculate the maximum transferred energy as:

$$EFV = \int F(t)\, V(t)\, dt$$

The integration is performed over the time period from which the energy transfer begins (non-zero) and terminates at the time when the energy transfer reaches a maximum value. This method is theoretically correct for all rod lengths regardless of the 2L/c stress wave travel time (L is the rod length and c is the stress wave speed in the rod) and the number of non-uniform rod corrections. This calculation is the method we use to compute the energy transfer ratio, ETR, which is computed as:

$$ETR = EFV / \text{Rated Hammer Energy}$$

Dynamic Test Results

The PDA calculated results are given in Appendix A and include the energy transfer (EFV), the energy transfer ratio (ETR), the hammer blow rate (BPM), the maximum impact force (FMX), and the maximum rod velocity (VMX). For each sample depth interval, the average, maximum, minimum and standard deviation of each value are given in Appendix A. Other information includes the sample depth interval and the total number of blows for the reported depth interval. A statistical summary of all data is given below. The average ETR for this hammer was 74% for 510 hammer blows with a standard deviation of 3%.

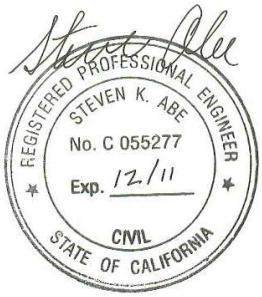
Statistical Summary of Energy Measurement Data

	ETR	EFV	BPM	VMX	RTL	FMX
	%	ft-lb	bl/min	ft/sec	kips	kips
AVG	74	261	45.9	11.8	38.4	38.3
STD	3	9	2.6	0.7	3.8	1.5
MAX	81	283	51.1	13.0	48.4	41.9
MIN	65	228	39.0	10.0	26.4	33.9
#BLS	510	510	510	510	510	510

I appreciate the opportunity to be of assistance to you on this project. Please contact me if you have any questions regarding this report, or if I may be of further service.

Very truly yours,

Steven K. Abe, P.E.



APPENDIX A

Dynamic Measurement Results

Info: PRECISION CME 75

BL# end	bl/ft	depth ft	TYPE	#Bls	ETR %	EFV ft-lb	BPM bl/min	VMX ft/sec	RTL kips	FMX kips
29	5	12.00	AVG	28	68	241	42.5	11.2	42.0	36.9
			STD	28	1	5	0.3	0.3	1.1	0.8
			MAX	28	73	257	44.0	11.8	45.4	39.9
			MIN	28	65	228	42.0	10.7	40.2	34.6
44	1	17.00	AVG	15	75	263	47.6	11.5	46.4	38.6
			STD	15	2	6	0.5	0.3	1.9	1.2
			MAX	15	77	272	48.1	12.0	48.4	40.5
			MIN	15	72	254	46.0	11.0	40.3	36.5
89	9	25.00	AVG	45	75	263	47.7	11.4	43.7	39.7
			STD	45	2	8	0.4	0.2	1.1	1.2
			MAX	45	79	277	48.5	11.8	46.2	41.9
			MIN	45	71	248	46.0	10.9	40.5	37.2
122	6	30.00	AVG	33	75	264	47.5	11.1	38.1	39.0
			STD	33	1	5	0.5	0.3	2.7	1.4
			MAX	33	78	273	48.0	11.5	43.4	41.3
			MIN	33	72	254	45.0	10.3	33.1	36.2
162	8	35.00	AVG	40	76	266	48.2	11.4	38.3	40.3
			STD	40	2	6	1.4	0.3	1.3	1.0
			MAX	40	79	276	48.9	12.0	40.8	41.9
			MIN	40	72	252	40.0	10.7	33.4	37.9
217	11	40.00	AVG	55	77	270	47.7	11.4	40.2	38.7
			STD	55	2	7	1.1	0.3	2.5	1.2
			MAX	55	81	283	48.5	11.9	43.0	41.0
			MIN	55	71	251	40.1	10.0	32.1	35.8
263	9	45.00	AVG	46	75	263	48.1	10.8	30.9	37.8
			STD	46	2	7	1.4	0.4	2.9	1.0
			MAX	46	79	277	48.9	12.3	38.6	40.4
			MIN	46	69	244	39.0	10.2	26.4	35.8
313	10	50.00	AVG	50	75	262	47.0	12.6	38.4	37.6
			STD	50	2	5	1.4	0.2	0.9	0.9
			MAX	50	78	273	48.1	13.0	41.1	39.8
			MIN	50	71	250	39.8	12.0	36.5	35.8
NW Rod										
332	3	55.00	AVG	19	77	271	49.1	12.6	40.1	39.7
			STD	19	2	6	3.5	0.2	1.2	1.3
			MAX	19	80	280	51.1	12.9	42.2	41.4
			MIN	19	73	256	40.3	12.2	37.2	36.9
440	21	60.00	AVG	108	74	261	43.7	12.6	37.7	38.0
			STD	108	1	5	0.4	0.2	1.2	1.0
			MAX	108	77	271	44.2	13.0	40.0	39.9
			MIN	108	71	251	42.0	11.7	34.5	35.4

BL# end bl/ft	depth ft	TYPE	#Bls	ETR %	EFV ft-lb	BPM bl/min	VMX ft/sec	RTL kips	FMX kips
510	65.00	AVG	70	73	256	42.5	11.9	36.2	36.9
		STD	70	1	5	0.1	0.3	1.4	1.5
		MAX	70	76	267	42.8	12.6	39.0	39.4
		MIN	70	70	246	42.2	11.4	32.9	33.9

STATISTICS FOR ALL DATA

	ETR %	EFV ft-lb	BPM bl/min	VMX ft/sec	RTL kips	FMX kips
AVG	74	261	45.9	11.8	38.4	38.3
STD	3	9	2.6	0.7	3.8	1.5
MAX	81	283	51.1	13.0	48.4	41.9
MIN	65	228	39.0	10.0	26.4	33.9
#BLS	510	510	510	510	510	510

COMMENTS
Hex Rod 12 ft to 50 ft; NW Rod after 50 ft

DRIVEN (2010-Aug-12 : 10B018.Q01)

APPENDIX C

Task Order 1
Cone Penetrometer Test Logs

Table C-1. Summary of Task Order 1 Hand-Augered Cone Penetrometer Tests

Exploration ID	Date	Location (Crest/Toe)	Interval (feet)	Total Depth	Soil Class	SBFCA Station	Northing	Easting
MA 7								
SM0007_001H[1]	11/11/2010	Landside toe	0.0-5.0	5	SM	1842+85	2255008.65	6665412.79
SM0007_002H	10/7/2010	Landside toe	0.0-5.0	5	SM	2063+84	2270206.84	6667070.17
SM0007_003H	10/8/2010	Landside toe	0.0-5.0	5	ML	2113+89	2273462.94	6664974.87
SM0007_004H	11/18/2010	Landside toe	0.0-5.0	5	SM	2149+85	2275634.97	6664798.25
SM0007_005H	11/18/2010	Landside toe	0.0-5.0	5	SC	1698+85	2241600.44	6665290.76
SM0007_006H	11/19/2010	Landside toe	0.0-5.0	5	SM	2286+75	2285958.26	6661461.68
MA 16								
SM0016_001H	10/7/2010	Landside toe	0.0-5.0	5	ML	1476+77	2221019.61	6664501.39
LD 9								
SL0009_001H	10/13/2010	Landside toe	0.0-5.0	6	ML	1195+85	2194216.11	6669134.51
			5.0-6.0		ML	1195+85		
SL0009_003H	10/13/2010	Landside toe	0.0-5.0	5	SC	1392+82	2212820.33	6665126.33
SL0009_004H	10/14/2010	Landside toe	0.0-5.0	5	ML	1429+45	2216316.76	6664327.52
SL0001_009H	9/29/2010	Landside toe	0.0-5.0	5	SP	827+86	2160230.83	6675030.41
LD 1								
SL0001_001H	10/6/2010	Landside toe	0.0 - 4.0	5	SM	306+35	2111059.31	6679469.72
			4.0 - 5.0		ML	306+35		
SL0001_002H	9/30/2010	Landside toe	0.0-5.0	5	ML	359+02	2116124.08	6678408.95
	10/12/2010	Landside toe	0.0 - 1.0	5	ML	359+02	2116124.08	6678408.95
			1.0 - 3.0		SP-SM	359+02		
			3.0 - 4.0		ML	359+02		
			4.0 - 5.0		SM	359+02		
SL0001_003H	10/5/2010	Landside toe	0.0-5.0	5	CL	468+46	2126774.22	6676056.13
	10/11/2010	Landside toe	0.0 - 2.0	5	ML	468+46	2126768.11	6676058.42
			3.0 - 5.0		CL	468+46		
SL0001_004H	10/6/2010	Landside toe	0.0 - 4.0	4	CL-ML	538+93	2132316.05	6672498.84
SL0001_005H	9/30/2010	Landside toe	0.0-2.5	5	ML	626+37	2140726.03	6671942.81
			2.5-5.0		ML	626+37		
SL0001_007H	9/29/2010	Landside toe	0.0-5.0	5	ML	674+00	2145436.30	6671981.76
SL0001_008H	9/29/2010	Landside toe	0.0-3.5	5	SM	809+03	2158448.43	6674473.38
			3.5-5.0	5	CL/ML	809+03	2158448.43	6674473.38
SL0001_012H	10/8/2010	Landside toe	0.0-5.0	5	ML	998+12	2175969.51	6673515.37
MA 3								
SM0003_001H	10/1/2010	Landside toe	0.0 - 2.5	5	CL	29+08	2089995.14	6671959.66
			2.5 - 4.5		SP-SM	29+08		
			4.5 - 5.0		CL	29+08		
SM0003_002H	10/4/2010	Landside toe	0.0 - 2.0	5	ML	58+38	2090962.83	6674499.05
			2.0 - 3.0		ML/SM	58+38		
			3.0 - 5.0		CL	58+38		
SM0003_003H	10/4/2010	Landside toe	0.0 - 2.0	5	SM	74+25	2090651.91	6675931.83
			2.0 - 5.0		CL	74+25		
SM0003_004H	10/1/2010	Landside toe	0.0 - 2.0	5	SM	106+30	2092685.59	6678386.52
			2.0 - 5.0		CL	106+30		
SM0003_006H	11/12/2010	Landside toe	0.0 - 5.0	5	ML	190+80	2100244.04	6678869.29
SM0003_007H	11/12/2010	Landside toe	0.0 - 5.0	5	ML	198+47	2100657.14	6678249.27
SM0003_008H	10/12/2010	Landside toe	0.0 - 5.0	5	SM	239+44	2104552.69	6678684.22

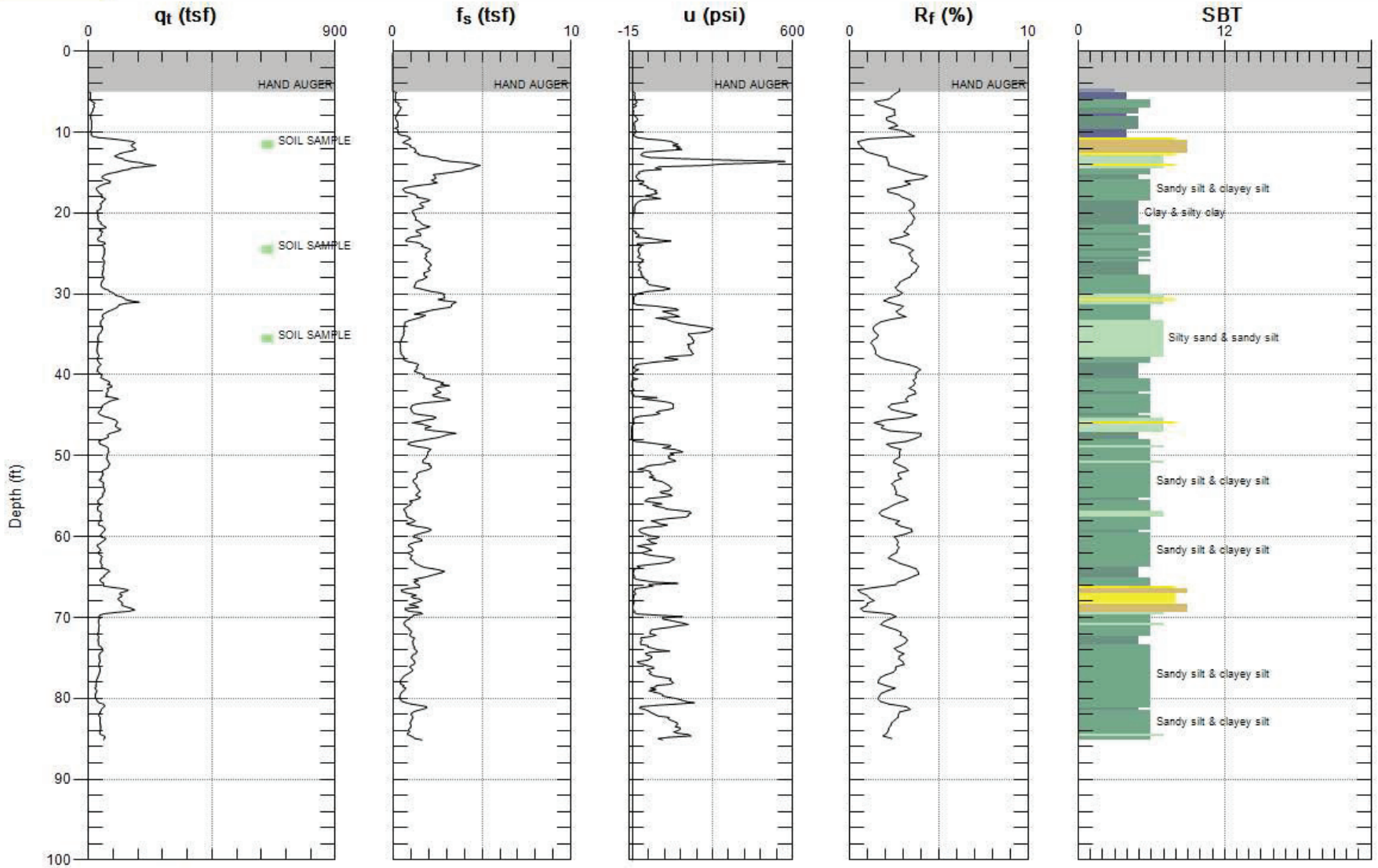
[1]Exploration IDs ending in "H" denote upper 4 to 6 feet of the same Exploration IDs ending in "C."

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_001C

Engineer: M.WEIL
Date: 10/1/2010 01:31



Max. Depth: 85.138 (ft)
Avg. Interval: 0.328 (ft)

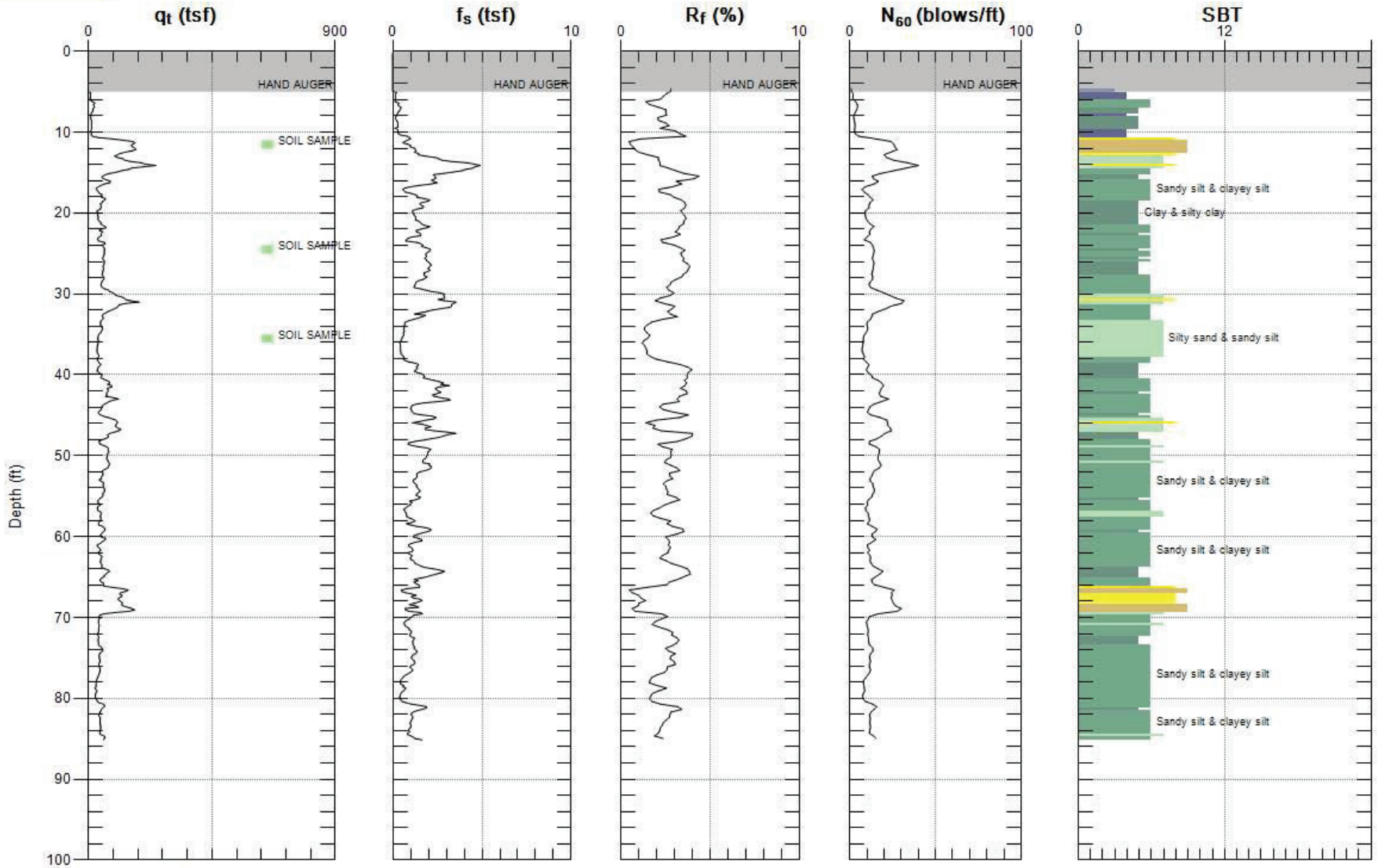
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_001C

Engineer: M.WEIL
Date: 10/1/2010 01:31



Max. Depth: 85.138 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

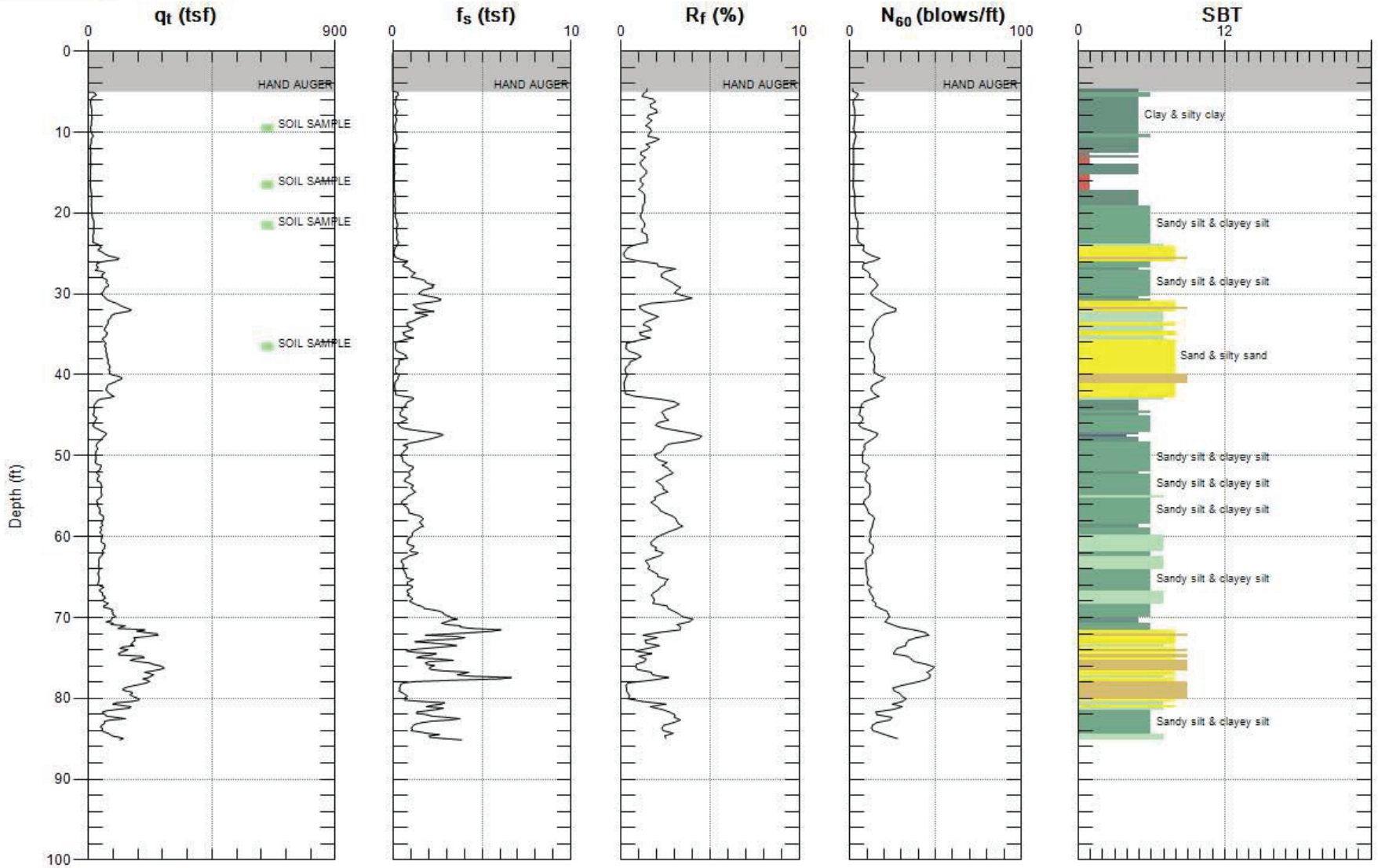
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_002C

Engineer: M.WEIL

Date: 10/4/2010 10:00



Max. Depth: 85.138 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

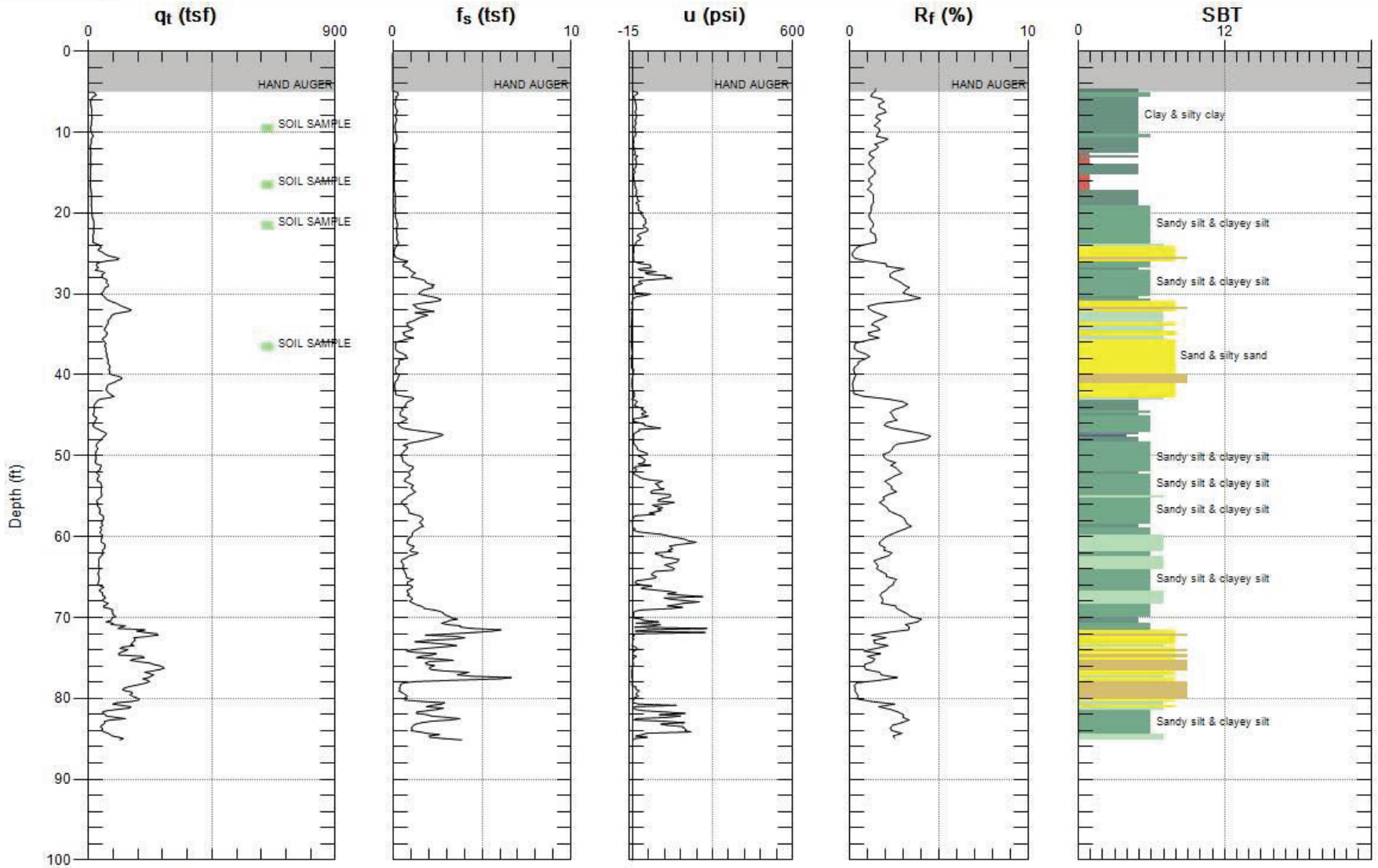
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_002C

Engineer: M.WEIL

Date: 10/4/2010 10:00



Max. Depth: 85.138 (ft)

Avg. Interval: 0.328 (ft)

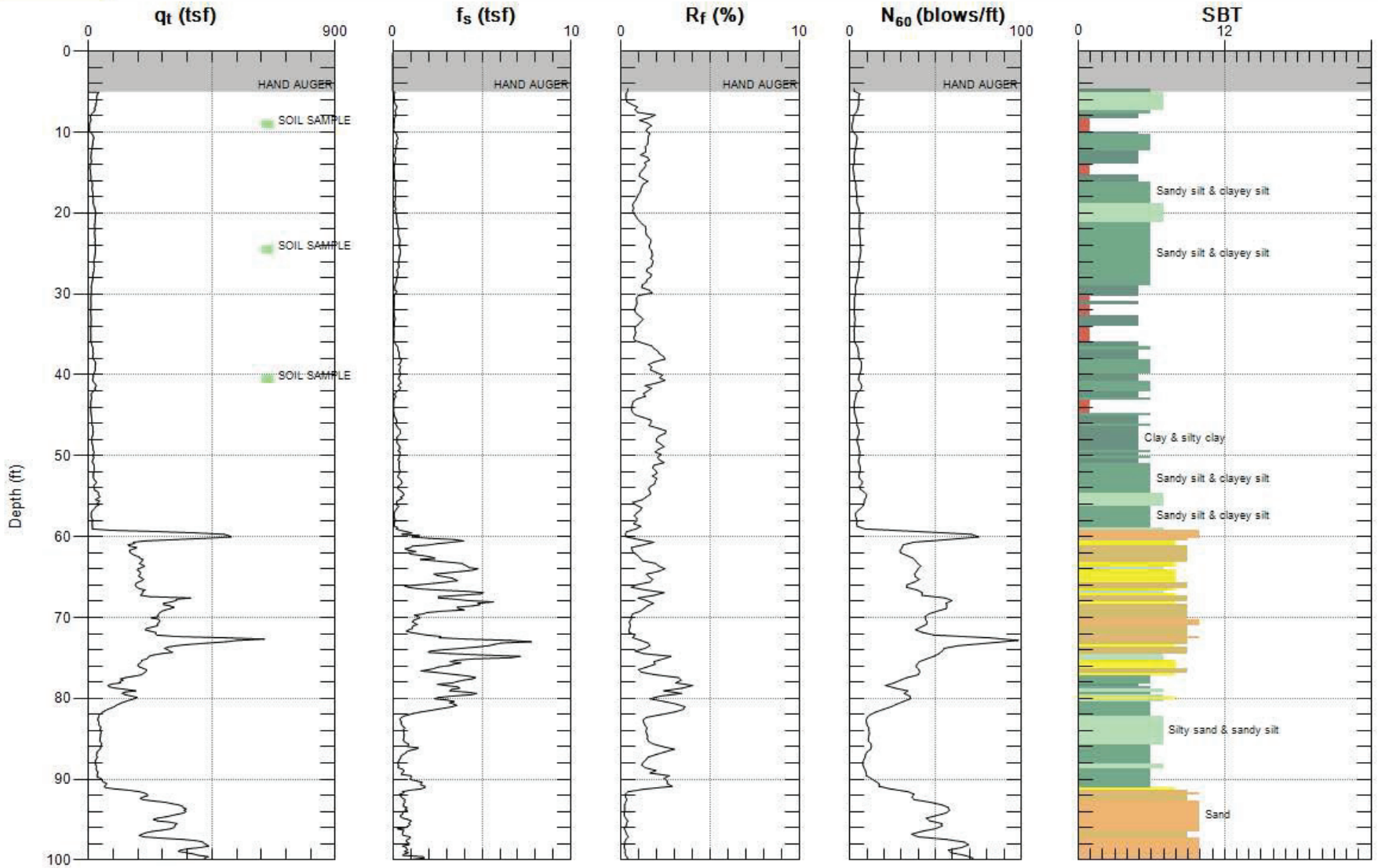
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_003C

Engineer: M.WEIL
Date: 10/4/2010 01:50



Max. Depth: 121.227 (ft)
Avg. Interval: 0.328 (ft)

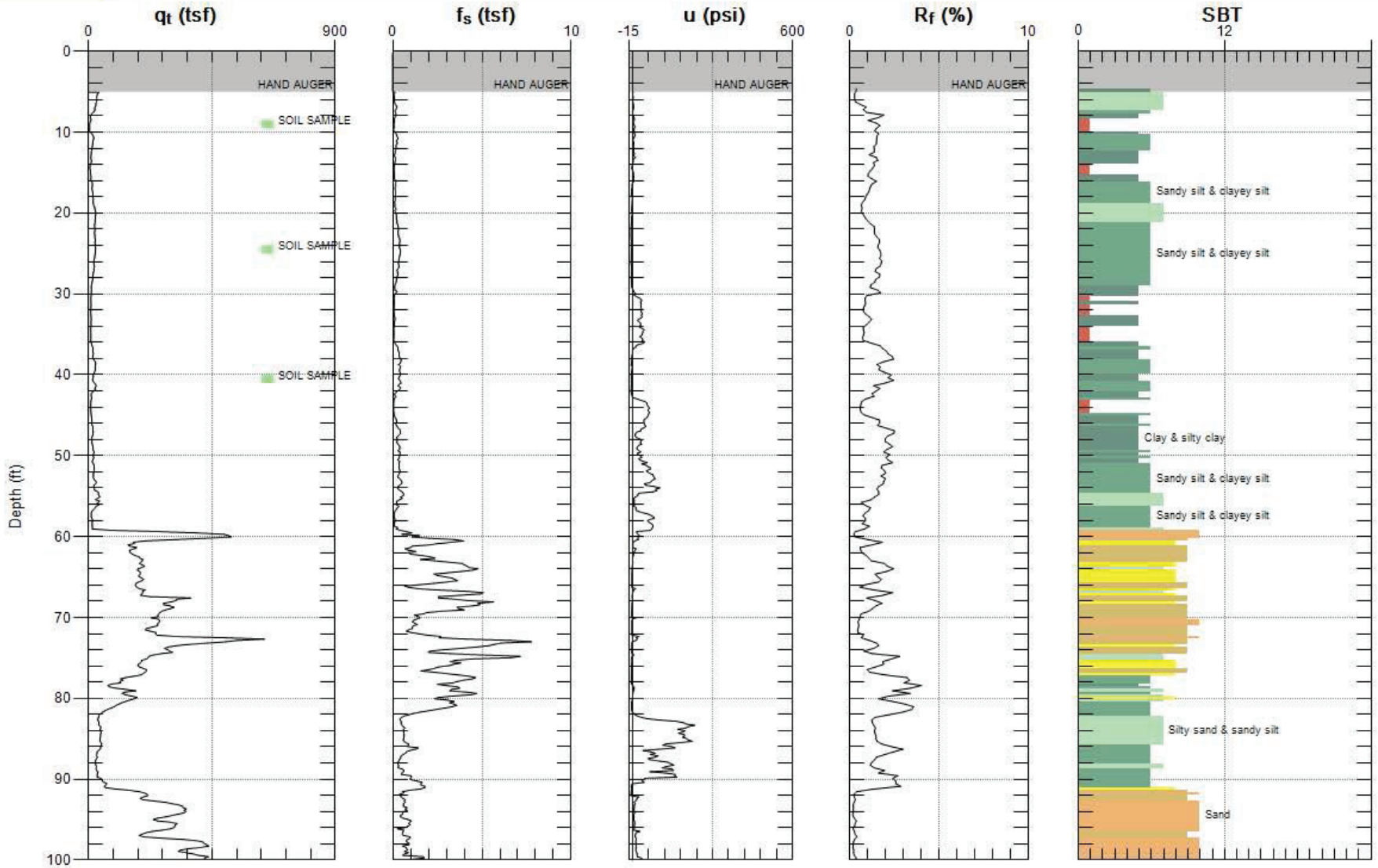
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_003C

Engineer: M.WEIL
Date: 10/4/2010 01:50



Max. Depth: 121.227 (ft)
Avg. Interval: 0.328 (ft)

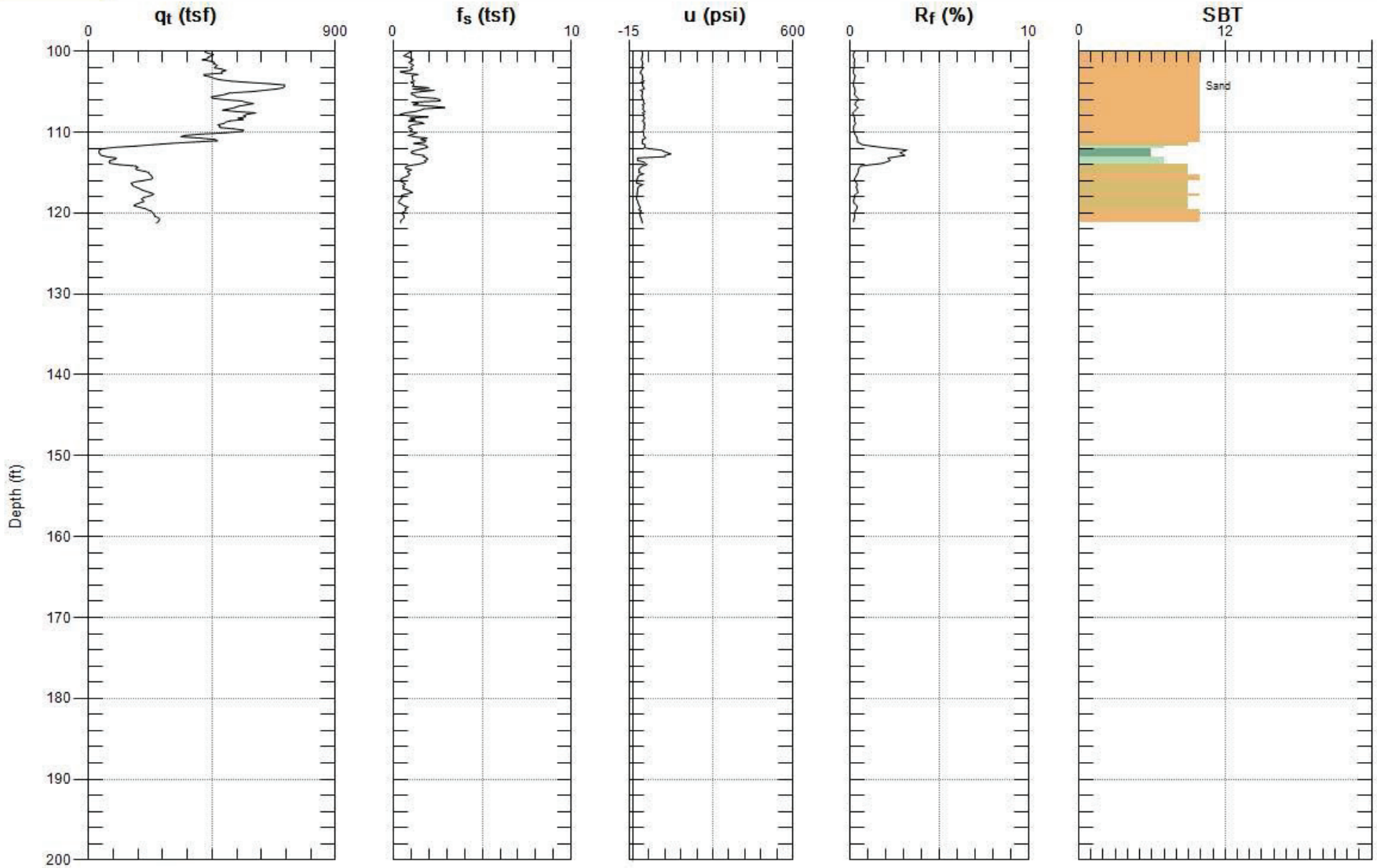
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_003C

Engineer: M.WEIL
Date: 10/4/2010 01:50



Max. Depth: 121.227 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

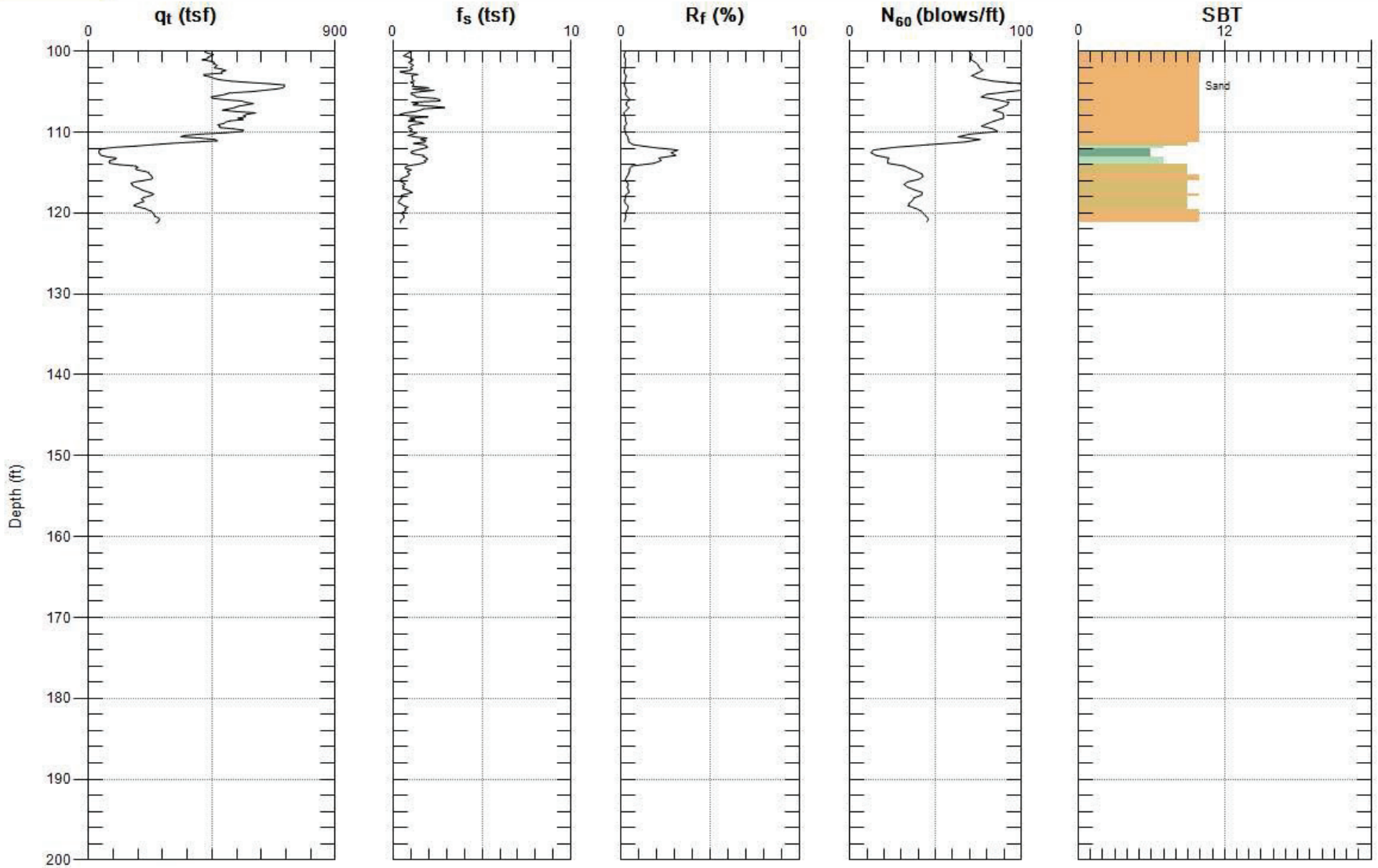
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_003C

Engineer: M.WEIL

Date: 10/4/2010 01:50



Max. Depth: 121.227 (ft)

Avg. Interval: 0.328 (ft)

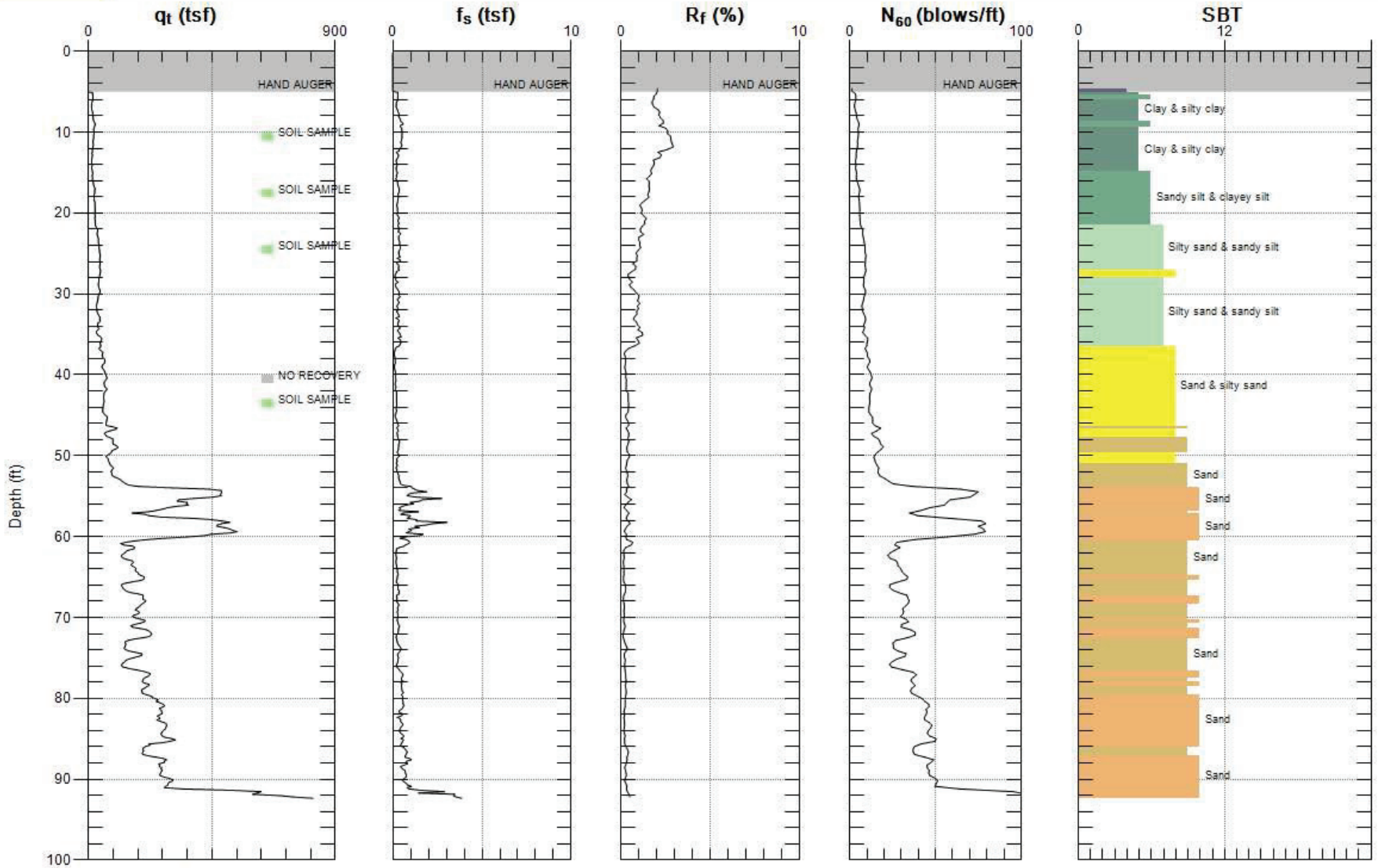
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_004C

Engineer: M.WEIL
Date: 10/1/2010 08:57



Max. Depth: 92.356 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

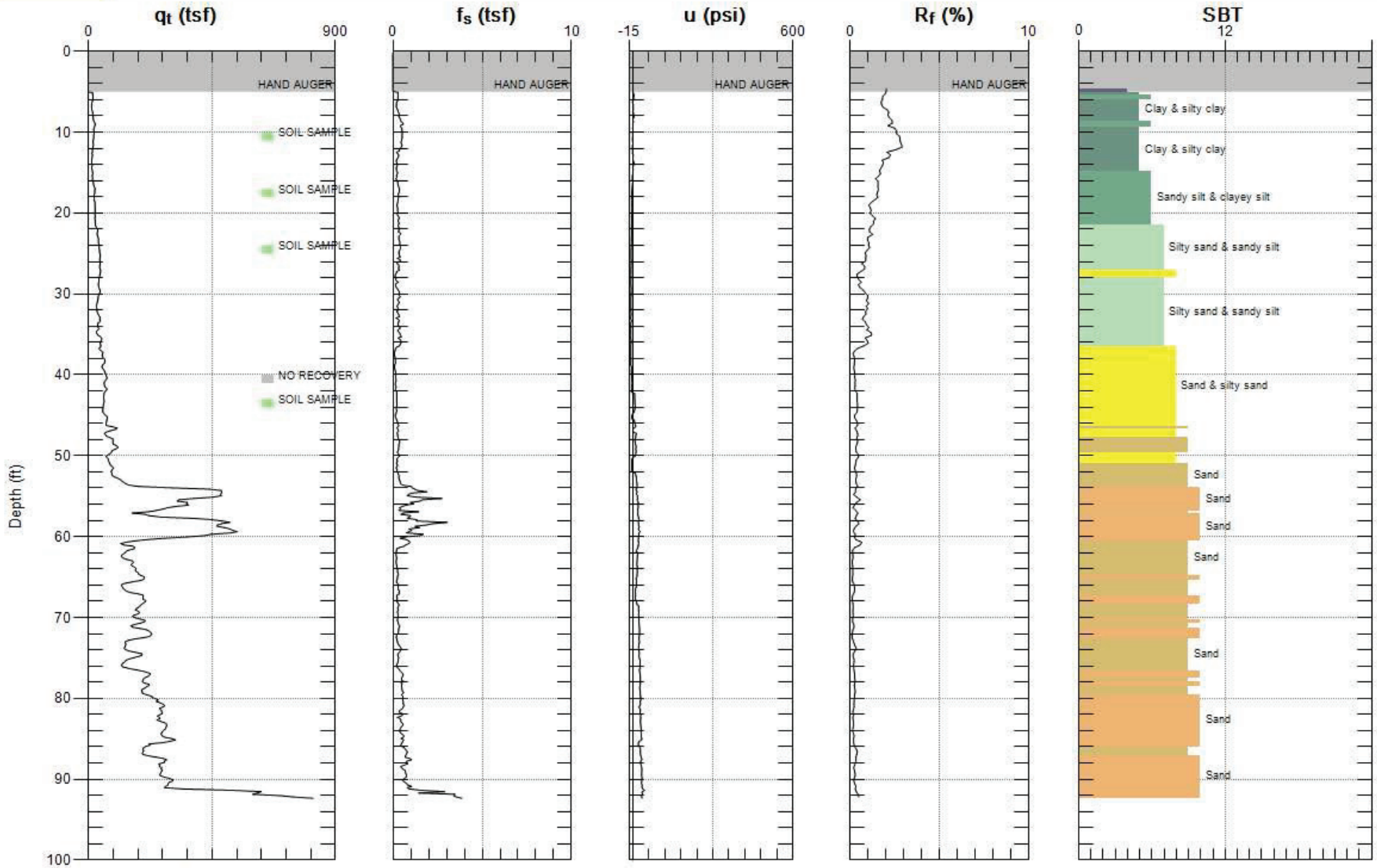
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_004C

Engineer: M.WEIL

Date: 10/1/2010 08:57



Max. Depth: 92.356 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

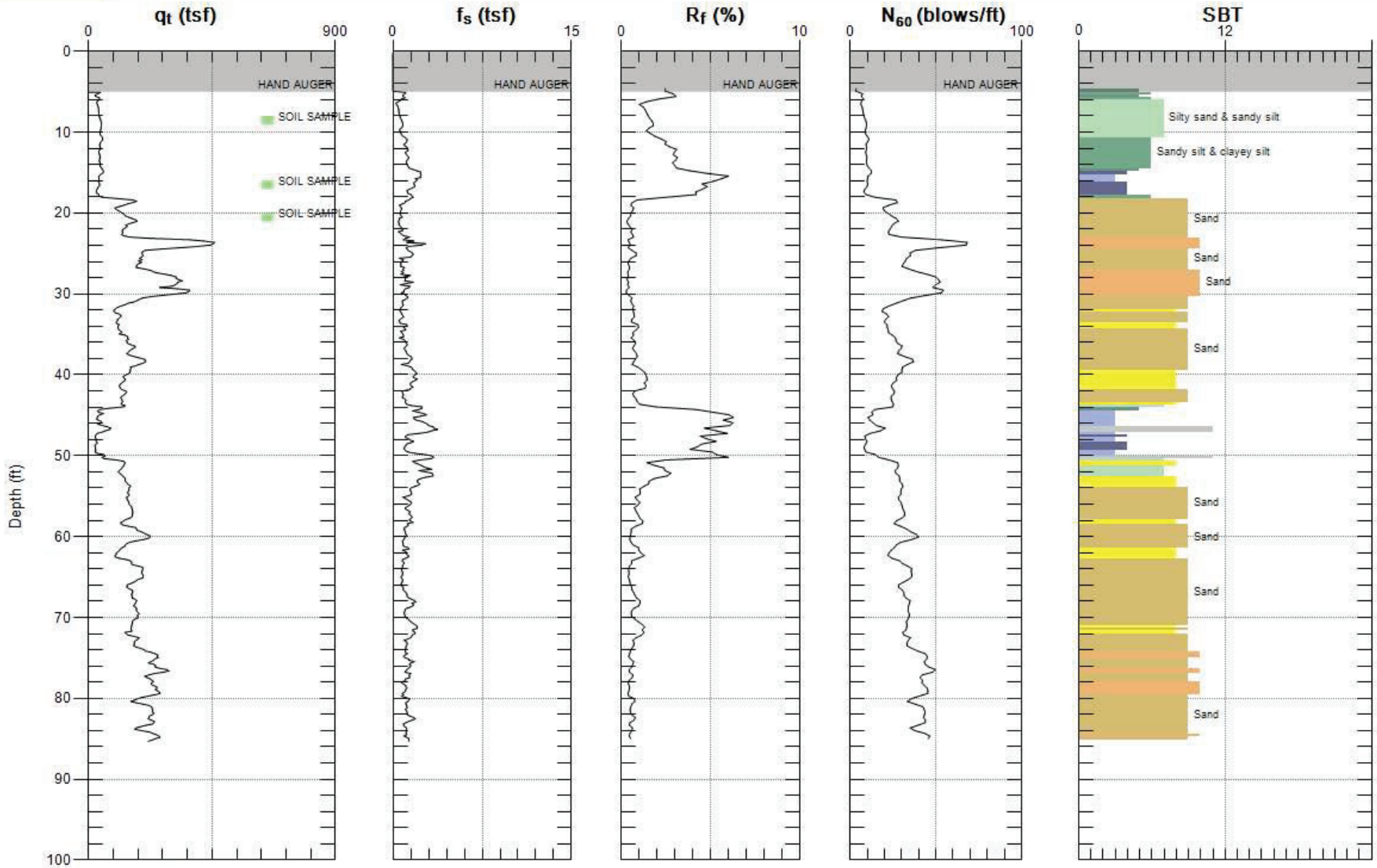
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_006C

Engineer: D.MORRELL

Date: 11/12/2010 08:28



Max. Depth: 85.302 (ft)

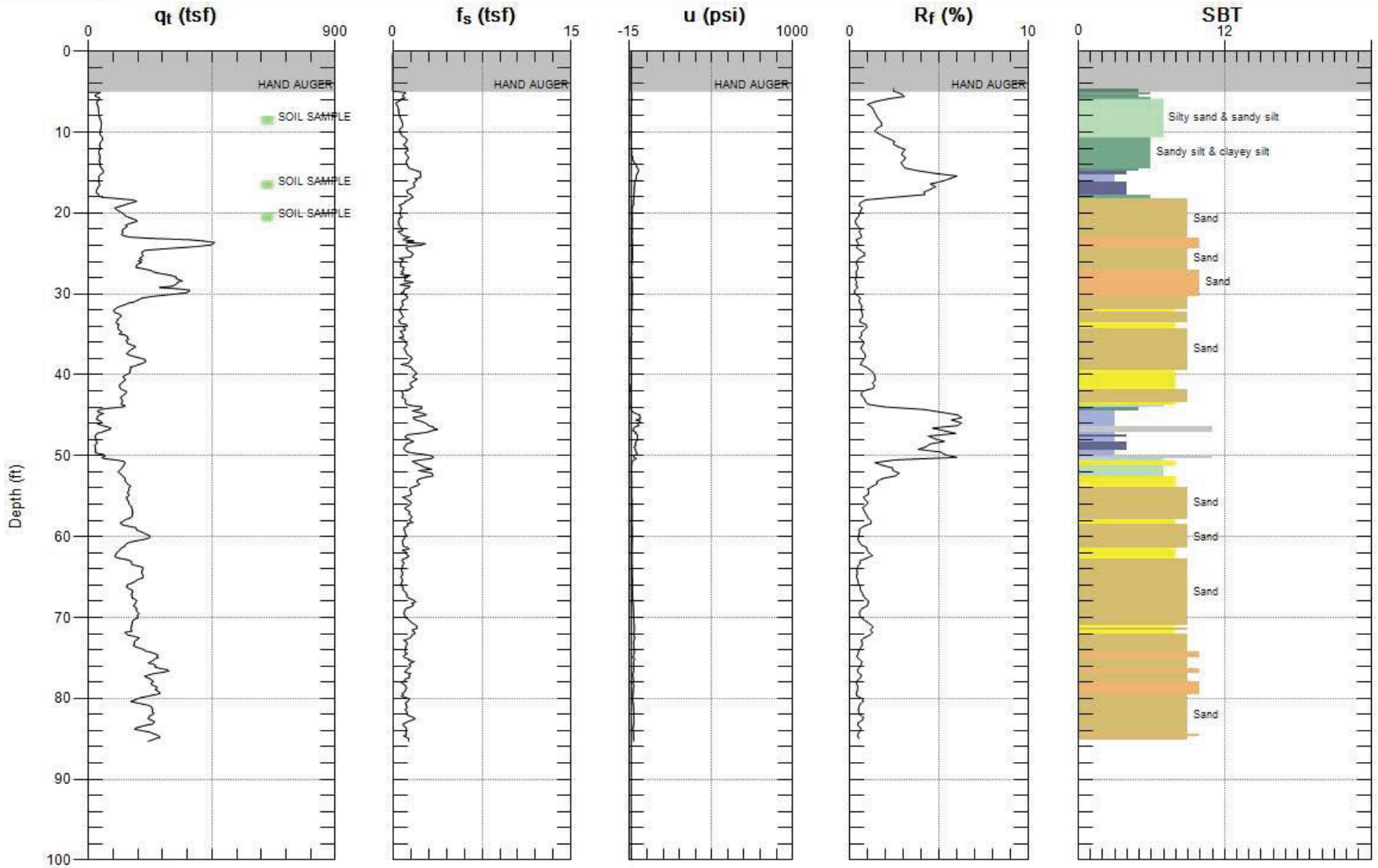
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_006C
Engineer: D.MORRELL
Date: 11/12/2010 08:28



Max. Depth: 85.302 (ft)
Avg. Interval: 0.328 (ft)

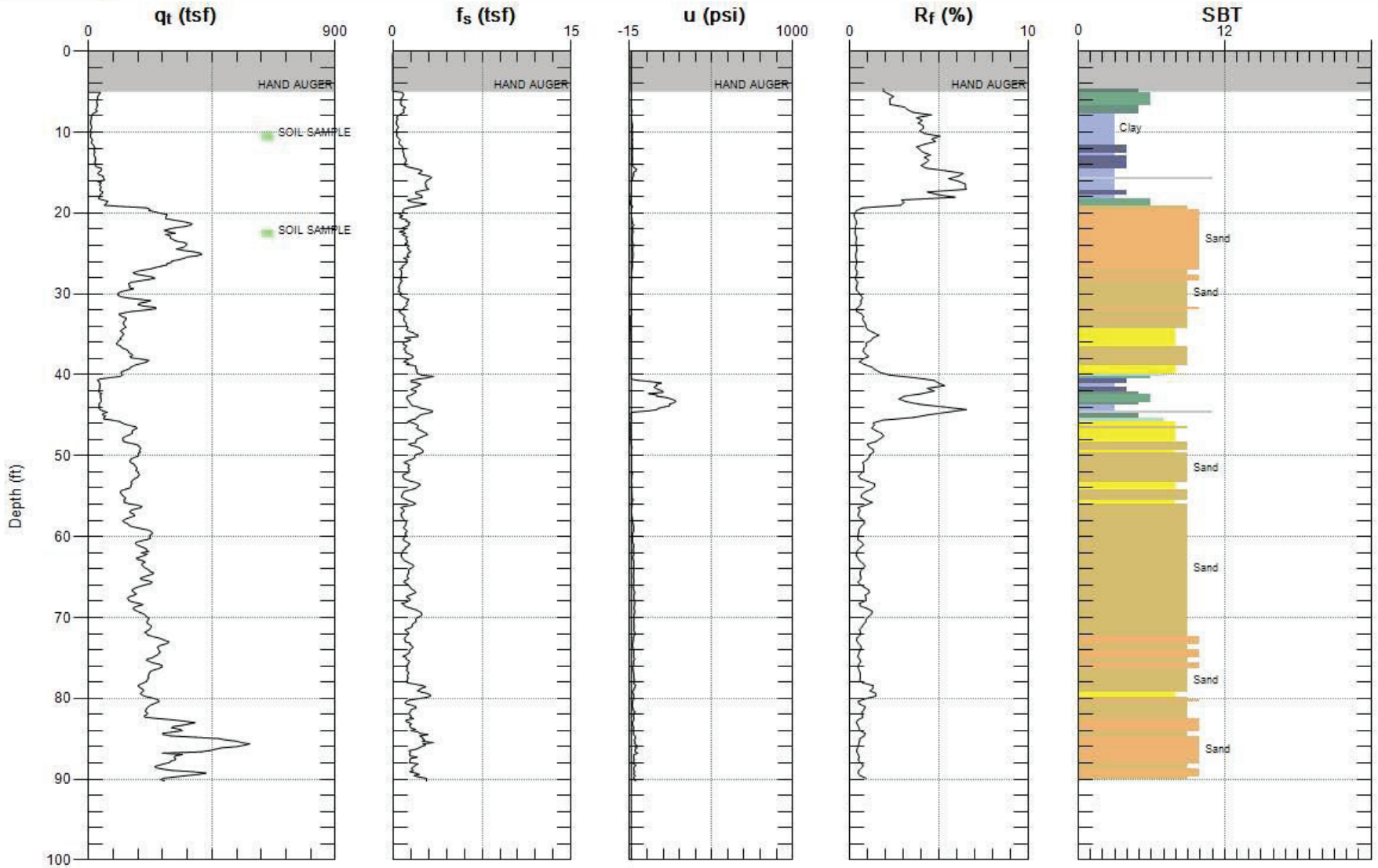
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_007C

Engineer: D.MORRELL
Date: 11/12/2010 11:18



Max. Depth: 90.223 (ft)
Avg. Interval: 0.328 (ft)

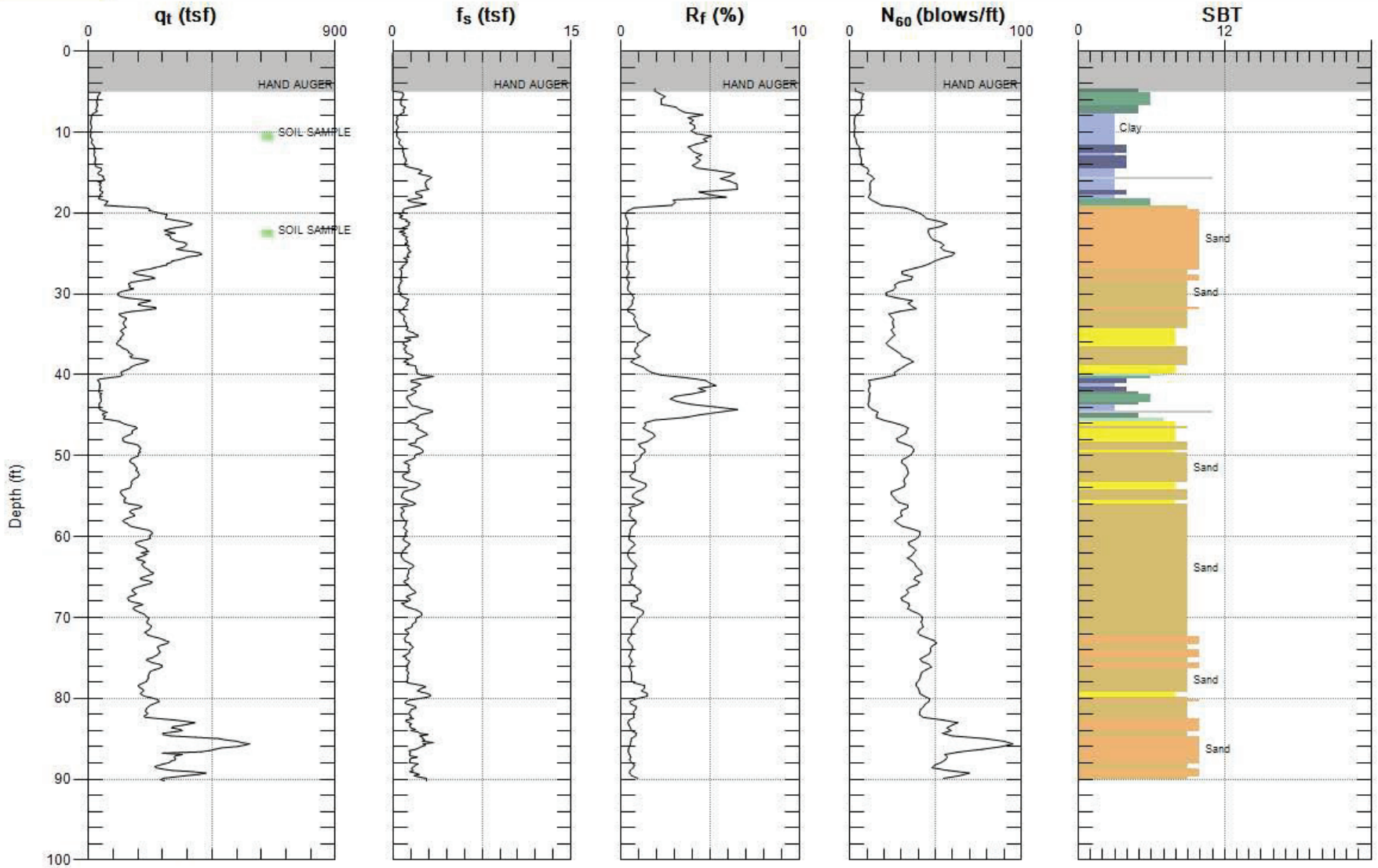
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0003_007C

Engineer: D.MORRELL
Date: 11/12/2010 11:18



Max. Depth: 90.223 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

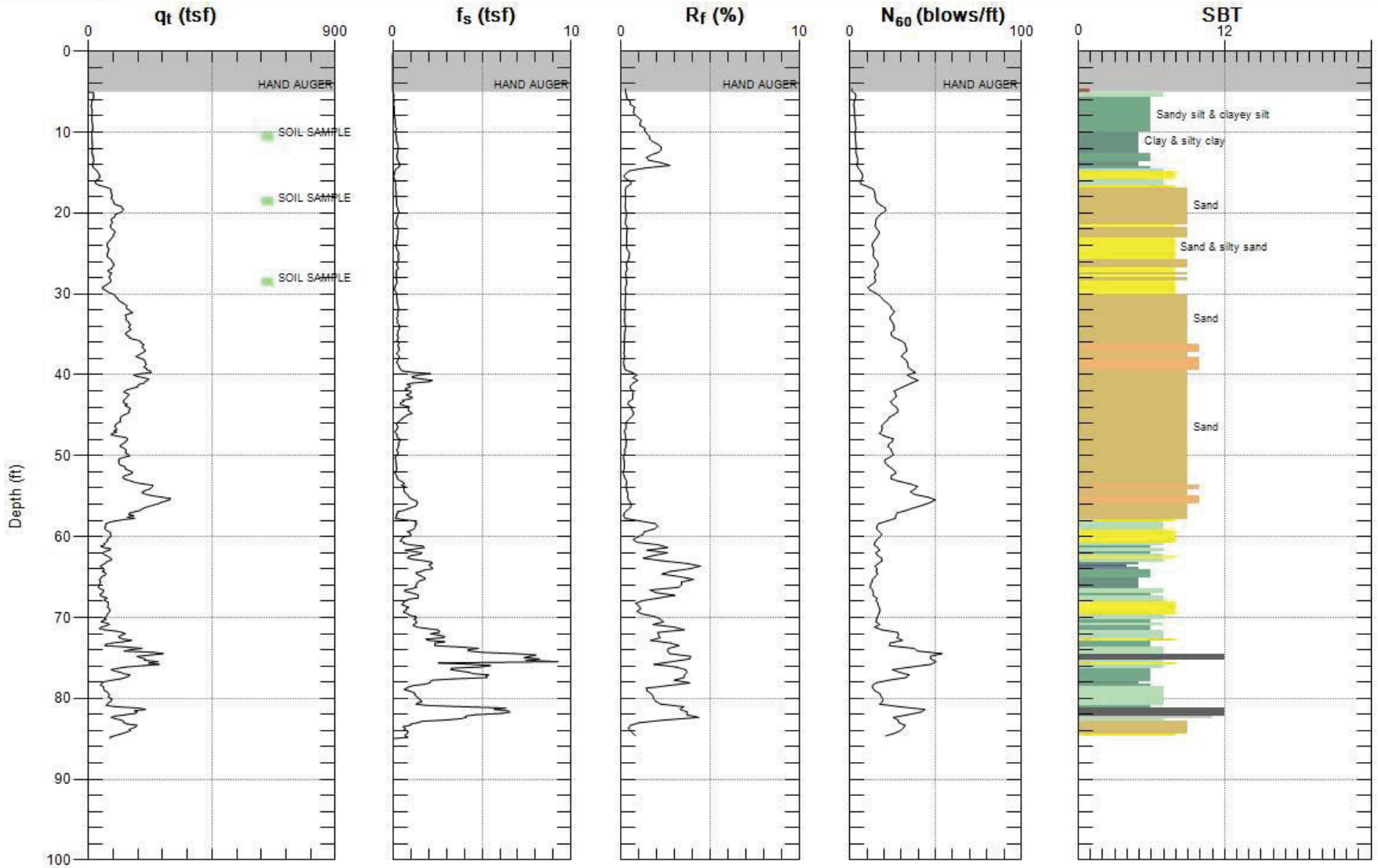
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_008C

Engineer: M.WEIL

Date: 10/12/2010 12:45



Max. Depth: 84.974 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

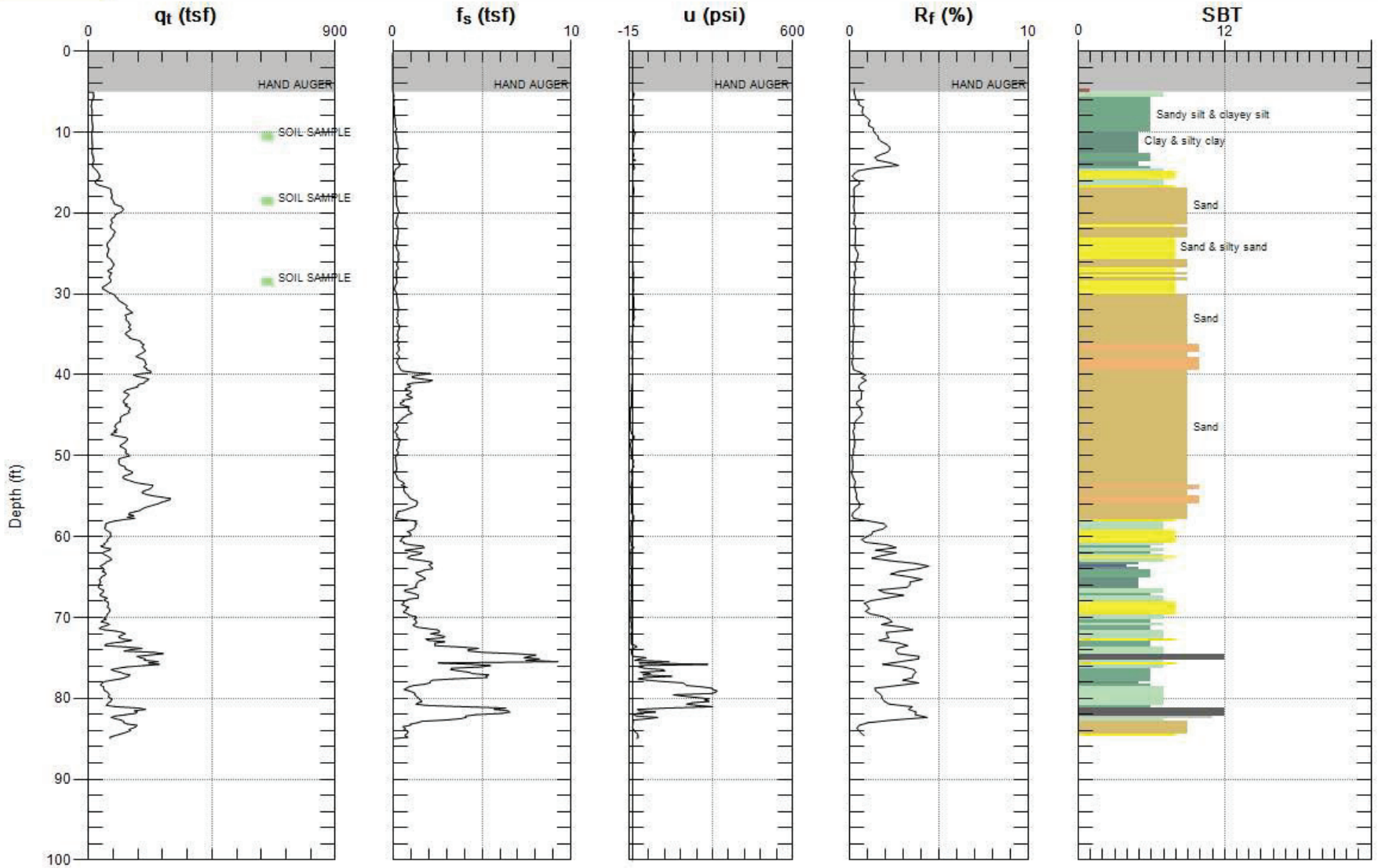
URS

Site: SBFCA FRWL EIP

Sounding: SM0003_008C

Engineer: M.WEIL

Date: 10/12/2010 12:45



Max. Depth: 84.974 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

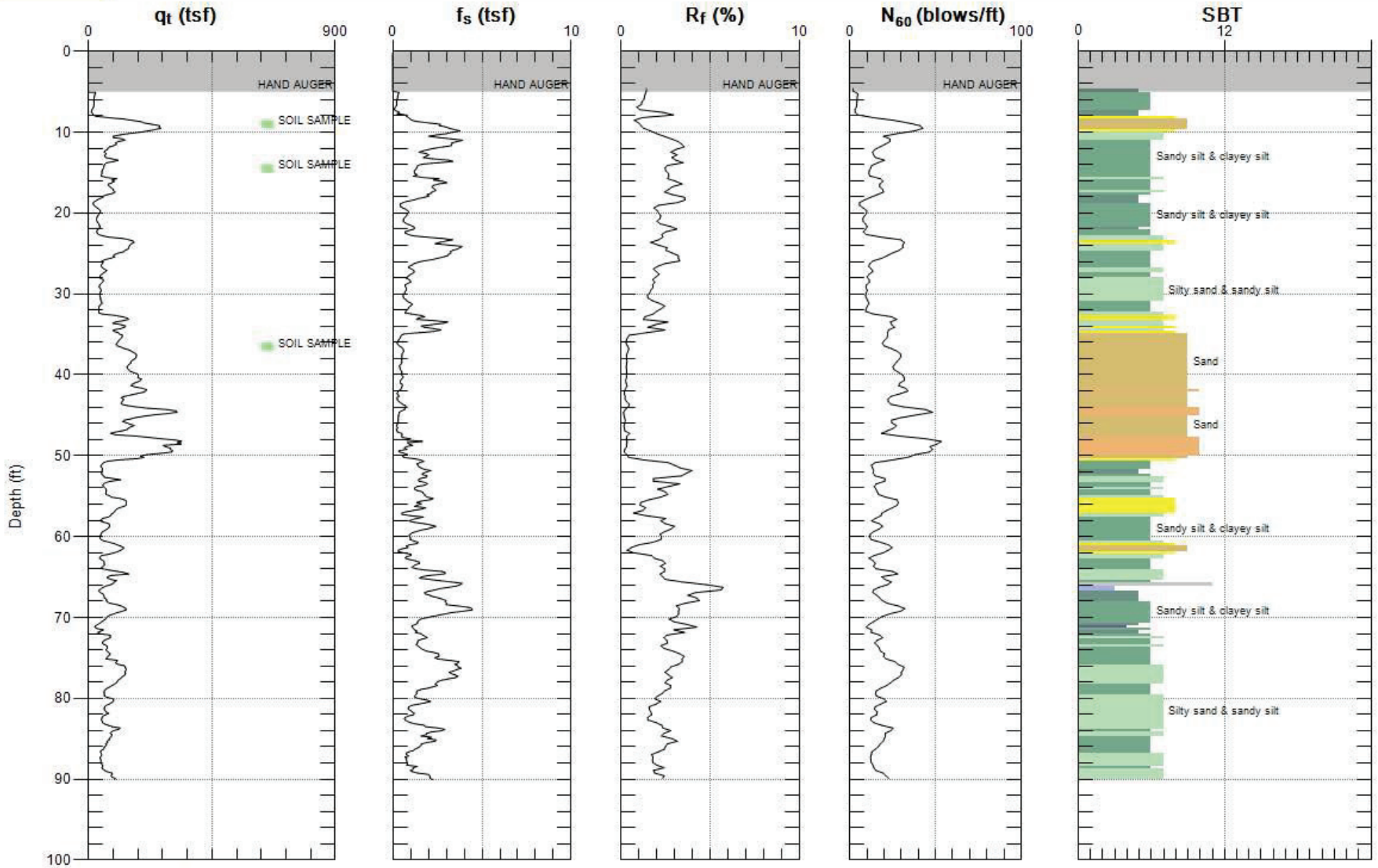
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_001C

Engineer: M.WEIL

Date: 10/6/2010 01:05



Max. Depth: 90.059 (ft)

Avg. Interval: 0.328 (ft)

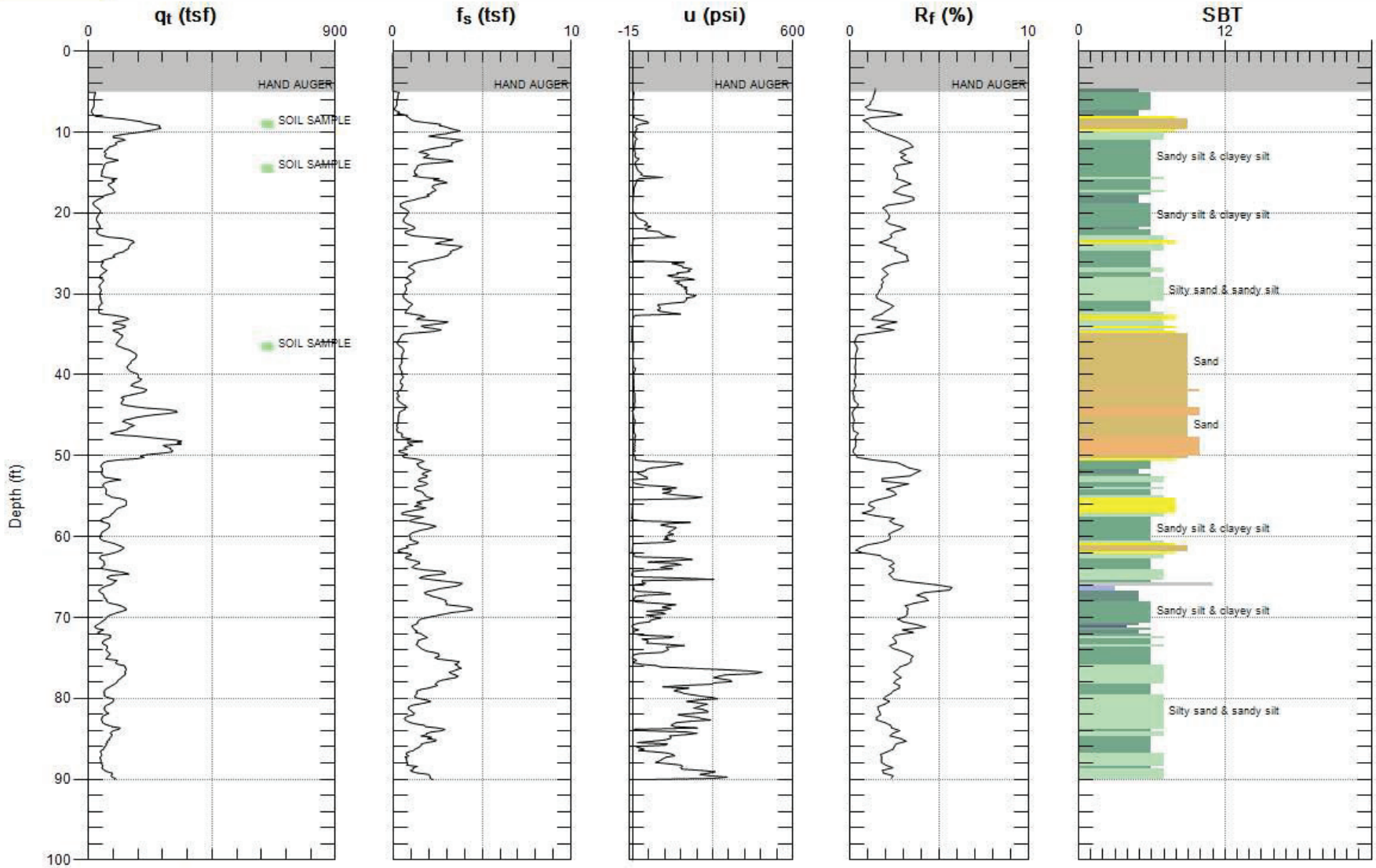
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_001C

Engineer: M.WEIL
Date: 10/6/2010 01:05



Max. Depth: 90.059 (ft)
Avg. Interval: 0.328 (ft)

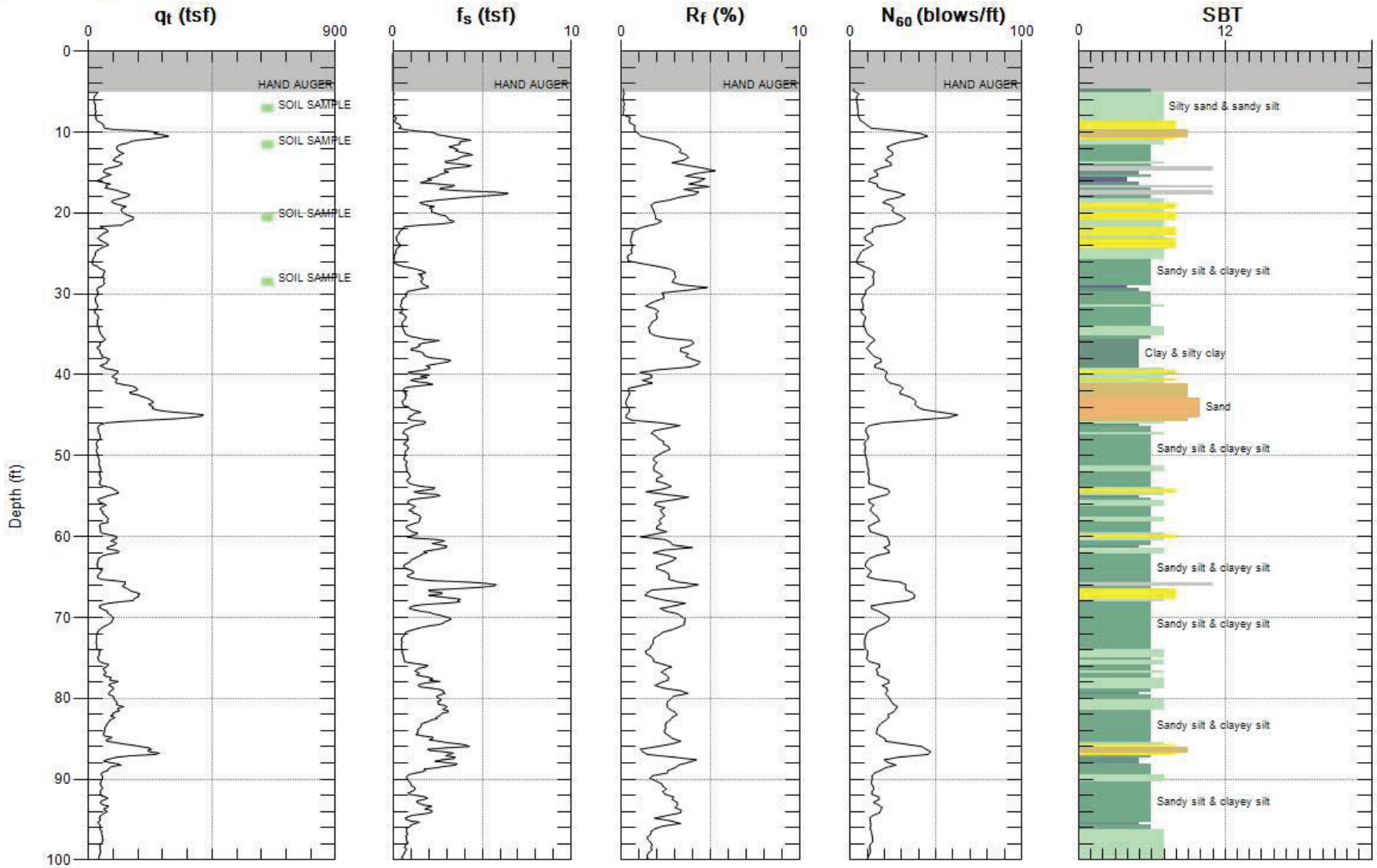
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_002C

Engineer: M.WEIL
Date: 10/12/2010 08:42



Max. Depth: 120.407 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

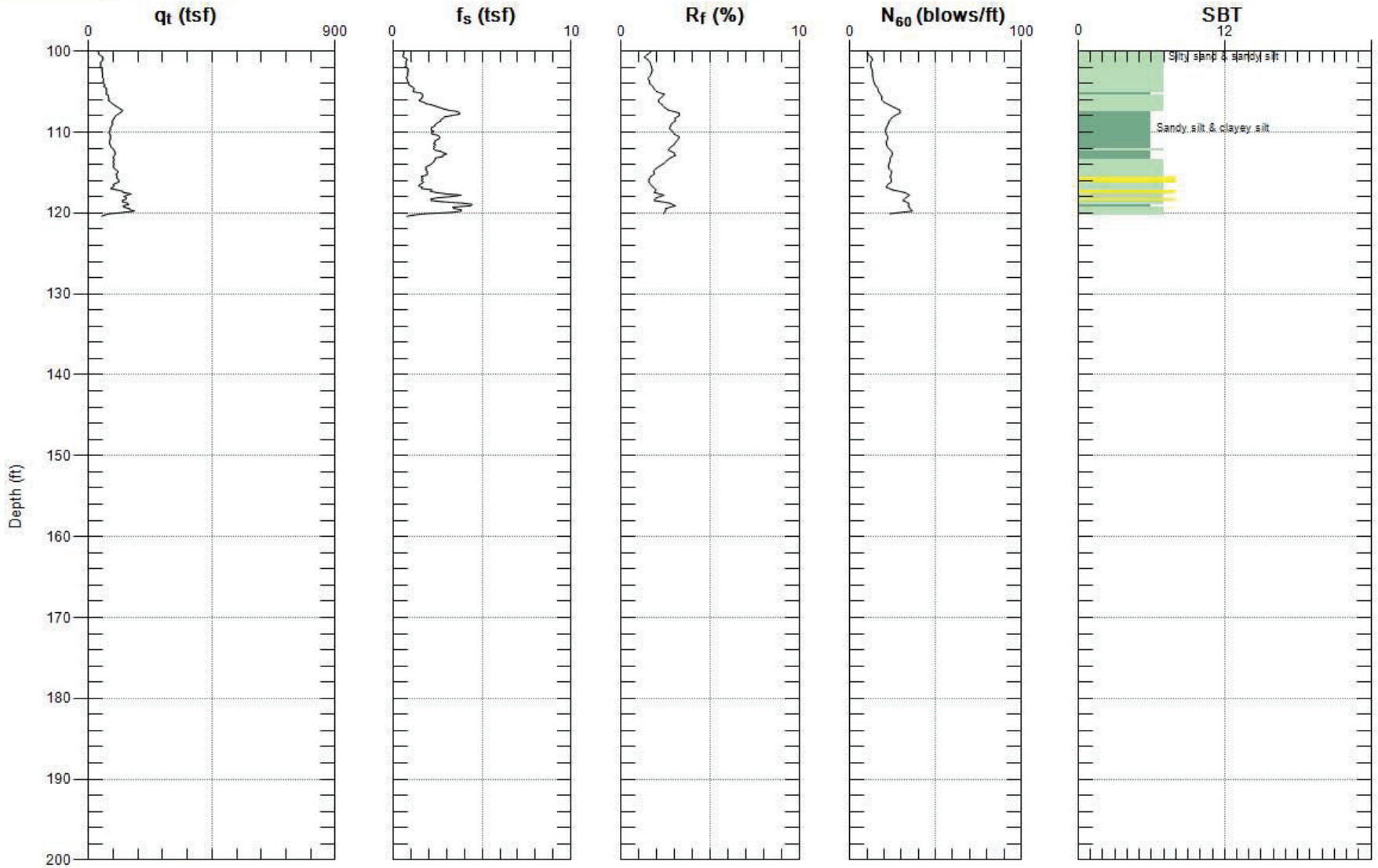
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_002C

Engineer: M.WEIL

Date: 10/12/2010 08:42



Max. Depth: 120.407 (ft)

Avg. Interval: 0.328 (ft)

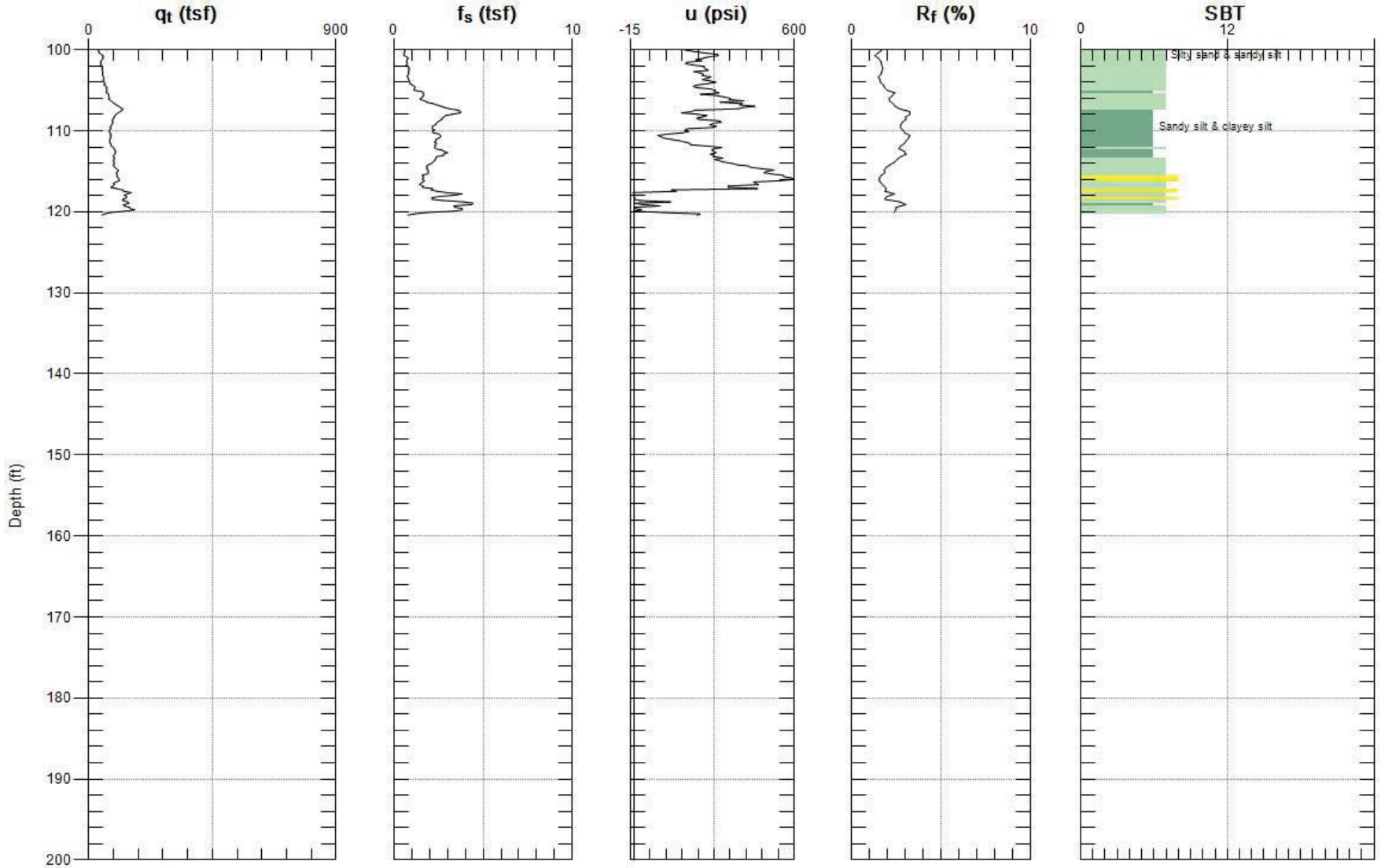
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_002C

Engineer: M.WEIL
Date: 10/12/2010 08:42



Max. Depth: 120.407 (ft)
Avg. Interval: 0.328 (ft)

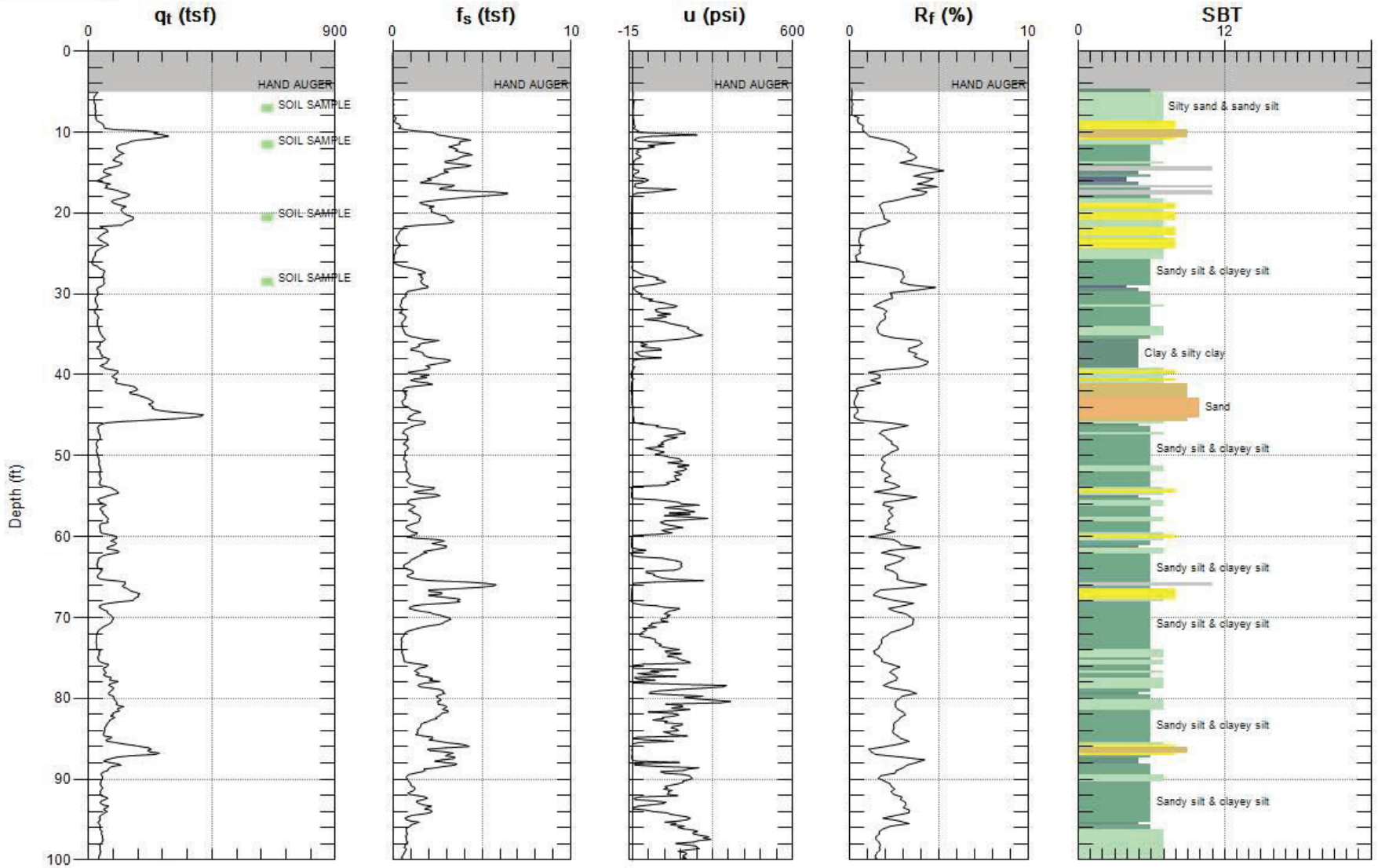
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_002C

Engineer: M.WEIL
Date: 10/12/2010 08:42



Max. Depth: 120.407 (ft)
Avg. Interval: 0.328 (ft)

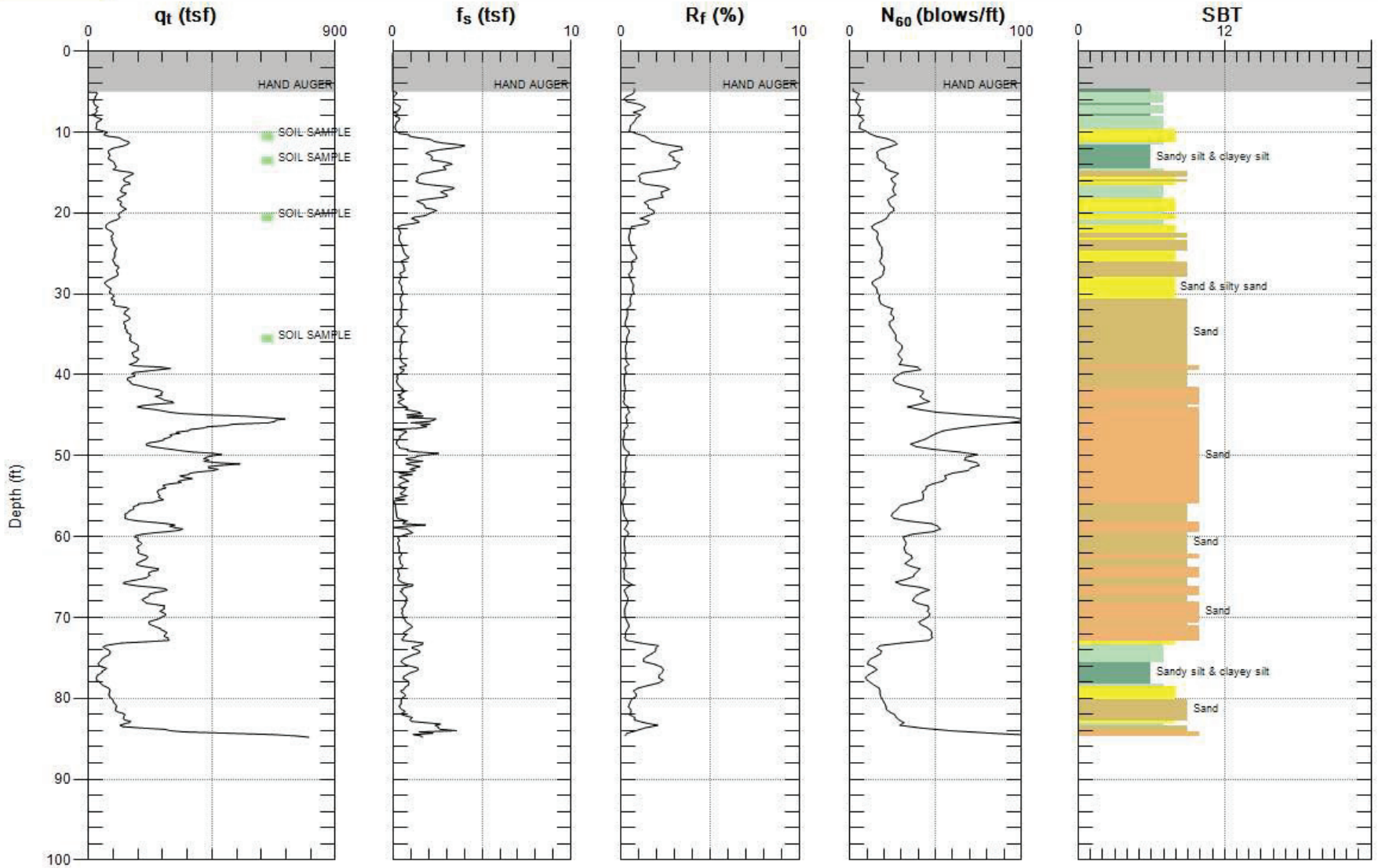
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_003C

Engineer: M.WEIL
Date: 10/11/2010 12:48



Max. Depth: 84.810 (ft)
Avg. Interval: 0.328 (ft)

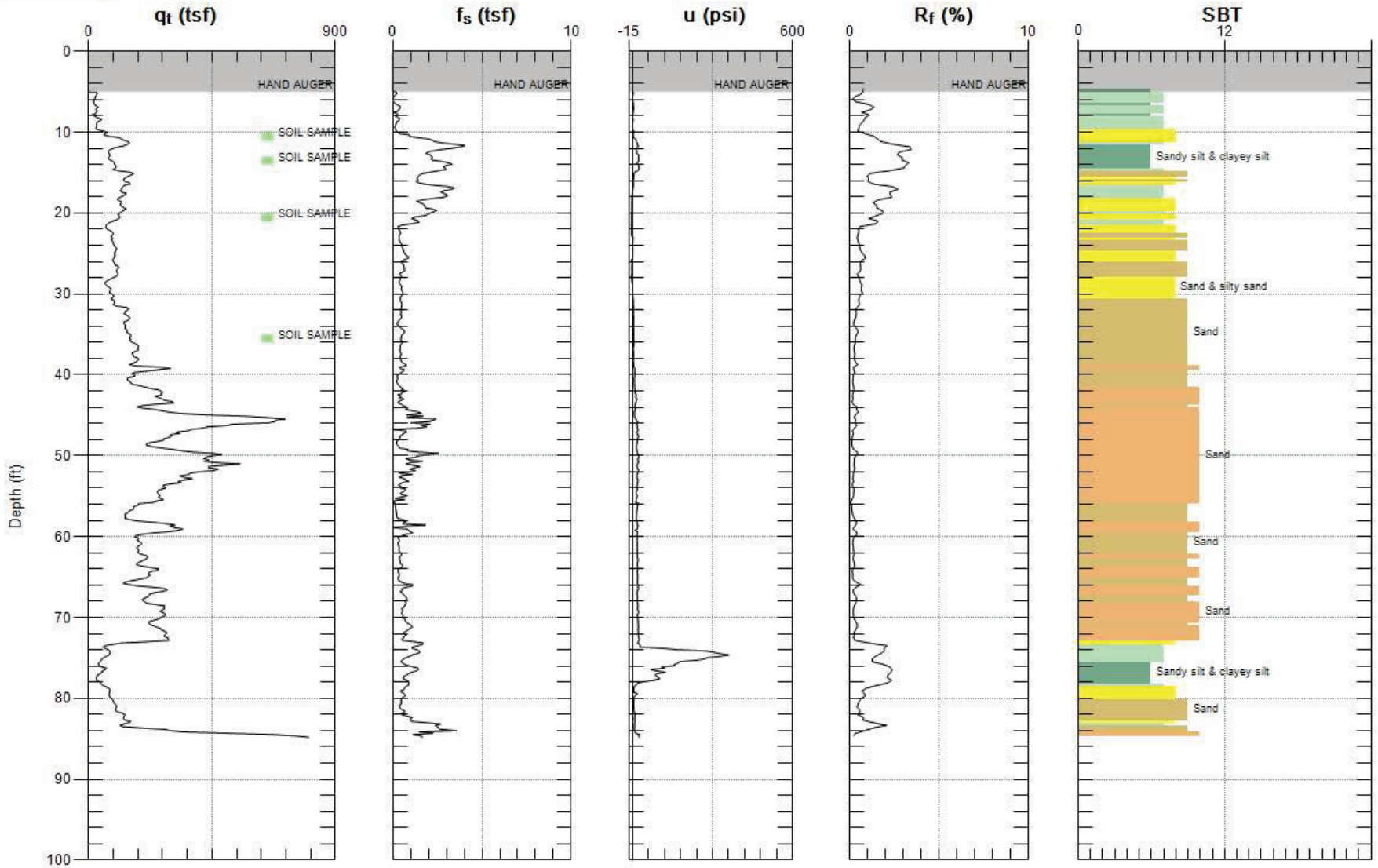
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_003C

Engineer: M.WEIL
Date: 10/11/2010 12:48



Max. Depth: 84.810 (ft)
Avg. Interval: 0.328 (ft)

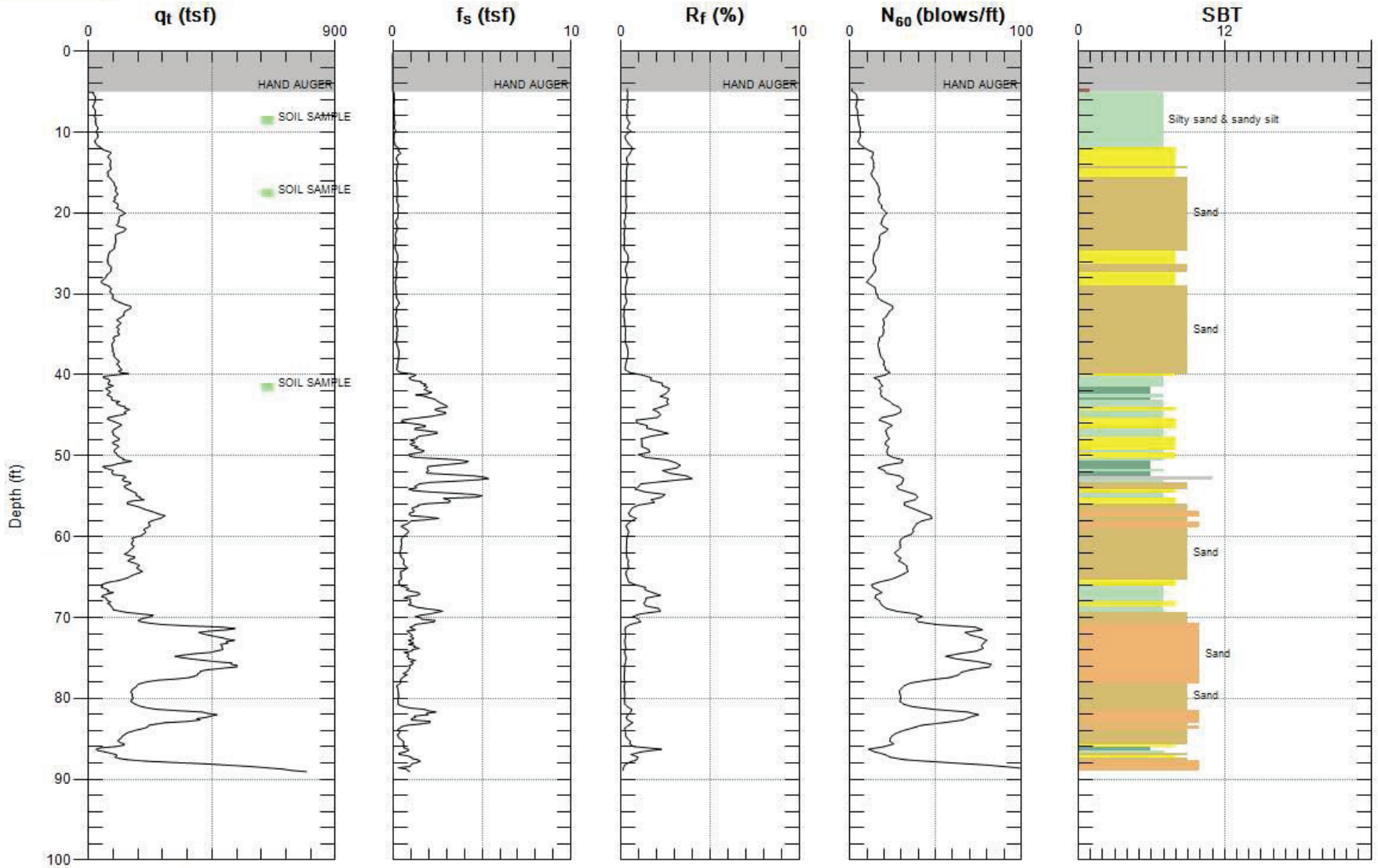
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_004C

Engineer: M.WEIL
Date: 10/6/2010 09:14



Max. Depth: 89.075 (ft)
Avg. Interval: 0.328 (ft)

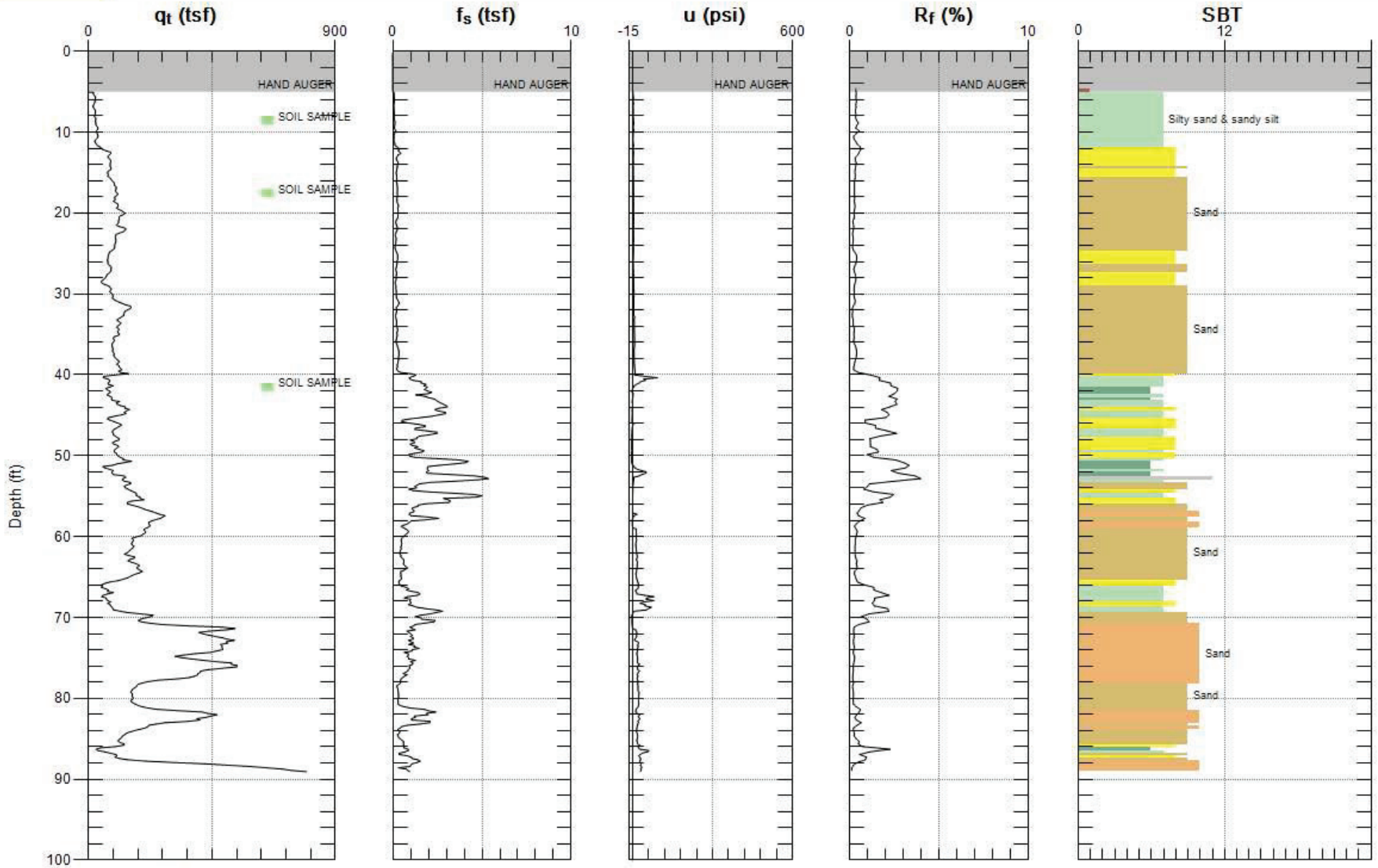
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_004C

Engineer: M.WEIL
Date: 10/6/2010 09:14



Max. Depth: 89.075 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

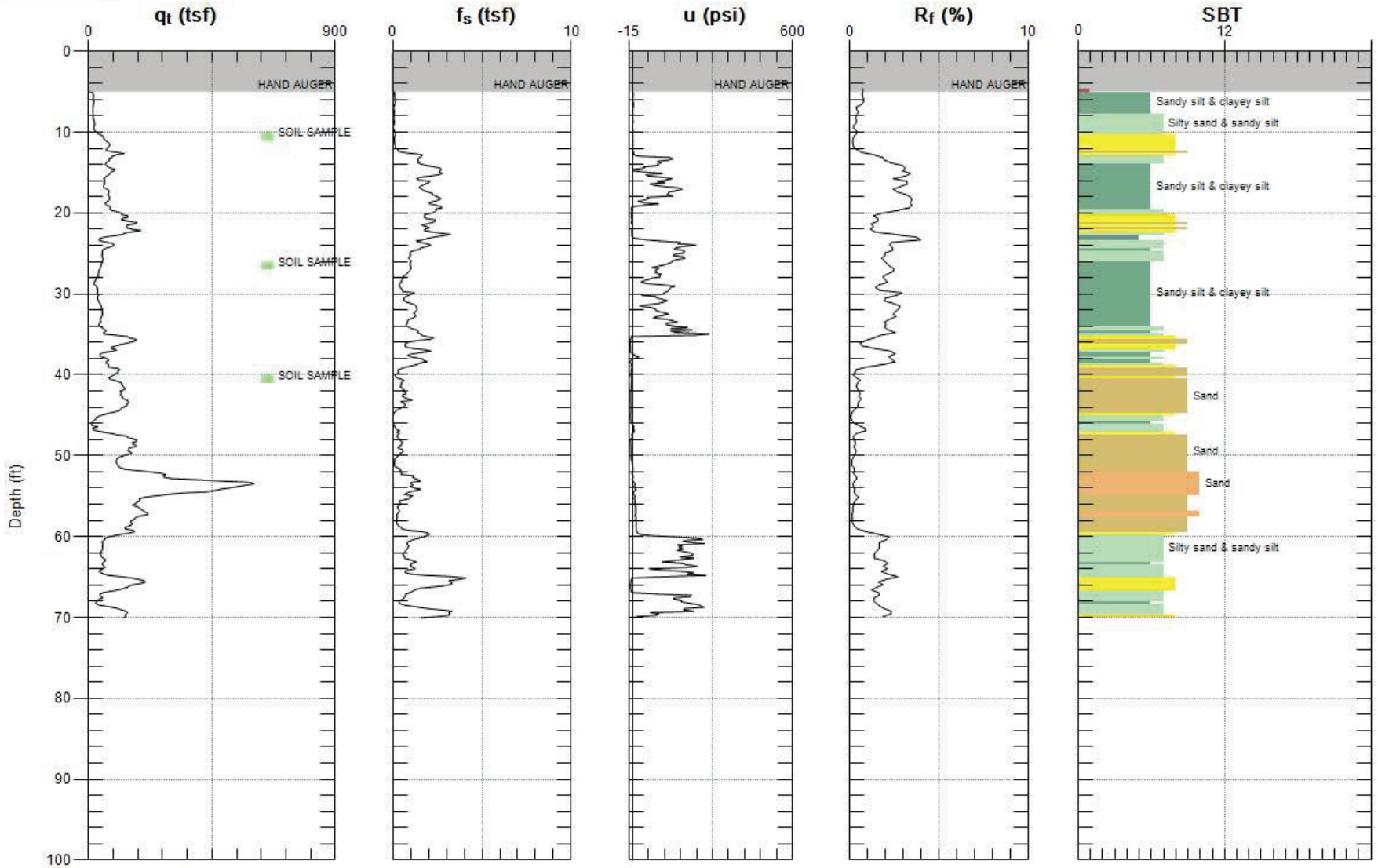
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_005C

Engineer: M.WEIL

Date: 9/30/2010 09:08



Max. Depth: 70.046 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

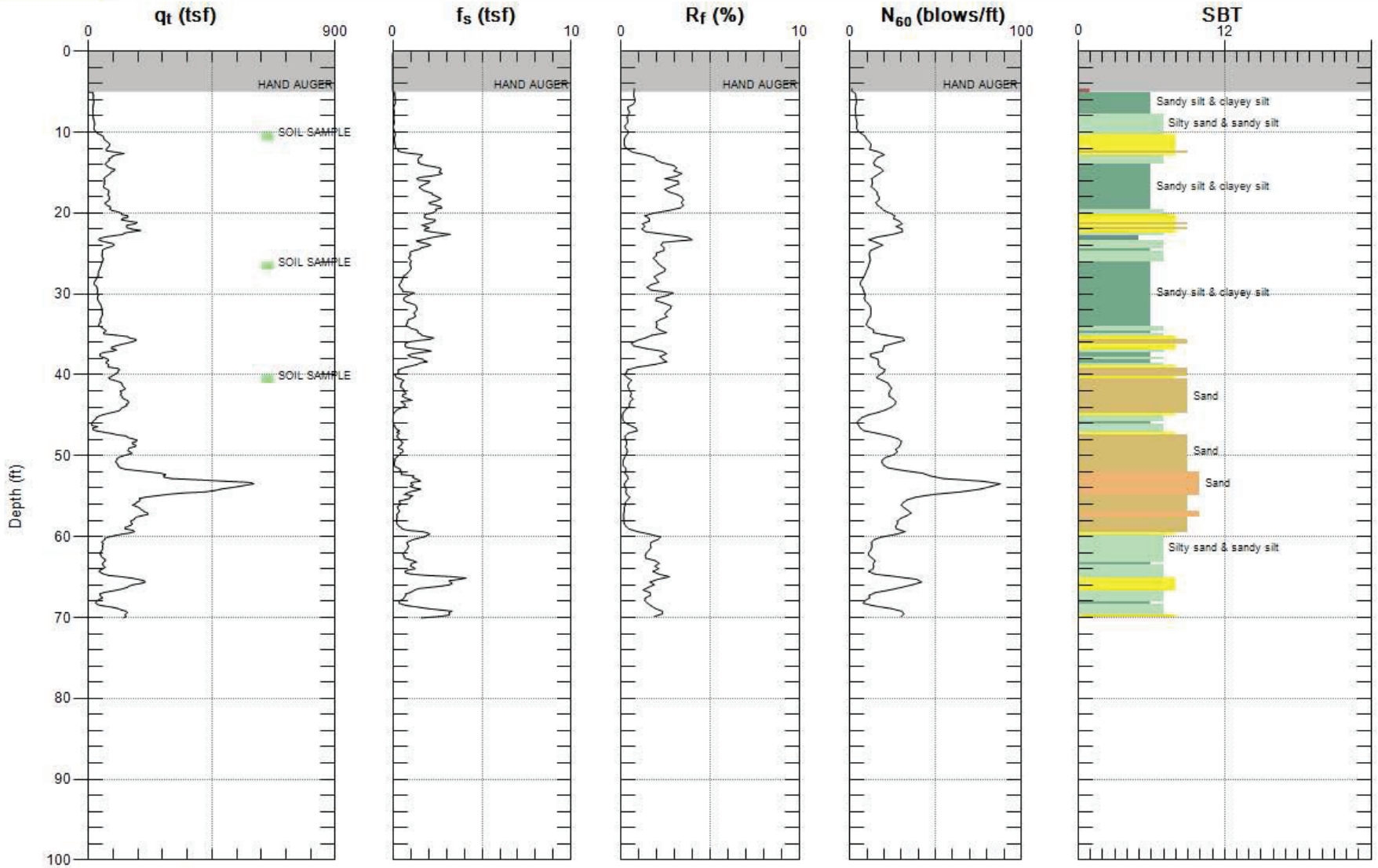
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_005C

Engineer: M.WEIL

Date: 9/30/2010 09:08



Max. Depth: 70.046 (ft)

Avg. Interval: 0.328 (ft)

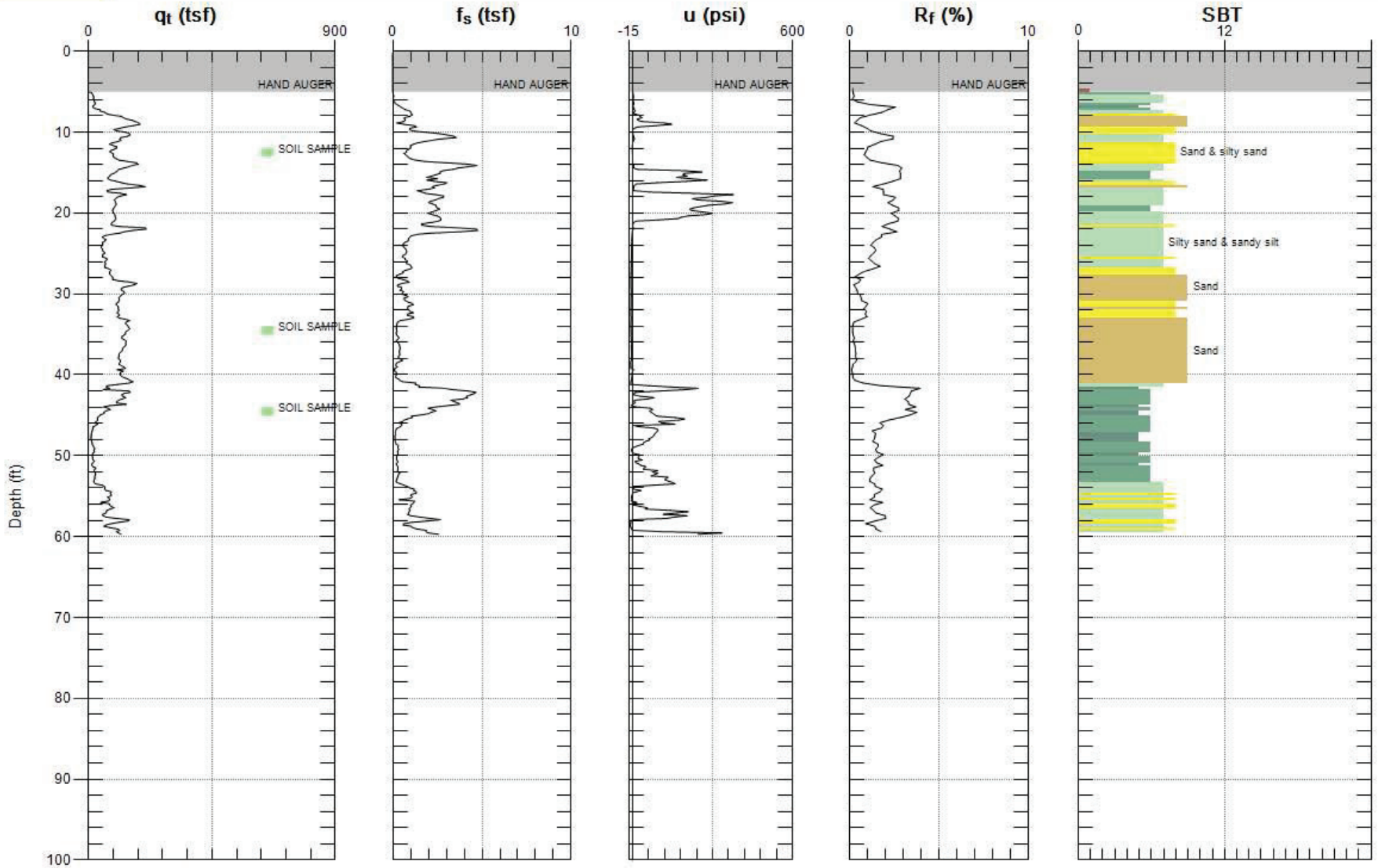
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_007C

Engineer: M.WEIL
Date: 9/29/2010 04:25



Max. Depth: 59.711 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

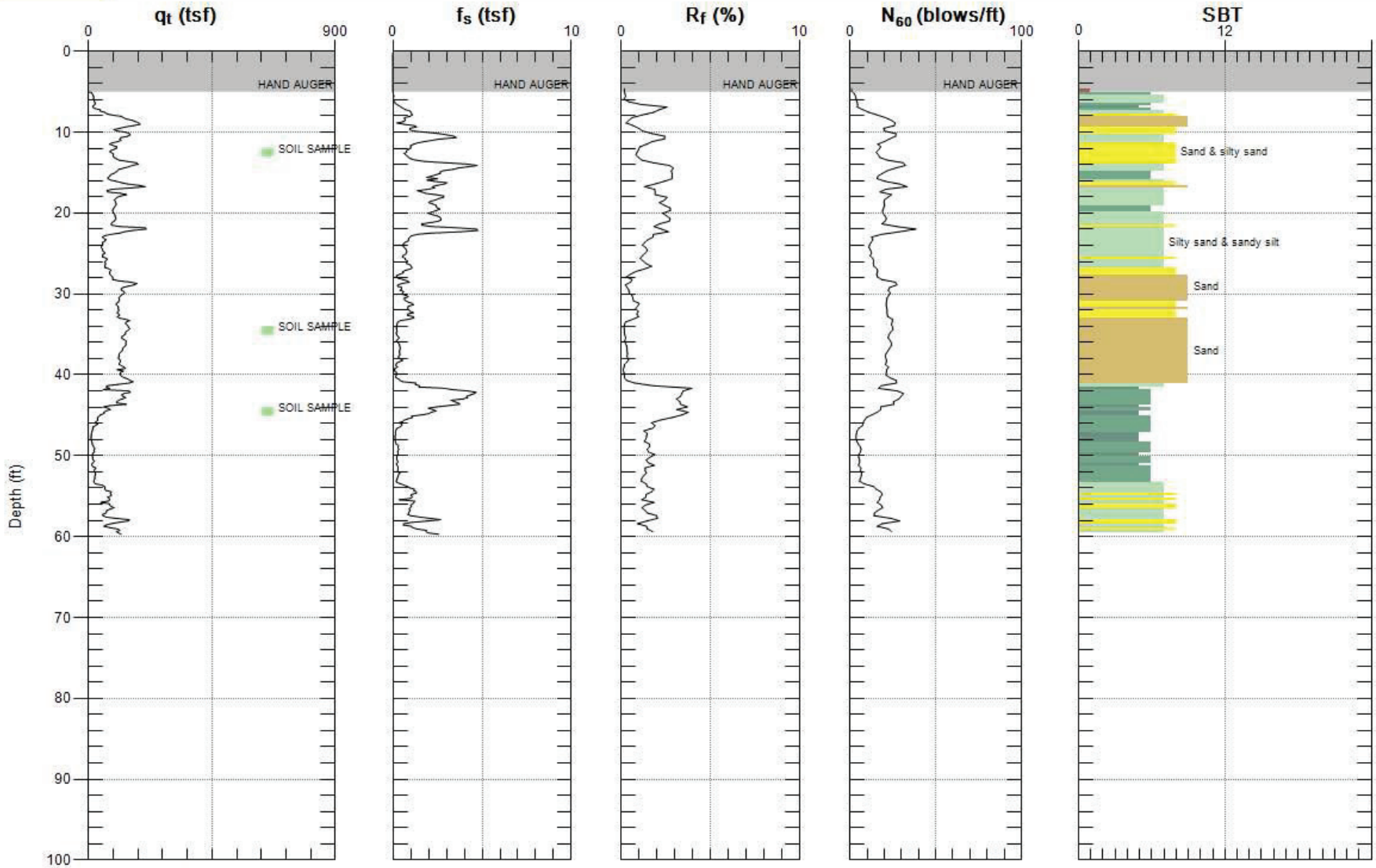
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_007C

Engineer: M.WEIL

Date: 9/29/2010 04:25



Max. Depth: 59.711 (ft)

Avg. Interval: 0.328 (ft)

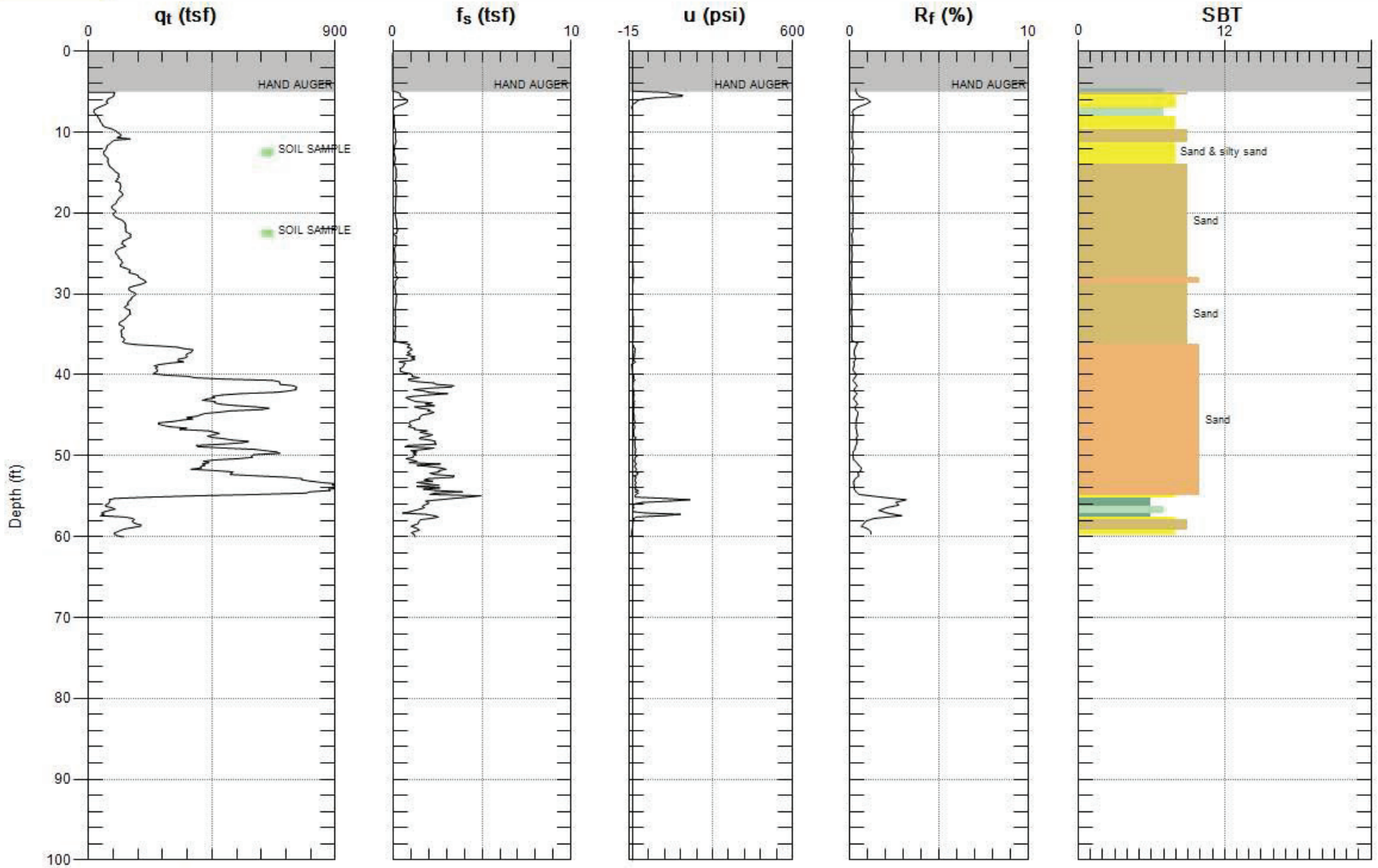
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_008C

Engineer: M.WEIL
Date: 9/29/2010 12:41



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

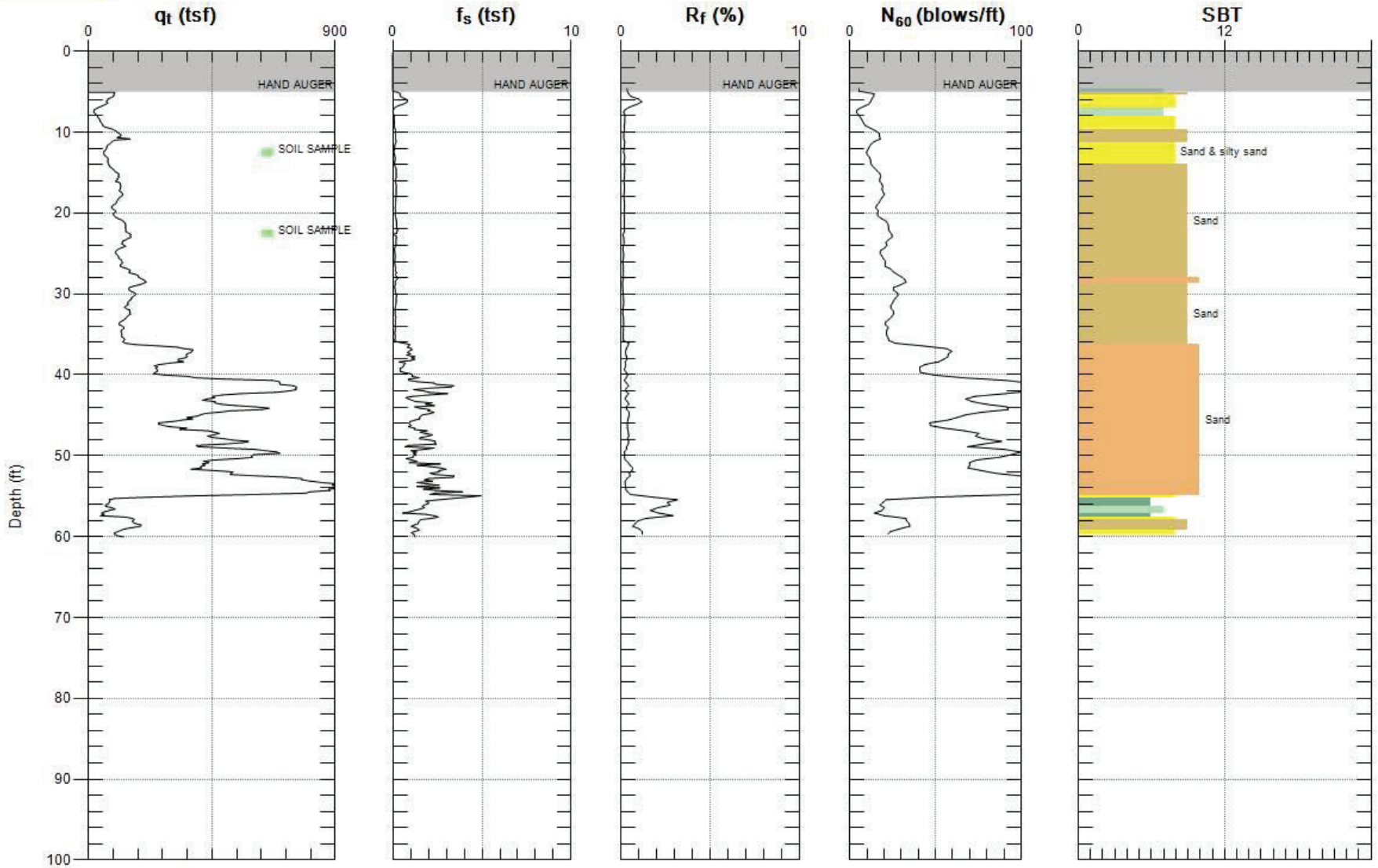
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_008C

Engineer: M.WEIL

Date: 9/29/2010 12:41



Max. Depth: 60.039 (ft)

Avg. Interval: 0.328 (ft)

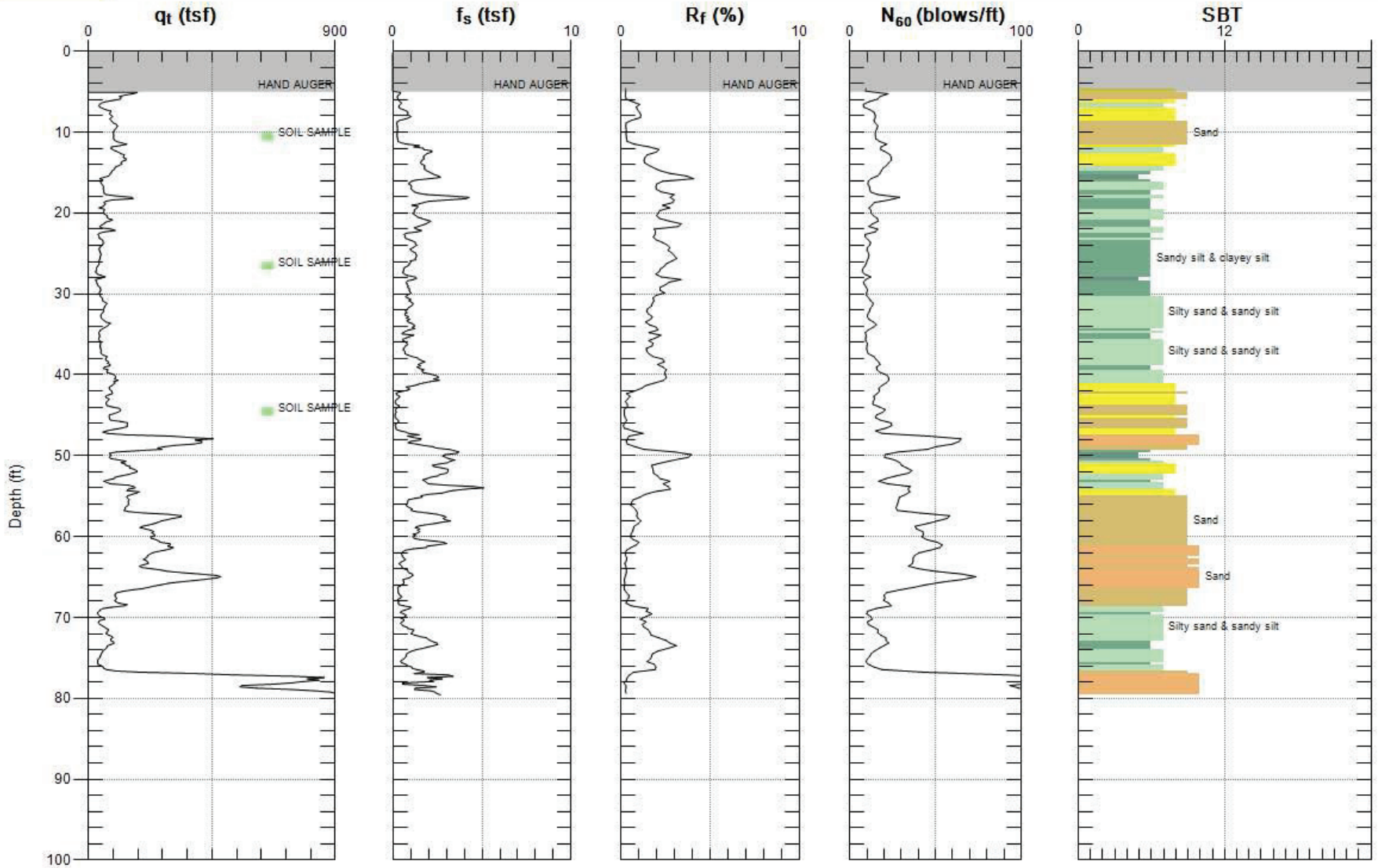
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_009C

Engineer: M.WEIL
Date: 9/29/2010 08:48



Max. Depth: 79.560 (ft)
Avg. Interval: 0.328 (ft)

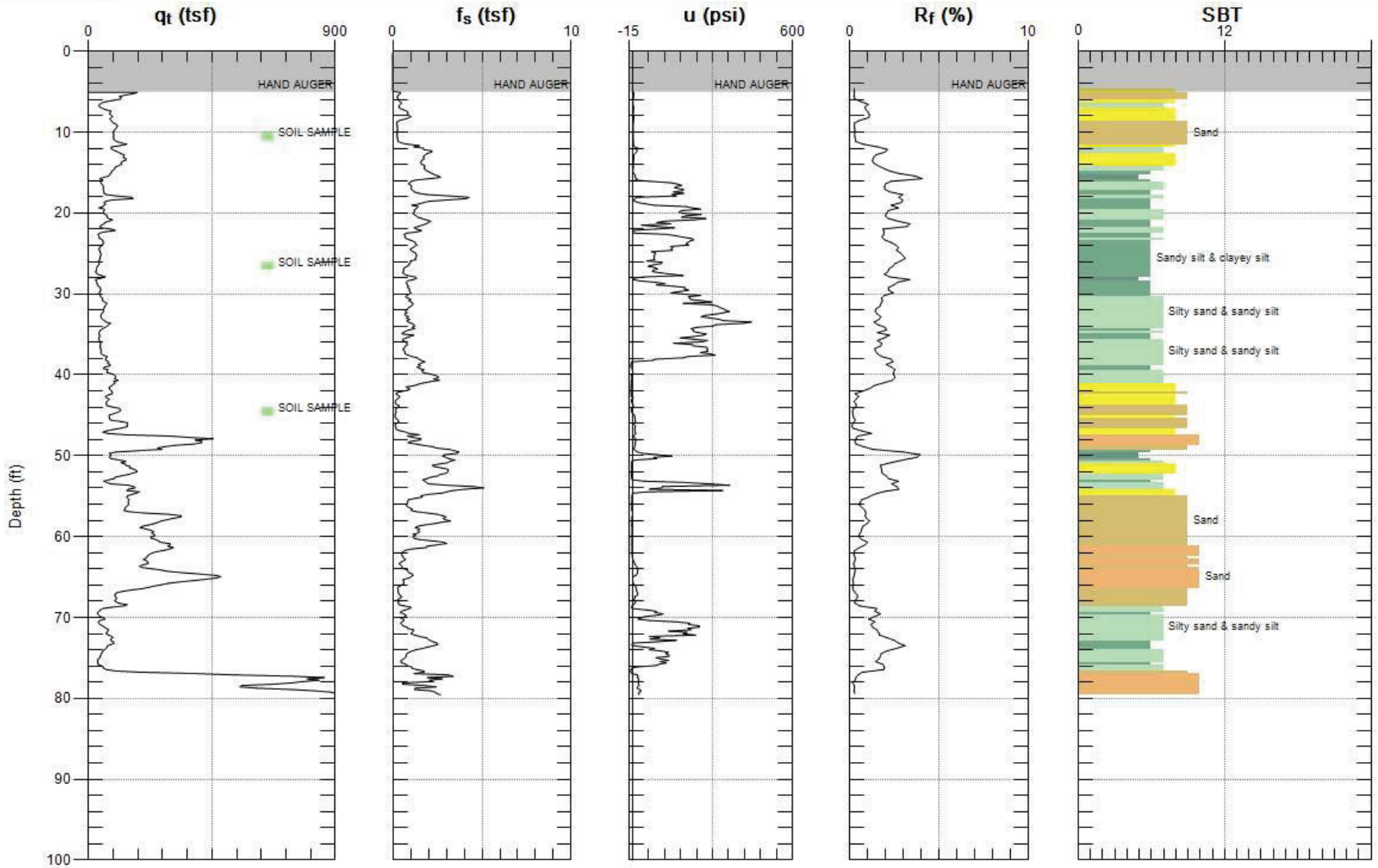
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_009C

Engineer: M.WEIL
Date: 9/29/2010 08:48



Max. Depth: 79.560 (ft)
Avg. Interval: 0.328 (ft)

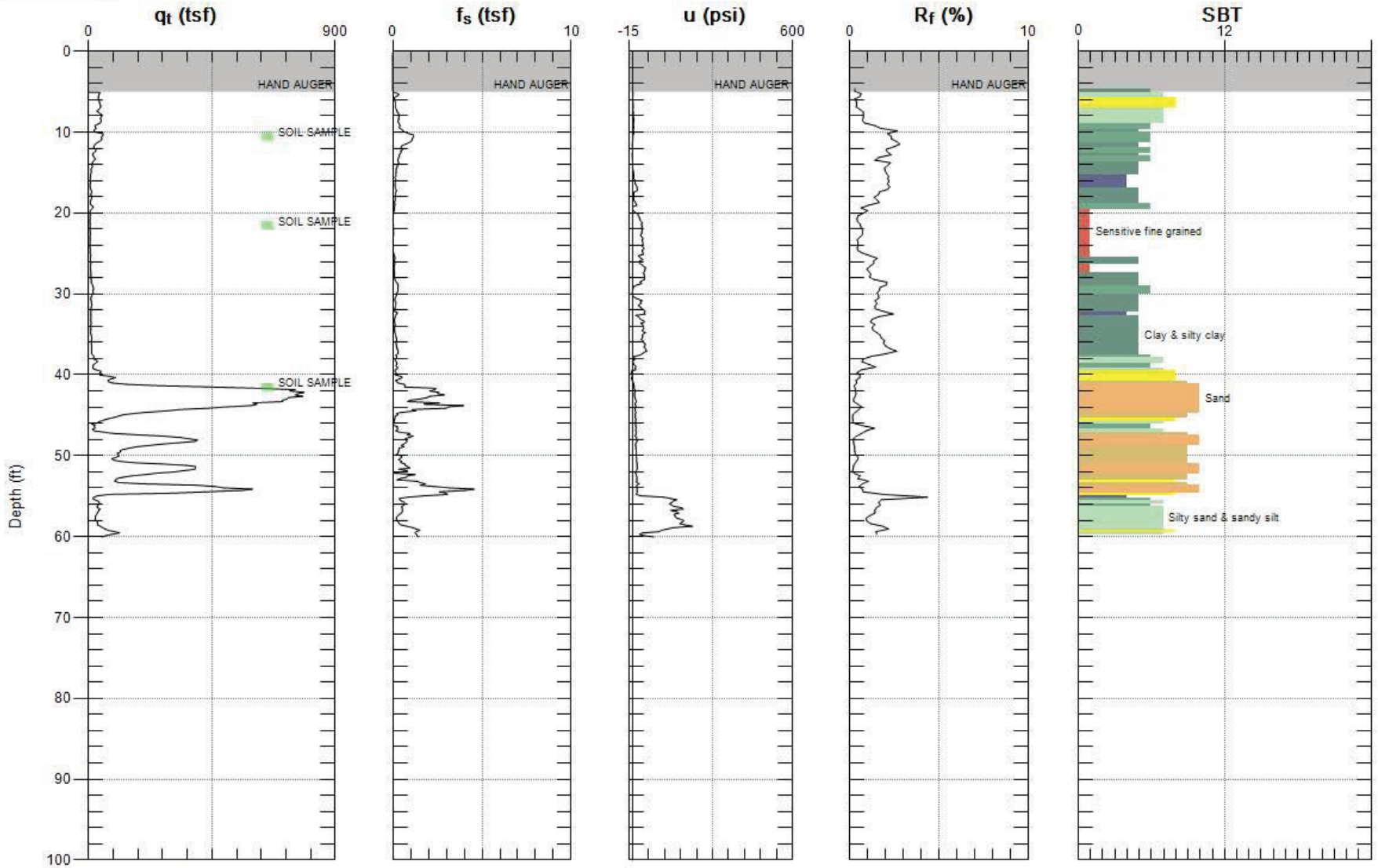
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_010C

Engineer: M.WEIL
Date: 9/28/2010 12:14



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

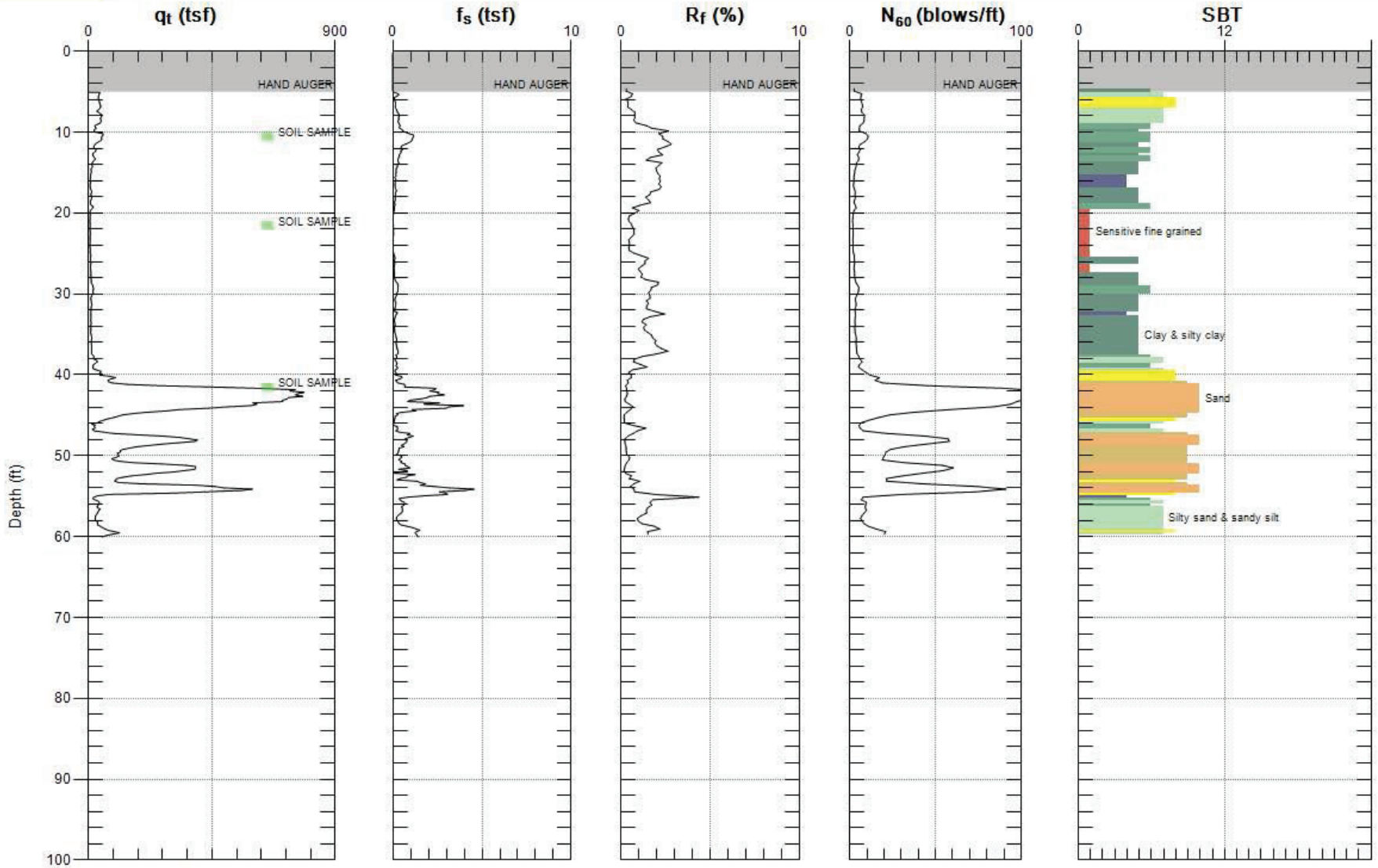
URS

Site: SBFCA FRWL EIP

Sounding: SL0001_010C

Engineer: M.WEIL

Date: 9/28/2010 12:14



Max. Depth: 60.039 (ft)

Avg. Interval: 0.328 (ft)

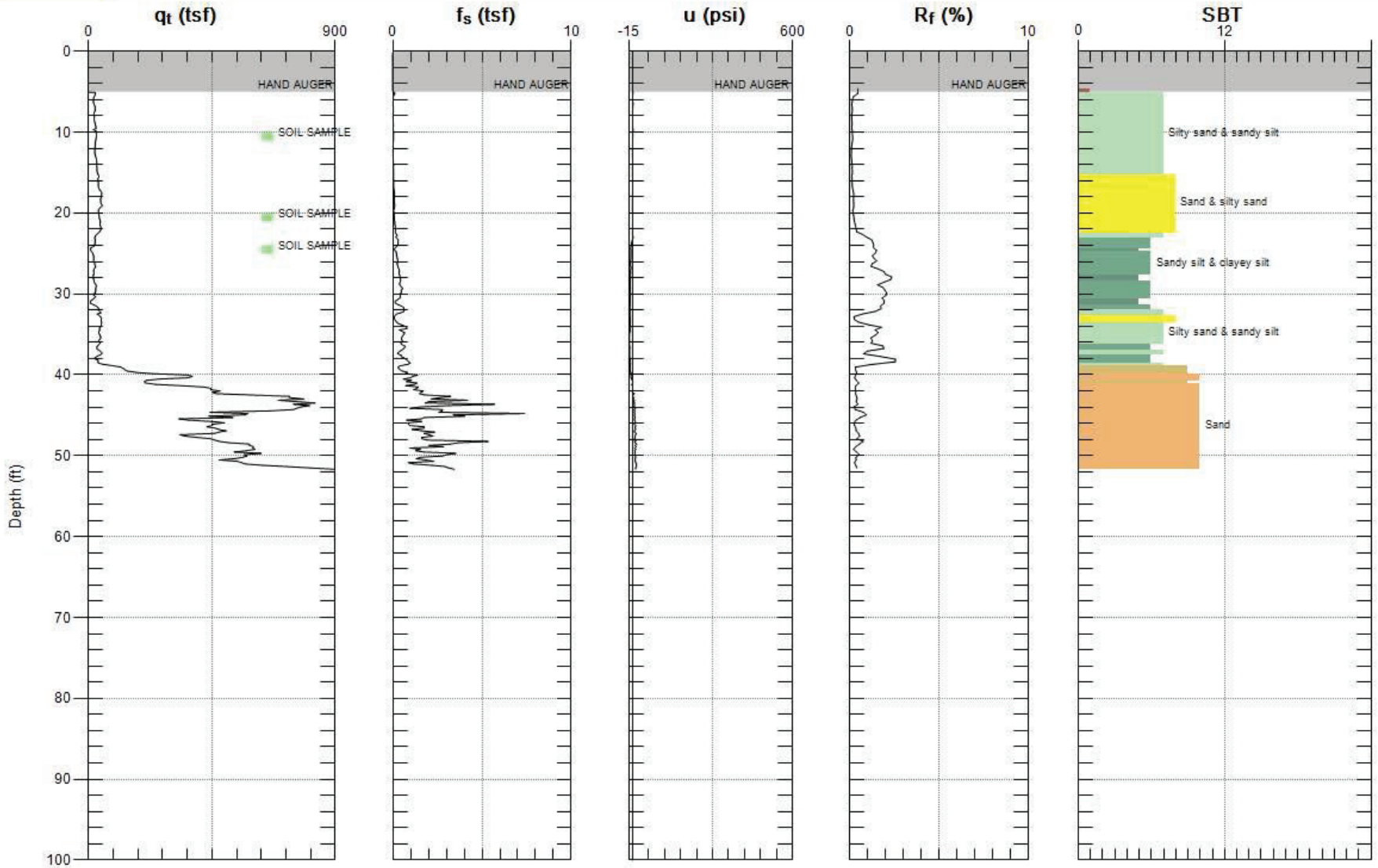
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_011C

Engineer: M.WEIL
Date: 9/28/2010 04:10



Max. Depth: 51.673 (ft)
Avg. Interval: 0.328 (ft)

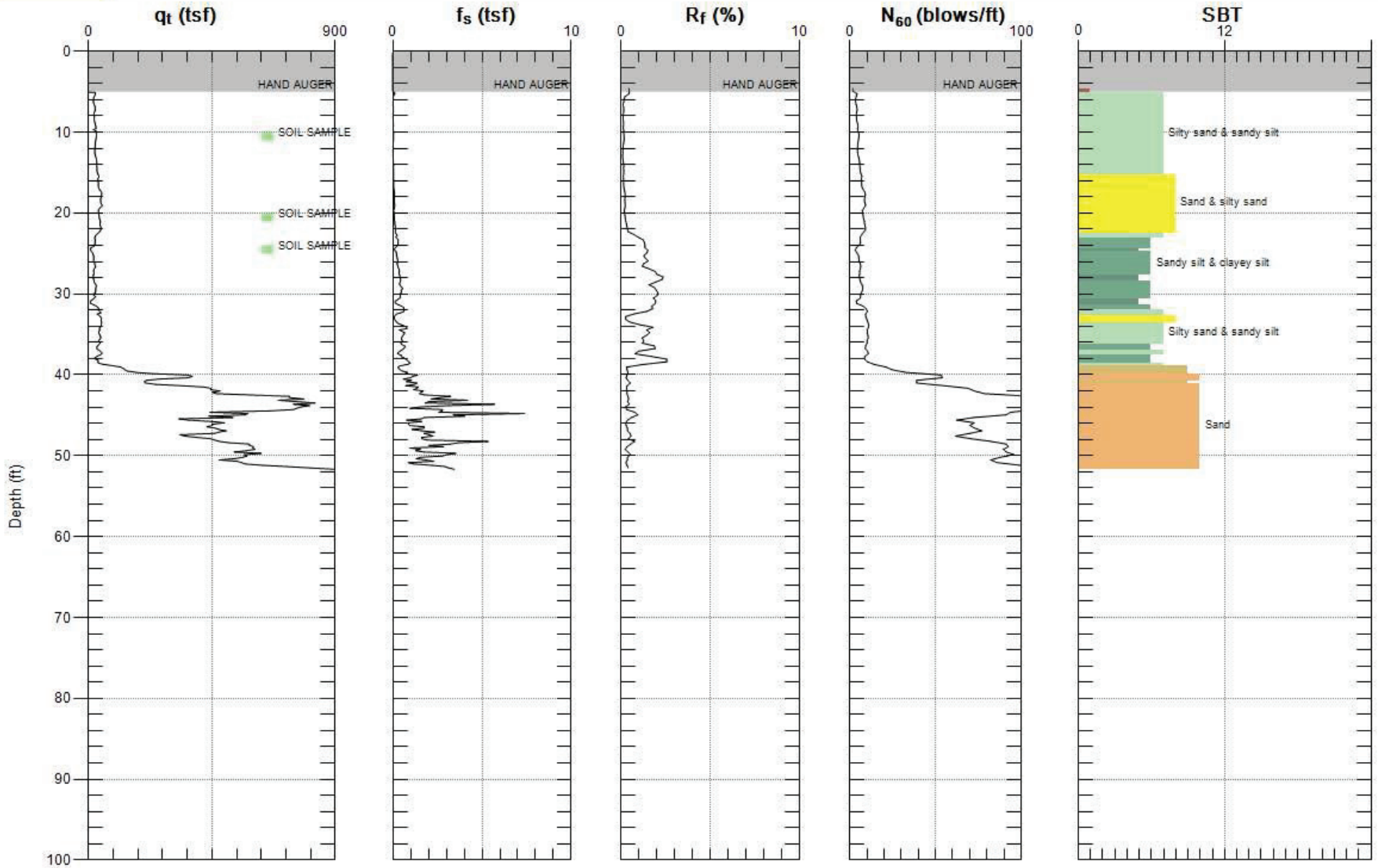
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_011C

Engineer: M.WEIL
Date: 9/28/2010 04:10



Max. Depth: 51.673 (ft)
Avg. Interval: 0.328 (ft)

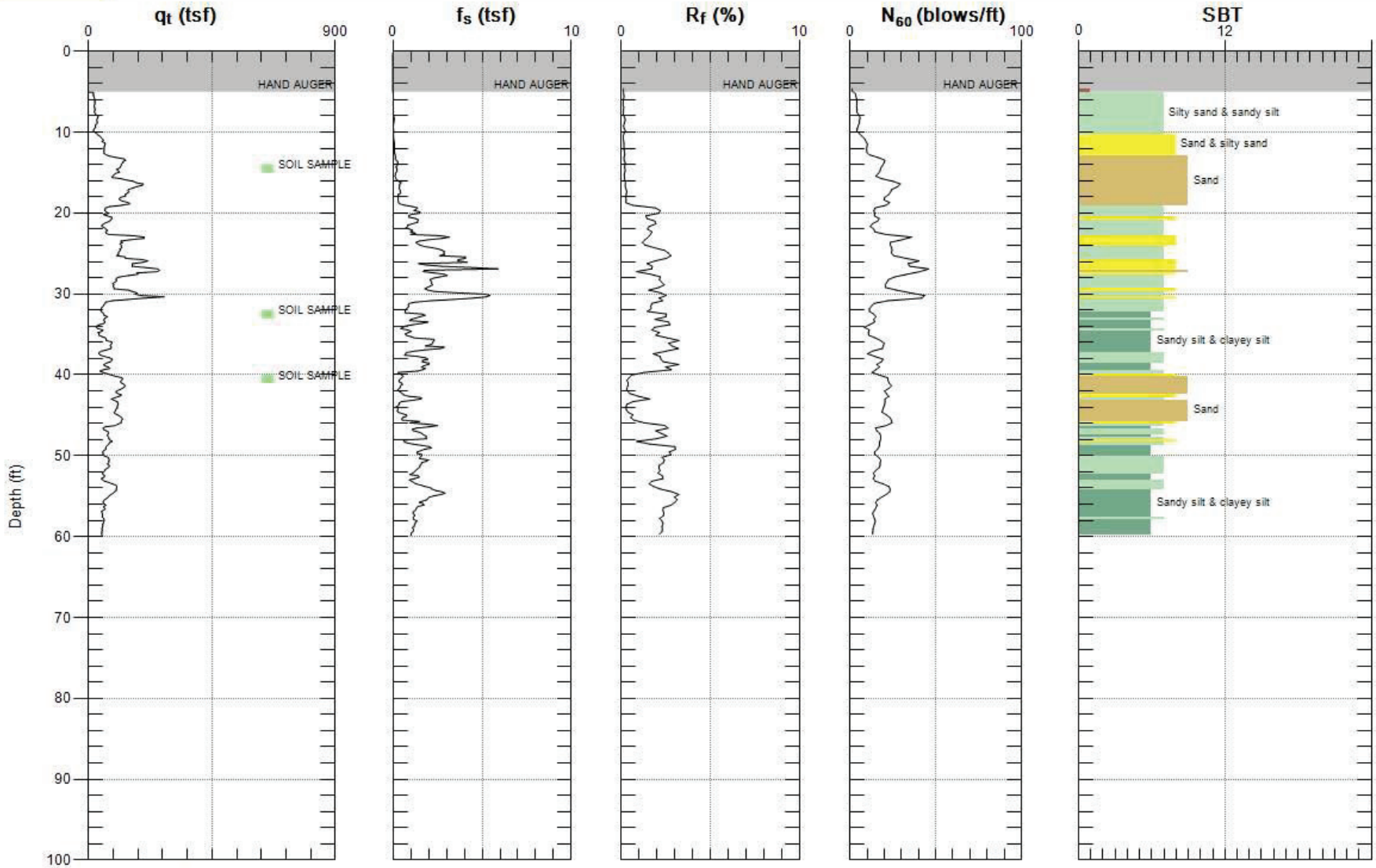
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_012C

Engineer: M.WEIL
Date: 10/8/2010 09:29



Max. Depth: 59.875 (ft)
Avg. Interval: 0.328 (ft)

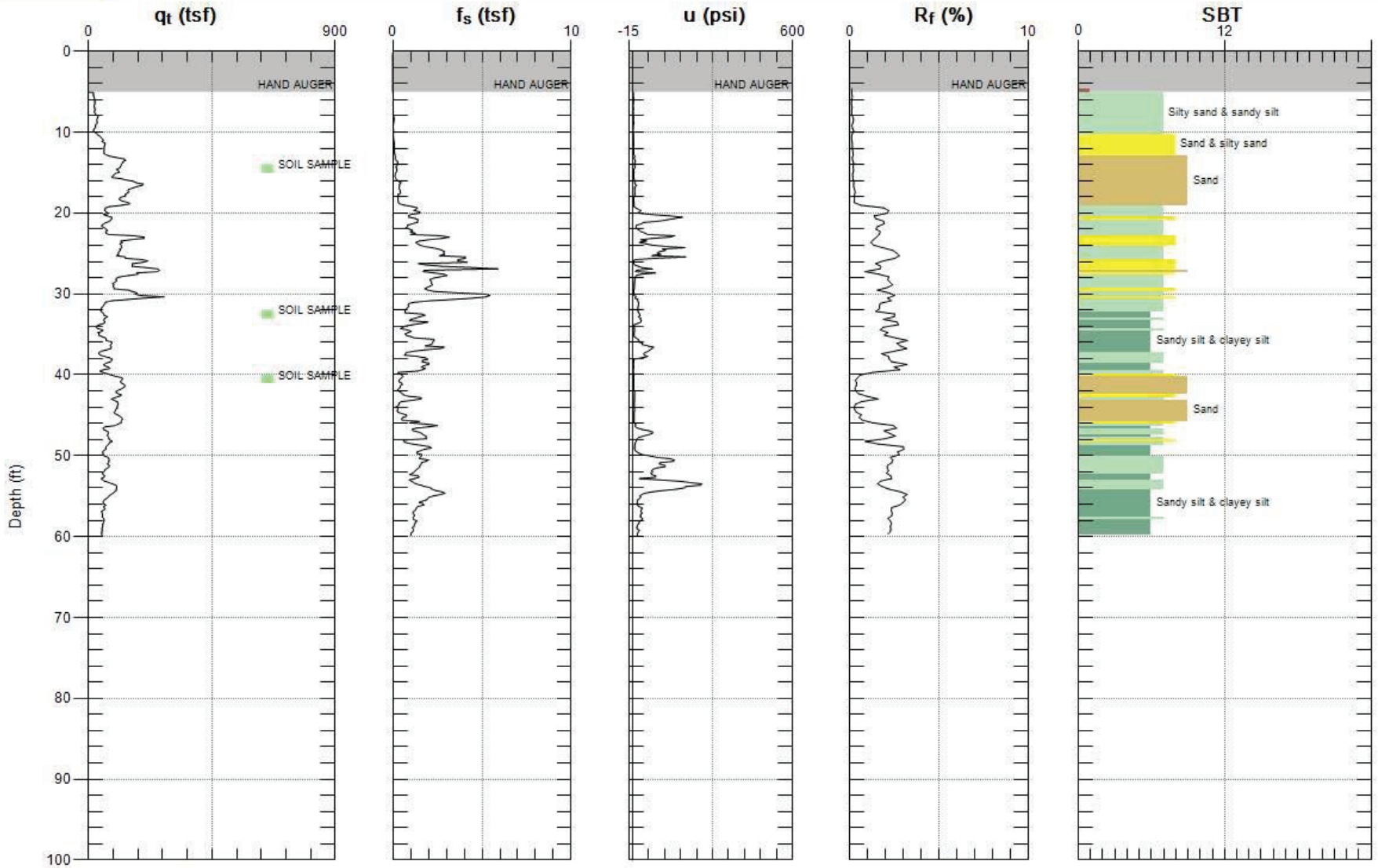
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0001_012C

Engineer: M.WEIL
Date: 10/8/2010 09:29



Max. Depth: 59.875 (ft)
Avg. Interval: 0.328 (ft)

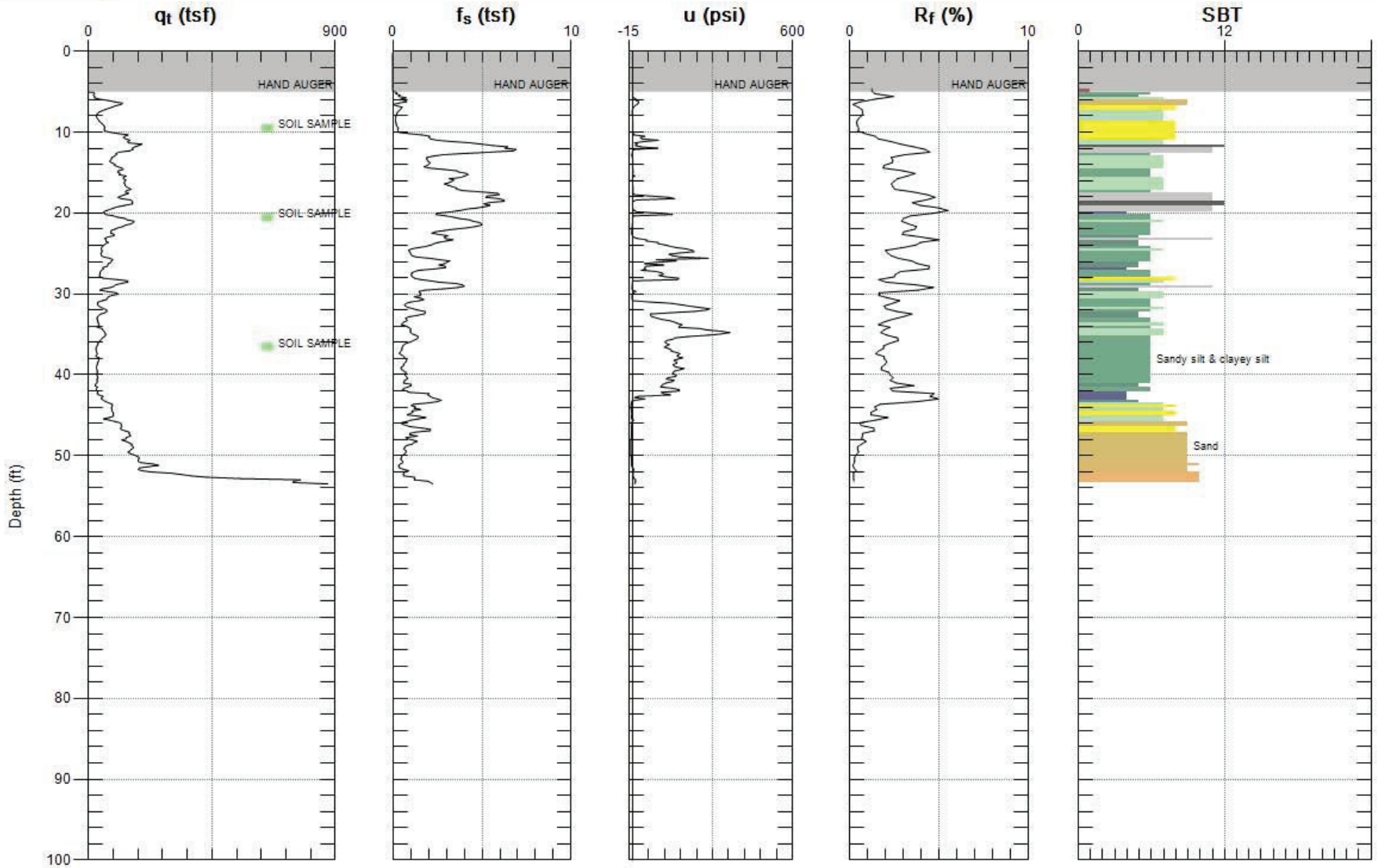
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0009_001C

Engineer: M.WEIL
Date: 10/13/2010 11:37



Max. Depth: 53.478 (ft)
Avg. Interval: 0.328 (ft)

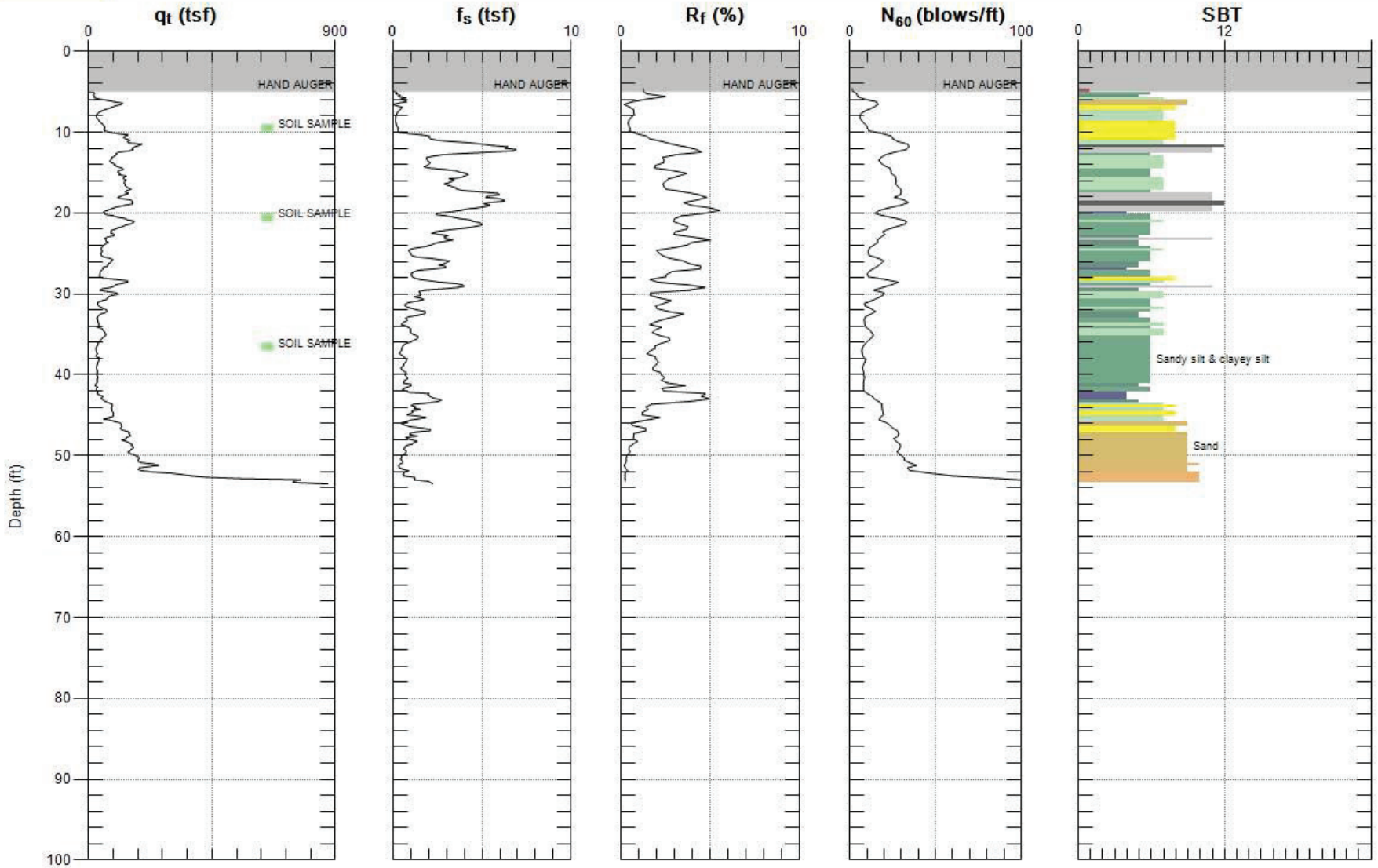
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0009_001C

Engineer: M.WEIL
Date: 10/13/2010 11:37



Max. Depth: 53.478 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

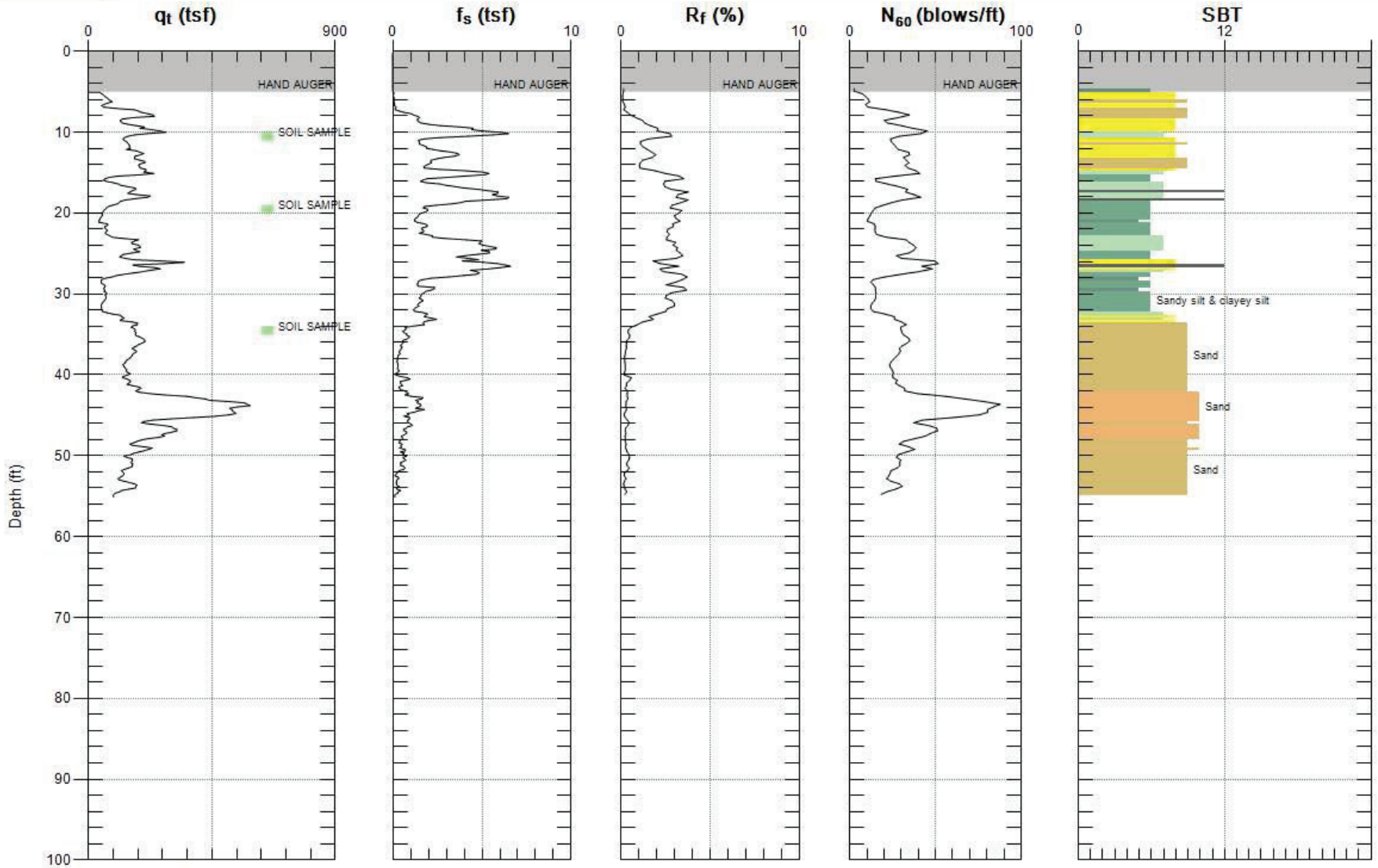
URS

Site: SBFCA FRWL EIP

Sounding: SL0009_002C

Engineer: M.WEIL

Date: 9/30/2010 01:04



Max. Depth: 55.118 (ft)

Avg. Interval: 0.328 (ft)

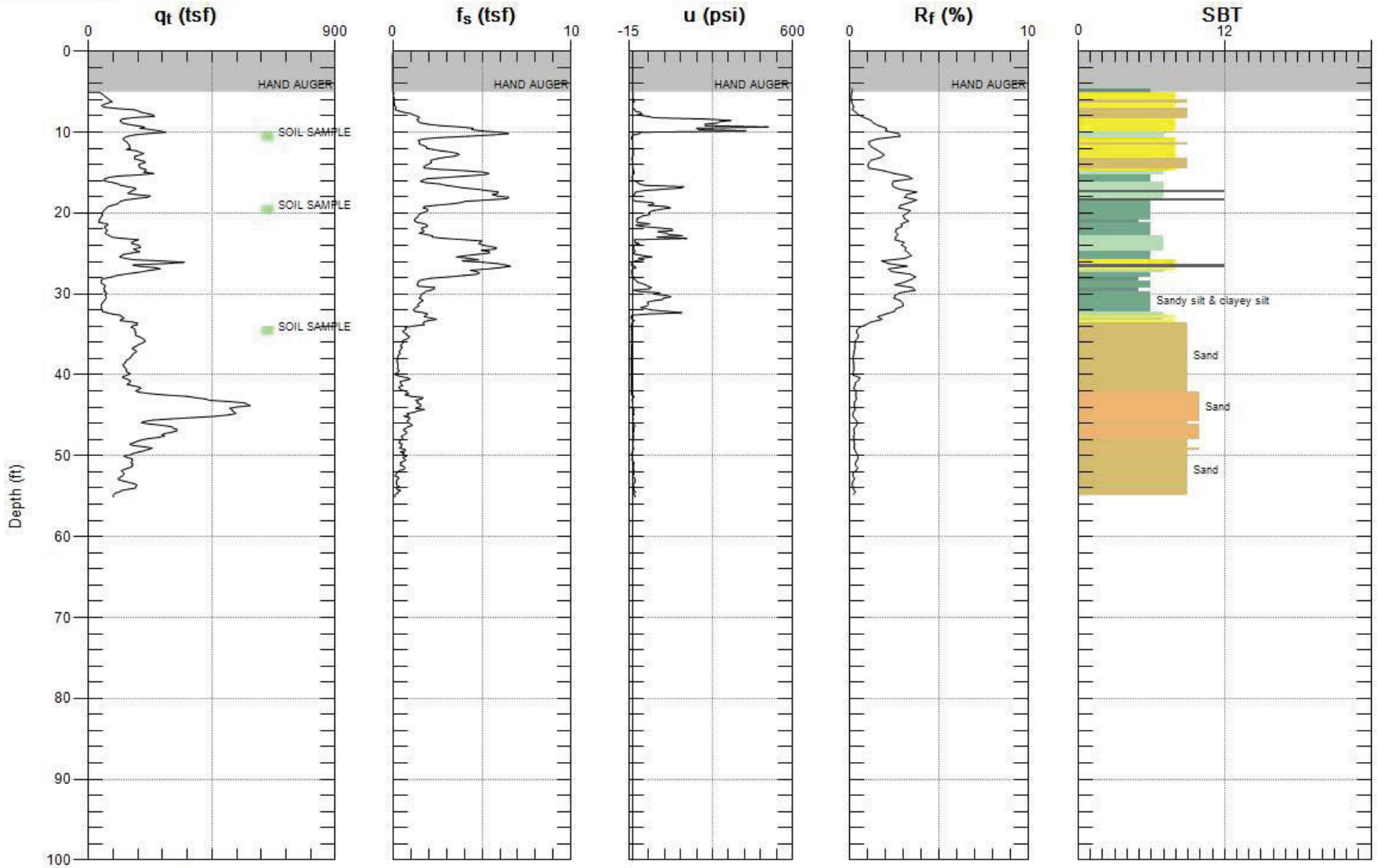
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0009_002C

Engineer: M.WEIL
Date: 9/30/2010 01:04



Max. Depth: 55.118 (ft)
Avg. Interval: 0.328 (ft)

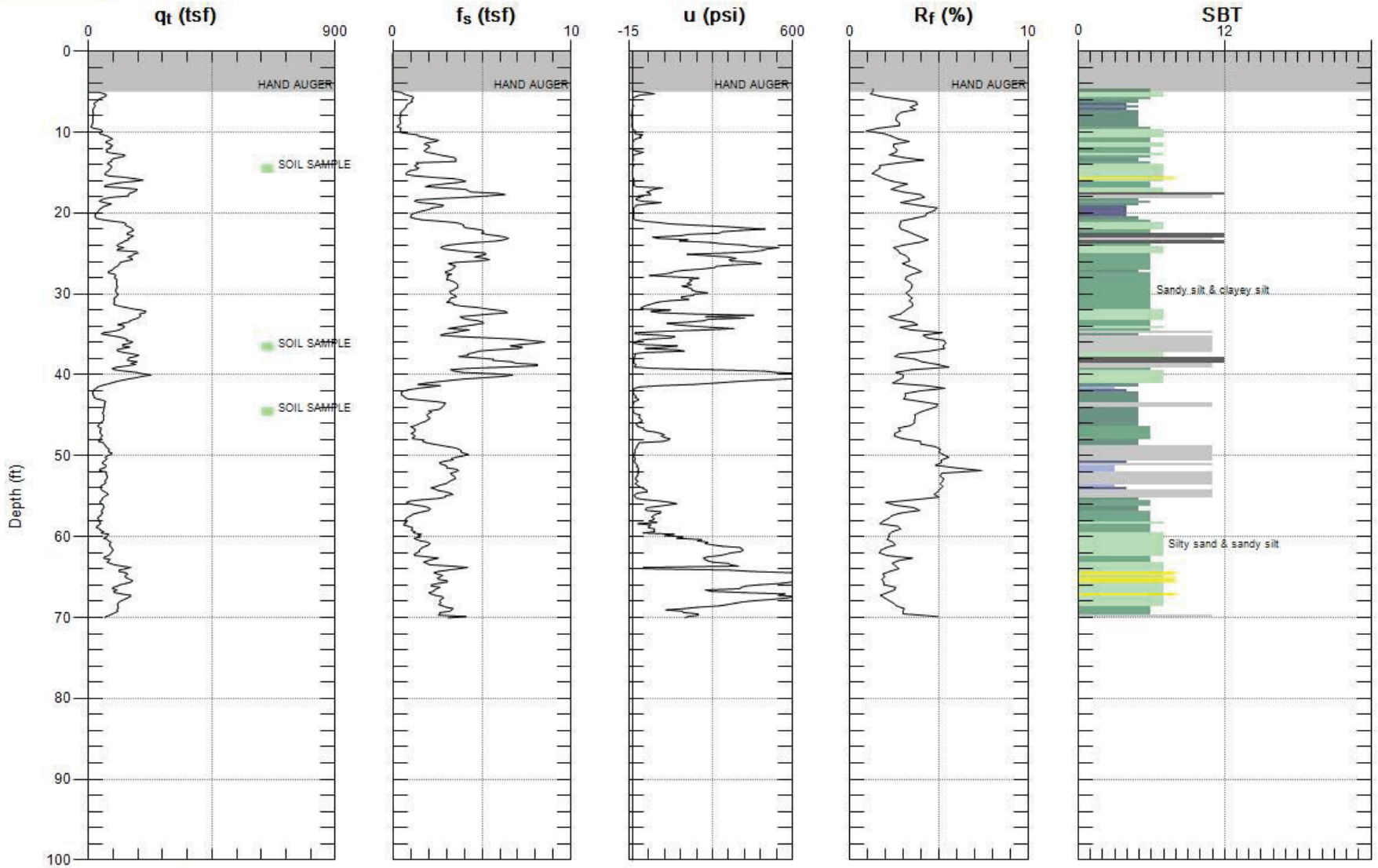
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

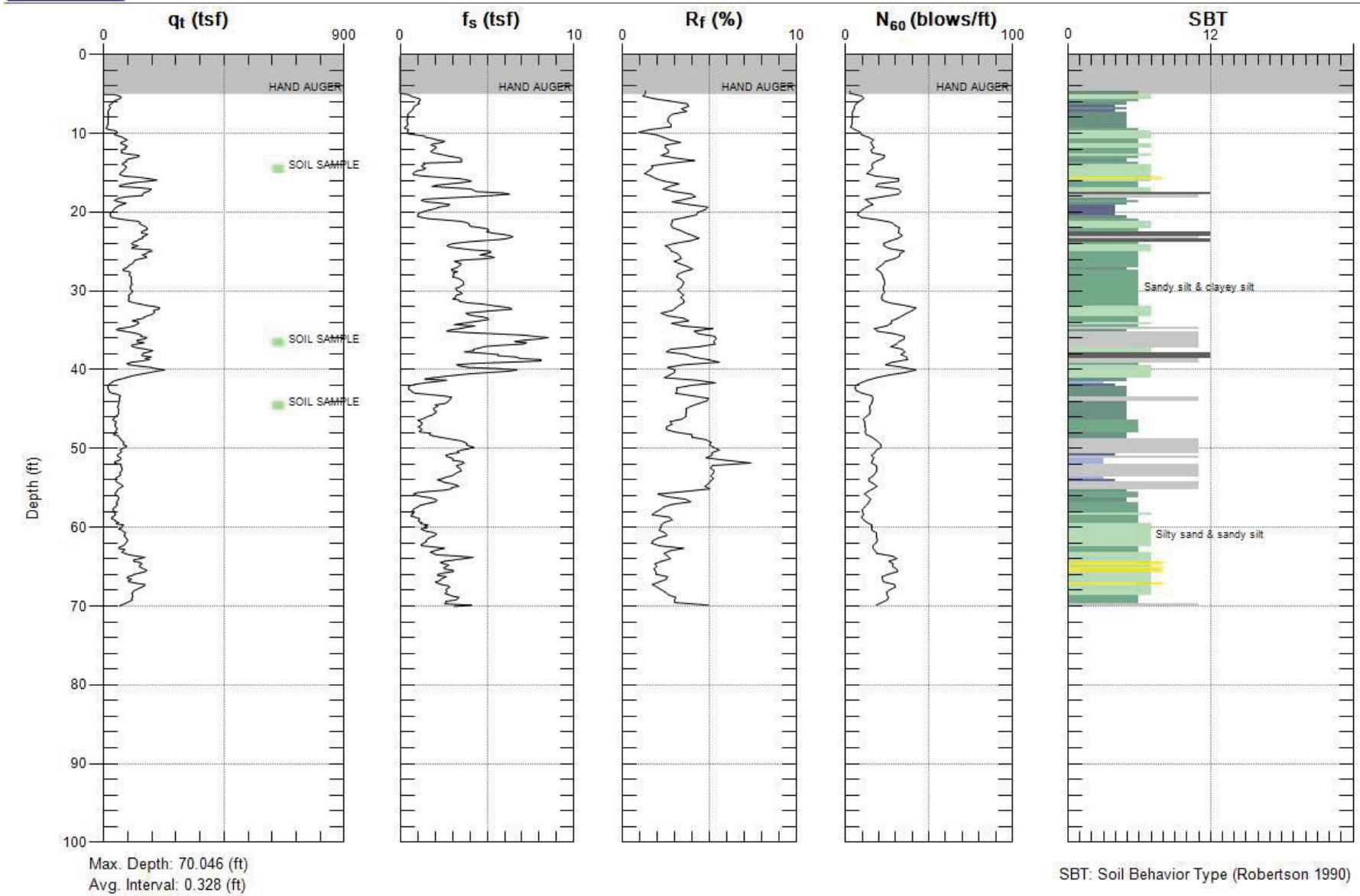
Site: SBFCA FRWL EIP
Sounding: SL0009_003C

Engineer: M.WEIL
Date: 10/13/2010 03:47



Max. Depth: 70.046 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

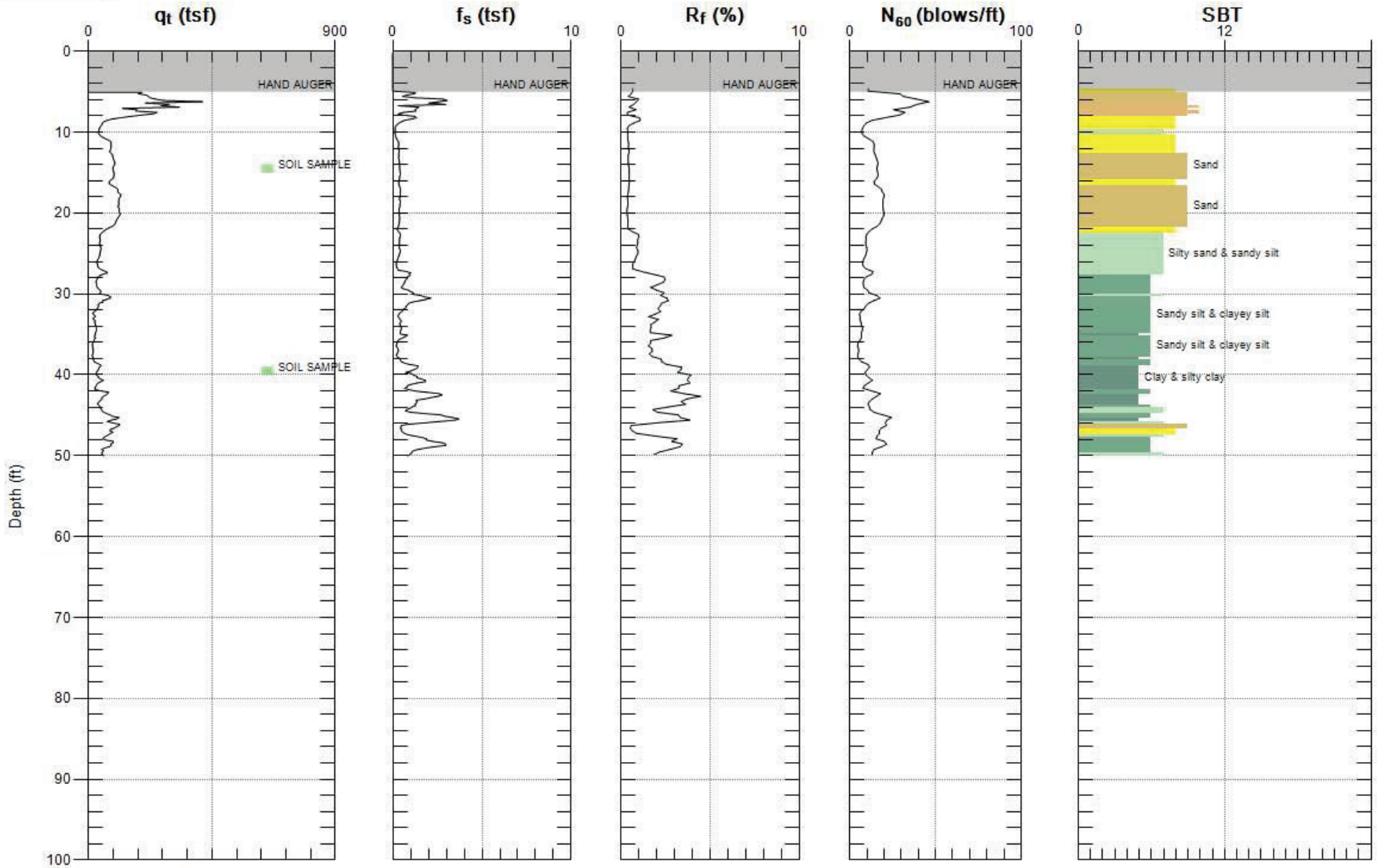

GREGG
URS
Site: SBFCA FRWL EIP
Sounding: SL0009_003C
Engineer: M.WEIL
Date: 10/13/2010 03:47
q_t (tsf)
f_s (tsf)
R_f (%)
N_{60} (blows/ft)
SBT
HAND AUGER
SOIL SAMPLE
SOIL SAMPLE
SOIL SAMPLE
Sandy silt & clayey silt
Silty sand & sandy silt
Depth (ft)
Max. Depth: 70.046 (ft)
Avg. Interval: 0.328 (ft)
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0009_004C

Engineer: M.WEIL
Date: 10/14/2010 08:59



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

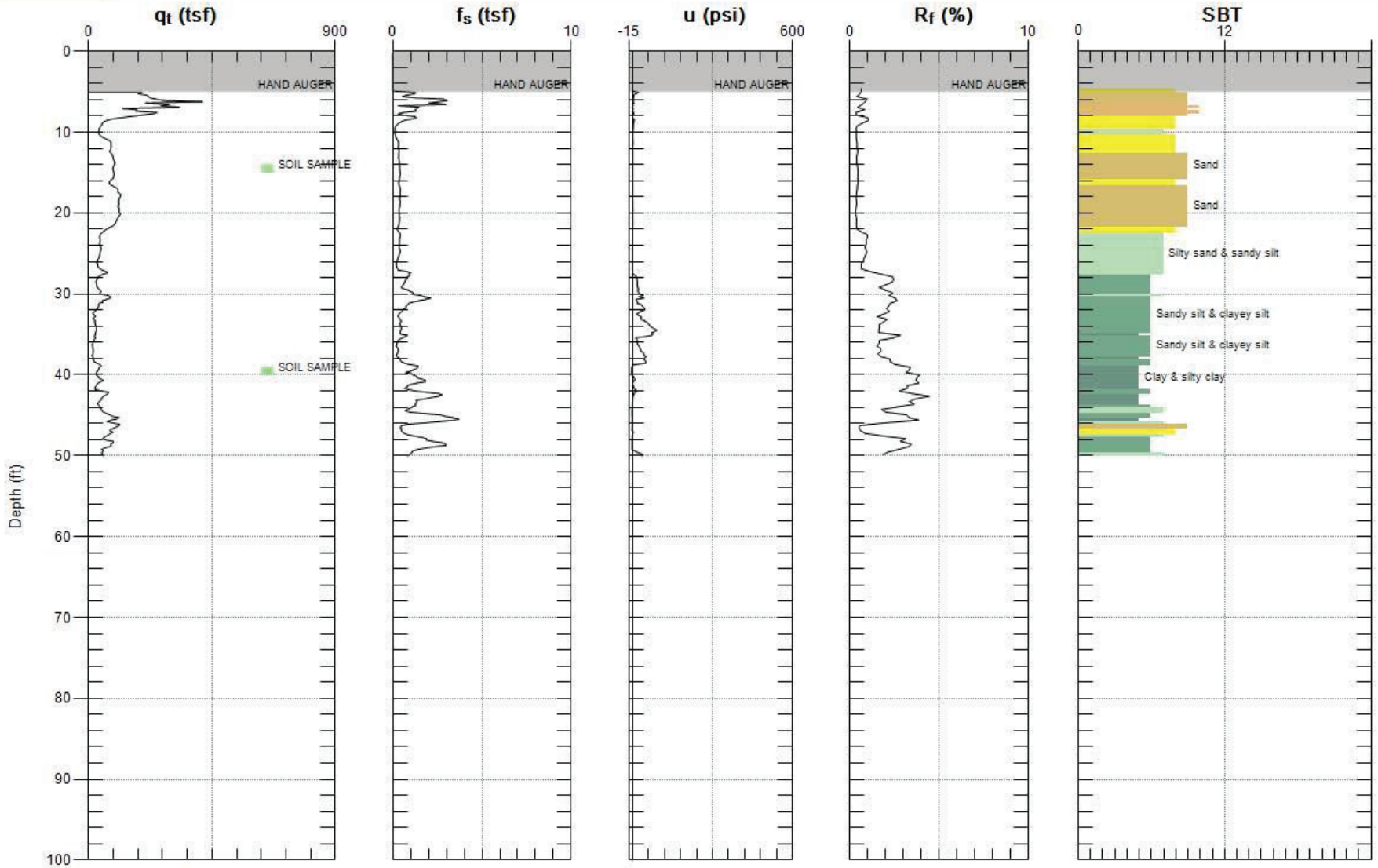
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SL0009_004C

Engineer: M.WEIL
Date: 10/14/2010 08:59



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

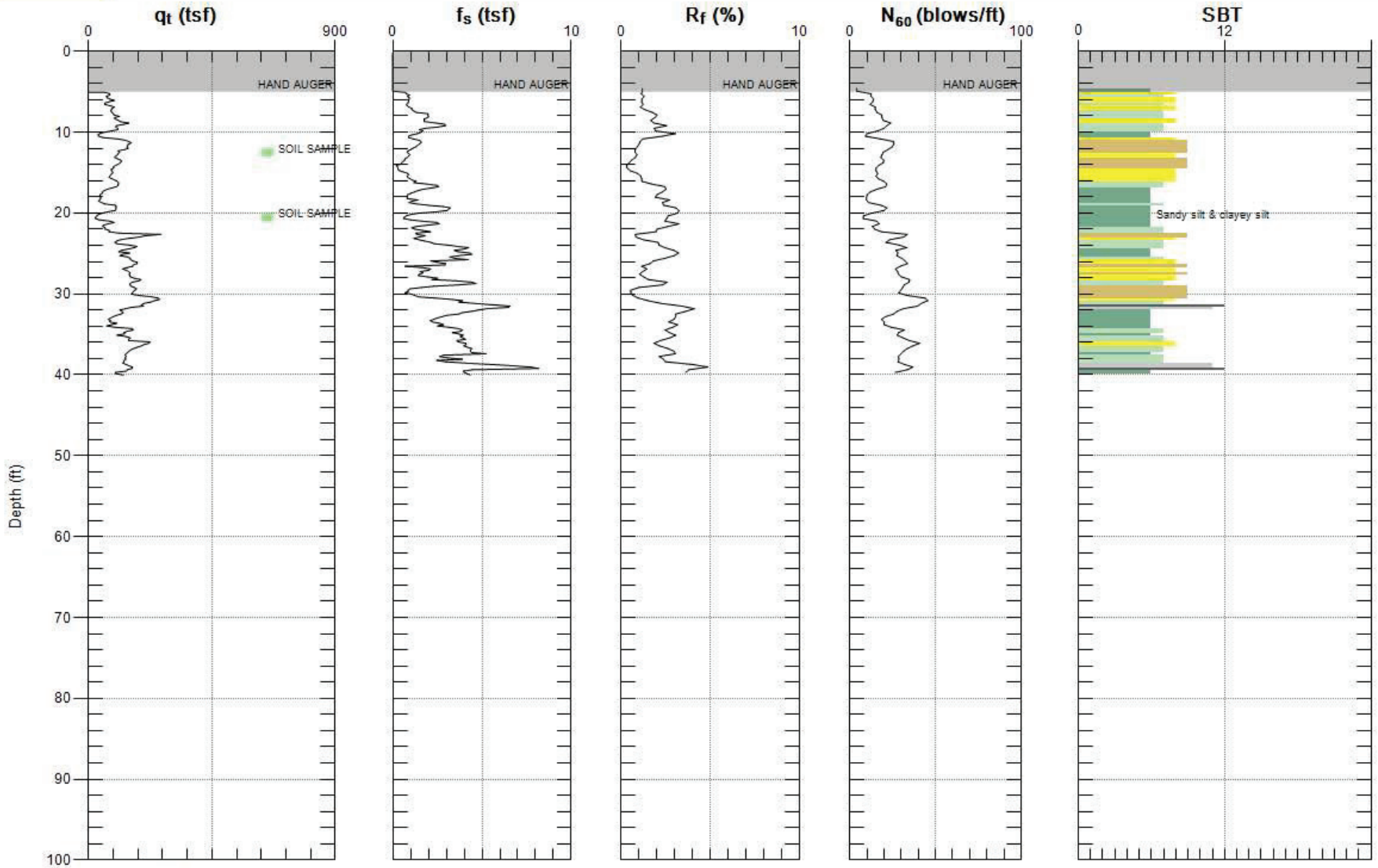
URS

Site: SBFCA FRWL EIP

Sounding: SM0016_001C

Engineer: M.WEIL

Date: 10/7/2010 09:45



Max. Depth: 40.026 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

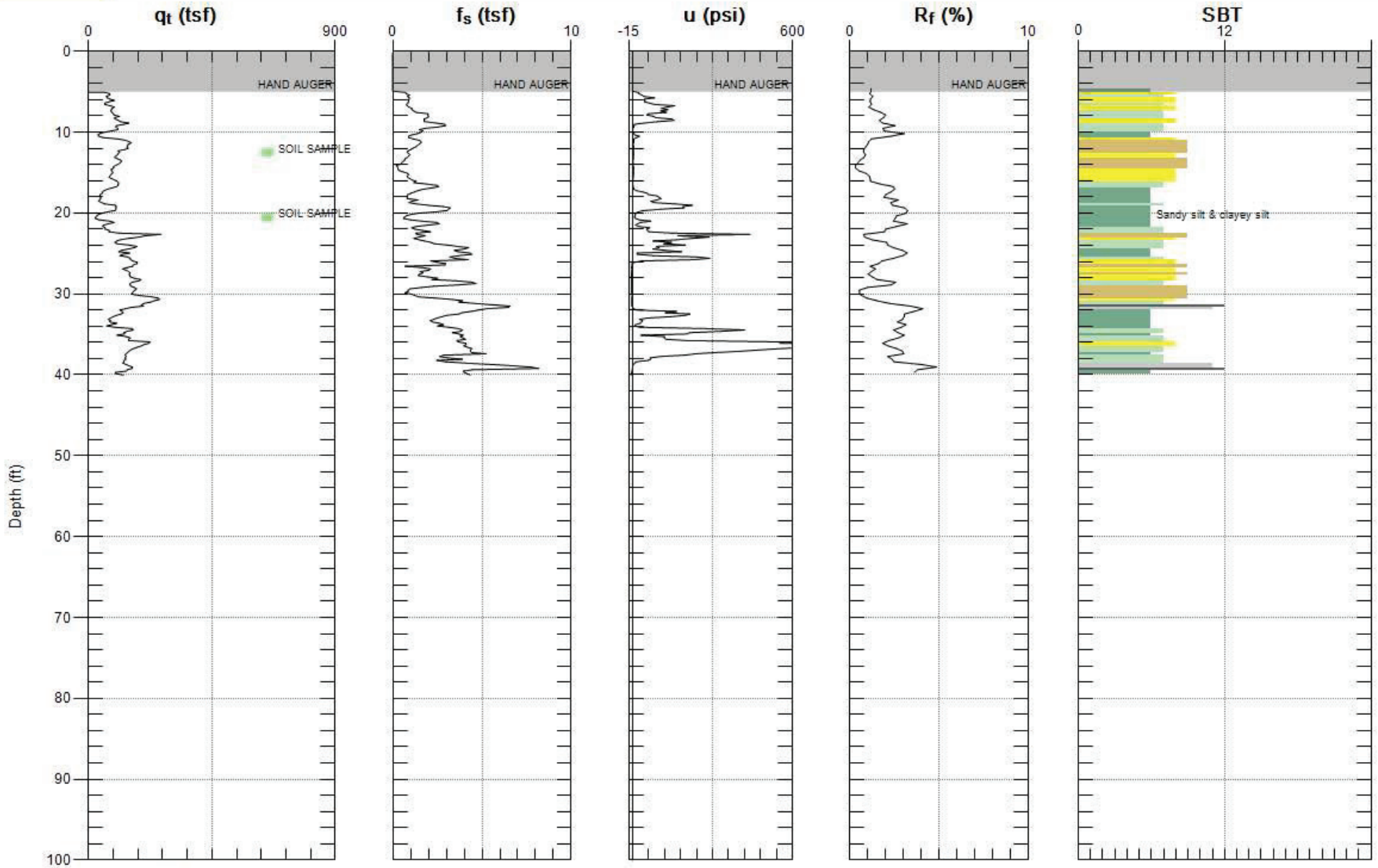
URS

Site: SBFCA FRWL EIP

Sounding: SM0016_001C

Engineer: M.WEIL

Date: 10/7/2010 09:45



Max. Depth: 40.026 (ft)

Avg. Interval: 0.328 (ft)

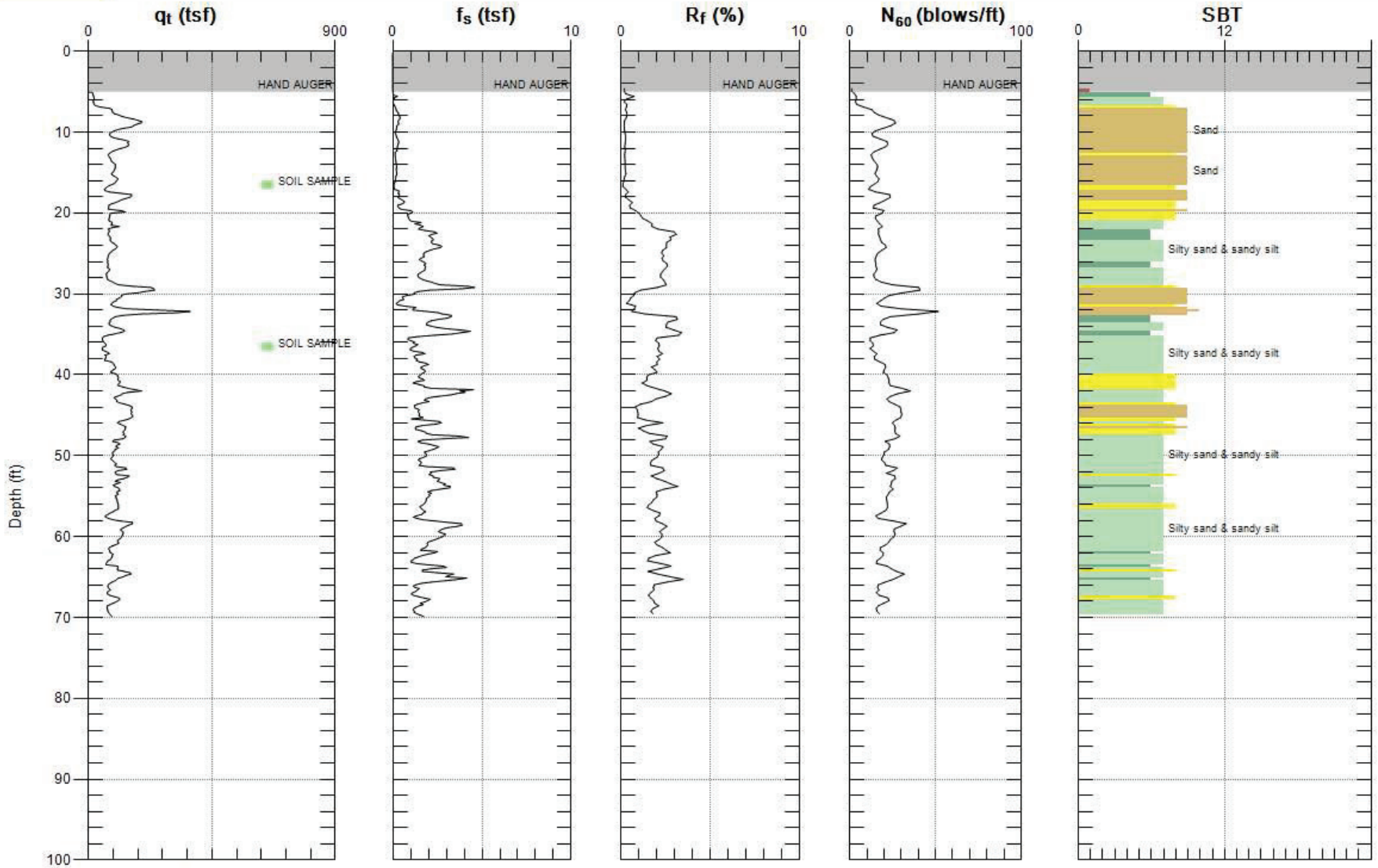
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0016_003C

Engineer: M.WEIL
Date: 10/5/2010 09:57



Max. Depth: 69.882 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

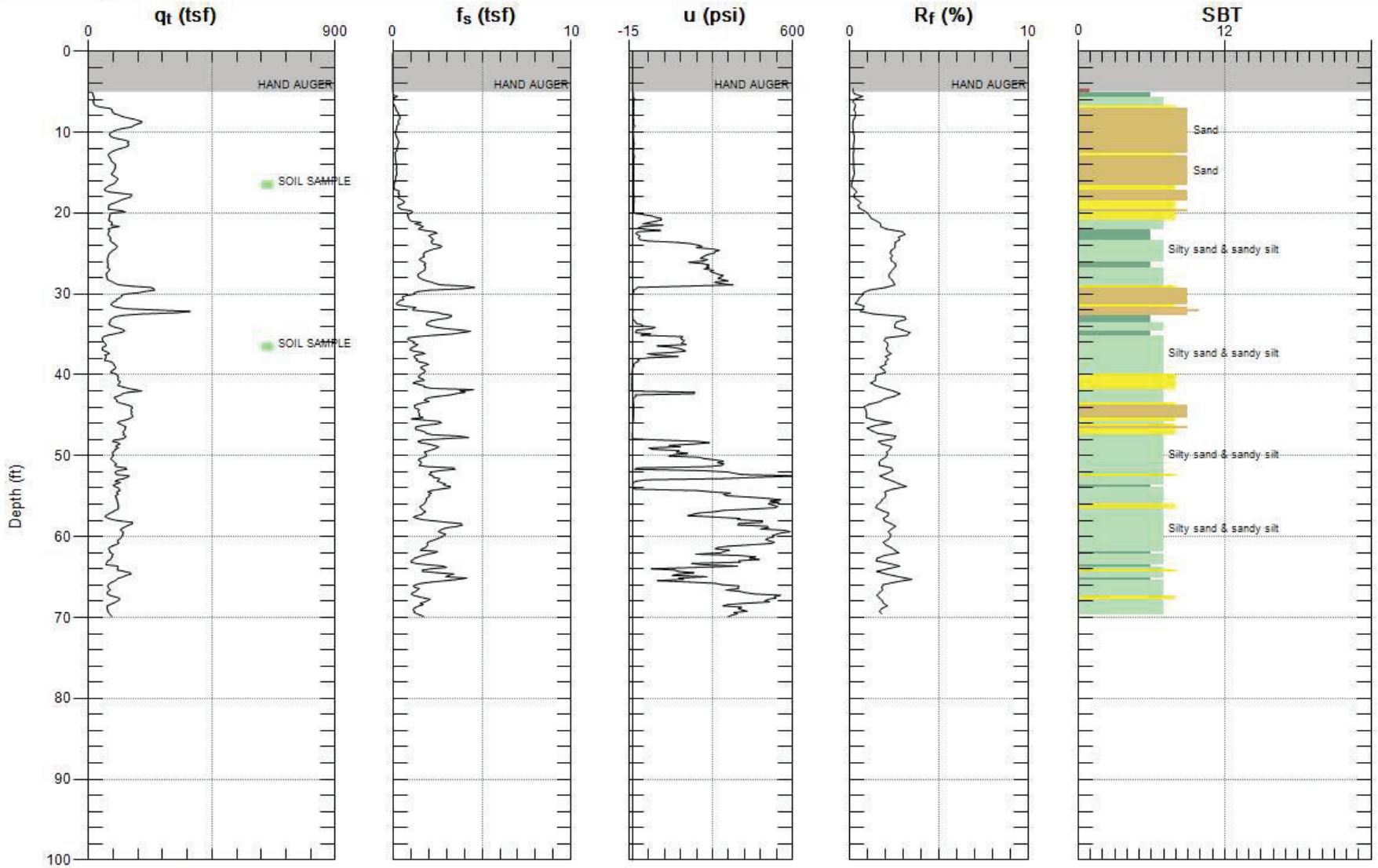
URS

Site: SBFCA FRWL EIP

Sounding: SM0016_003C

Engineer: M.WEIL

Date: 10/5/2010 09:57



Max. Depth: 69.882 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

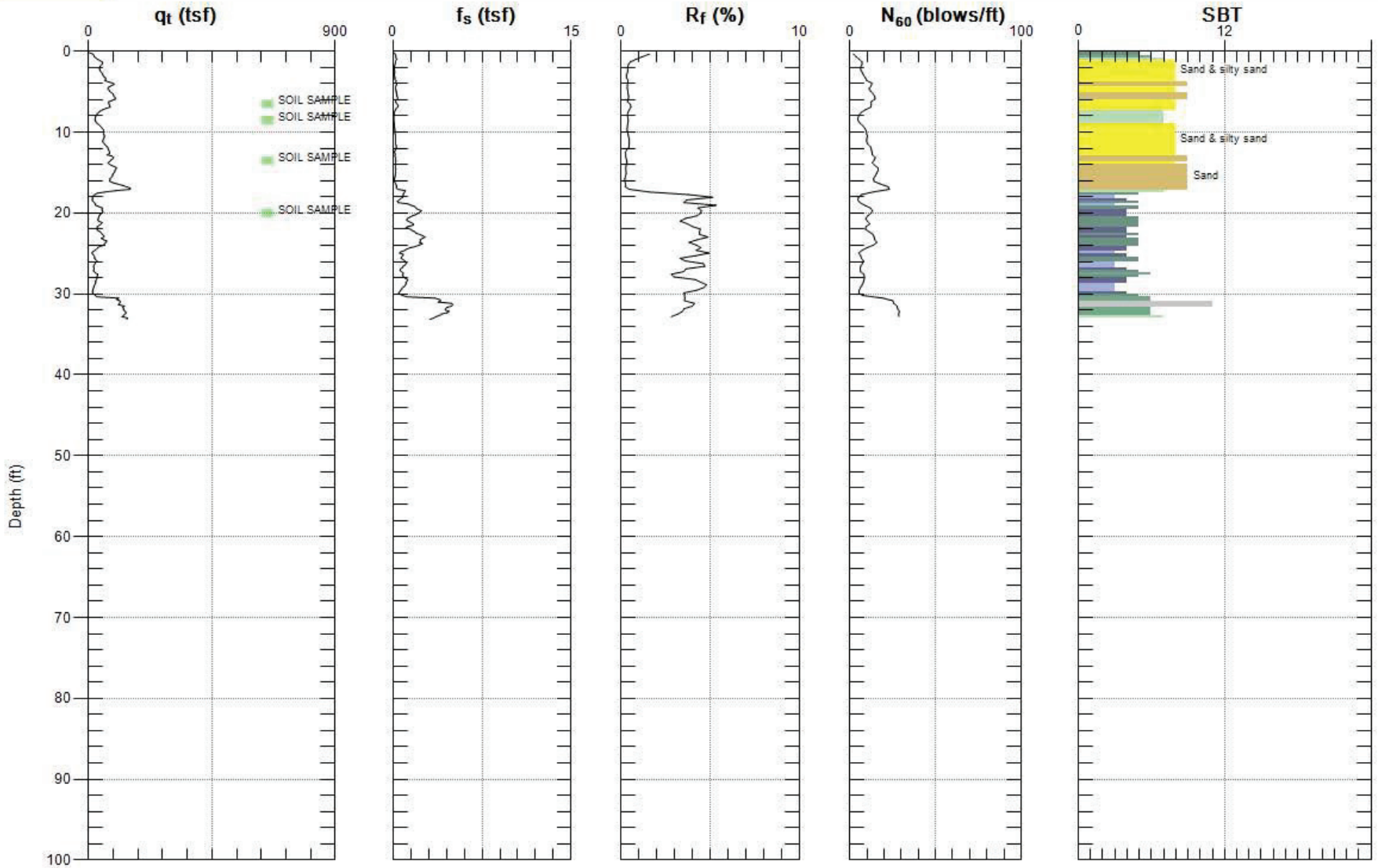
URS

Site: SBFCA FRWL EIP

Sounding: SM0007_005C

Engineer: MEHRZAD

Date: 11/18/2010 01:47



Max. Depth: 33.136 (ft)

Avg. Interval: 0.328 (ft)

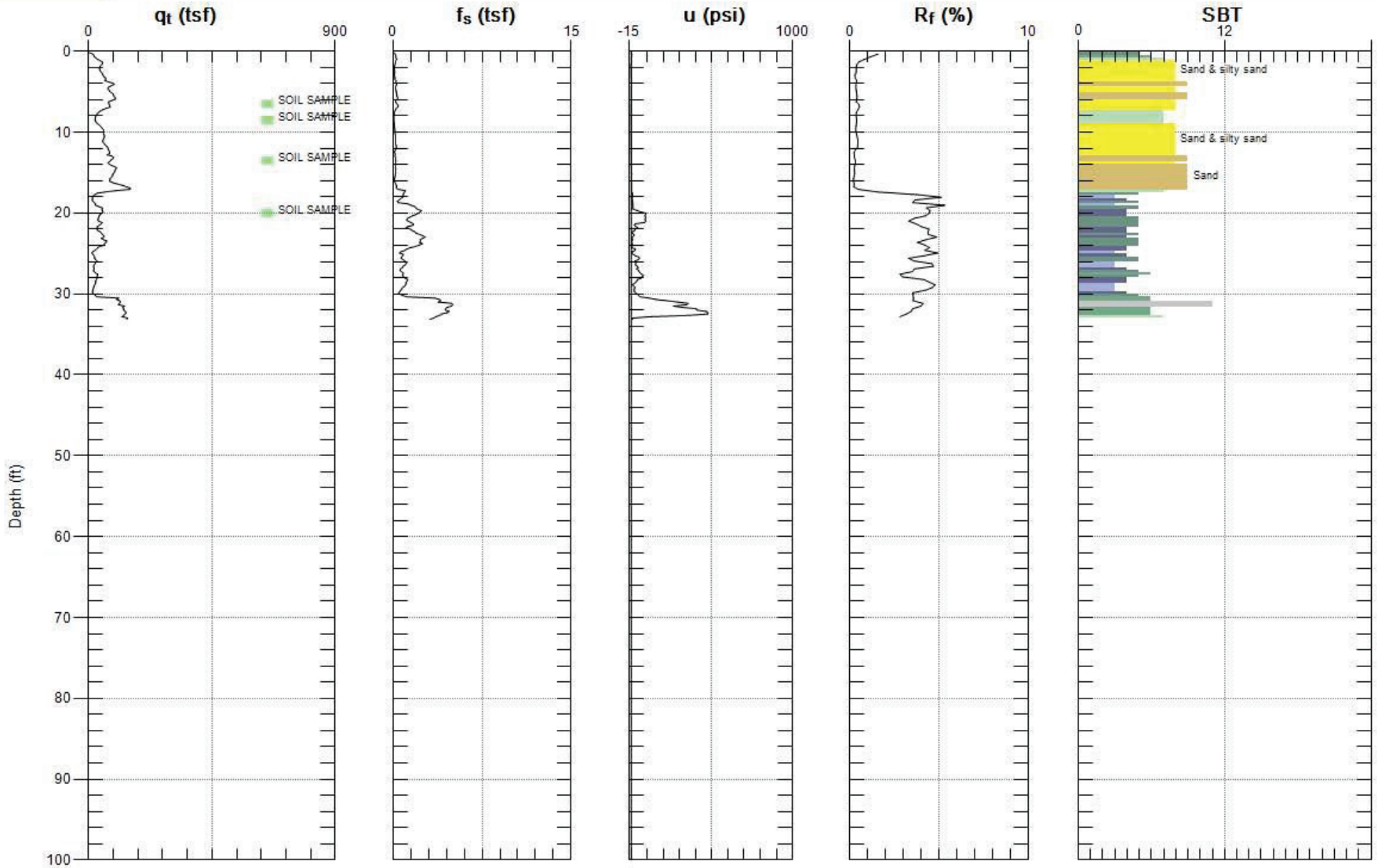
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0007_005C

Engineer: MEHRZAD
Date: 11/18/2010 01:47



Max. Depth: 33.136 (ft)
Avg. Interval: 0.328 (ft)

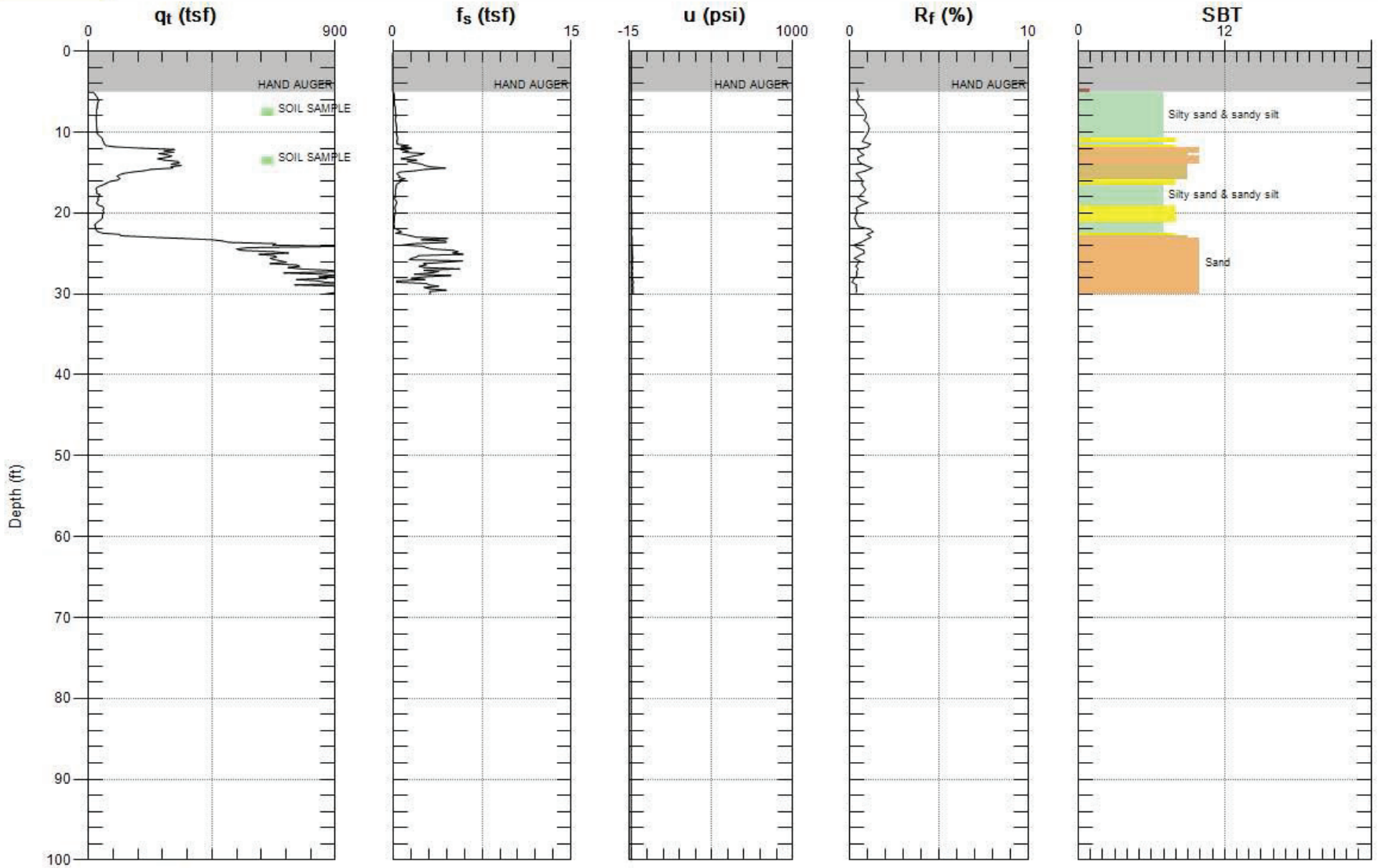
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0007_001C

Engineer: D.MORRELL
Date: 11/11/2010 08:45



Max. Depth: 30.020 (ft)
Avg. Interval: 0.328 (ft)

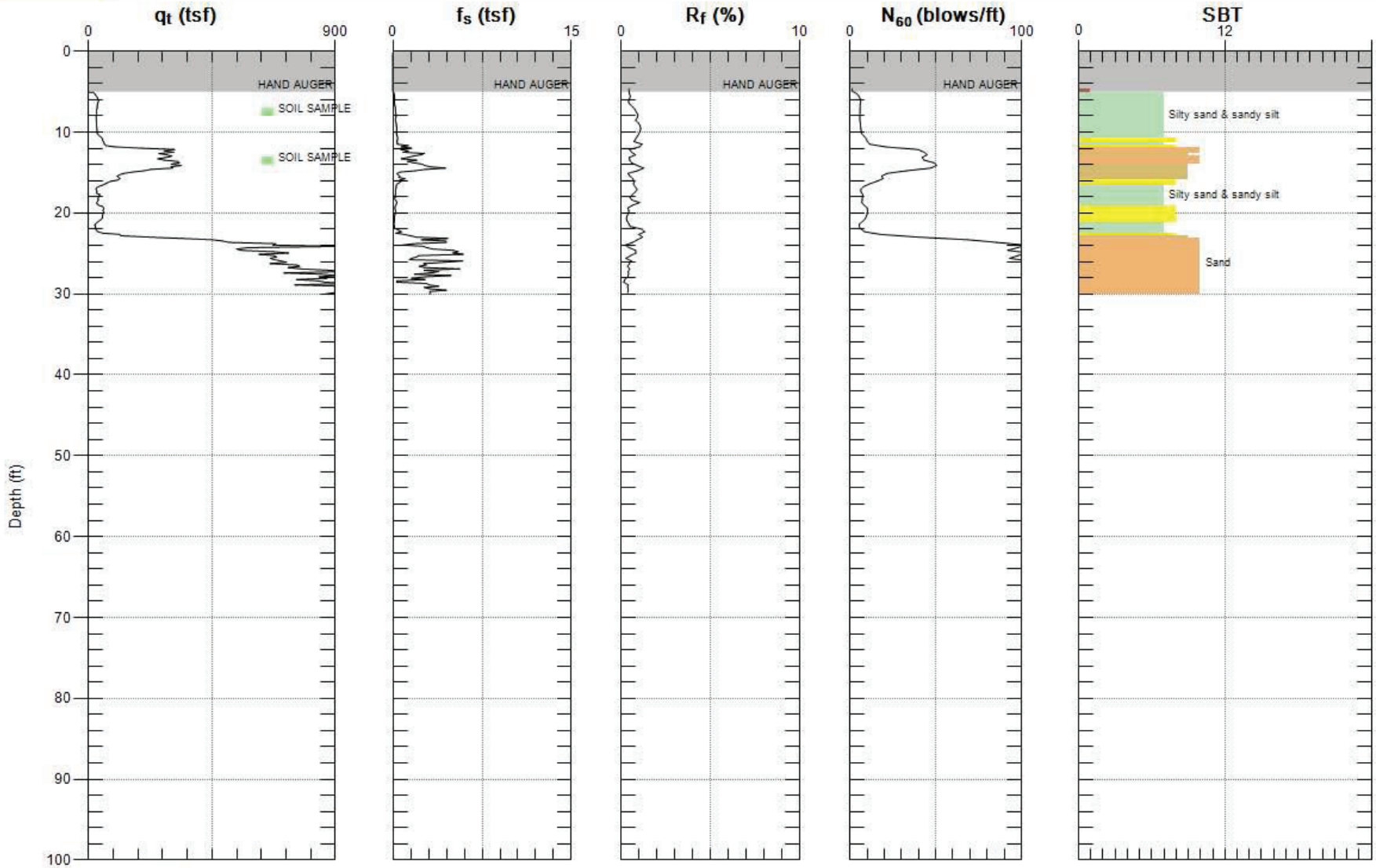
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0007_001C

Engineer: D.MORRELL
Date: 11/11/2010 08:45



Max. Depth: 30.020 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

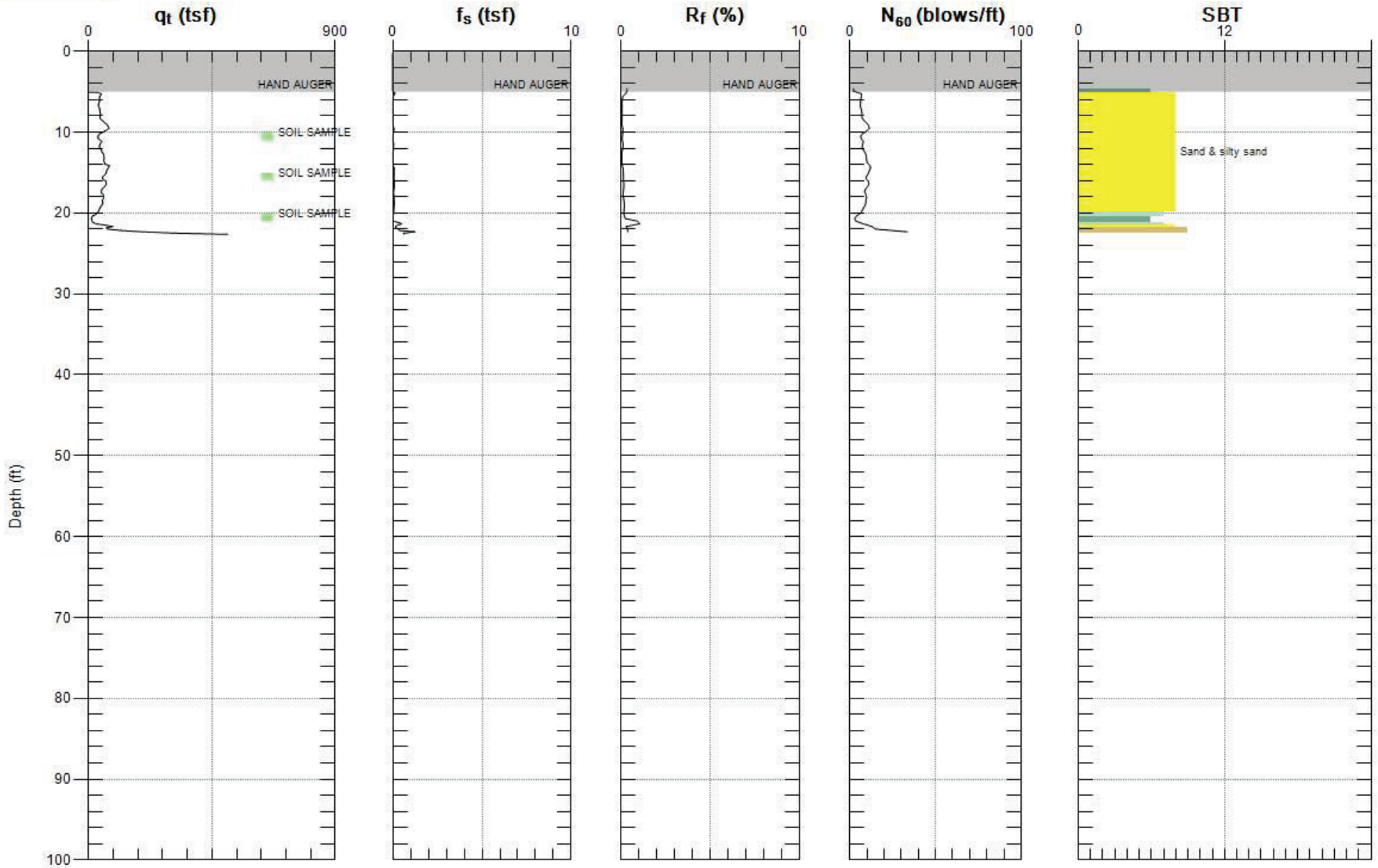
URS

Site: SBFCA FRWL EIP

Sounding: SM0007_002C

Engineer: M.WEIL

Date: 10/7/2010 02:42



Max. Depth: 22.638 (ft)

Avg. Interval: 0.328 (ft)

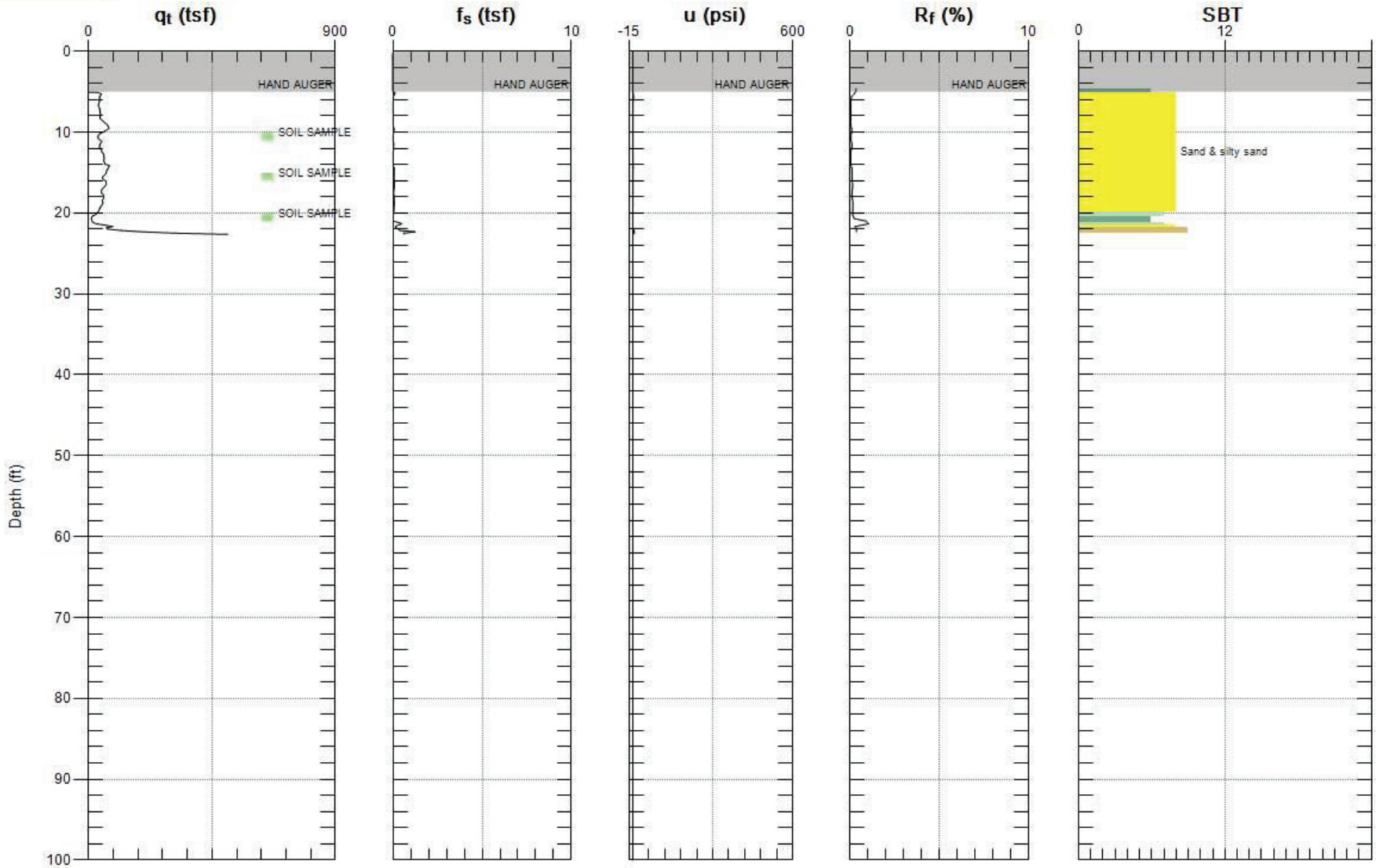
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0007_002C

Engineer: M.WEIL
Date: 10/7/2010 02:42



Max. Depth: 22.638 (ft)
Avg. Interval: 0.328 (ft)

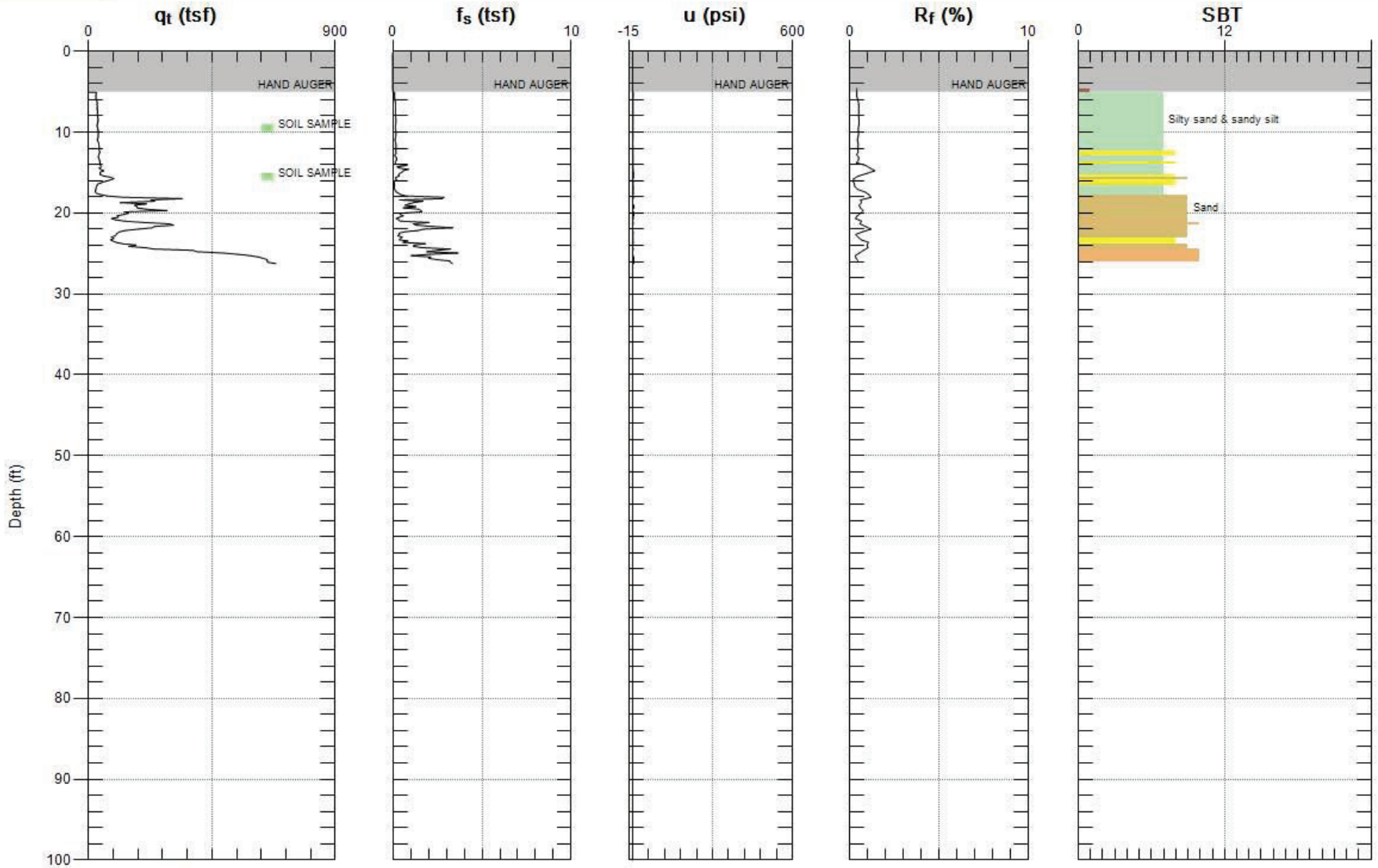
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0007_003C

Engineer: M.WEIL
Date: 10/11/2010 08:51



Max. Depth: 26.247 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

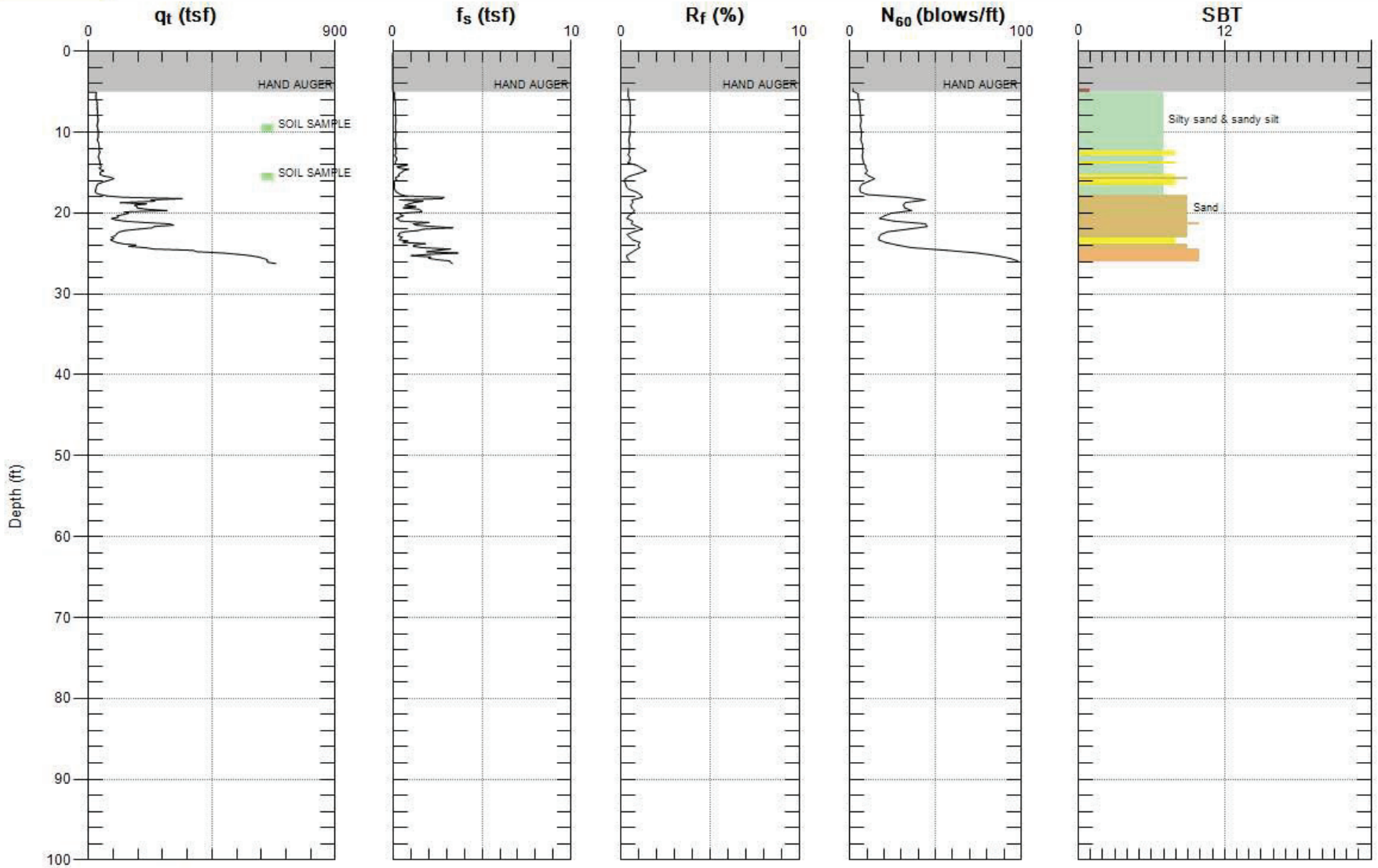
URS

Site: SBFCA FRWL EIP

Sounding: SM0007_003C

Engineer: M.WEIL

Date: 10/11/2010 08:51



Max. Depth: 26.247 (ft)

Avg. Interval: 0.328 (ft)

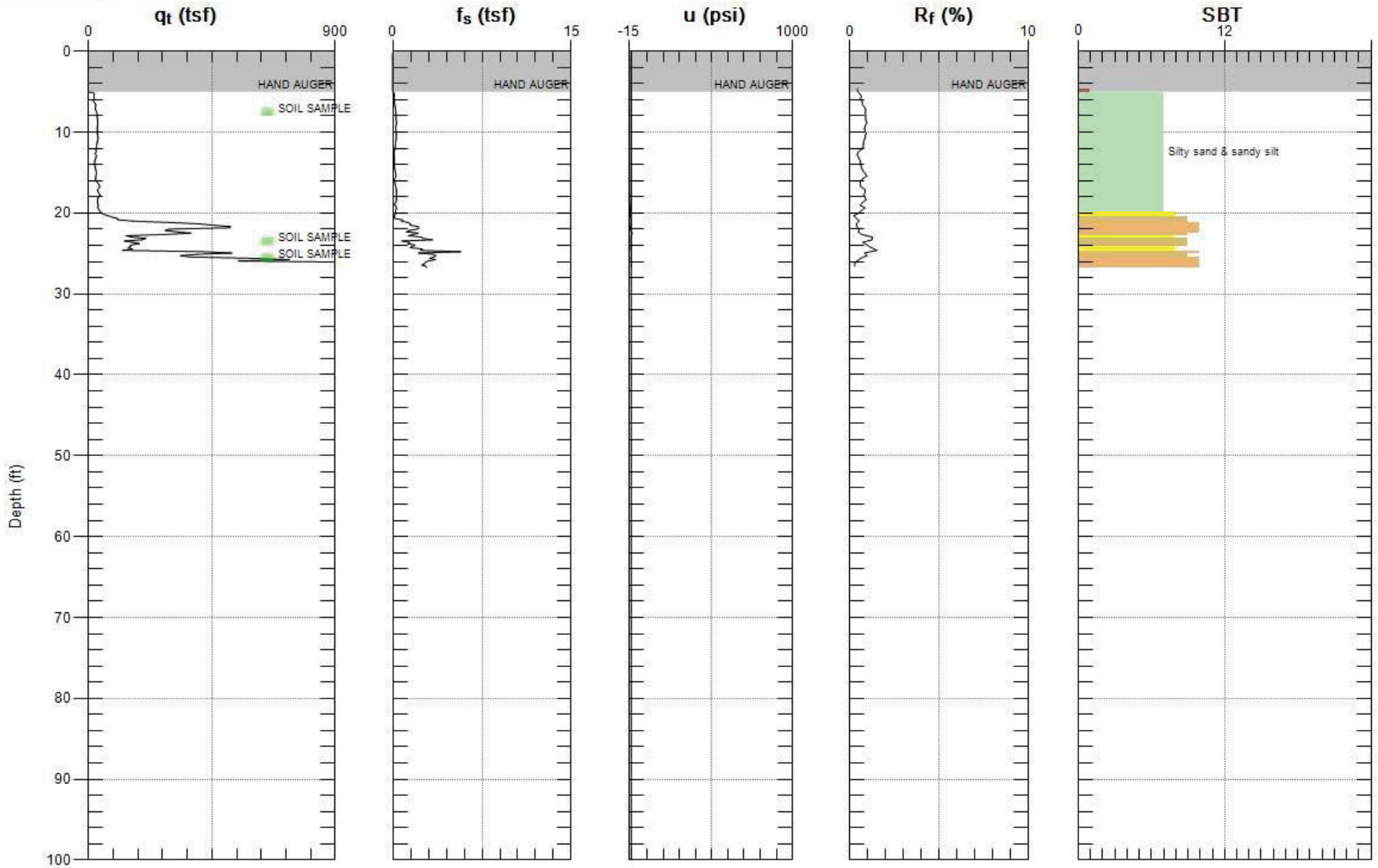
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: SBFCA FRWL EIP
Sounding: SM0007_004C

Engineer: MEHRZAD
Date: 11/18/2010 09:45



Max. Depth: 26.739 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

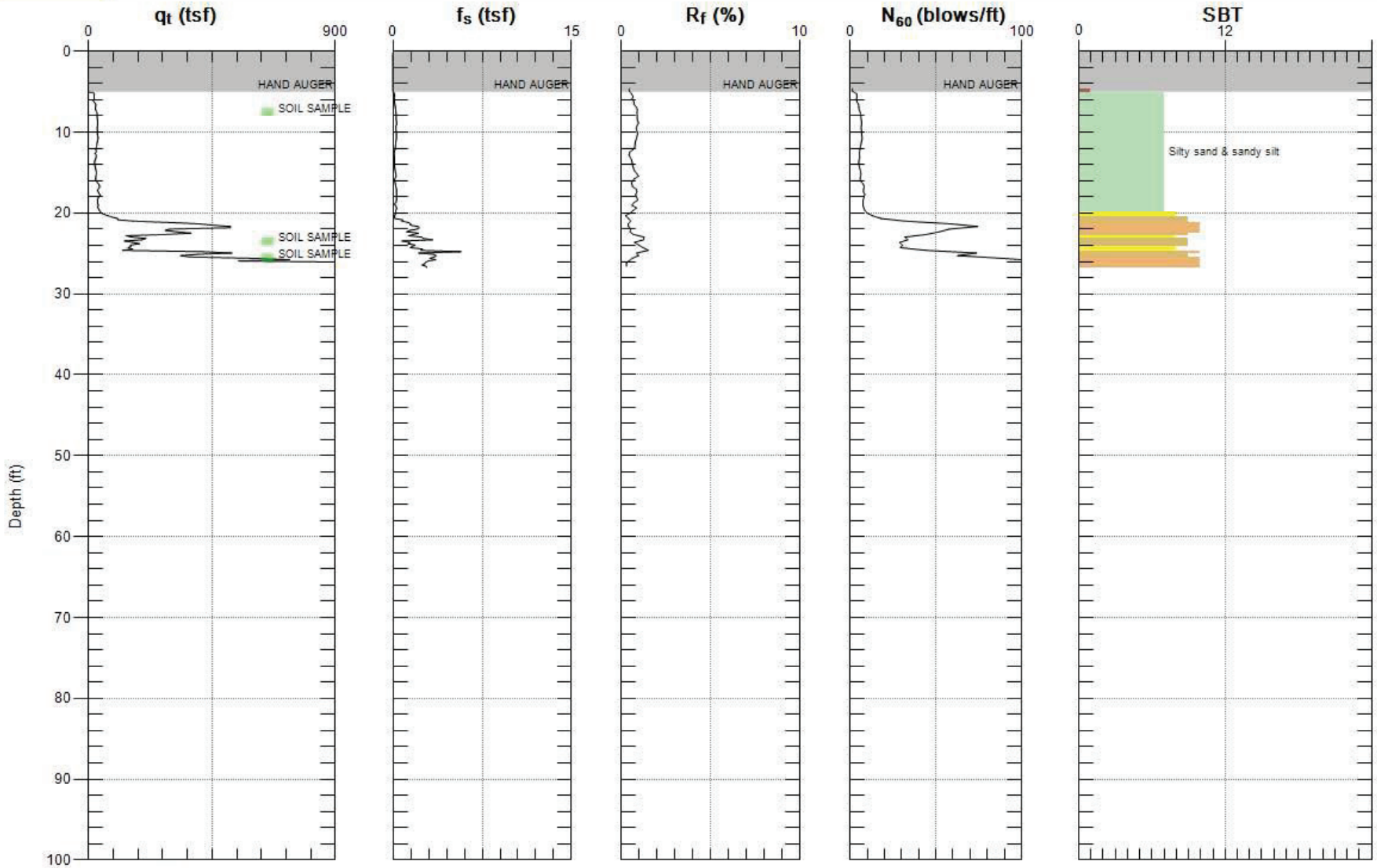
URS

Site: SBFCA FRWL EIP

Sounding: SM0007_004C

Engineer: MEHRZAD

Date: 11/18/2010 09:45



Max. Depth: 26.739 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

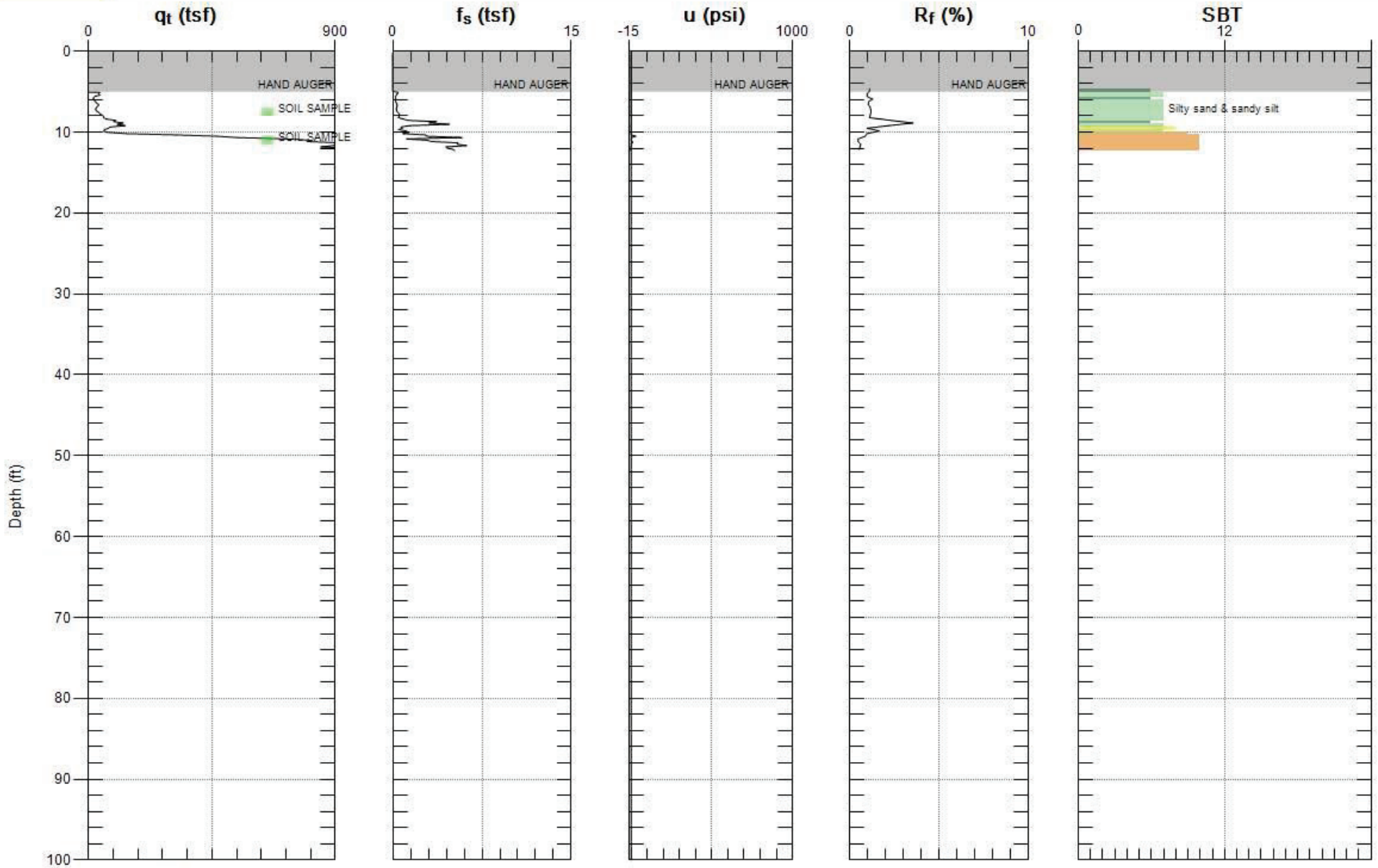
URS

Site: SBFCA FRWL EIP

Sounding: SM0007_006C

Engineer: MEHRZAD

Date: 11/19/2010 08:59



Max. Depth: 12.303 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

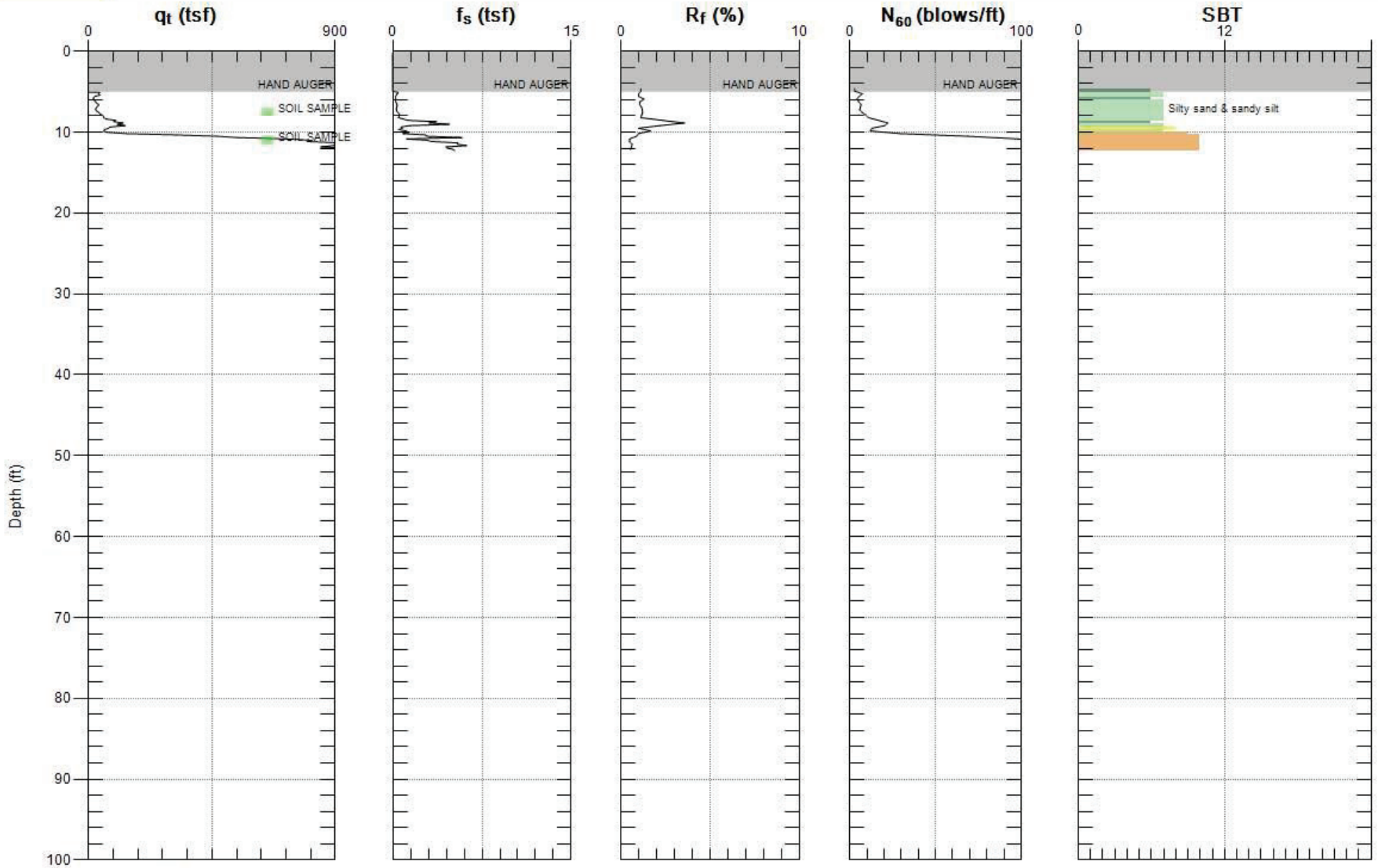
URS

Site: SBFCA FRWL EIP

Sounding: SM0007_006C

Engineer: MEHRZAD

Date: 11/19/2010 08:59



Max. Depth: 12.303 (ft)

Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

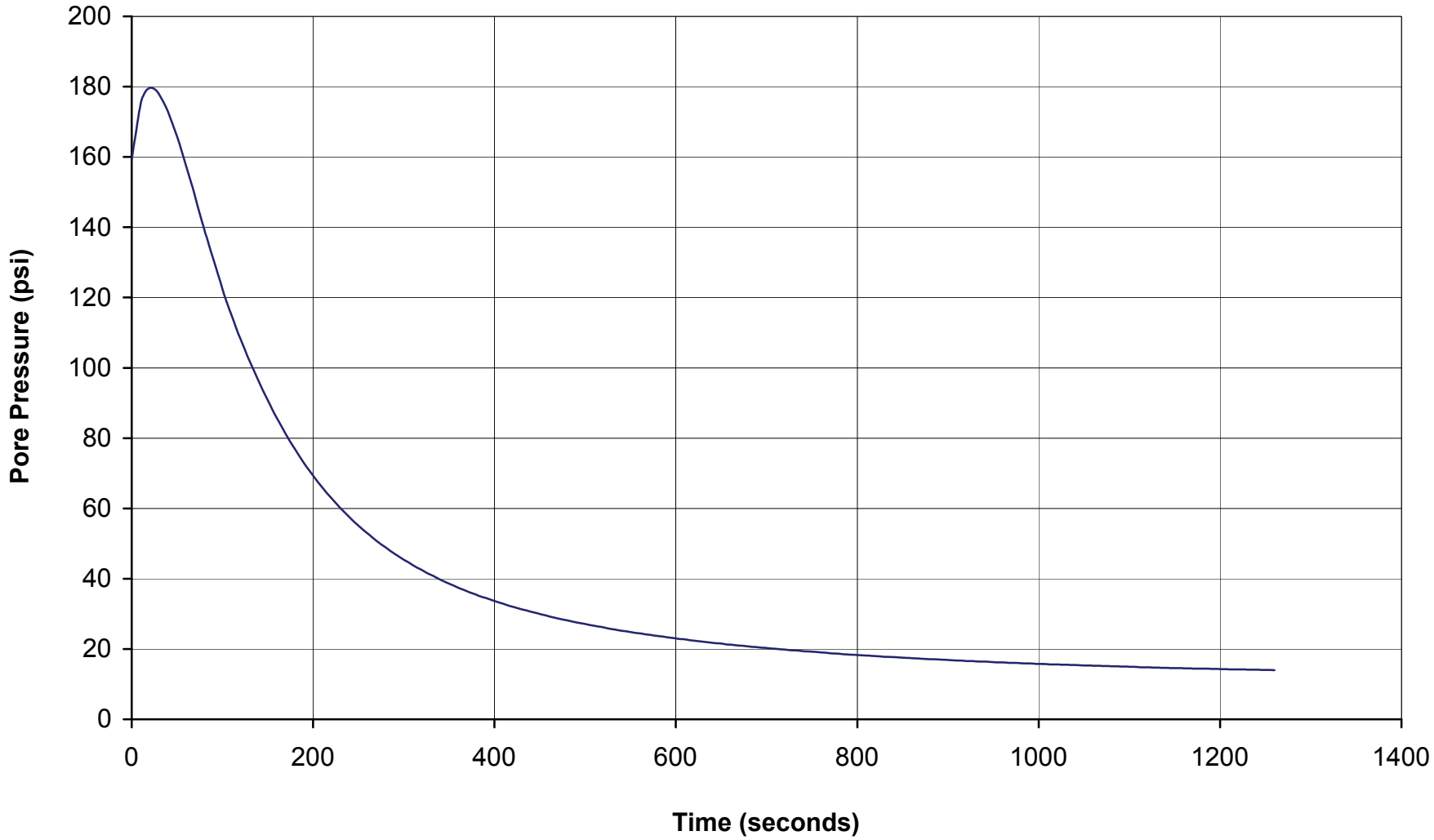
APPENDIX D

Task Order 1
Pore Pressure Dissipation Test Results

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

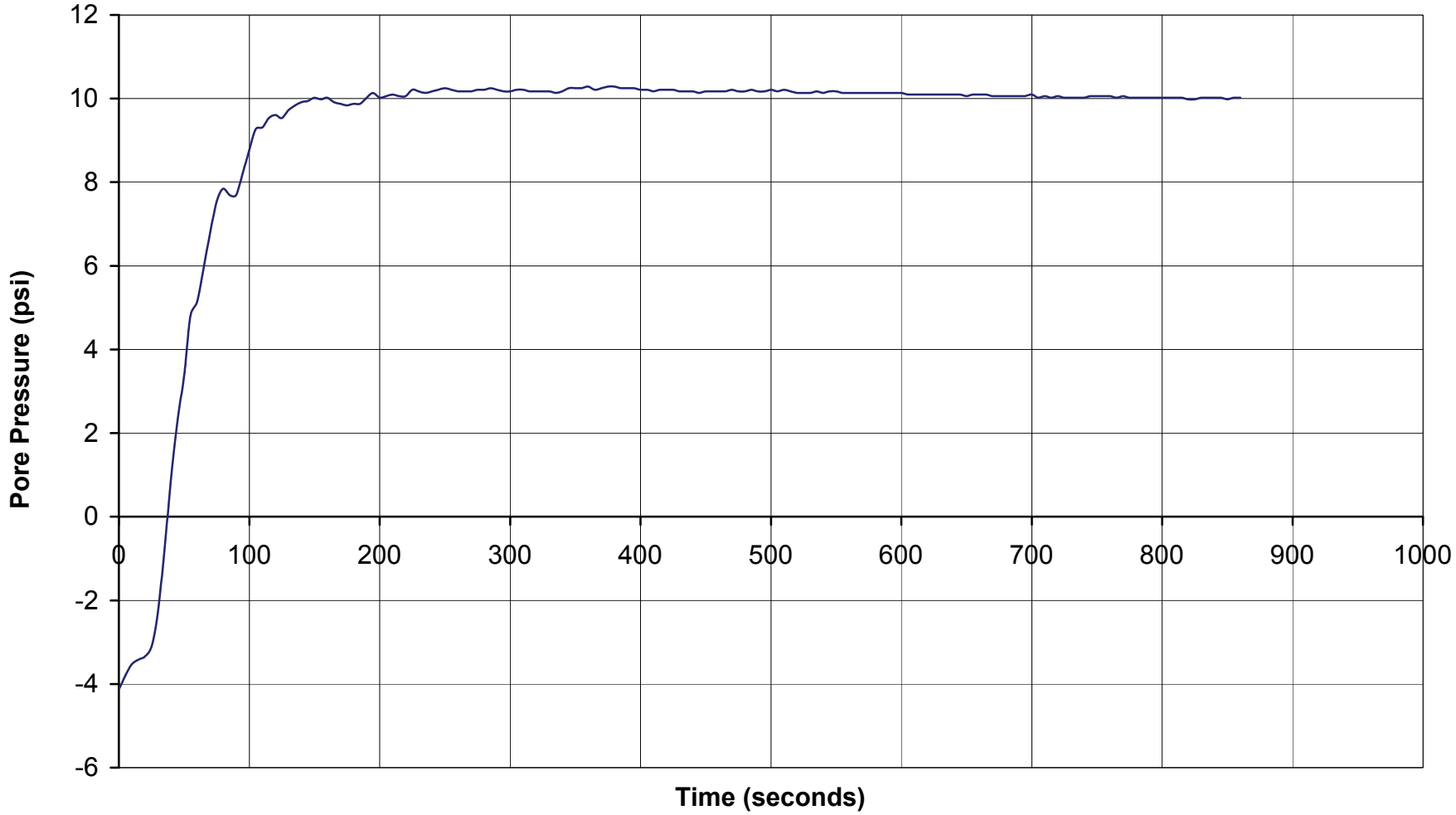
Sounding: SM0003_001C
Depth: 32.8083
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

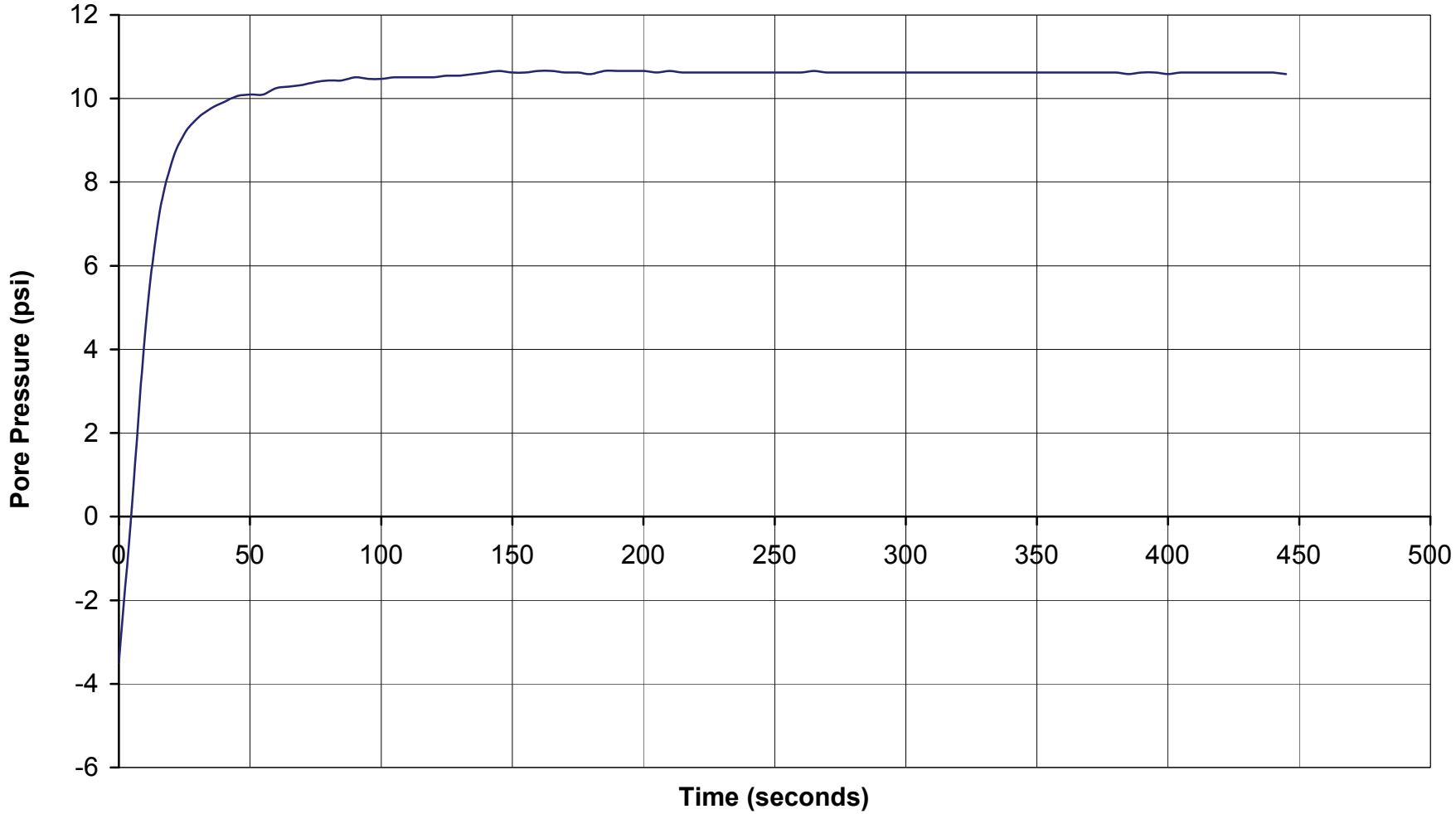
Sounding: SM0003_002C
Depth: 32.480217
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

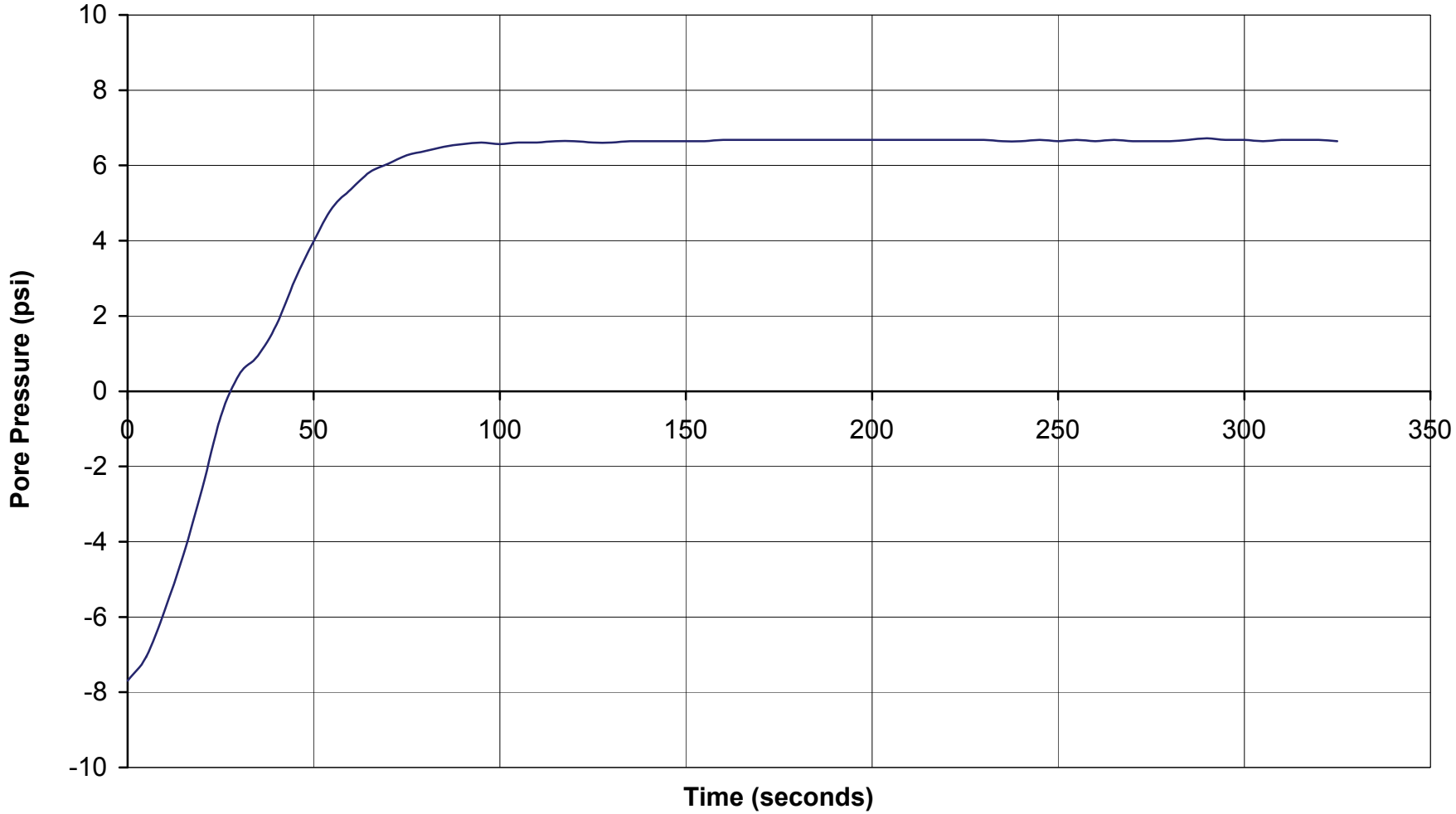
Sounding: SM0003_003C
Depth: 38.8778355
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

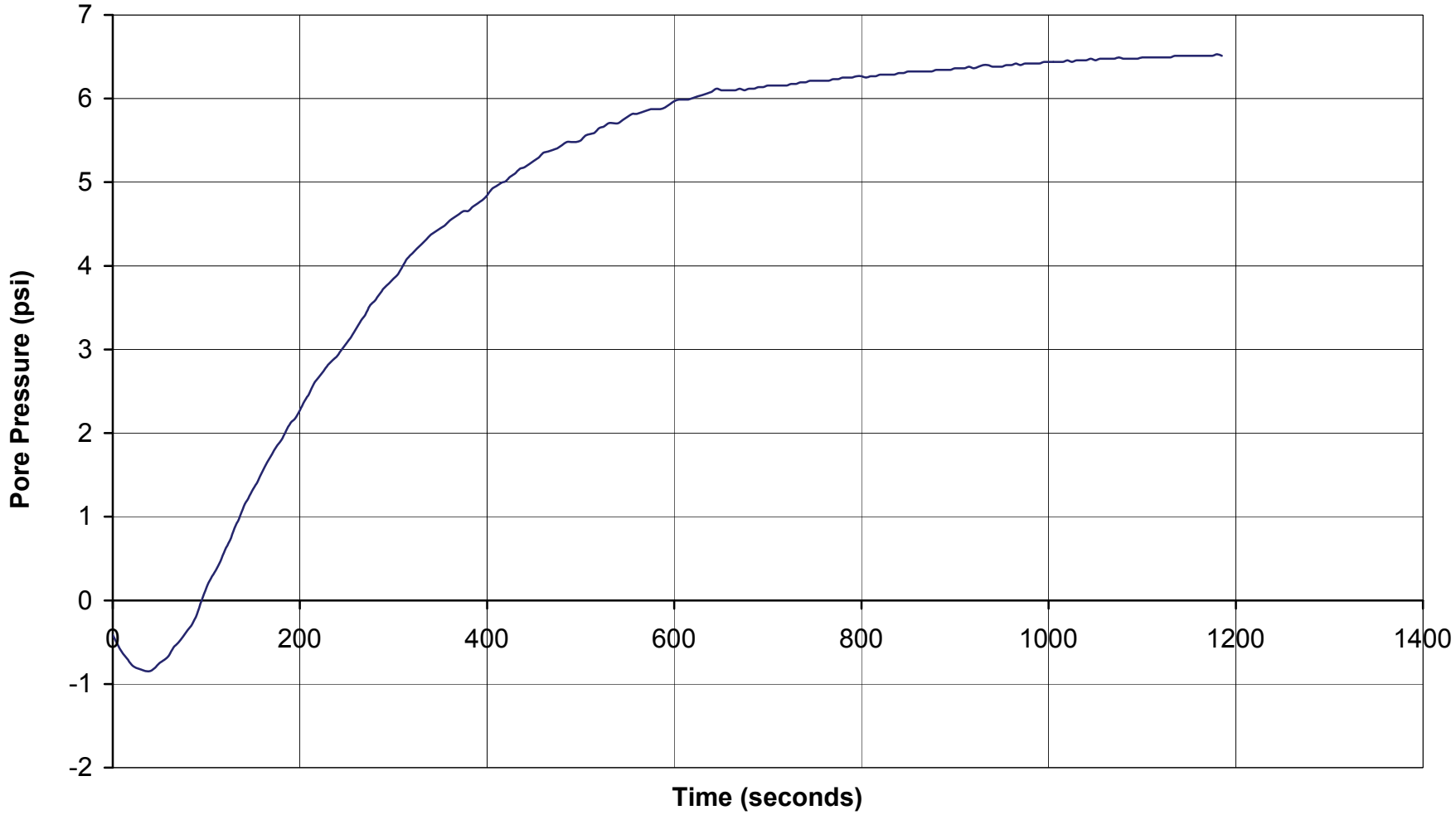
Sounding: SM0003_004C
Depth: 32.3161755
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

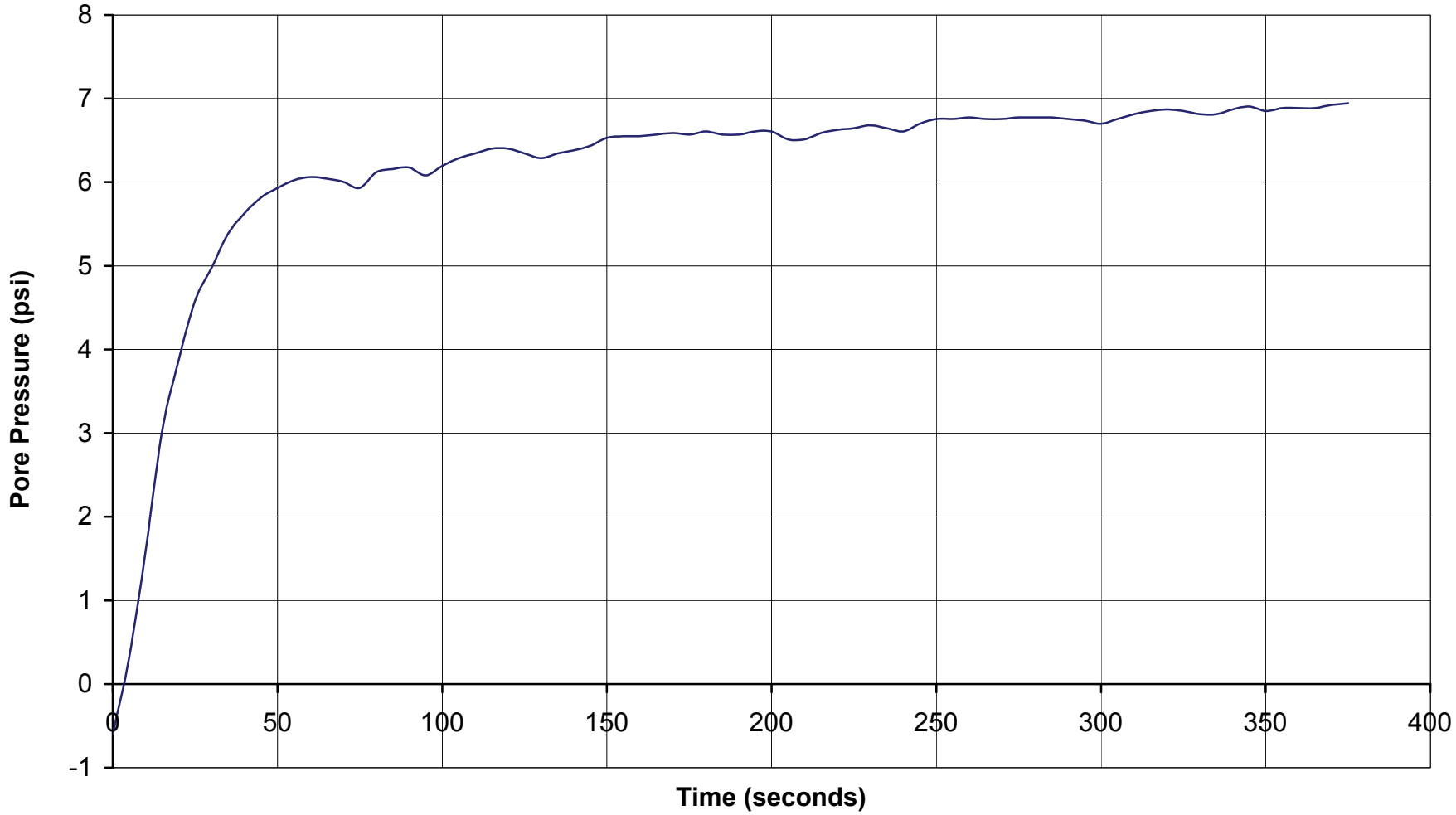
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Depth: 34.776798
Site: SBFCA FRWL EIP
Engineer: DAVE MORRELL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

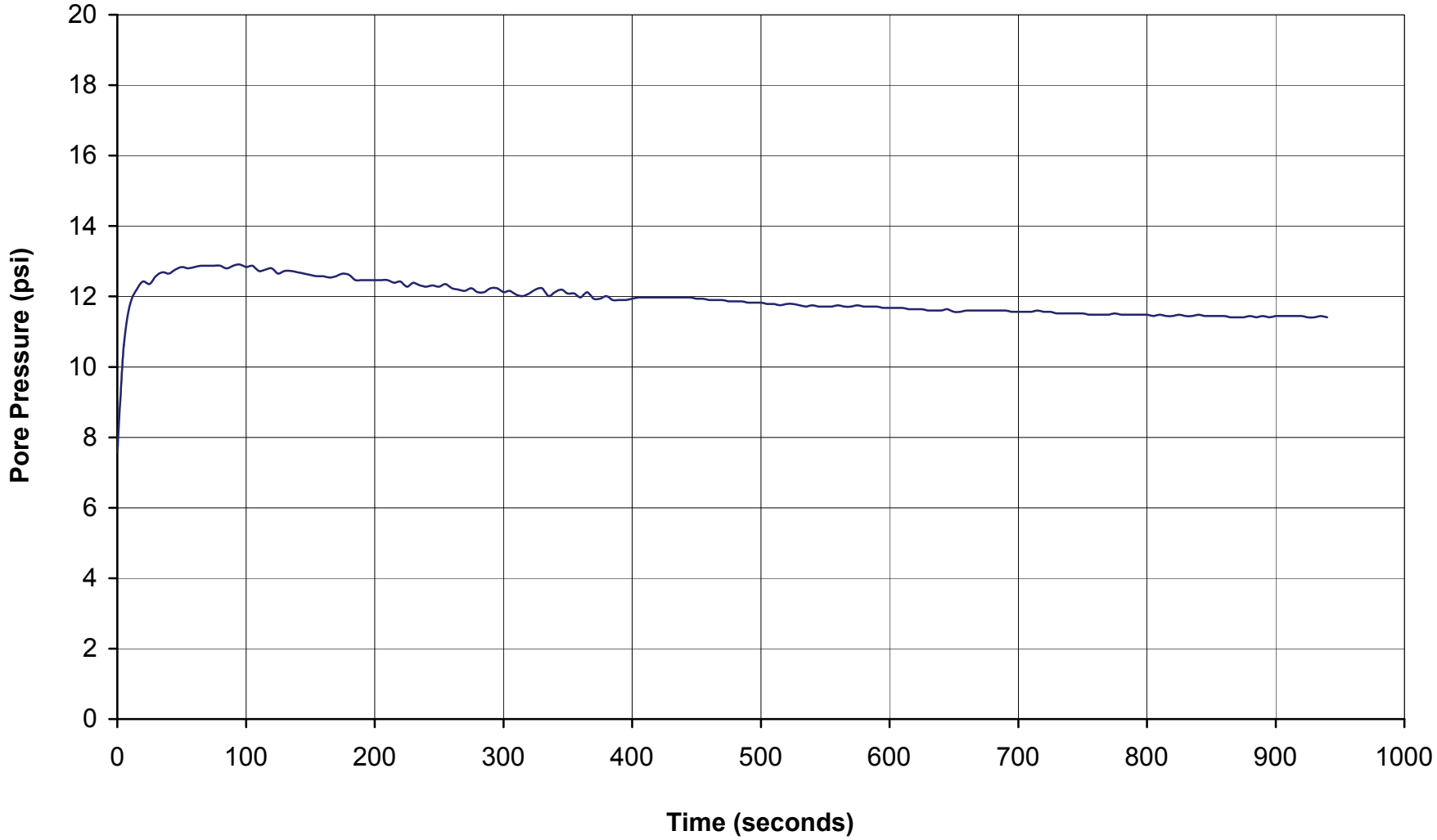
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Site: SBFCA FRWL EIP
Engineer: DAVE MORRELL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

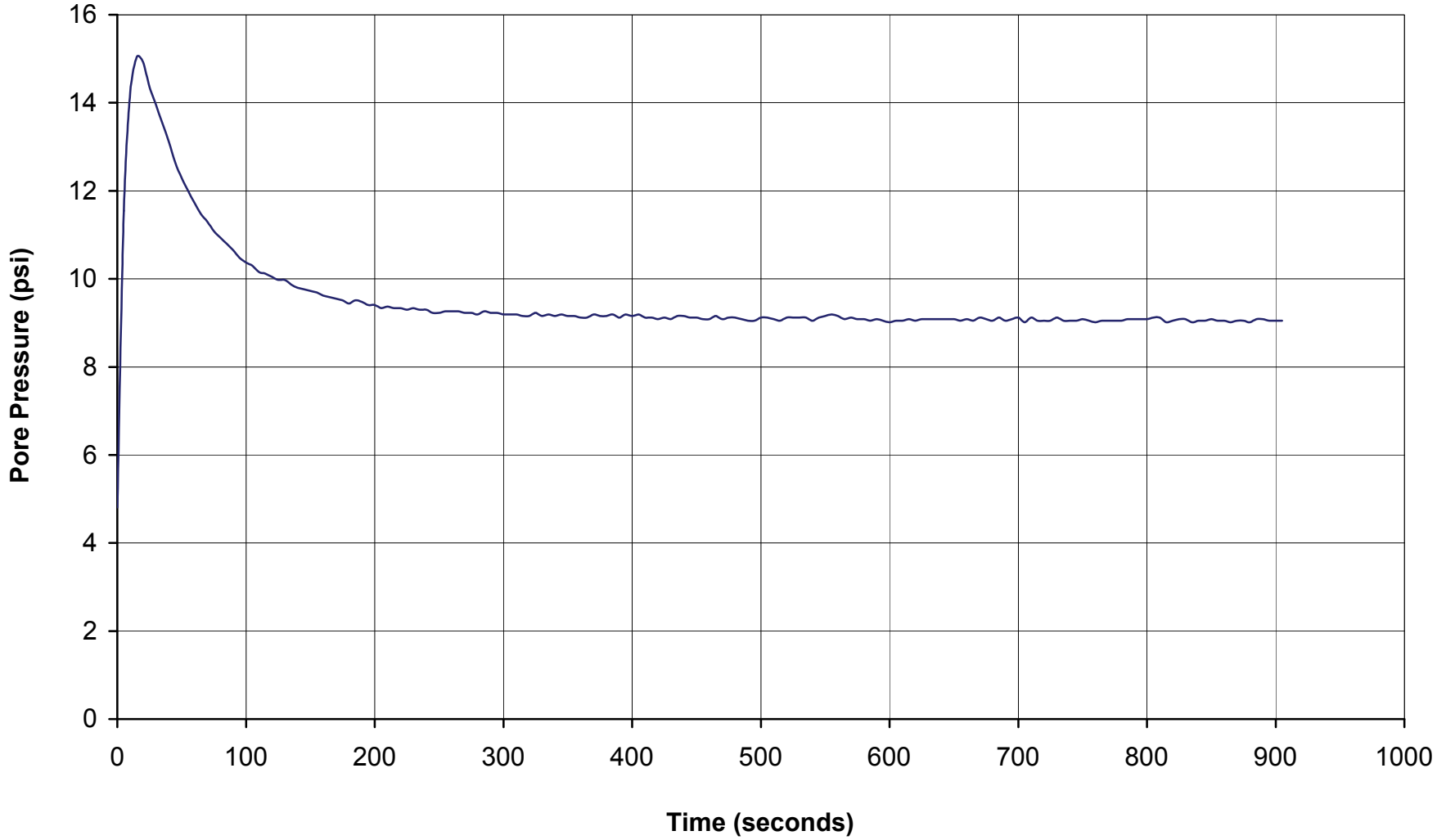
Sounding: SL0001_001C
Depth: 48.556284
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

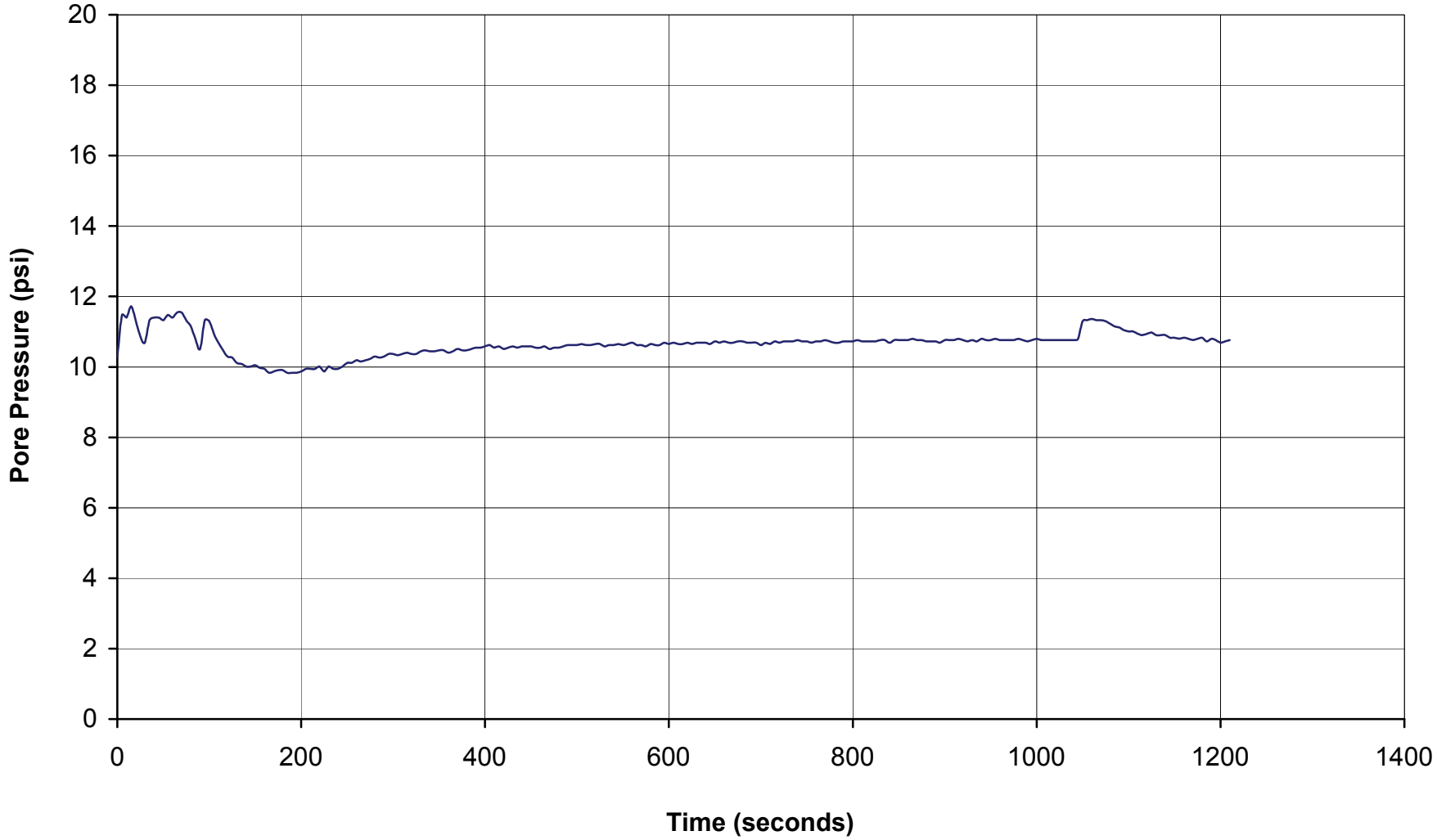
Sounding: SL0001_002C
Depth: 38.385711
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

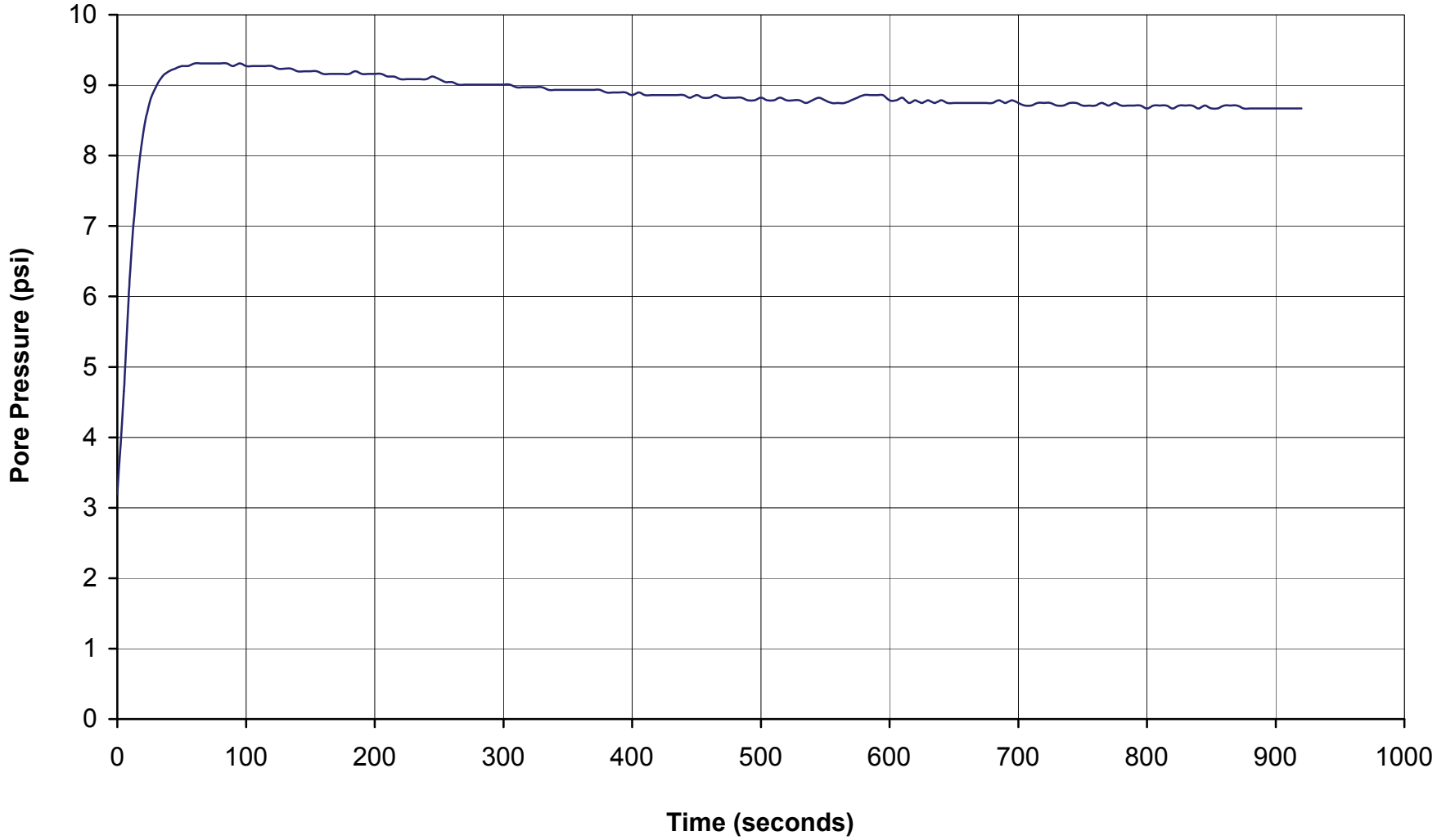
Sounding: SL0001_003C
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

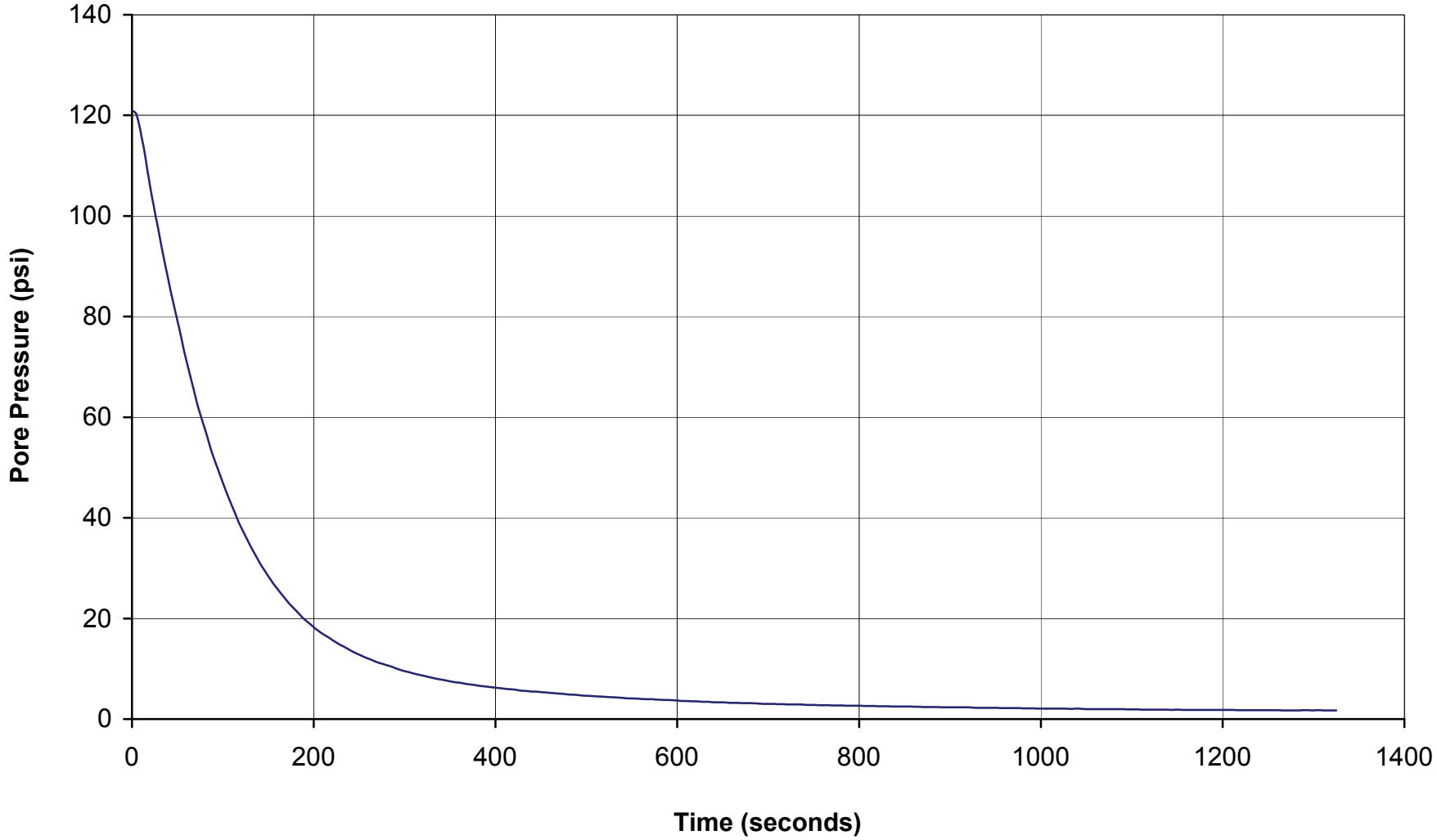
Sounding: SL0001_004C
Depth: 41.5024995
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

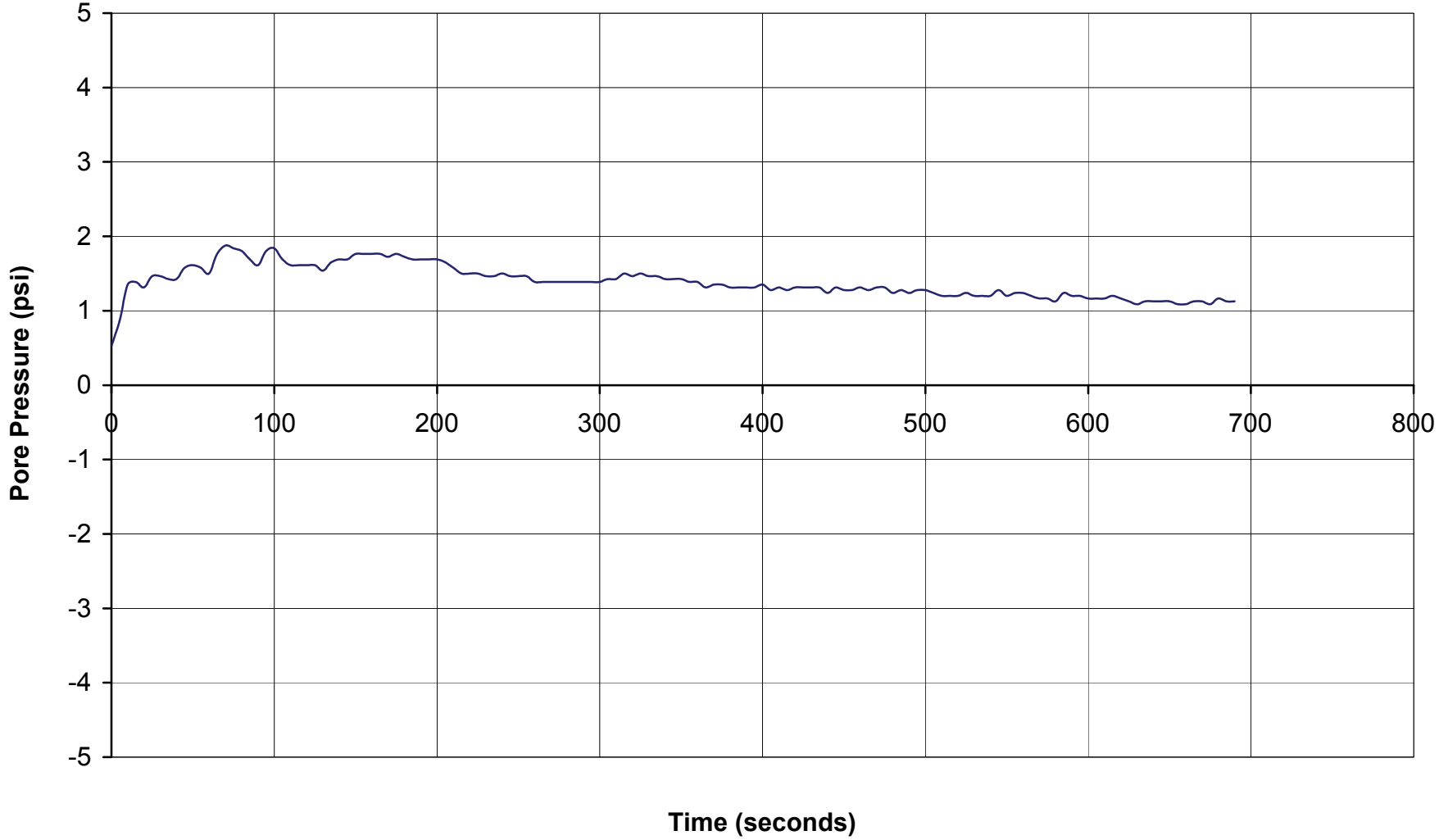
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

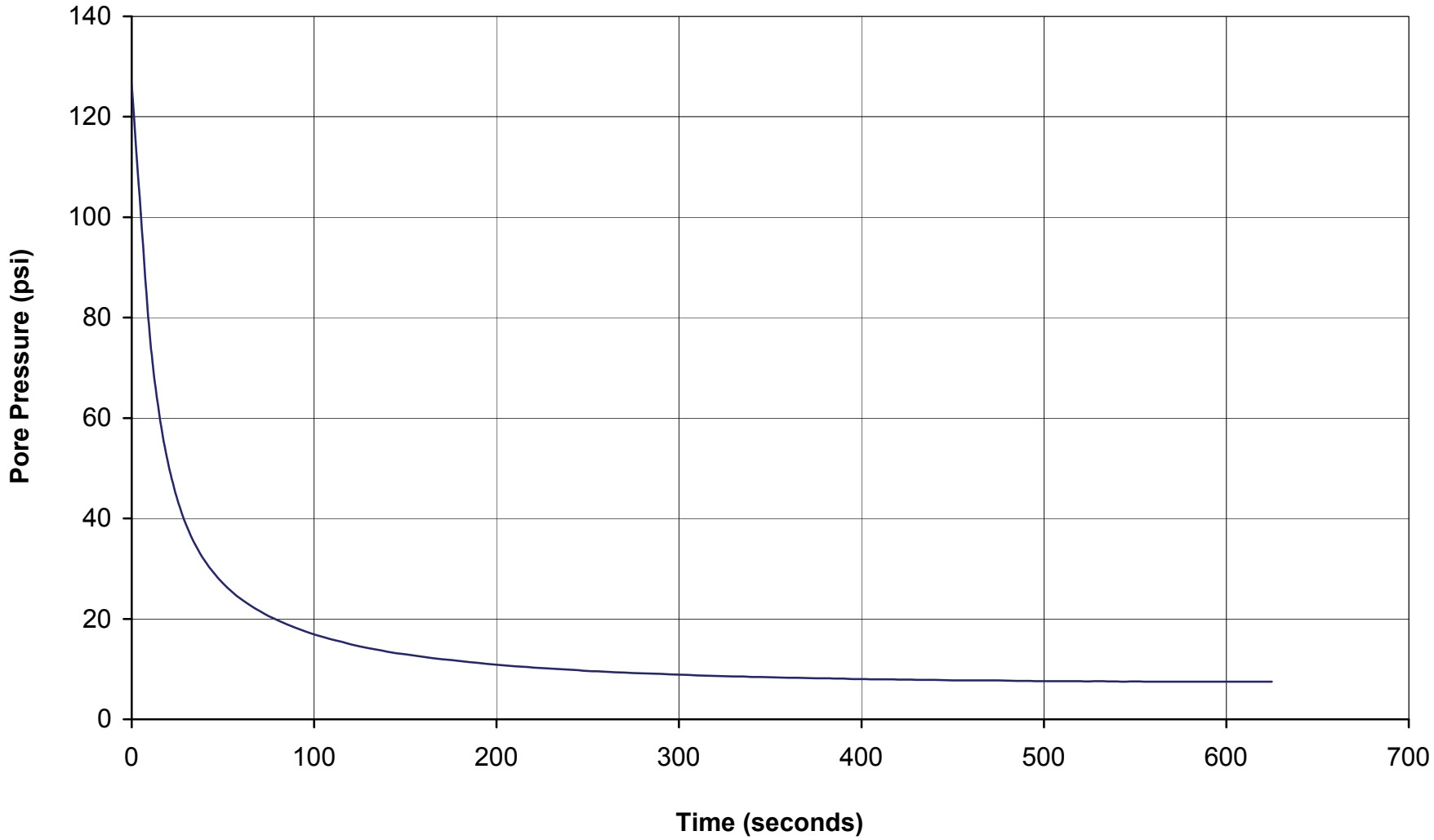
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Site:	SBFCA FRWL EIP
Engineer:	M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

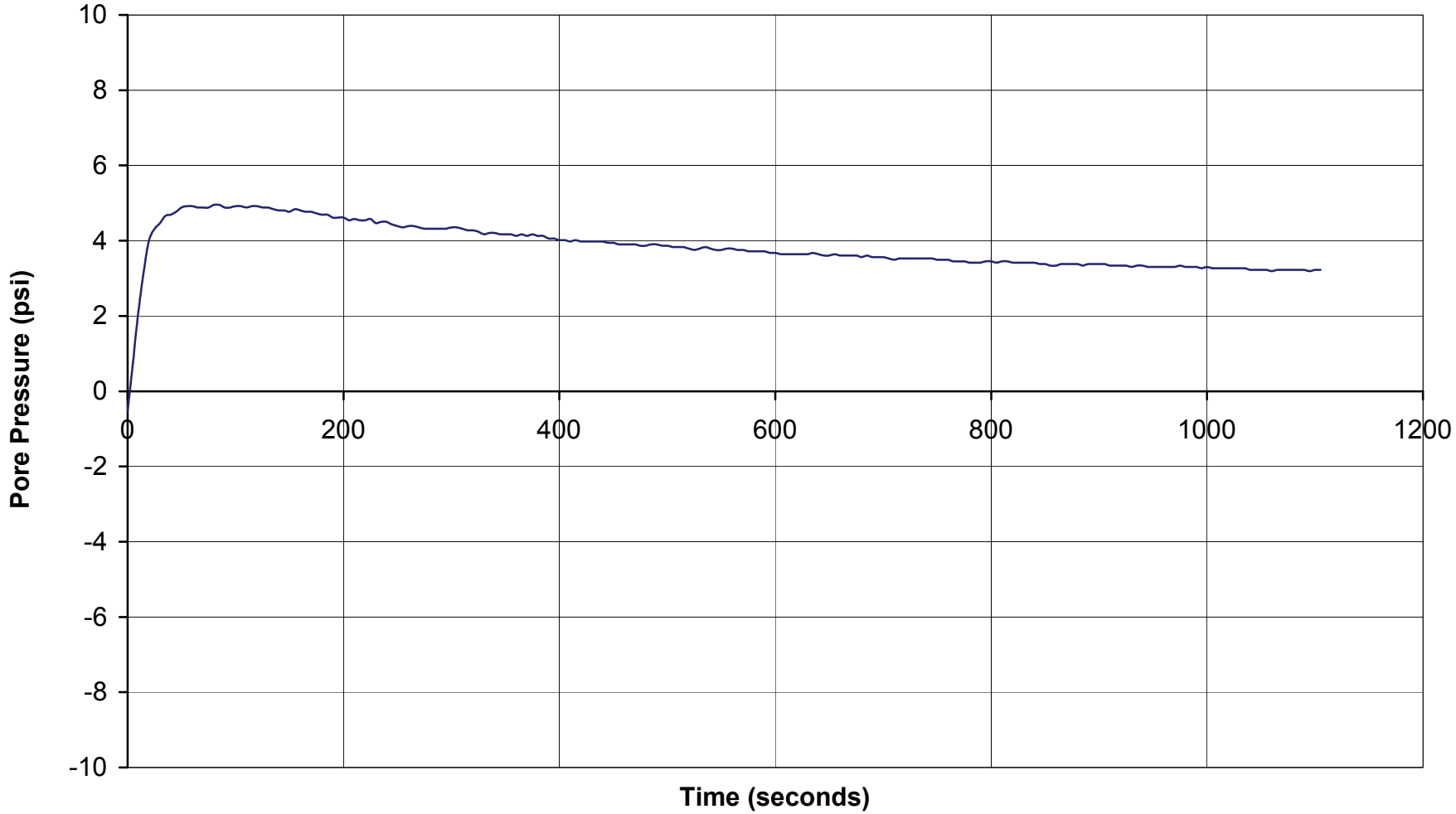
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

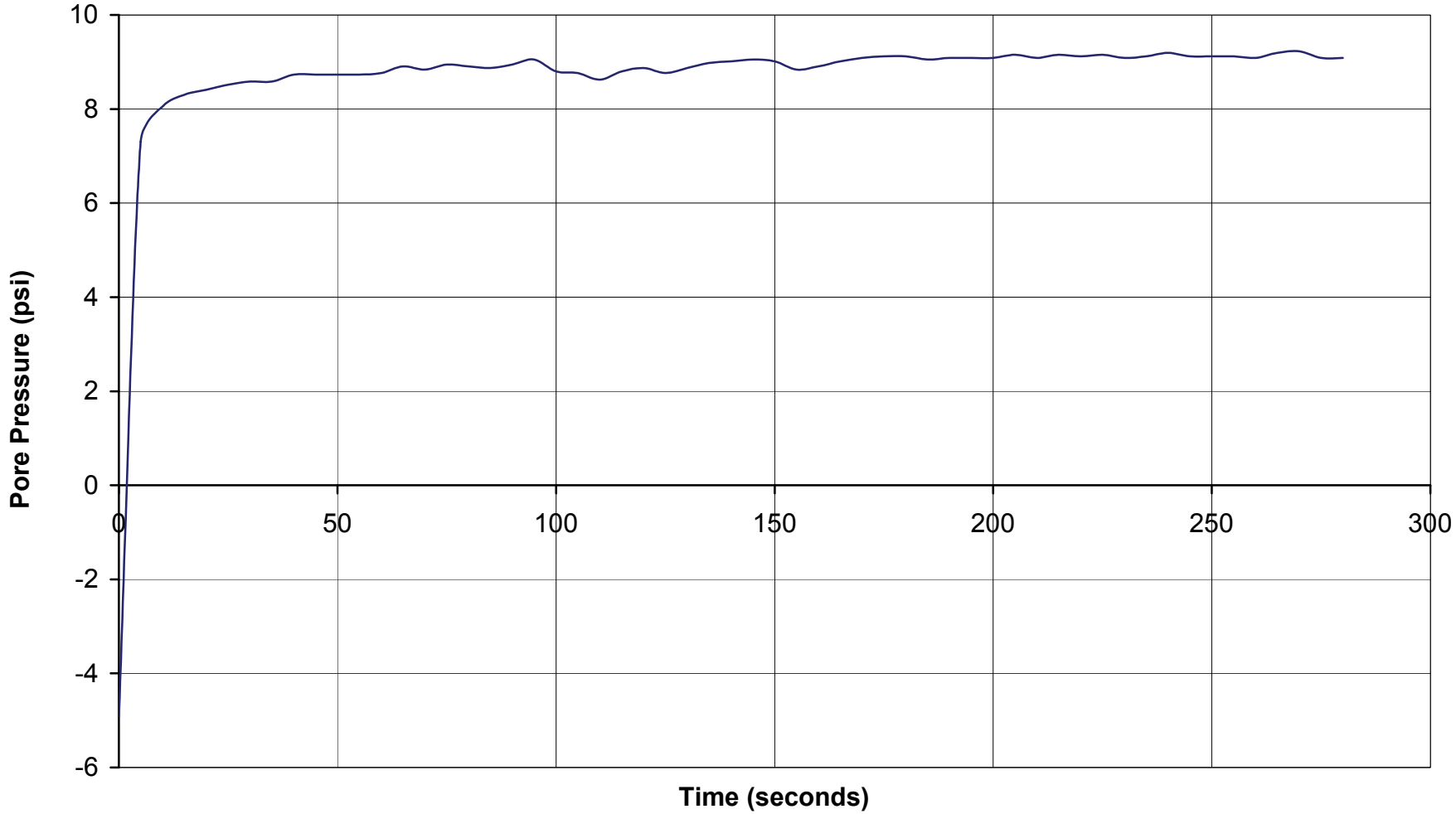
Sounding: SL0001_008C
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

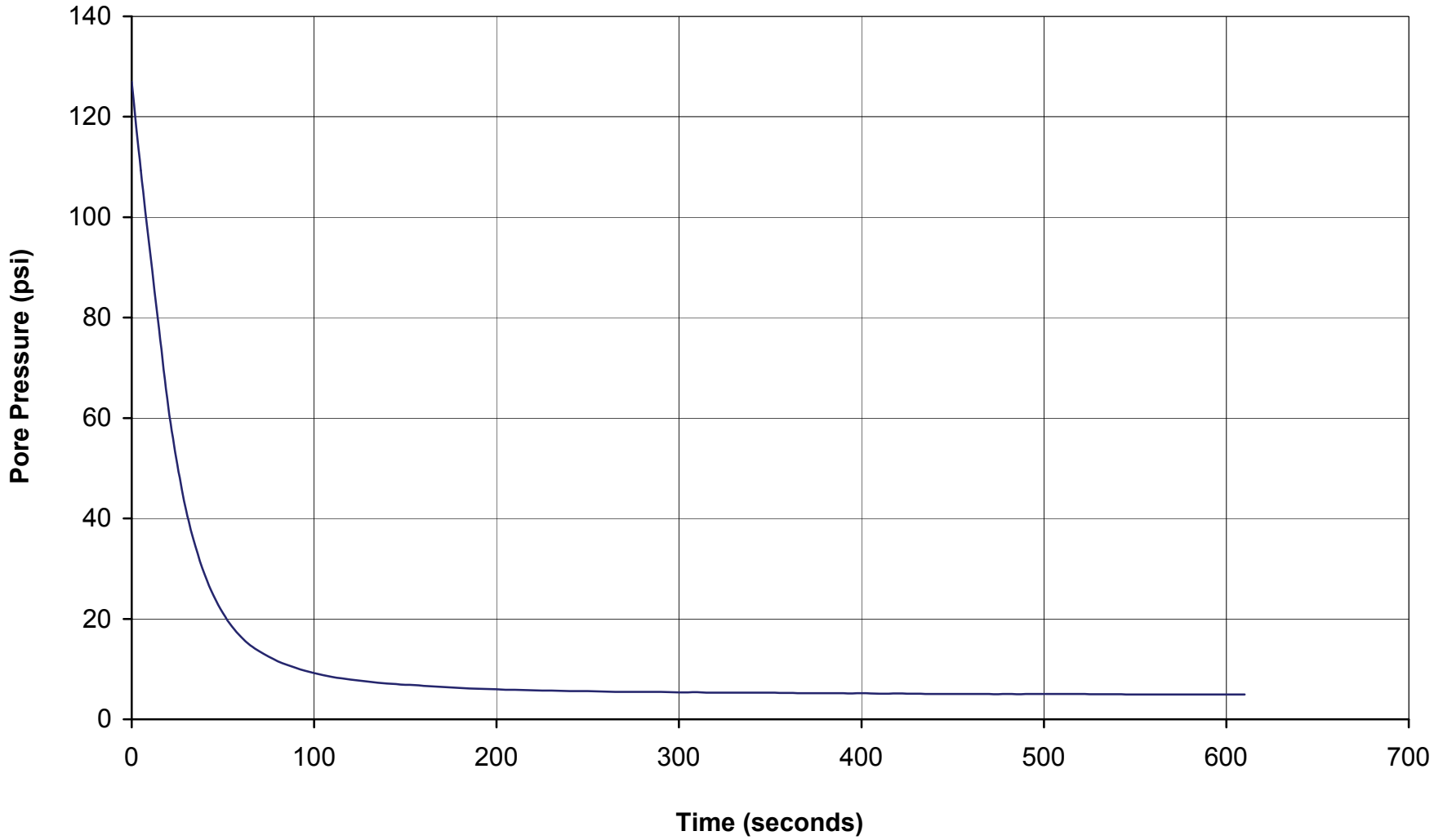
Sounding: SL0001_008C
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

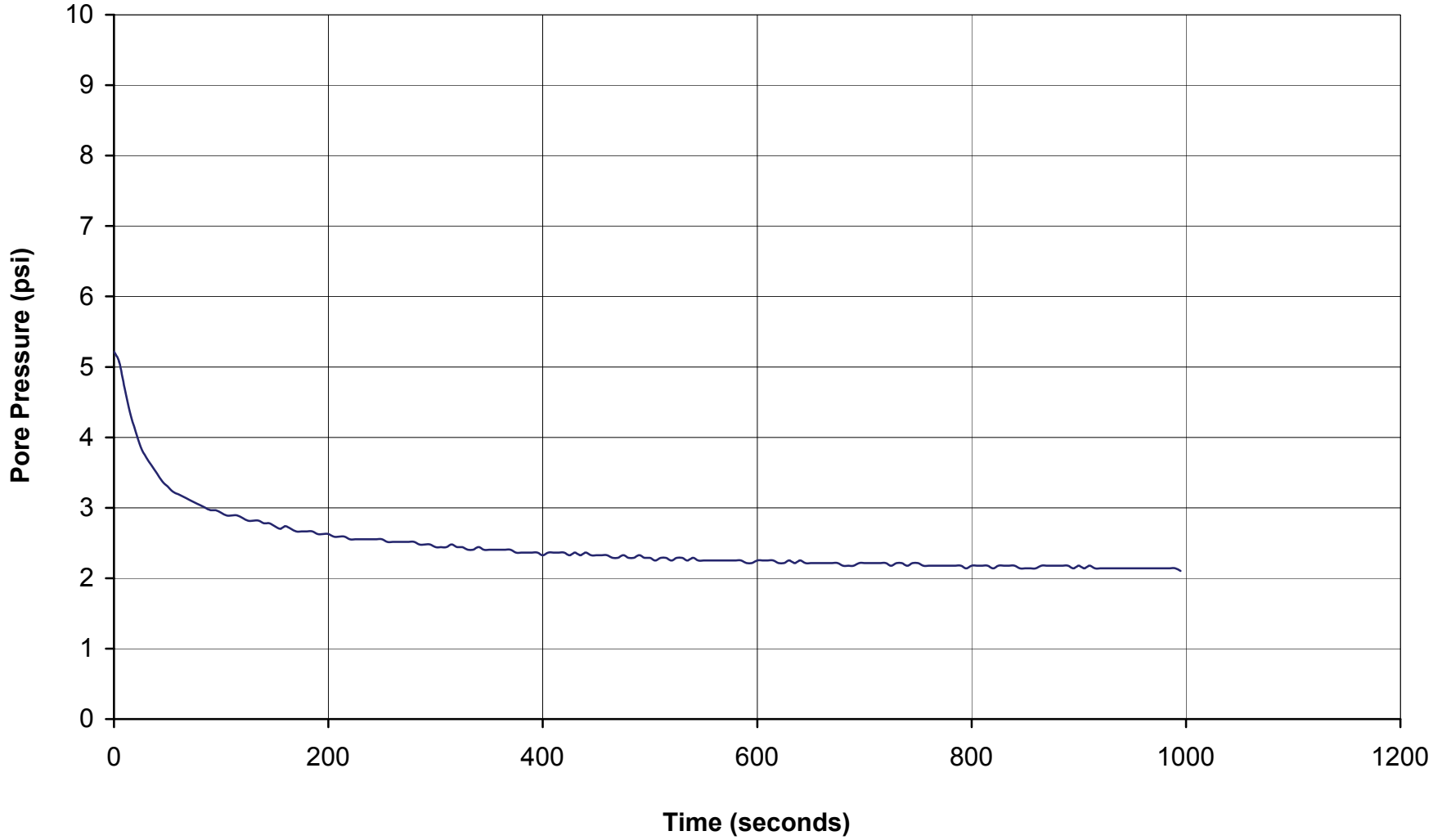
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

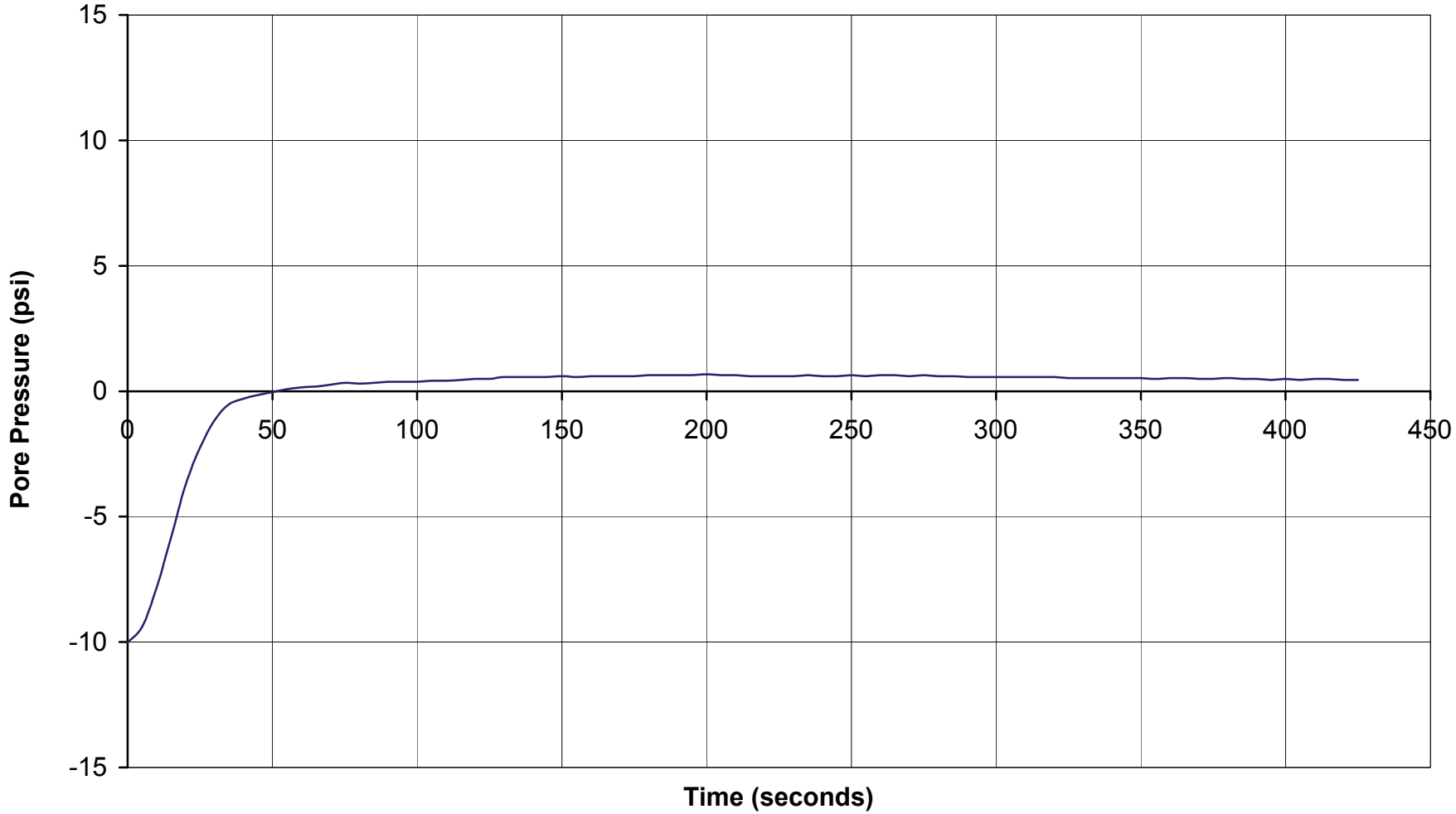
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

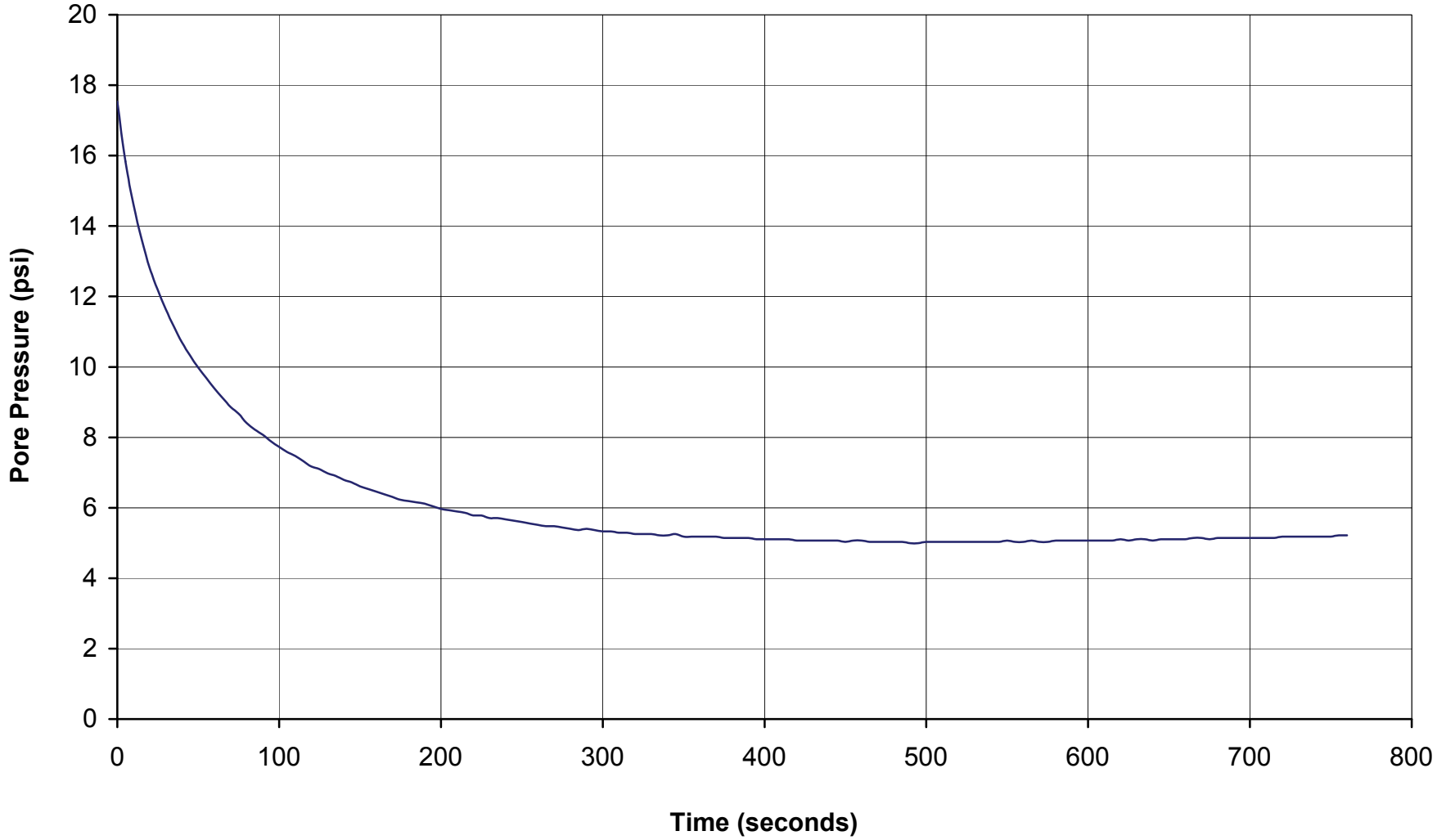
Sounding: SL0001_011C
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

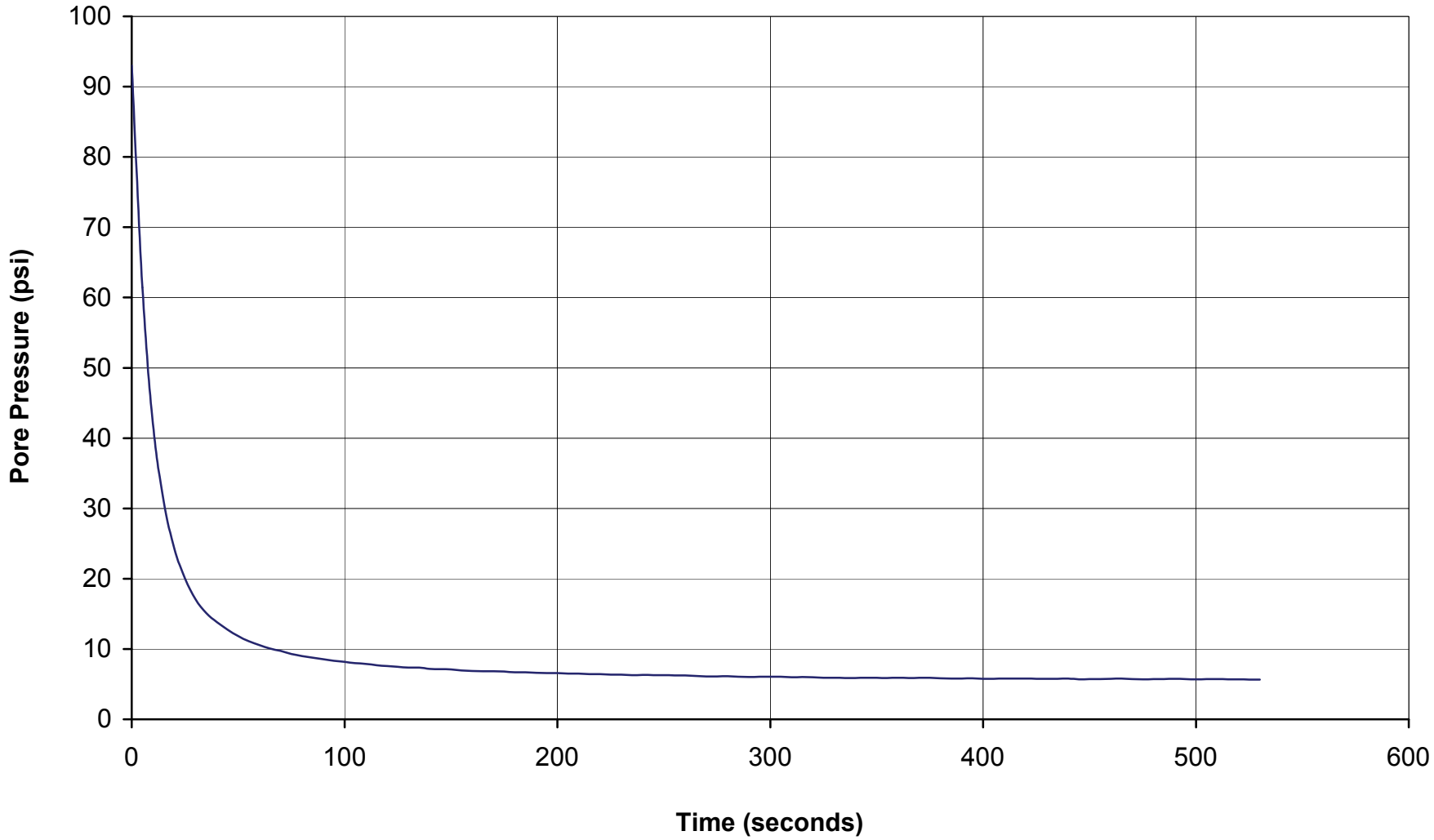
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

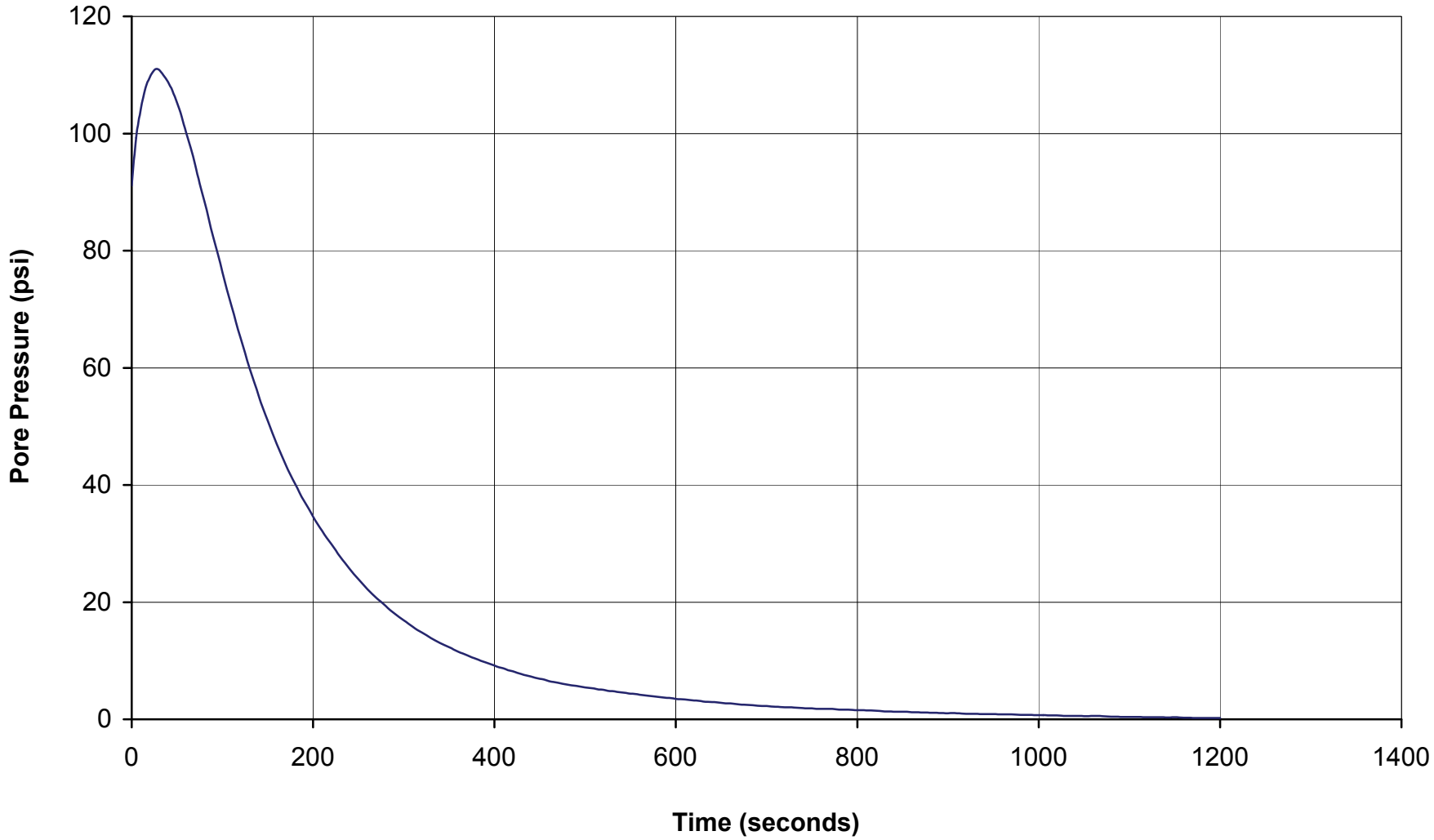
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

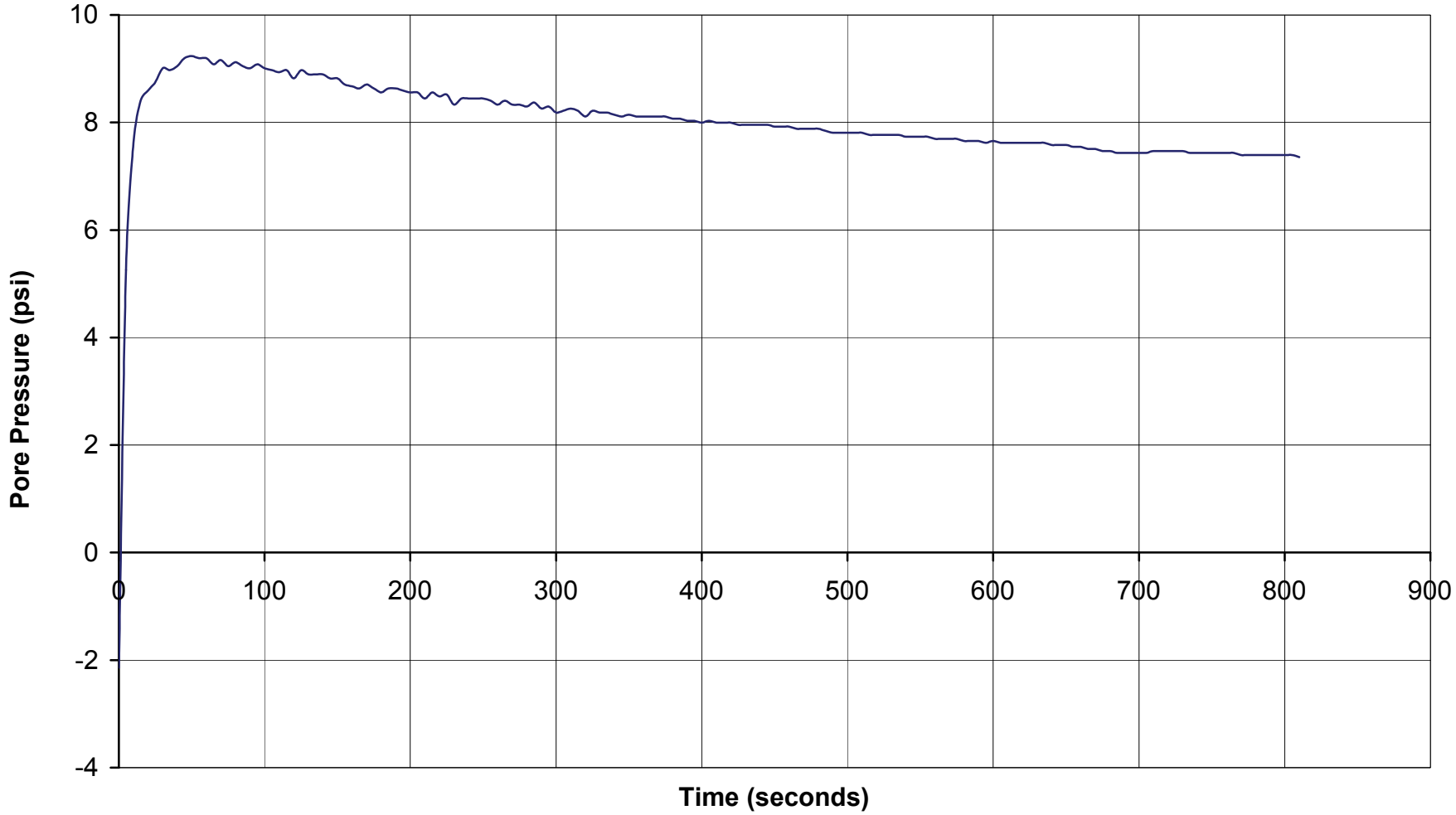
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Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

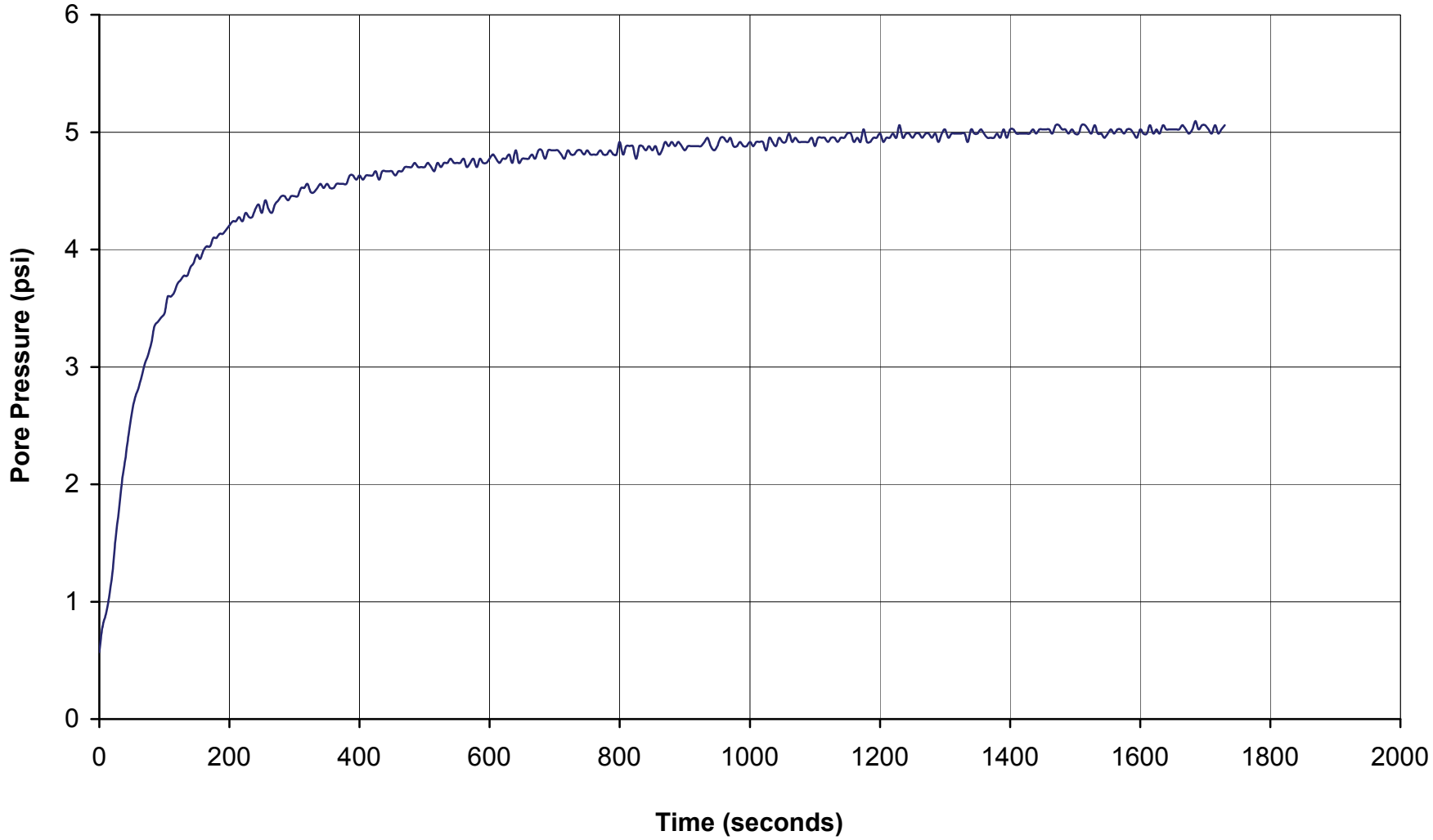
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

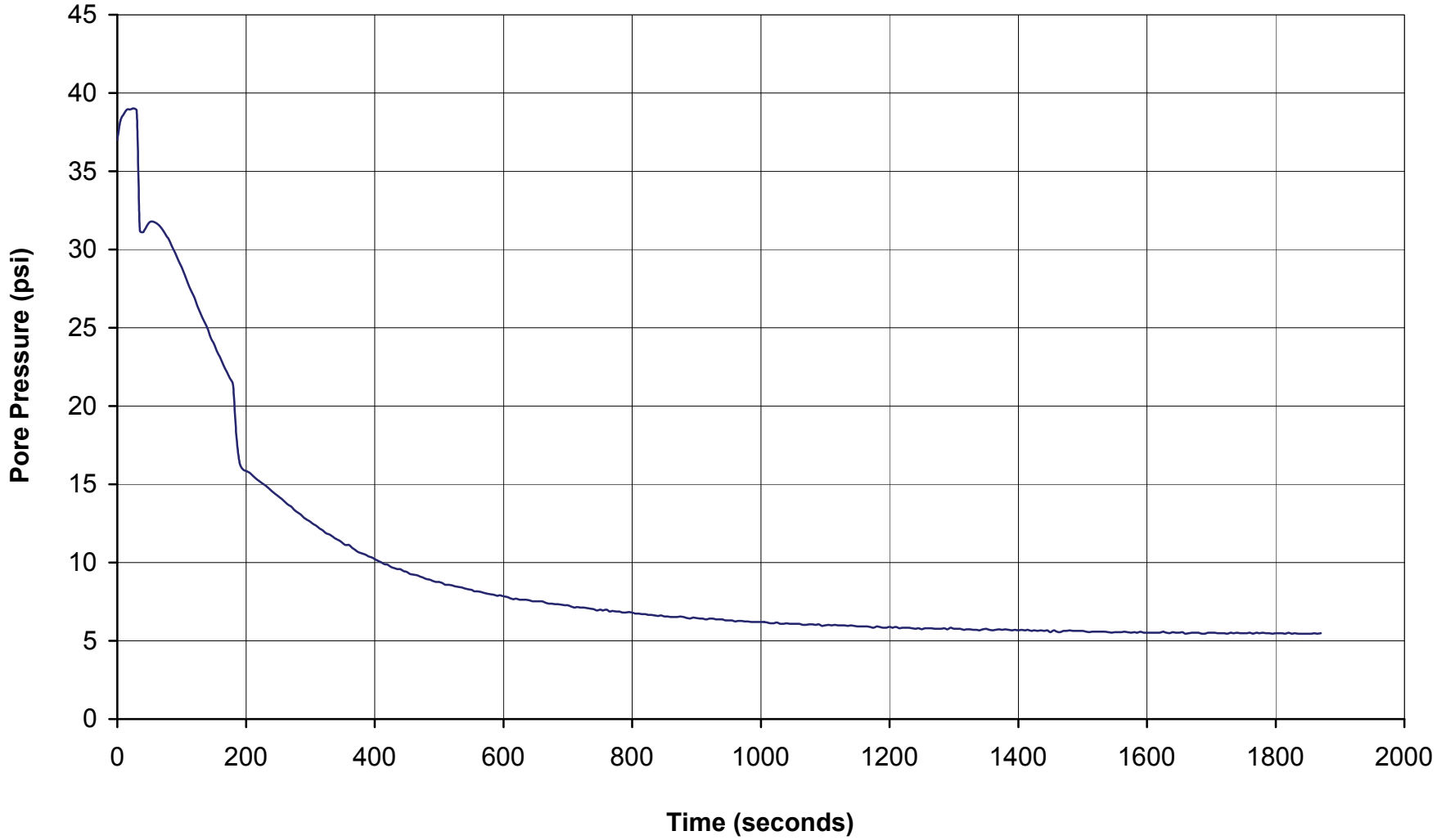
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

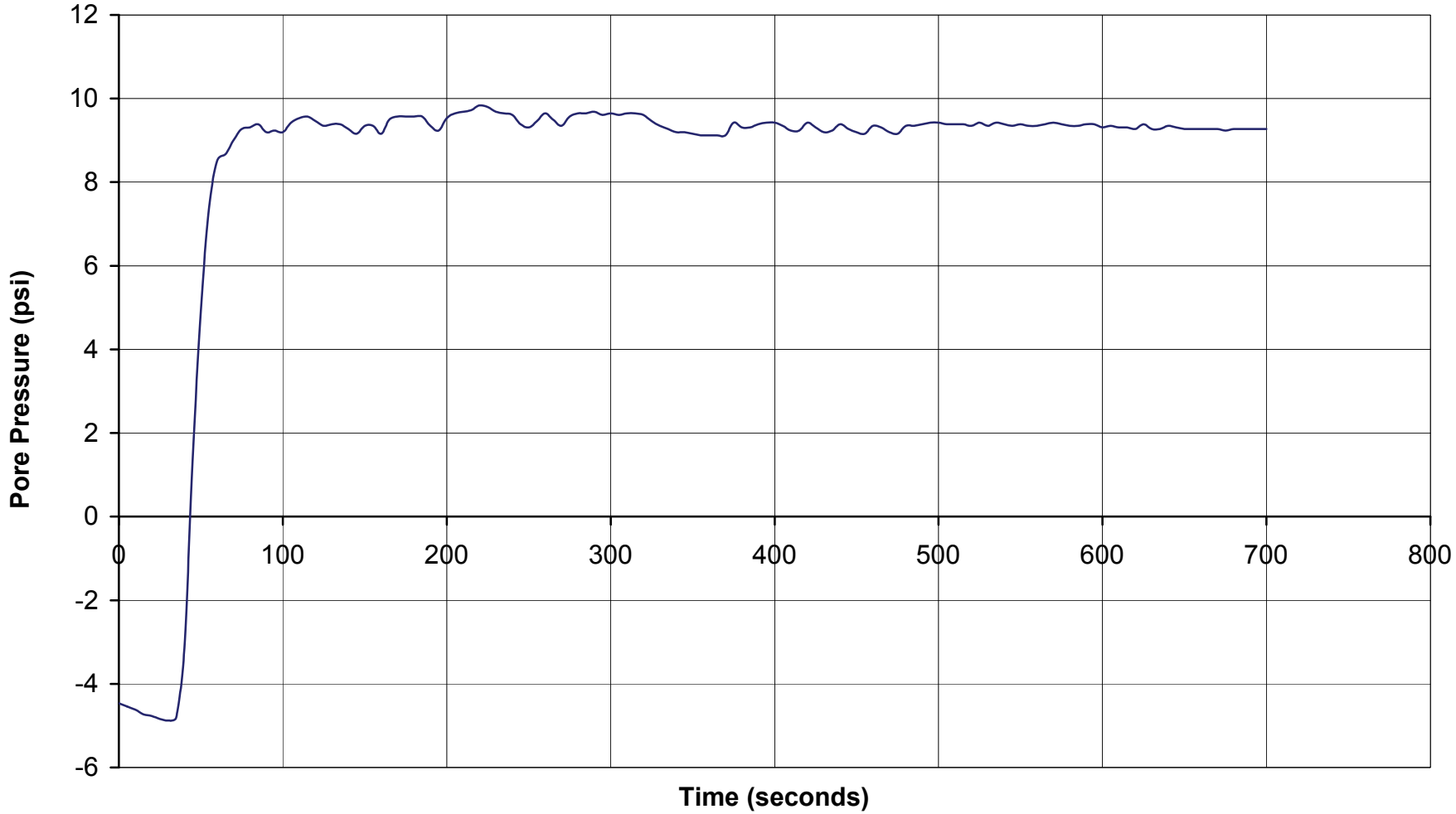
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Depth: 35.2689225
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

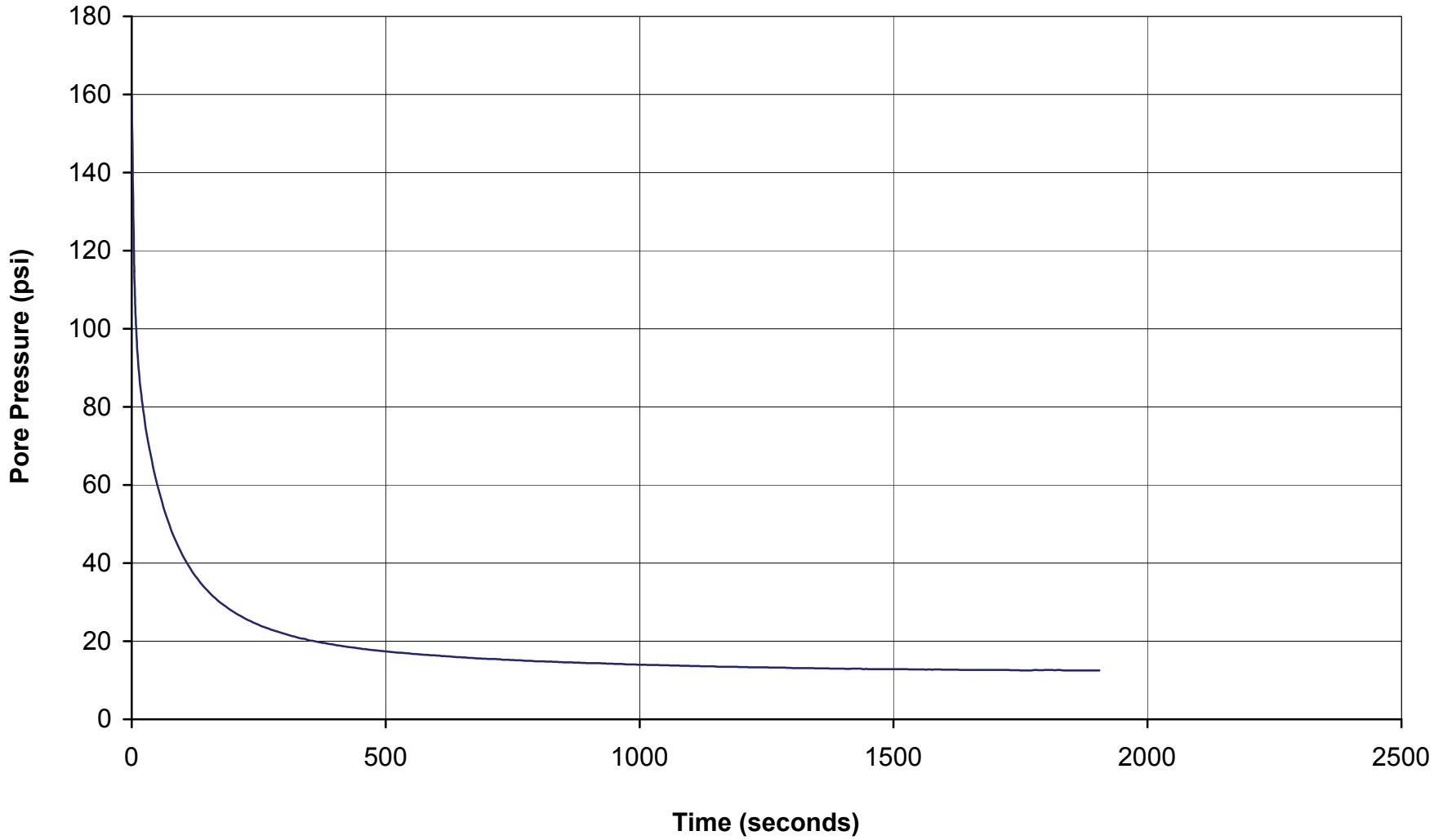
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

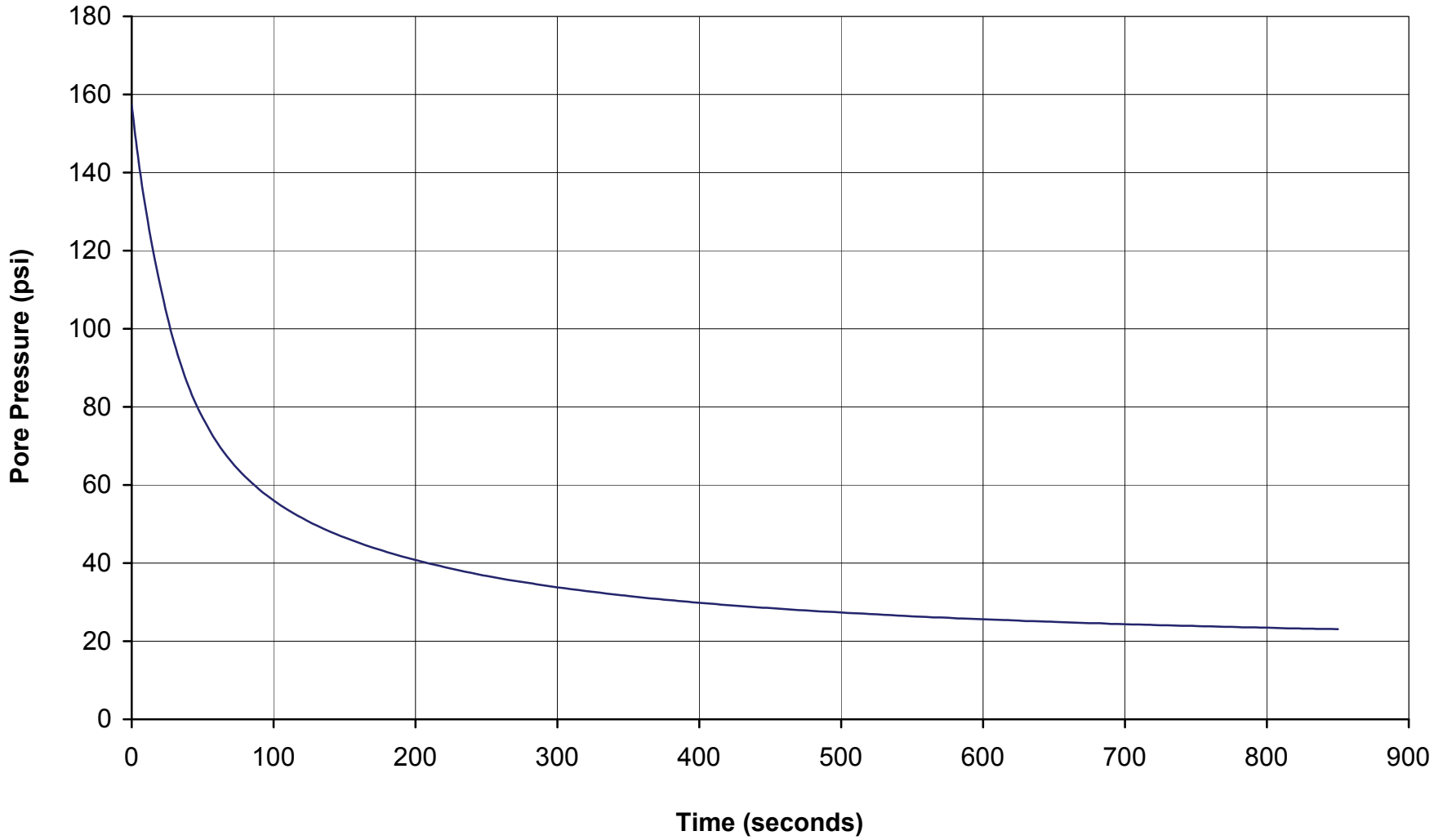
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Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

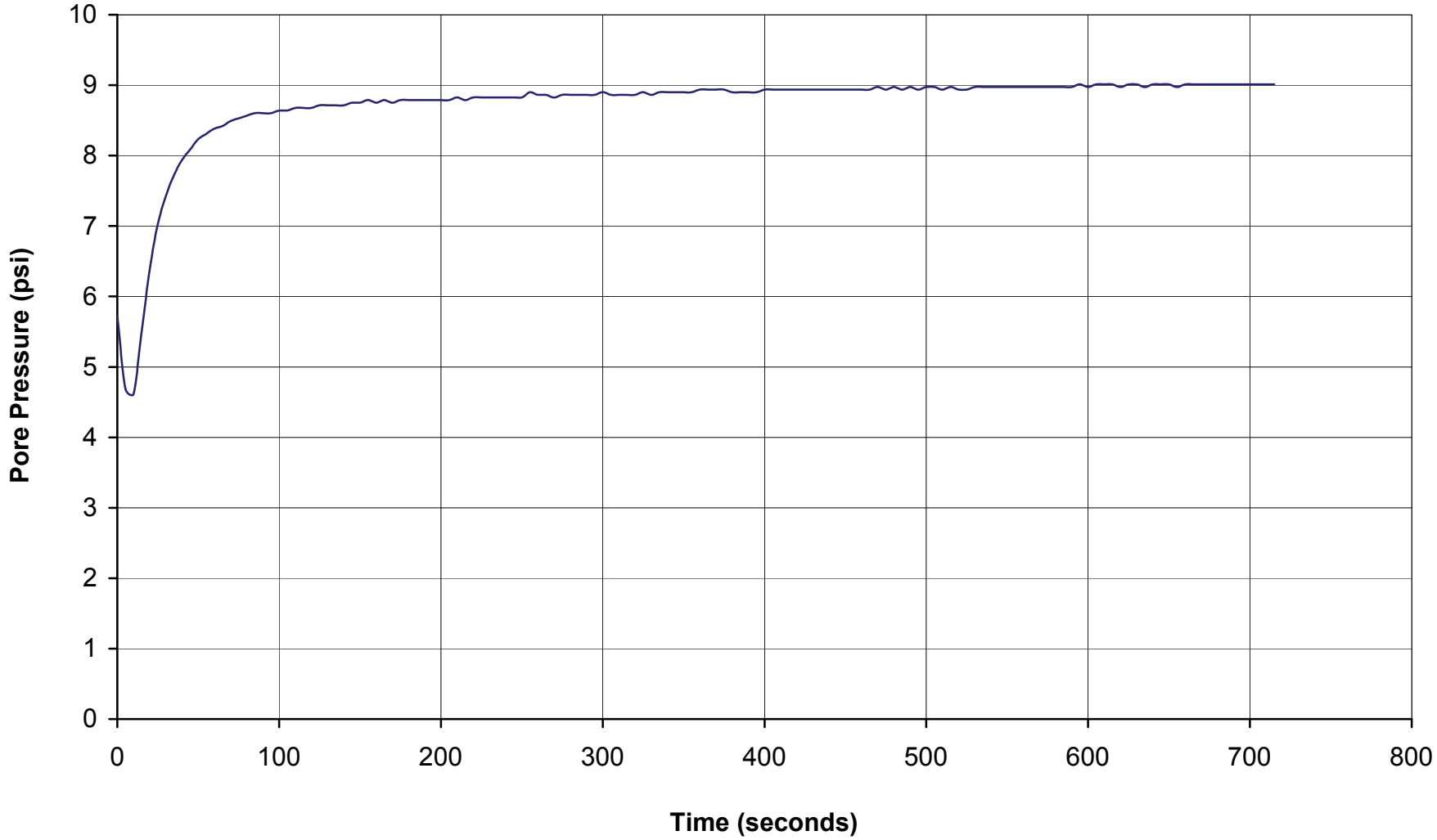
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Site: SBFCA FRWL EIP
Engineer: MEHRZAD



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

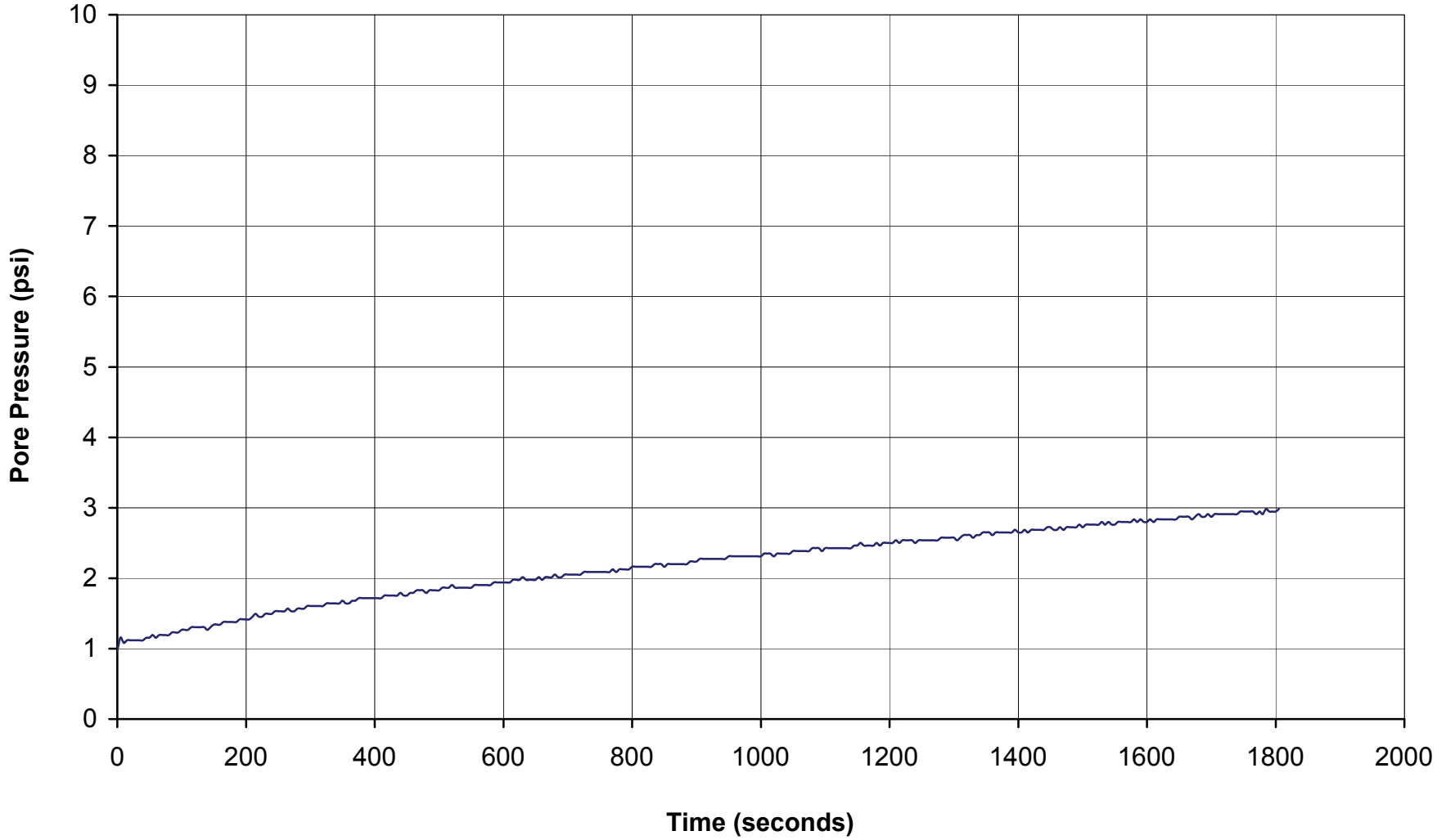
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Site: SBFCA FRWL EIP
Engineer: MEHRZAD



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

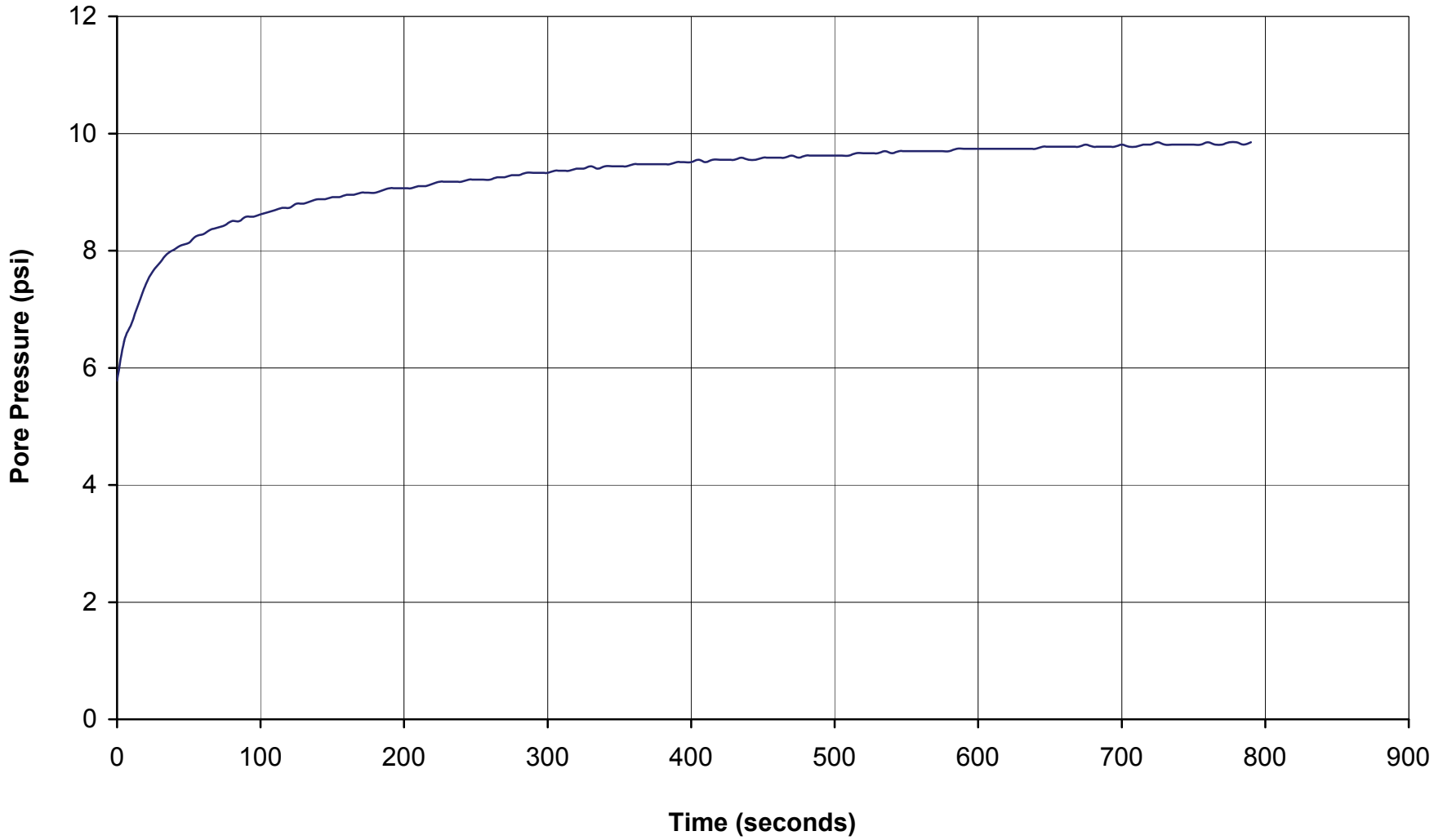
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Site: SBFCA FRWL EIP
Engineer: D.MORRELL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

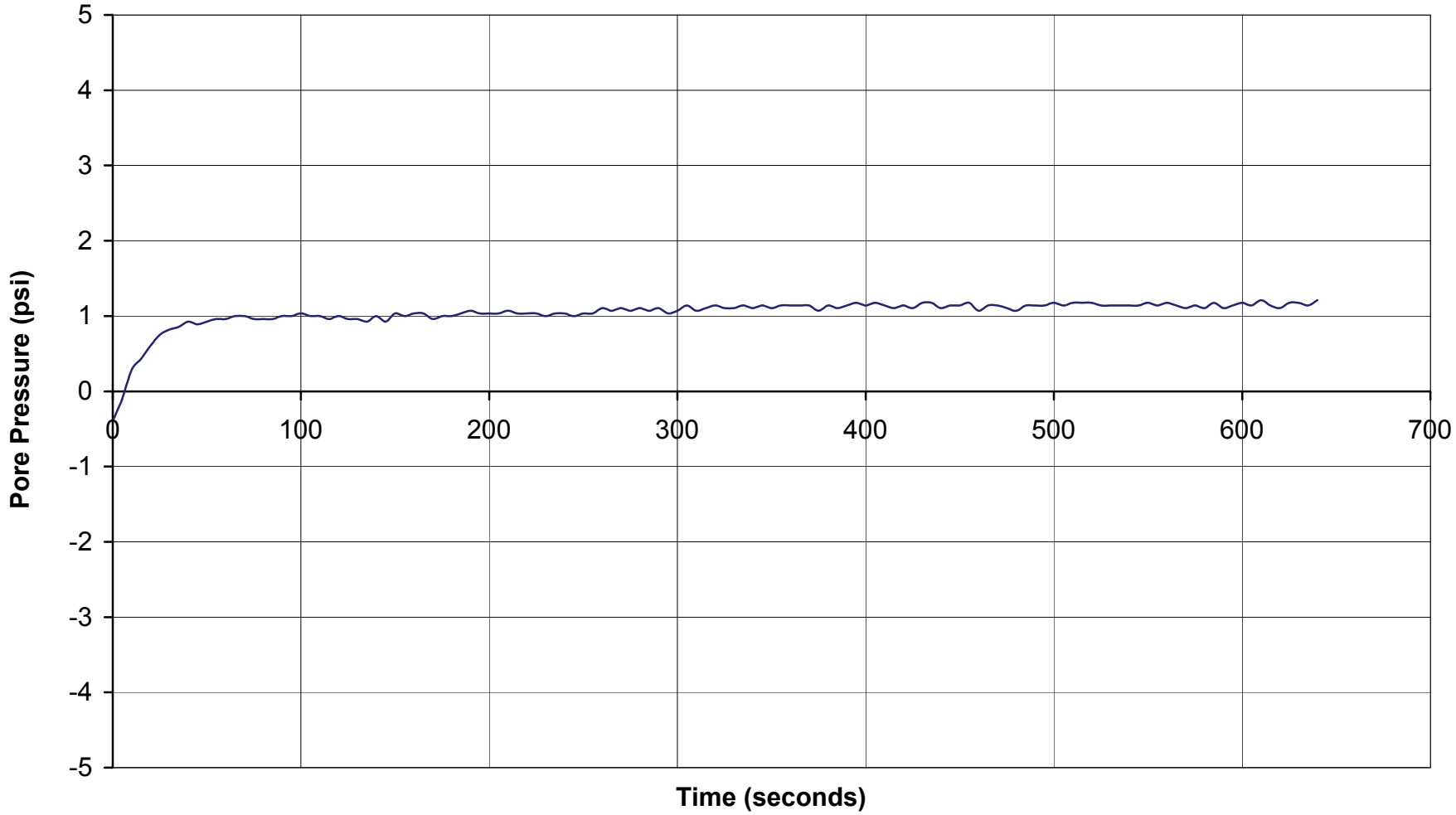
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Site: SBFCA FRWL EIP
Engineer: D.MORRELL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

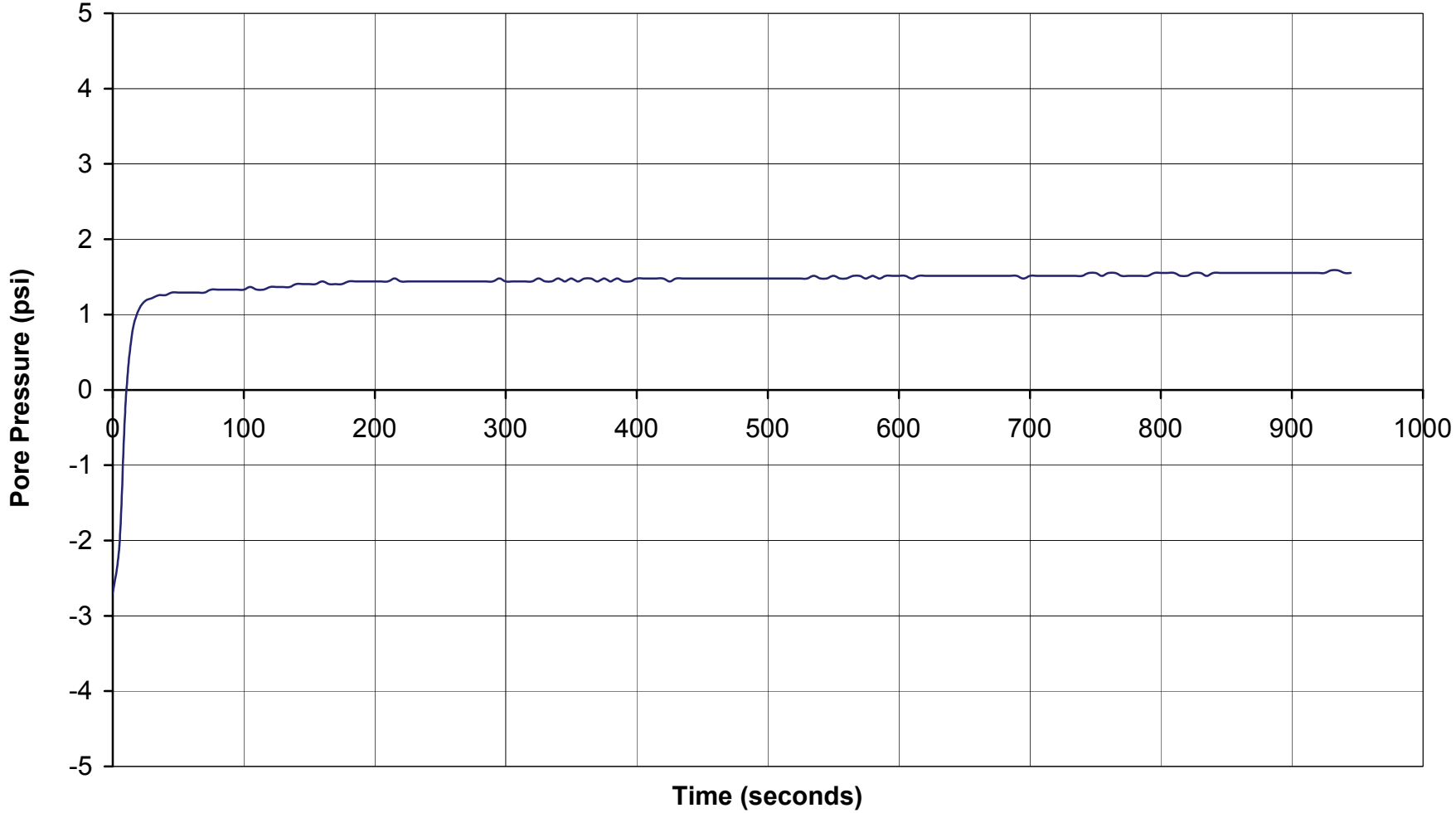
Sounding: SM0007_003C
Depth: 26.24664
Site: SBFCA FRWL EIP
Engineer: M.WEIL



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: SM0007_004C
Depth: 26.7387645
Site: SBFCA FRWL EIP
Engineer: MEHRZAD



APPENDIX E

Task Order 1
Laboratory Test Results

blackburn consulting
2491 Boatman Avenue
West Sacramento, CA 95691
www.blackburnconsulting.com

Project Name: SBFCA FRWL EIP
BCI File No: 1967.1

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Pocket Pen. (tsf)	Description (USC Classification)
SM0007_001B-5A	8.5-9.0	129.8	107.4	20.9	3.0	Lean CLAY (CL), dark brown
SM0007_001B-10B	19.0-19.5	117.0	85.3	37.2	2.5	SILT with SAND (ML), olive brown
SM0007_001B-21A	46.5-47.0	n/a	n/a	40.9	-	SILT (ML), yellowish brown
SM0007_002B-3A	5.0-5.5	132.5	86.3	53.6	-	SILT (ML), dark olive brown
SM0007_002B-3B*	5.5-6.0	n/a	n/a	55.6	-	SILT (ML), dark yellowish brown
SM0007_002B-15	45.0-46.5	n/a	n/a	31.9	-	Lean CLAY with SAND (CL), dark yellowish brown
SM0007_003A-7B	13.0-13.5	117.4	90.4	29.9	-	SILT with SAND (ML), yellowish brown, fine sand
SM0007_004A-3A	5.5-6.0	126.6	105.5	20.0	4.5	Lean CLAY with SAND (CL), dark yellowish brown
SM0007_004A-6A	13.0-13.5	136.5	109.2	25.0	4.5	Lean CLAY (CL), yellowish brown
SM0007_005B-3A	5.0-5.5	97.7	92.1	6.1	-	Poorly-graded SAND (SP), dark yellowish brown
SM0007_005B-11	35.0-36.5	n/a	n/a	36.4	-	Lean CLAY (CL), olive brown
SM0007_010B-2A	5.5-6.0	124.5	106.2	17.2	-	Lean CLAY (CL), dark yellowish brown
SM0007_010B-6A	15.5-16.0	119.2	102.1	16.8	-	Lean CLAY (CL), very dark grayish brown
SM0007_010B-8A	20.5-21.0	128.0	110.6	15.8	-	Lean CLAY (CL), dark yellowish brown
SL0001_001B-3A	3.5-4.0	118.6	101.9	16.6	4.0	Lean CLAY (CL), yellowish brown
SL0001_001B-6B	8.0-8.5	107.4	81.3	32.1	4.5	SILT (ML), dark yellowish brown
SL0001_001B-7	10.0-11.5	n/a	n/a	31.6	-	Elastic SILT (MH), light yellowish brown
SL0001_002B-25B	68.0-68.5	n/a	n/a	34.4	-	SILT (ML), dark olive gray
SL0009_001B-2A	3.5-4.0	112.8	97.6	15.7	-	Lean CLAY (CL), dark yellowish brown
SL0009_001B-14A	33.5-34.0	n/a	n/a	18.0	-	SILT with SAND (ML), yellowish brown
SL0009_001B-27A	66.0-66.5	n/a	n/a	20.1	-	Lean CLAY with SAND (CL), dark greenish gray
SL0009_002B-2A	3.0-3.5	103.0	89.6	15.0	-	SILT with SAND (ML), dark yellowish brown
SL0009_002B-4A	8.0-8.5	102.0	77.4	31.7	-	SILT with SAND (ML), dark yellowish brown
SL0009_002B-26A	78.0-79.5	n/a	n/a	19.0	-	Lean CLAY (CL), pale yellow
SL0009_003B-2A	3.0-3.5	113.4	104.2	8.8	3.5	SILTY SAND (SM), dark reddish brown
SL0009_003B-11A	24.5-25.0	116.8	86.6	34.8	-	SILT (ML), yellowish brown

* Sample partially disturbed

2491 Boatman Avenue
West Sacramento, CA 95691
www.blackburnconsulting.com

Project Name: Feather River West Levee
BCI File No: 1967.1 (LD1)

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Pocket Pen. (tsf)	Description (USC Classification)
SL0001_001H-1	1.0-1.5	104.4	99.3	5.1	>4.5	dark brown
SL0001_001H-4	4.0-4.5	105.5	87.6	20.5	-	brown
SL0001_002H-3	4.0-4.5	97.5	86.1	13.3	3.5	dark brown
SL0001_003H-1	1.0-1.5	106.5	93.6	13.8	>4.5	dark brown
SL0001_004H-4	4.0-4.5	116.1	101.0	15.0	>4.5	dark brown

Project Name: Feather River West Levee Page 1 of 1

BCI File No: 1967.1

Date: 11/1/2010

Technician: BKR

blackburn consulting

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

	SM0003	SM0003	SM0003	SM0003	SM0003	SM0003	SM0003
Sample No.	001H/1	002H/1	002H/4	003H/1	003H/4	004H/1	004H/4
Depth (ft.)	1.0-1.5	1.0-1.5	4.0-4.5	1.0-1.5	4.0-4.5	1.0-1.5	4.0-4.5
Sample + Tube (g)	714.00	592.90	833.80	913.60	873.10	855.00	647.80
Diameter (in.)	2.398	2.373	2.390	2.389	2.388	2.387	2.3850
Sample Length (in.)	3.353	2.395	3.841	4.544	4.197	4.821	2.6830
Tube (g)	290.20	286.30	286.00	286.30	282.90	285.60	288.70
Wet Weight (g)	423.80	306.60	547.80	627.3	590.2	569.4	359.1
Sample Volume (ft^3)	0.00876	0.00613	0.00997	0.01179	0.01088	0.01249	0.00694
Tare No.	F4	G8	H2	E7	F2	G7	E1
Tare (g)	186.50	170.60	168.10	177.00	167.10	178.70	169.60
Wet Soil + Tare (g)	609.80	332.80	520.90	546.20	463.70	529.30	528.80
Dry Soil + Tare (g)	556.10	303.60	448.70	487.50	396.90	503.60	453.60
Dry Soil Weight (g)	369.6	133.0	280.6	310.5	229.8	324.9	284.0
Water (g)	53.7	29.2	72.2	58.7	66.8	25.7	75.2
Moisture (%)	**14.5**	**22.0**	**25.7**	**18.9**	**29.1**	**7.9**	**26.5**
Wet Density (pcf)	**106.6**	**110.3**	**121.1**	**117.3**	**119.6**	**100.5**	**114.1**
Dry Density (pcf)	**93.1**	**90.4**	**96.3**	**98.7**	**92.7**	**93.2**	**90.2**
Pocket Pen (tsf)							

	SM0003	SM0003					
Sample No.	008H/1	008H/4					
Depth (ft.)	1.0-1.5	4.0-4.5					
Sample + Tube (g)		975.60					
Diameter (in.)		2.4240					
Sample Length (in.)	Disturbed	5.2220					
Tube (g)		207.20					
Wet Weight (g)		768.40					
Sample Volume (ft^3)		0.01395					
Tare No.	G8	F4					
Tare (g)	170.70	186.20					
Wet Soil + Tare (g)	477.10	514.60					
Dry Soil + Tare (g)	442.00	480.90					
Dry Soil Weight (g)	271.3	294.7					
Water (g)	35.1	33.7					
Moisture (%)	**12.9**	**11.4**					
Wet Density (pcf)		**121.5**					
Dry Density (pcf)		**109.0**					
Pocket Pen (tsf)							

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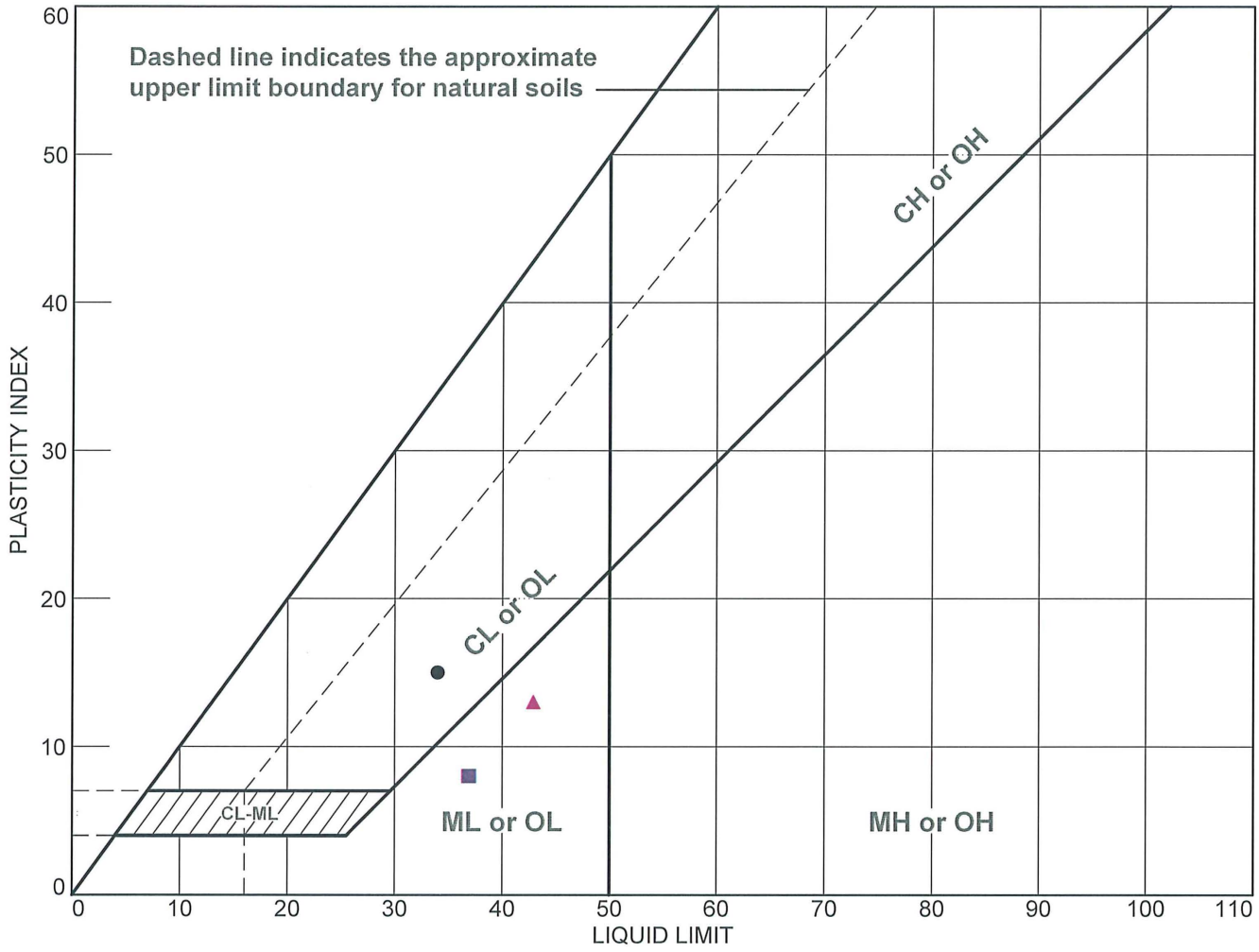
Project Name: SBFCA FRWL EIP
BCI File No: 1967.1

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Pocket Pen. (tsf)	Description (USC Classification)
SM0007_001B-13	26.52-27.18	116.6	91.0	28.1	-	SILT with SAND (ML), yellowish brown. At 26.77': slight cementation, transition to SILTY SAND (SM)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_001B	5A	8.0-9.5'	20.9	19	34	15	CL
■	SM0007_001B	10B	19.0-19.5'	37.2	29	37	8	ML
▲	SM0007_001B	21A	46.5-47.0'	40.9	30	43	13	ML

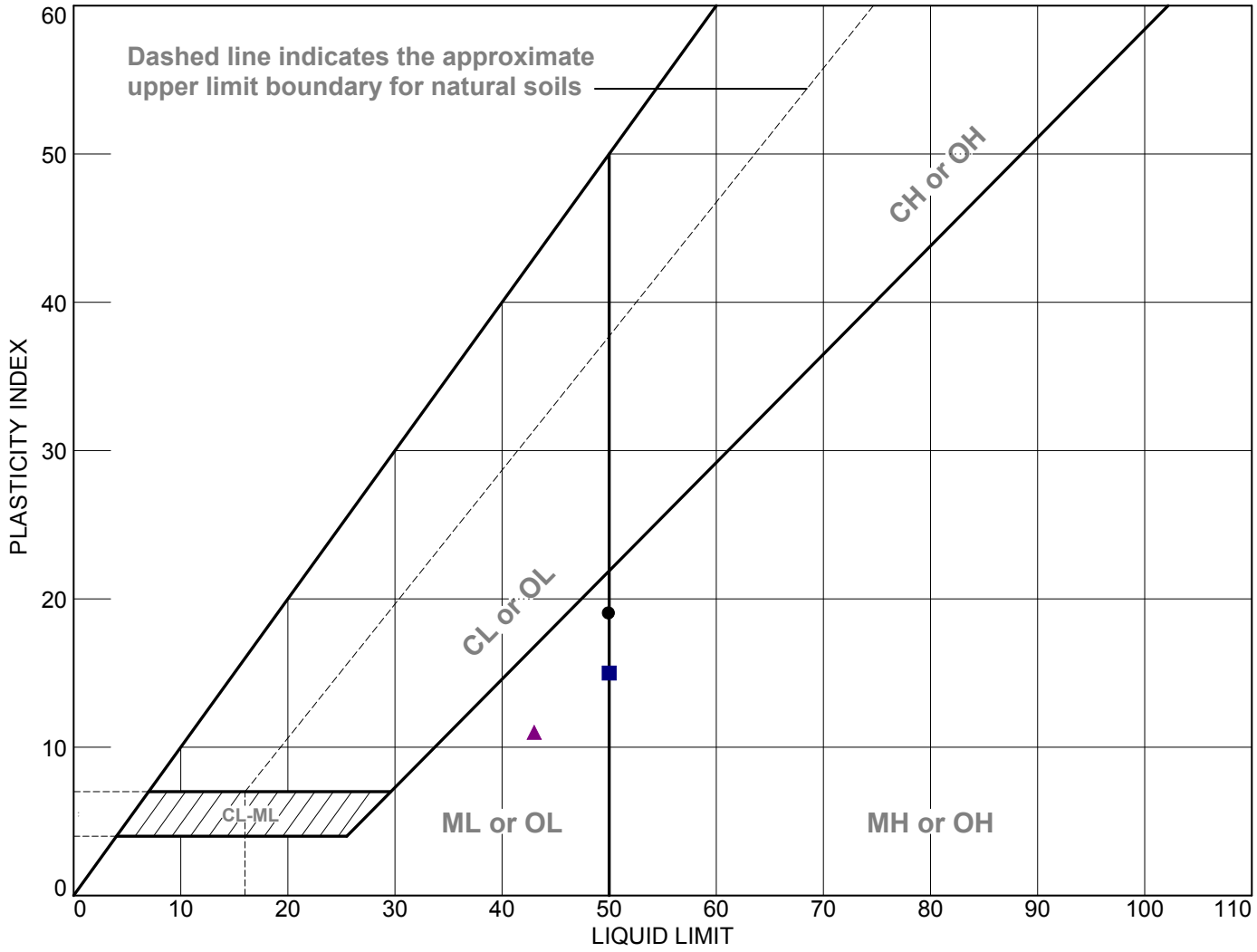
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_001B	9 Triax 1	16.02-16.68'	37.1	31	50	19	MH
■	SM0007_001B	9 Triax 2	16.68-17.34'	37.8	35	50	15	MH
▲	SM0007_001B	9 Triax 3	17.34-18.0'	36.0	32	43	11	ML

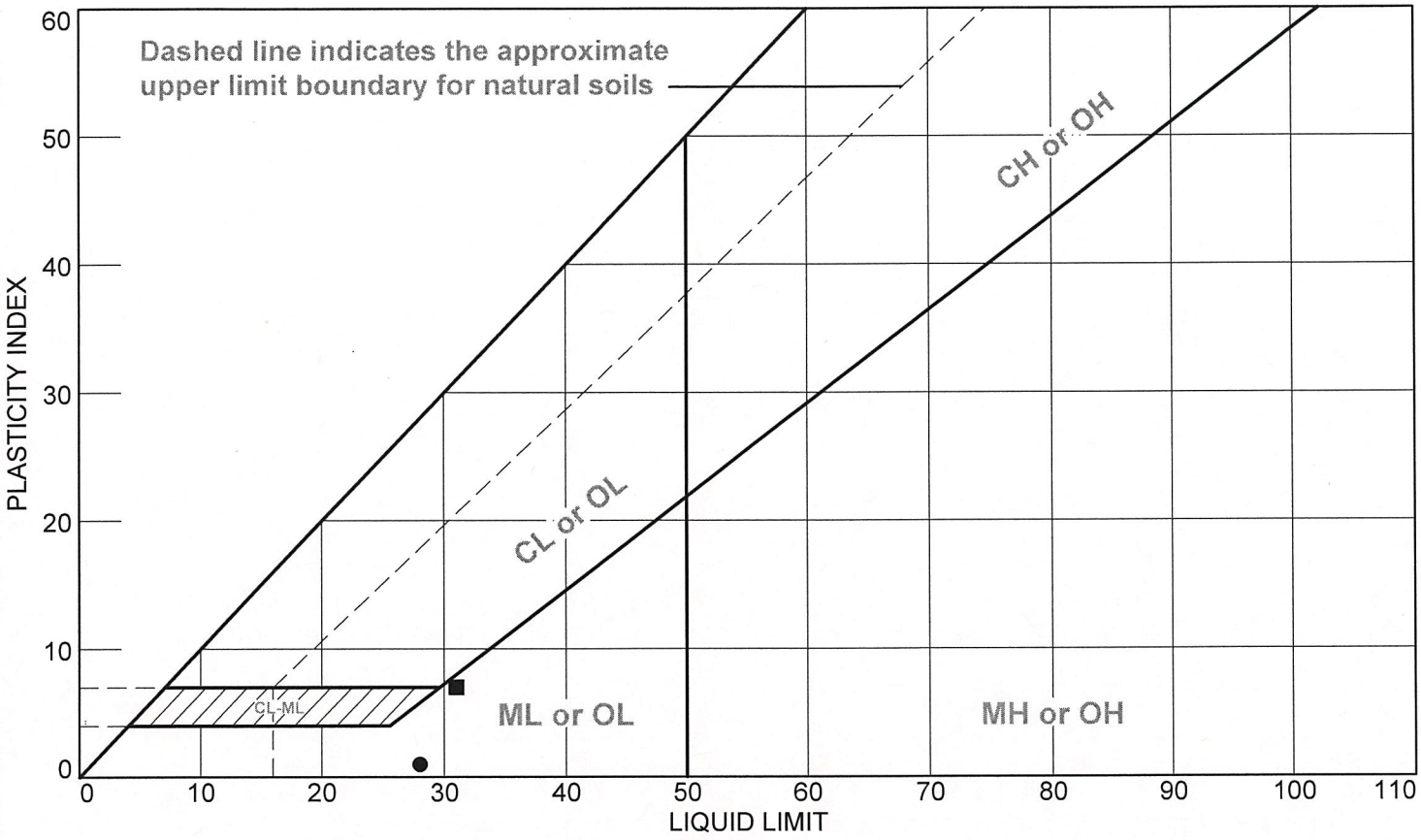
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS) **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_001B	6 (PI from consol)	10.33-10.5'	25.5	27	28	1	ML
■	SM0007_001B	13 (PI from consol)	26.52-26.73'	28.1	24	31	7	ML
▲	SM0007_004B	7 (PI from consol)	14.19-14.5'	34.6	27	26	NP	ML

Blackburn Consulting

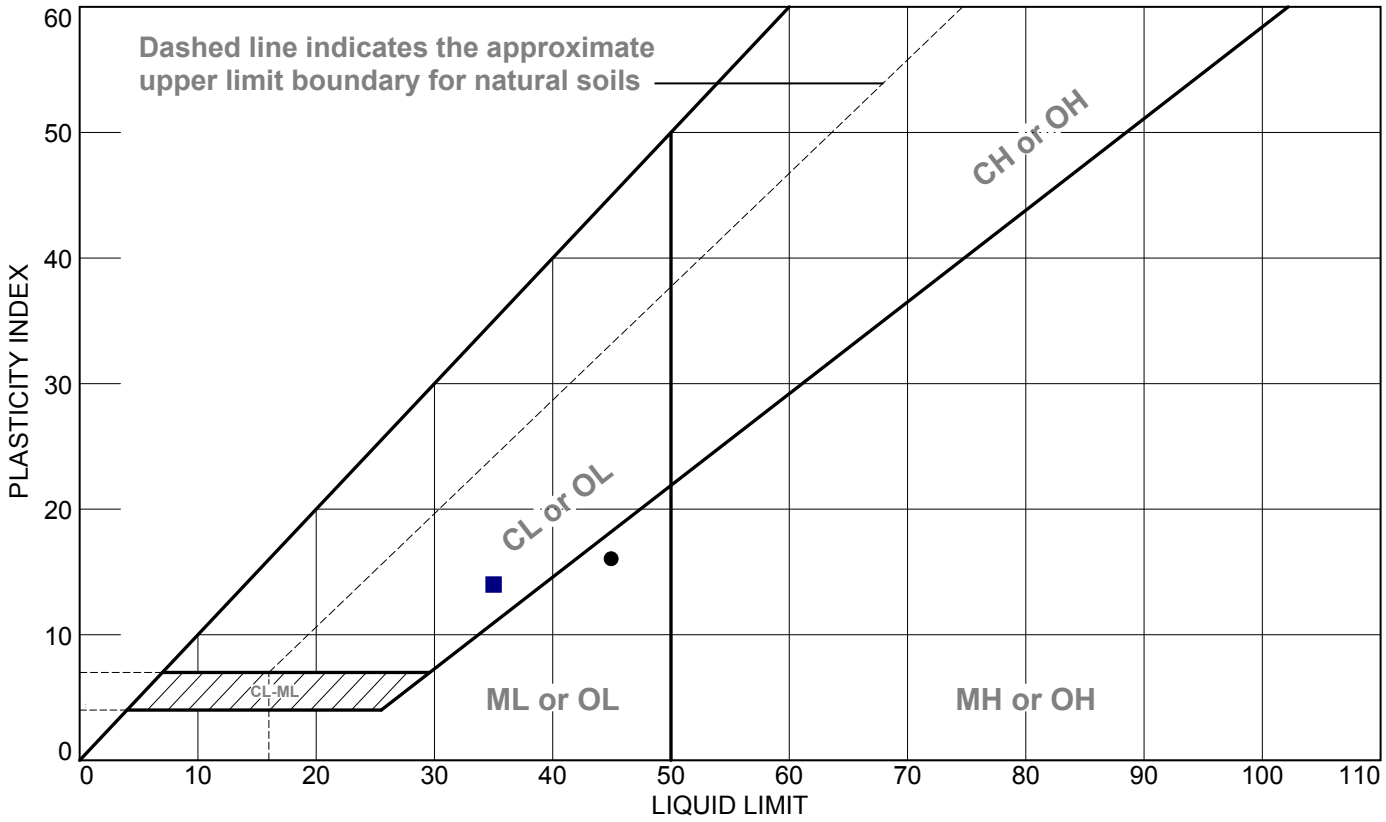
W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_002B	3B	5.5-6.0'	55.6	29	45	16	ML
■	SM0007_002B	15	45.0-46.5'	31.9	21	35	14	CL

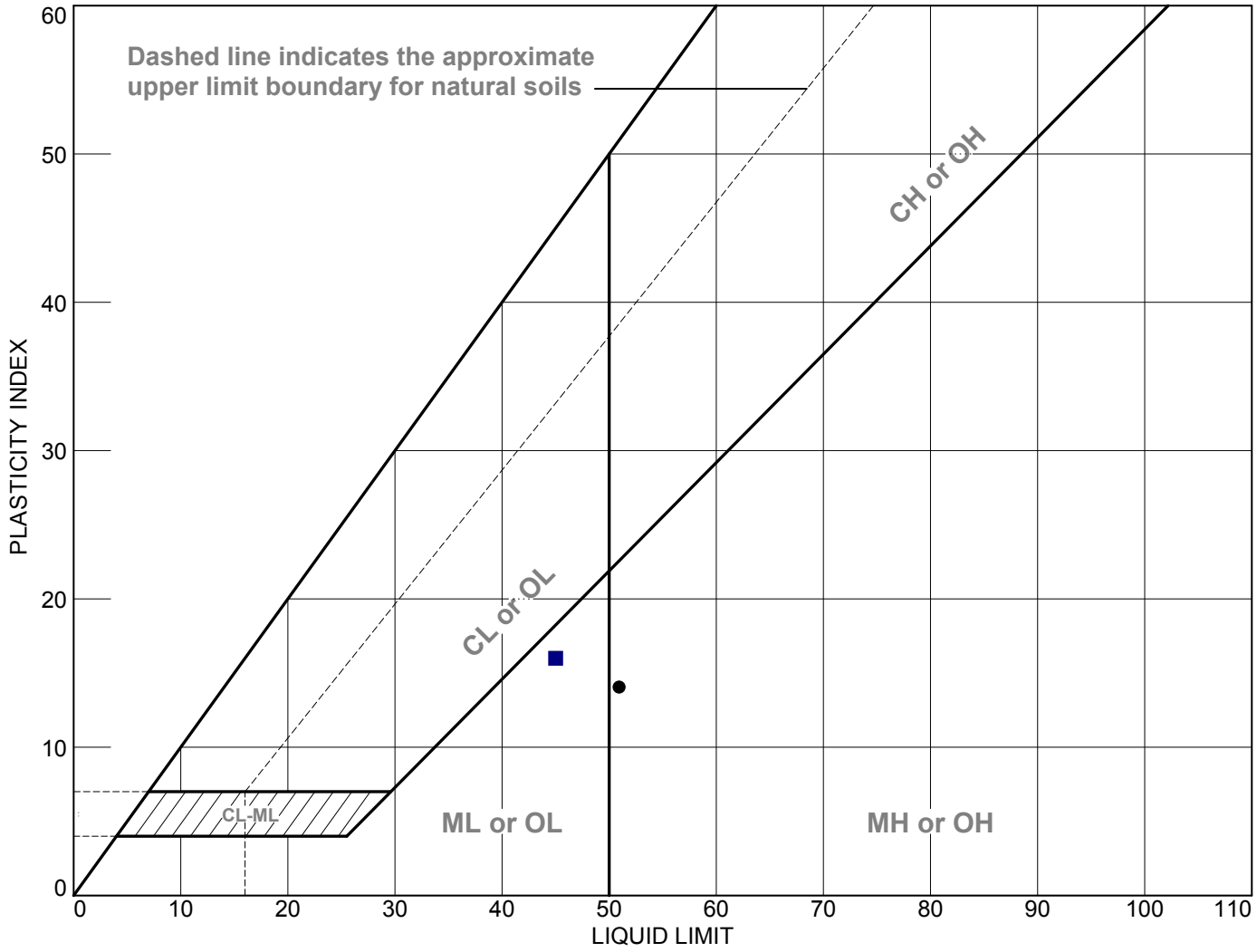
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS) **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_002B	4 Triax 1	6.52-7.18'	64.0	37	51	14	MH
■	SM0007_002B	4 Triax 2	7.18-7.84'	54.9	29	45	16	ML
▲	SM0007_002B	4 Triax 3	7.84-8.5'	40.3	NP	NV	NP	ML

Blackburn Consulting

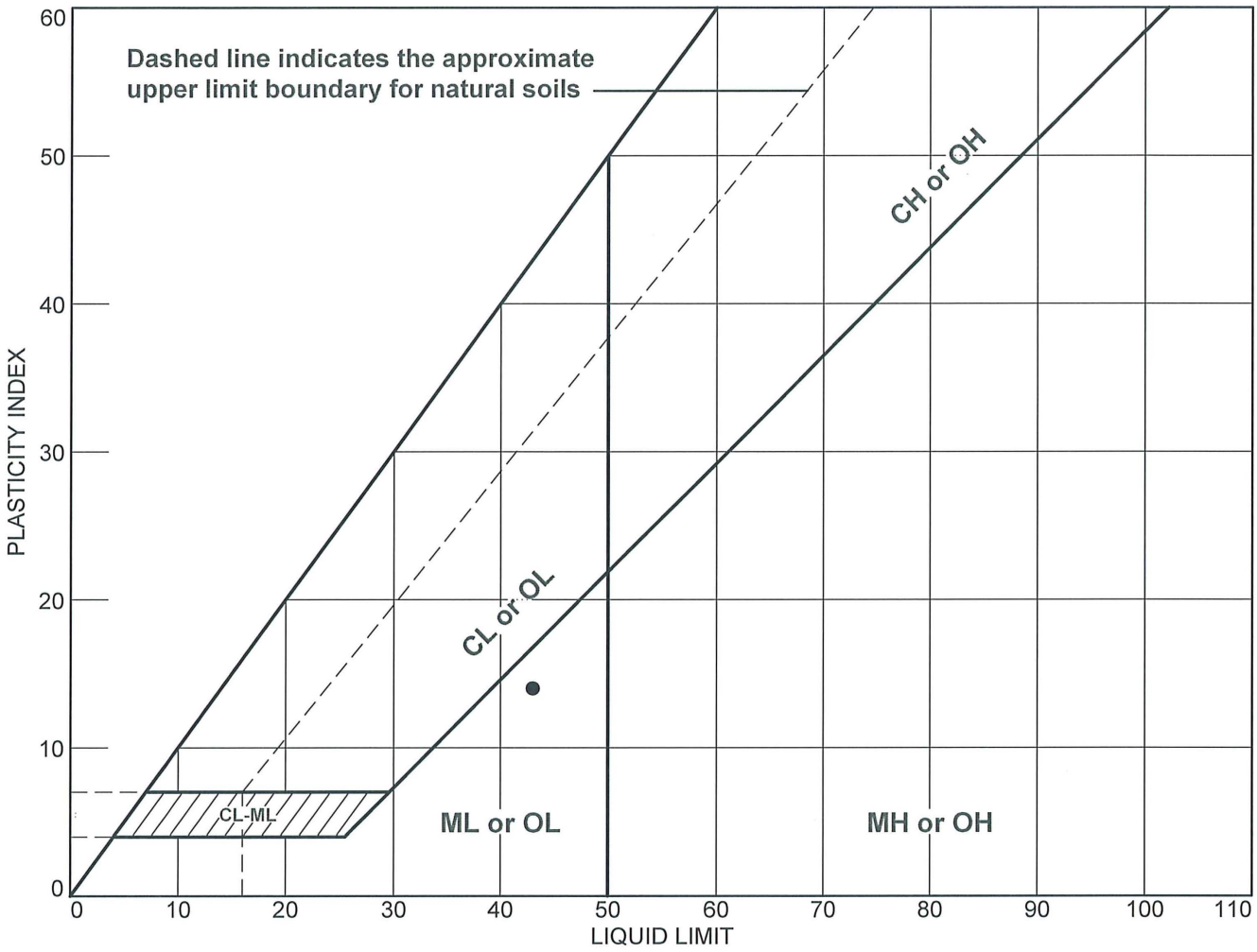
W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_003A	7B	13.0-13.5'	29.9	29	43	14	ML

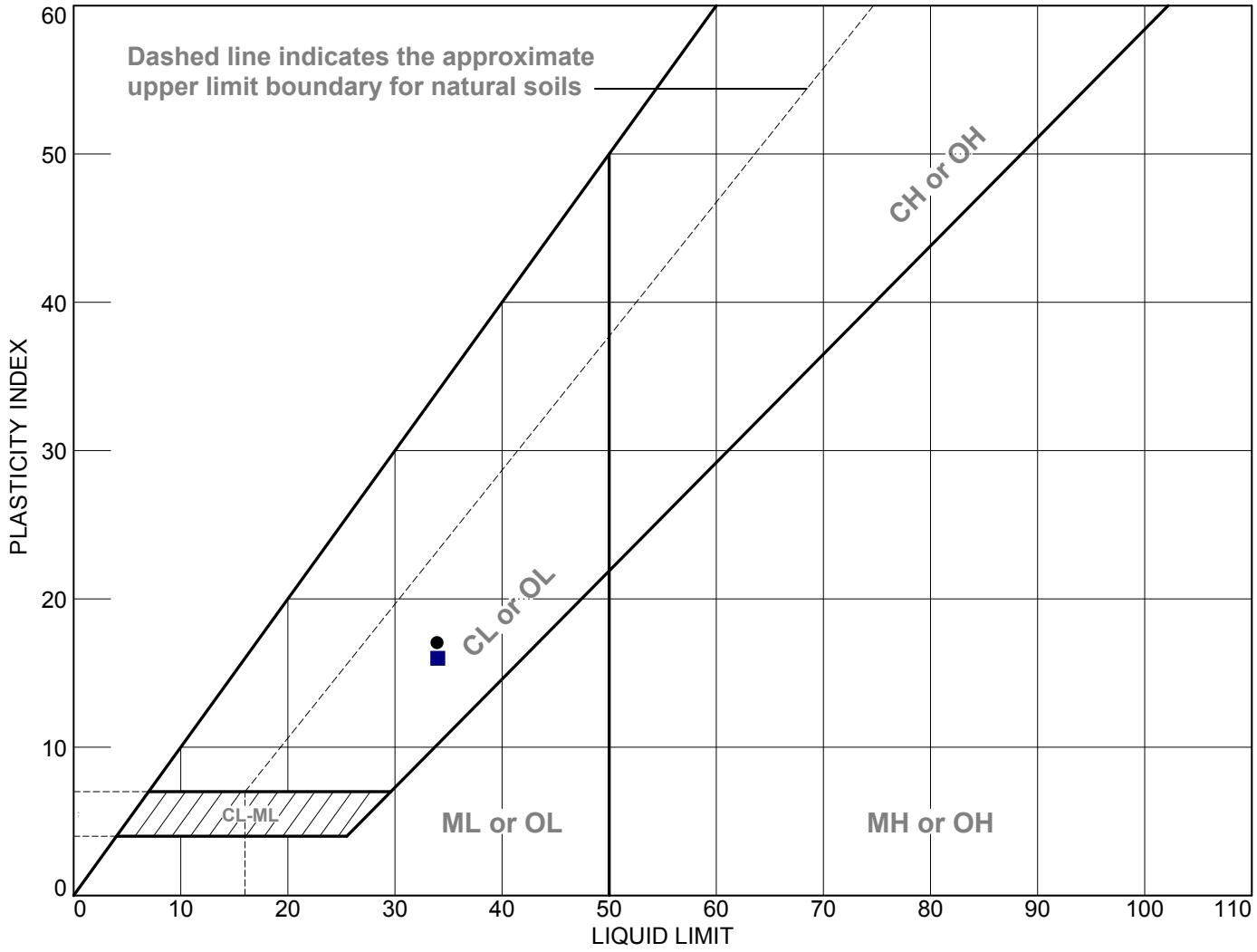
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_003A	4 Triax 1	4.59-5.09'	20.6	17	34	17	CL
■	SM0007_003A	4 Triax 2	5.21-5.71'	20.8	18	34	16	CL

Blackburn Consulting

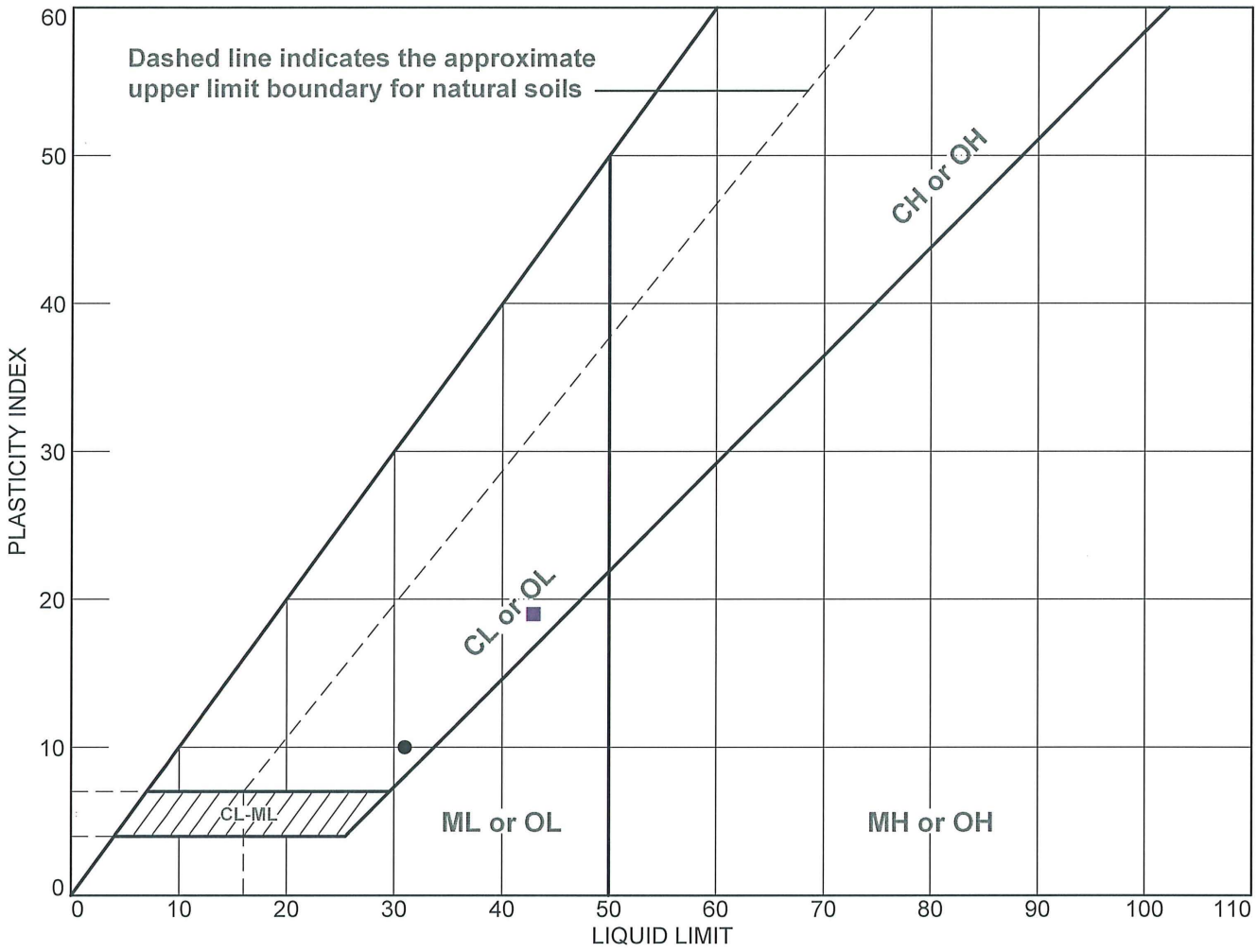
W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_004A	3A	5.5-6.0'	20.0	21	31	10	CL
■	SM0007_004A	6A	13.0-13.5'	25.0	24	43	19	CL

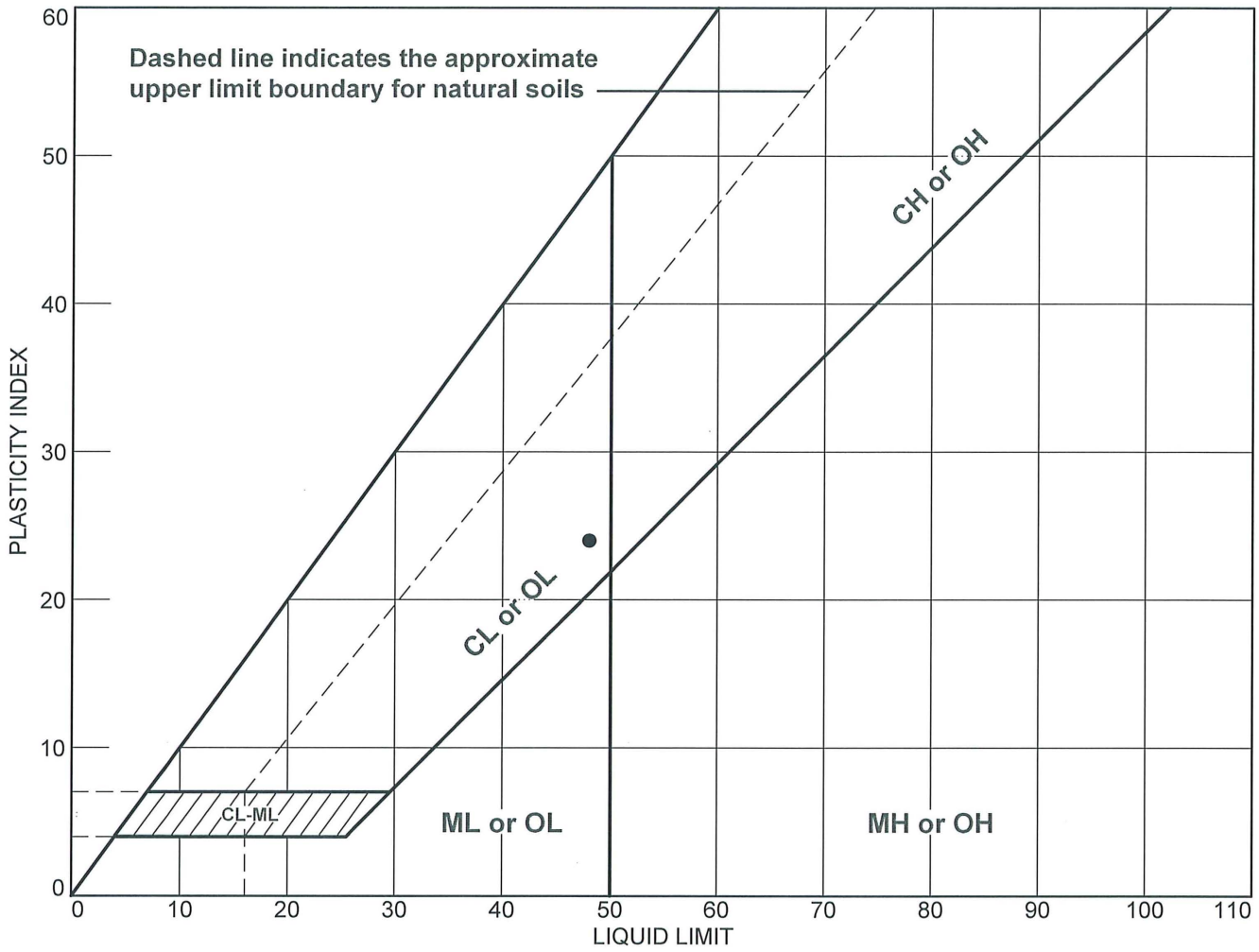
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_005B	11	35.0-36.5'	36.4	24	48	24	CL

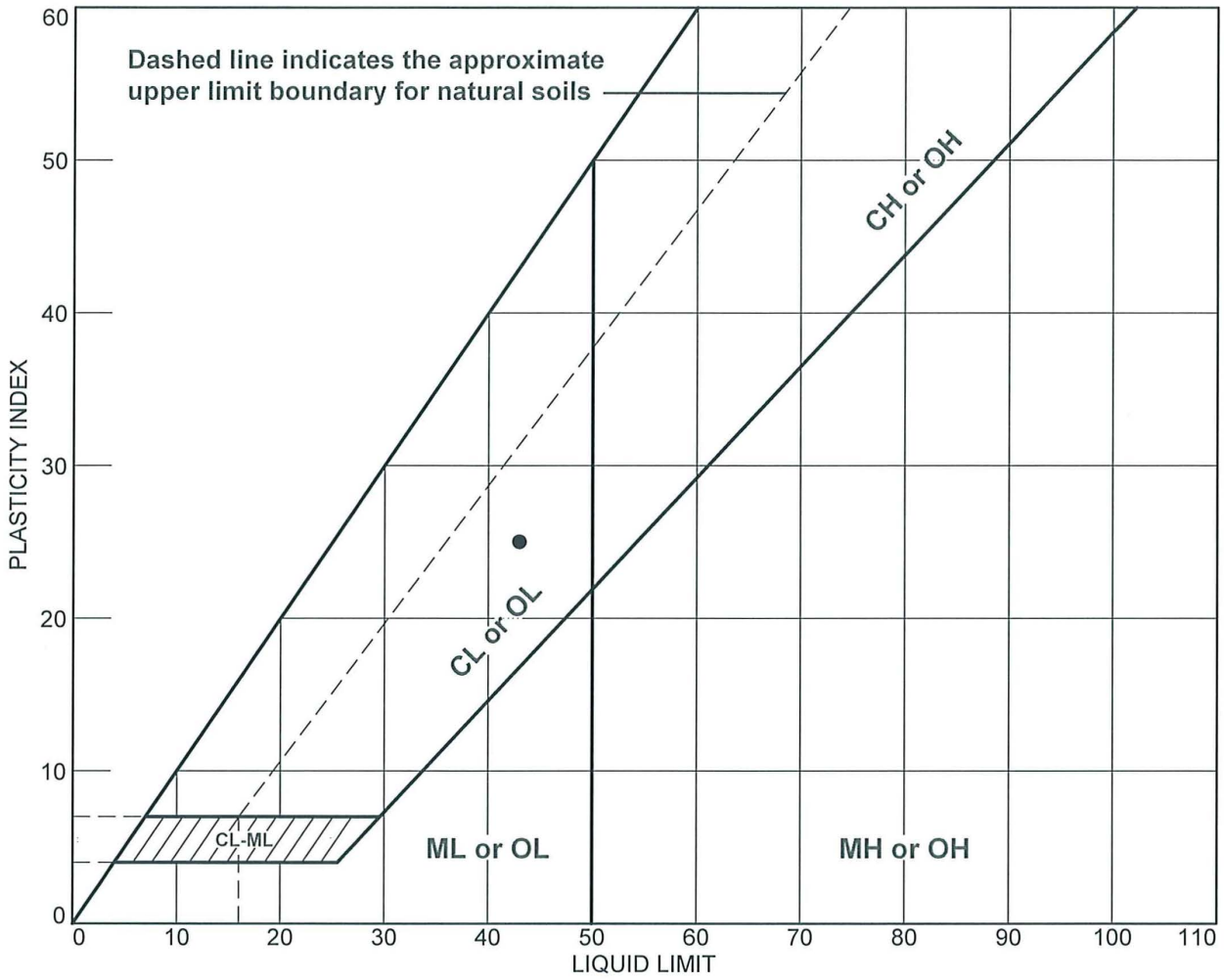
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_005C	5A	19.5-20.5'	25.7	18	43	25	CL

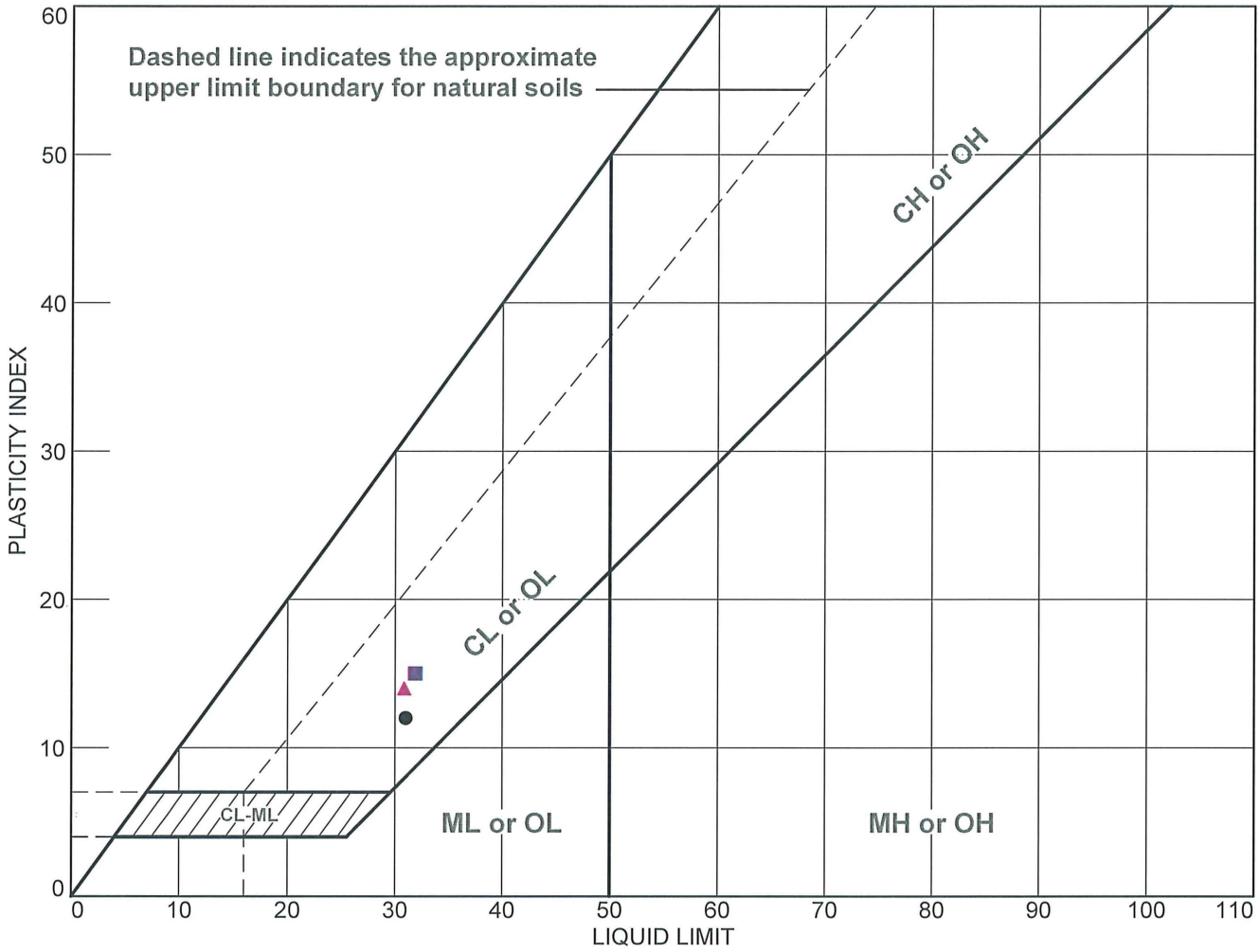
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP - CPT2

Project No.: 1967.1 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_010B	2A	5.5-6.0'	17.2	19	31	12	CL
■	SM0007_010B	6A	15.5-16.0'	16.8	17	32	15	CL
▲	SM0007_010B	8A	20.5-21.0'	15.8	17	31	14	CL

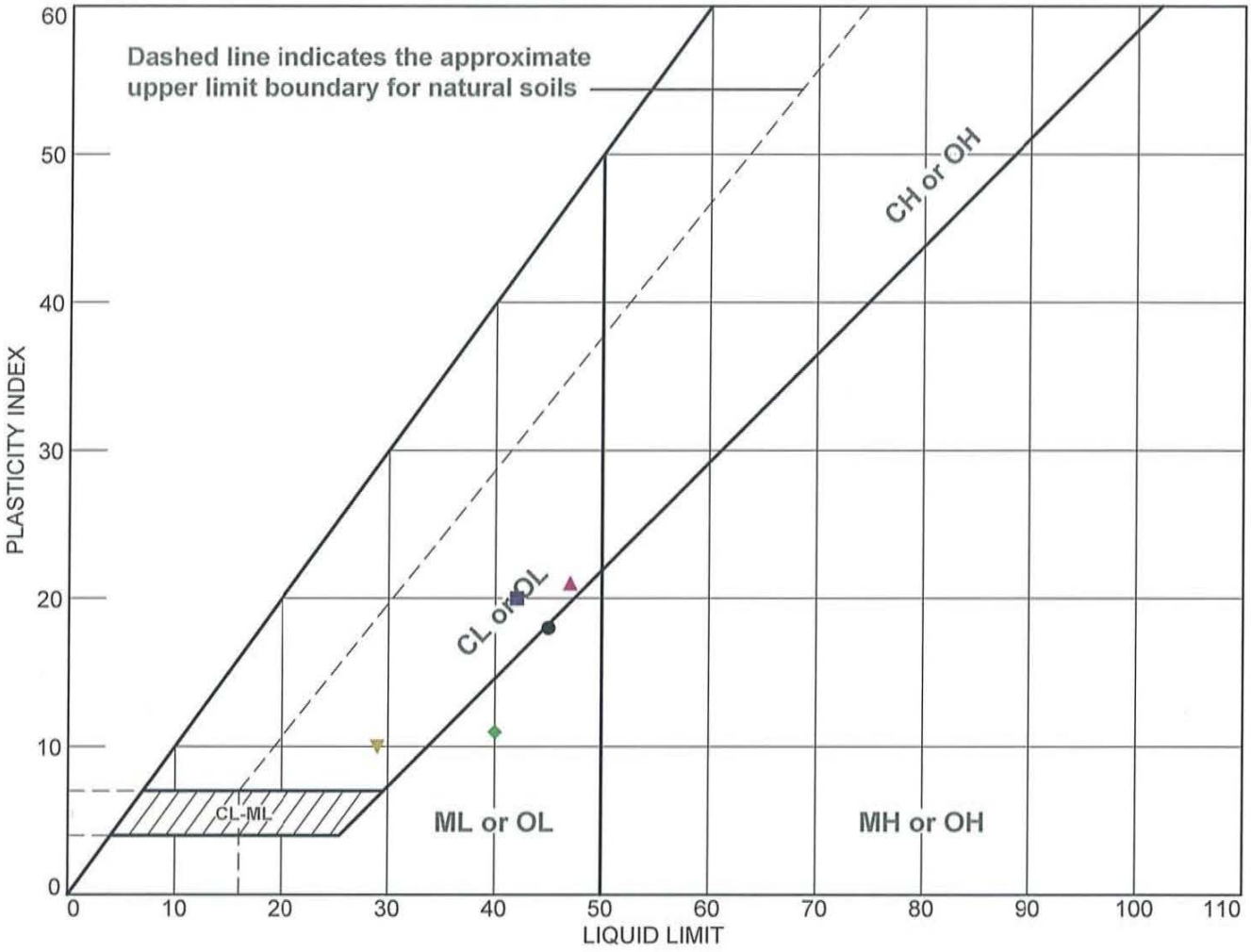
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0016_001C	2	20.0-21.0'	35.1	27	45	18	CL
■	SM0016_003C	2	36.0-37.0'	24.6	22	42	20	CL
▲	SL0001_005C	2	26.0-27.0'	33.8	26	47	21	CL
◆	SL0001_007C	3	44.0-45.0'	39.2	29	40	11	ML
▼	SL0001_008H	2	4.0-5.0'	18.7	19	29	10	CL

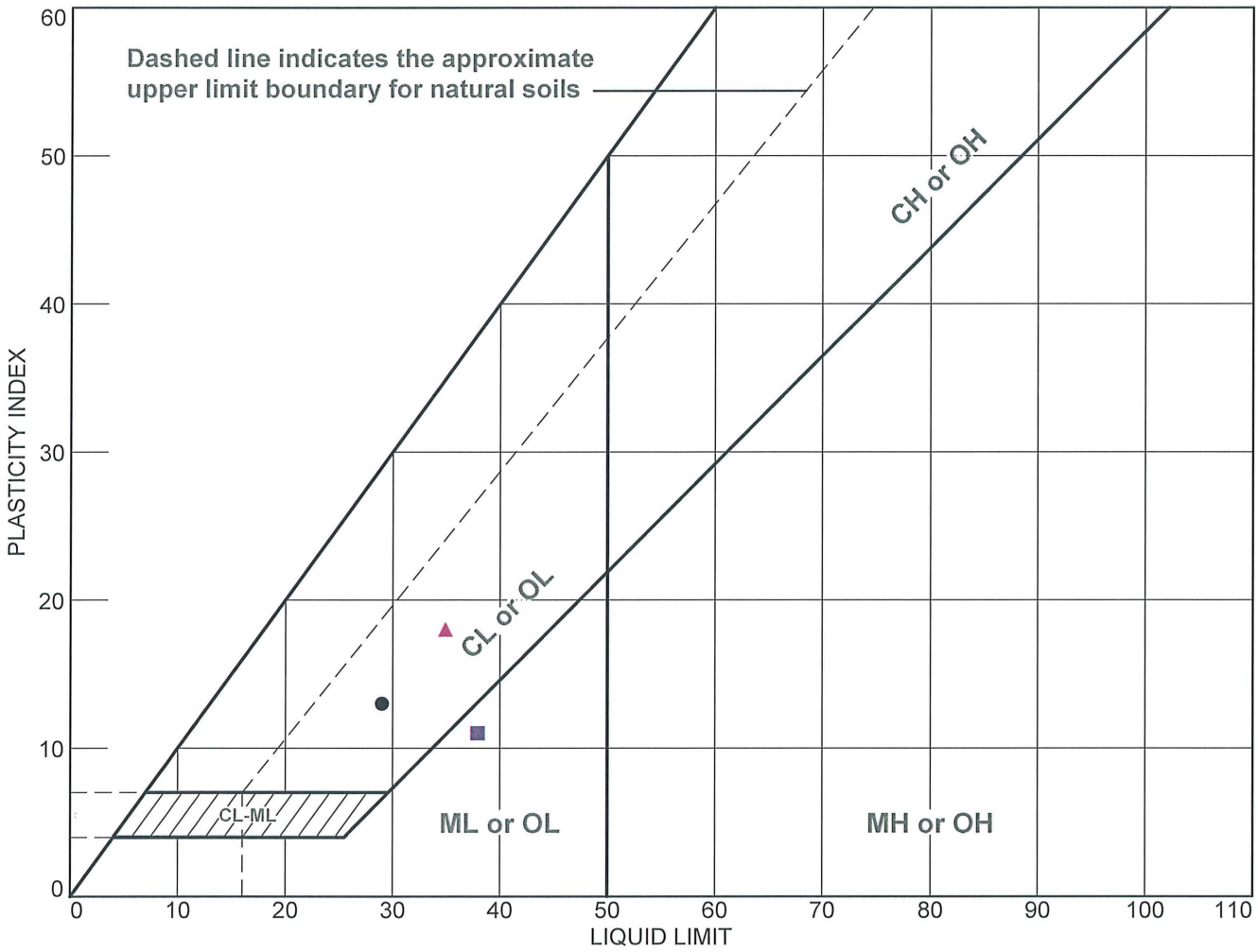
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP - CPT

Project No.: 1967.1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0009_001B	2A	3.5-4.0'	15.7	16	29	13	CL
■	SL0009_001B	14A	33.5-34.0'	18.0	27	38	11	ML
▲	SL0009_001B	27A	66.0-66.5'	20.1	17	35	18	CL

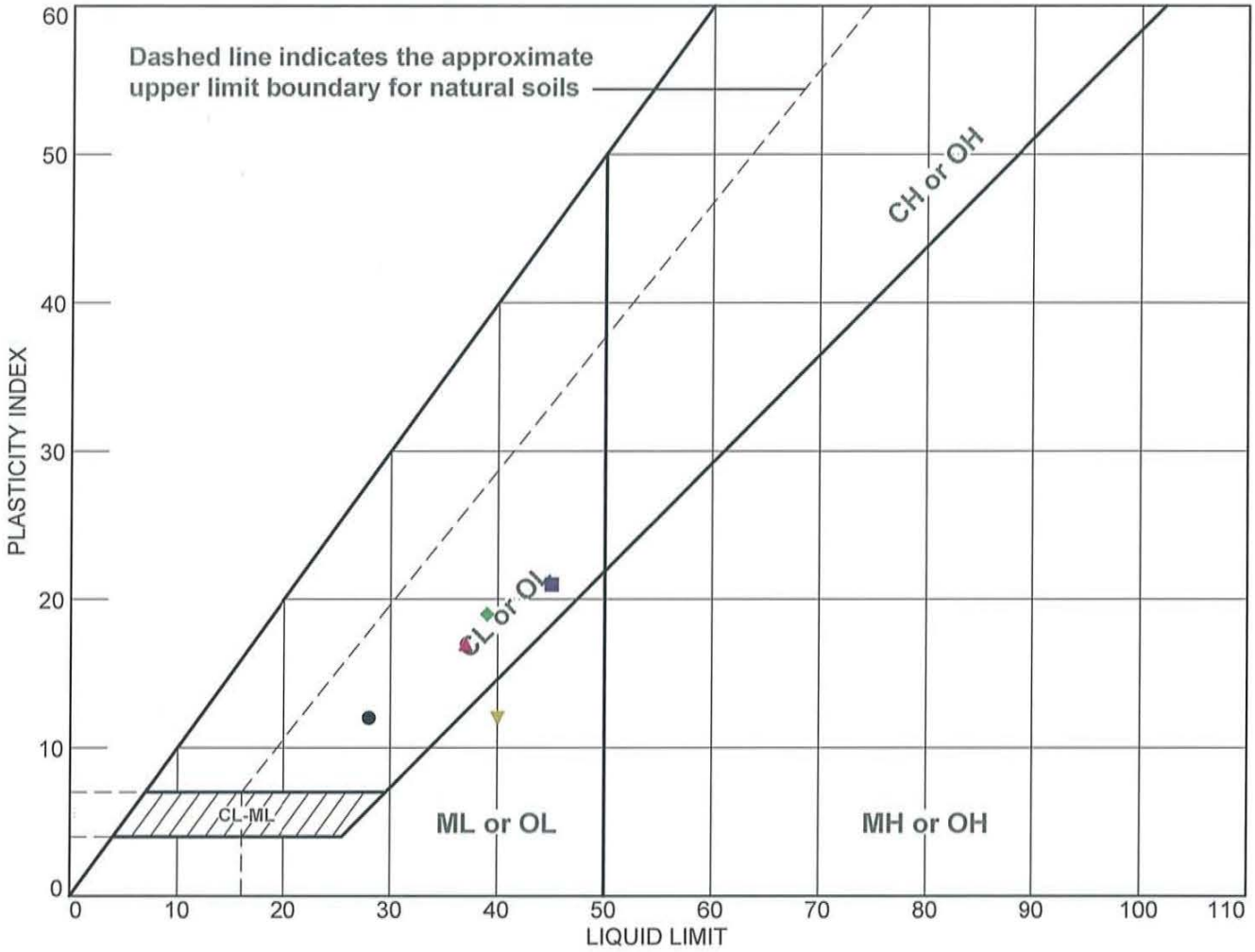
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

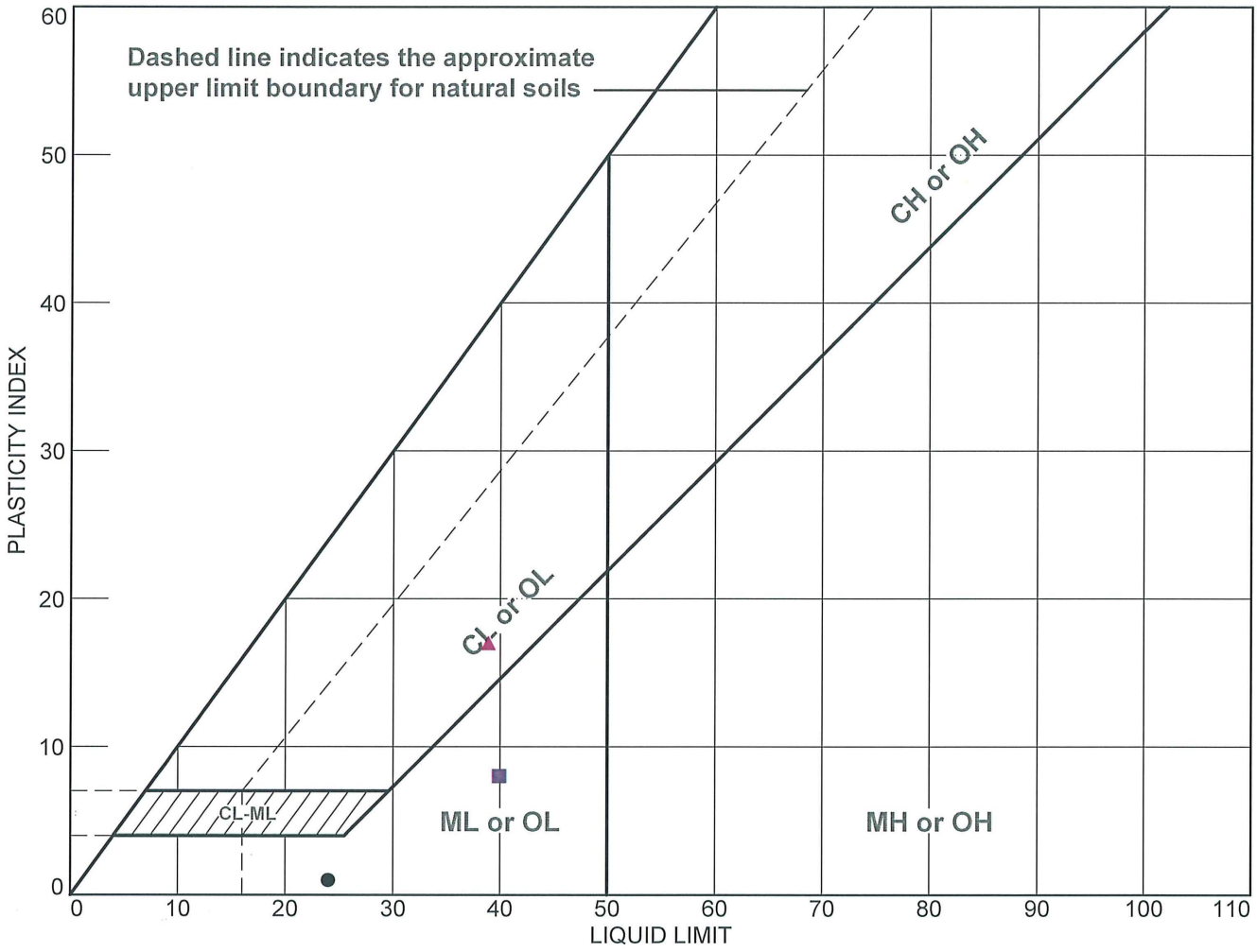
Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_009C	2	26.0-27.0'	21.8	16	28	12	CL
■	SL0009_001C	3	36.0-37.0'	34.2	24	45	21	CL
▲	SL0009_002C	2	19.0-20.0'	20.4	20	37	17	CL
◆	SL0009_003H	2	4.0-5.0'	20.0	20	39	19	CL
▼	SL0009_003C	1	15.0-16.0'	33.1	28	40	12	ML

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0009_002B	2A	3.0-3.5'	15.0	23	24	1	ML
■	SL0009_002B	4A	8-8.5	31.7	32	40	8	ML
▲	SL0009_002B	26A	78.5-79.0'	19.0	22	39	17	CL

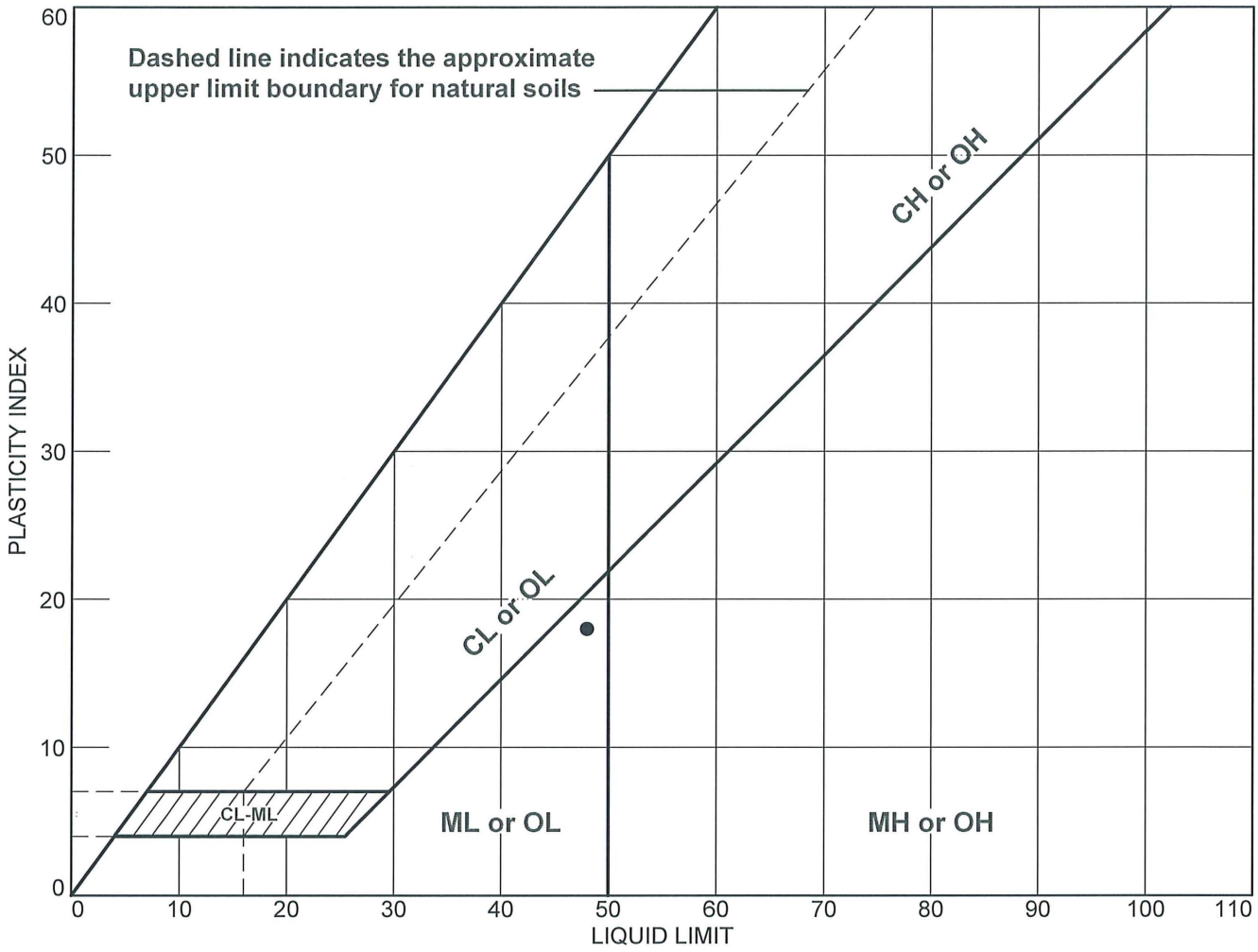
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0009_003B	11A	24.5-25.0'	34.8	30	48	18	ML

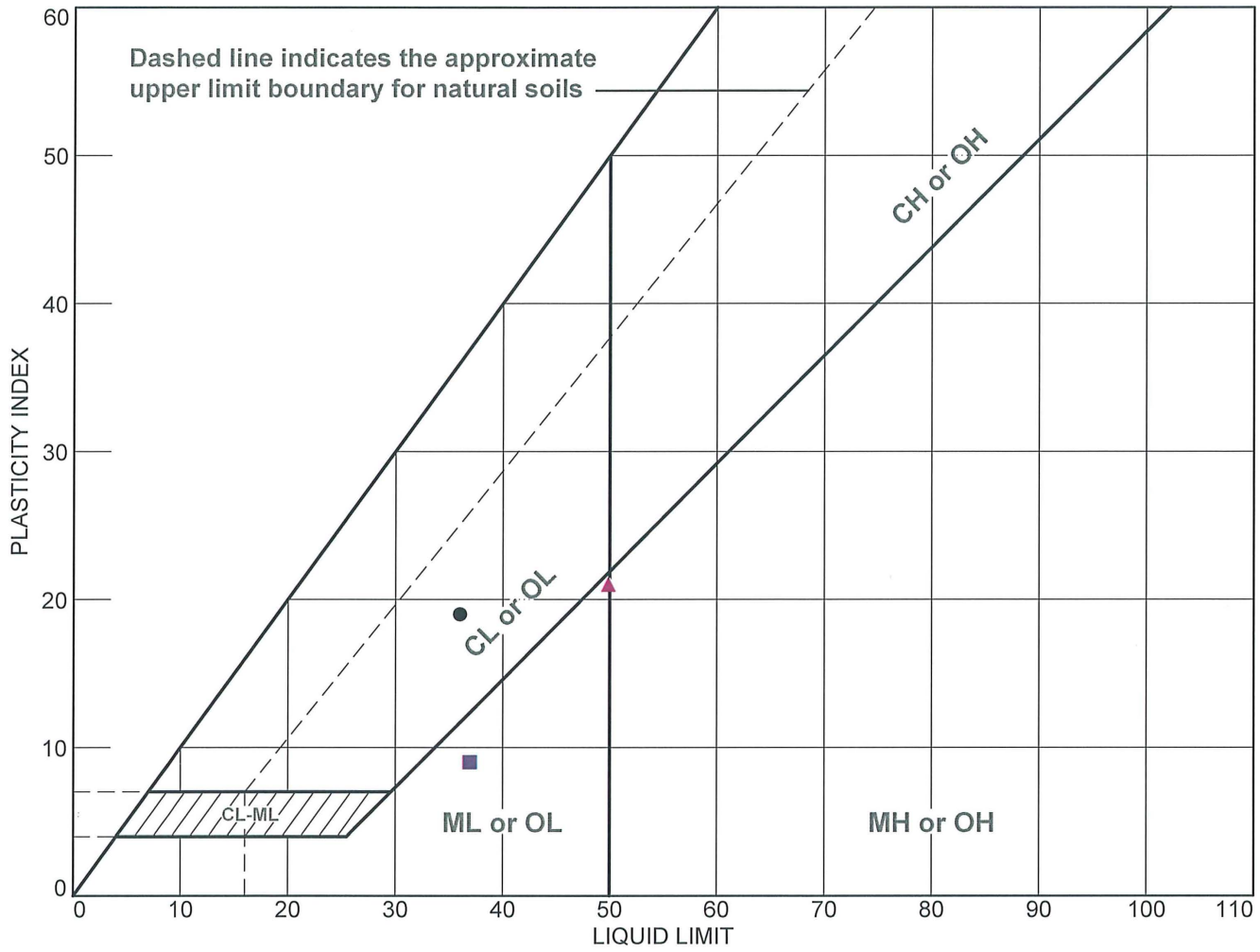
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_001B	3A	3.5-4.0'	16.6	17	36	19	CL
■	SL0001_001B	6B	8.0-8.5'	32.1	28	37	9	ML
▲	SL0001_001B	7	10.0-11.5'	31.6	29	50	21	MH

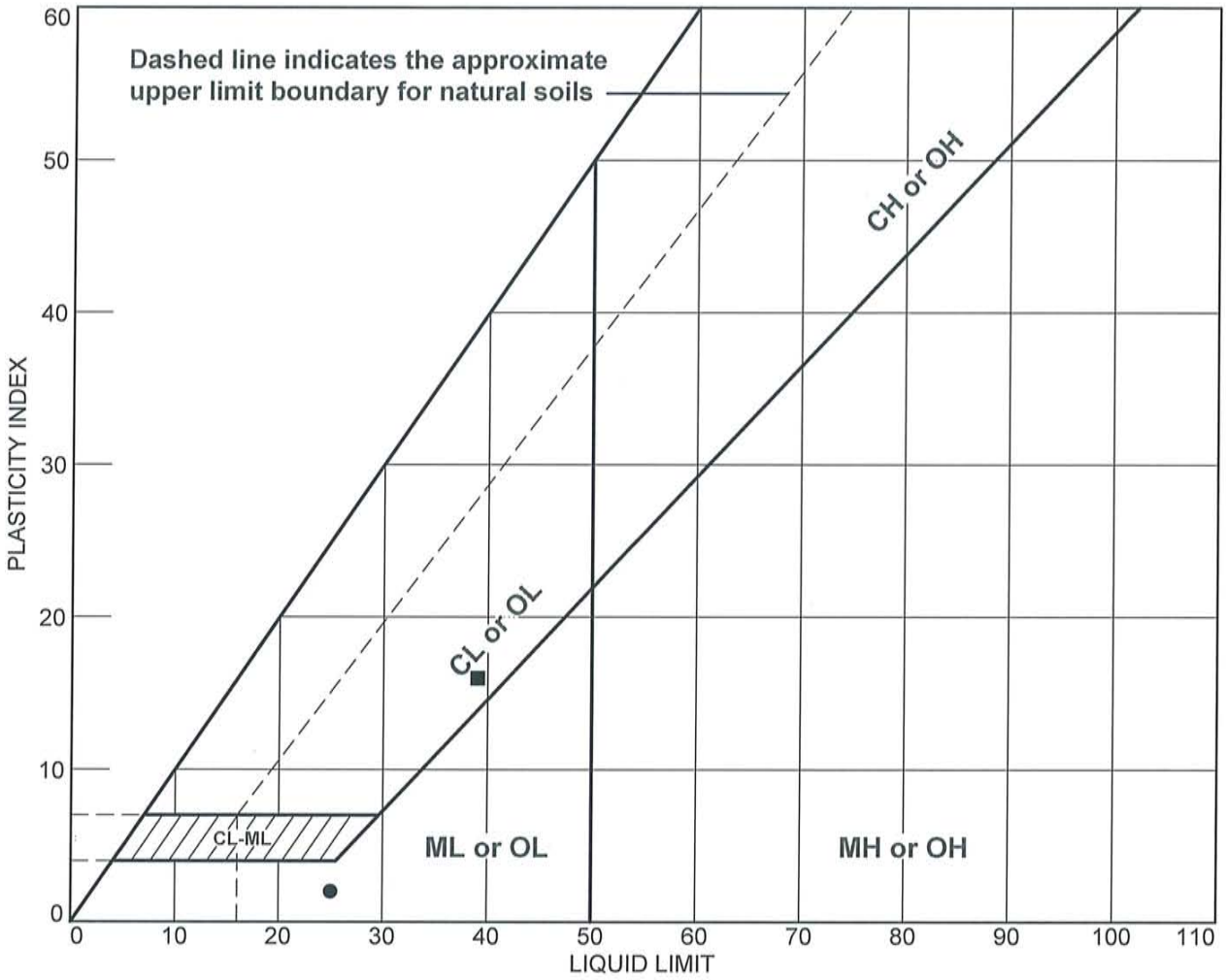
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_001C	1B	9.0-9.5'		23	25	2	ML
■	SL0001_001C	2A/2B	14.0-15.0'		23	39	16	CL

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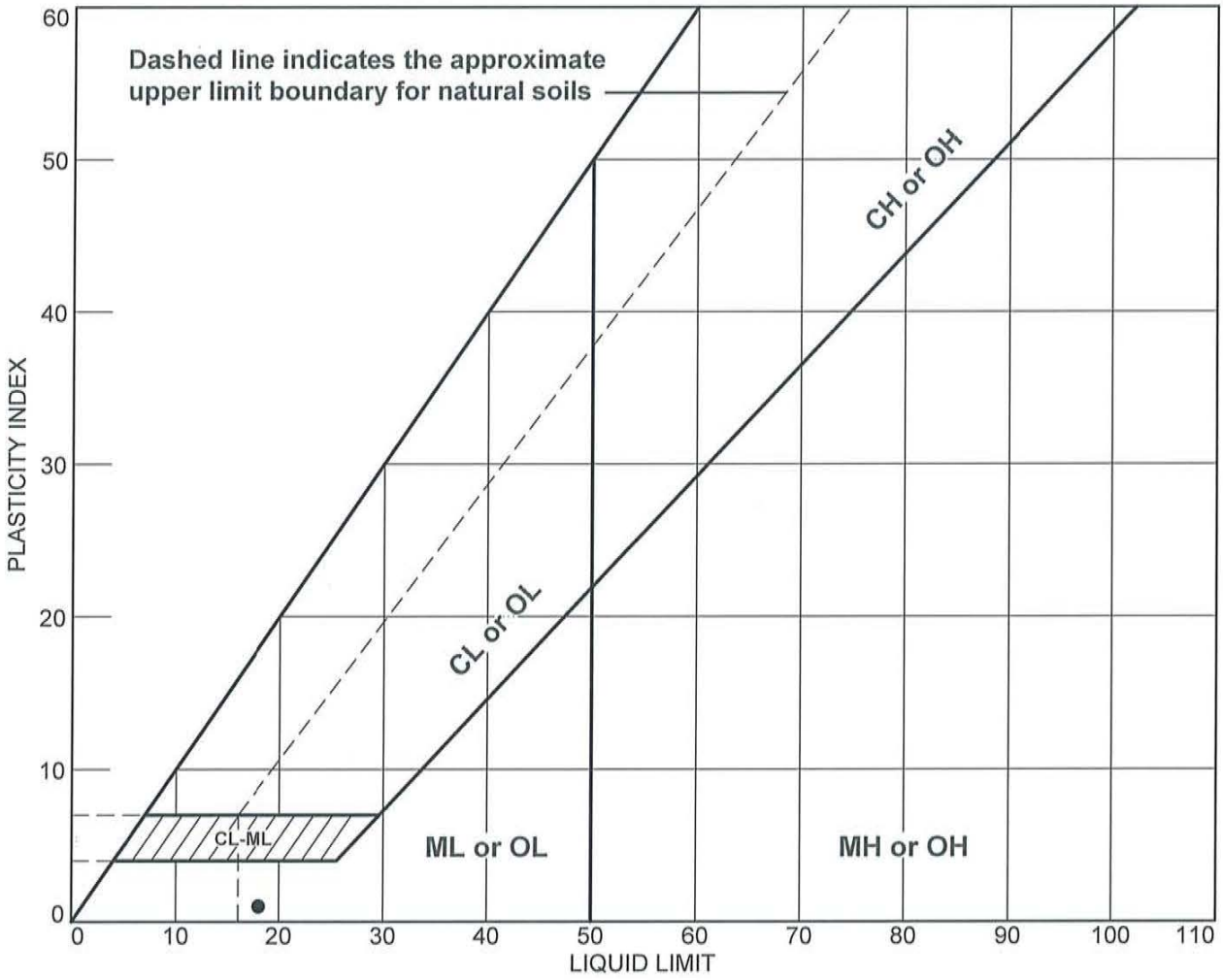
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_001H	3	3.0-3.5'		17	18	1	SM

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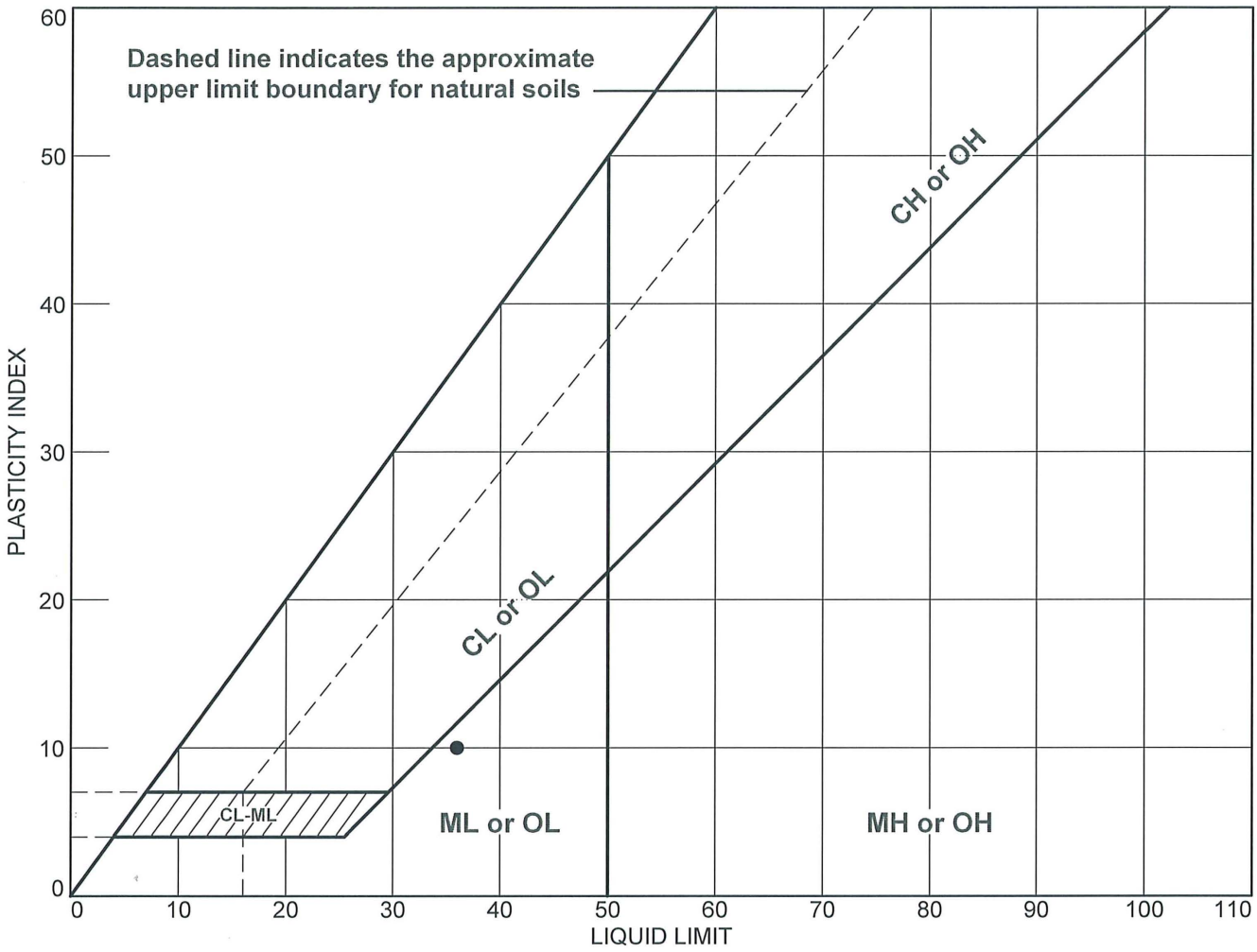
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_002B	25B	68.0-68.5'	34.4	26	36	10	ML

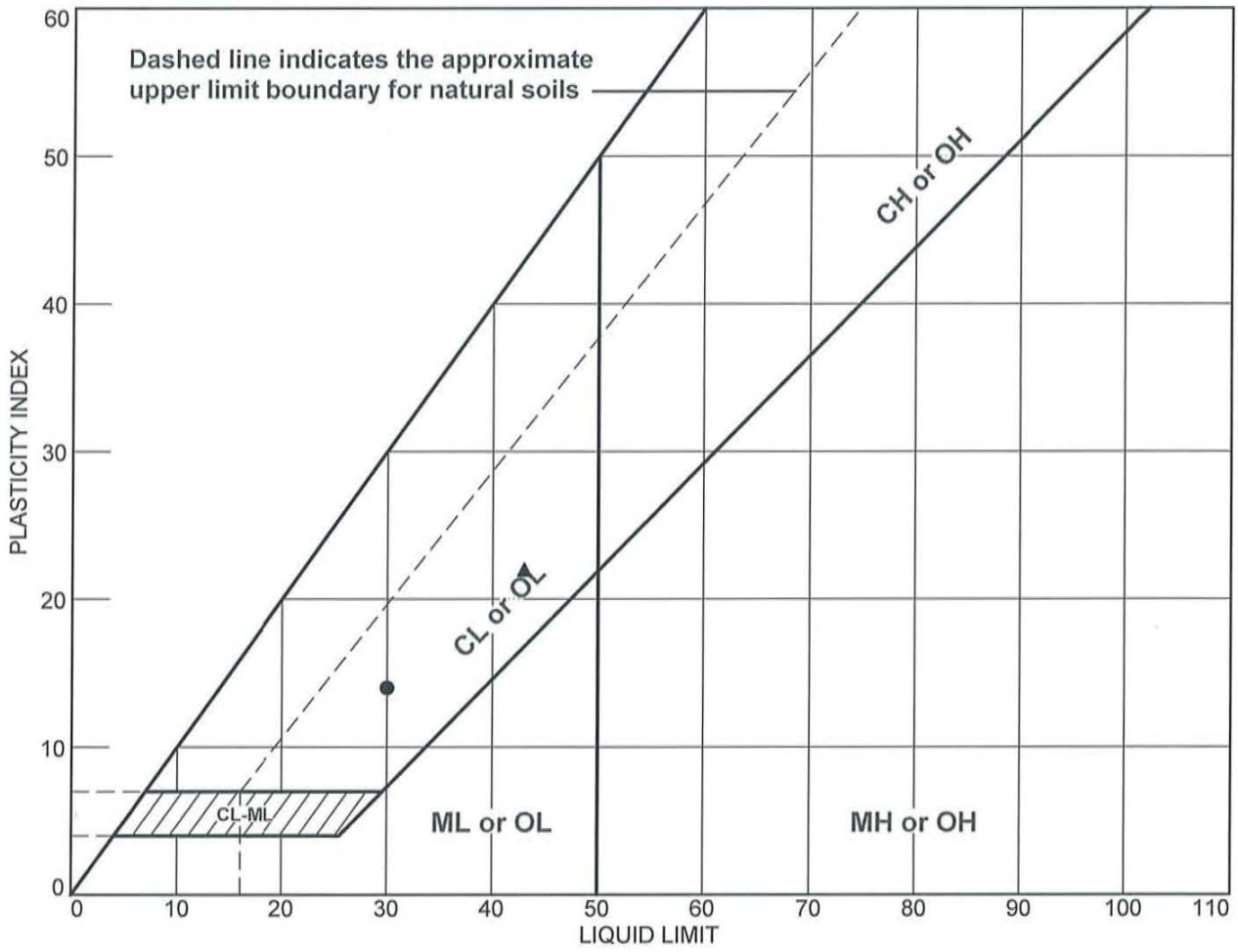
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: SBFCA FRWL EIP

Project No.: 1967.1 (URS)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_002C	1B	6.4-7.4'		16	30	14	CL
■	SL0001_002C	3B	20.5-21.0'		NP	NV	NP	ML
▲	SL0001_002C	4B	28.5-29.0'		21	43	22	CL

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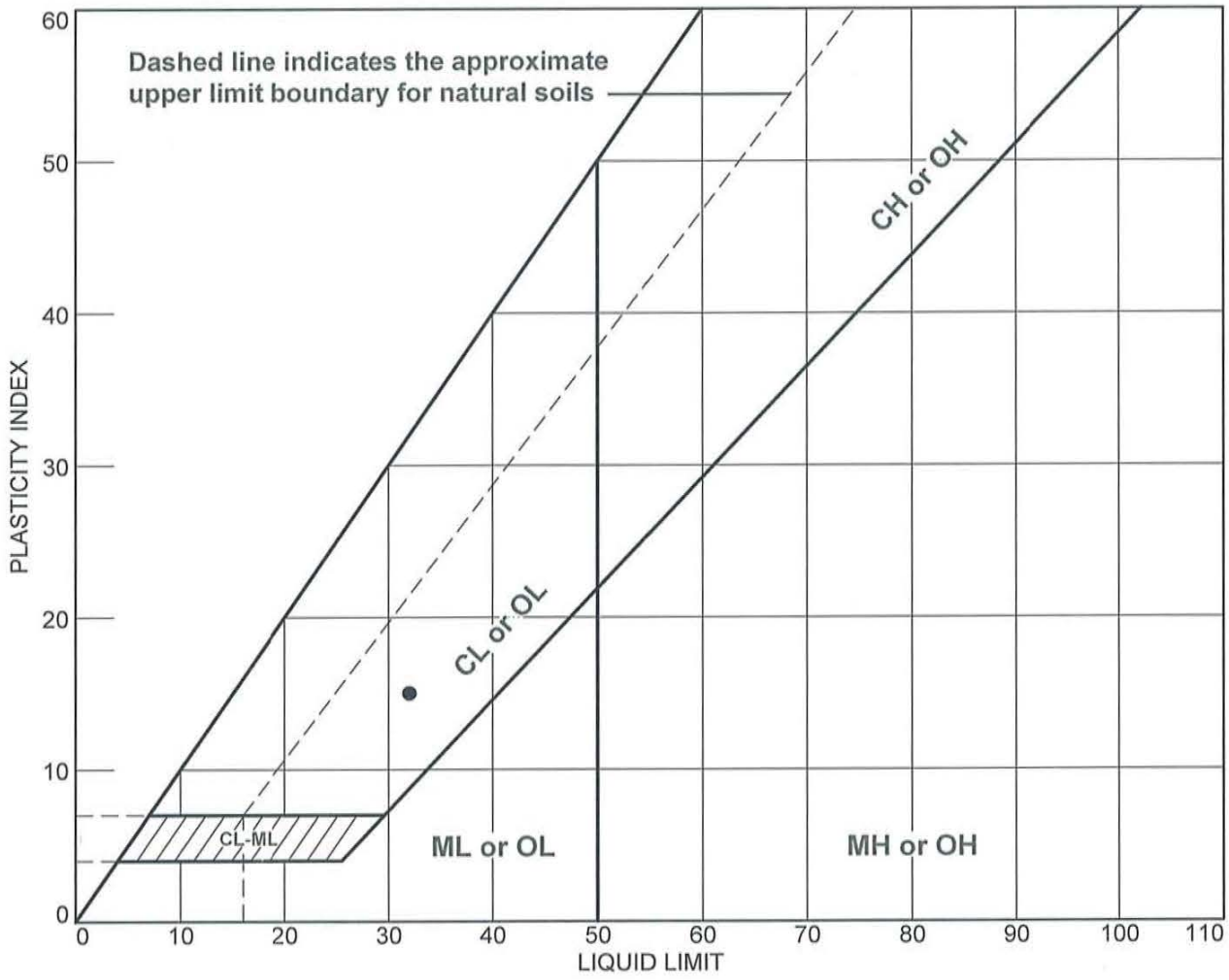
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1 **Figure**

Tested By: B. Moore

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_003H	3	3.0-4.0'		17	32	15	CL

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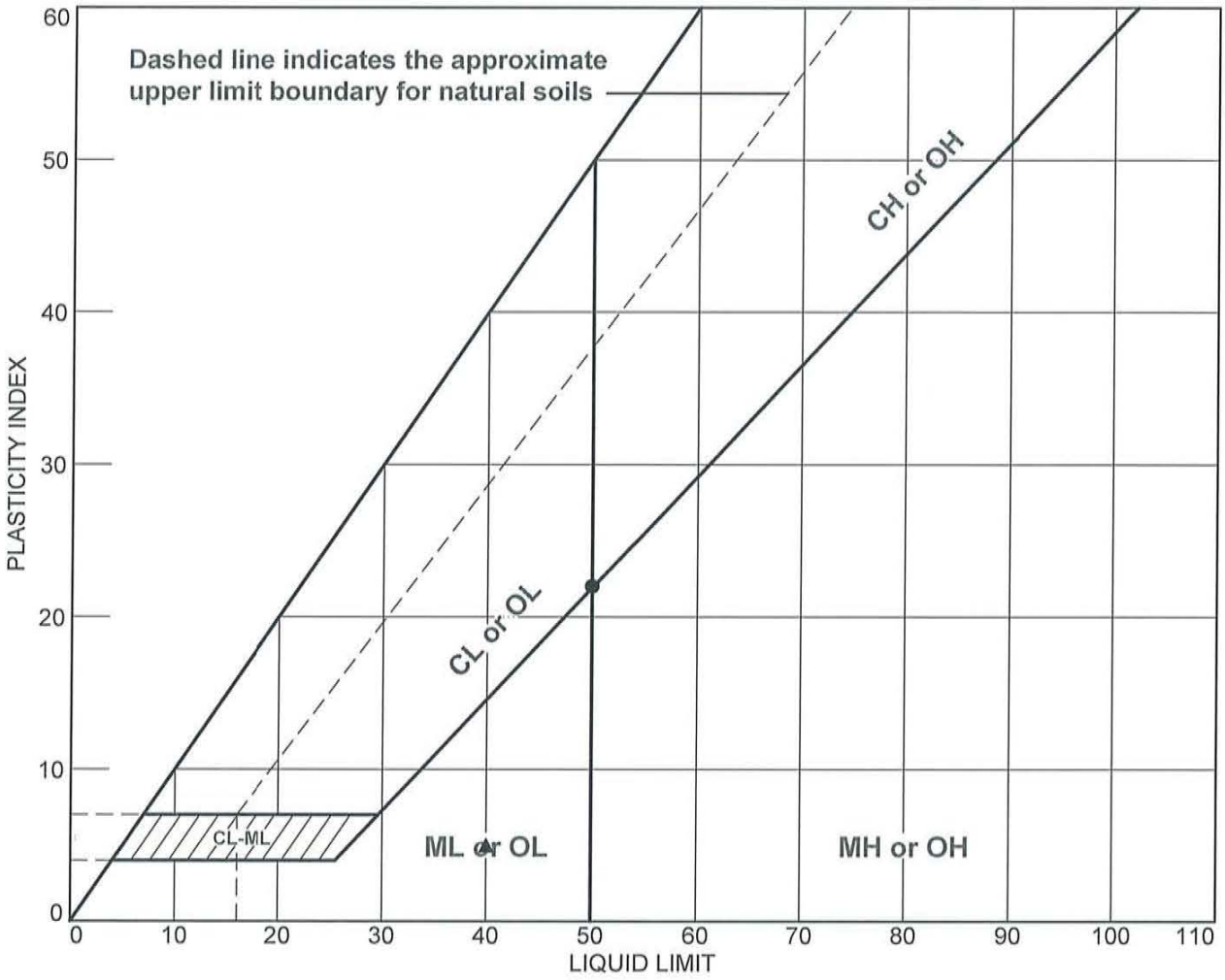
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_003C	2B	13.5-14.0'		28	50	22	CH
■	SL0001_003C	3A	20.0-20.5'		NP	NV	NP	SM
▲	SL0001_003C	1B	10.5-11.0'		35	40	5	ML

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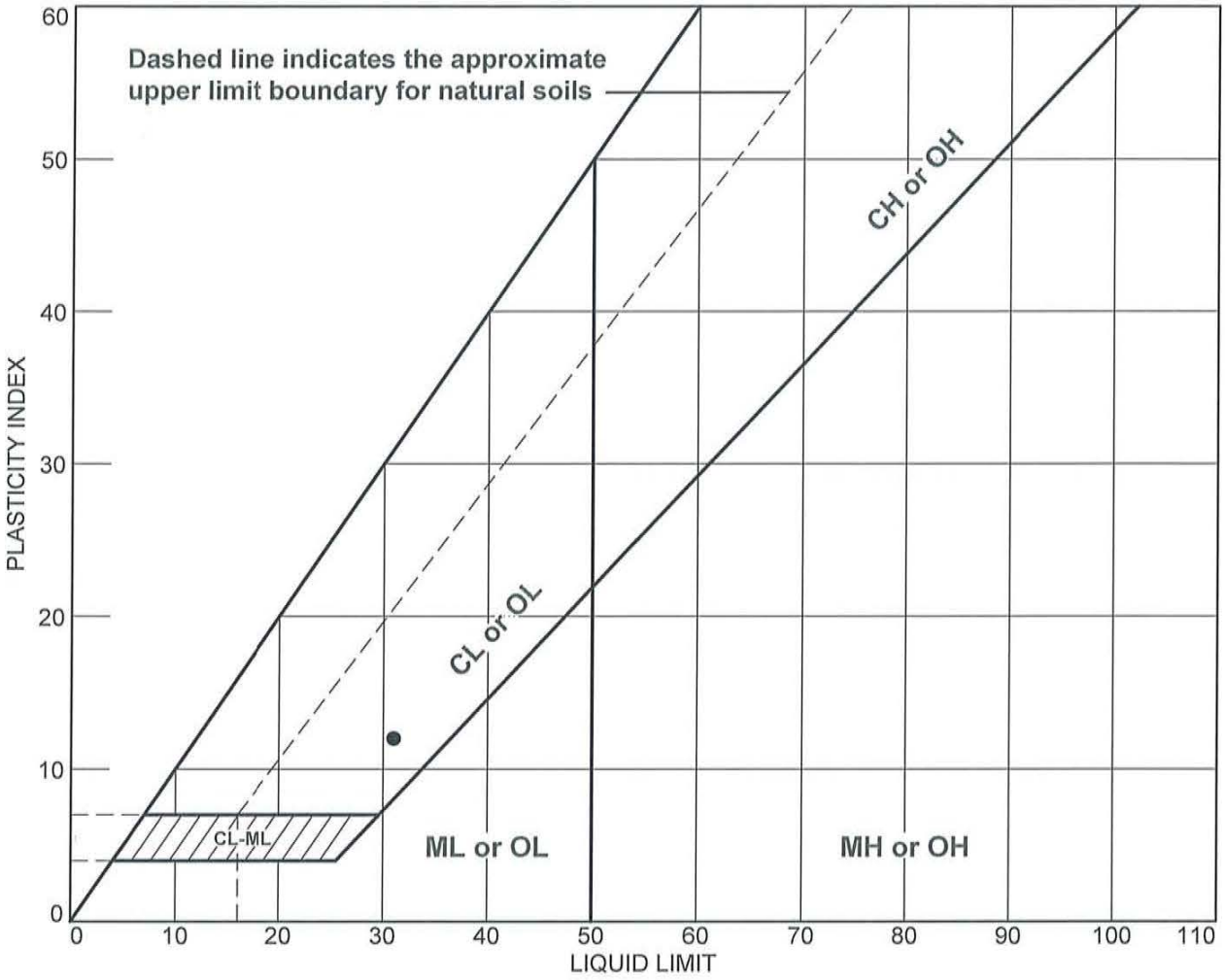
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_004H	3	3.0-3.5'		19	31	12	CL

Blackburn Consulting

W. Sacramento, CA

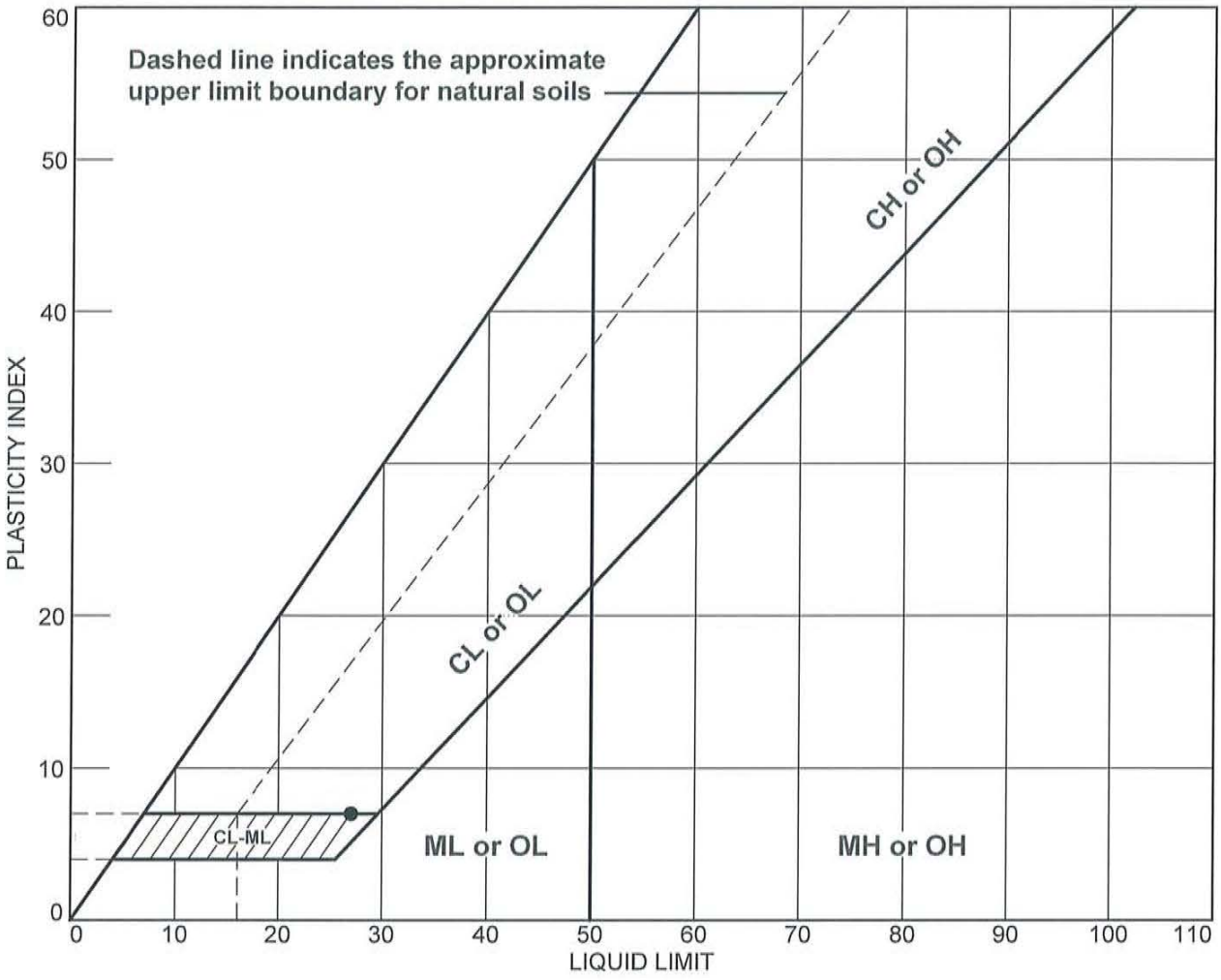
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1

Figure

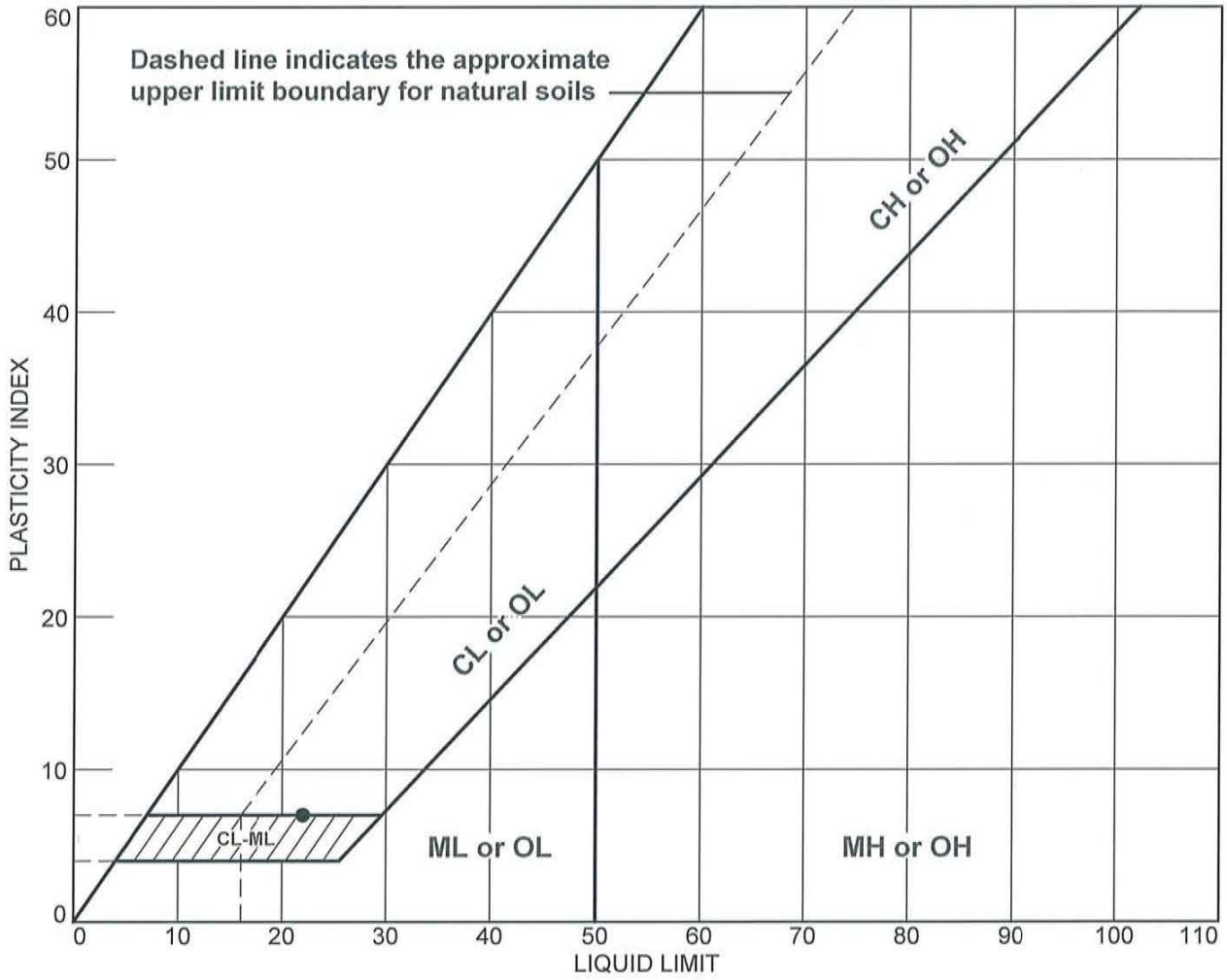
LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_004H1	2	3.0-3.5'		20	27	7	CL-ML

Blackburn Consulting **W. Sacramento, CA**	**Client:** URS **Project:** Feather River West Levee Rehabilitation Project **Project No.:** 1967.1 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_004C	1A/1B	8.0-9.0'		15	22	7	CL-ML
■	SL0001_004C	3A/3B	41.0-42.0'		27	24	NP	SM
▲	SL0001_004C	2B	17.5-18.0		NP	NV	NP	SP

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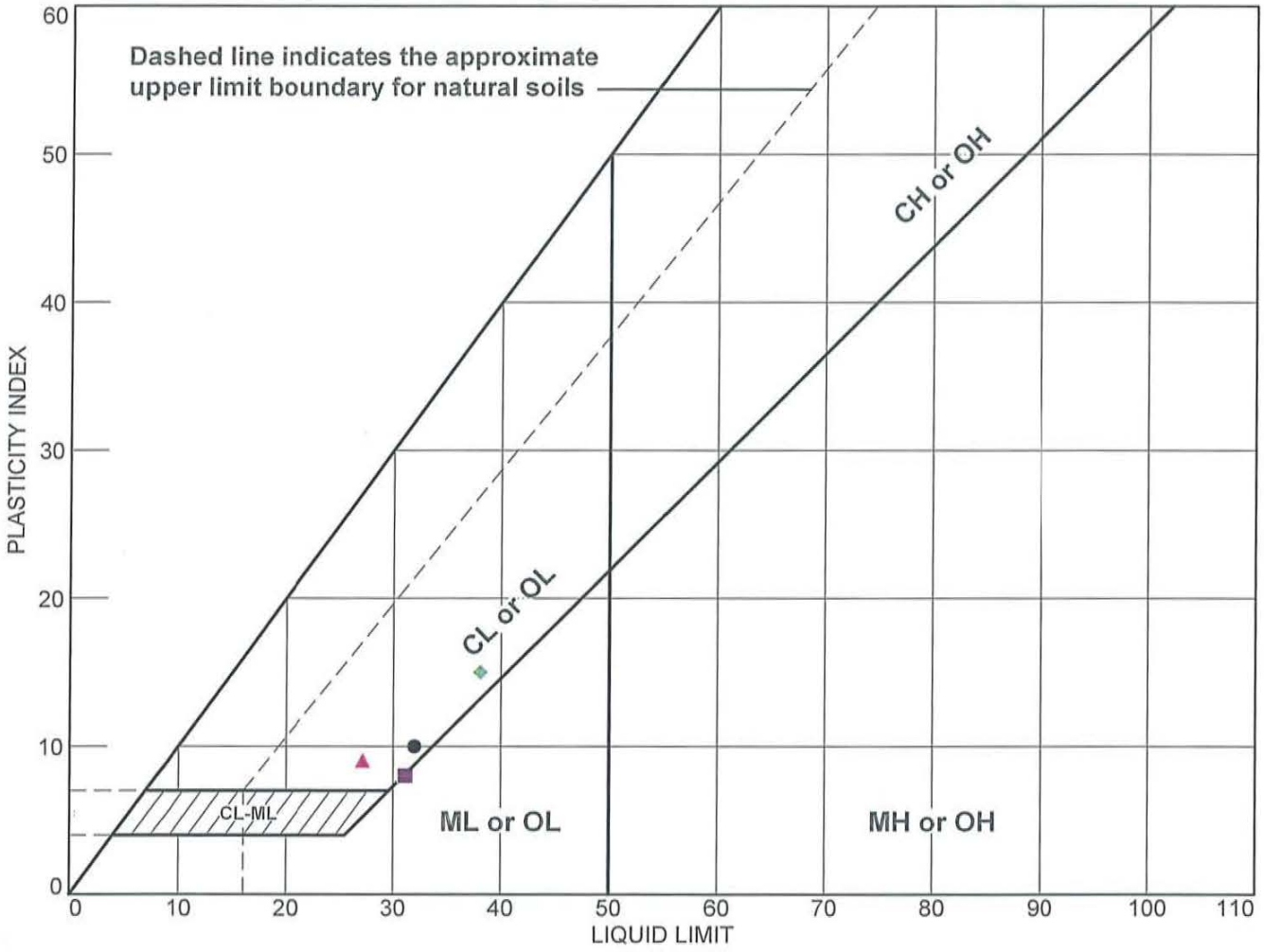
Client: URS

Project: Feather River West Levee Rehabilitation Project

Project No.: 1967.1

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

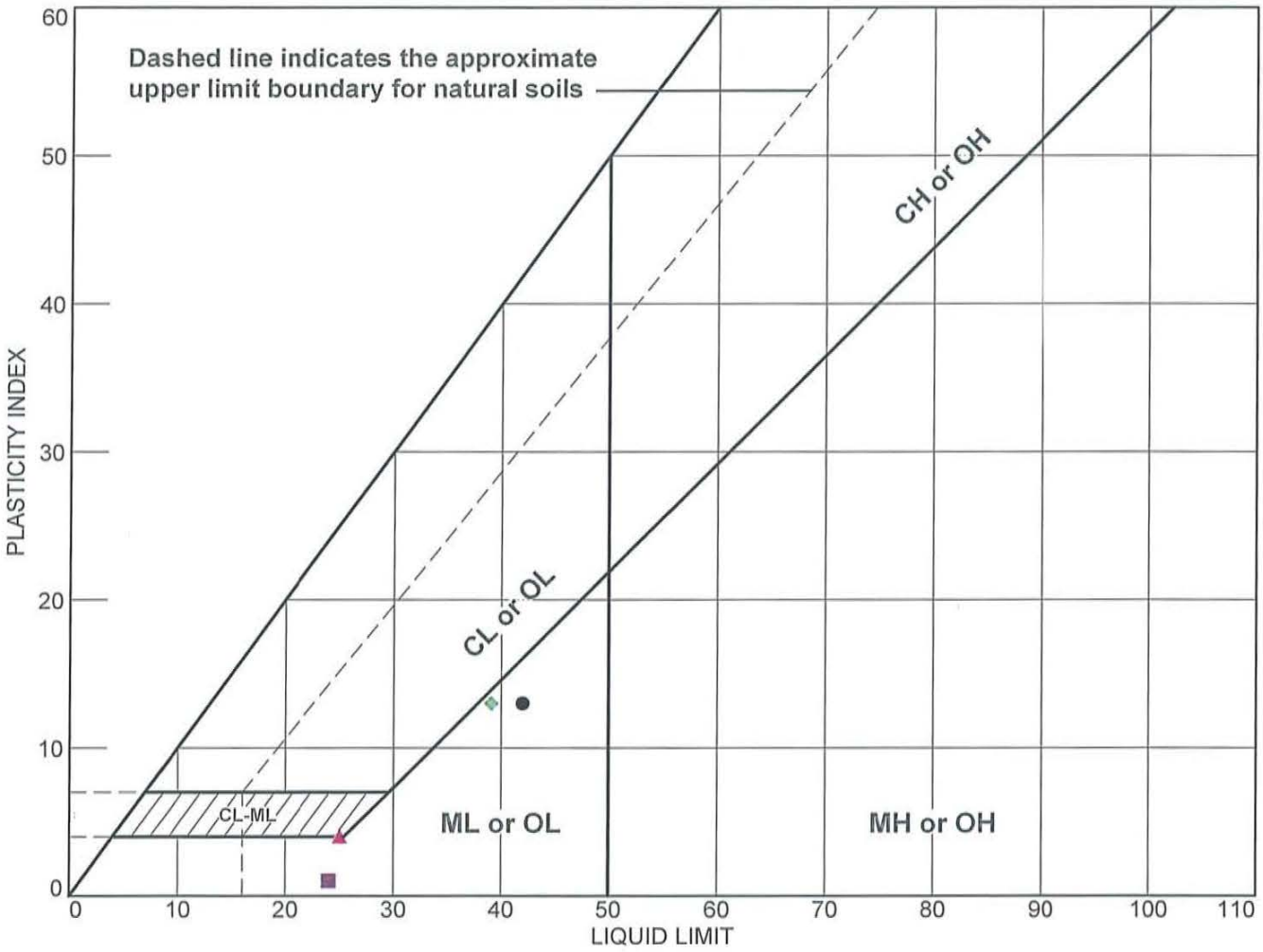
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_002C	1A	9.0-9.5'		22	32	10	CL
■	SM0003_002C	2A/2B	16.0-17.0'		23	31	8	CL
▲	SM0003_002C	3	21.2-22.0'		18	27	9	CL
◆	SM0003_002H	3	3.0-3.5'		23	38	15	CL

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W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee Rehabilitation
Project No.: 1967.1 (SM)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_003C	1A/1B	8.5-9.5'		29	42	13	ML
■	SM0003_003C	2	24.0-25.0'		23	24	1	ML
▲	SM0003_003C	3A/3B	40.0-41.0'		21	25	4	CL-ML
◆	SM0003_003H	3	3.0-3.5'		26	39	13	CL

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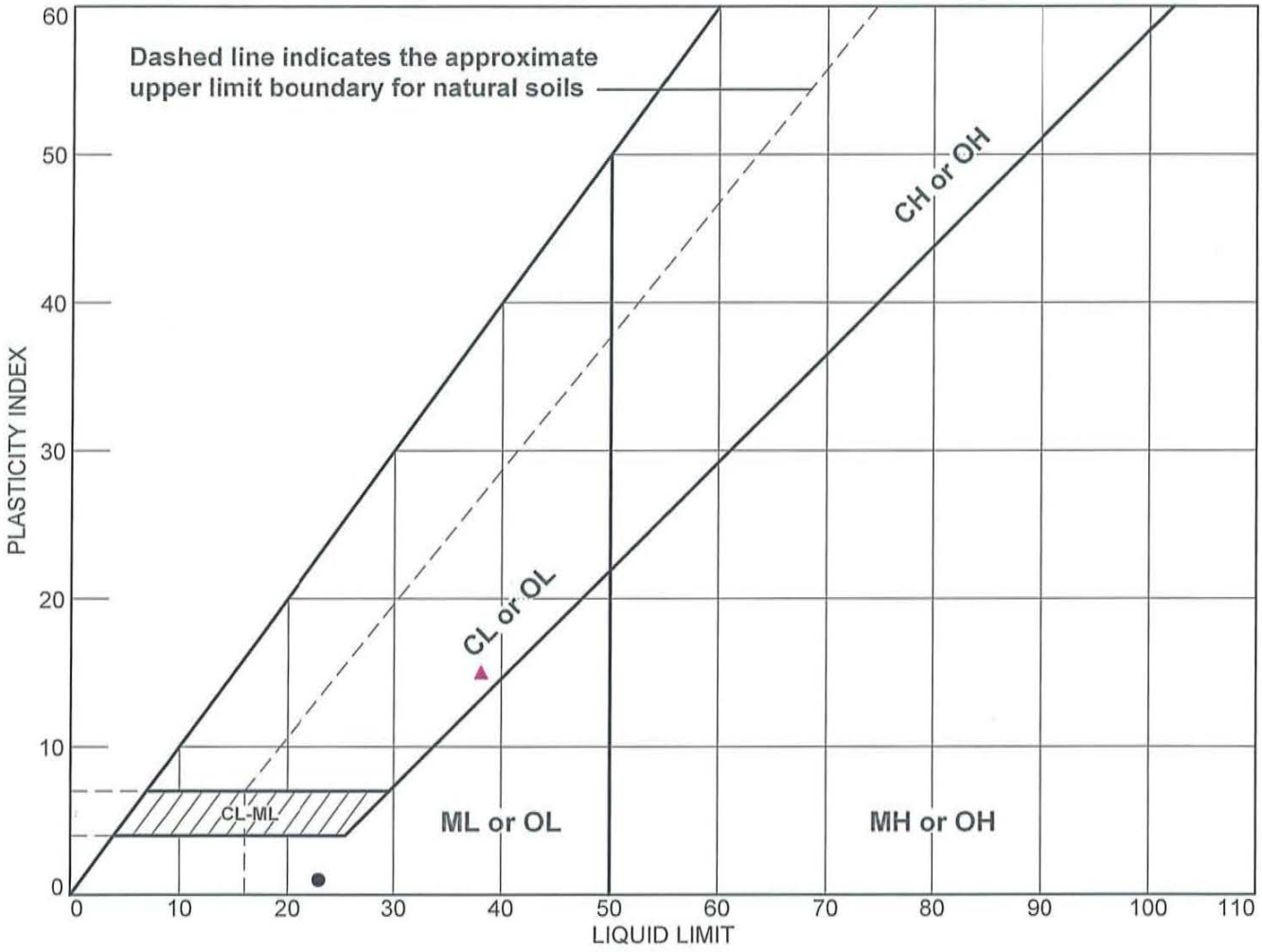
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_004C	2A/2B	17.0-18.0'		22	23	1	ML
■	SM0003_004C	3A/3B	24.0-25.0		NP	NV	NP	ML
▲	SM0003_004H	5	4.5-5.0'		23	38	15	CL

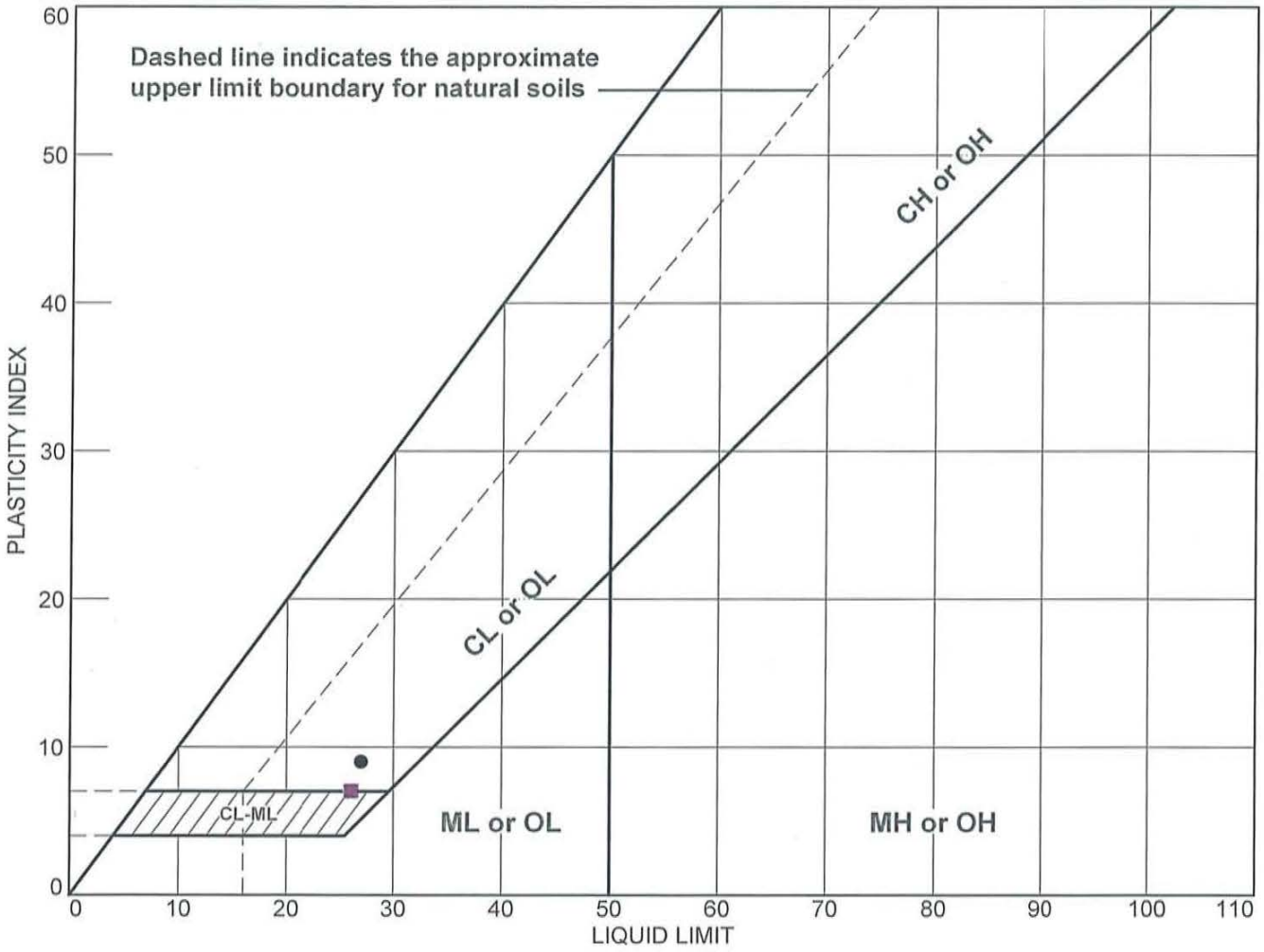
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Client: URS Corporation
Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

LIQUID AND PLASTIC LIMITS TEST REPORT



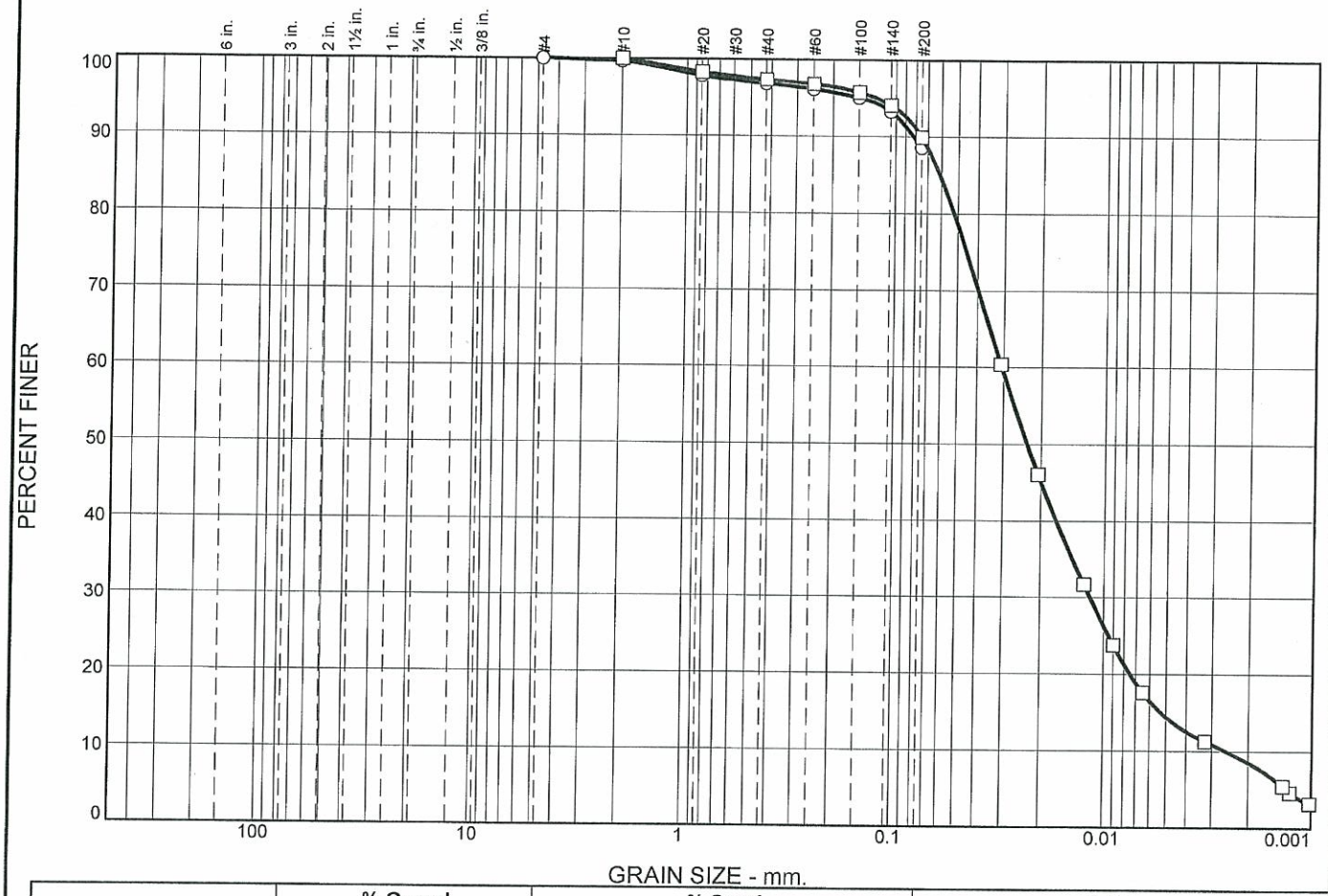
SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_008C	1A/1B	10.0-11.0'		18	27	9	CL
■	SM0003_008H	2	2.0-3.0'		19	26	7	CL-ML

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Client: URS Corporation
Project: Feather River West Levee Rehabilitation
Project No.: 1967.1 (SM)

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.3	2.9	8.2	88.6	
□	0.0	0.0	0.0	0.0	2.7	7.4	75.6	14.3

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○											
□	3.1			0.0612	0.0307	0.0234	0.0117	0.0054	0.0026	1.71	11.77

Material Description	USCS	AASHTO
○ SILT, brown, with cemented nodules	ML	
□ SILT, brown, with cemented nodules	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Sample Source:** SM0007_001B **Depth:** 23.5-25.0' **Sample No.:** 12 Grain Size

□ **Sample Source:** SM0007_001B **Depth:** 23.5-25.0' **Sample No.:** 12 Hydro

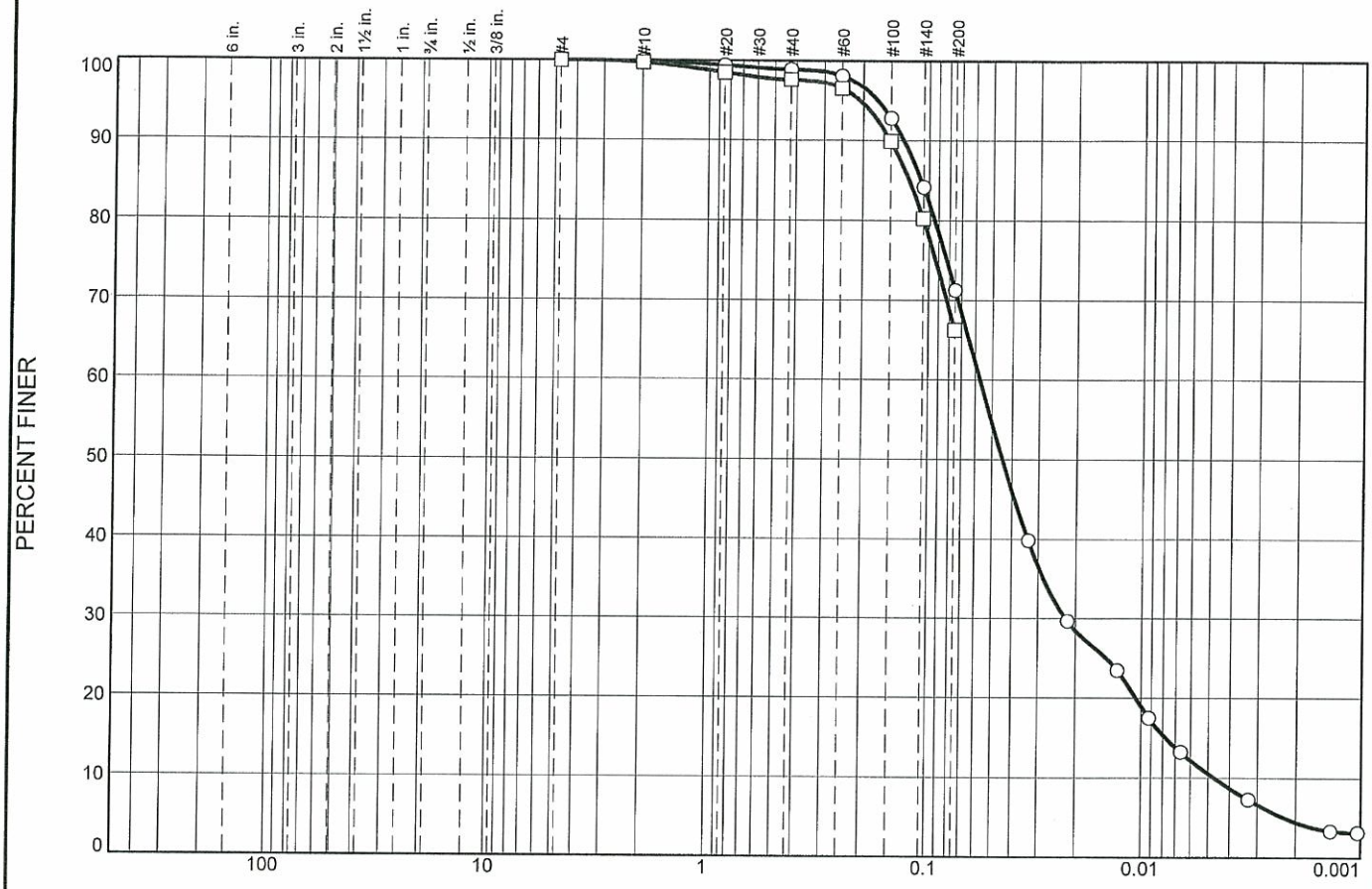
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.1	27.6	60.8	10.5
□	0.0	0.0	0.0	0.3	2.1	31.3	66.3	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	3.1			0.1089	0.0571	0.0445	0.0223	0.0078	0.0047	1.85	12.12
□				0.1231							

Material Description	USCS	AASHTO
○ SILT with SAND, dark yellowish brown, with cemented nodules	ML	
□ SANDY SILT, dark yellowish brown, with cemented nodules	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Sample Source:** SM0007_001B **Depth:** 31.0-32.5' **Sample No.:** 15 Hydro

□ **Sample Source:** SM0007_001B **Depth:** 31.0-32.5' **Sample No.:** 15 Grain Size

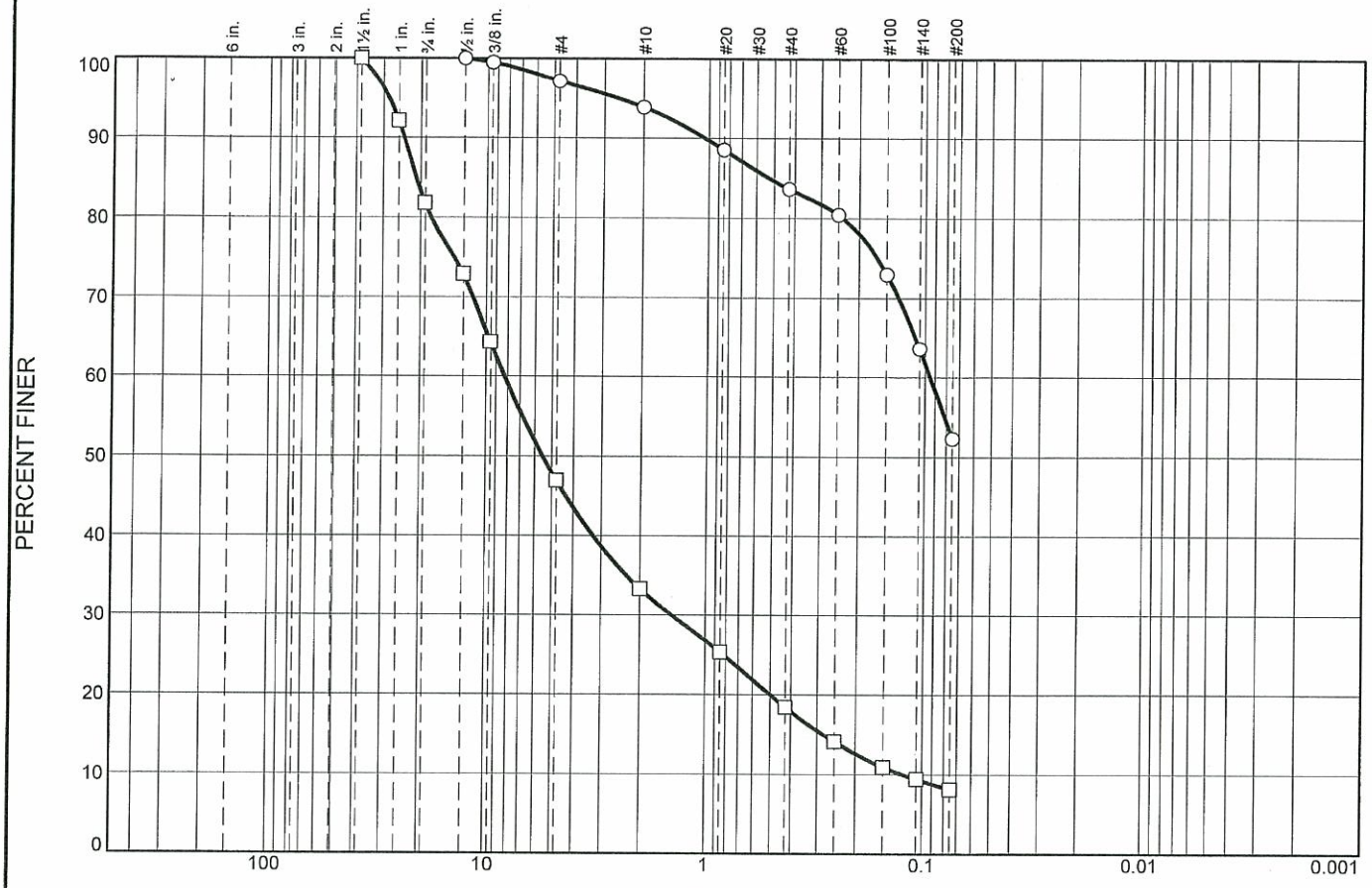
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.9	3.2	10.3	31.3	52.3	
□	0.0	18.2	34.9	13.6	14.9	10.3	8.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.5265	0.0945						
□				20.8966	8.2016	5.4891	1.4393	0.2818	0.1235	2.05	66.42

Material Description	USCS	AASHTO
○ SANDY lean CLAY, yellowish brown		
□ Well-graded GRAVEL with SILT and SAND, light olive brown	GW-GM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_001B **Depth:** 38.5-40.0' **Sample Number:** 18

□ **Source of Sample:** SM0007_001B **Depth:** 41.0-42.5' **Sample Number:** 19

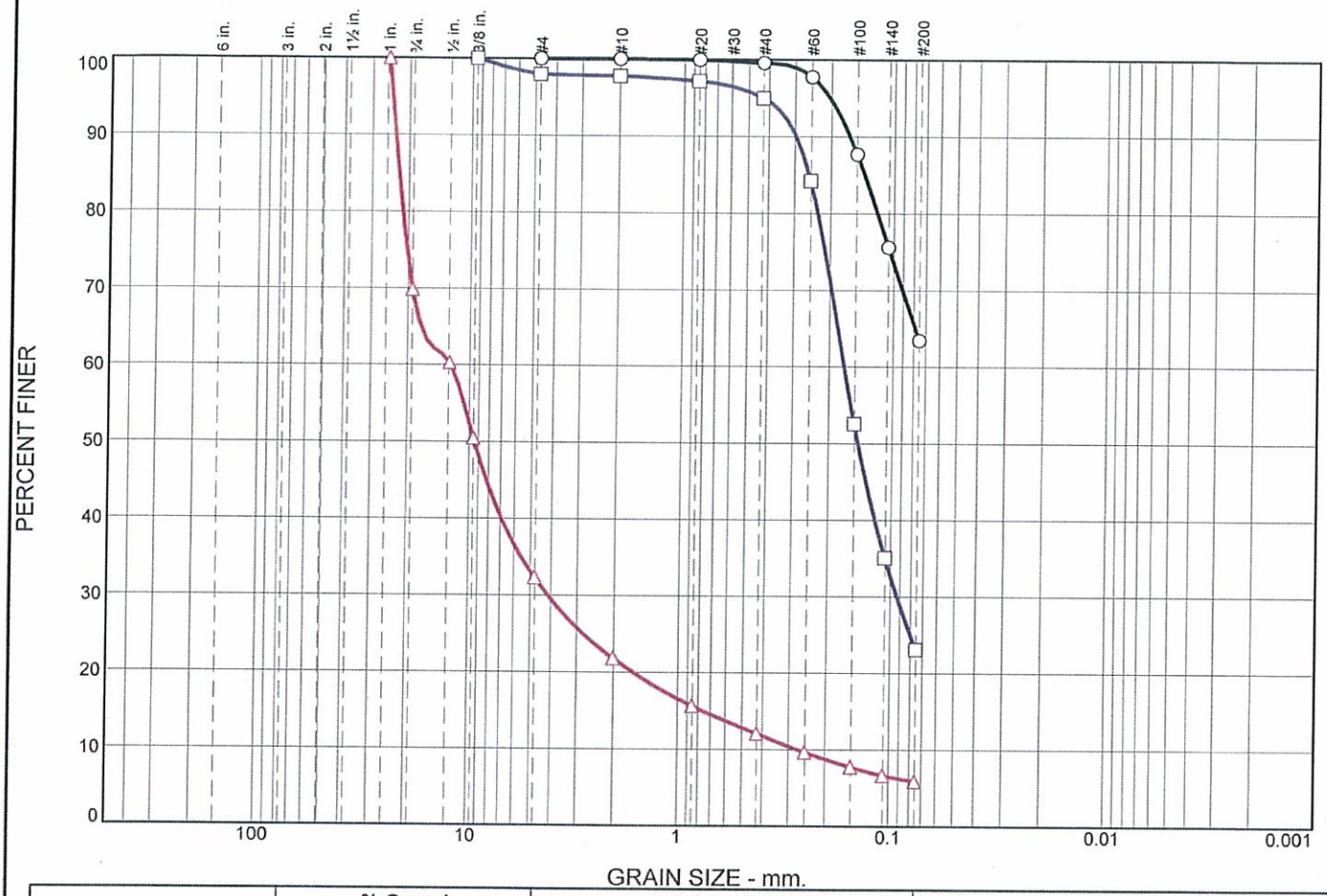
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	36.0	63.5	
□	0.0	0.0	2.1	0.1	2.8	71.9	23.1	
△	0.0	29.9	37.8	10.5	9.7	6.2	5.9	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1378							
□				0.2544	0.1683	0.1437	0.0926				
△				22.1893	12.3128	9.3793	4.1027	0.7596	0.2706	5.05	45.51

Material Description	USCS	AASHTO
○ SANDY SILT, dark brown	ML	
□ SILTY SAND, dark brown	SM	
△ Poorly-graded GRAVEL with SILT and SAND, olive brown	GP-GM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT2

○ **Source of Sample:** SM0007_001H **Depth:** 0.0-5.0' **Sample Number:** 1A

□ **Source of Sample:** SM0007_001C **Depth:** 7.0-8.0' **Sample Number:** 2A

△ **Source of Sample:** SM0007_001C **Depth:** 13.0-14.0' **Sample Number:** 3A

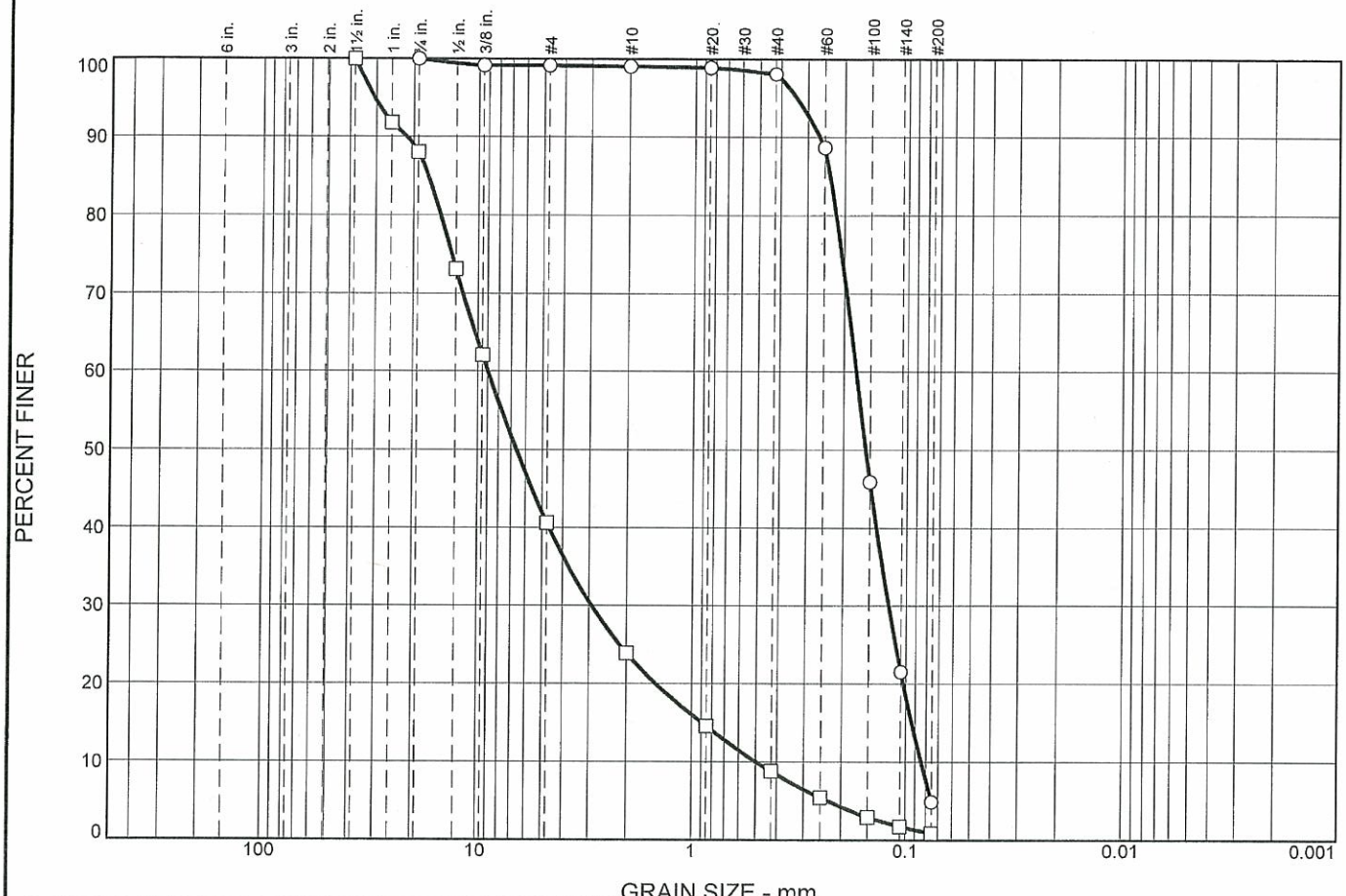
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.9	0.1	0.9	93.2	4.9	
□	0.0	12.0	47.4	16.7	15.1	8.0	0.8	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.2355	0.1753	0.1572	0.1217	0.0936	0.0841	1.00	2.08
□				17.0940	8.9831	6.6300	2.9223	0.8953	0.5002	1.90	17.96

Material Description	USCS	AASHTO
○ Poorly-graded SAND, yellowish brown	SP	
□ Well-graded GRAVEL with SAND, olive	GW	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_002B **Depth:** 11.0-12.5' **Sample Number:** 6

□ **Source of Sample:** SM0007_002B **Depth:** 27.5-29.0' **Sample Number:** 10

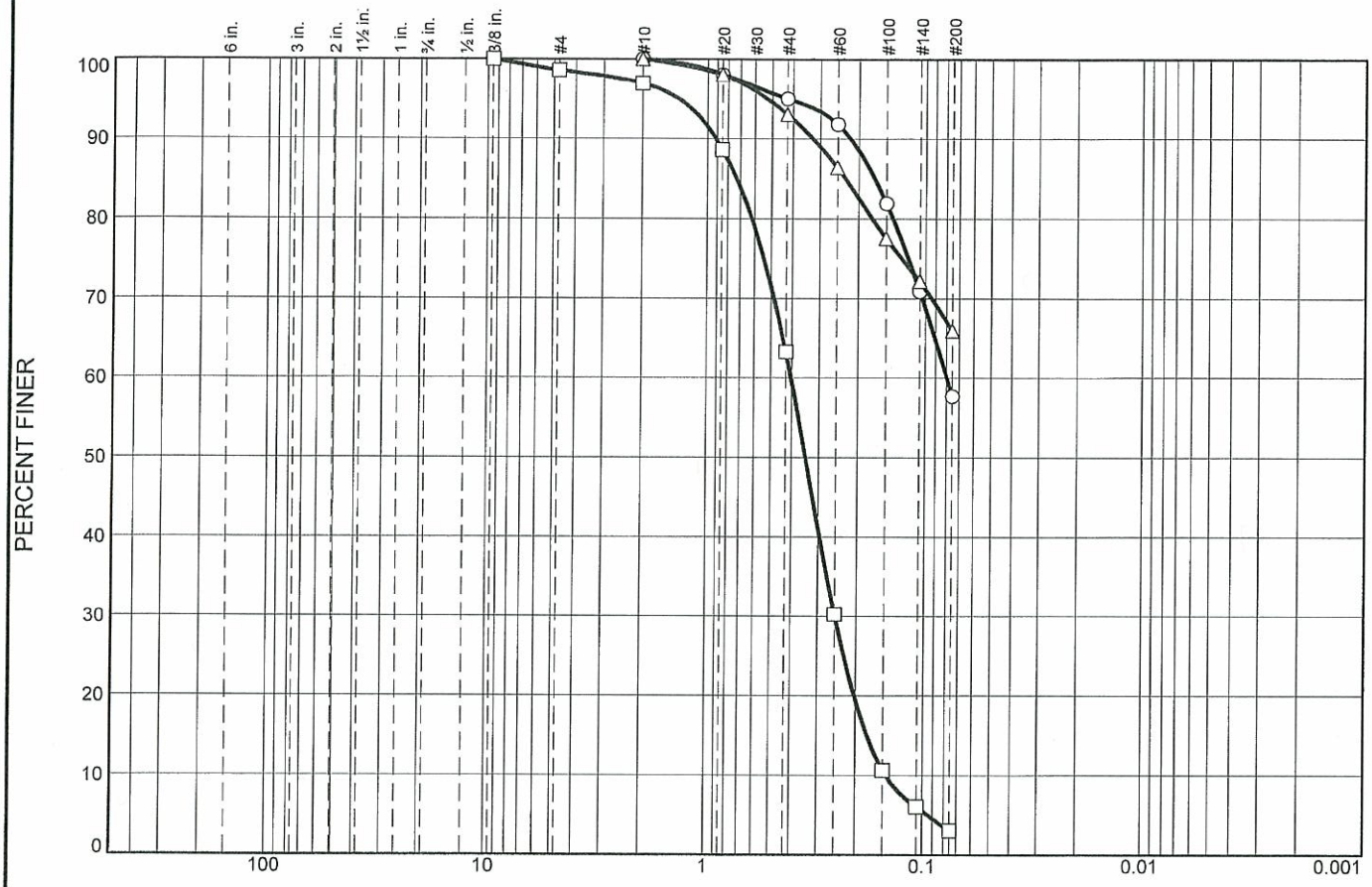
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.0	37.3	57.7	
□	0.0	0.0	1.4	1.7	33.6	60.3	3.0	
△	0.0	0.0	0.0	0.0	7.0	27.0	66.0	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1695	0.0795						
□				0.7284	0.4016	0.3426	0.2488	0.1768	0.1455	1.06	2.76
△		35	21	0.2296							

Material Description	USCS	AASHTO
○ SANDY SILT, yellowish brown	ML	
□ Poorly-graded SAND, brown	SP	
△ SANDY lean CLAY, dark yellowish brown	CL	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_002B **Depth:** 35.0-36.5' **Sample Number:** 11

□ **Source of Sample:** SM0007_002B **Depth:** 42.5-44.0' **Sample Number:** 14

△ **Source of Sample:** SM0007_002B **Depth:** 45.0-46.5' **Sample Number:** 15

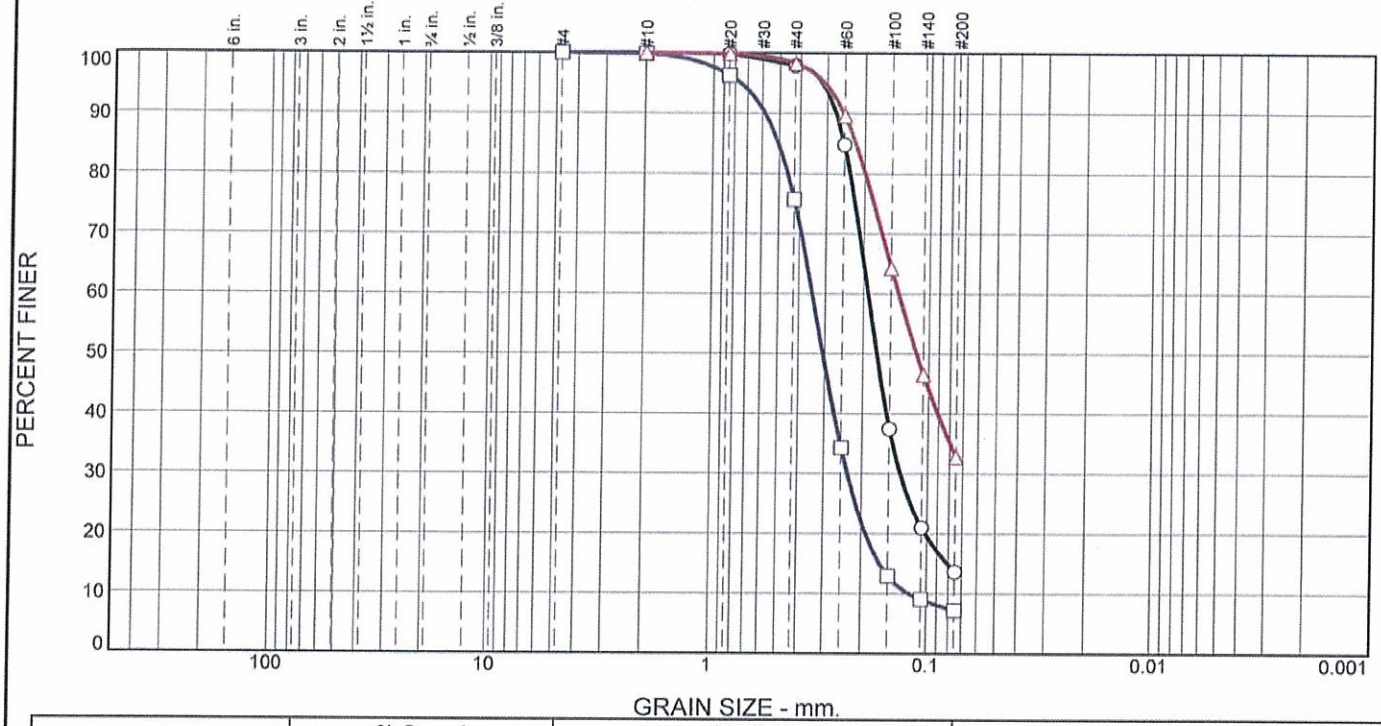
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	2.1	84.3	13.6	
□	0.0	0.0	0.0	0.2	24.1	68.5	7.2	
△	0.0	0.0	0.0	0.0	1.7	65.6	32.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2507	0.1906	0.1727	0.1336	0.0808			
□			0.5077	0.3450	0.3061	0.2339	0.1641	0.1206	1.32	2.86
△			0.2227	0.1388	0.1143					

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, light olive brown	SP-SM	
□ Poorly-graded SAND with SILT, very dark brown	SP-SM	
△ SANDY SILT, dark brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SM0007_002C **Depth:** 15.0-16.0' **Sample Number:** 2

□ **Source of Sample:** SM0007_002C **Depth:** 20.0-21.0' **Sample Number:** 3

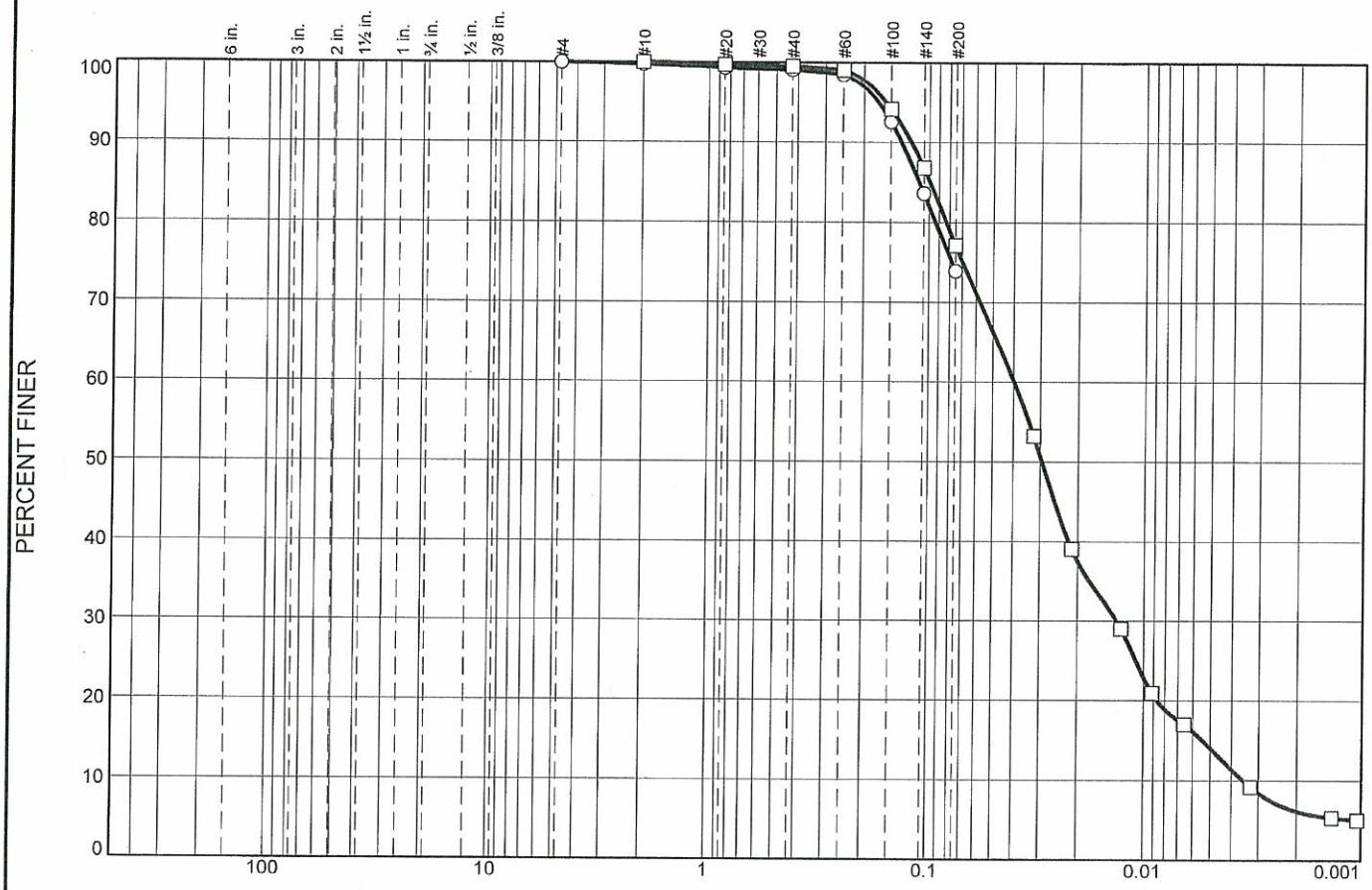
△ **Source of Sample:** SM0007_002H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	0.7	25.2	73.9	
□	0.0	0.0	0.0	0.0	0.5	22.4	63.1	14.0

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1114							
□				0.0991	0.0398	0.0295	0.0134	0.0055	0.0036	1.26	11.12

Material Description	USCS	AASHTO
○ SILT with SAND, brown		
□ SILT with SAND, brown		

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Sample Source:** SM0007_003A **Depth:** 18.5-20.0' **Sample No.:** 10 Grain Size

□ **Sample Source:** SM0007_003A **Depth:** 18.5-20.0' **Sample No.:** 10 Hydro

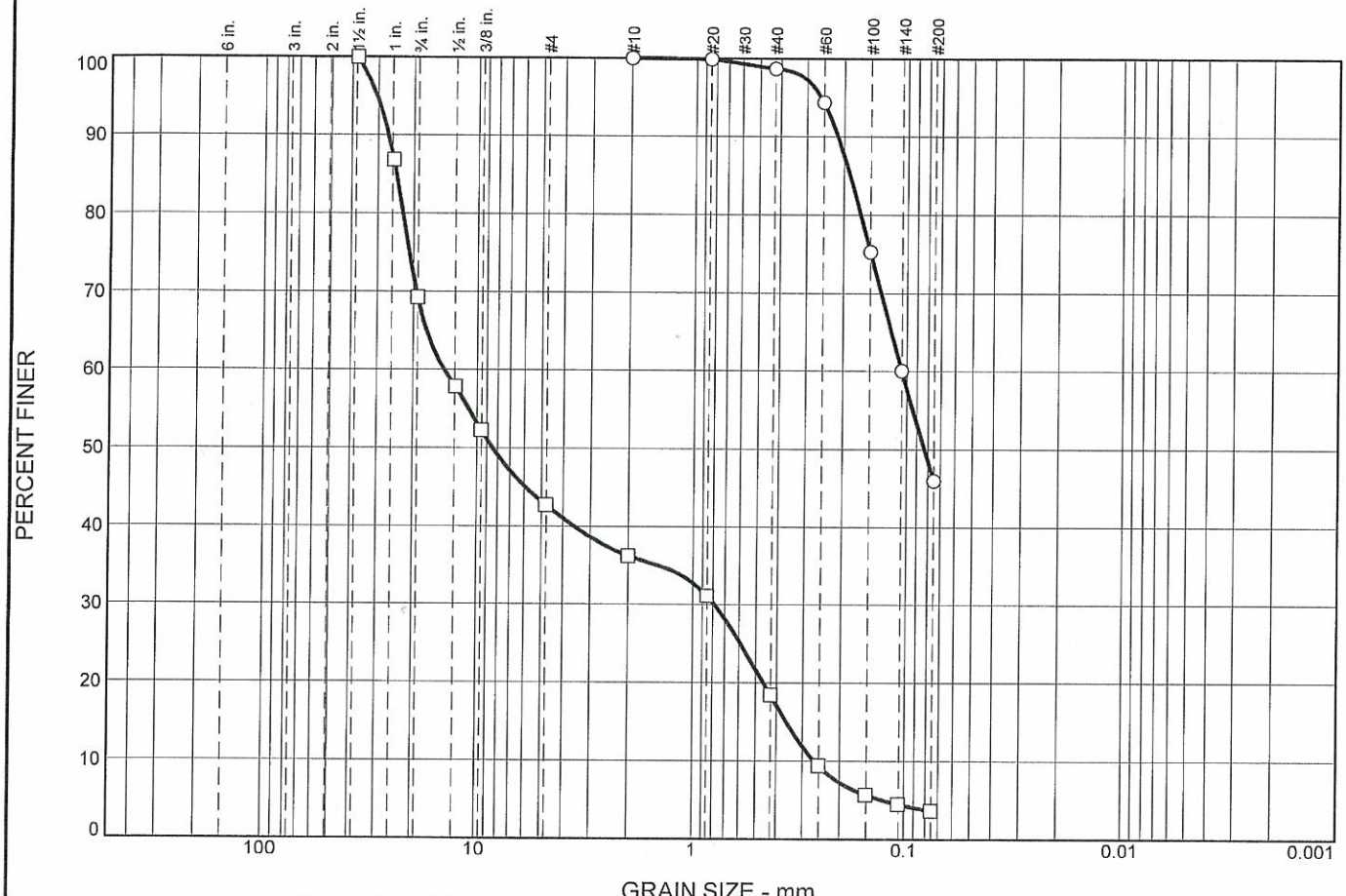
Date: ○ 11-21-10 □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.3	52.7	46.0	
□	0.0	30.6	26.7	6.5	17.8	14.7	3.7	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1878	0.1059	0.0830					
□				24.2337	14.1575	8.4075	0.7838	0.3567	0.2623	0.17	53.97

Material Description	USCS	AASHTO
○ SILTY SAND, light olive brown	SM	
□ Poorly-graded GRAVEL with SAND, light olive brown	GP	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Sample Source:** SM0007_003A **Depth:** 21.5-22.0' **Sample No.:** 11B

□ **Sample Source:** SM0007_003A **Depth:** 26.5-27.0' **Sample No.:** 13A

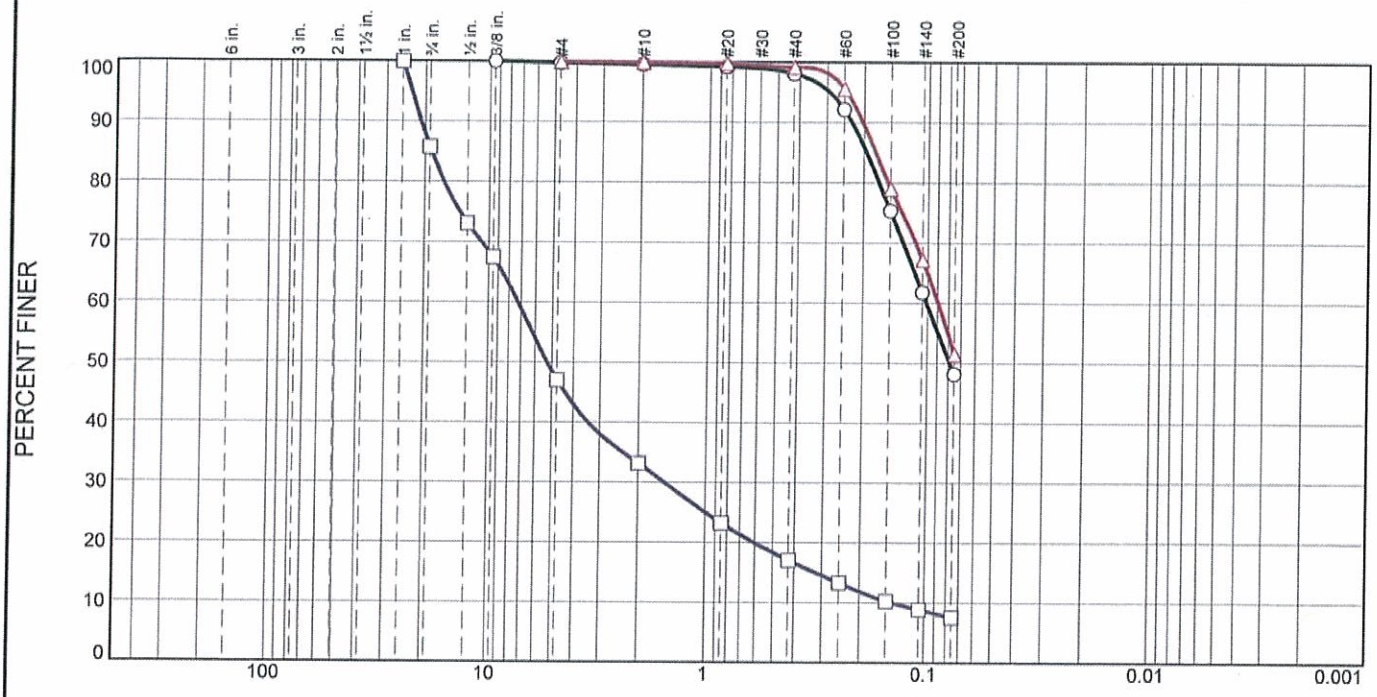
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.2	0.3	1.4	49.9	48.2	
□	0.0	14.2	38.8	13.8	16.2	9.5	7.5	
△	0.0	0.0	0.0	0.1	0.7	47.6	51.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1950	0.1012	0.0786					
□			18.7045	7.2540	5.2766	1.5315	0.3212	0.1423	2.27	50.98
△			0.1772	0.0895						

Material Description	USCS	AASHTO
○ SILTY SAND, dark brown	SM	
□ Well-graded GRAVEL with SILT and SAND, light olive brown	GW-GM	
△ SANDY SILT, very dark brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SM0007_003C **Depth:** 9.0-10.0' **Sample Number:** 1

□ **Source of Sample:** SM0007_003C **Depth:** 15.0-16.0' **Sample Number:** 2

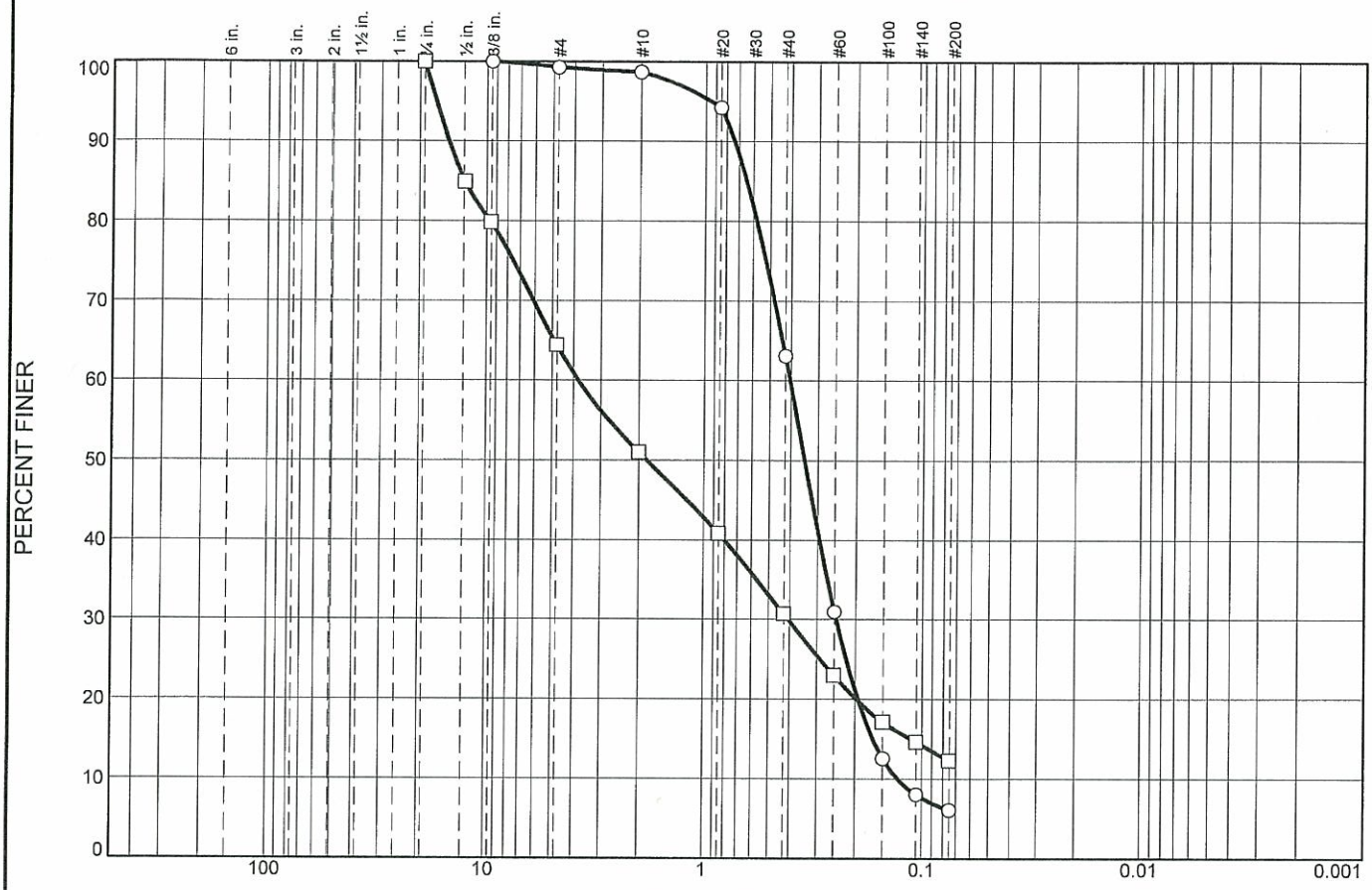
△ **Source of Sample:** SM0007_003H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.7	0.6	35.6	57.0	6.1	
□	0.0	0.0	35.5	13.5	20.3	18.4	12.3	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.6466	0.4040	0.3447	0.2452	0.1663	0.1290	1.15	3.13
□				12.5314	3.7770	1.8402	0.4053	0.1125			

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, yellowish brown	SP-SM	
□ SILTY SAND with GRAVEL, olive brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_004A **Depth:** 20.0-21.5' **Sample Number:** 9

□ **Source of Sample:** SM0007_004A **Depth:** 27.5-29.0' **Sample Number:** 11

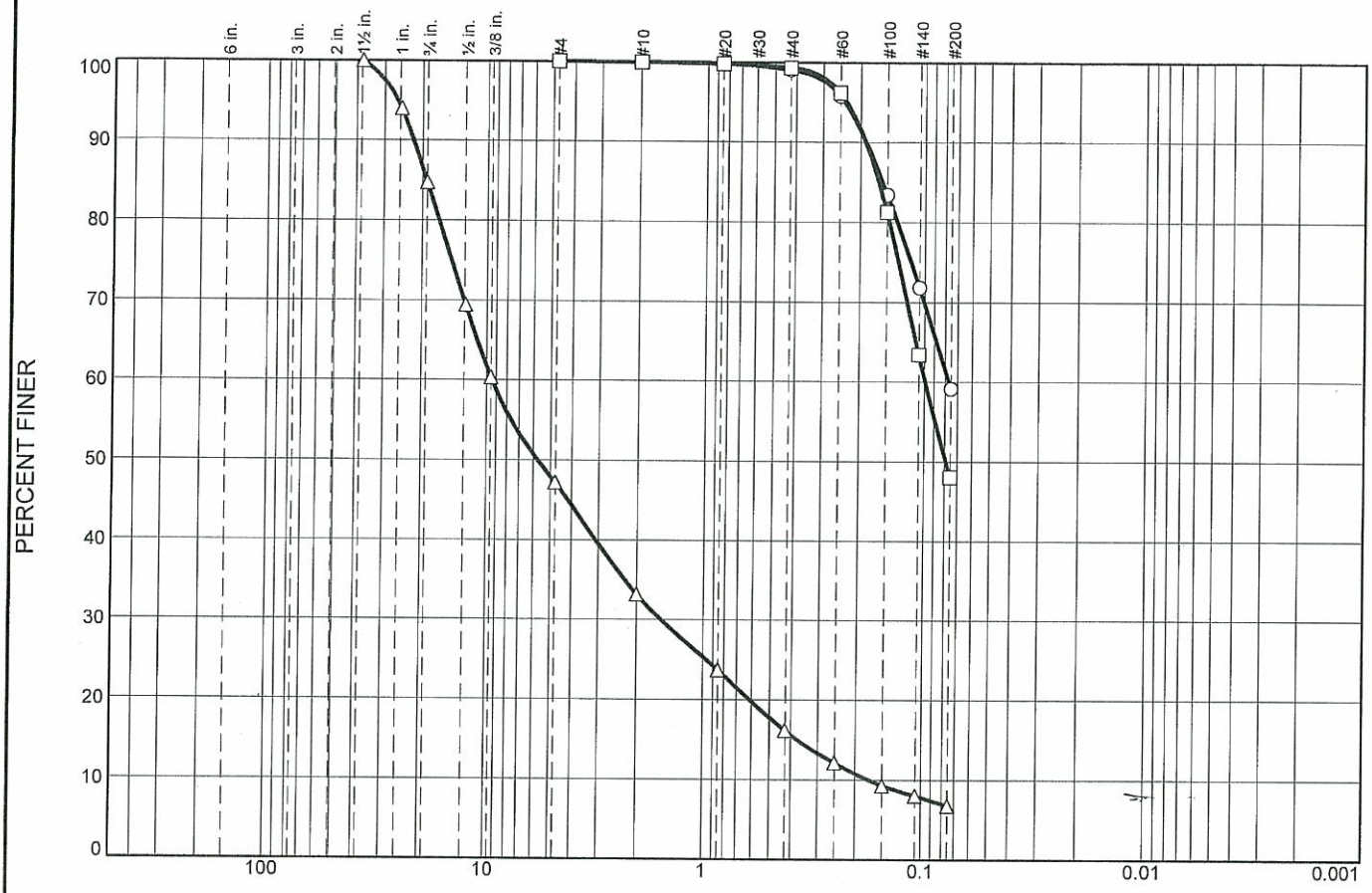
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.9	39.9	59.2	
□	0.0	0.0	0.0	0.1	0.6	51.3	48.0	
△	0.0	15.2	37.6	14.0	17.1	9.4	6.7	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1578	0.0767						
□				0.1637	0.0988	0.0786					
△				19.1372	9.3827	5.7210	1.5494	0.3734	0.1745	1.47	53.77

Material Description	USCS	AASHTO
○ SANDY SILT, strong brown	ML	
□ SILTY SAND, olive brown	SM	
△ Well-graded GRAVEL with CLAY and SAND, olive	GW-GC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_004B **Depth:** 4.0-5.5' **Sample Number:** 3

□ **Source of Sample:** SM0007_004B **Depth:** 15.0-16.0' **Sample Number:** 8B

△ **Source of Sample:** SM0007_004B **Depth:** 30.0-31.5' **Sample Number:** 12

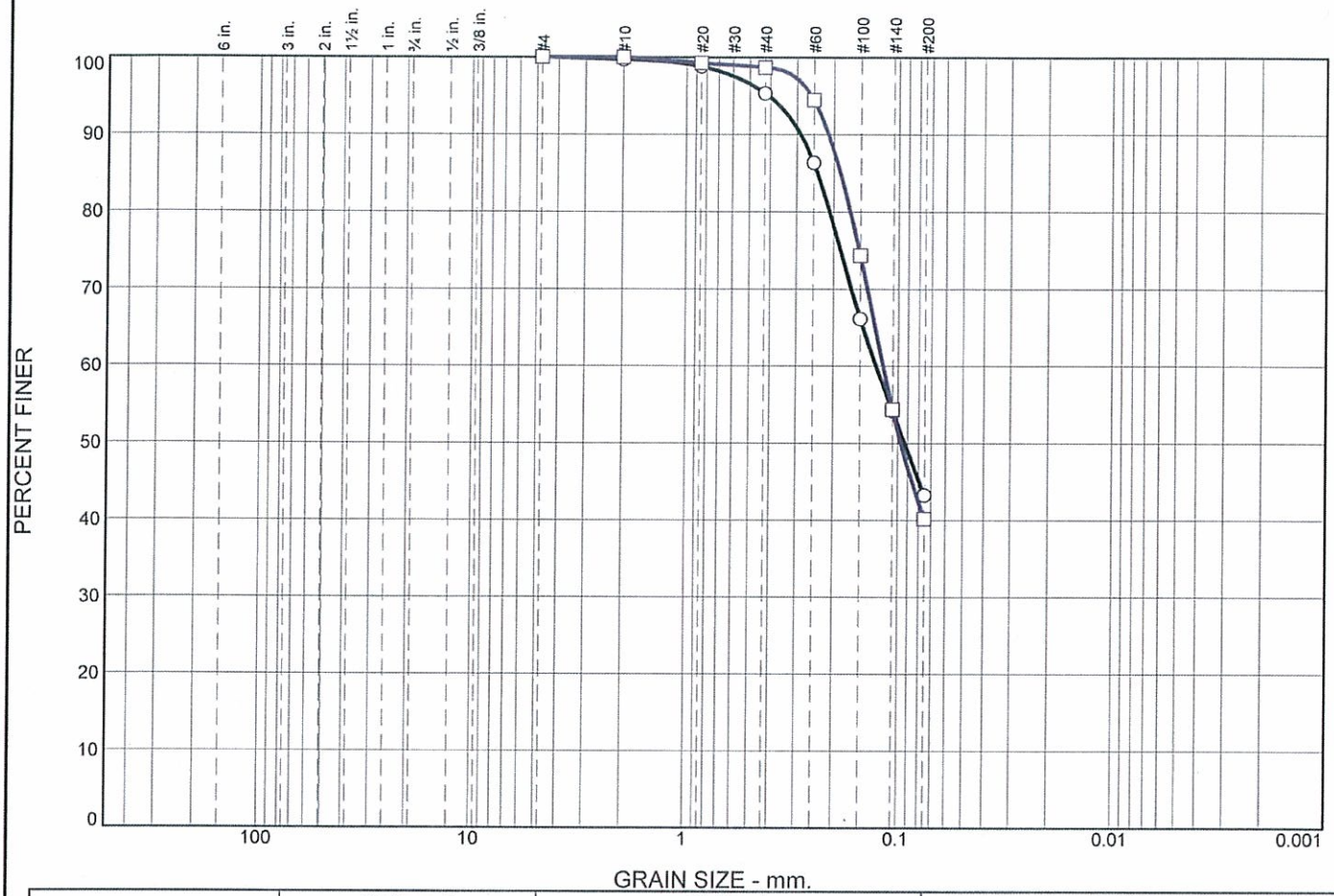
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.3	4.4	52.0	43.3	
□	0.0	0.0	0.0	0.0	1.3	58.6	40.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.2395	0.1266	0.0929					
□				0.1863	0.1175	0.0967					

Material Description	USCS	AASHTO
○ SILTY SAND, dark yellowish brown	SM	
□ SILTY SAND, dark yellowish brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT2

○ **Source of Sample:** SM0007_004H **Depth:** 0.0-5.0' **Sample Number:** 1A

□ **Source of Sample:** SM0007_004C **Depth:** 7.0-8.0' **Sample Number:** 2A

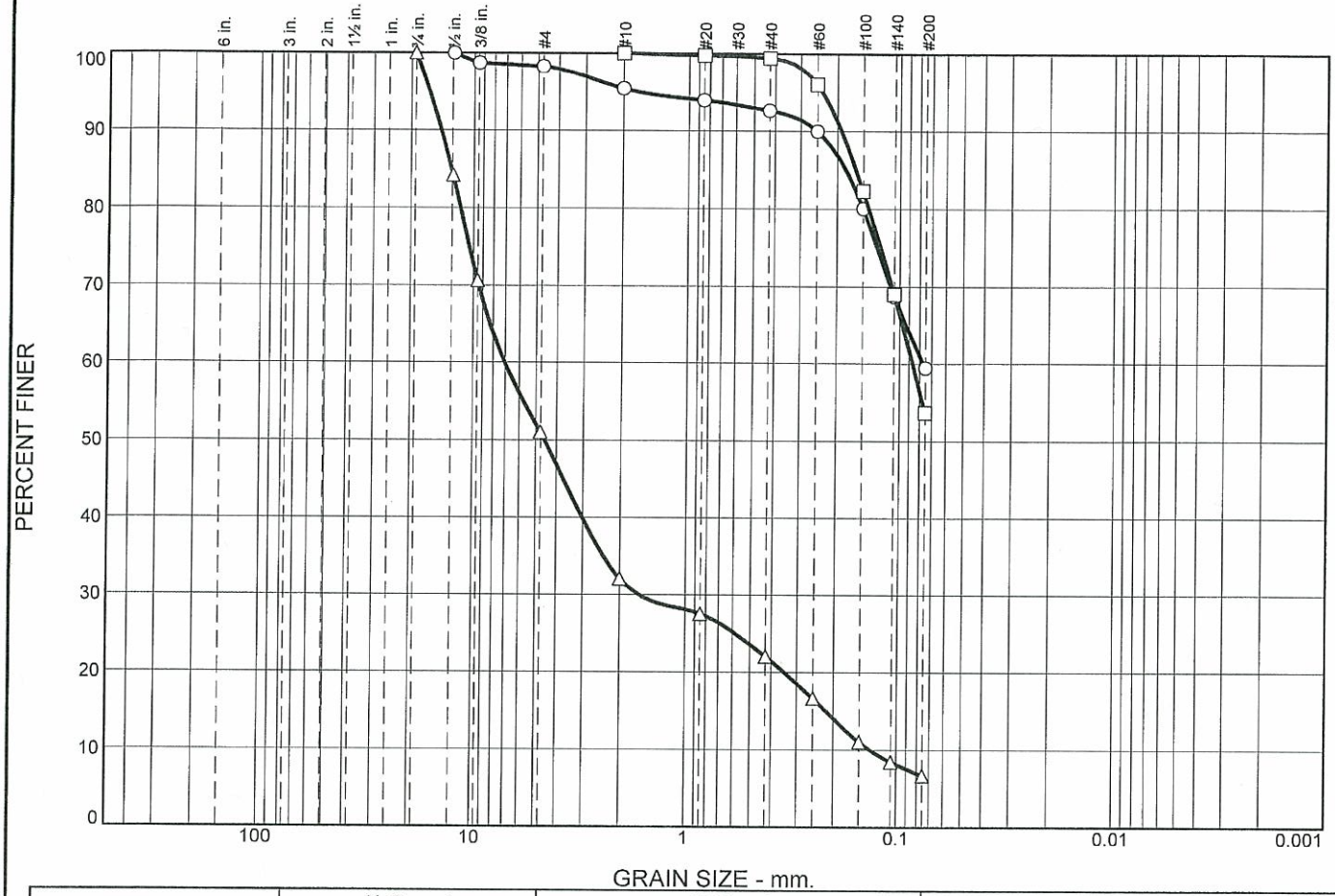
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.7	2.9	2.8	33.1	59.5	
□	0.0	0.0	0.0	0.0	0.6	45.8	53.6	
△	0.0	0.0	49.0	18.9	10.1	15.4	6.6	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1820	0.0767						
□				0.1626	0.0863						
△				12.7219	7.0180	4.5485	1.6375	0.2169	0.1334	2.86	52.61

Material Description	USCS	AASHTO
○ SANDY SILT, dark yellowish brown	ML	
□ SANDY SILT, dark yellowish brown	ML	
△ Well-graded GRAVEL with SILT and SAND, olive gray	GW-GM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_005A **Depth:** 9.5-11.0' **Sample Number:** 2

□ **Source of Sample:** SM0007_005A **Depth:** 29.0-29.5' **Sample Number:** 6A

△ **Source of Sample:** SM0007_005A **Depth:** 32.0-32.5' **Sample Number:** 7B

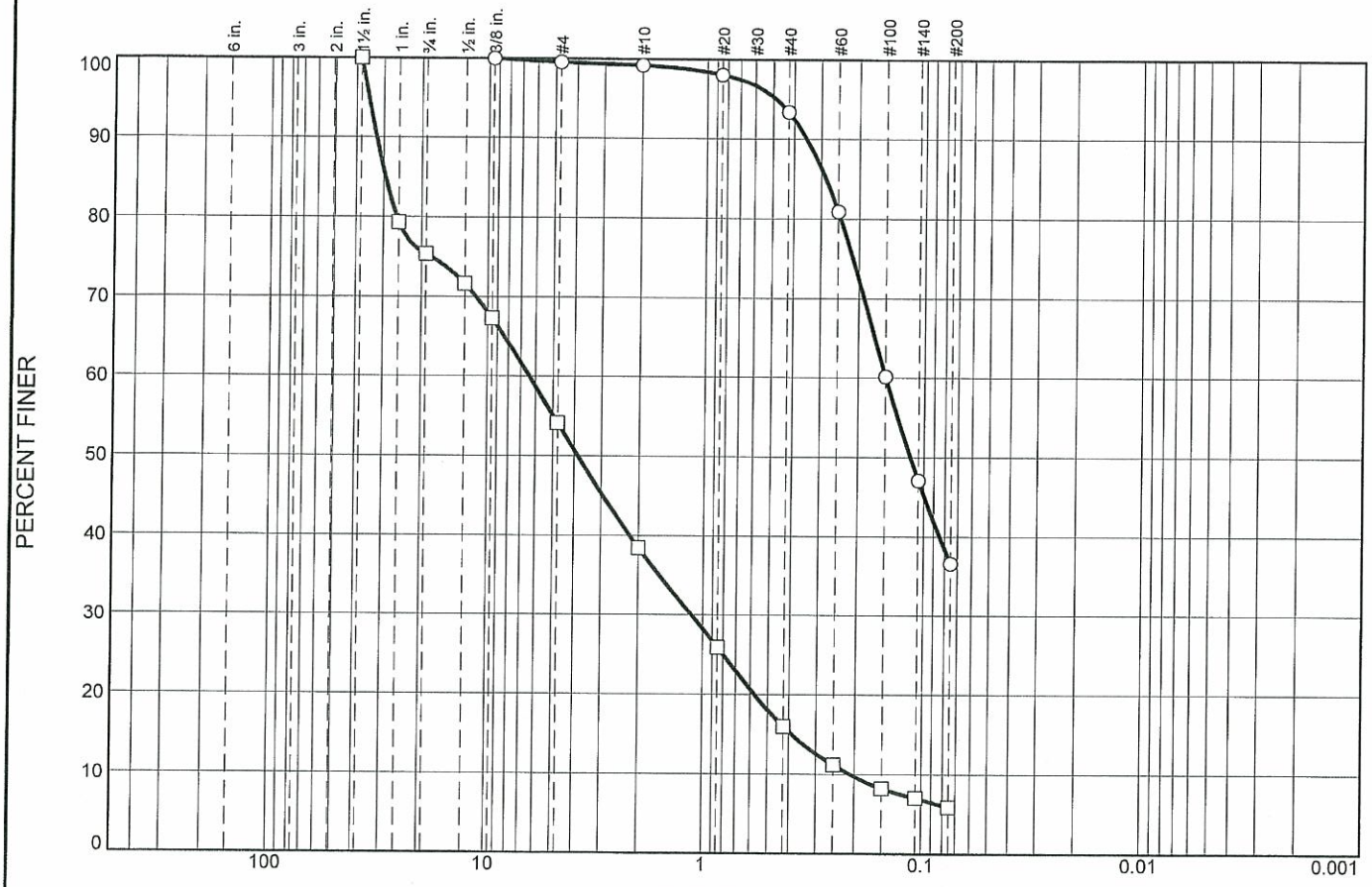
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	0.4	5.9	56.7	36.6	
□	0.0	24.6	21.3	15.7	22.4	10.2	5.8	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.2848	0.1494	0.1154					
□				29.3604	6.3978	3.8396	1.1281	0.3900	0.2109	0.94	30.34

Material Description	USCS	AASHTO
○ SILTY SAND, dark brown	SM	
□ Poorly-graded SAND with SILT and GRAVEL, olive brown	SP-SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_005B **Depth:** 5.0-5.5' **Sample Number:** 3A

□ **Source of Sample:** SM0007_005B **Depth:** 22.5-24.0' **Sample Number:** 8

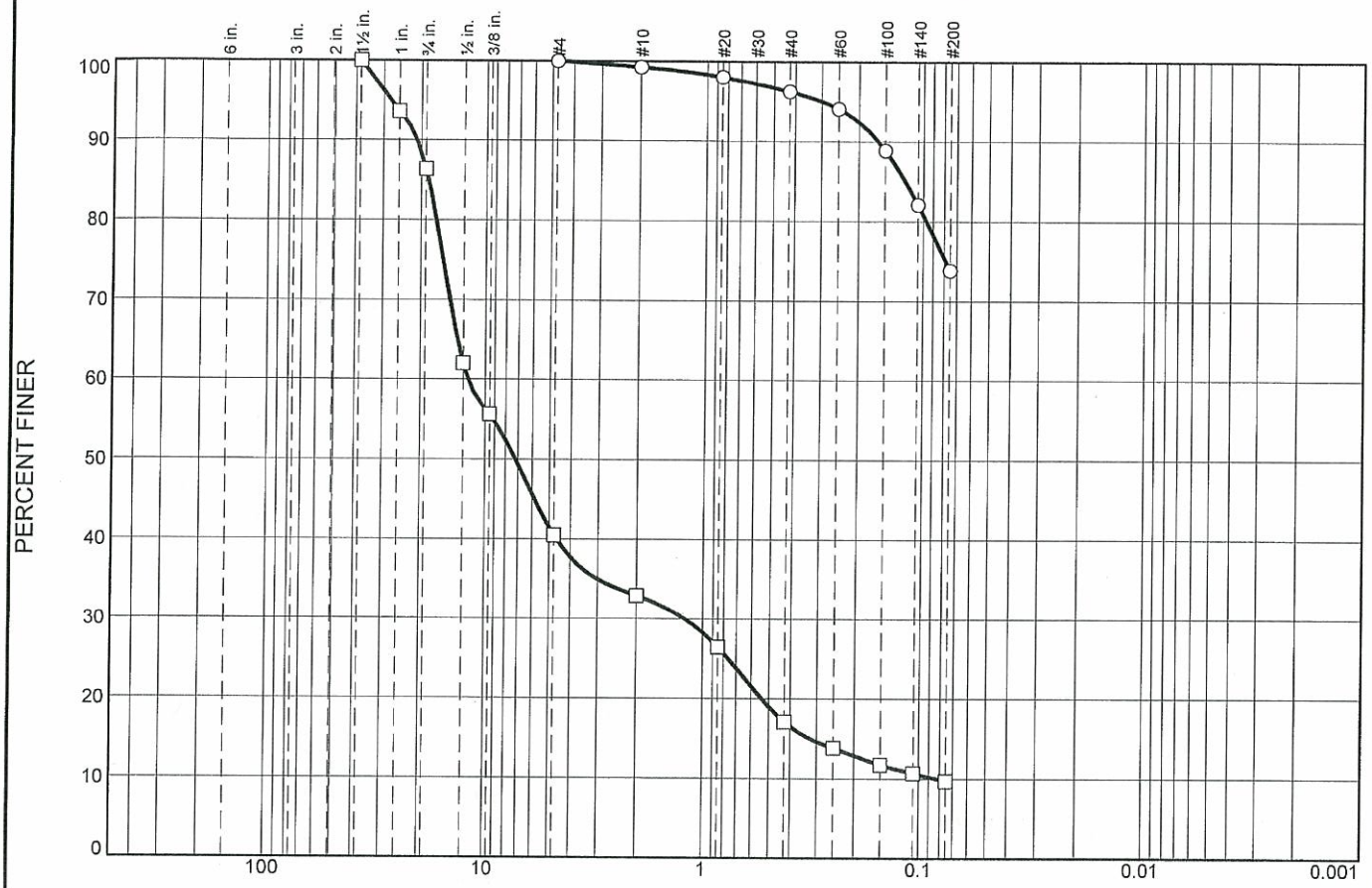
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.7	3.1	22.3	73.9	
□	0.0	13.6	45.9	7.6	15.8	7.4	9.7	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		48	24	0.1213							
□				18.5221	12.0205	7.2049	1.2124	0.3219	0.0835	1.46	143.97

Material Description	USCS	AASHTO
○ Lean CLAY with SAND, olive brown	CL	
□ Well-graded GRAVEL with CLAY and SAND, olive brown	GW-GC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_005B **Depth:** 35.0-36.5' **Sample Number:** 11

□ **Source of Sample:** SM0007_005B **Depth:** 45.0-46.5' **Sample Number:** 13

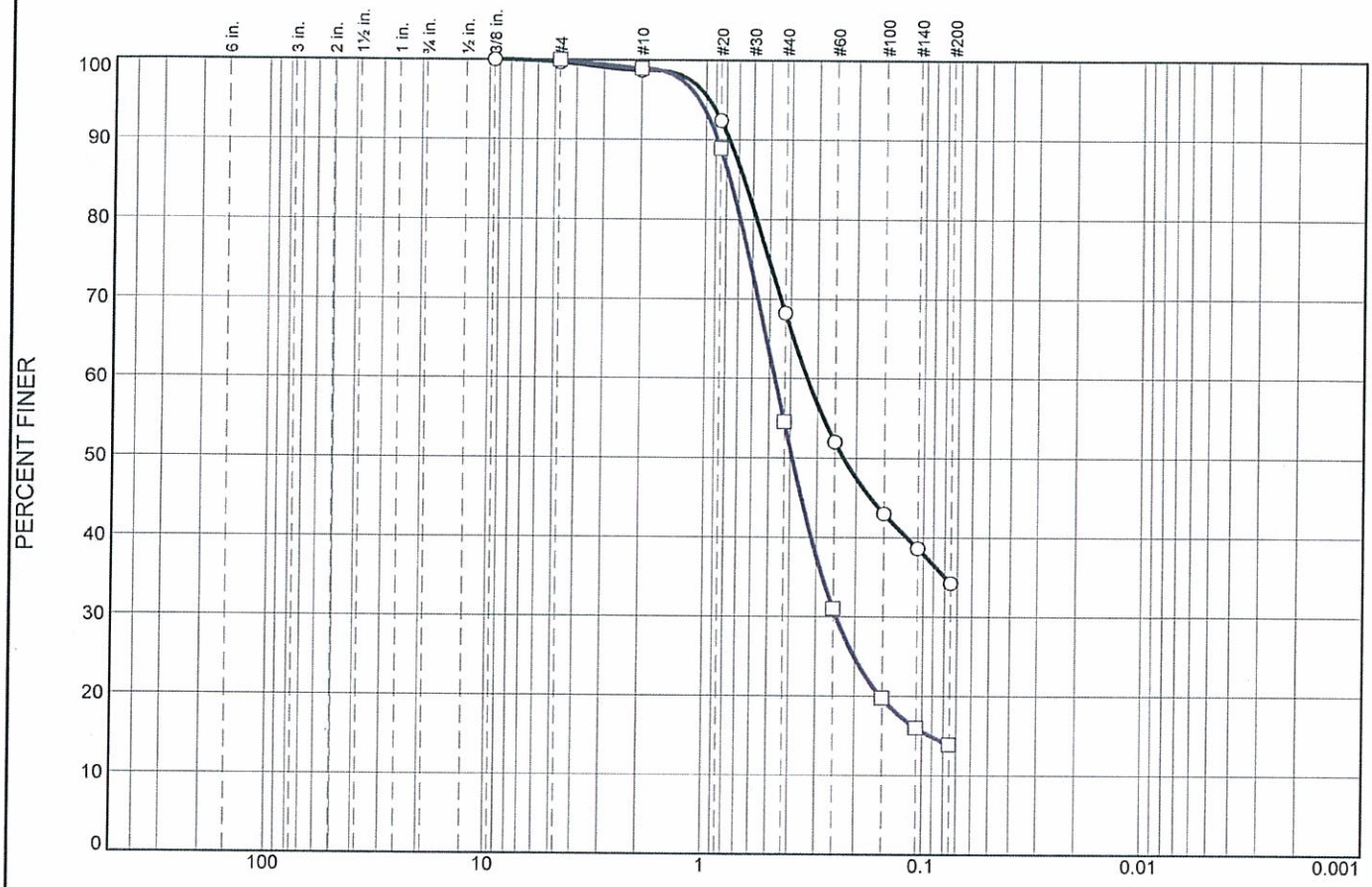
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.3	1.0	30.4	34.1	34.2	
□	0.0	0.0	0.0	1.1	44.3	40.7	13.9	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.6625	0.3340	0.2285					
□				0.7663	0.4699	0.3895	0.2423	0.0919			

Material Description	USCS	AASHTO
○ CLAYEY SAND, dark brown	SC	
□ SILTY SAND, dark reddish brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT2

○ **Source of Sample:** SM0007_005H **Depth:** 0.0-5.0' **Sample Number:** 1A

□ **Source of Sample:** SM0007_005C **Depth:** 6.0-7.0' **Sample Number:** 2A

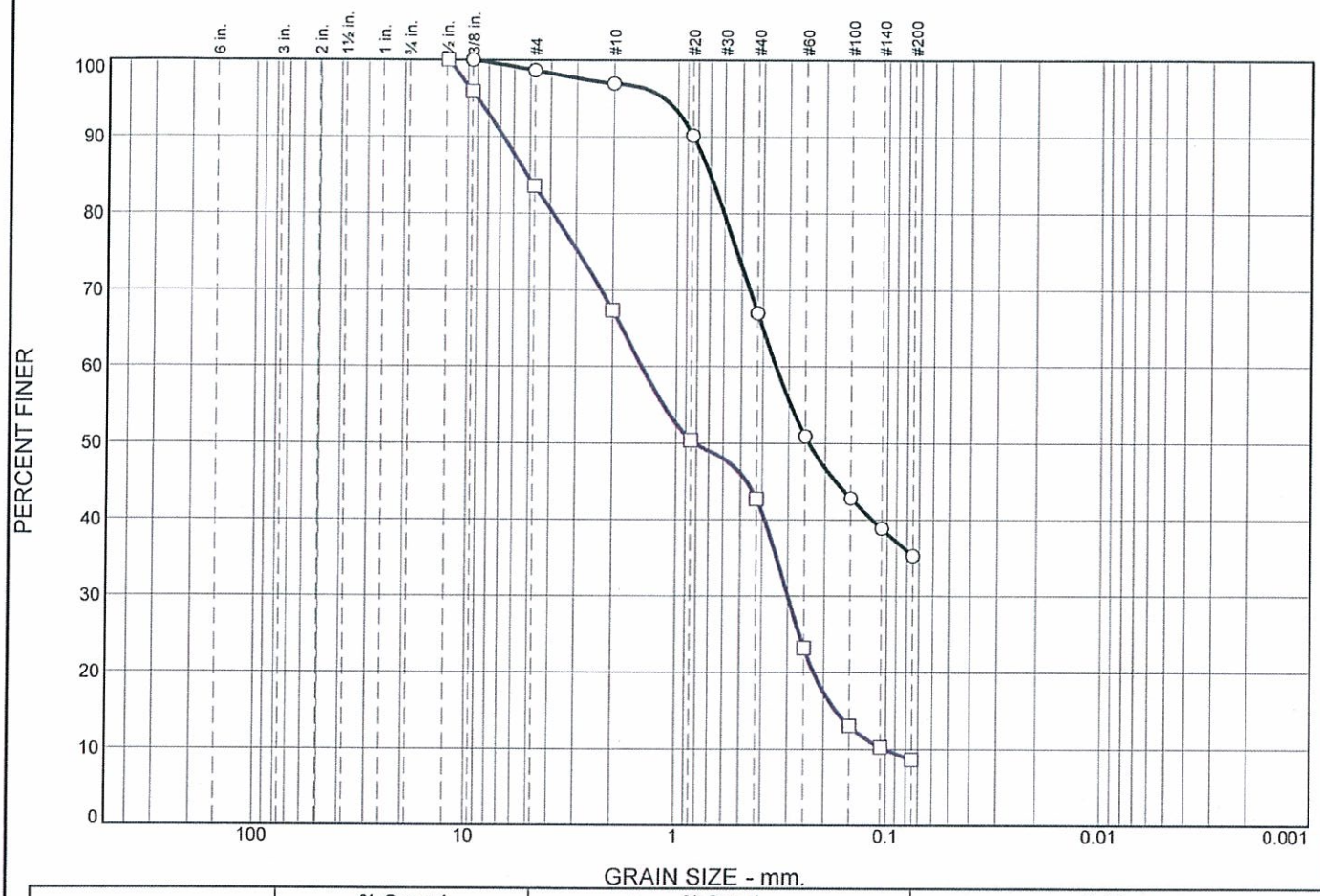
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.4	1.7	29.8	31.8	35.3	
□	0.0	0.0	16.4	16.2	24.7	34.1	8.6	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.7025	0.3463	0.2396					
□				5.1357	1.4498	0.8151	0.3000	0.1751	0.1017	0.61	14.26

Material Description	USCS	AASHTO
○ CLAYEY SAND, dark brown	SC	
□ Poorly-graded SAND with SILT and GRAVEL, dark olive brown	SP-SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT2

○ **Source of Sample:** SM0007_005C **Depth:** 8.0-9.0' **Sample Number:** 3A

□ **Source of Sample:** SM0007_005C **Depth:** 13.0-14.0' **Sample Number:** 4A

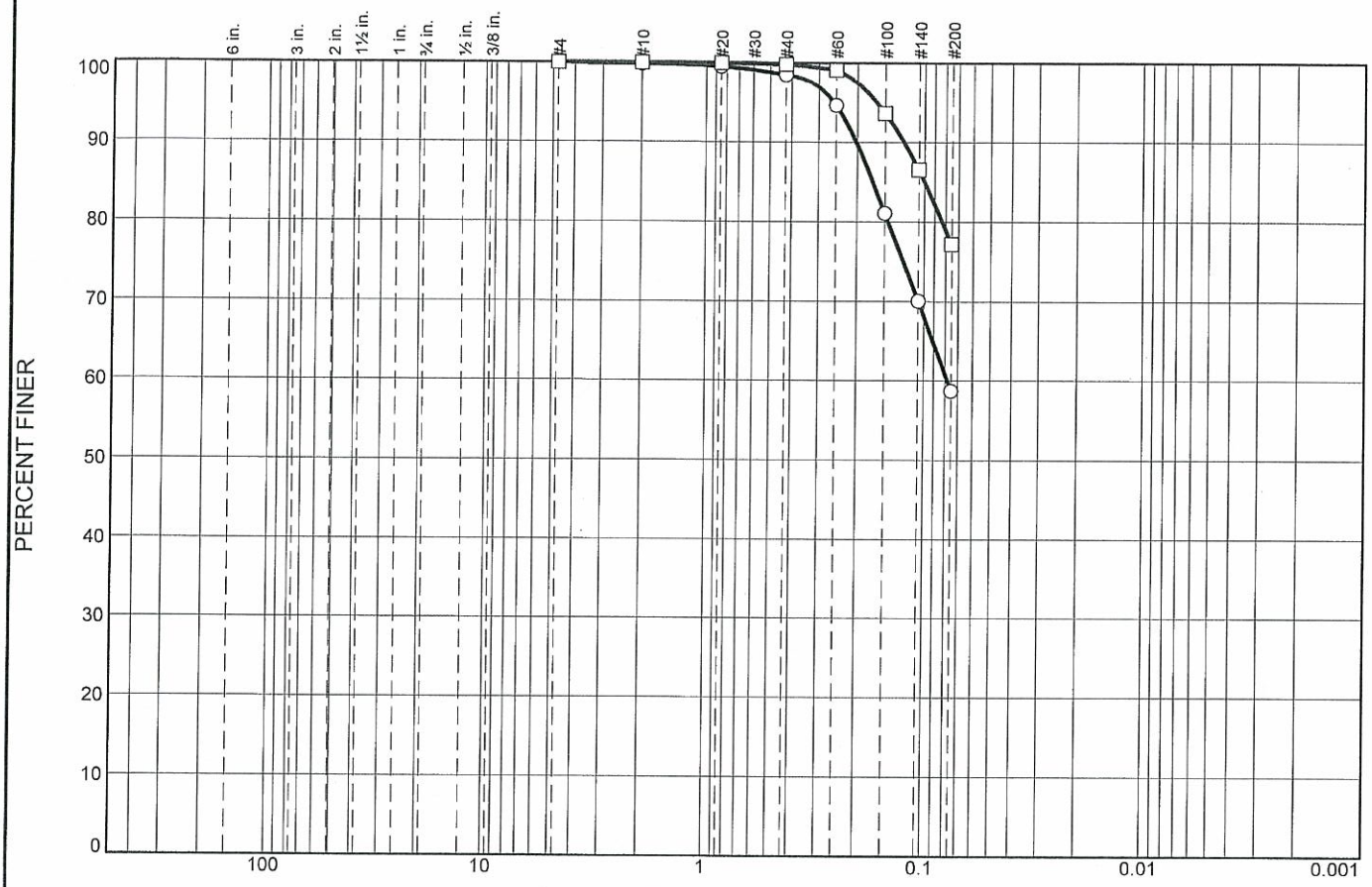
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	1.4	39.7	58.7	
□	0.0	0.0	0.0	0.0	0.3	22.5	77.2	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1702	0.0780						
□				0.0998							

Material Description	USCS	AASHTO
○ SANDY SILT, dark olive brown	ML	
□ SILT with SAND, dark olive brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_006A **Depth:** 10.5-11.0' **Sample Number:** 5A

□ **Source of Sample:** SM0007_006A **Depth:** 23.0-24.5' **Sample Number:** 10

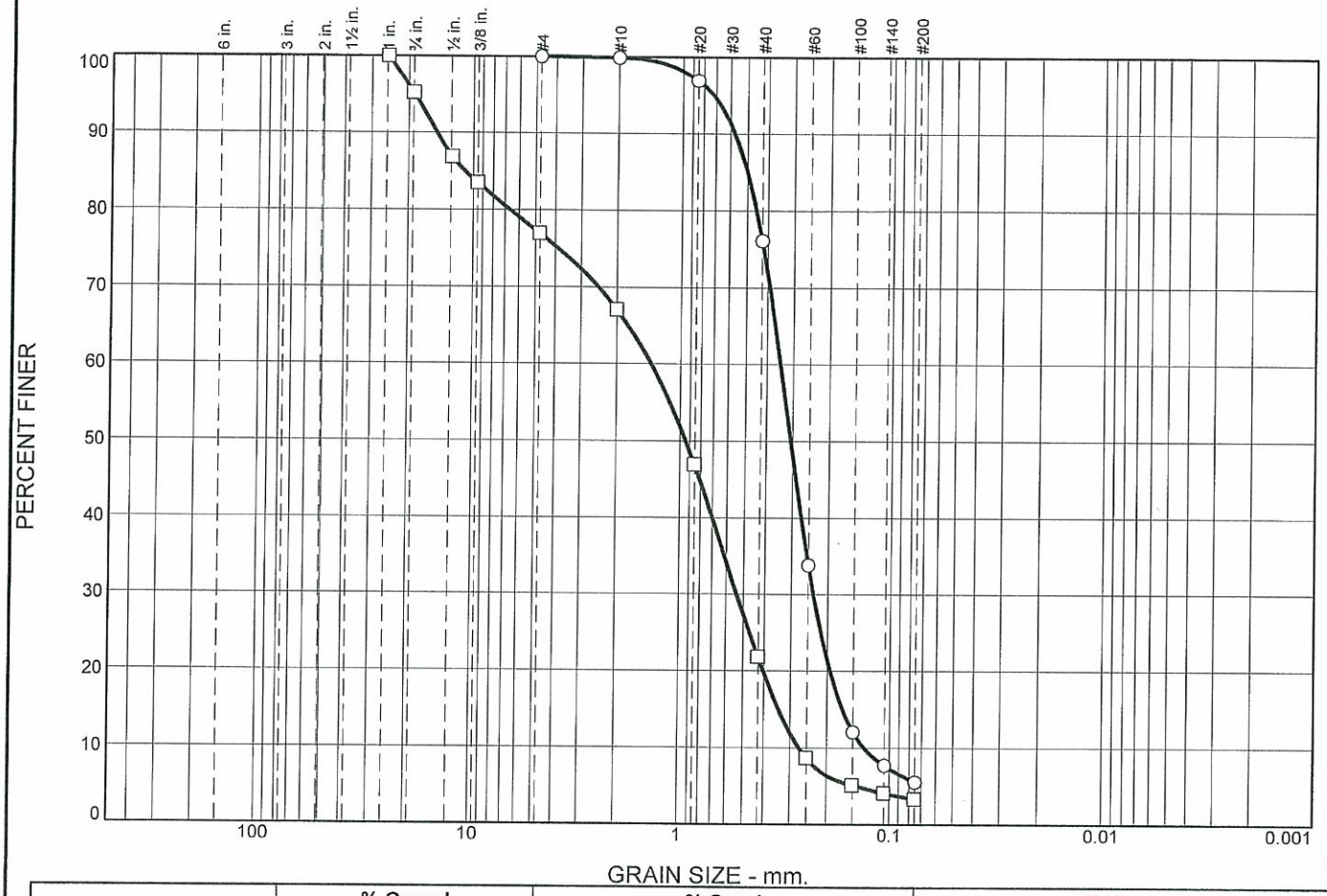
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	23.8	70.6	5.5	
□	0.0	4.8	18.2	9.9	45.3	18.5	3.3	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.5003	0.3446	0.3065	0.2360	0.1690	0.1332	1.21	2.59
□				10.9009	1.3708	0.9365	0.5347	0.3388	0.2714	0.77	5.05

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, olive brown	SP-SM	
□ Poorly-graded SAND with GRAVEL, olive	SP	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_006A **Depth:** 28.5-30.0' **Sample Number:** 12

□ **Sample Source:** SM0007_006A **Depth:** 32.0-33.0' **Sample No.:** 13B

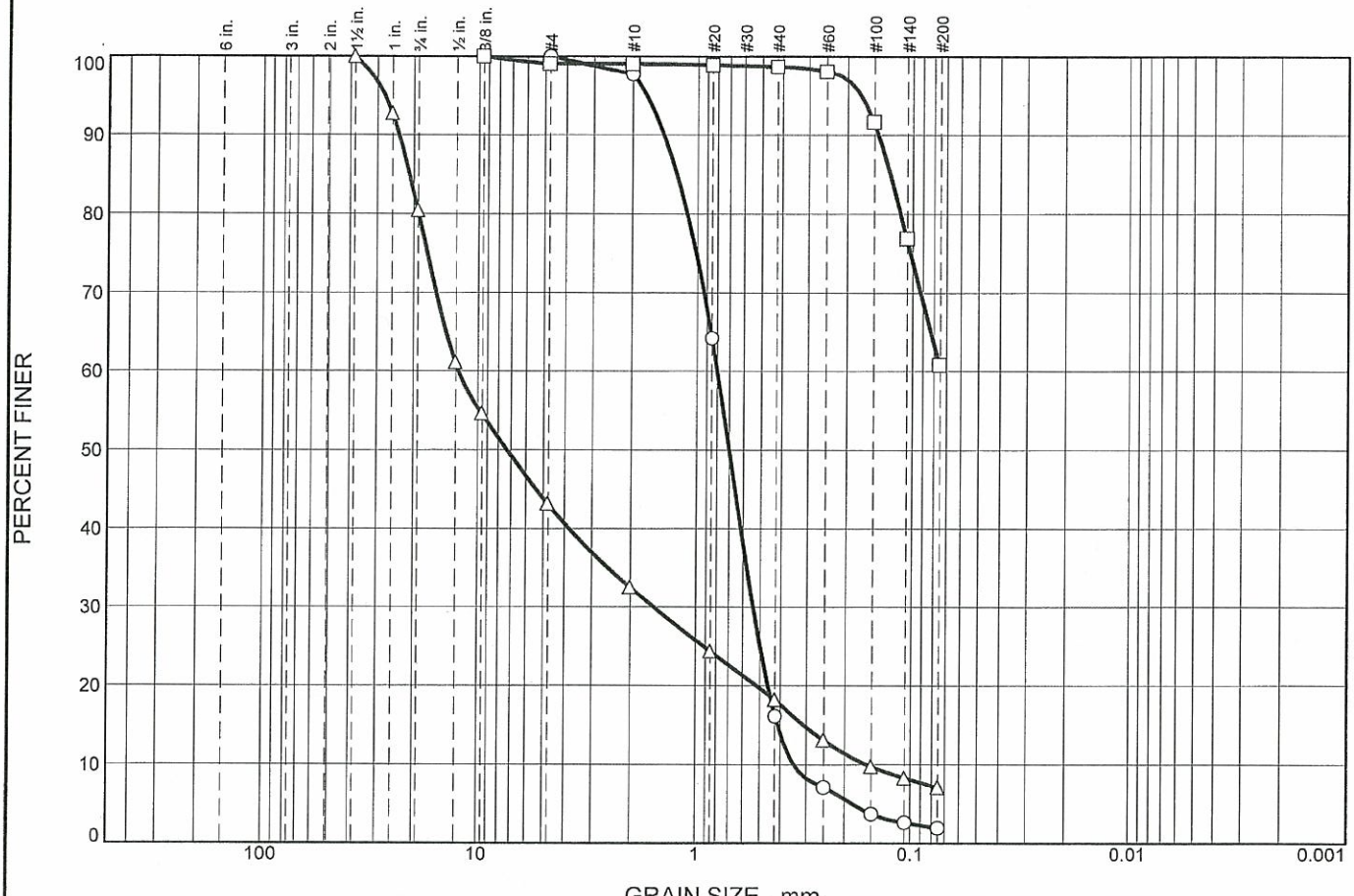
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	2.3	81.6	14.2	1.9	
□	0.0	0.0	1.0	0.0	0.3	37.9	60.8	
△	0.0	19.5	37.3	10.6	14.4	11.1	7.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				1.2496	0.8006	0.7015	0.5391	0.4133	0.3446	1.05	2.32
□				0.1261							
△				20.9013	12.2551	7.2492	1.5519	0.3070	0.1581	1.24	77.53

Material Description	USCS	AASHTO
○ Poorly-graded SAND, olive	SP	
□ SANDY SILT, dark yellowish brown	ML	
△ Well-graded GRAVEL with CLAY and SAND, olive brown	GW-GC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_006B **Depth:** 15.0-15.5' **Sample Number:** 8A

□ **Source of Sample:** SM0007_006B **Depth:** 5.0-5.5' **Sample Number:** 3A

△ **Source of Sample:** SM0007_006B **Depth:** 19.5-21.0' **Sample Number:** 10

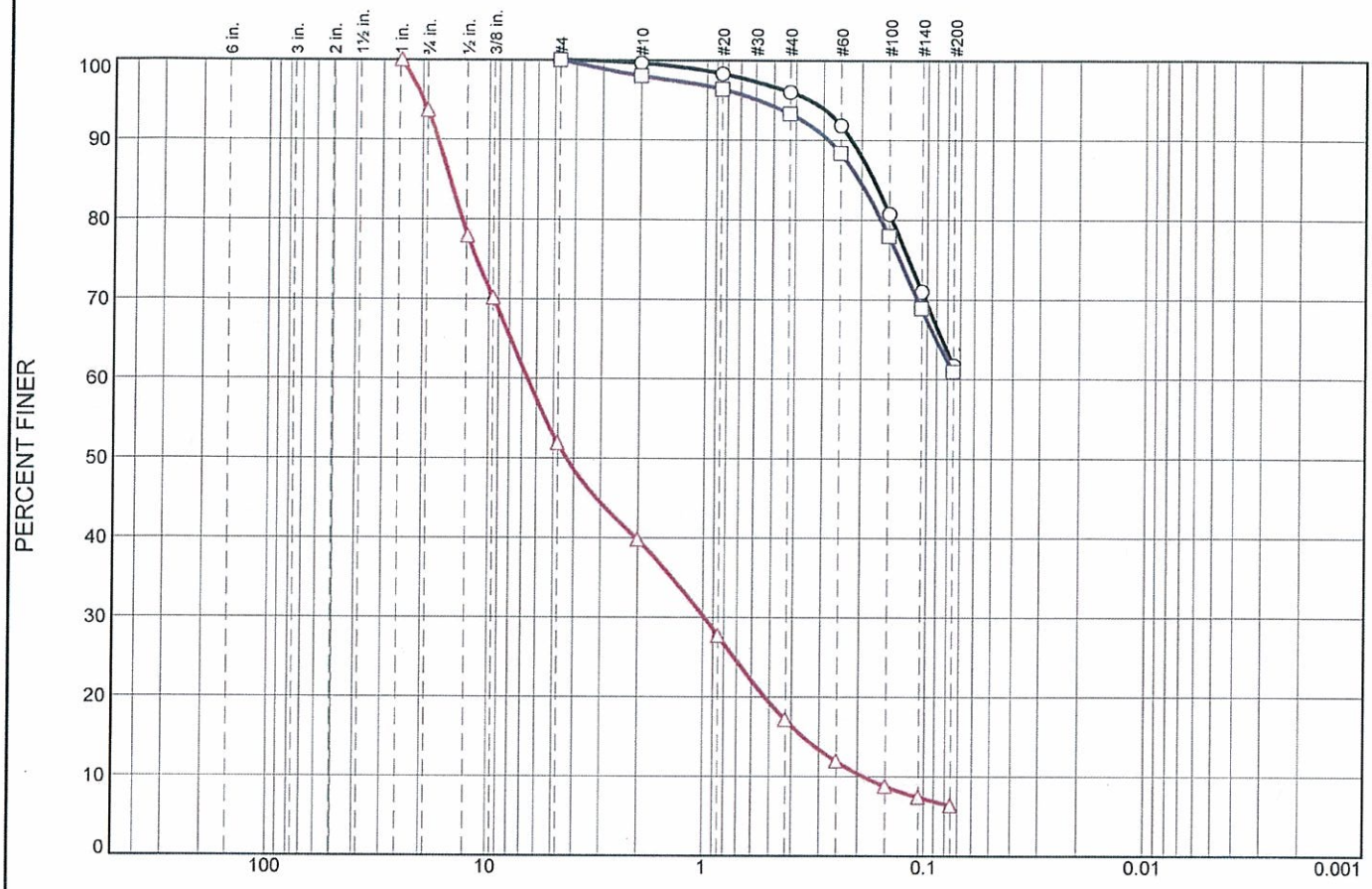
Date: ○ □ △

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.4	3.6	34.2	61.8	
□	0.0	0.0	0.0	2.0	4.7	32.3	61.0	
△	0.0	6.2	41.9	12.1	22.7	10.7	6.4	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1768							
□				0.2051							
△				15.0293	6.5744	4.3171	0.9818	0.3526	0.1881	0.78	34.95

Material Description	USCS	AASHTO
○ SANDY SILT, dark reddish brown	ML	
□ SANDY SILT, strong brown	ML	
△ Poorly-graded GRAVEL with SILT and SAND	GP-GM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT2

○ **Source of Sample:** SM0007_006H **Depth:** 0.0-5.0' **Sample Number:** 1A

□ **Source of Sample:** SM0007_006C **Depth:** 7.0-8.0' **Sample Number:** 2A

△ **Source of Sample:** SM0007_006C **Depth:** 10.5-11.5' **Sample Number:** 3A

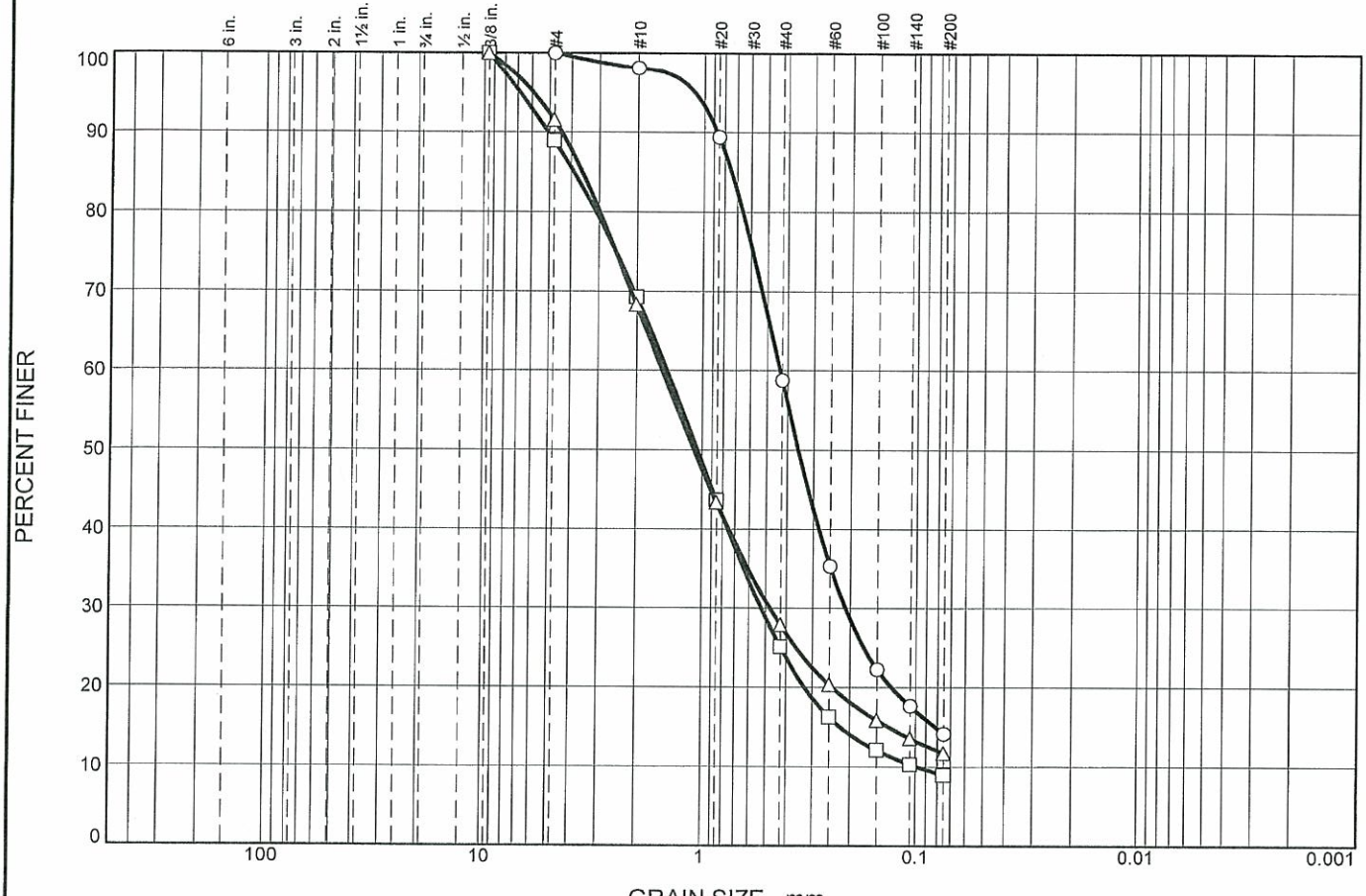
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.9	39.3	44.6	14.2	
□	0.0	0.0	11.1	19.6	44.2	16.2	8.9	
△	0.0	0.0	8.5	23.2	40.4	16.2	11.7	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.7453	0.4354	0.3545	0.2114	0.0818			
□				3.8718	1.4511	1.0470	0.5228	0.2224	0.0993	1.90	14.61
△				3.5474	1.5223	1.0827	0.4755	0.1328			

Material Description	USCS	AASHTO
○ CLAYEY SAND, dark yellowish brown	SC	
□ Well-graded SAND with CLAY, dark yellowish brown	SW-SC	
△ Well-graded SAND with CLAY, dark yellowish brown	SW-SC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_008B **Depth:** 2.5-4.0' **Sample Number:** 2

□ **Source of Sample:** SM0007_008B **Depth:** 12.5-14.0' **Sample Number:** 6

△ **Source of Sample:** SM0007_008B **Depth:** 17.5-19.0' **Sample Number:** 8

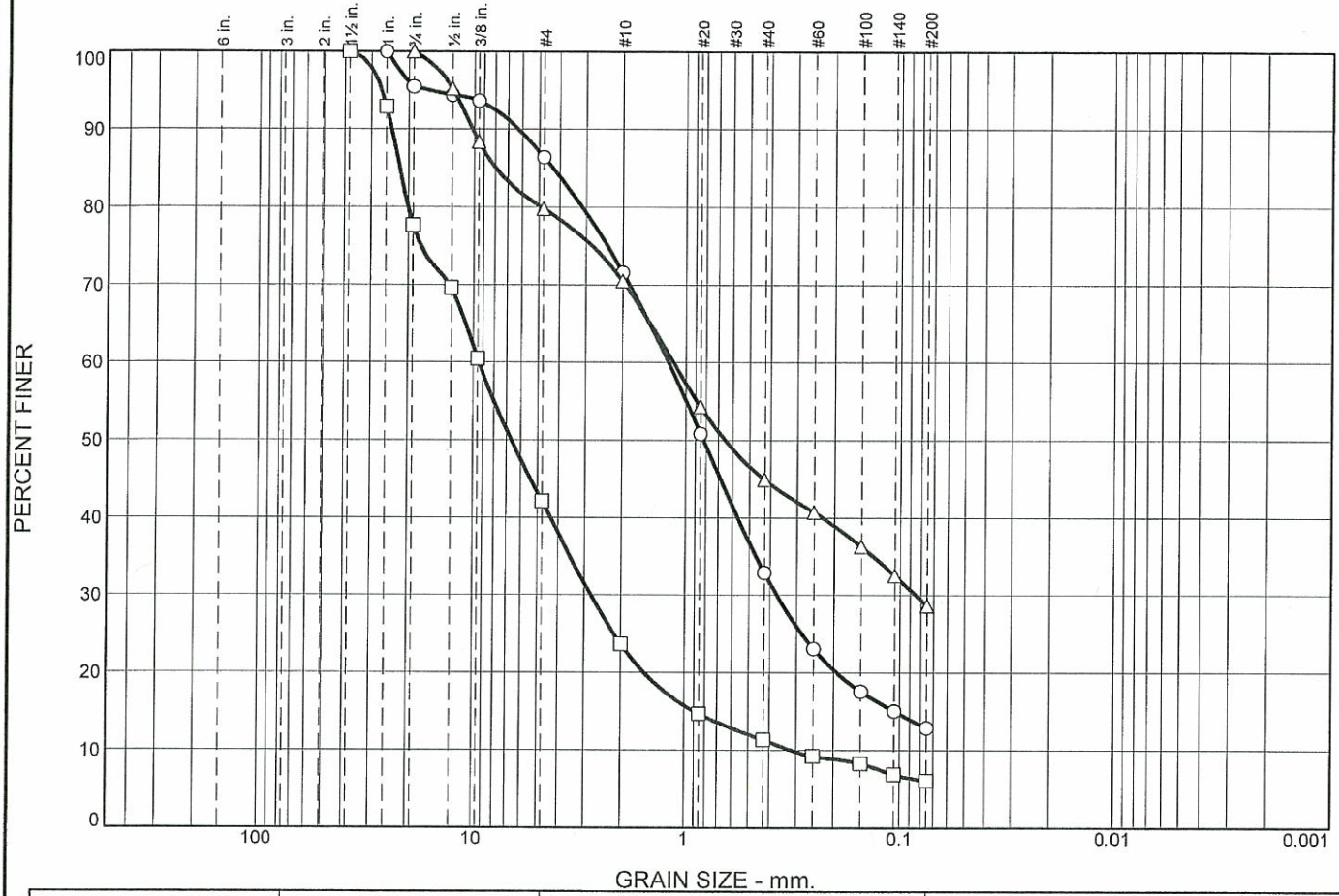
Date: ○ □ △

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.6	9.0	14.8	38.7	20.0	12.9	
□	0.0	22.4	35.5	18.5	12.3	5.2	6.1	
△	0.0	0.0	20.2	9.3	25.6	16.3	28.6	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				4.3181	1.2096	0.8240	0.3714	0.1054			
□				21.9477	9.3988	6.6483	2.7877	0.8999	0.3168	2.61	29.67
△				7.9608	1.1460	0.6508	0.0845				

Material Description	USCS	AASHTO
○ CLAYEY SAND, dark yellowish brown	SC	
□ Well-graded GRAVEL with CLAY and SAND, dark yellowish brown	GW-GC	
△ CLAYEY SAND with GRAVEL, dark yellowish brown	SC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_008B **Depth:** 22.3-24.0' **Sample Number:** 10

□ **Source of Sample:** SM0007_008B **Depth:** 30.0-31.5' **Sample Number:** 13

△ **Source of Sample:** SM0007_008B **Depth:** 40.0-41.5 **Sample Number:** 16

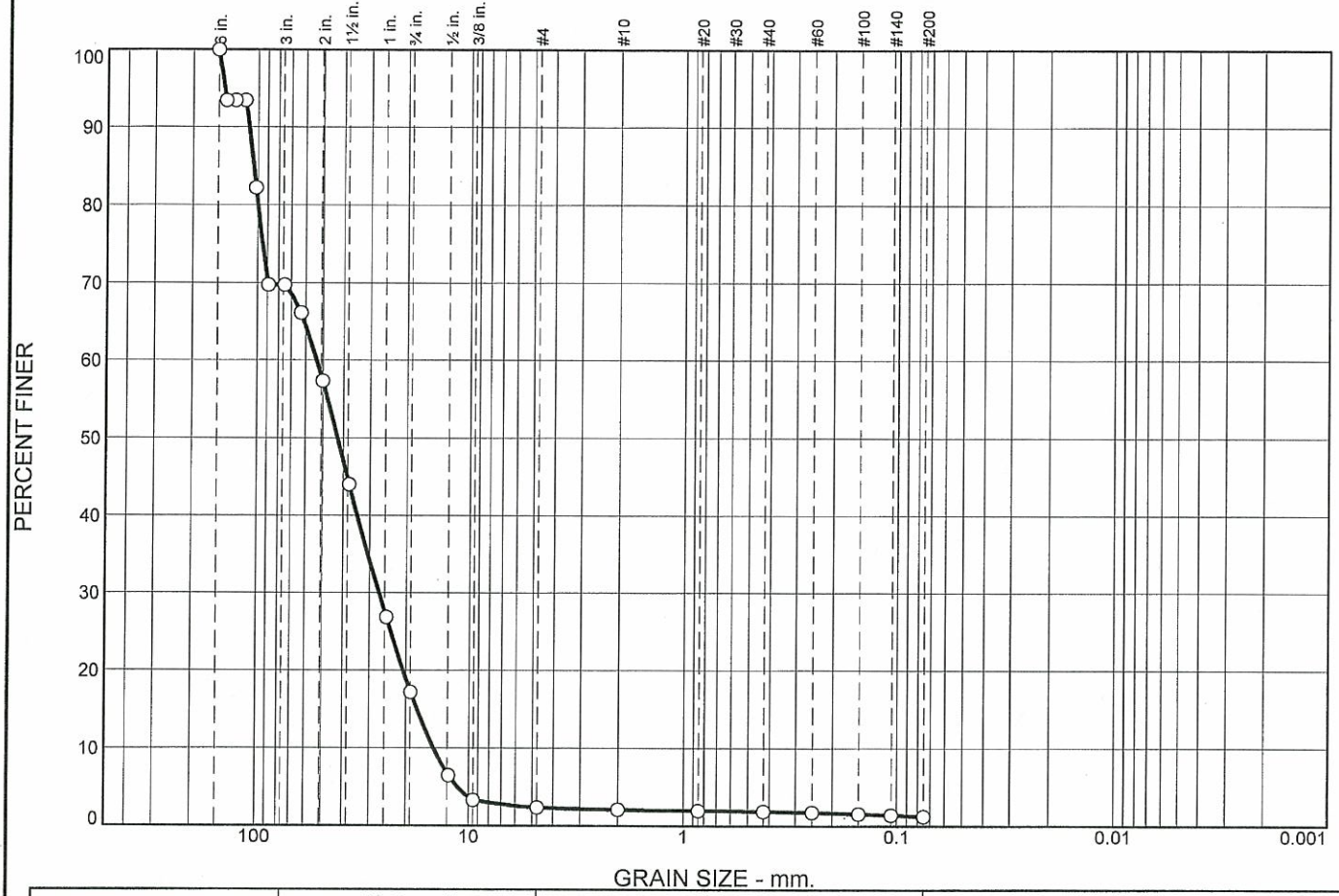
Date: ○ □ △

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	30.3	52.4	15.0	0.2	0.3	0.6	1.2	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				104.0357	53.3425	42.5638	27.1091	17.7152	14.7772	0.93	3.61

Material Description	USCS	AASHTO
○ Poorly-graded GRAVEL, dark gray, gray brown, and brown	GP	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SM0007_009B **Depth:** 1.5-5.0' **Sample Number:** 2

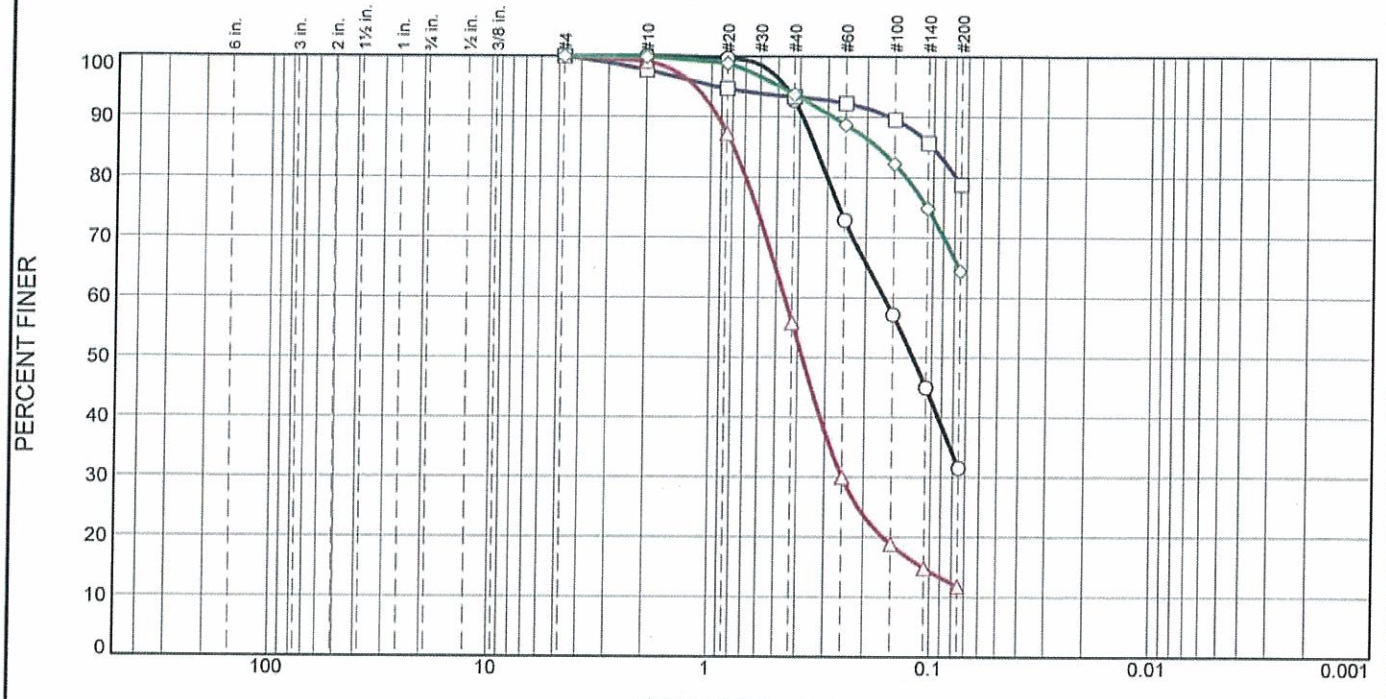
Date: ○ 11-23-10

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	7.3	61.2	31.5	
□	0.0	0.0	0.0	2.3	4.4	14.6	78.7	
△	0.0	0.0	0.0	0.8	43.4	44.0	11.8	
◇	0.0	0.0	0.0	0.1	6.2	29.4	64.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3400	0.1648	0.1214					
□			0.1022							
△			0.7950	0.4599	0.3819	0.2503	0.1081			
◇			0.1811							

Material Description	USCS	AASHTO
○ SILTY SAND, dark brown	SM	
□ SILT with SAND, dark yellowish brown	ML	
△ Well-graded SAND with SILT, gray	SW-SM	
◇ SANDY SILT, dark brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SM0016_001C **Depth:** 11.0-12.0' **Sample Number:** 1

□ **Source of Sample:** SM0016_001H **Depth:** 4.0-5.0' **Sample Number:** 2

△ **Source of Sample:** SM0016_003C **Depth:** 16.0-17.0' **Sample Number:** 1

◇ **Source of Sample:** SM0016_003H **Depth:** 4.0-5.0' **Sample Number:** 2

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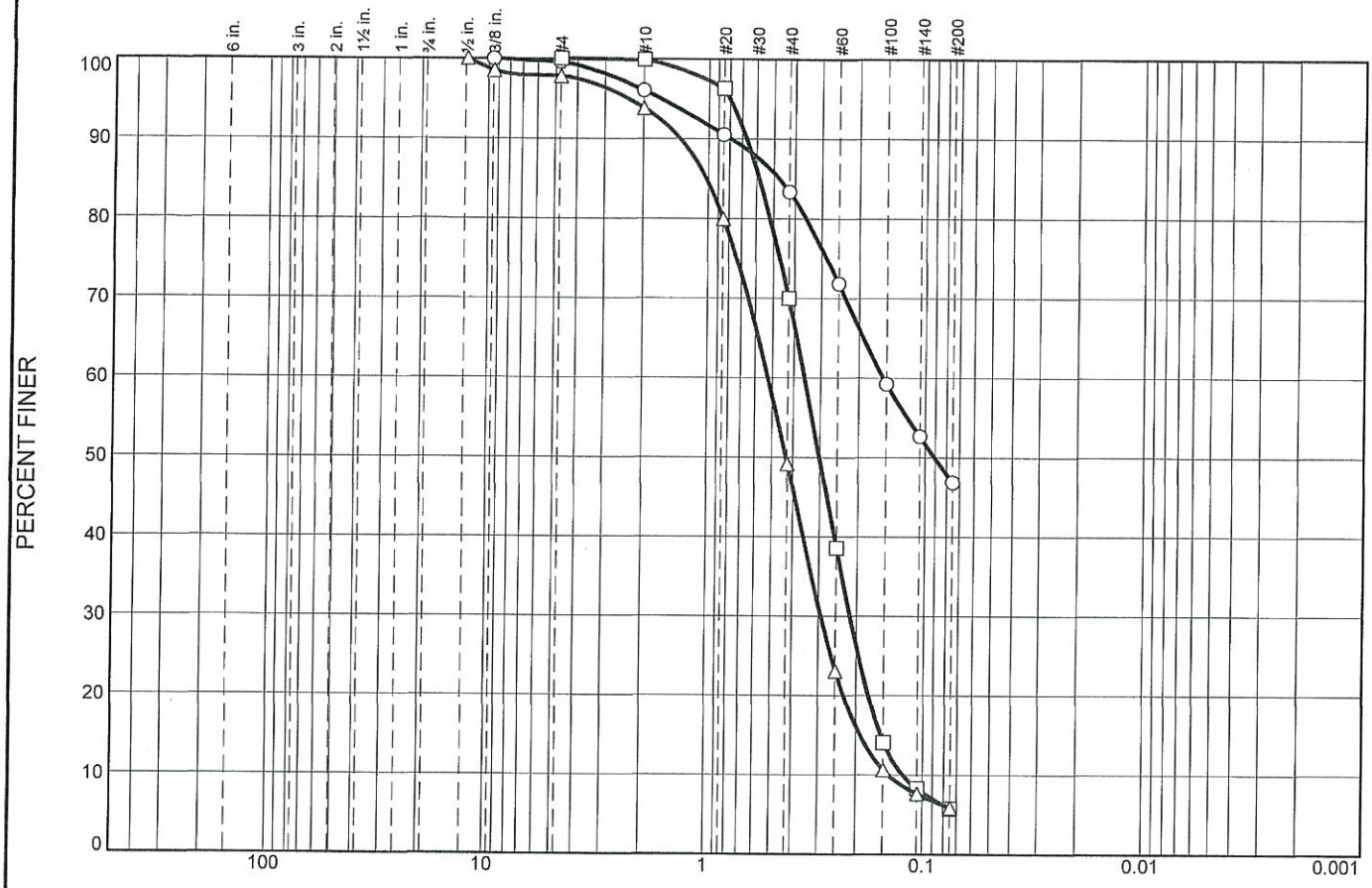
Remarks:

○ Cemented nodules did not fully break down in #200 wash with deflocculant and agitation

□ Cemented nodules did not fully break down in #200 wash with deflocculant and agitation

◇ Cemented nodules did not fully

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	3.5	12.7	36.5	46.9	
□	0.0	0.0	0.0	0.1	29.9	64.3	5.7	
△	0.0	0.0	2.2	4.0	44.6	43.4	5.8	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.4733	0.1553	0.0906					
□				0.5848	0.3564	0.3019	0.2155	0.1547	0.1237	1.05	2.88
△				1.0257	0.5249	0.4317	0.2936	0.1922	0.1430	1.15	3.67

Material Description	USCS	AASHTO
○ CLAYEY SAND, yellowish brown	SC	
□ Poorly-graded SAND with SILT, olive brown	SP-SM	
△ Poorly-graded SAND with CLAY, light olive brown	SP-SC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0009_001B **Depth:** 8.5-9.0' **Sample Number:** 4A

□ **Source of Sample:** SL0009_001B **Depth:** 13.5-14.0' **Sample Number:** 6A

△ **Source of Sample:** SL0009_001B **Depth:** 28.0-29.0' **Sample Number:** 12A

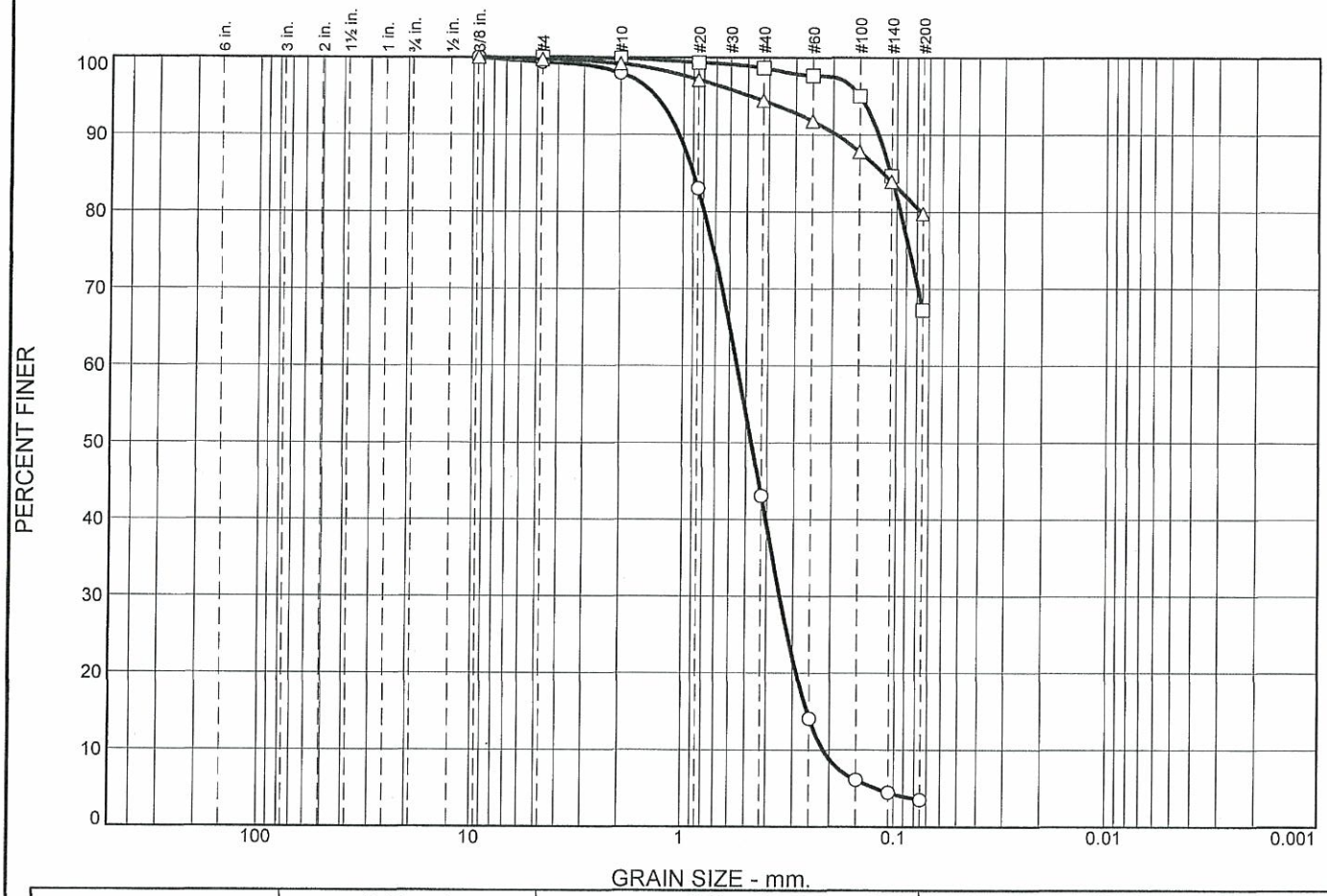
Date: ○ □ △

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.6	1.4	54.9	39.6	3.5	
□	0.0	0.0	0.0	0.1	1.3	31.4	67.2	
△	0.0	0.0	0.3	0.5	4.8	14.6	79.8	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.8943	0.5522	0.4725	0.3457	0.2564	0.2151	1.01	2.57
□				0.1069							
△				0.1164							

Material Description	USCS	AASHTO
○ Poorly-graded SAND, dark yellowish brown	SP	
□ SANDY SILT, yellowish brown	ML	
△ Lean CLAY with SAND, light olive brown	CL	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0009_001B **Depth:** 14.0-15.5' **Sample Number:** 7

□ **Source of Sample:** SL0009_001B **Depth:** 38.5-39.0' **Sample Number:** 15B

△ **Source of Sample:** SL0009_001B **Depth:** 6.0-6.5' **Sample Number:** 3A

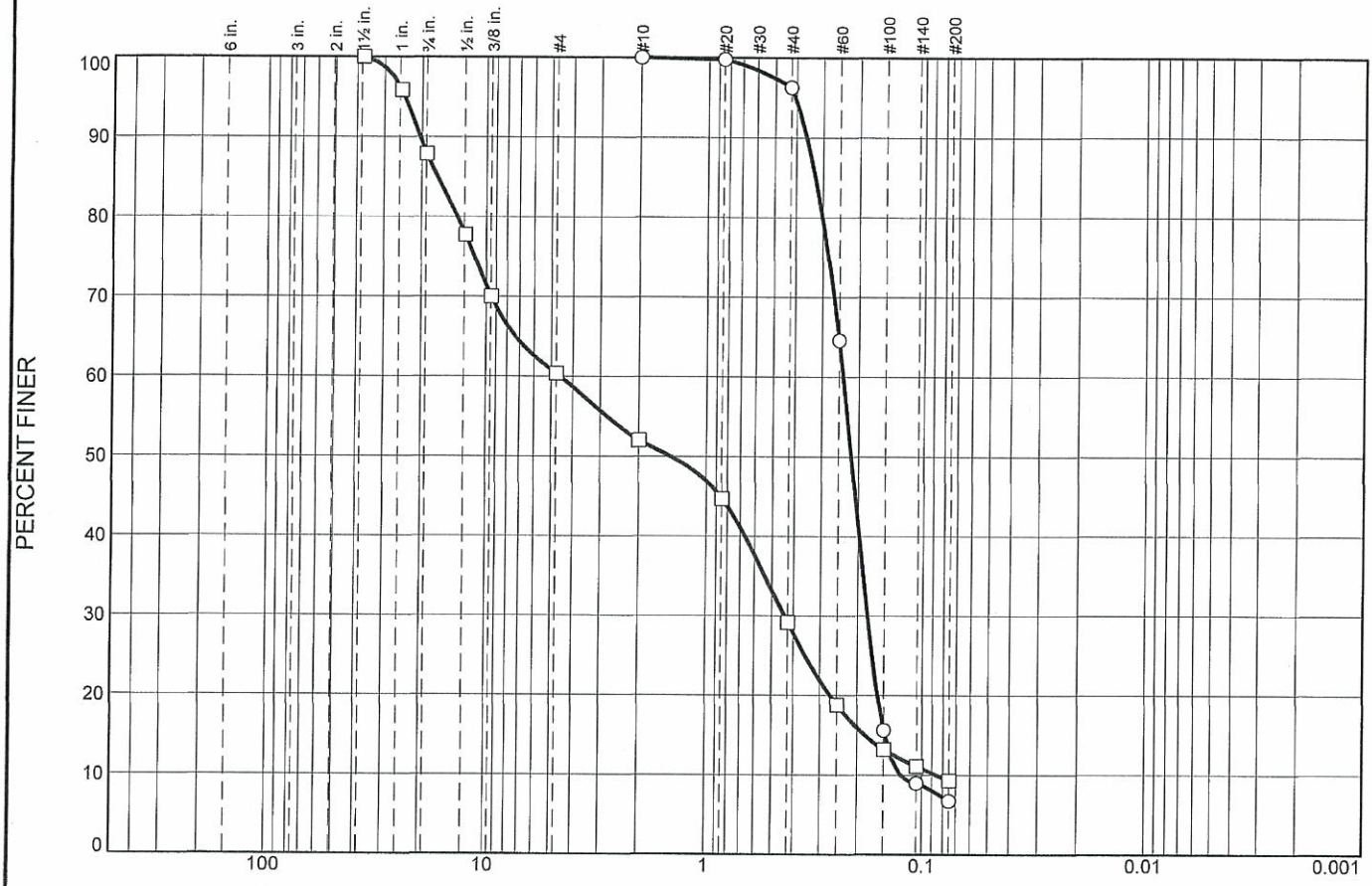
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	3.7	89.6	6.7	
□	0.0	12.1	27.5	8.4	22.9	19.9	9.2	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.3257	0.2387	0.2173	0.1800	0.1482	0.1254	1.08	1.90
□				17.0214	4.5680	1.4491	0.4411	0.1847	0.0867	0.49	52.69

Material Description	USCS	AASHTO
○ Poorly-graded SAND with CLAY, olive yellow	SP-SC	
□ Poorly-graded SAND with CLAY and GRAVEL, light olive gray	SP-SC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0009_001B **Depth:** 45.0-46.5' **Sample Number:** 19A

□ **Source of Sample:** SL0009_001B **Depth:** 55.0-56.5' **Sample Number:** 23A

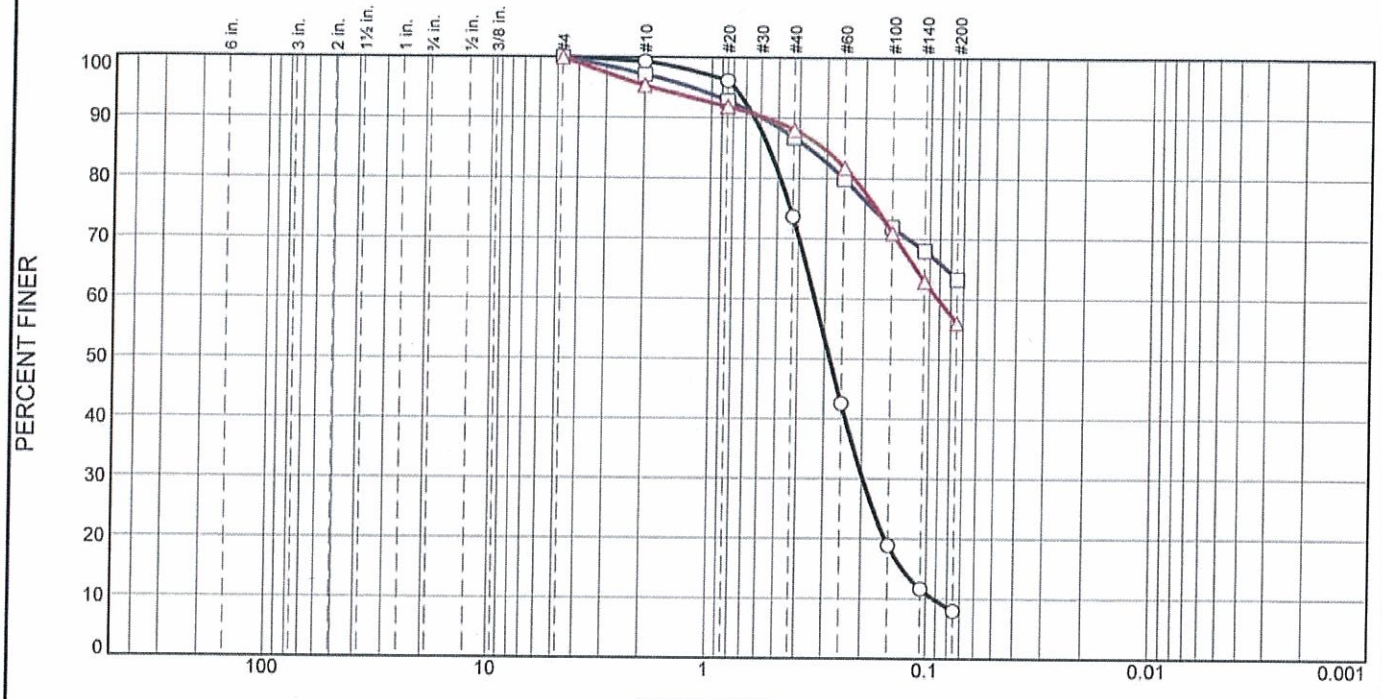
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.7	25.7	65.6	8.0	
□	0.0	0.0	0.0	2.9	10.3	23.5	63.3	
△	0.0	0.0	0.0	4.6	7.4	32.0	56.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5512	0.3338	0.2832	0.1977	0.1291	0.0925	1.27	3.61
□			0.3639							
△			0.3129	0.0921						

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, yellowish brown	SP-SM	
□ SANDY SILT, dark yellowish brown	ML	
△ SANDY SILT, dark yellowish brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0009_001C **Depth:** 9.0-10.0' **Sample Number:** 1

□ **Source of Sample:** SL0009_001H **Depth:** 4.0-5.0' **Sample Number:** 2

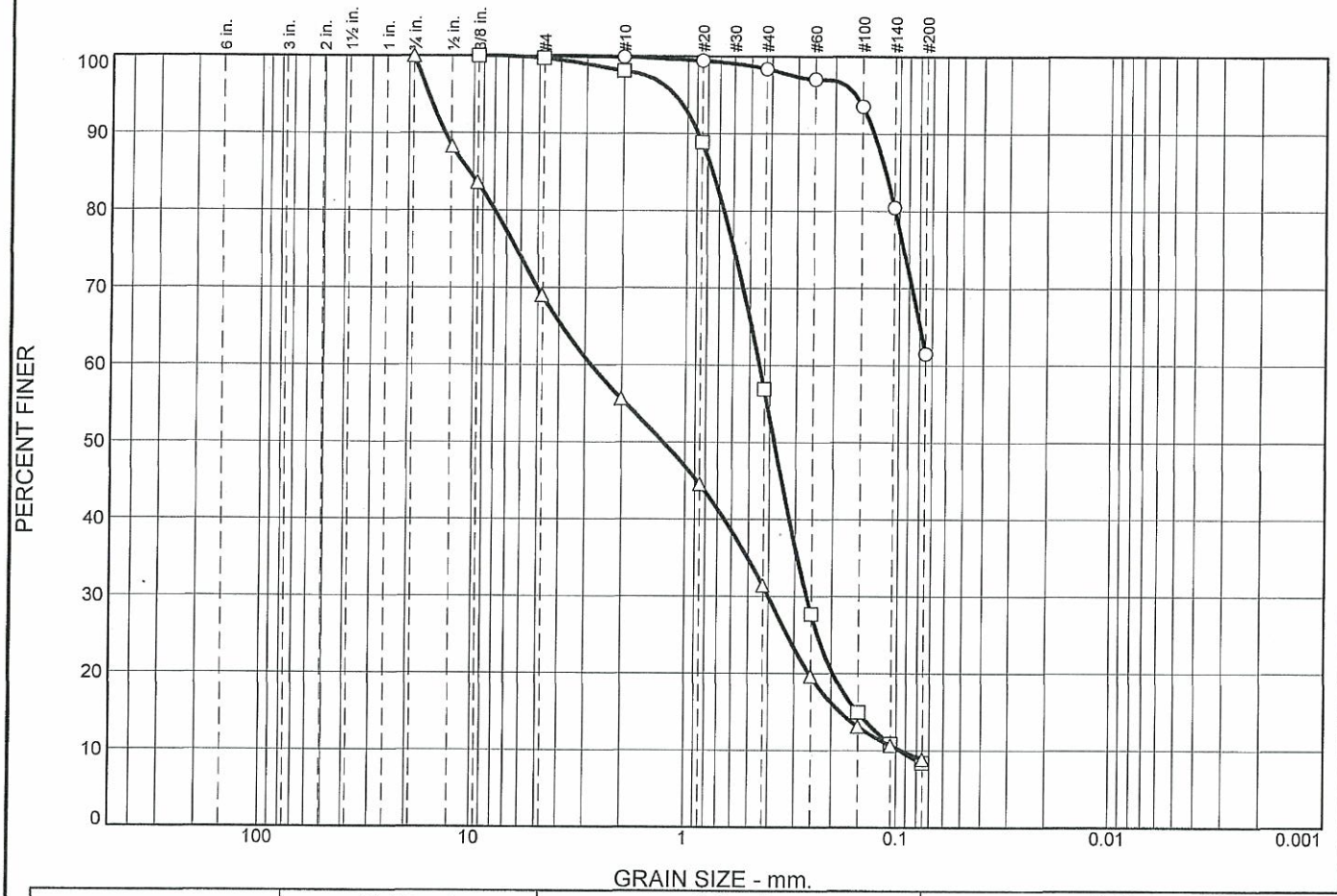
△ **Source of Sample:** SL0009_001H **Depth:** 5.0-6.0' **Sample Number:** 3

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	1.5	36.9	61.5	
□	0.0	0.0	0.3	1.6	41.2	48.6	8.3	
△	0.0	0.0	31.0	13.3	24.3	22.6	8.8	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1169							
□				0.7543	0.4481	0.3785	0.2635	0.1507	0.0958	1.62	4.68
△				10.3483	2.7794	1.2586	0.3995	0.1818	0.0944	0.61	29.43

Material Description	USCS	AASHTO
○ SANDY SILT, yellowish brown	ML	
□ Poorly-graded SAND with SILT, light olive brown	SP-SM	
△ Poorly-graded SAND with SILT, olive	SP-SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0009_002B **Depth:** 30.0-30.5' **Sample Number:** 13A

□ **Source of Sample:** SL0009_002B **Depth:** 40.0-41.0' **Sample Number:** 17

△ **Source of Sample:** SL0009_002B **Depth:** 61.0-61.5' **Sample Number:** 23

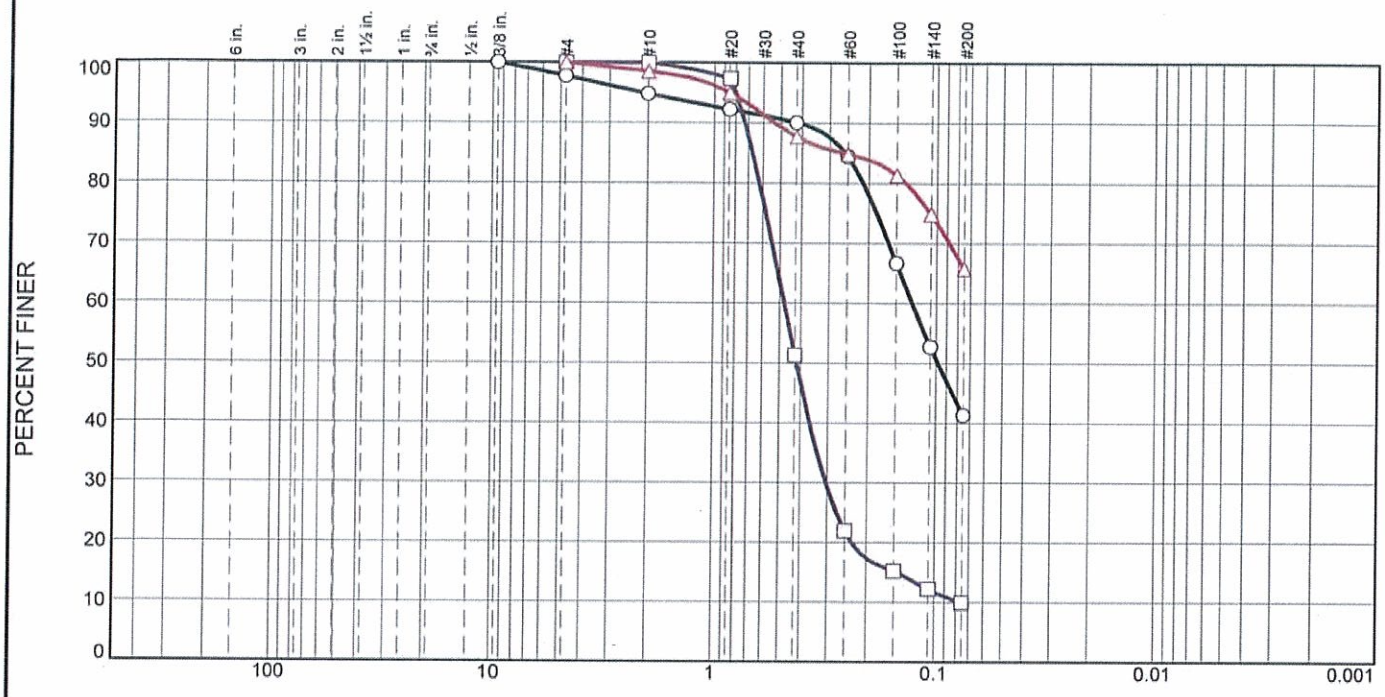
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.3	2.9	4.8	48.7	41.3	
□	0.0	0.0	0.0	0.0	48.6	41.5	9.9	
△	0.0	0.0	0.0	1.5	10.8	21.9	65.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2564	0.1275	0.0980					
□			0.6721	0.4768	0.4169	0.3035	0.1458	0.0759	2.55	6.28
△			0.2572							

Material Description	USCS	AASHTO
○ SILTY SAND, yellowish brown, with cemented SILT nodules	SM	
□ Well-graded SAND with SILT, yellowish brown	SW-SM	
△ SANDY SILT, dark brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0009_002C **Depth:** 10.0-11.0' **Sample Number:** 1

□ **Source of Sample:** SL0009_002C **Depth:** 34.0-35.0' **Sample Number:** 3

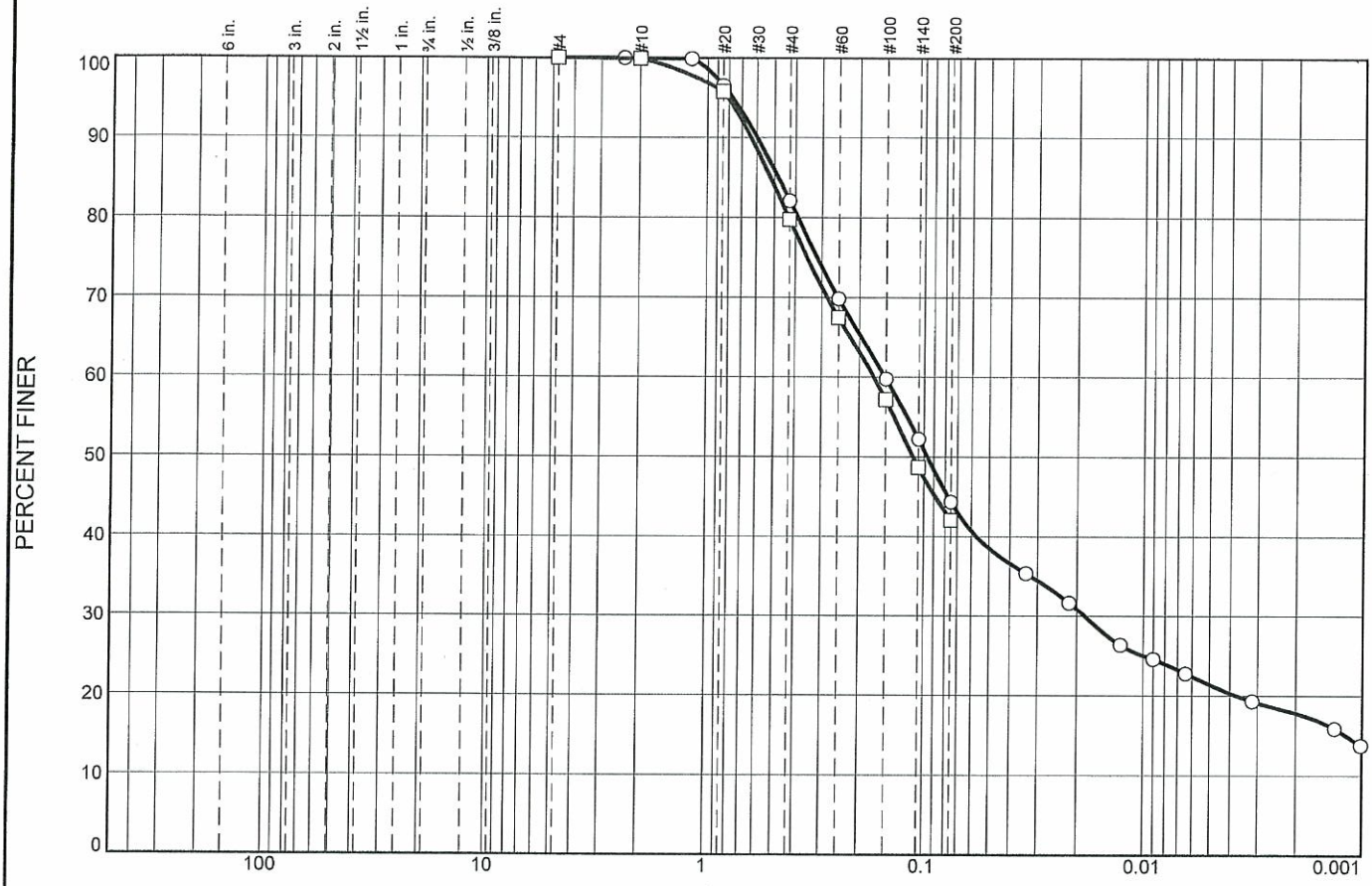
△ **Source of Sample:** SL0009_002H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	17.8	37.7	23.0	21.4
□	0.0	0.0	0.0	0.1	20.1	37.7	42.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	13.8			0.4801	0.1517	0.0965	0.0184	0.0012			
□				0.5204	0.1706	0.1121					

Material Description	USCS	AASHTO
○ SILTY SAND, dark reddish brown	SM	
□ SILTY SAND, dark reddish brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Sample Source:** SL0009_003B **Depth:** 3.0-3.5' **Sample No.:** 2A Hydro

□ **Sample Source:** SL0009_003B **Depth:** 3.0-3.5' **Sample No.:** 2A Grain Size

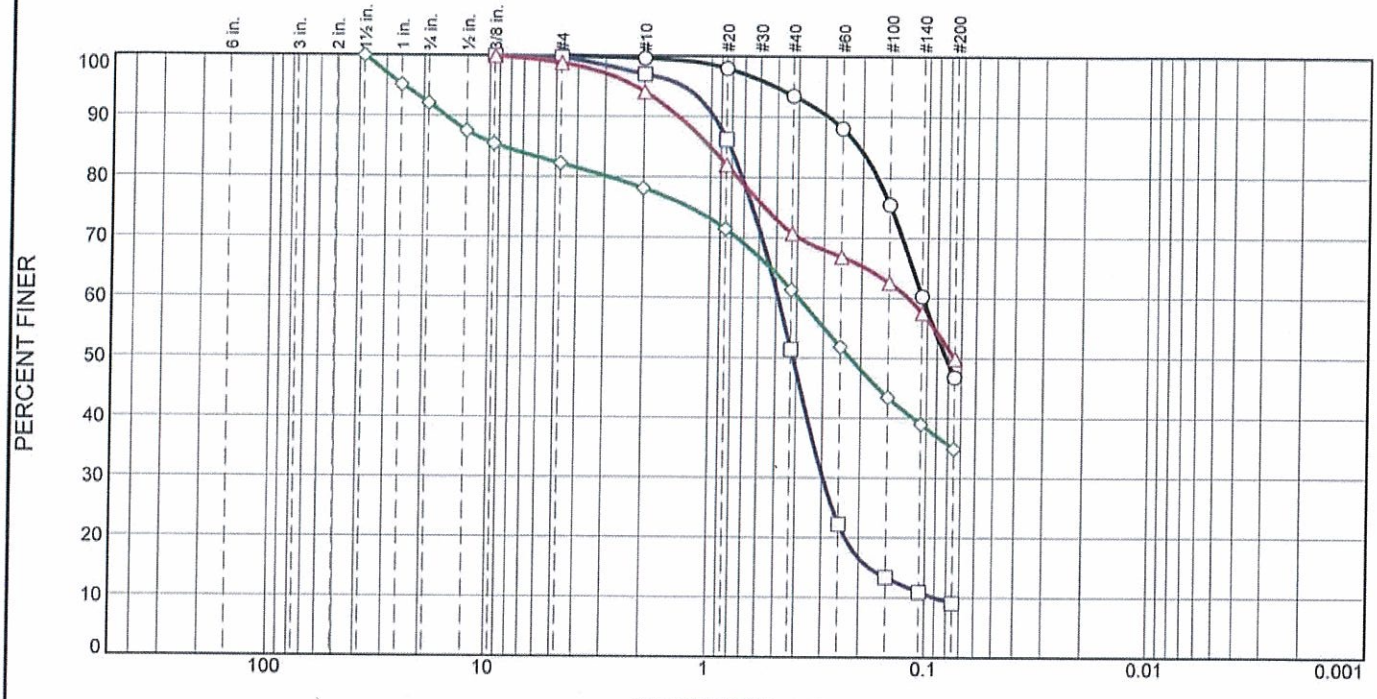
Date: ○ □

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Remarks:

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.4	6.2	46.6	46.8	
□	0.0	0.0	0.3	2.7	45.6	42.4	9.0	
△	0.0	0.0	1.1	4.8	23.4	20.8	49.9	
◇	0.0	7.9	9.9	4.1	16.8	26.5	34.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2097	0.1054	0.0818					
□			0.8184	0.4895	0.4154	0.2970	0.1801	0.0913	1.97	5.36
△			1.0071	0.1230	0.0753					
◇			8.8201	0.3940	0.2256					

Material Description	USCS	AASHTO
○ SILTY SAND, dark yellowish brown	SM	
□ Well-graded SAND with SILT, very dark grayish brown	SW-SM	
△ SILTY SAND, brown	SM	
◇ SILTY SAND,dark brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0009_003C **Depth:** 36.0-37.0' **Sample Number:** 2

□ **Source of Sample:** SL0009_004C **Depth:** 14.0-15.0' **Sample Number:** 1

△ **Source of Sample:** SL0009_004C **Depth:** 39.0-40.0' **Sample Number:** 2

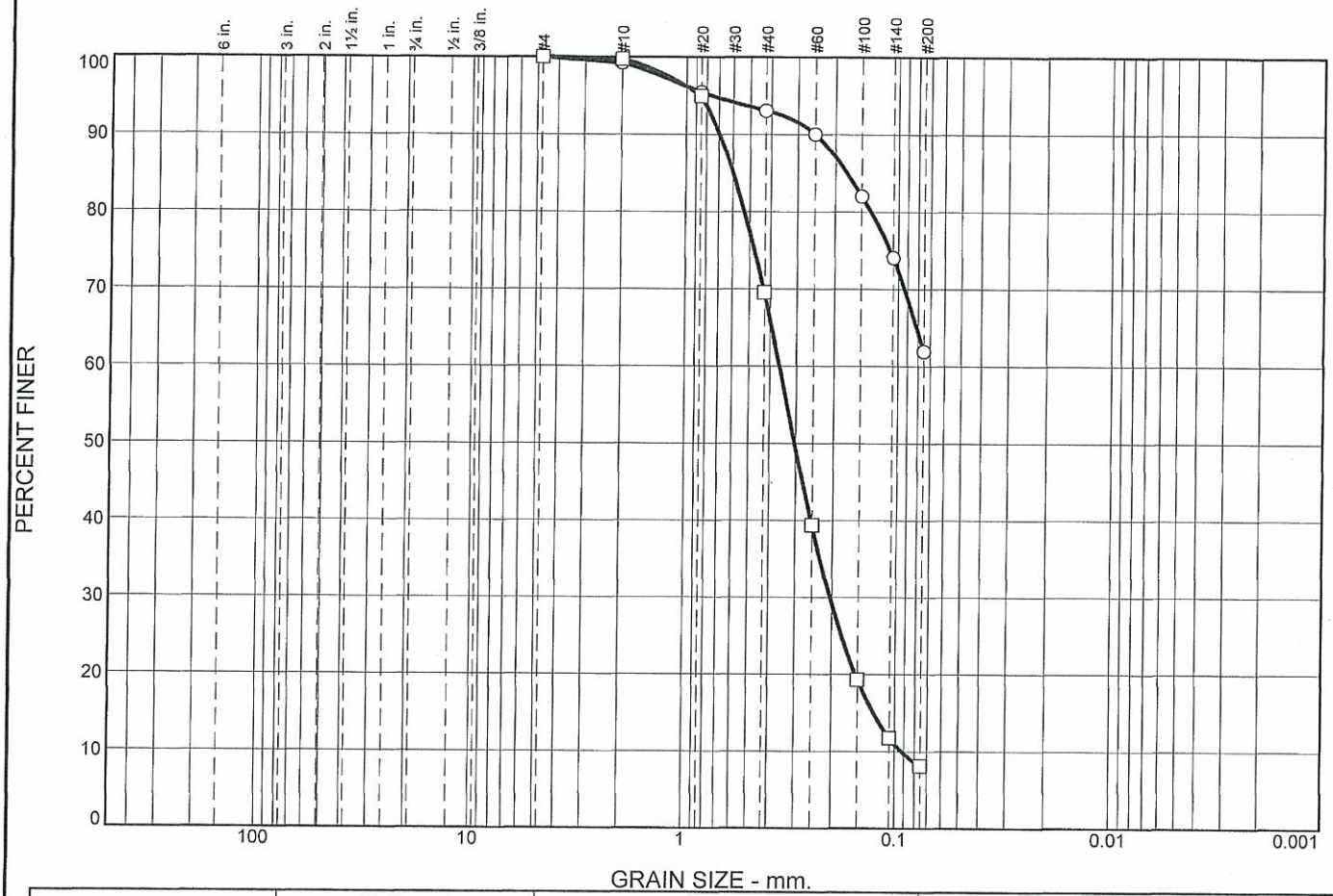
◇ **Source of Sample:** SL0009_004H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.8	6.1	31.1	62.0	
□	0.0	0.0	0.0	0.3	30.1	61.5	8.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.1764							
□				0.5977	0.3587	0.3027	0.2042	0.1262	0.0923	1.26	3.89

Material Description	USCS	AASHTO
○ SANDY lean CLAY, olive	CL	
□ Poorly-graded SAND with SILT, yellowish brown	SP-SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0001_001B **Depth:** 14.0-15.5' **Sample Number:** 9

□ **Source of Sample:** SL0001_001B **Depth:** 26.5-28.0' **Sample Number:** 14

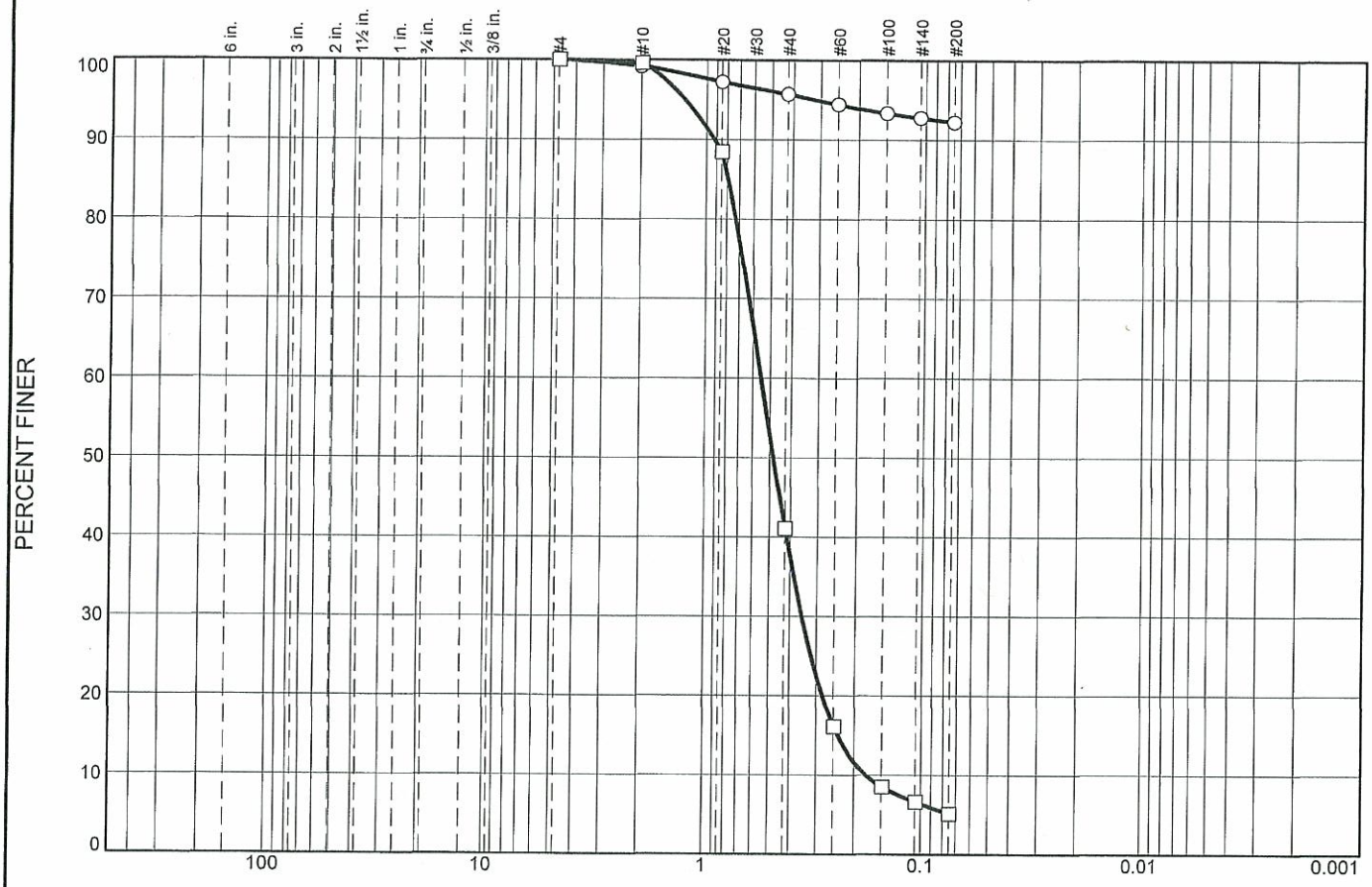
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.8	3.5	3.5	92.2	
□	0.0	0.0	0.0	0.4	58.6	35.9	5.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○											
□				0.7952	0.5522	0.4830	0.3530	0.2401	0.1793	1.26	3.08

Material Description	USCS	AASHTO
○ Lean CLAY, olive	CL	
□ Poorly-graded SAND with CLAY, bluish gray	SP-SC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0001_001B **Depth:** 44.0-45.5' **Sample Number:** 21

□ **Source of Sample:** SL0001_001B **Depth:** 67.0-68.5' **Sample Number:** 28

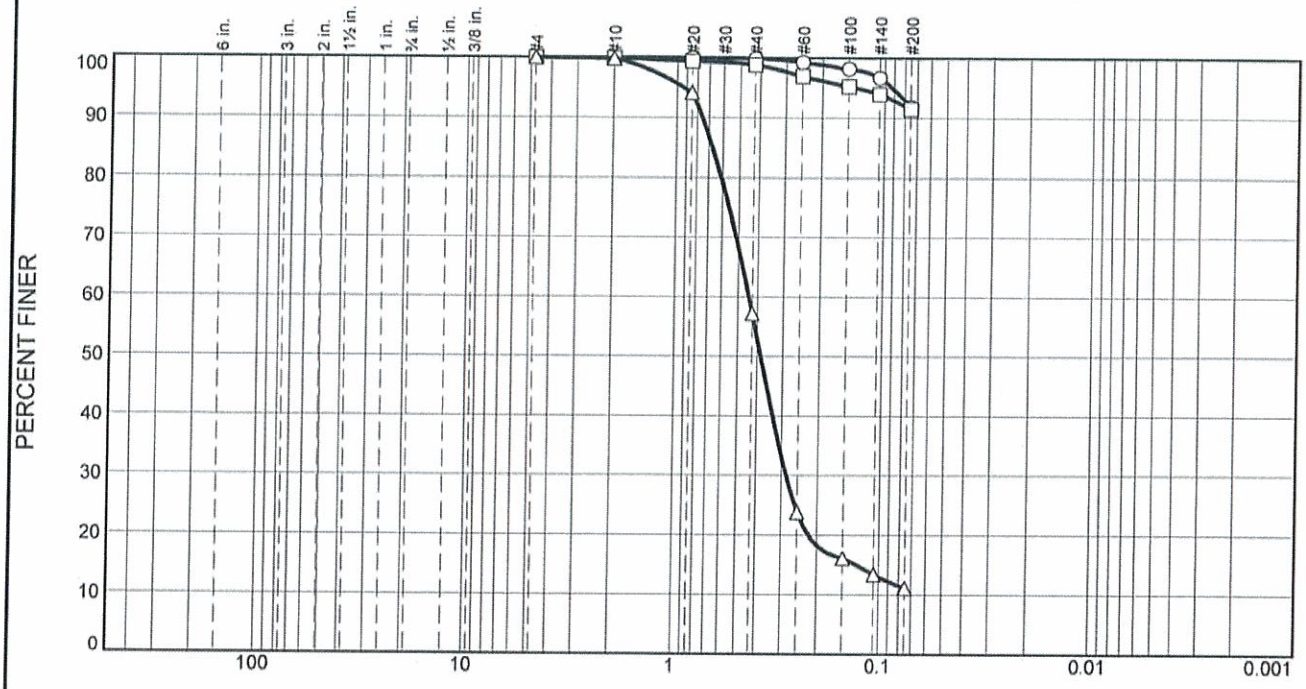
Date: ○ □

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	8.0	91.9	
□	0.0	0.0	0.0	0.1	1.1	7.3	91.5	
△	0.0	0.0	0.0	0.1	42.7	46.1	11.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	25	23								
□	39	23								
△			0.6720	0.4422	0.3843	0.2844	0.1289			

Material Description	USCS	AASHTO
○ SILT, Dark yellowish brown	ML	A-4(1)
□ Lean CLAY, Yellowish brown	CL	A-6(16)
△ Poorly-graded SAND with SILT, Bluish gray	SP-SM	

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Sample Source:** SL0001_001C **Depth:** 9.0-9.5' **Sample No.:** 1B

□ **Sample Source:** SL0001_001C **Depth:** 14.0-15.0' **Sample No.:** 2A/2B

△ **Sample Source:** SL0001_001C **Depth:** 36.5-37.0' **Sample No.:** 3B

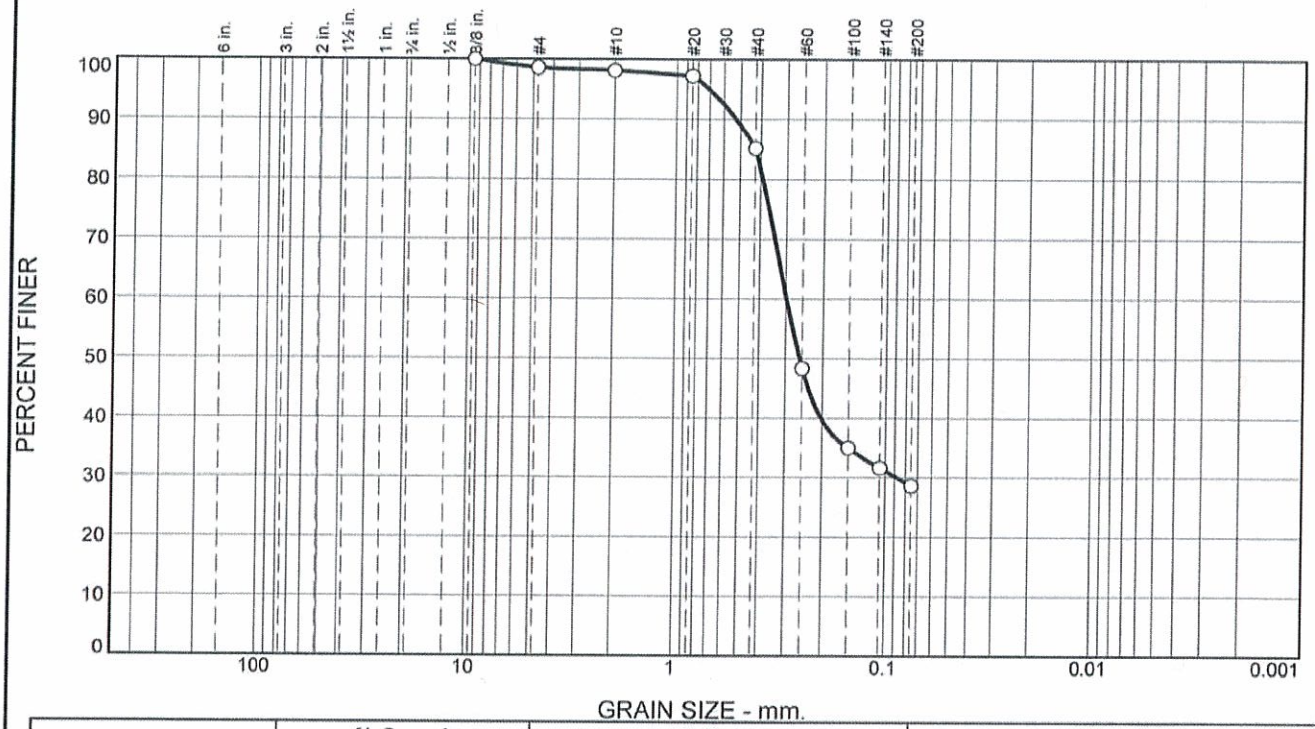
Remarks:

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.4	0.5	12.9	56.6	28.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	17	0.4237	0.2983	0.2575	0.0883				

Material Description	USCS	AASHTO
○ SILTY SAND, Dark brown	SM	A-2-4(0)

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Source of Sample:** SL0001_001H **Depth:** 3.0-3.5' **Sample Number:** 3

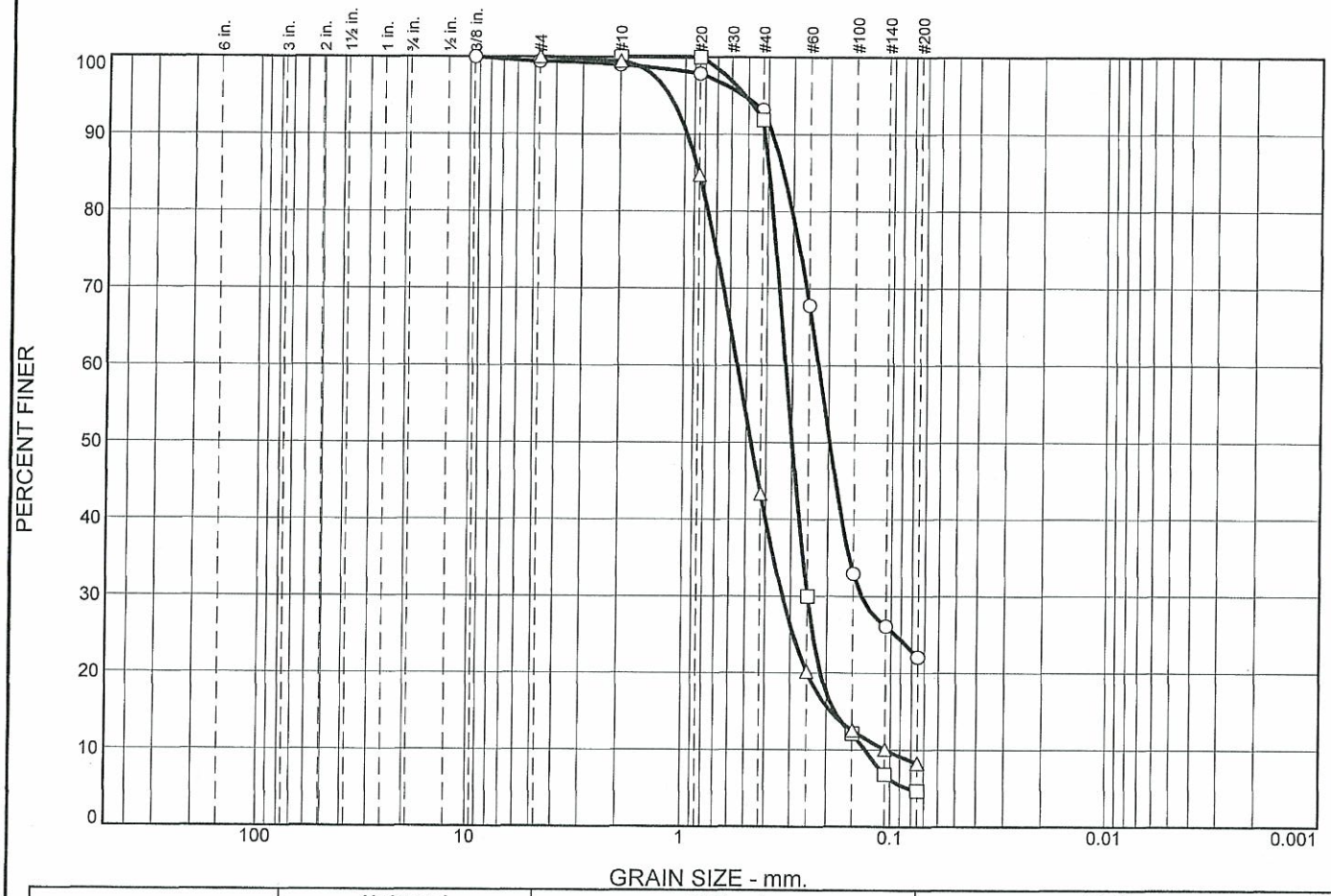
Remarks:

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.6	0.4	5.8	71.1	22.1	
□	0.0	0.0	0.0	0.0	8.2	87.2	4.6	
△	0.0	0.0	0.0	0.6	56.1	35.1	8.2	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.3367	0.2250	0.1975	0.1376				
□				0.3958	0.3232	0.2993	0.2501	0.1835	0.1311	1.48	2.47
△				0.8548	0.5539	0.4743	0.3288	0.1917	0.1059	1.84	5.23

Material Description	USCS	AASHTO
○ SILTY SAND, dark yellowish brown	SM	
□ Poorly-graded SAND, yellowish brown	SP	
△ Poorly-graded SAND with CLAY, light olive brown	SP-SC	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0001_002B **Depth:** 2.5-4.0' **Sample Number:** 2

□ **Source of Sample:** SL0001_002B **Depth:** 15.0-16.5' **Sample Number:** 7

△ **Source of Sample:** SL0001_002B **Depth:** 32.5-34.0' **Sample Number:** 13

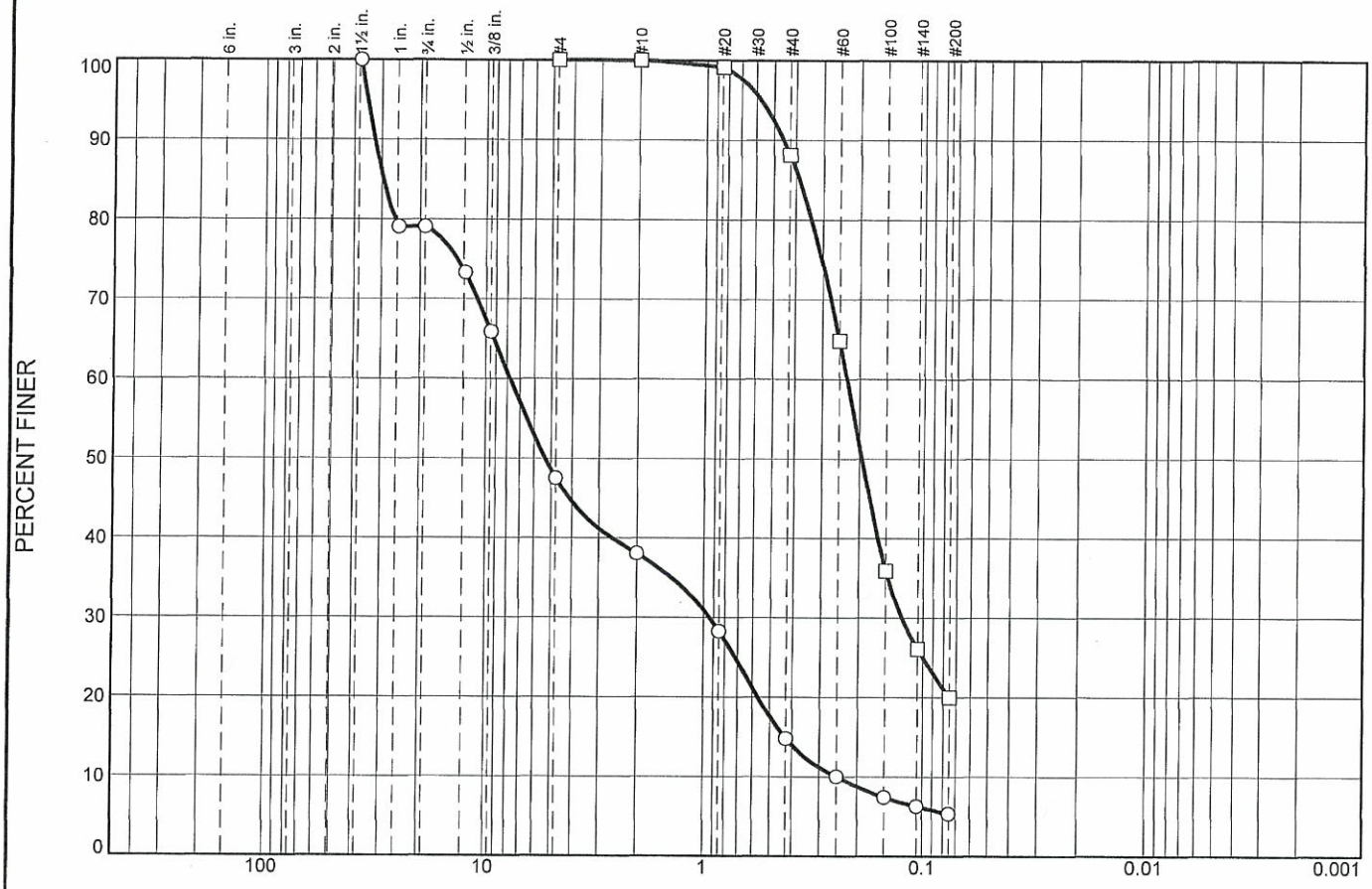
Date: ○ □ △

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	20.9	31.6	9.4	23.3	9.5	5.3	
□	0.0	0.0	0.0	0.1	11.8	68.1	20.0	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				29.4921	7.7534	5.3325	0.9396	0.4306	0.2495	0.46	31.07
□				0.3864	0.2305	0.1957	0.1262				

Material Description	USCS	AASHTO
○ Poorly-graded GRAVEL with CLAY and SAND, light yellowish brown	GP-GC	
□ SILTY SAND, olive yellow	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

○ **Source of Sample:** SL0001_002B **Depth:** 40.0-41.5' **Sample Number:** 16

□ **Source of Sample:** SL0001_002B **Depth:** 73.0-74.5' **Sample Number:** 27

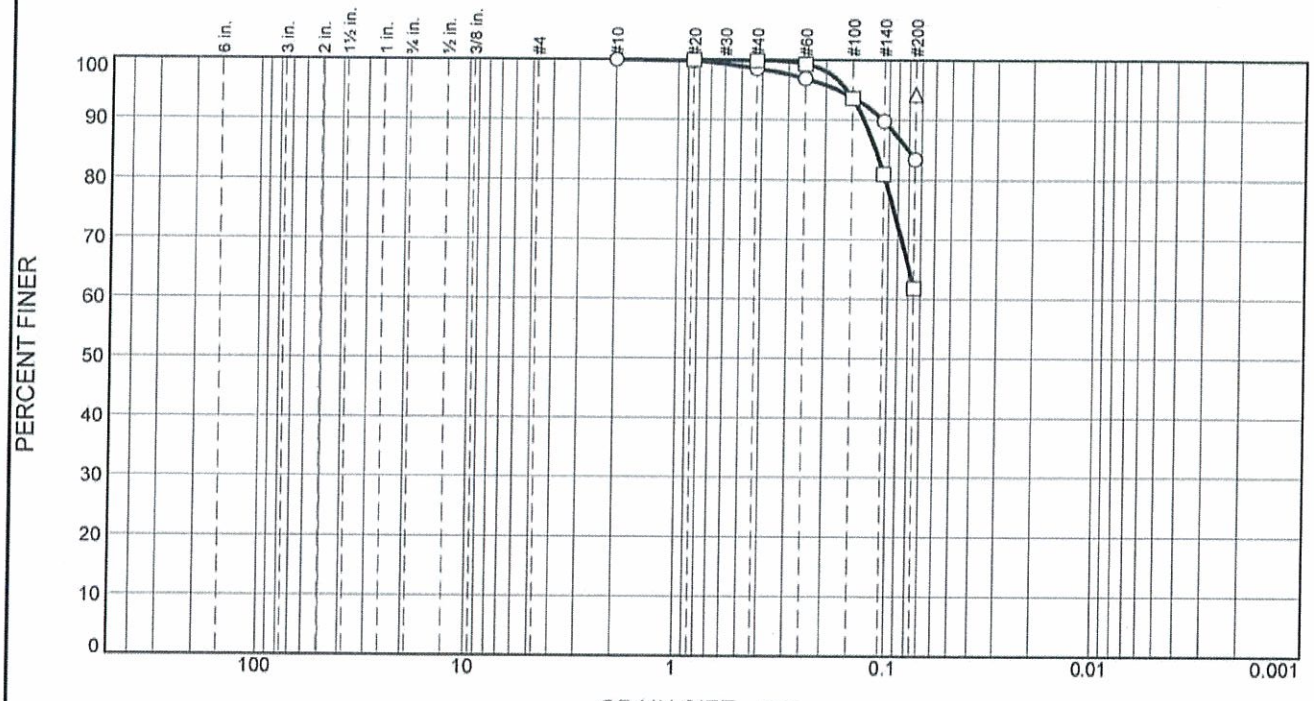
Date: ○ □

Remarks:

Blackburn Consulting

W. Sacramento, CA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.5	15.1	83.4	
□	0.0	0.0	0.0	0.0	0.1	38.1	61.8	
△							94.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	16	0.0812							
□	NV	NP	0.1158							
△	43	21								

Material Description	USCS	AASHTO
○ Lean CLAY with SAND, Dark yellowish brown	CL	A-6(10)
□ SANDY SILT, Olive brown	ML	A-4(0)
△ Lean CLAY, Yellowish brown	CL	

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Sample Source:** SL0001_002C **Depth:** 6.4-7.4' **Sample No.:** 1B

□ **Sample Source:** SL0001_002C **Depth:** 20.5-21.0' **Sample No.:** 3B

△ **Sample Source:** SL0001_002C **Depth:** 28.5-29.0' **Sample No.:** 4B

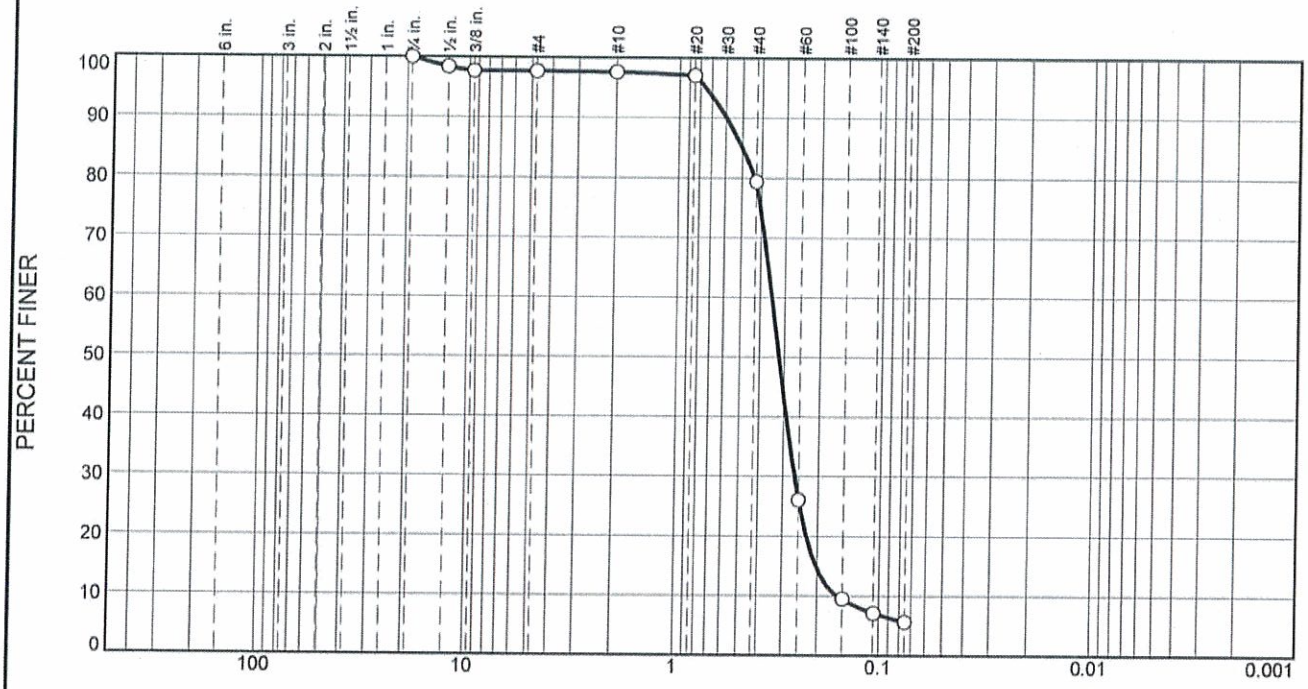
Remarks:

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.3	0.1	18.2	73.7	5.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5007	0.3487	0.3187	0.2622	0.2038	0.1584	1.24	2.20

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, Light brown, moderately cemented	SP-SM	

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Source of Sample:** SL0001_002H **Depth:** 2.0-3.0' **Sample Number:** 1

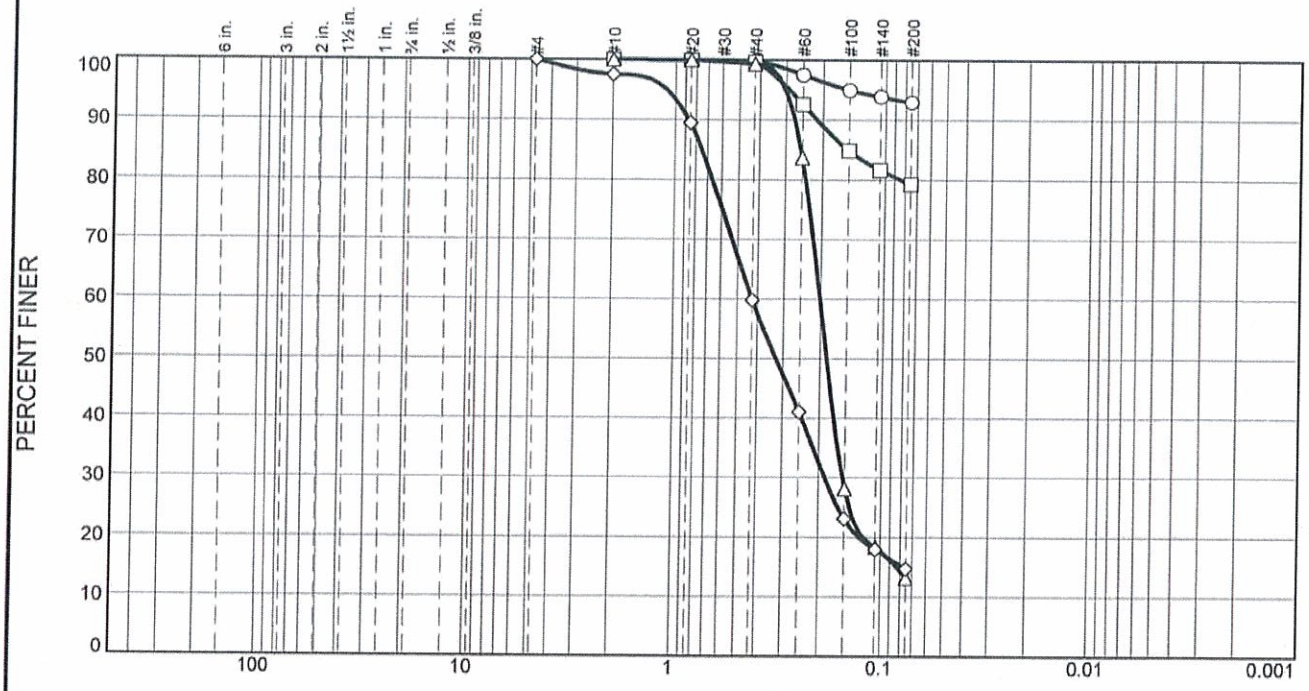
Remarks:

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	6.9	93.0	
□	0.0	0.0	0.0	0.0	0.3	20.4	79.3	
△	0.0	0.0	0.0	0.0	0.7	86.1	13.2	
◇	0.0	0.0	0.0	2.5	37.7	45.1	14.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	40	35								
□	50	28	0.1517							
△			0.2539	0.2018	0.1862	0.1539	0.0833			
◇			0.7478	0.4271	0.3246	0.1872	0.0775			

Material Description	USCS	AASHTO
○ SILT, Dark yellowish brown	ML	A-4(8)
□ Fat CLAY with SAND, Grayish brown	CH	A-7-6(19)
△ SILTY SAND, Yellowish brown	SM	
◇ SILTY SAND, Brown	SM	

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Sample Source:** SL0001_003C **Depth:** 10.5-11.0' **Sample No.:** 1B

□ **Sample Source:** SL0001_003C **Depth:** 13.5-14.0' **Sample No.:** 2B

△ **Sample Source:** SL0001_003C **Depth:** 20.5-21.0' **Sample No.:** 3B

◇ **Sample Source:** SL0001_003C **Depth:** 35.5-36.0 **Sample No.:** 4B

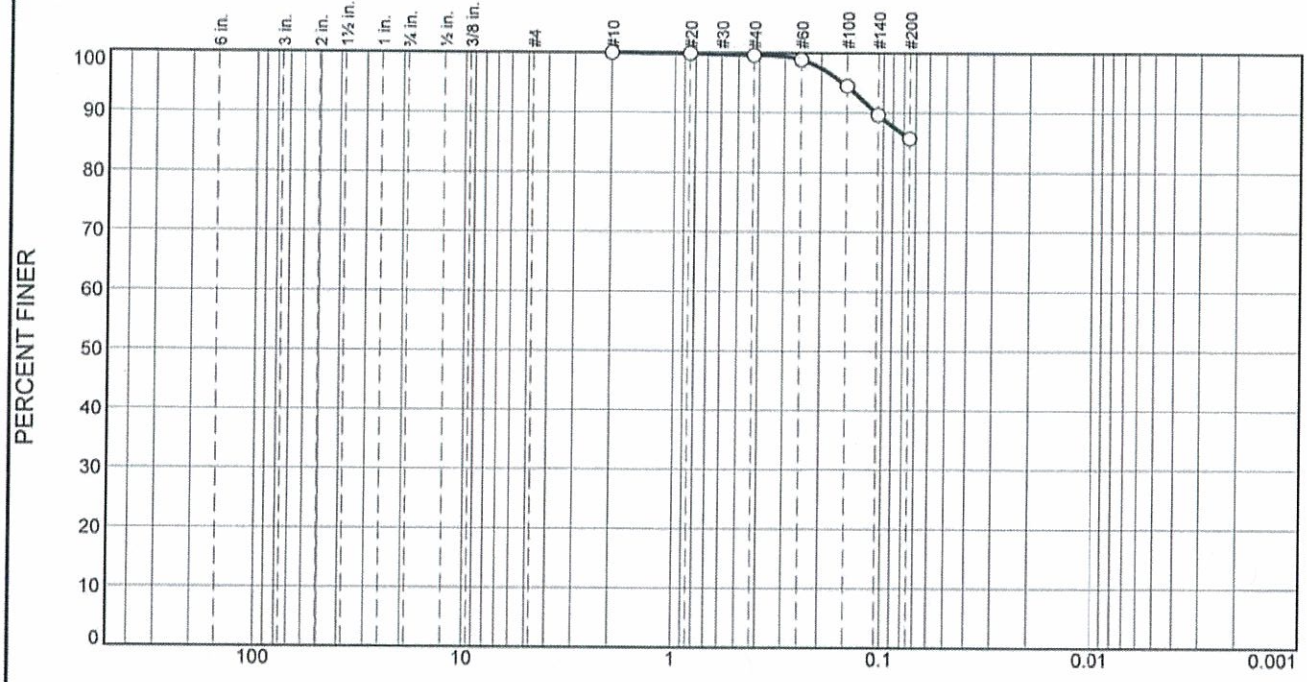
Remarks:

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	13.9	85.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	32	17								

Material Description	USCS	AASHTO
○ Lean CLAY, Dark brown	CL	A-6(12)

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Source of Sample:** SL0001_003H **Depth:** 3.0-4.0' **Sample Number:** 3

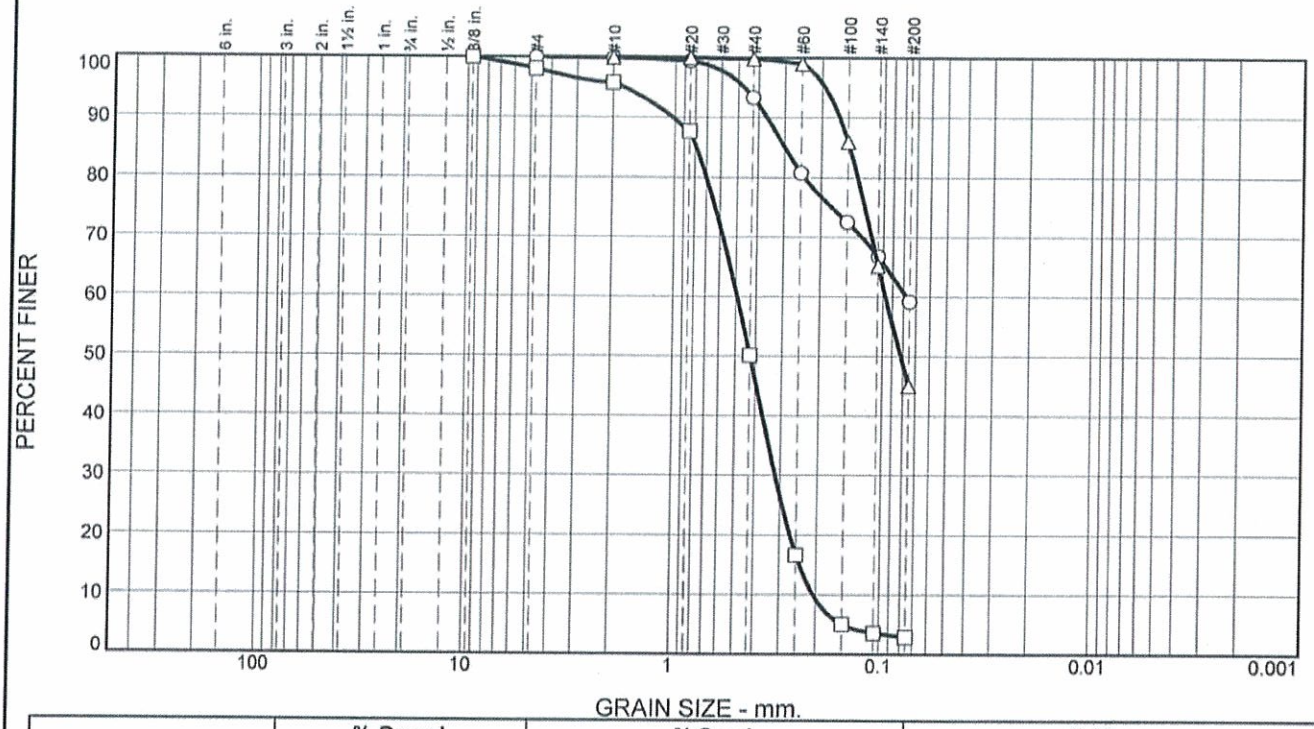
Remarks:

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	6.6	34.2	59.1	
□	0.0	0.0	1.9	2.3	45.7	47.2	2.9	
△	0.0	0.0	0.0	0.0	0.2	54.8	45.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22	15	0.2988	0.0779						
□	NV	NP	0.7870	0.4921	0.4242	0.3173	0.2406	0.2065	0.99	2.38
△	24	27	0.1472	0.0974	0.0820					

Material Description	USCS	AASHTO
○ SANDY SILTY CLAY, Dark yellowish brown	CL-ML	A-4(1)
□ Poorly-graded SAND, Light brown	SP	A-1-b
△ SILTY SAND, Dark olive gray	SM	A-4(0)

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Sample Source:** SL0001_004C **Depth:** 8.0-9.0' **Sample No.:** 1A/1B

□ **Sample Source:** SL0001_004C **Depth:** 17.5-18.0 **Sample No.:** 2B

△ **Sample Source:** SL0001_004C **Depth:** 41.0-42.0' **Sample No.:** 3A/3B

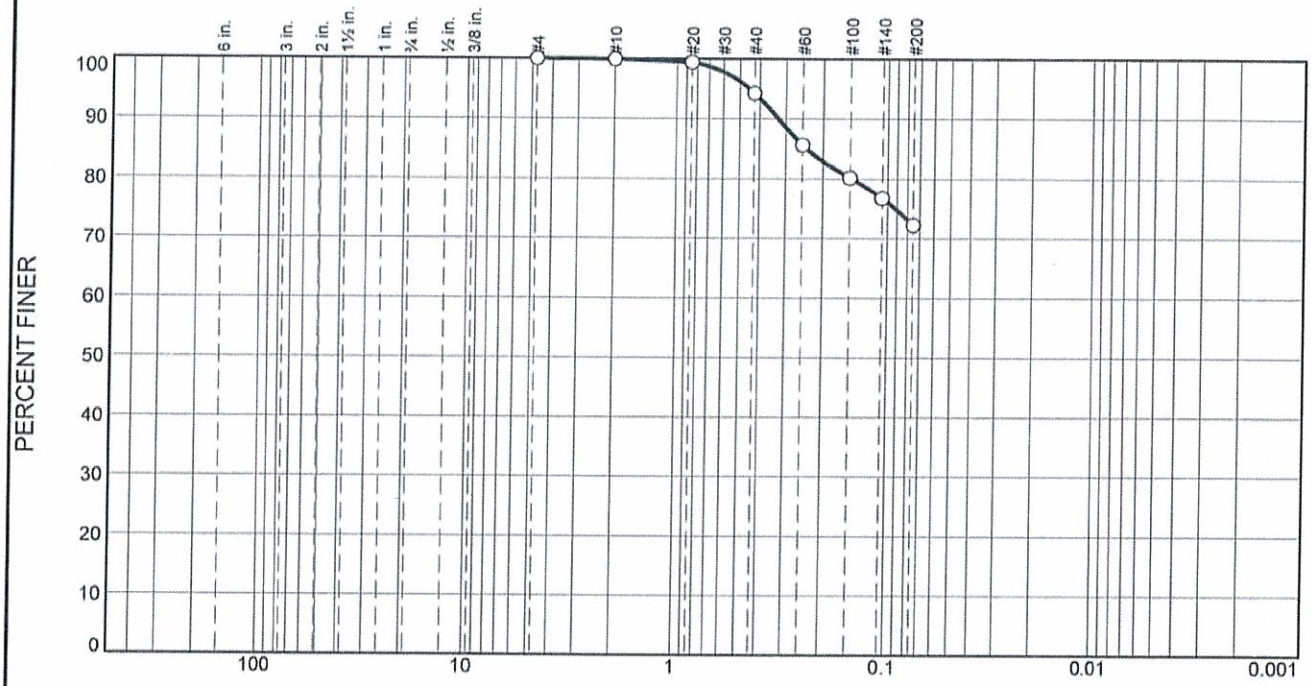
Remarks:

Blackburn Consulting

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	5.6	22.0	72.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27	20	0.2387							

Material Description	USCS	AASHTO
○ SILTY CLAY with SAND, Dark yellowish brown	CL-ML	A-4(3)

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Sample Source:** SL0001_004H1 **Depth:** 3.0-3.5' **Sample No.:** 2

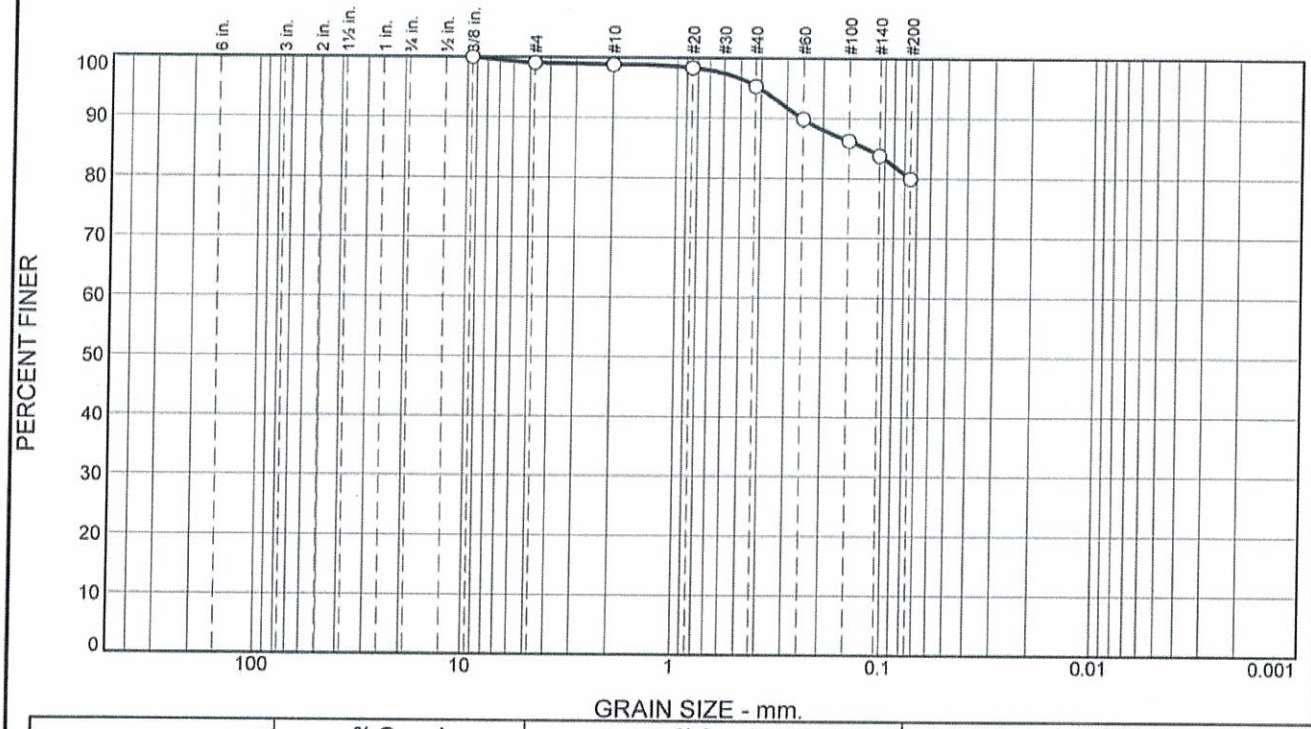
Remarks:

Blackburn Consulting

W. Sacramento, CA

Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.9	0.2	3.6	15.4	79.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	31	19	0.1231							

Material Description	USCS	AASHTO
○ Lean CLAY with SAND, Dark olive brown	CL	A-6(8)

Project No. 1967.1 **Client:** URS

Project: Feather River West Levee Rehabilitation Project

○ **Source of Sample:** SL0001_004H **Depth:** 3.0-3.5' **Sample Number:** 3

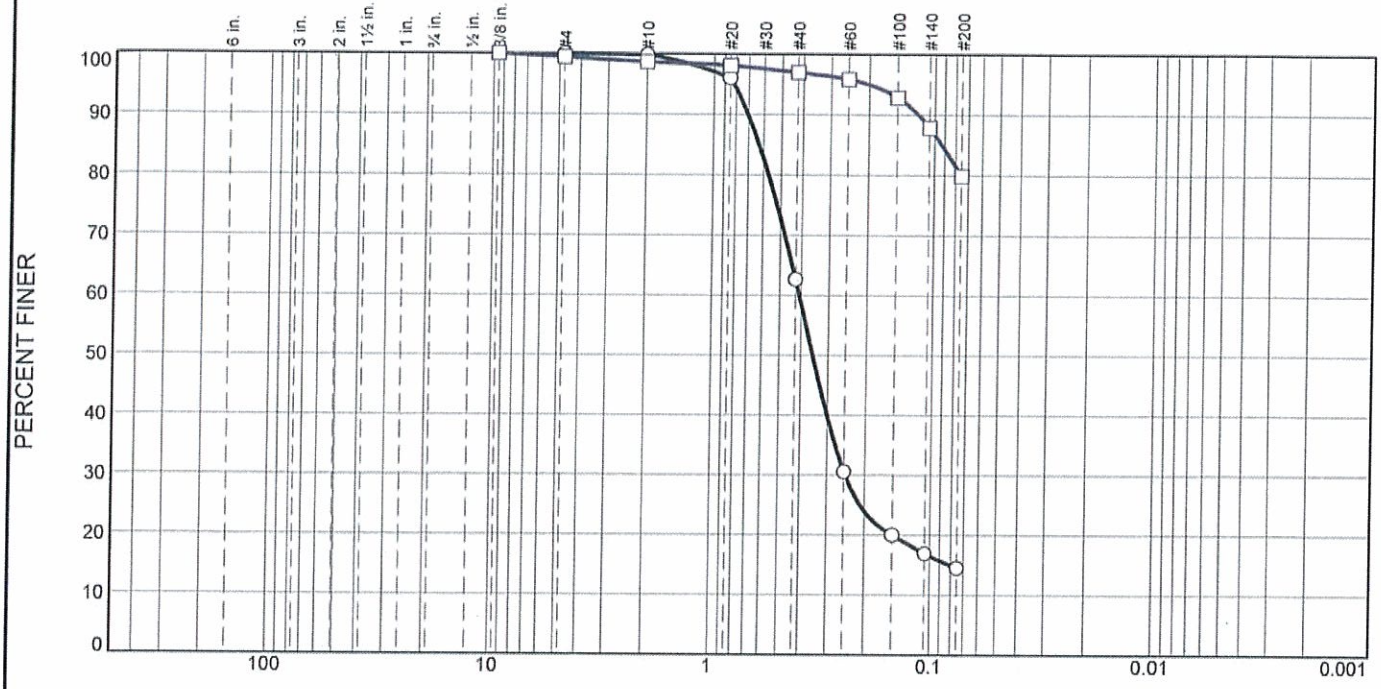
Remarks:

Blackburn Consulting

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Figure

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	37.1	48.2	14.5	
□	0.0	0.0	0.6	0.8	1.7	17.1	79.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6291	0.4082	0.3516	0.2465	0.0807			
□			0.0930							

Material Description	USCS	AASHTO
○ SILTY SAND, yellowish brown	SM	
□ SILT with SAND, very dark brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0001_005C **Depth:** 40.0-41.0' **Sample Number:** 3

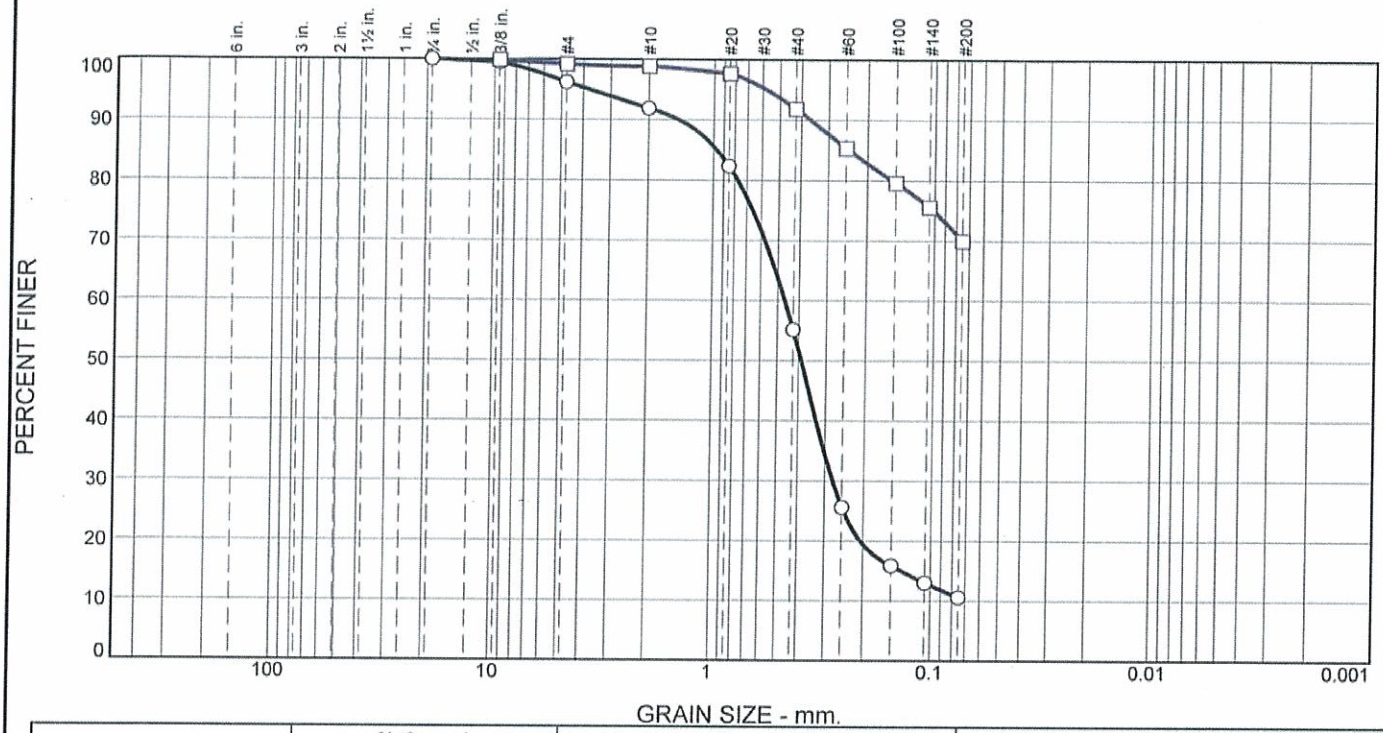
□ **Source of Sample:** SL0001_005H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.8	4.3	36.7	44.6	10.6	
□	0.0	0.0	0.7	0.4	7.0	21.9	70.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.9655	0.4645	0.3892	0.2760	0.1357			
□			0.2420							

Material Description	USCS	AASHTO
○ Well-graded SAND with SILT, bluish gray	SW-SM	
□ SANDY SILT, very dark brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0001_007C **Depth:** 34.0-35.0' **Sample Number:** 2

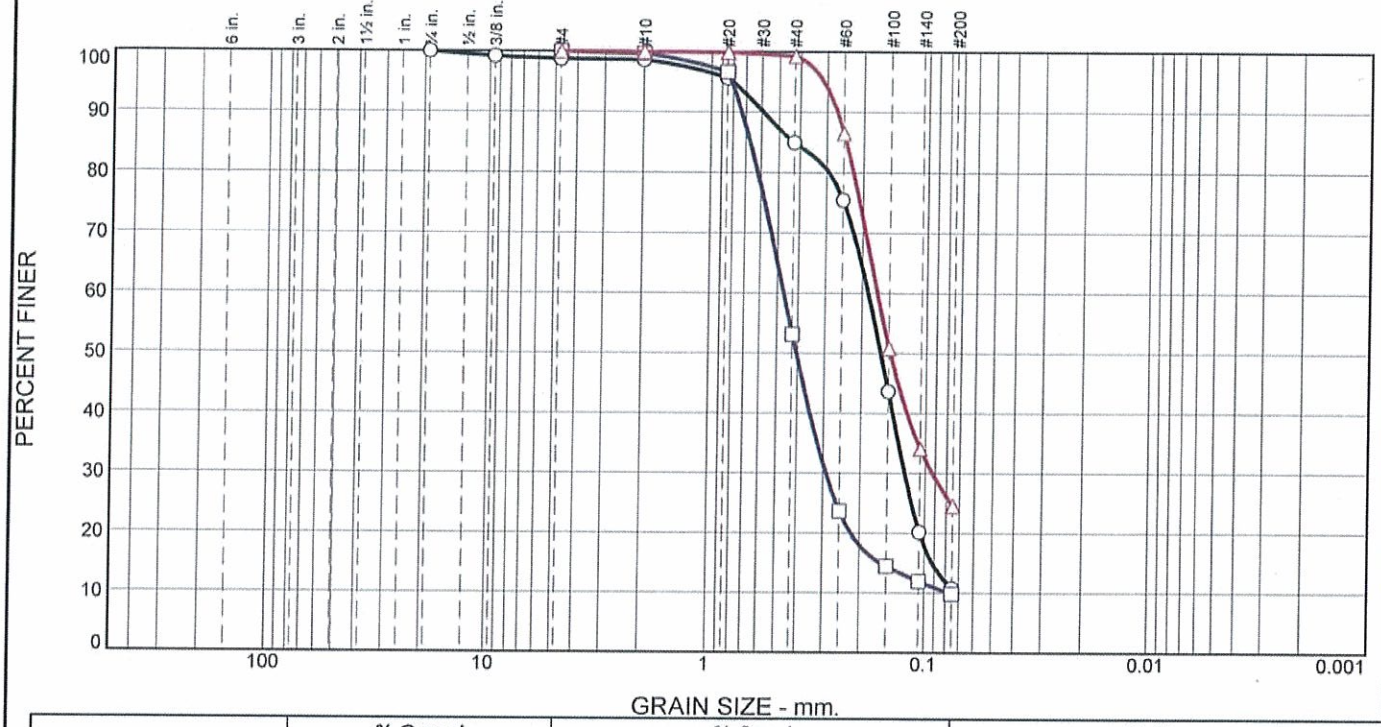
□ **Source of Sample:** SL0001_007H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.3	0.1	13.7	74.1	10.8	
□	0.0	0.0	0.0	0.4	46.5	43.3	9.8	
△	0.0	0.0	0.0	0.1	0.7	74.8	24.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4280	0.1879	0.1632	0.1249	0.0922			
□			0.6724	0.4680	0.4064	0.2910	0.1603	0.0779	2.32	6.01
△			0.2432	0.1710	0.1481	0.0932				

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, dark yellowish brown	SP-SM	
□ Well-graded SAND with SILT, yellowish brown	SW-SM	
△ SILTY SAND, brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0001_008C **Depth:** 12.0-13.0' **Sample Number:** 1

□ **Source of Sample:** SL0001_008C **Depth:** 22.0-23.0' **Sample Number:** 2

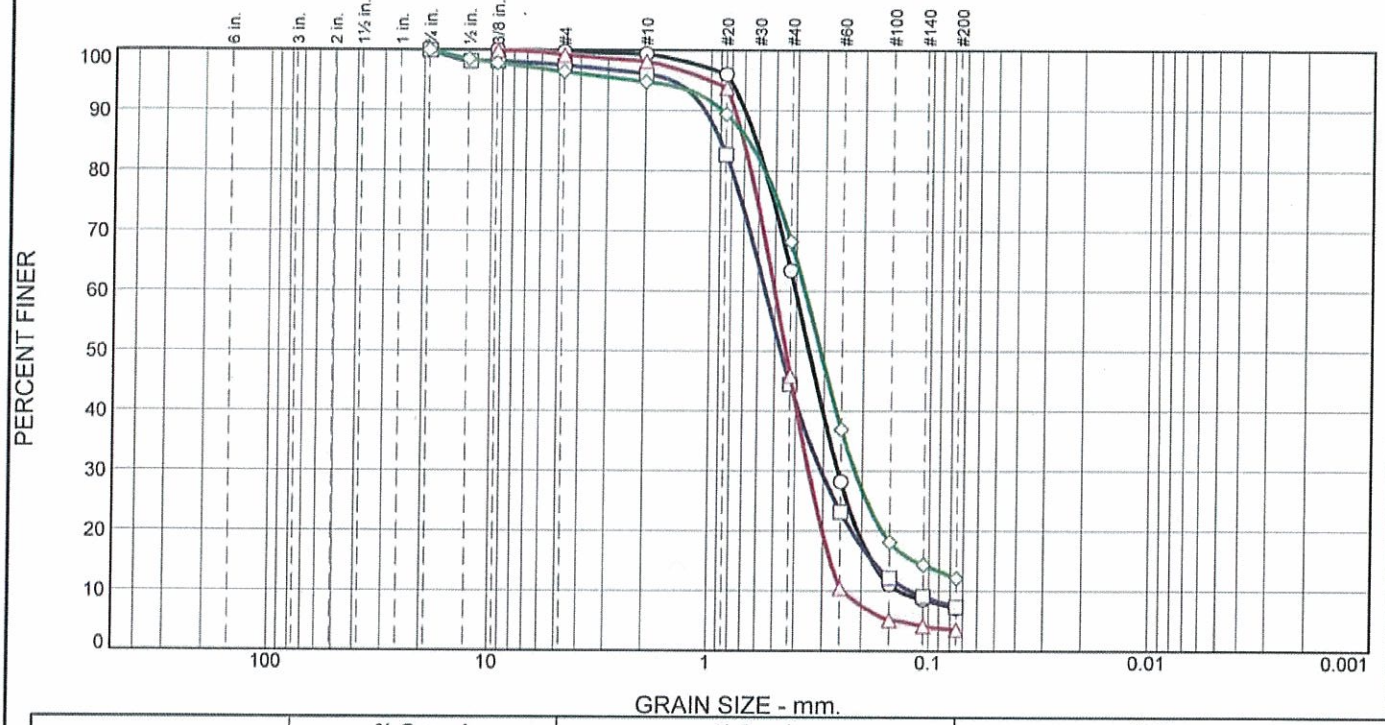
△ **Source of Sample:** SL0001_008H **Depth:** 1.0-2.0' **Sample Number:** 1

Remarks:

Blackburn Consulting

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.3	0.4	35.8	56.4	7.1	
□	0.0	0.0	2.5	1.4	51.6	37.2	7.3	
△	0.0	0.0	0.8	1.0	52.2	42.4	3.6	
◇	0.0	0.0	3.6	1.7	26.5	56.1	12.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6217	0.4038	0.3499	0.2583	0.1805	0.1365	1.21	2.96
□			0.9012	0.5560	0.4693	0.3066	0.1789	0.1211	1.40	4.59
△			0.7119	0.5038	0.4462	0.3484	0.2770	0.2431	0.99	2.07
◇			0.6734	0.3670	0.3119	0.2173	0.1172			

Material Description	USCS	AASHTO
○ Poorly-graded SAND with CLAY, yellowish brown	SP-SC	
□ Poorly-graded SAND with CLAY, very dark gray	SP-SC	
△ Poorly-graded SAND, dark yellowish brown	SP	
◇ SILTY SAND, dark yellowish brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0001_009C **Depth:** 10.0-11.0' **Sample Number:** 1

□ **Source of Sample:** SL0001_009C **Depth:** 44.0-45.0 **Sample Number:** 3

△ **Source of Sample:** SL0001_009H **Depth:** 4.0-5.0' **Sample Number:** 2

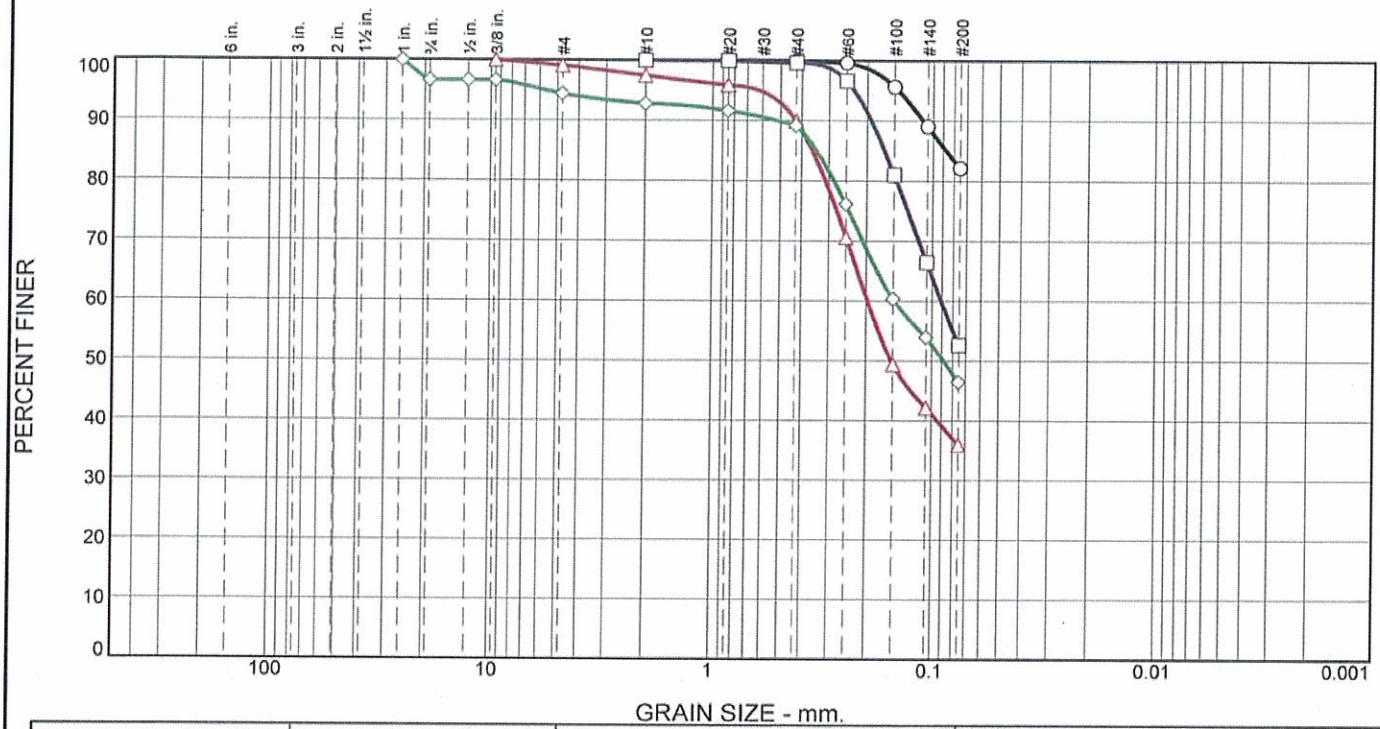
◇ **Source of Sample:** SL0001_010H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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W. Sacramento, CA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	17.8	82.1	
□	0.0	0.0	0.0	0.0	0.4	47.0	52.6	
△	0.0	0.0	0.9	1.6	7.6	53.9	36.0	
◇	0.0	3.4	2.2	1.6	3.6	42.7	46.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0869							
□			0.1660	0.0904						
△			0.3576	0.1980	0.1529					
◇			0.3414	0.1479	0.0875					

	Material Description	USCS	AASHTO
○	SILTY CLAY with SAND, very dark gray/black, some organics	CL-ML	
□	SANDY SILT, dark yellowish brown	ML	
△	dark yellowish brown		
◇	SILTY SAND, dark brown, trace GRAVEL	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0001_010C **Depth:** 21.0-22.0' **Sample Number:** 2

□ **Source of Sample:** SL0001_011C **Depth:** 20.0-21.0' **Sample Number:** 2

△ **Source of Sample:** SL0001_011C **Depth:** 24.0-25.0' **Sample Number:** 3

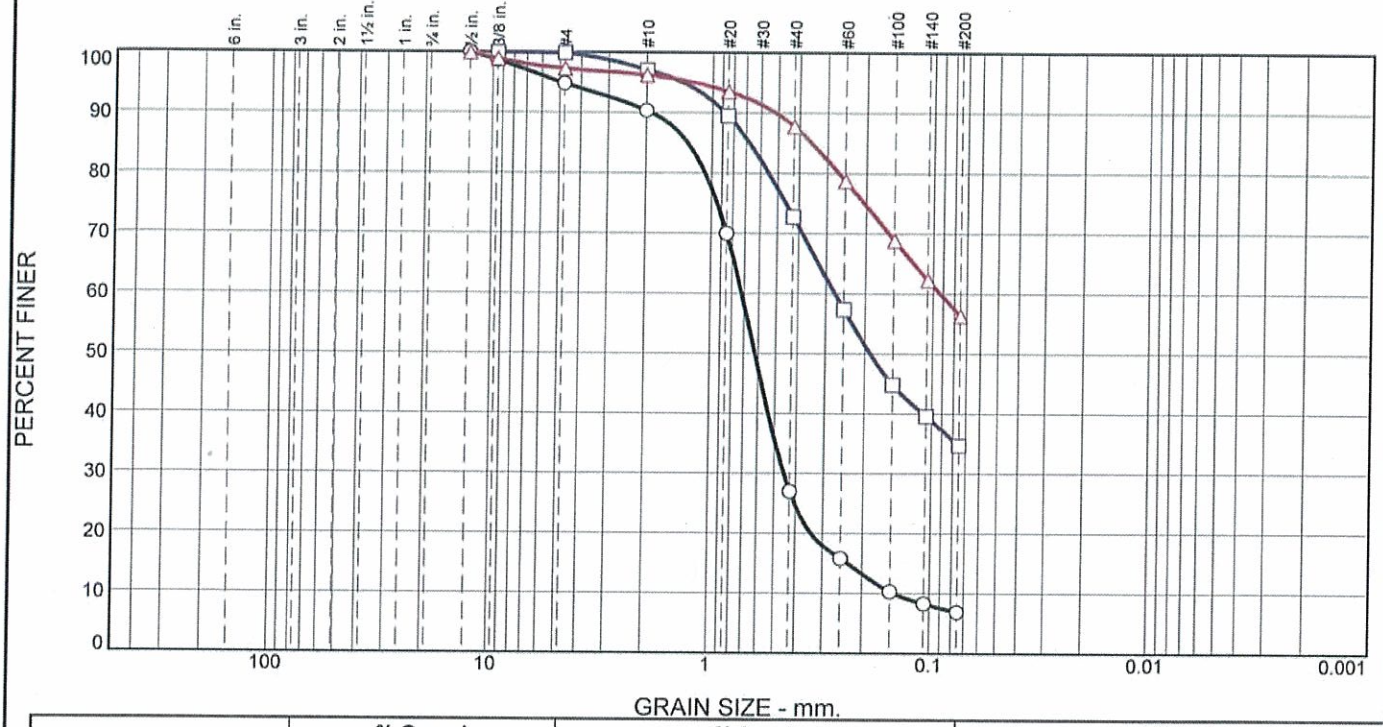
◇ **Source of Sample:** SL0001_011H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	5.2	4.5	63.4	20.0	6.9	
□	0.0	0.0	0.1	2.8	24.3	38.1	34.7	
△	0.0	0.0	2.6	1.1	8.5	31.4	56.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.2923	0.7207	0.6225	0.4533	0.2325	0.1449	1.97	4.97
□			0.6771	0.2739	0.1898					
△			0.3526	0.0927						

Material Description	USCS	AASHTO
○ Poorly-graded SAND with SILT, dark olive brown	SM	
□ SILTY SAND,dark yellowish gray	ML	
△ SANDY SILT, dark brown		

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP - CPT

○ **Source of Sample:** SL0001_012C **Depth:** 14.0-15.0' **Sample Number:** 1

□ **Source of Sample:** SL0001_012C **Depth:** 40.0-41.0' **Sample Number:** 3

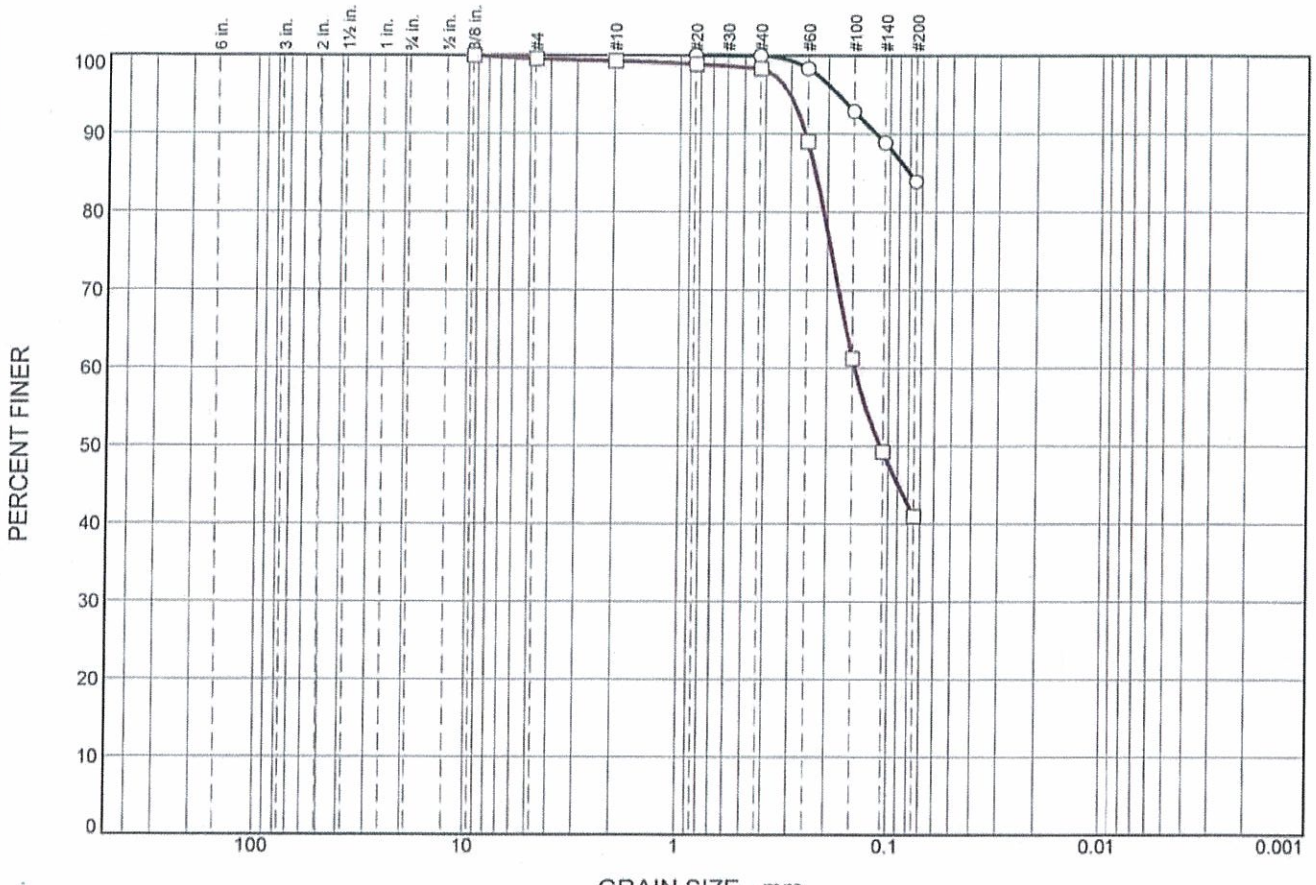
△ **Source of Sample:** SL0001_012H **Depth:** 4.0-5.0' **Sample Number:** 2

Remarks:

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	16.1	83.9	
□	0.0	0.0	0.4	0.3	1.0	57.3	41.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	SM0003_001C	1A	11.0-11.5'	Lean CLAY with SAND, dark yellowish brown	CL
□	SM0003_001H	3	3.0-3.5'	SILTY SAND	SM

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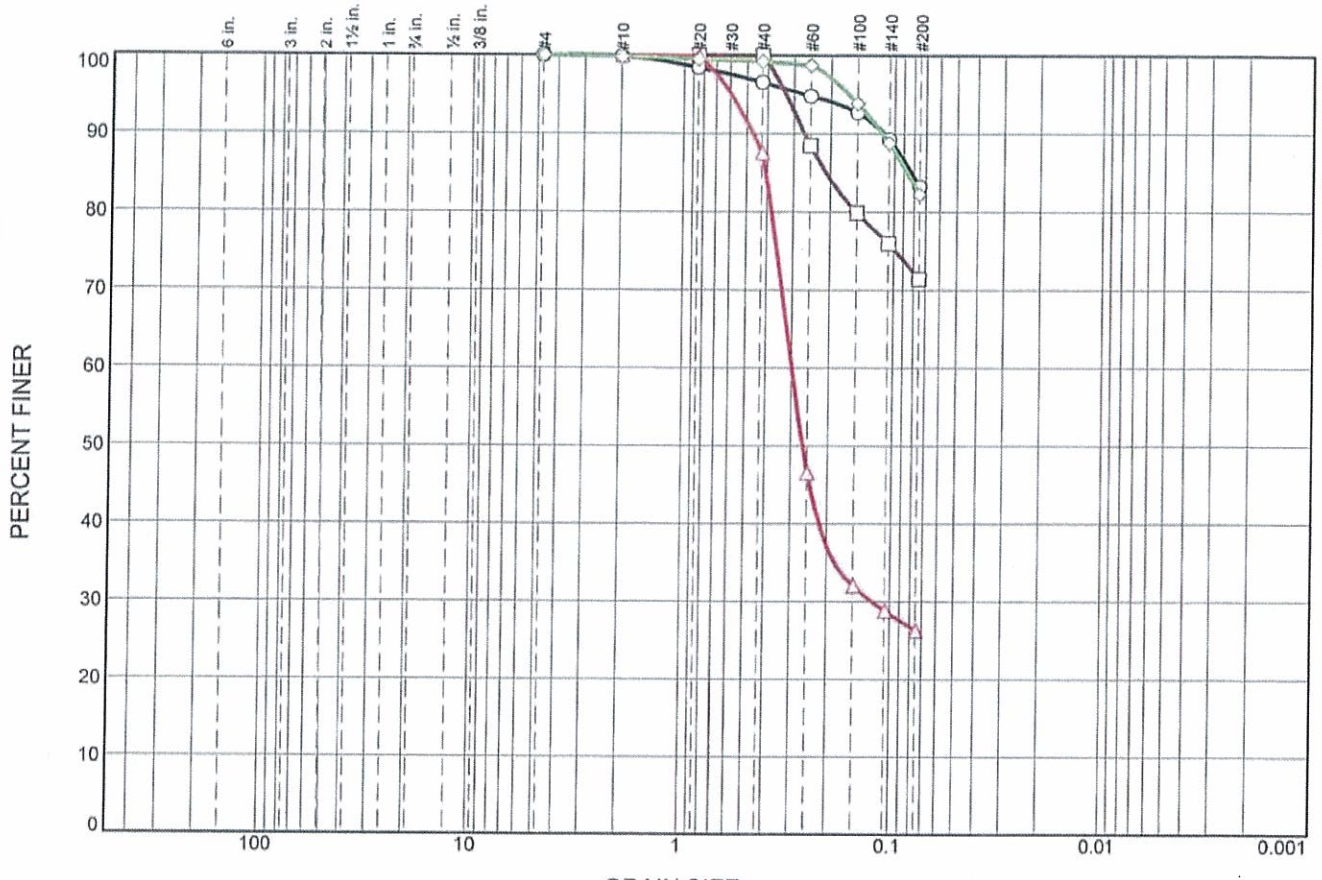
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	3.3	13.4	83.2	
□	0.0	0.0	0.0	0.0	0.0	28.6	71.4	
△	0.0	0.0	0.0	0.0	12.4	61.3	26.3	
◇	0.0	0.0	0.0	0.2	0.6	17.0	82.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	SM0003_002C	2A/2B	16.0-17.0'	Lean CLAY with SAND, dark olive brown	CL
□	SM0003_002C	3	21.2-22.0'	Lean CLAY with SAND, brown	CL
△	SM0003_002C	4	36.0-37.0'	SILTY SAND	SM
◇	SM0003_002H	3	3.0-3.5'	Lean CLAY with SAND, yellowish brown	CL

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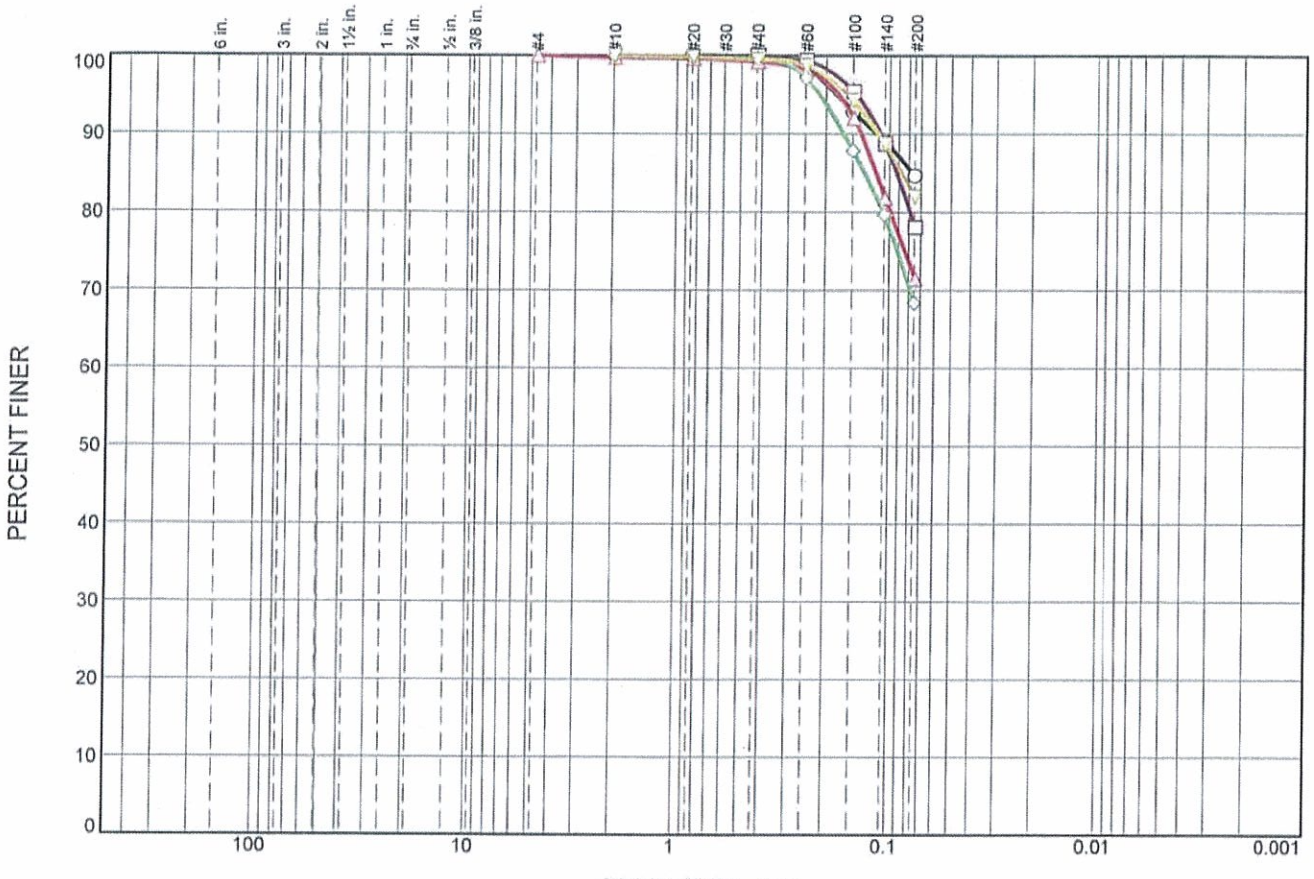
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	15.3	84.7	
□	0.0	0.0	0.0	0.0	0.0	21.9	78.1	
△	0.0	0.0	0.0	0.3	0.5	27.7	71.5	
◇	0.0	0.0	0.0	0.0	0.3	31.3	68.4	
▽	0.0	0.0	0.0	0.0	0.5	17.5	82.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	SM0003_003C	1A/1B	8.5-9.5'	Lean CLAY with SAND, dark olive brown	ML
□	SM0003_003C	2	24.0-25.0'	SILT with SAND, dark yellowish brown	ML
△	SM0003_003C	3A/3B	40.0-41.0'	SILTY CLAY with SAND, dark yellowish brown	CL-ML
◇	SM0003_003H	2	2.0-2.5'	SANDY Lean CLAY	CL
▽	SM0003_003H	3	3.0-3.5'	Lean CLAY with SAND, yellowish brown	CL

Blackburn Consulting

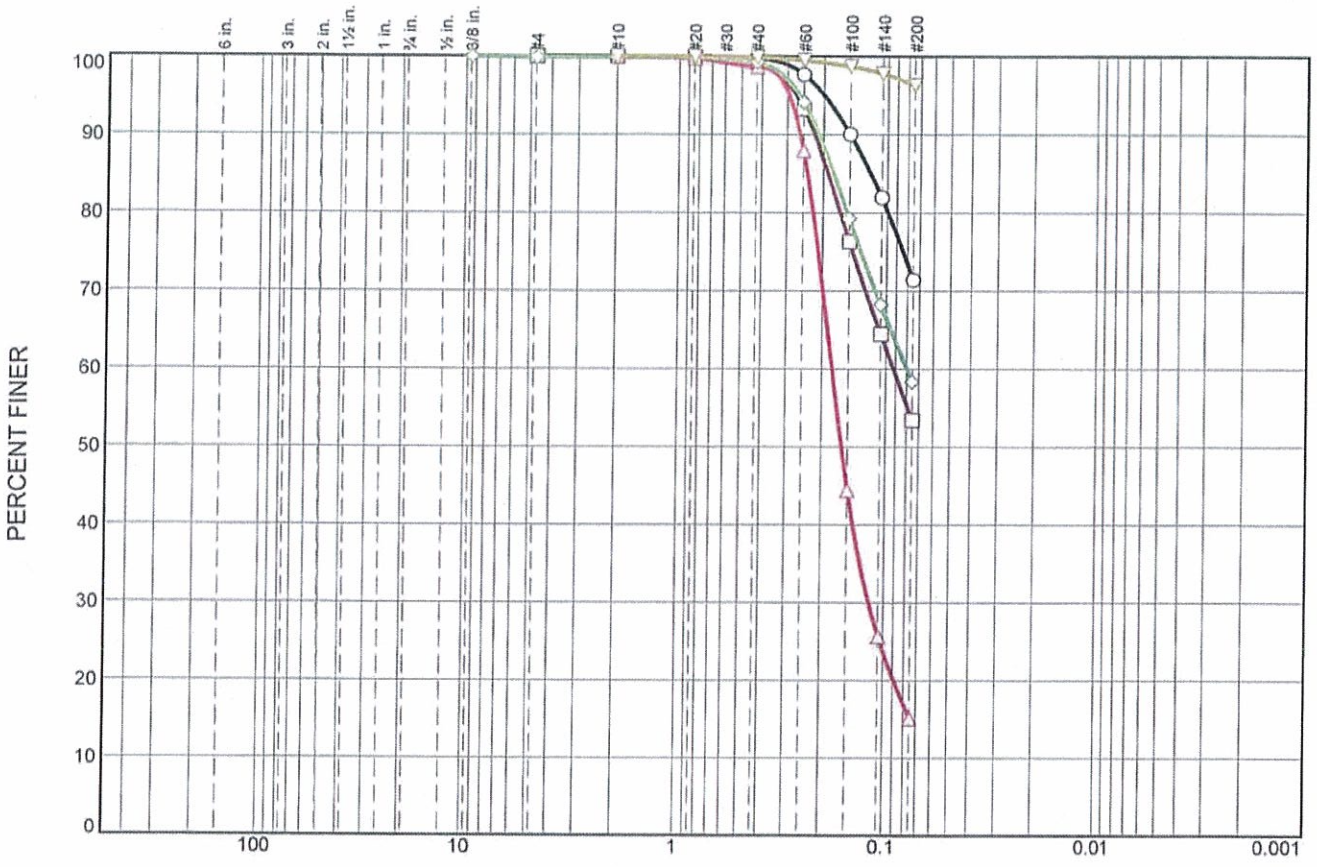
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	28.4	71.4	
□	0.0	0.0	0.0	0.0	0.7	45.9	53.4	
△	0.0	0.0	0.0	0.0	1.3	83.7	15.0	
◇	0.0	0.0	0.1	0.0	0.6	41.0	58.3	
▽	0.0	0.0	0.0	0.0	0.1	3.6	96.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	SM0003_004C	2A/2B	17.0-18.0'	SILT with SAND, dark yellowish brown	ML
□	SM0003_004C	3A/3B	24.0-25.0	SANDY SILT, olive	ML
△	SM0003_004C	4	43.5-44.0'	SILTY SAND, grayish brown	SM
◇	SM0003_004H	2	2.0-2.5'	Lean CLAY with SAND	CL
▽	SM0003_004H	5	4.5-5.0'	Lean CLAY, dark yellowish brown	CL

Blackburn Consulting

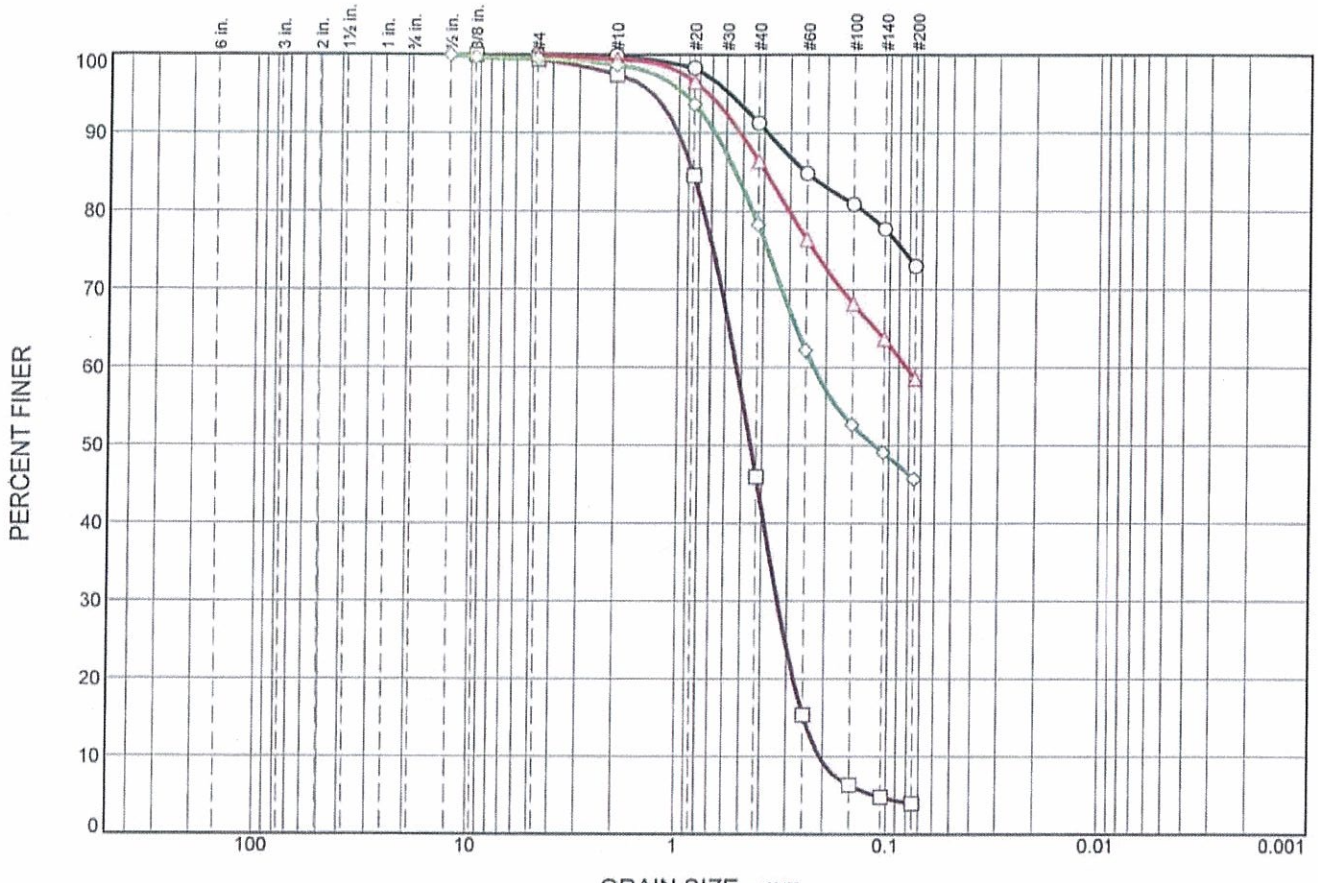
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	8.6	18.3	73.0	
□	0.0	0.0	0.6	1.9	51.6	42.0	3.9	
△	0.0	0.0	0.0	0.5	13.0	27.9	58.6	
◇	0.0	0.0	0.5	0.8	20.4	32.6	45.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	SM0003_008C	1A/1B	10.0-11.0'	Lean CLAY with SAND, dark yellowish brown	CL
□	SM0003_008C	2B	18.5-19.0'	Poorly-graded SAND, dark yellowish brown	SP
△	SM0003_008H	2	2.0-3.0'	SANDY SILTY CLAY, dark yellowish brown	CL-ML
◇	SM0003_008H	4	4.0-4.5'	SILTY CLAYEY SAND, dark olive brown	

Blackburn Consulting

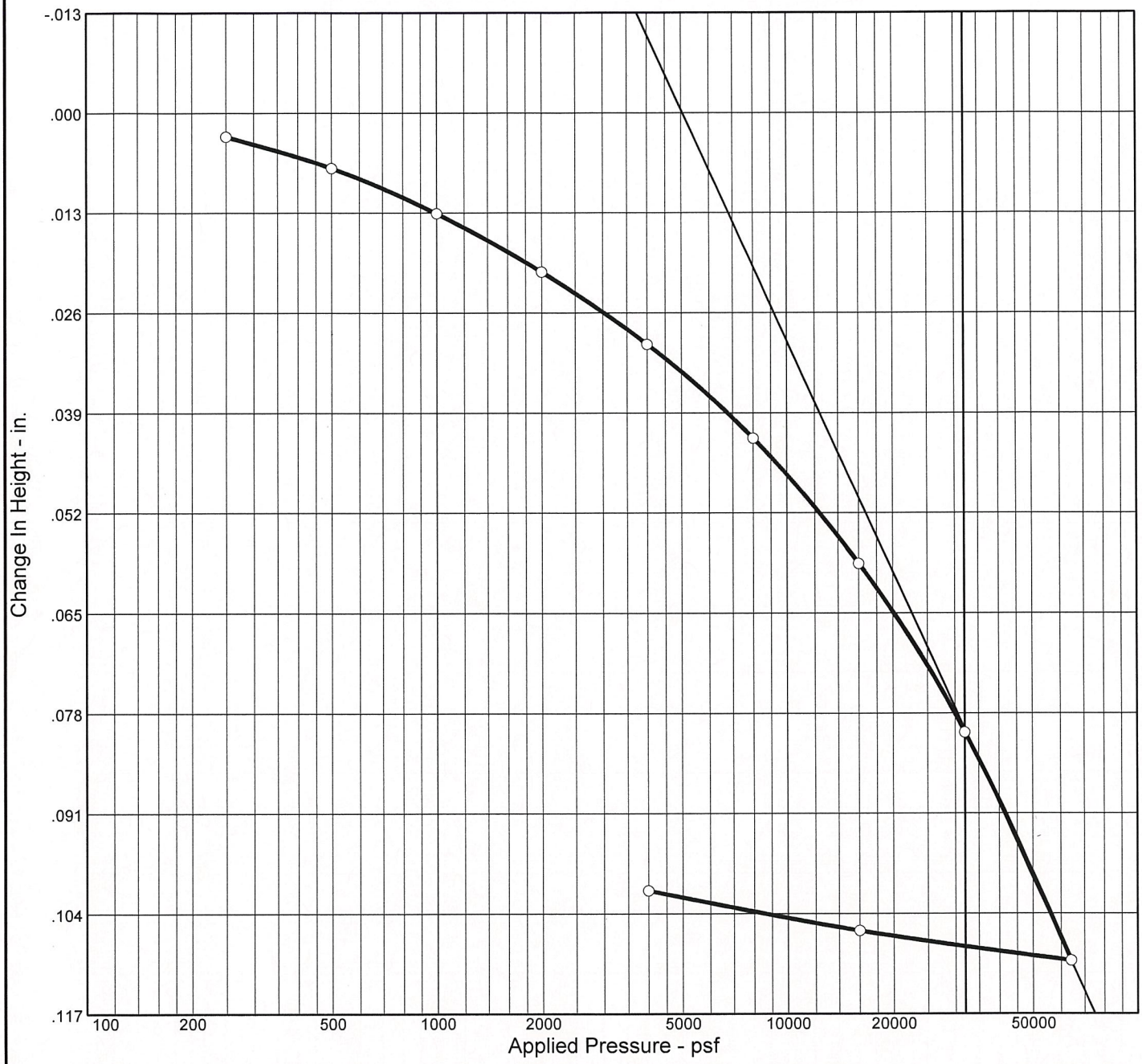
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee Rehabilitation

Project No.: 1967.1 (SM)

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
92.6 %	27.1 %	92.9			2.65	1230	32551	0.18	0.01	0.776

MATERIAL DESCRIPTION	USCS	AASHTO
SILT, brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

Source: SM0007_001B **Sample No.:** 6 Consol **Elev./Depth:** 10.25-10.33'

Blackburn Consulting

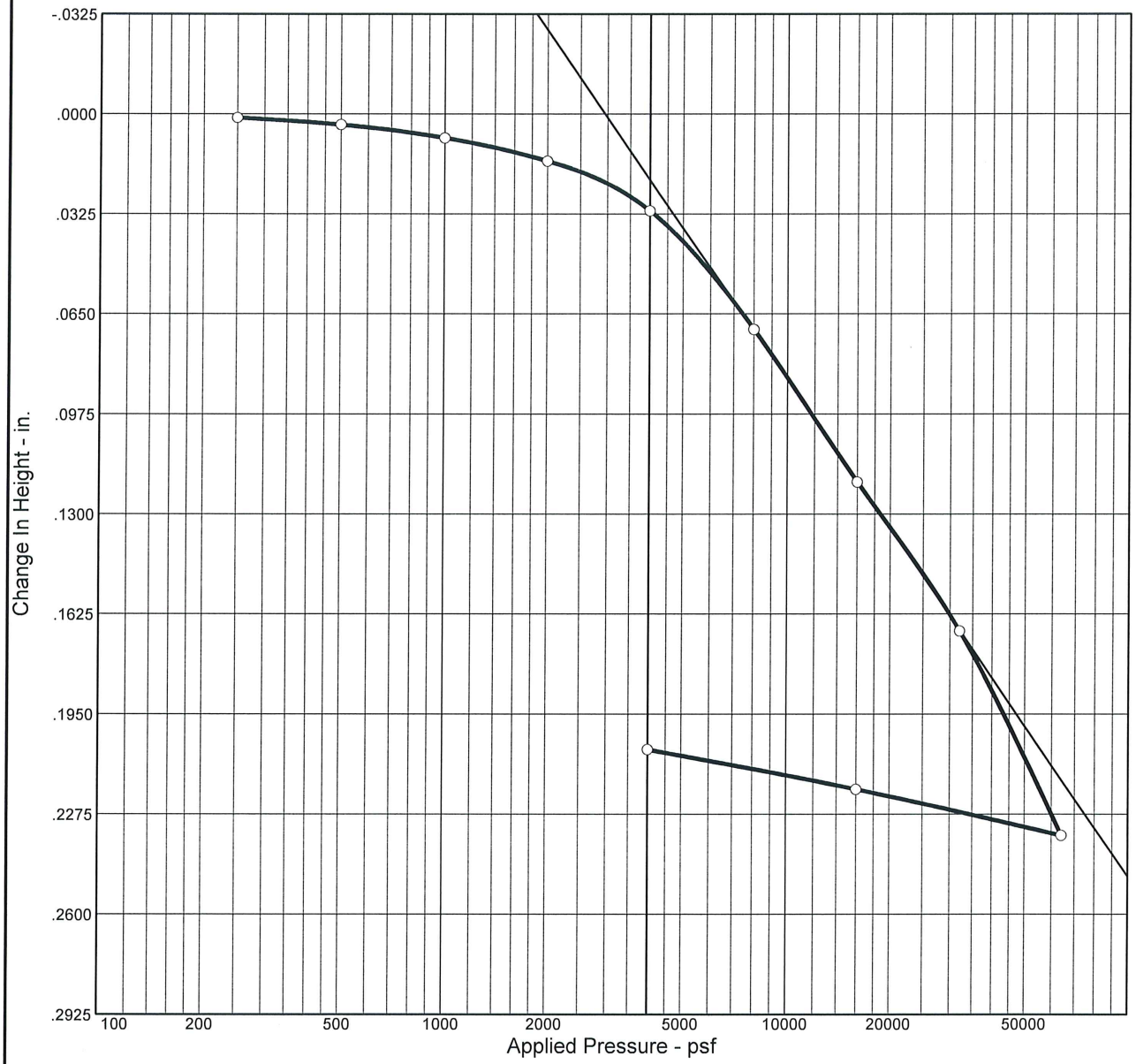
W. Sacramento, CA

Remarks:

86.3% Fines

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
80.6 %	39.5 %	72.7	50	15	2.65	2069	4862	0.37	0.05	1.299

MATERIAL DESCRIPTION	USCS	AASHTO
Elastic SILT, dark yellowish brown, with mottled cemented nodules	MH	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

Source: SM0007_001B **Sample No.:** 9 Consol **Elev./Depth:** 17.24-17.32'

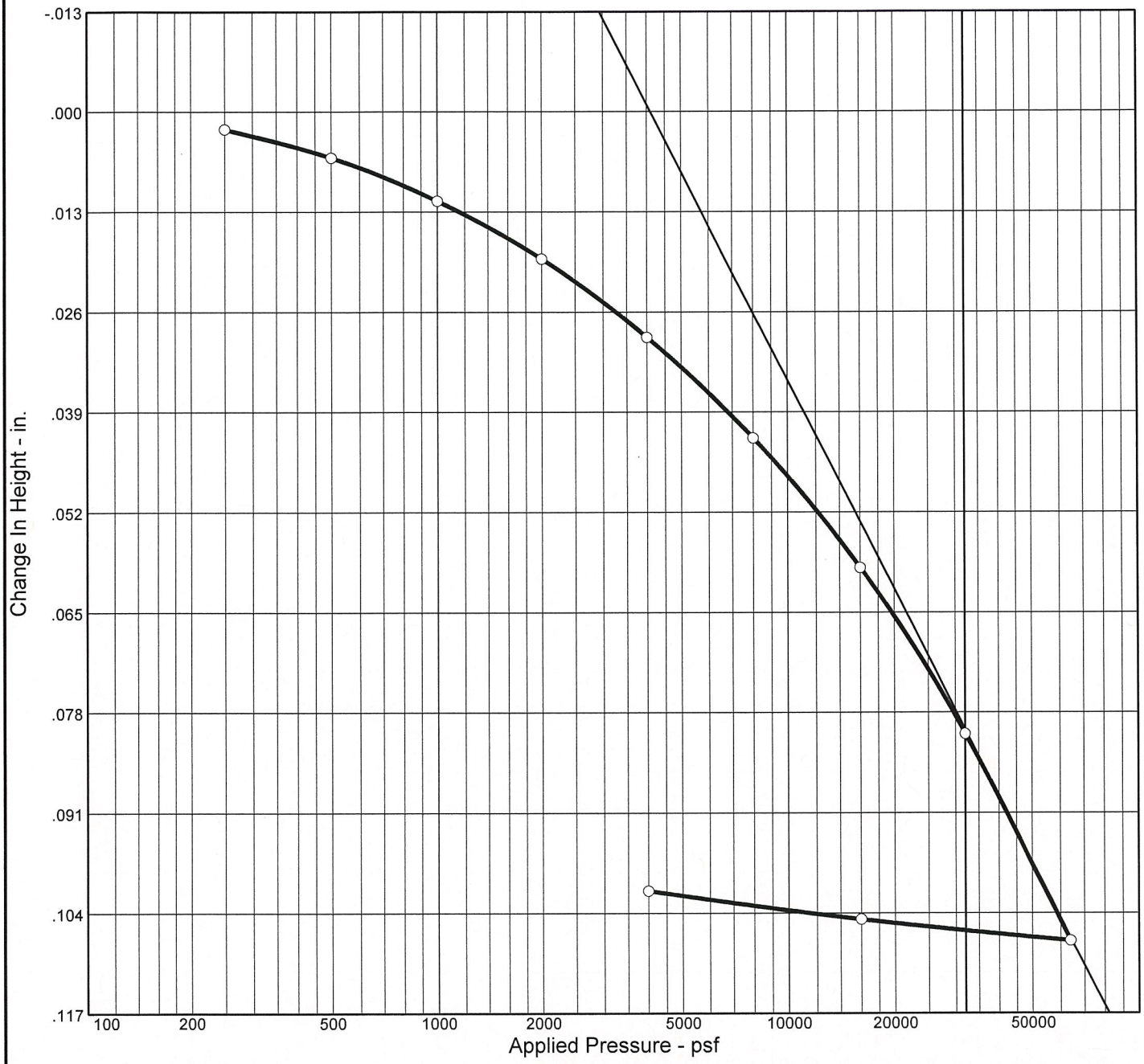
Blackburn Consulting

W. Sacramento, CA

Remarks:

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
100.6 %	32.0 %	89.8	31	7	2.65	2890	32841	0.22	0.01	0.842

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND, brown	SM	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

Source: SM0007_001B **Sample No.:** 13 Consol **Elev./Depth:** 26.56-26.62'

Blackburn Consulting

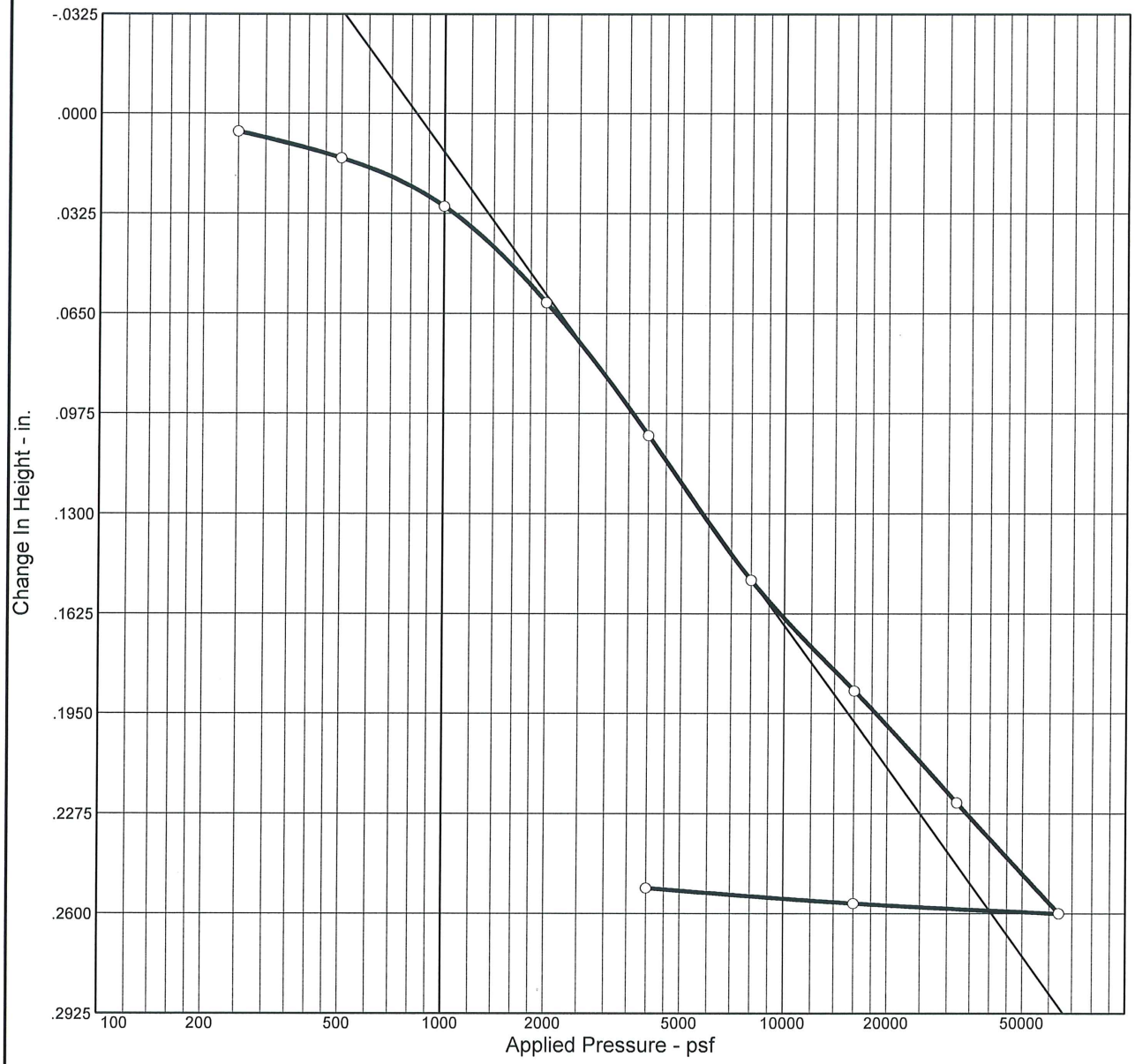
W. Sacramento, CA

Remarks:

Fines = ML

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
88.0 %	52.2 %	65.4			2.65	918	1419	0.53	0.02	1.571

MATERIAL DESCRIPTION	USCS	AASHTO
SILT with SAND, very dark brown, fine sand, trace organics, trace cemented nodules	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

Source: SM0007_002B **Sample No.:** 4 Consol **Elev./Depth:** 7.66-7.72'

Blackburn Consulting

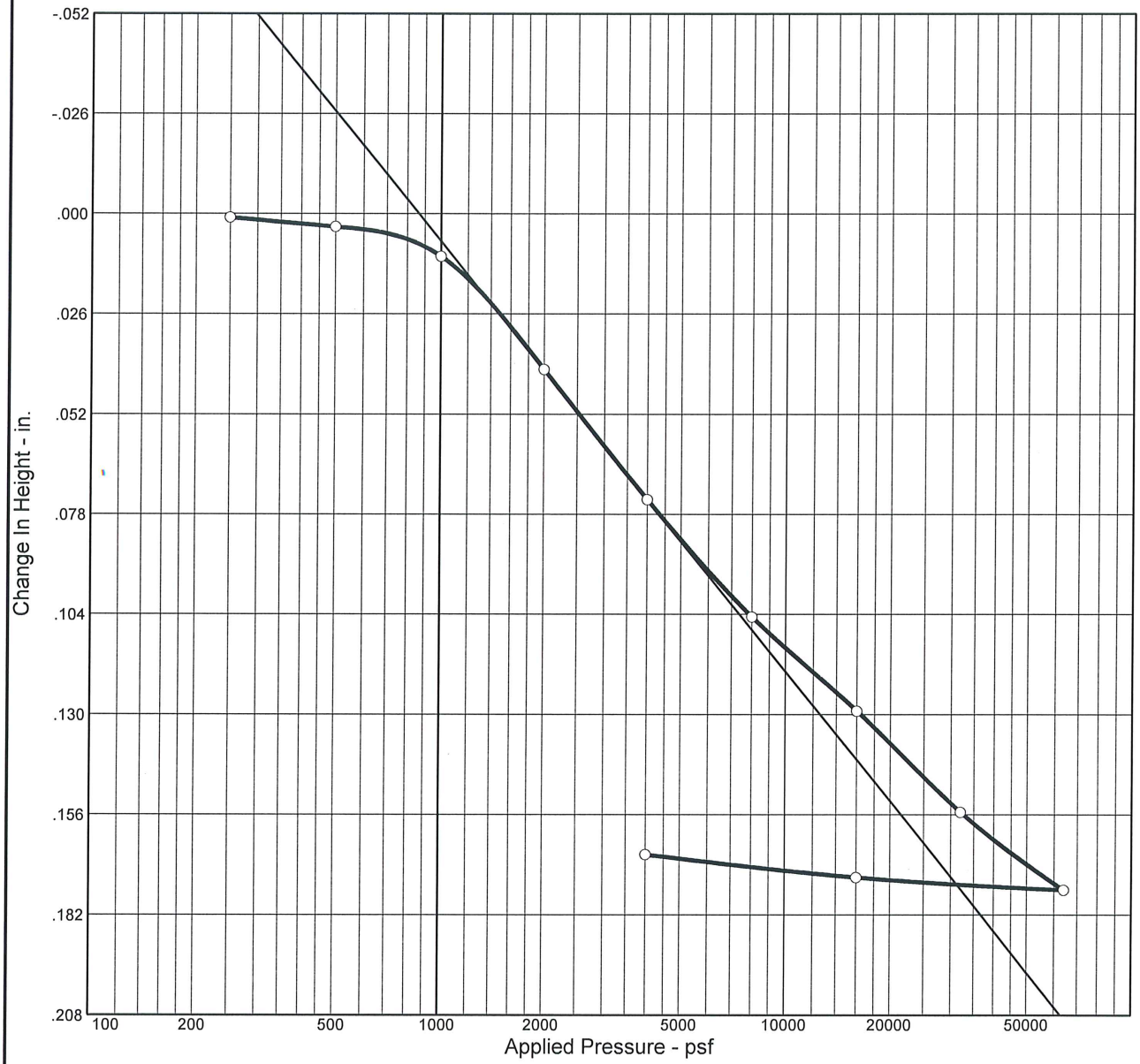
W. Sacramento, CA

Remarks:

12/2/10: Atterberg test results are pending completion of triaxial test.

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
66.9 %	19.6 %	93.6	34	16	2.65	618	1121	0.26	0.02	0.776

MATERIAL DESCRIPTION	USCS	AASHTO
Lean CLAY with SAND, dark reddish brown	CL	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

Source: SM0007_003A **Sample No.:** 4 Consol **Elev./Depth:** 5.15-5.21'

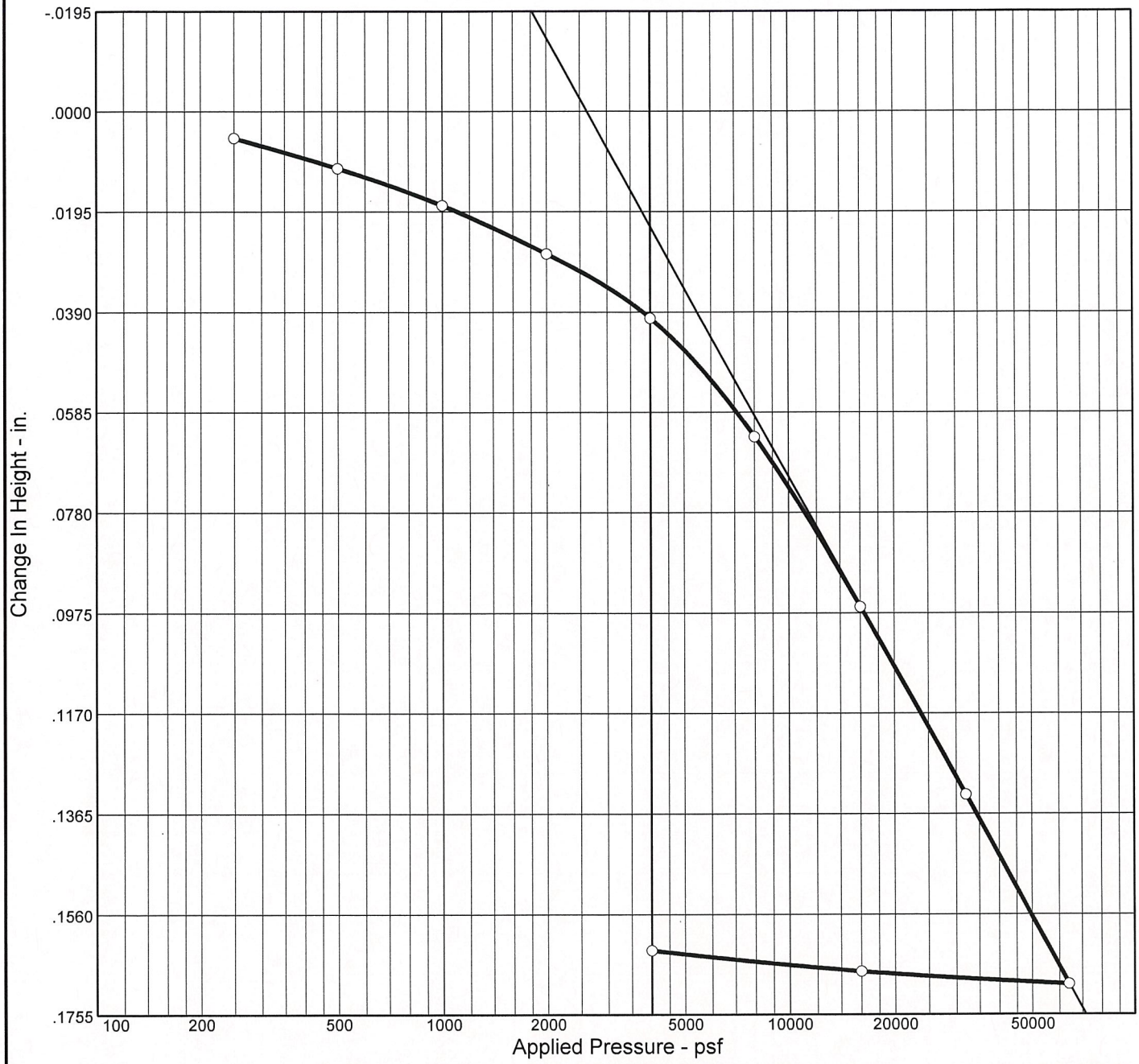
Blackburn Consulting

W. Sacramento, CA

Remarks:

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
89.2 %	36.5 %	80.4	26	NP	2.65	1712	6177	0.34	0.02	1.084

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT, dark brown	ML	

Project No. 1967.1 **Client:** URS Corporation

Project: SBFCA FRWL EIP

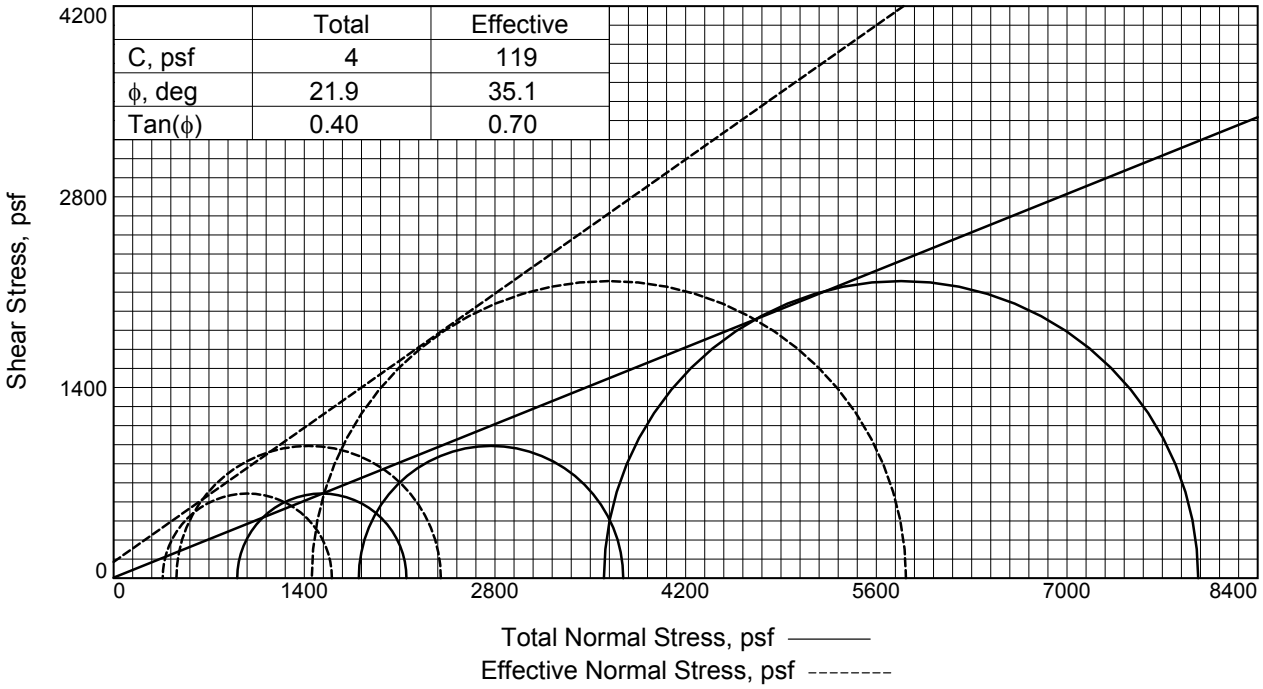
Source: SM0007_004B **Sample No.:** 7 Consol **Elev./Depth:** 14.27-14.33'

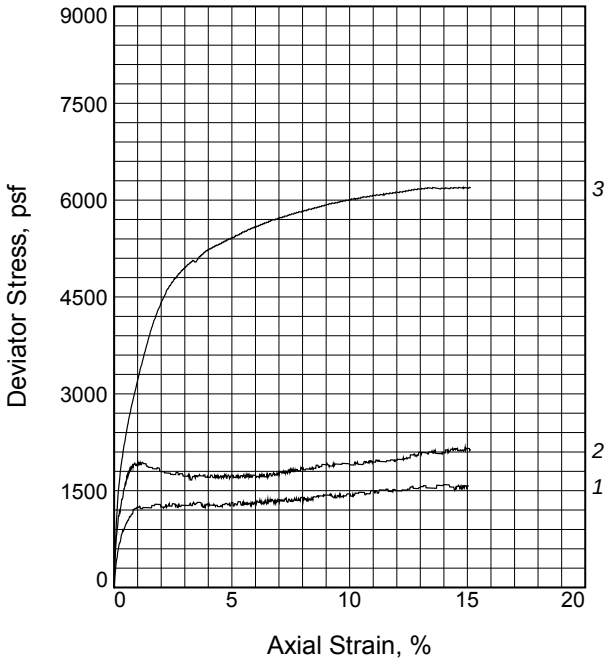
Blackburn Consulting

W. Sacramento, CA

Remarks:

Figure





Specimen No.		1	2	3
Initial	Water Content, %	37.1	37.8	36.0
	Dry Density, pcf	76.0	75.3	80.7
	Saturation, %	82.3	82.6	89.3
	Void Ratio	1.2177	1.2373	1.0897
	Diameter, in.	2.873	2.884	2.882
	Height, in.	5.997	5.947	5.863
At Test	Water Content, %	42.2	43.1	37.2
	Dry Density, pcf	78.8	77.9	84.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.1401	1.1637	1.0055
	Diameter, in.	2.827	2.843	2.837
	Height, in.	5.977	5.917	5.808
Strain rate, in./min.		0.0005	0.0005	0.0005
Eff. Cell Pressure, psf		907	1800	3600
Fail. Stress, psf		1243	1942	4363
Excess Pore Pr., psf		547	1339	2146
Strain, %		1.0	1.0	2.0
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1603	2403	5818
$\bar{\sigma}_3$ Failure, psf		360	461	1454

Type of Test:
CU with Pore Pressures

Sample Type: 3" Shelby Tube

Description:
Triax 1&2: Light olive brown elastic SILT
Triax 3: Light olive brown SILT

Assumed Specific Gravity= 2.7

Remarks:
Triax 1: LL=50, PI=19
Triax 2: LL=50, PI=15
Triax 3: LL=43, PI=11

Figure _____

Client: URS Corporation

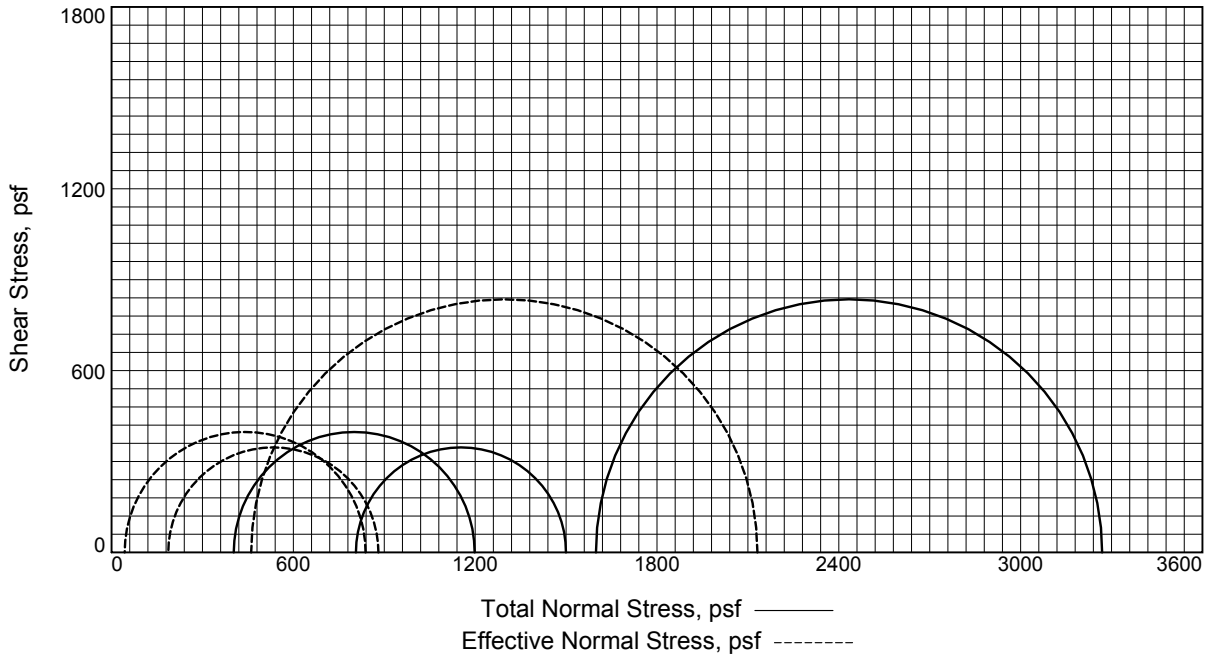
Project: SBFCA FRWL EIP

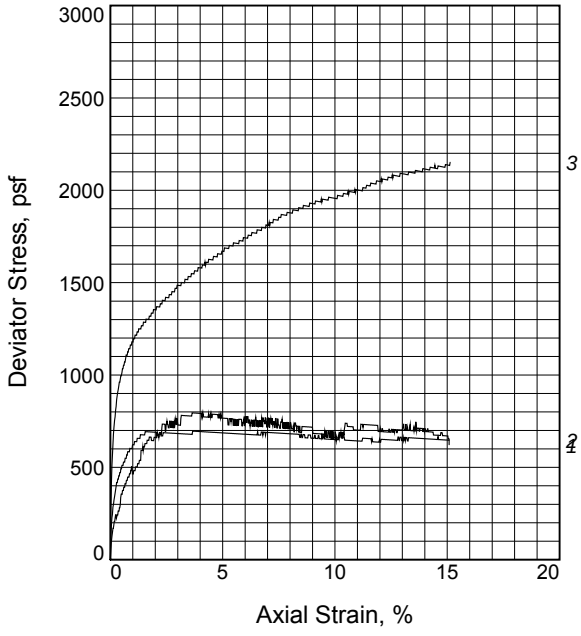
Source of Sample: SM0007_001B **Depth:** 16.02-18.0'

Sample Number: 9 Triax (all)

Proj. No.: 1967.1 (URS) **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2	3
Initial	Water Content, %	64.0	54.9	40.3
	Dry Density, pcf	60.0	65.7	81.7
	Saturation, %	95.6	94.6	102.3
	Void Ratio	1.8084	1.5667	1.0637
	Diameter, in.	2.860	2.862	2.869
	Height, in.	5.882	5.927	5.947
At Test	Water Content, %	64.0	54.8	37.0
	Dry Density, pcf	61.8	68.0	84.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.7273	1.4805	0.9979
	Diameter, in.	2.824	2.823	2.832
	Height, in.	5.857	5.889	5.908
Strain rate, in./min.		0.0005	0.0005	0.0005
Eff. Cell Pressure, psf		403	806	1598
Fail. Stress, psf		795	693	1670
Excess Pore Pr., psf		360	619	1138
Strain, %		3.6	1.6	5.0
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		838	880	2131
$\bar{\sigma}_3$ Failure, psf		43	187	461

Type of Test:
CU with Pore Pressures

Sample Type: 3" Shelby Tube

Description: Triax 1: Elastic SILT w/ organics
Triax 2: SILT w/ organics & wood fragments
Triax 3: SANDY SILT

Assumed Specific Gravity= 2.7

Remarks:
Triax 1: LL=51, PI=14
Triax 2: LL=45, PI=16
Triax 3: LL=NV, PI=NP

Figure _____

Client: URS Corporation

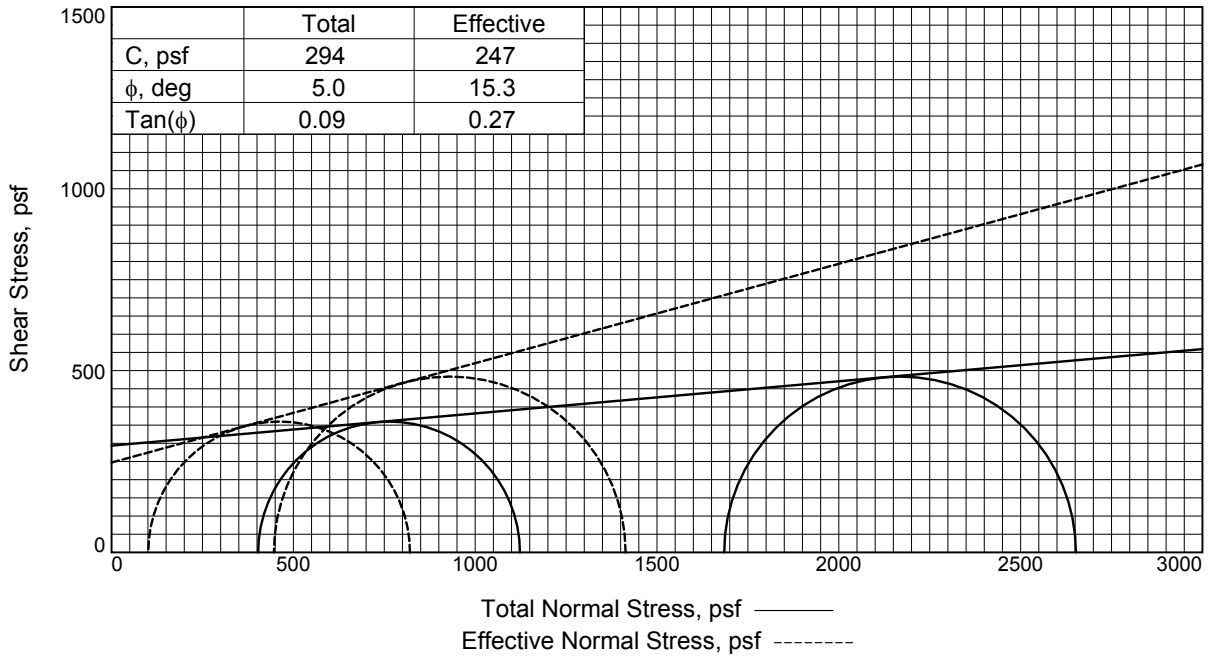
Project: SBFCA FRWL EIP

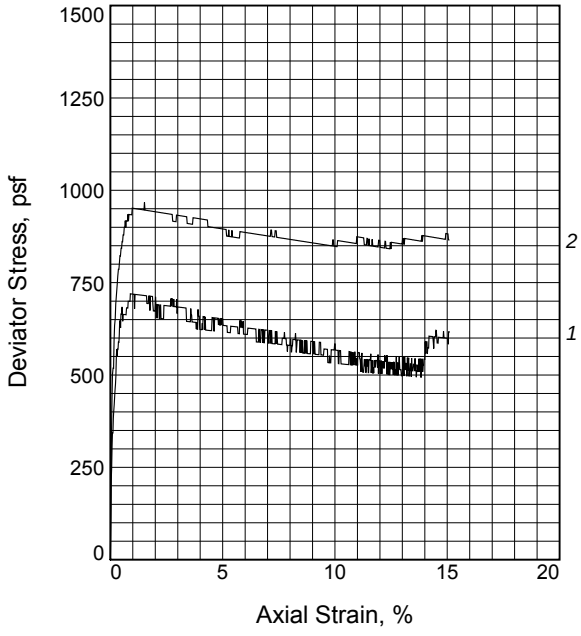
Source of Sample: SM0007_002B **Depth:** 6.52-8.5'

Sample Number: 4 Triax

Proj. No.: 1967.1 (URS) **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2
Initial	Water Content, %	20.6	20.7
	Dry Density, pcf	94.8	95.9
	Saturation, %	71.6	73.8
	Void Ratio	0.7787	0.7570
	Diameter, in.	2.862	2.864
	Height, in.	5.989	5.858
At Test	Water Content, %	25.7	25.1
	Dry Density, pcf	99.4	100.4
	Saturation, %	100.0	100.0
	Void Ratio	0.6951	0.6787
	Diameter, in.	2.802	2.807
	Height, in.	5.954	5.827
Strain rate, in./min.		0.0005	0.0005
Eff. Cell Pressure, psf		403	1685
Fail. Stress, psf		720	967
Excess Pore Pr., psf		302	1238
Strain, %		0.9	1.5
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		821	1414
$\bar{\sigma}_3$ Failure, psf		101	446

Type of Test:
CU with Pore Pressures

Sample Type: 3" Shelby Tube

Description:
Dark brown lean CLAY

Assumed Specific Gravity= 2.7

Remarks:
Triax 1: LL=34, PI=17
Triax 2: LL=34, PI=16

Figure _____

Client: URS Corporation

Project: SBFCA FRWL EIP

Source of Sample: SM0007_003A **Depth:** 4.59-5.71'

Sample Number: 4 Triax

Proj. No.: 1967.1 (URS) **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA

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2491 Boatman Ave • West Sacramento, CA 95691
(916) 375-8706 • Fax: (916) 375-8709

blackburn consulting

Main Office: (530) 887-1494
11521 Blocker Drive, Suite 110 • Auburn, CA 95603
West Sacramento Office: (916) 375-8706

Geotechnical • Construction Services • Forensics

December 17, 2010

Mehrzad Maghsoudlou
URS Corporation
2870 Gateway Oaks Drive, Suite 150
Sacramento, CA 95833

Subject: **QC/QA Procedure for Laboratory Test Results**
SBFCA FRWL EIP Project
BCI # 1967.1 (various)

Project QC/QC procedures are as follows;
Test results are recorded on standard laboratory worksheets which are submitted to the Laboratory Manager (Michael Robertson) or Assistant Laboratory Manager (Mark Robertson), who reviews them prior to preparing a test report. When the laboratory testing reports are completed, they are submitted to the Geotechnical Services Manager (Bob Lokteff) or assigned Engineer (Kristy Chapman) for review. The original LTS and worksheets are then filed in the lab testing folder and saved for 5 years per ASSHTO R18. Completed lab reports are placed in the project folder and filed. Lab results and reports are then submitted to URS. Lab test performed by other labs are reported as received on their own letterhead if applicable.

If we can provide further services or if you have any questions, please call.

Sincerely,

BLACKBURN CONSULTING

Reviewed by:

Michael D. Robertson
Laboratory Manager

Robert B. Lokteff, P.E.
Senior Engineer

Copies: 1 to Addressee

Lab Certifications
AMRL 4122
Caltrans 248
CCRL 2342
USACE

APPENDIX F

Task Order 2 and Task Order 4 Boring Logs

GROUP SYMBOLS AND NAMES

Graphic	Group Names	Graphic	Group Names	Graphic	Group Names
	Lean Clay (CL)		Lean Clay with Sand (CL)		Lean Clay with Gravel (CL)
	Sandy Lean Clay (CL)		Fat Clay (CH)		Fat Clay with Sand (CH)
	Fat Clay with Gravel (CH)		Sandy Fat Clay (CH)		Silty Clay (CL-ML)
	Silty Clay with Sand (CL-ML)		Sandy Silty Clay (CL-ML)		Clayey Silt (ML/CL)
	Silt (ML)		Silt with Sand (ML)		Sandy Silt (ML)
	Elastic Silt (MH)		Sandy Elastic Silt (MH)		Poorly Graded Sand (SP)
	Poorly Graded Sand with Gravel (SP)		Poorly Graded Sand with Clay (SP-SC)		Poorly Graded Sand with Clay and Gravel (SP-SC)
	Poorly Graded Sand with Silt (SP-SM)		Poorly Graded Sand with Silt and Gravel (SP-SM)		Well-Graded Sand (SW)
	Well-Graded Sand with Gravel (SW)		Well-Graded Sand with Clay (SW-SC)		Well-Graded Sand with Clay and Gravel (SW-SC)
	Well-Graded Sand with Silt (SW-SM)		Well-Graded Sand with Silt and Gravel (SW-SM)		Clayey Sand (SC)
	Clayey Sand with Gravel (SC)		Silty Clayey Sand (SC-SM)		Silty Sand (SM)
	Silty Sand with Gravel (SM)		Poorly Graded Gravel (GP)		Poorly Graded Gravel with Sand (GP)
	Poorly Graded Gravel with Clay (GP-GC)		Poorly Graded Gravel with Clay and Sand (GP-GC)		Poorly Graded Gravel with Silt (GP-GM)
	Poorly Graded Gravel with Silt and Sand (GP-GM)		Well-Graded Gravel (GW)		Well-Graded Gravel with Sand (GW)
	Well-Graded Gravel with Clay (GW-GC)		Well-Graded Gravel with Clay and Sand (GW-GC)		Well-Graded Gravel with Silt (GW-GM)
	Well-Graded Gravel with Silt and Sand (GW-GM)		Clayey Gravel (GC)		Clayey Gravel with Sand (GC)
	Silty Clayey Gravel (GC-GM)		Silty Gravel (GM)		Silty Gravel with Sand (GM)

Note: Soils were classified in the field in general accordance with ASTM D2488-06, Standard Practice for Description and Identification of Soils (Visual Manual Procedure). Where laboratory testing was performed, classifications were modified in general accordance with ASTM D2487-06, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

Borderline symbols, two group symbols separated by a slash, may be used in field visual classification when (1) percentage of fines is estimated to be between 45% and 55%, (2) percentages of sand and gravel are estimated to be about the same, (3) soil could be either well graded or poorly graded, (4) soil could be either a silt or a clay, or (5) fine-grained soil has properties indicating that it is at the boundary between low and high plasticity. Refer to DWR Soil and Rock Logging, Classification, and Presentation Manual for guidelines in the use of borderline symbols.

FIELD AND LABORATORY TESTS

AL	Atterberg Limits - Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02 & T 90-00)
CCRS	One Dimensional Consolidation Controlled-Strain (ASTM D 4186)
CDDS	Consolidated Drained Direct Shear
CL	Collapse Potential (ASTM D 5333-03)
CN	Consolidation (ASTM D 2435-04)
CP	Relative Compaction (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CRSC	Constant Rate of Strain Consolidation
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
CUDS	Consolidated Undrained Direct Simple (ASTM D 6528-07)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
FWK	Hydraulic Conductivity Flexible Wall Permeameter (ASTM D 5084)
HD	Hydrometer (ASTM)
N_{60}	$N_{60}(ASTM)=N_m*(Eri/60)$
OC	Organic Content (ASTM D 2974-07)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PE	Permeability (CTM 220 - 05)
PM	Pressure Meter
PP	Pocket Penetrometer
RV	R-Value (CTM 301 - 00)
SCUDSS	Special Consolidated Undrained Direct Simple Shear (ASTM D 6528)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression (ASTM D 2166-06)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223 - 96 [2004])
WC	Water Content (ASTM D 2216-05)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test
- Standard California
- Modified California
- Shelby Tube
- Punch Core
- Sonic Core
- Dry Core
- Bag Sample
- Vane Shear
- Tricone Bit
- NSD — Non Sample Drilling

WATER LEVEL SYMBOLS

- First water encountered during drilling
- Water level measured after drilling
- Static water level reading (short-term)
- Static water leavel reading (long-term)

SBFCA PAGE1 DYNAMIC NO WELL GRAPHICS SBFCA FRWL.GPJ SUTTERBUTTELIBRARY01272012.GLB 2/21/12

SUTTER BUTTE FLOOD CONTROL AGENCY

SBFCA Feather River West Levee

BORING LOG LEGEND

CONSISTENCY OF COHESIVE SOILS (AASHTO 1988)		
Descriptor	**Pocket Penetrometer (tsf)**	**Torvane (tsf)**
Very Soft	< 0.25	< 0.12
Soft	0.25 - 0.50	0.12 - 0.25
Medium Stiff	0.50 - 1.0	0.25 - 0.50
Stiff	1.0 - 2.0	0.50 - 1.0
Very Stiff	2.0 - 4.0	1.0 - 2.0
Hard	> 4.0	> 2.0

APPARENT DENSITY OF COHESIONLESS SOILS (ASTM 6066-96 (2004))	
Descriptor	**SPT N(60) - Value (blows / foot)**
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE (ASTM D 2488-06)	
Descriptor	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

SOIL PARTICLE SIZE (ASTM D 2488-06)		
Descriptor		**Size**
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

DRY STRENGTH OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
None	Dry specimen crumbles into powder with mere pressure of handling.
Low	Dry specimen crumbles into powder with some finger pressure.
Medium	Dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	Dry specimen cannot be broken with finger pressure; will break into pieces between thumb and a hard surface.
Very High	Dry specimen cannot be broken between thumb and a hard surface.

DILATANCY OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear, or disappears slowly, upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

TOUGHNESS OF FINE-GRAINED SOILS (ASTM D 2488-06)	
Descriptor	**Criteria**
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

CEMENTATION (ASTM D 2488-06)	
Descriptor	**Criteria**
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure.

SBFCA Feather River West Levee

BORING LOG LEGEND

DATE STARTED 8/3/11 **DATE COMPLETED** 8/3/11	**GROUND ELEVATION** 35.00 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 31.5 ft
DRILLING CONTRACTOR Pitcher Drilling Co.	**DRILLER'S NAME** James **HELPER'S NAME** Malakai	**TOTAL DEPTH OF FILL** 0 ft
DRILLING METHOD 0-12.5': HSA, 12.5-31.5': Mud Rotary	**DRILL RIG MAKE AND MODEL** CME 55	**CONSULTANT COMPANY** Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" (OD) HSA; 3 7/8" tri-cone (mud rotary)	**DRILLING ROD TYPE AND DIAMETER** 8" (OD) HSA; NWJ 2 5/8" (OD)	**FIELD LOGGER** AGW
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** None	**FIELD LOG REVIEWER** JTF
SAMPLER TYPE(S) Shelby(2.87"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Automatic trip, 140 lb / 30-in drop	**HAMMER EFFICIENCY** 77%
BOREHOLE BACKFILL OR COMPLETION neat cement grout	**GROUNDWATER READING: DURING DRILLING** 12.5 ft	**AFTER DRILLING (DATE-TIME)** Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
35	0		LEAN CLAY with SAND (CL); hard; dark yellowish brown; moist; fine sand.												
	1				1				>4.5P	19	34	13	84	UW, HD, PA	Pushed Shelby tube at 400 psi
	2														
	3		As above except medium stiff.		2		2 3 4 [7]	9							
	4														
30	5		LEAN CLAY (CL); stiff to very stiff; brown; moist; fine sand.												
	6				3				1.1P 2.5P 3.1P	29	39	15	96	UW, PA	Pushed Shelby tube at 150 psi
	7														
	8		As above except soft.		4		0 0 2 [2]	3		32	35	11	94	PA	
	9														
25	10		SILT (ML); soft; brown; moist; fine sand.												
	11		As above except stiff.		5				1.1P <0.5P	33	33	9	86	PA	Pushed Shelby tube at 75 psi
	12		As above except very soft.						<0.5P						
	13		SILTY CLAY with Sand (CL-ML); medium stiff; brown; wet; fine to medium sand.		6		2 2 3 [5]	6			28	6	73	PA	
	14														
20	15		LEAN CLAY with Sand (CL); medium stiff; brown; wet; fine sand.												
	16				7				0.75P 1.0P 0.75P	28	30	8	79	PA	Pushed Shelby tube at 50 psi
	17									26	28	9	79	CU, PA	
	18				8		1 2 3 [5]	6		25	29	10	79	PA	
	19														
	20														

Final Report Version

Borehole Location: L/S Toe of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,090,754.33 **Easting:** 6,675,123.51
Latitude: 38.90253 **Longitude:** -121.60131
Levee Station or Milepost: 64+97 **Levee Mile:**
Levee Segment Reach 1
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_001B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
15	20	As above except moist; 85-95% fines; 5-15% fine to medium sand.		9				0.75P 2.0P 0.75P						Pushed Shelby tube at 150 psi
	21	As above except stiff.												
	22	As above except medium stiff.												
	23	SANDY SILTY CLAY (CL-ML); medium stiff; very dark greenish gray; moist; fine sand.		10		2 2 3 [5]	6		23	24	6	57	PA	
	24													
10	25	SILTY SAND (SM); medium dense; very dark greenish gray; moist; no plasticity fines; fine sand; with lenses of Poorly Graded SAND and Poorly Graded SAND with Silt.		11										Pushed Shelby tube at 200 psi
	26								26			15 19	PA UW, PA FWK	
	27													
	28	Poorly Graded SAND (SP); medium dense; very dark greenish gray; moist; 95% fine sand; 5% fines; 0% gravel.		12		2 4 8 [12]	15							
	29													
5	30	Well-Graded SAND (SW); medium dense; very dark greenish gray; moist; fine to coarse sand; about 5% fine to coarse gravel.		13		2 5 7 [12]	15					4	PA	
	31													
	32	Borehole terminated at 31.5 feet. Backfilled with neat cement grout.												
	33													
	34													
0	35													
	36													
	37													
	38													
	39													
-5	40													
	41													
	42													
	43													
	44													
	45													

Final Report Version

Borehole Location: L/S Toe of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,090,754.33 **Easting:** 6,675,123.51
Latitude: 38.90253 **Longitude:** -121.60131
Levee Station or Milepost: 64+97 **Levee Mile:**
Levee Segment Reach 1
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_001B
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 8/15/11 **DATE COMPLETED** 8/15/11	**GROUND ELEVATION** 61.41 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 51.0 ft
DRILLING CONTRACTOR Gregg Drilling & Testing, Inc.	**DRILLER'S NAME** Robert **HELPER'S NAME** Marten	**TOTAL DEPTH OF FILL** 5.1 ft
DRILLING METHOD HSA	**DRILL RIG MAKE AND MODEL** Versa V100M	**CONSULTANT COMPANY** Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" (OD) HSA	**DRILLING ROD TYPE AND DIAMETER** 8" (OD) HSA	**FIELD LOGGER** AGW
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** None	**FIELD LOG REVIEWER** JTF
SAMPLER TYPE(S) Shelby(2.87"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Automatic trip, 140 lb / 30-in drop	**HAMMER EFFICIENCY** 85%
BOREHOLE BACKFILL OR COMPLETION neat cement grout	**GROUNDWATER READING: DURING DRILLING** Not encountered during drilling	**AFTER DRILLING (DATE-TIME)** Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL]												
60	1		SILT (ML); soft to very stiff; brown; moist; 90% low plasticity fines; 10% fine sand; 0% gravel.		1				3.8P 1.5P	10				UW	Pushed Shelby tube at 0 psi
	2														
	3		[LEVEE FILL] SILTY SAND (SM); very loose; brown; moist; 70% fine sand; 30% low plasticity fines; 0% gravel.		2		2 1 1 [2]	3							
FILL	4														
	5		[Approximate depth of Levee Fill].												
55	6		SANDY SILT (ML); very soft to stiff; dark yellowish brown; moist; 60% no to low plasticity fines; 40% fine sand; 0% gravel; interfingered with SILTY SAND.		3				1.4P	21				UW	Pushed Shelby tube at 0 psi
	7														
	8		SILT with Sand (ML); soft; dark yellowish brown; moist; fine sand.		4		1 2 1 [3]	4		22	29	6	83	PA	
	9														
50	10		SANDY SILT (ML); stiff; brown; moist; 70% low plasticity fines; 30% fine sand; 0% gravel.		5				1.5P	23				UW	Pushed Shelby tube at 0 psi
	11														
	12		SILTY CLAY with SAND (CL-ML); stiff; brown; moist; fine sand.		6		2 2 2 [4]	6		23	26	4	78	PA	
	13														
	14		SANDY SILT (ML); soft to stiff; brown; moist; fine sand.		7				2.0P	18	NP	NP	51	PA	Pushed Shelby tube at 0 psi
	15														
45	16														
	17		LEAN CLAY with SAND (CL); medium stiff to very stiff; brown; moist; fine to medium sand.		8		2 3 3 [6]	9	1.2P						
	18														
	19				9				2.25P	25	28	8	71	PA	Pushed Shelby tube at 0 psi (18.5-20') Pushed Shelby
	20														

Final Report Version

Borehole Location: W/S of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,094,266.86 **Easting:** 6,679,522.90
Latitude: 38.91212 **Longitude:** -121.58579
Levee Station or Milepost: 126+00 **Levee Mile:**
Levee Segment Reach 1
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_002B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20				9				2.25P						tube at 100 psi (20-20.5')
	21														
40	22		As above except with lenses of gray, fine sand.		10		2 4 4 [8]	11	1.2P						
	23		LEAN CLAY (CL); stiff; brown; moist; fine sand.												
	24				11				1.0P 1.2P 1.3P 1.8P	29	34	12	89	PA	Pushed Shelby tube at 75 psi
	25														
	26		SANDY SILT (ML); stiff; dark brown; moist; 70% low to medium plasticity fines; 30% fine sand; 0% gravel; with some organic matter.		12		4 5 7 [12]	17							
35	27														
	28		Poorly Graded SAND with Silt (SP-SM); loose; light brownsih gray; moist; 90% fine sand; 10% fines; 0% gravel. SILTY SAND (SM); loose; yellowish brown; moist; 80% fine sand; 20% fines; 0% gravel.		13										Pushed Shelby tube at 0 psi
	29		CLAYEY SAND (SC); loose; very dark grayish brown; moist; 60% fine sand; 40% medium plasticity fines; 0% gravel.												
	30		LEAN CLAY (CL); medium stiff; dark brown; moist; fine sand.		14		2 3 3 [6]	9							
30	31														
	32				15					27	36	13	90	PA	Pushed Shelby tube at 0 psi
	33														
	34														
	35		SILT with Sand (ML); medium stiff; brown; moist; 85% low to medium plasticity fines; 15% fine sand; 0% gravel.		16		3 4 4 [8]	11							
	36														
25	37		As above except stiff.		17				1.5P						Pushed Shelby tube at 100 psi (36.5-37.5') Pushed Shelby tube at 150 psi (37.5-38.5')
	38														
	39		As above except medium stiff.		18		3 3 3 [6]	9							
	40														
	41														
20	42				19				0.6P						Pushed Shelby tube at 0 psi
	43									26	25	2	76	PA	
	44		As above except soft.		20		2 2 3 [5]	7							
	45														

Final Report Version

Borehole Location: W/S of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,094,266.86 **Easting:** 6,679,522.90
Latitude: 38.91212 **Longitude:** -121.58579
Levee Station or Milepost: 126+00 **Levee Mile:**
Levee Segment Reach 1
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_002B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		As above except very soft.		21	0									Pushed Shelby tube at 0 psi
15	46														
	47														
	48		SANDY SILT (ML); very soft; brown; wet; fine sand.												
	49				22		2 1 1 [2]	3		25	NP	NP	57	PA	
	50				23		P P P [0]	0							
	51		Borehole terminated at 51 feet. Backfilled with neat cement grout.												
10	52														
	53														
	54														
	55														
5	56														
	57														
	58														
	59														
	60														
0	61														
	62														
	63														
	64														
	65														
-5	66														
	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE FLOOD CONTROL AGENCY

Borehole Location: W/S of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,094,266.86 **Easting:** 6,679,522.90
Latitude: 38.91212 **Longitude:** -121.58579
Levee Station or Milepost: 126+00 **Levee Mile:**
Levee Segment Reach 1
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_002B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/4/11	8/4/11	37.39 ft	NAVD 88	51.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Pitcher Drilling Co.	James	Malakai	0 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
0-19': HSA, 19-51.5': Mud Rotary	CME 55	Blackburn Consulting

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" (OD) HSA; 3 7/8" tri-cone (mud rotary)	8" (OD) HSA; NWJ 2 5/8" (OD)	AGW

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	None	JTF

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Shelby(2.87"), SPT(1.375")	Automatic trip, 140 lb / 30-in drop	77%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
neat cement grout	17.5 ft	Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY LEAN CLAY (CL); very soft to hard; dark yellowish brown; moist; fine sand.		1				<0.5P >4.5P 1.7P 3.75P	12 16 22	31 34 37	12 13 13	55 59 92	PA PA UW, PA	Pushed Shelby tube at 250 psi
35	2		LEAN CLAY (CL); very stiff; dark brown; moist; fine sand.												
	3		As above except soft.		2		1 1 2 [3]	4			37	14			
	4		As above except stiff; brown.												
	5				3				1.3P	23 24	32 32 30	13 12 9	91 94 97	PA CU, PA PA	Pushed Shelby tube at 75 psi
30	7		As above except medium stiff.		4		0 2 4 [6]	8							
	8														
	9														
	10				5				1.9P	23	47	24	94	UW, HD, PA	Pushed Shelby tube at 200 psi
25	11		As above except stiff.												
	12				6		5 8 12 [20]	26							
	13														
	14		LEAN CLAY with Sand (CL); very stiff to hard; dark grayish brown; moist; fine sand; weak cementation.												
	15				7				2.5P >4.5P >4.5P	31	38	15	80	UW, PA	Pushed Shelby tube at 500 psi
20	16														
	17				8		1 3 7 [10]	13							
	18														
	19		SANDY SILT (ML); very stiff; dark yellowish brown; wet; fine to medium sand.												
	20														

Final Report Version

Borehole Location: Beyond L/S Toe of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,102,070.70 **Easting:** 6,678,089.55
Latitude: 38.93357 **Longitude:** -121.59071
Levee Station or Milepost: 212+98 **Levee Mile:**
Levee Segment Reach 2
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_003B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20							3.0P	36	32	7	70	PA	Pushed Shelby tube at 225 psi
	21			9				2.2P						
	22	SILT (ML); very stiff; brown; moist; fine sand.						2.0P	41	38	12	87	PA	
15	23			10		3 5 7 [12]	15							
	24													
	25	SANDY SILT (ML); very stiff; olive brown; moist; fine sand.												
	26	SILTY SAND (SM); medium dense; olive brown; moist; no plasticity fines; fine sand.		11					38			53 39	PA UW, PA FWK	Pushed Shelby tube at 250 psi
	27	Poorly Graded SAND (SP); medium dense; olive brown; wet; fine sand.										4	PA	
10	28			12		3 5 5 [10]	13							
	29	SILT (ML); medium stiff; light olive gray; moist.												
	30													
	31	SANDY LEAN CLAY (CL); stiff; light olive brown; moist; fine sand.		13				1.2P 1.8P	33	31	10	64	PA	Pushed Shelby tube at 75 psi
	32	Poorly Graded SAND with Silt (SP-SM); loose to medium dense; dark gray; wet; no plasticity fines; fine to coarse, mostly medium sand.												
5	33	As above except very dark grayish brown; moist.		14		2 7 13 [20]	26							
	34													
	35													
	36	SILTY SAND (SM); dense; dark gray; wet; fine to medium sand.		15					30			5 27	PA UW, PA FWK	Pushed Shelby tube at 200 psi/1 ft and 500 psi/1 ft GSA: 0.8% gravel; 94.6% sand
	37													
0	38			16		8 15 22 [37]	47							
	39													
	40	Poorly Graded SAND with Silt (SP-SM); dense; dark gray; wet; fine to medium sand.												
	41			17		10 15 17 [32]	41					9	PA	GSA: 0.4% gravel; 90.9% sand
	42													
-5	43	Well-Graded SAND with Silt (SW-SM); dense; dark gray; wet; fine to coarse sand.		18		6 12 16 [28]	36							
	44													
	45													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Beyond L/S Toe of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,102,070.70 **Easting:** 6,678,089.55
Latitude: 38.93357 **Longitude:** -121.59071
Levee Station or Milepost: 212+98 **Levee Mile:**
Levee Segment Reach 2
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_003B

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45			X	19		11 16 22 [38]	49							
-10	47														
	48			X	20		10 15 20 [35]	45							
	49														
	50		As above except medium dense.	X	21		9 11 8 [19]	24		22			8	PA	
-15	52		Borehole terminated at 51.5 feet. Backfilled with neat cement grout.												
	53														
	54														
	55														
	56														
-20	57														
	58														
	59														
	60														
	61														
-25	62														
	63														
	64														
	65														
	66														
-30	67														
	68														
	69														
	70														

Final Report Version

Borehole Location: Beyond L/S Toe of Levee, MA 3 **County:** Sutter
Coordinates: Northing: 2,102,070.70 **Easting:** 6,678,089.55
Latitude: 38.93357 **Longitude:** -121.59071
Levee Station or Milepost: 212+98 **Levee Mile:**
Levee Segment Reach 2
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0003_003B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 8/10/11	**DATE COMPLETED** 8/10/11	**GROUND ELEVATION** 58.84 ft	**ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 49.5 ft
DRILLING CONTRACTOR Gregg Drilling & Testing, Inc.		**DRILLER'S NAME** Robert	**HELPER'S NAME** Brandon		**TOTAL DEPTH OF FILL** 19 ft
DRILLING METHOD 0-35': HSA, 35-49.5': Mud Rotary		**DRILL RIG MAKE AND MODEL** Versa V100M			**CONSULTANT COMPANY** Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" (OD) HSA; 3 7/8" tri-cone (mud rotary)		**DRILLING ROD TYPE AND DIAMETER** 8" (OD) HSA; NWJ 2 5/8" (OD)			**FIELD LOGGER** DPC
[X] **VERTICAL** [ ] **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** None			**FIELD LOG REVIEWER** JTF
SAMPLER TYPE(S) Shelby(2.87"), SPT(1.375")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Automatic trip, 140 lb / 30-in drop			**HAMMER EFFICIENCY** 85%
BOREHOLE BACKFILL OR COMPLETION neat cement grout		**GROUNDWATER READING:**	**DURING DRILLING** 35.0 ft	**AFTER DRILLING (DATE-TIME)** Not measured	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] SILT with Sand (ML); stiff to very stiff; light yellowish brown; moist; fine sand.		1				1.5P 2.5P 1.1P	14			82	UW, PA	
	1														
	2														
	3		[LEVEE FILL] SILTY SAND (SM); loose; light brown; dry; fine sand.		2		2 3 3 [6]	9							
55	4														
	5				3					15			37	UW, PA	
	6		As above except brown. As above except light yellowish brown.							8			22	UW, PA	
	7														
	8		Lens of medium stiff SILT with Sand from 8.25'-8.75'.		4		1 3 2 [5]	7							
50	9														
	10		Lens of stiff to very stiff SANDY SILT from 10.4-10.9'.		5				1.5P 2.3P						
	11														
	12				6		2 3 3 [6]	9							
	13		[LEVEE FILL] SILT with Sand (ML); stiff; light brown; dry; fine sand.												
45	14														
	15				7					24	33	9	74	UW, PA	
	16														
	17		[LEVEE FILL] SILT (ML); medium stiff; light reddish brown; dry; 90-95% no plasticity fines; 5-10% sand; 0% gravel.		8		2 3 3 [6]	9	0.75P						
FILL	18														
40	19		[LEVEE FILL] SILTY SAND (SM); loose to medium dense; yellowish brown; dry; 75-85% fine sand; 15-25% fines; 0% gravel; strong cementation.		9				3.7P						
	20		[Approximate bottom of Levee Fill].												

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,112,299.63 **Easting:** 6,679,413.28
Latitude: 38.96164 **Longitude:** -121.58589
Levee Station or Milepost: 318+83 **Levee Mile:**
Levee Segment Reach 4
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_003B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		LEAN CLAY with Sand (CL); very stiff to hard; dark olive brown; dry; fine sand.		9				4.5P	24	38	14	80	PA	
	21														
	22				10		3 6 6	17	4.0P						
	23		As above except medium stiff.				[12]								
35	24				11				1.0P	21 21 20	27 29 26	10 13 11	78 81 82	PA CU, PA PA	
	25														
	26		SILTY SAND (SM); dense; light olive brown; dry; 55-70% fine sand; 30-45% fines; 0% gravel.		12		4 10 16	37							
	27						[26]								
	28		SILT with Sand (ML); hard; light olive brown; dry; fine sand.		13				>4.5P	19	NP	NP	72 86	PA PA	
30	29														
	30		LEAN CLAY (CL); hard; light olive brown; moist; 90% fines; 10% fine sand; weak cementation.		14		4 9 11	28	>4.5P		43	18			
	31						[20]								
	32		SILT (ML); hard; olive brown; moist; fine sand.		15				>4.5P	31	32	2	96	PA	
25	33														
	34														
	35		SILT with Sand (ML); very stiff; olive brown; wet; fine sand.		16		8 14 15	41							
	36						[29]								
	37				17				1.3P 4.2P >4.5P	30			81	UW, PA	
	38														
20	39		SILT (ML); very stiff; olive brown; wet; 85-90% fines; 10-15% fine to medium sand; 0% gravel.		18		8 14 15	41	>4.5P		44	16			
	40						[29]								
	41		LEAN CLAY with Sand (CL); very stiff to hard; brown; wet; fine sand; moderate cementation.		19				2.0P 4.2P 3.2P	24	37	17	85	PA	
	42														
	43														
15	44				20		5 5 5	14	1.2P		38	16			
	45														

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,112,299.63 **Easting:** 6,679,413.28
Latitude: 38.96164 **Longitude:** -121.58589
Levee Station or Milepost: 318+83 **Levee Mile:**
Levee Segment Reach 4
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_003B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45						[10]								
	46														
	47				21					30	36	14	82	PA	
	48		SILT (ML); stiff to very stiff; olive brown; wet; fine sand.				5								
10	49				22		8 12	28	1.5P				89	PA	
	50						[20]								
	51		Borehole terminated at 49.5 feet. Backfilled with neat cement grout.												
	52														
	53														
5	54														
	55														
	56														
	57														
	58														
0	59														
	60														
	61														
	62														
	63														
-5	64														
	65														
	66														
	67														
	68														
-10	69														
	70														

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,112,299.63 **Easting:** 6,679,413.28
Latitude: 38.96164 **Longitude:** -121.58589
Levee Station or Milepost: 318+83 **Levee Mile:**
Levee Segment Reach 4
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_003B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 8/4/11	**DATE COMPLETED** 8/4/11	**GROUND ELEVATION** 41.33 ft	**ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 40.0 ft
DRILLING CONTRACTOR Pitcher Drilling Co.		**DRILLER'S NAME** James	**HELPER'S NAME** Malakai	**TOTAL DEPTH OF FILL** 0 ft
DRILLING METHOD 0-18': HSA, 18-40': Mud Rotary		**DRILL RIG MAKE AND MODEL** CME 55		**CONSULTANT COMPANY** Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" (OD) HSA; 3 7/8" tri-cone (mud rotary)		**DRILLING ROD TYPE AND DIAMETER** 8" (OD) HSA; NWJ 2 5/8" (OD)		**FIELD LOGGER** AGW
[X] **VERTICAL** [ ] **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** None		**FIELD LOG REVIEWER** BDC
SAMPLER TYPE(S) Shelby(2.87"), SPT(1.375")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Automatic trip, 140 lb / 30-in drop		**HAMMER EFFICIENCY** 77%
BOREHOLE BACKFILL OR COMPLETION neat cement grout		**GROUNDWATER READING:**	**DURING DRILLING** 11 ft	**AFTER DRILLING (DATE-TIME)** Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY with SAND (CL); hard; dark yellowish brown; dry; fine sand.		1				>4.5P	6	28	8	78	UW, PA	Pushed Shelby tube at 300 psi
40	1														
	2														
	3		As above except very stiff.		2		2 3 4 [7]	9	2.75P						
	4		SILT with SAND (ML); very stiff; light olive brown; moist; fine sand.												
	5				3				3.1P 3.6P	20	NP	NP	76	UW, PA	Pushed Shelby tube at 500 psi
35	6														
	7				4		13 25 15	51							
	8		SANDY SILT (ML); very stiff; yellowish brown; moist; 70% no plasticity fines; 30% fine sand; 0% gravel.				[40]								
	9														
	10		SILTY CLAY (CL-ML); very stiff; light olive brown; moist; 90-95% medium plasticity fines; 5-10% fine sand; 0% gravel; weak to moderate cementation.		5				2.0P >4.5P	34	39	6	88	PA	
	11		SILT (ML); hard; light olive brown; moist; fine sand; weak to moderate cementation.												Pushed Shelby tube at 500 psi
30	12				6		12 15 14	37					92	PA	
	13						[29]								
	14				7				>4.5P >4.5P >4.5P						Pushed Shelby tube at 500 psi
	15														
	16		SILTY SAND (SM); medium dense; dark yellowish brown; moist; fine sand.		8		6 10 4	18					33	PA	
25	17						[14]								
	18		SILT (ML); stiff; light olive brown; moist; fine sand; weak cementation.		9				1.8P >4.5P >4.5P	39	45	15	96	PA	
	19		As above except hard.												Pushed Shelby tube at 500 psi
	20				10		11	47							

Final Report Version

Borehole Location: Beyond L/S Toe of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,115,326.80 **Easting:** 6,678,539.17
Latitude: 38.96996 **Longitude:** -121.58891
Levee Station or Milepost: 351+09 **Levee Mile:**
Levee Segment Reach 4
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_004B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		As above except yellowish brown.		10		16 21 [37]	47							
20	21														
	22								>4.5P >4.5P 2.5P				91	PA	Pushed Shelby tube at 500 psi
	23		As above except brown.		11										
	24		LEAN CLAY (CL); hard; brown; moist; fine sand; weak cementation.		12		10 14 16 [30]	39							
	25														
	26		As above except soft to stiff.						1.3P 0.6P 0.5P 1.8P 4.4P	32	40	20	94	HD, PA	Pushed Shelby tube at 600 psi
15	27				13										
	28		As above except hard.												
	29		As above except stiff; dark greenish gray.		14		3 3 4 [7]	9		31	37	17	89	PA	
	30														
	31		As above except very soft.						<0.5P 3.9P 2.8P 2.5P	32	36	13	87	UW, PA	Pushed Shelby tube at 500 psi
10	32		As above except very stiff.		15										
	33														
	34		SILT with Sand (ML); stiff; olive; moist; fine sand.		16		3 3 6 [9]	12		37	36	10	83	PA	
	35														
	36														
5	37		SANDY SILT (ML); stiff; dark greenish gray; moist; fine sand. As above except very stiff.		17				1.7P 2.6P 3.6P 3.5P	32	28	1	55	PA	Pushed Shelby tube at 450 psi
	38														
	39				18		4 6 10 [16]	21		30			61	PA	
	40														
	41		Borehole terminated at 40 feet. Backfilled with neat cement grout.												
0	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: Beyond L/S Toe of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,115,326.80 **Easting:** 6,678,539.17
Latitude: 38.96996 **Longitude:** -121.58891
Levee Station or Milepost: 351+09 **Levee Mile:**
Levee Segment Reach 4
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_004B
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/5/11	8/5/11	62.48 ft	NAVD 88	52.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Pitcher Drilling Co.	James	Malakai	24.6 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME 55	Blackburn Consulting

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" (OD) HSA	8" (OD) HSA	AGW

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	None	BDC

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Shelby(2.87"), SPT(1.375")	Automatic trip, 140 lb / 30-in drop	77%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
neat cement grout	37 ft	Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] SILT with Sand (ML); medium stiff to stiff; yellowish brown; dry; 80-85% no to low plasticity fines; 15-20% fine sand; 0% gravel.		1				1.0P 1.7P	13				UW	Pushed Shelby tube at 150 psi
60	2		[LEVEE FILL] SILTY SAND (SM); loose; yellowish brown; dry; 75-85% fine sand; 15-25% no plasticity fines; 0% gravel.		2		1 1 2 [3]	4							
	3		[LEVEE FILL] Poorly Graded SAND with Clay (SP-SC); very loose; yellowish brown; dry; 90% fine sand; 10% low to medium plasticity fines; 0% gravel.												
	4														
	5		[LEVEE FILL] SILTY SAND (SM); very loose; light brown; dry; 70% fine sand; 30% no plasticity fines; 0% gravel.		3					18				UW	Pushed Shelby tube at 150 psi
	6		[LEVEE FILL] CLAYEY SAND (SC); loose; light brown; dry; fine sand.												
55	7				4		1 2 3 [5]	6		19			45	PA	
	8														
	9		[LEVEE FILL] SILTY SAND (SM); loose; light brown; moist; 55-65% fine sand; 35-45% no plasticity fines; 0% gravel; with lenses of Poorly Graded SAND with SILT and very soft SILT.												
	10				5					29				UW	Pushed Shelby tube at 150 psi
	11														
	12								<0.5P						
50	13		[LEVEE FILL] Poorly Graded SAND with Clay (SP-SC); medium dense; yellowish brown; moist; 90% fine sand; 10% fines; 0% gravel.		6		1 4 6 [10]	13							
	14		[LEVEE FILL] SILT with Sand (ML); stiff; olive brown; moist.												
	15									29	38	11	76	PA	
	16				7				1.5P	31	36	11	70	CU, PA	Pushed Shelby tube at 100 psi
	17		As above except with trace clay.							34	39	13	79	PA	
45	18				8		2 2 4 [6]	8							
	19		[LEVEE FILL] LEAN CLAY with SAND (CL); stiff; brown; moist; fine												
	20														

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,123,747.47 **Easting:** 6,676,932.88
Latitude: 38.99310 **Longitude:** -121.59443
Levee Station or Milepost: 437+98 **Levee Mile:**
Levee Segment Reach 5
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_005B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		sand.		9				1.2P 1.5P 1.0P	21	31	14	82	PA	Pushed Shelby tube at 200 psi
40	21														
	22														
	23				10		1 4 6 [10]	13		23	31	13	85	PA	
FILL	24														
	25		[Approximate bottom of Levee Fill].												
	26		As above except very stiff.		11				2.3P 1.0P >4.5P >4.5P						Pushed Shelby tube at 200psi/1ft, 500psi/1ft
	27		SILTY CLAY (CL-ML); stiff to hard; brown; moist; 90% fine sand; 10% low plasticity fines; 0% gravel; trace clay.												
35	28		SANDY SILT (ML); very stiff; yellowish brown; moist; fine sand.		12		9 10 13 [23]	30		22	NP	NP	68	PA	
	29														
	30		Poorly Graded SAND with Silt (SP-SM); medium dense; dark yellowish brown; moist; 95% fine to medium sand; 5% no plasticity fines; 0% gravel.		13					10			7	UW, PA FWK	
	31														
	32														Pushed Shelby tube at 250 psi
30	33		LEAN CLAY (CL); hard; yellowish brown; moist; 90% fines; 10% fine sand; 0% gravel.		14		9 21 30 [51]	65			36	14			
	34														
	35		Poorly Graded SAND (SP); loose; brown; moist; fine to medium sand.										2	PA	
	36		SILTY SAND (SM); dense; stiff; brown; moist; fine sand.		15					27			34	PA	Pushed Shelby tube at 600 psi
	37												32	UW, PA FWK	
25	38		As above except very dense; yellowish brown; wet.		16		9 16 21 [37]	47							
	39														
	40		SILT (ML); very soft; brown; moist; fine sand.		17				<0.5P						
	41		As above except hard.		18		7 11 17 [28]	36		31	31	3	96	PA	Pushed Shelby tube at 600 psi
20	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,123,747.47 **Easting:** 6,676,932.88
Latitude: 38.99310 **Longitude:** -121.59443
Levee Station or Milepost: 437+98 **Levee Mile:**
Levee Segment Reach 5
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_005B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		LEAN CLAY with Sand (CL); hard; olive brown; moist; fine sand; weak cementation.		19				>4.5P >4.5P >4.5P	27	38	17	82	UW, PA	Pushed Shelby tube at 500 psi
	46														
15	47		As above except stiff.		20		6 5 4 [9]	12							
	48														
	49		LEAN CLAY (CL); very stiff; olive brown; moist; fine sand.		21				2.0P 2.0P 2.3P 1.8P	30	35	14	87	PA	Pushed Shelby tube at 300 psi
	50														
	51		SILT with Sand (ML); stiff; dark greenish gray; moist; fine to medium sand.		22		2 4 8 [12]	15		32	30	5	75	PA	
10	52														
	53		Borehole terminated at 52.5 feet. Backfilled with neat cement grout.												
	54														
	55														
	56														
5	57														
	58														
	59														
	60														
	61														
0	62														
	63														
	64														
	65														
	66														
-5	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,123,747.47 **Easting:** 6,676,932.88
Latitude: 38.99310 **Longitude:** -121.59443
Levee Station or Milepost: 437+98 **Levee Mile:**
Levee Segment Reach 5
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_005B
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/5/11	8/5/11	44.60 ft	NAVD 88	30.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Pitcher Drilling Co.	James	Malakai	0 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME 55	Blackburn Consulting

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" (OD) HSA	8" (OD) HSA	AGW

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	None	BDC

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Shelby(2.87"), SPT(1.375")	Automatic trip, 140 lb / 30-in drop	77%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
neat cement grout	17.5 ft	Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY (CL); very stiff; dark brown; moist; fine sand.		1				2.3P 3.1P 3.4P 3.2P	15	30	13	85	UW, PA	Pushed Shelby tube at 250 psi
	1														
	2														
	3			X	2		2 2 3 [5]	6							
	4														
40	5		SILTY SAND (SM); medium dense; dark yellowish brown; moist; 60% fine to medium sand; 40% fines; 0% gravel.												
	6		LEAN CLAY (CL); stiff to hard; dark grayish brown; moist; fine sand.		3				>4.5P 1.5P	20	31	13	90	PA	Pushed Shelby tube at 200 psi
	7		SILT with Sand (ML); very stiff; dark grayish brown; moist.						3.4P	25	26	1	76	UW, PA	
	8		SANDY SILT (ML); very stiff; dark yellowish brown; moist; fine to medium sand.	X	4		2 4 6	13		20	NP	NP	66	PA	
	9						[10]								
35	10		Poorly Graded SAND with Silt (SP-SM); loose; dark brown; moist; 90% fine sand; 10% fines; 0% gravel.		5										Pushed Shelby tube at 200 psi
	11								3.5P	36			75	PA	
	12		SILT with Sand (ML); very stiff; olive brown; moist; no to low plasticity fines; fine sand.						3.5P	38			74	PA	
	13		SILT (ML); stiff; olive gray; moist; fine sand; weak cementation.	X	6		4 6 8	18			35	4			
	14						[14]								
30	15		As above except hard; light brownish gray; low to medium plasticity fines; moderate cementation.		7				4P	31			92	PA	
	16		As above except very stiff.	X	8		8 12 14	33	>4.5P		35	6			Pushed Shelby tube at 500 psi
	17														
	18						[26]								
	19														
25	20		Poorly Graded SAND with Silt (SP-SM); medium dense; dark yellowish brown; wet; fine to medium sand.												

Final Report Version

Borehole Location: Beyond L/S Toe of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,127,646.16 **Easting:** 6,675,901.92
Latitude: 39.00382 **Longitude:** -121.59800
Levee Station or Milepost: 480+67 **Levee Mile:**
Levee Segment Reach 6
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_006B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20				9										Pushed Shelby tube at 500 psi
	21		As above except dense.												
	22				10		8 12 14 [26]	33		24			7	PA	
	23														
	24				11		6 12 14 [26]	33							
20	25														
	26		As above except medium dense.												
	27				12		2 4 6 [10]	13					11	PA	
	28														
	29		As above except dense.												
15	30				13		9 16 20 [36]	46							
	31		Borehole terminated at 30 feet. Backfilled with neat cement grout.												
	32														
	33														
	34														
10	35														
	36														
	37														
	38														
	39														
5	40														
	41														
	42														
	43														
	44														
0	45														

Final Report Version

Borehole Location: Beyond L/S Toe of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,127,646.16 **Easting:** 6,675,901.92
Latitude: 39.00382 **Longitude:** -121.59800
Levee Station or Milepost: 480+67 **Levee Mile:**
Levee Segment Reach 6
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_006B
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/16/11	8/16/11	66.82 ft	NAVD 88	51.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Gregg Drilling & Testing, Inc.		Robert	Marten	21.3 ft
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
0-36': HSA, 36-51': Mud Rotary		Versa V100M		Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
8" (OD) HSA; 3 7/8" tri-cone (mud rotary)		8" (OD) HSA; NWJ 2 5/8" (OD)		AGW
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** None		**FIELD LOG REVIEWER** BDC
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Shelby(2.87"), SPT(1.375")		Automatic trip, 140 lb / 30-in drop		85%
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
neat cement grout			36 ft	Not measured

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] SILT (ML); very soft; dark grayish brown; moist; fine sand.		1				<0.5P <0.5P	23				UW	
65	1								1.3P	25	43	10	96	PA	Pushed Shelby tube at 0 psi
	2		As above except stiff.												
	3		As above except soft; olive brown.	X	2		1 2 1 [3]	4		23			95	PA	
	4														
	5				3										Pushed Shelby tube at 0 psi
	6								2.5P	35				UW	
60	7		As above except medium stiff.	X	4		2 2 3 [5]	7			42	12			
	8														
	9		As above except stiff; brown.		5										
	10								1.2P	29				UW	Pushed Shelby tube at 0 psi
	11														
55	12			X	6		2 2 3 [5]	7							
	13														
	14		As above except with oxidation mottling.		7				1.7P >4.5P	36 36	47	19	93	UW PA	
	15								1.6P						Pushed Shelby tube at 0 psi/1.5ft and 100 psi/0.5ft
	16		As above except soft.	X	8		1 2 1 [3]	4							
50	17														
	18		[LEVEE FILL] ELASTIC SILT (MH); hard; olive brown; moist; fine sand.		9					47	53	23	86	PA	
	19									55	57	27	95	CU, PA	
	20									42	52	23	88	PA	Pushed Shelby tube at 0 psi/1.5ft

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,132,923.82 **Easting:** 6,672,364.16
Latitude: 39.01835 **Longitude:** -121.61037
Levee Station or Milepost: 545+02 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_007B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														and 50 psi/0.5ft
FILL	21		As above except medium stiff; brown.	X	10		2 4 4 [8]	11							
45	22		[Approximate bottom of Levee Fill].												
	23		LEAN CLAY (CL); stiff; olive brown; moist; fine sand.		11					30	41	17	88	UW, PA	Pushed Shelby tube at 0 psi/1ft and 175 psi/1ft
	24														
	25			X	12		3 4 4 [8]	11							
40	26														
	27		SILT (ML); hard; light gray; moist; fine sand; strong cementation.		13				1.5P 0.7P >4.5P	27	44	17	92	HD, PA	Pushed Shelby tube at 175 psi
	28														
	29														
	30			X	14		7 13 18	44							
	31						[31]								
35	32		SANDY SILT (ML); stiff to very stiff; light olive brown; moist; fine sand.		15				4.0P 1.7P 0.8P	35	NP	NP	69	PA	Pushed Shelby tube at 225 psi
	33		As above except medium stiff; dark grayish brown.												
	34		Poorly Graded SAND (SP); medium dense; yellowish brown; moist; 95% fine to medium sand; 5% fines; 0% gravel.	X	16		5 7 8	21							
	35		As above except gray; trace silt.				[15]								
	36														
30	37		6" lense of SILTY SAND (SM); medium dense; olive brown; wet; fine sand.		17					33 22			47 4	PA UW, PA FWK	Pushed Shelby tube at 175 psi
	38														
	39		6" lense of SILTY SAND (SM); medium dense; dark yellowish brown; wet; fine sand. As above except dark gray; wet.	X	18		4 6 12	26							
	40						[18]								
	41		As above except loose; dark olive brown; wet.		19					20 21			3 6	UW PA FWK UW, PA	Pushed Shelby tube at 170 psi
25	42		Poorly Graded SAND with Silt (SP-SM); dense; dark grayish brown; wet; fine to medium sand. As above except yellowish brown.												
	43			X	20		10 11 12	33							
	44						[23]								
	45														

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,132,923.82 **Easting:** 6,672,364.16
Latitude: 39.01835 **Longitude:** -121.61037
Levee Station or Milepost: 545+02 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_007B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45				21	0									Pushed Shelby tube at 500 psi
20	46														
	47		SILTY SAND (SM); medium dense; gray; wet; fine to medium sand.												
	48				22		7 7 9	23		27			15	PA	
	49		Well-Graded SAND (SW); dense; gray; moist; 95% fine to coarse sand; 5% fines; 0% gravel; trace silt.				[16]								
	50				23		9 13 13	37							
	51						[26]								
15	52		Borehole terminated at 51 feet. Backfilled with neat cement grout.												
	53														
	54														
	55														
	56														
10	57														
	58														
	59														
	60														
	61														
5	62														
	63														
	64														
	65														
	66														
0	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,132,923.82 **Easting:** 6,672,364.16
Latitude: 39.01835 **Longitude:** -121.61037
Levee Station or Milepost: 545+02 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_007B
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED 1/13/12 **DATE COMPLETED** 1/13/12	**GROUND ELEVATION** 70.5 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 130.0 ft
DRILLING CONTRACTOR Cascade	**DRILLER'S NAME** Kevin Rogers **HELPER'S NAME** Jason Jones, Brandon Maple	**TOTAL DEPTH OF FILL** 20 ft
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** Sonic Core SDC 500	**CONSULTANT COMPANY** Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4-3/8" Stainless Steel Core Barrel	**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF	**FIELD LOGGER** Aaron Wood
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 5-7/8" OD	**FIELD LOG REVIEWER** KC
SAMPLER TYPE(S) Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Neat cement grout	**GROUNDWATER READING: DURING DRILLING** Not measured	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
70	0		[LEVEE FILL] SILTY SAND (SM); light brown (7.5YR 6/4); moist; 60% fine to medium sand; 40% fines.												Run 1 0-10' 80% recovery
	1														
	2														
	3														
	4														
	5														
65	6														
	7														
	8		[LEVEE FILL] SANDY SILT (ML); stiff; greenish gray (10Y 5/1); moist; 70% fines; 30% fine sand.						1.1P						
	9														
	10		[LEVEE FILL] SILTY SAND (SM); yellowish brown (10YR 5/6); moist; 70% fine to medium sand; 30% fines.												Run 2 10-20' 80% recovery
60	11														
	12														
	13														
	14														
	15														
55	16														
	17														
	18														
	19														
FILL	20														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,135,713.44 **Easting:** 6,671,594.22
Latitude: 39.02602 **Longitude:** -121.61304
Levee Station or Milepost: 574+91 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001S
Sheet 1 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
50	20		SILT with Sand (ML); stiff; dark gray (5Y 4/1); moist; 85% fines; 15% fine sand.												Run 3 20-30' 80% recovery
	21														
	22								1.2P						
	23														
	24														
45	25														
	26														
	27		SILTY SAND (SM); yellowish brown (10YR 5/6); moist; 70% fine to medium sand; 30% fines.												
	28		SILT (ML); stiff; brownish yellow (10YR 6/8); moist.												
	29								1.25P						
	30		SILTY SAND (SM); dark yellowish brown (10YR 4/6); wet; 80% fine to medium sand; 20% fines.												Run 4 30-50' 50% recovery
40	31														
	32														
	33														
	34														
	35														
35	36														
	37														
	38														
	39		SILT (ML); very stiff; yellowish brown (10YR 5/6); moist; 90% fines; 10% fine sand.												
30	40														
	41														
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,135,713.44 **Easting:** 6,671,594.22
Latitude: 39.02602 **Longitude:** -121.61304
Levee Station or Milepost: 574+91 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001S
Sheet 2 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
25	45								3.0P						
	46														
	47														
	48		SILTY SAND (SM); dark brown (10YR 3/3); moist; 60% fine sand; 40% fines.												
	49														
	50		Poorly Graded SAND (SP); dark gray (5Y 4/1); moist; no plasticity fines; 80% fine to coarse sand; 15% fine to coarse gravel.												Run 5 50-70' 100% recovery
20	51														
	52														
	53														
	54														
	55														
15	56														
	57														
	58														
	59		SILT (ML); very stiff; dark gray (5Y 4/1); moist.												
	60								2.2P						
10	61														
	62								>4.5P						
	63														
	64														
	65														
5	66														
	67														
	68		SILTY SAND (SM); dark gray (5Y 4/1); moist; 70% fine to coarse sand; 15% fine gravel; 15% no plasticity fines.						2.2P						
	69														
	70														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: **Northing:** 2,135,713.44 **Easting:** 6,671,594.22
Latitude: 39.02602 **Longitude:** -121.61304
Levee Station or Milepost: 574+91 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001S
Sheet 3 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
0	70	LEAN CLAY (CL); stiff; olive gray (5Y 4/2); moist.						1.0P						Run 6 70-90' 100% recovery
	71	SANDY SILT (ML); very stiff; dark gray (5Y 4/1); moist; 60% fines; 40% fine sand.						2.0P						
	72													
	73													
	74													
-5	75													
	76							2.1P						
	77													
	78							>4.5P						
	79							2.0P						
-10	80	SILTY SAND (SM); dark gray (5Y 4/1); moist; 55% fine sand; 45% fines.												
	81													
	82													
	83	Poorly Graded SAND with Silt (SP-SM); dark gray (5Y 4/1); moist; 90% fine to medium sand; 10% fines.												
	84													
	85	SILTY SAND (SM); dark gray (5Y 4/1); moist; 60% fine sand; 40% fines.												
-15	86													
	87													
	88													
	89	Poorly Graded SAND (SP); dark gray (5Y 4/1); moist; 95% fine to coarse sand; 5% no plasticity fines.												
-20	90													Run 7 90-110' 100% recovery
	91													
	92													
	93													
	94	Poorly Graded GRAVEL (GP); dark gray (5Y 4/1); moist; no plasticity fines; 95% fine gravel; 5% fine to												
	95													

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,135,713.44 **Easting:** 6,671,594.22
Latitude: 39.02602 **Longitude:** -121.61304
Levee Station or Milepost: 574+91 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001S
Sheet 4 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	95		coarse sand.												
-25	96		Poorly Graded SAND (SP); dark gray (5Y 4/1); moist; 95% fine to coarse sand; 5% no plasticity fines.												
	97														
	98														
	99														
	100		SILTY GRAVEL with Sand (GM); dark gray (5Y 4/1); moist; 50% fine to coarse gravel; 30% fine to coarse sand; 20% no plasticity fines.		1										
-30	101														
	102														
	103														
	104														
	105				2										
-35	106														
	107		SILTY SAND (SM); dark gray (5Y 4/1); moist; 80% fine to medium sand; 20% fines.												
	108				3										
	109														
	110														Run 8 110-130' 100% recovery
-40	111														
	112		LEAN CLAY (CL); hard; olive gray (5Y 4/2); moist.		4										
	113														
	114														
	115														
-45	116				5				>4.5P		40	19			
	117								2.0P						
	118														
	119								>4.5P						
	120														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,135,713.44 **Easting:** 6,671,594.22
Latitude: 39.02602 **Longitude:** -121.61304
Levee Station or Milepost: 574+91 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001S
Sheet 5 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
-50	120				6				3.0P						
	121														
	122		CLAYEY SAND (SC); olive gray (5Y 4/2); moist; fine to medium sand.												
	123														
	124		SILTY SAND (SM); dark gray (5Y 4/1); moist; fine to medium sand.												
-55	125				7										
	126														
	127														
	128														
	129		LEAN CLAY (CL); very stiff; olive gray (5Y 4/2); moist.		8				3.0P						
-60	130		End of boring at 130 feet. Backfilled with neat cement grout.												
	131														
	132														
	133														
	134														
-65	135														
	136														
	137														
	138														
	139														
-70	140														
	141														
	142														
	143														
	144														
	145														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: **Northing:** 2,135,713.44 **Easting:** 6,671,594.22
Latitude: 39.02602 **Longitude:** -121.61304
Levee Station or Milepost: 574+91 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_001S
Sheet 6 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/9/11	8/9/11	64.59 ft	NAVD 88	49.5 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Gregg Drilling & Testing, Inc.		Robert	Brandon	16.4 ft
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
0- 36.0': HSA, 36-49.5': Mud Rotary		Versa V100M		Blackburn Consulting
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
8" (OD) HSA; 3 7/8" tri-cone (mud rotary)		8" (OD) HSA		RCP
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** None		**FIELD LOG REVIEWER** BDC
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Shelby(2.87"), SPT(1.375")		Automatic trip, 140 lb / 30-in drop		85%
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
neat cement grout			33 ft	33 ft on 8/9/11

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] SANDY SILT (ML); very stiff; dark yellowish brown; dry; no plasticity fines; fine sand; with lenses of loose to medium dense SILTY SAND.												
	1				1										Pushed Shelby tube at 0 psi
	2		As above except brownish yellow. As above except light olive brown.							17			64	PA	
	3														
	4				2		2 1 1 [2]	3	2.0P						
60	5		As above except yellowish brown.												
	6		As above except stiff; light olive brown.		3					12				UW	Pushed Shelby tube at 0 psi
	7		As above except olive brown.												
	8		[LEVEE FILL] SILT (ML); stiff; yellowish red; moist; 90% fines; 10% fine sand; 0% gravel; very thin seams of SILTY SAND.		4		2 1 2 [3]	4	1.75P						
	9														
55	10		[LEVEE FILL] SILTY SAND (SM); loose; light olive brown; moist; 70% fine sand; 30% fines; 0% gravel.		5					15				UW	Pushed Shelby tube at 100 psi
	11														
	12		[LEVEE FILL] SANDY SILT (ML); stiff to very stiff; olive brown; moist; 70% fines; 30% fine sand; 0% gravel; with lenses of loose SILTY SAND.		6		2 3 4 [7]	10	1.0P						
	13														
	14		[LEVEE FILL] SILTY SAND (SM); medium dense; light yellowish brown; moist; 70% fines; 30% fine sand; 0% gravel.												
50	15				7					8				UW	Pushed Shelby tube at 0 psi
FILL	16		[LEVEE FILL] Poorly Graded SAND with Silt (SP-SM); loose; light olive; dry to moist; 90-95% fine sand; 5-10% fines; 0% gravel; with thin seams of SANDY SILT. [Approximate bottom of Levee Fill].												
	17				8		1 3 4 [7]	10							
	18														
	19		As above except brown. As above except light olive brown.		9				1.3P	20			86	PA	
45	20		LEAN CLAY (CL); stiff to very stiff; dark olive brown;												Pushed Shelby

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,137,695.34 **Easting:** 6,671,921.18
Latitude: 39.03146 **Longitude:** -121.61186
Levee Station or Milepost: 595+45 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_008B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		moist; fine sand.		9				2.8P	18	30	14			tube at 0 psi
	21		SANDY SILT (ML); very stiff; dark olive brown; moist; fine sand.		10		2 1 4 [5]	7	3.0P						
	22		As above except olive gray.												
	23				11					22	29	4	52	PA	
	24									25	28	3	52	CU, PA	
40	25									32	NP	NP	69	PA	Pushed Shelby tube at 0 psi
	26				12		4 7 10	24							
	27		SILT with SAND (ML); stiff; olive brown; moist; fine sand.				[17]								
	28		As above except hard; light yellowish brown.		13				>4.5P	34	38	8	82	PA	Pushed Shelby tube at 100 psi
35	29														
	30		SANDY SILT (ML); very stiff; olive brown; moist; 85-90% fines; 10-15% fine sand; 0% gravel.		14		3 7 9	23	2.75P						
	31						[16]								
	32		Poorly Graded SAND (SP); medium dense; dark olive brown; wet; fine sand.		15					33			4	PA	Pushed Shelby tube at 0 psi
	33														
	34														
30	35				16		3 6 9	21							
	36						[15]								
	37		LEAN CLAY (CL); hard; light olive brown; wet; fine sand.		17				>4.5P	32	41	18	87	PA	Pushed Shelby tube at 100 psi
	38														
	39		SANDY SILT (ML); very stiff; olive brown; wet; 80% fines; 20% fine sand; 0% gravel.												
25	40				18		5 8 13	30	2.25P						
	41						[21]								
	42		Poorly Graded SAND with Silt (SP-SM); medium dense; olive brown; wet; fine sand.		19					31			6	PA	Pushed Shelby tube at 0 psi
	43		As above except dark gray.												
	44		SILTY SAND (SM); medium dense; gray; wet; 85% fine sand; 15% fines; 0% gravel.		20		6 9 10	27							
20	45														

Final Report Version

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,137,695.34 **Easting:** 6,671,921.18
Latitude: 39.03146 **Longitude:** -121.61186
Levee Station or Milepost: 595+45 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_008B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45						[19]								
	46				21										
	47		Poorly Graded GRAVEL with Silt (GP-GM); medium dense; gray; wet.												Pushed Shelby tube at 0 psi
	48		As above except very dense.				17								
	49				22		40 42	116							
15							[82]								
	50		Borehole terminated at 49.5 feet. Backfilled with neat cement grout.												
	51														
	52														
	53														
	54														
10															
	55														
	56														
	57														
	58														
	59														
5															
	60														
	61														
	62														
	63														
	64														
0															
	65														
	66														
	67														
	68														
	69														
-5															
	70														

Final Report Version

SUTTER BUTTE FLOOD CONTROL AGENCY

Borehole Location: W/S of Levee, LD 1 **County:** Sutter
Coordinates: Northing: 2,137,695.34 **Easting:** 6,671,921.18
Latitude: 39.03146 **Longitude:** -121.61186
Levee Station or Milepost: 595+45 **Levee Mile:**
Levee Segment Reach 7
Survey Method: GIS/LiDAR **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_008B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/21/11	7/21/11	47.8 ft	NAVD 88	76.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	Gyeong T. Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	27 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		1 inch Road gravel.												0-5' Hand auger
	1		LEAN CLAY (CL); dark brown; moist; 90% low plasticity, no dilatancy fines; 10% fine sand.												
	2														
45	3				HA1	100									HA1_3.0-3.5
	4														
	5														1_5.0-7.0
	6				1	71				18	29	13	82	UW, CN, DS, PA	400 PSI pushing Shelby
	7														
40	8		LEAN CLAY (CL); very stiff; yellowish brown; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.												
	9				2	42									2_8.0-9.0 Hard to push down 600 PSI pushing Shelby
	10														
	11				3A 3B	89	14 26 32 [58]		2.5P						3A_10.5-11.0 3B_11.0-11.5
	12														
35	13				4	72									4_12.5-14.0 600 psi pushing Shelby
	14														
	15														
	16				5A 5B	89	10 20 24 [44]		3.0P						5A_15.5-16.0 5B_16.0-16.5
	17														
30	18				6A 6B	89	6 14 17 [31]								6A_18.0-18.5 6B_18.5-19.0
	19		SILTY SAND (SM); medium dense; yellowish brown; moist; 80% fine sand; 20% no plasticity fines.												
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,141,656.88 **Easting:** 6,671,928.15
Latitude: 39.04234 **Longitude:** -121.61177
Levee Station or Milepost: 636+00 **Levee Mile:**
Levee Segment Reach 8
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_009B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20					7								7A_20.5-21.0
	21	Poorly Graded SAND (SP); medium dense; strong brown; moist; 95% sand; 5% no plasticity fines.		7A 7B	100	13 18 [31]						7	PA	7B_21.0-21.5
	22													
25	23													
	24													
	25	LEAN CLAY (CL); brown; moist; 95% no dilatancy fines; 5% fine sand.		8	78	9 11 16 [27]	39							8_25.0-26.5
	26													
	27													
20	28			9	100				31	32	12		UW	9_27.5-29.5 600 psi
	29													
	30													At 30' bgs switched to Mud Rotary
	31	SILTY SAND (SM); dense; brown; wet; 80% fine sand; 20% no plasticity fines.		10A 10B	83	12 17 20 [37]						21	PA	10A_30.5-31.0 10B_31.0-31.5
	32													
15	33													
	34													
	35	Poorly Graded SAND with Silt (SP-SM); dense; dark greenish gray; wet; 90% sand; 10% no plasticity fines.		11	67	9 12 12 [24]	35							11_35.0-36.5
	36													
	37													
10	38													
	39													
	40					7								12_40.0-41.5
	41			12	78	8 10 [18]	26					10	PA	
	42													
5	43													
	44													
	45													

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,141,656.88 **Easting:** 6,671,928.15
Latitude: 39.04234 **Longitude:** -121.61177
Levee Station or Milepost: 636+00 **Levee Mile:**
Levee Segment Reach 8
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_009B
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45			X	13	67	10 12 14 [26]	38							13_45.0-46.5
	46														
	47														
0	48														
	49														
	50		Well-Graded GRAVEL with Sand (GW); very dense; greenish gray; moist; 60% gravel; 35% sand; 5% no plasticity fines.	X	14	50	22 32 36 [68]	99							14_50.0-51.5
	51														
	52														
-5	53														
	54														
	55		Poorly Graded SAND (SP); dense; dark greenish gray; wet; 95% sand; 5% no plasticity fines.	X	15	28	6 13 17 [30]	44							15_55.0-56.5
	56														
	57														
-10	58														
	59														
	60			X	16	39	4 7 10 [17]	25							16_60.0-61.5
	61		At 61 feet changes to medium dense.												
	62														
-15	63														
	64														
	65		LEAN CLAY (CL); dark greenish gray; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.	X	17	39	10 17 28 [45]	66							17_65.0-66.5
	66														
	67														
-20	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,141,656.88 **Easting:** 6,671,928.15
Latitude: 39.04234 **Longitude:** -121.61177
Levee Station or Milepost: 636+00 **Levee Mile:**
Levee Segment Reach 8
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_009B
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														
	71			X	18	28	12 19 15	50							18_70.0-71.5
	72						[34]								
-25	73														
	74														
	75		SILTY SAND (SM); very dense; dark greenish gray; moist; 65% fine sand; 35% no plasticity fines.	X	19	44	10 19 21	58							19_75.0-76.5
	76						[40]								
	77		End of boring at 76.5'. Backfilled with cement bentonite grout. 11-47 lb. bags cement, 95 gallons water, 1/2 bag of bentonite (50 lb. bag)												
-30	78														
	79														
	80														
	81														
	82														
-35	83														
	84														
	85														
	86														
	87														
-40	88														
	89														
	90														
	91														
	92														
-45	93														
	94														
	95														

Final Report Version

SUTTER BUTTE FLOOD CONTROL AGENCY

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,141,656.88 **Easting:** 6,671,928.15
Latitude: 39.04234 **Longitude:** -121.61177
Levee Station or Milepost: 636+00 **Levee Mile:**
Levee Segment Reach 8
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_009B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/5/11 **DATE COMPLETED** 10/6/11	**GROUND ELEVATION** 48.9 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 86.5 ft
DRILLING CONTRACTOR Cascade	**DRILLER'S NAME** B. Bosworth **HELPER'S NAME** G. Woods III, A. Arroyo	**TOTAL DEPTH OF FILL**
DRILLING METHOD Mud Rotary	**DRILL RIG MAKE AND MODEL** Ditch Witch 148	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 3-1/4"	**DRILLING ROD TYPE AND DIAMETER**	**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** PW 3"	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Auto Hammer	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** NA	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY with Sand (CL); dark yellowish brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.												
	1														
	2														
	3				1					12	28	11	79	PA	1_3.0-4.0
45	4														
	5				2	33	3 3 3 [6]								2_5.0-7.0
	6														
	7														
	8														
40	9														
	10				3 4	100	13 16 30 [46]			21	NP	NP	79	PA	3_10.0-12.0 4_11.0-12.0
	11		At 11 feet olive brown; 85% low plasticity, slow dilatancy fines; 15% fine sand.												
	12														
	13		SILT (ML); olive brown; moist; 95% low plasticity, slow dilatancy fines; 5% fine sand.												
35	14														
	15				5	78	3 6 8 [14]								5_15.0-16.5
	16														
	17														
	18														
30	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,144,618.92 **Easting:** 6,671,968.30
Latitude: 39.05047 **Longitude:** -121.61159
Levee Station or Milepost: 665+84 **Levee Mile:**
Levee Segment Reach 9
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20			X	6	94	4 6 7 [13]						86	PA	6_20.0-21.5
	21														
	22														
	23		SANDY SILT (ML); brown; moist; 70% low plasticity, rapid dilatancy fines; 30% fine sand.												
25	24														
	25			X	7	94	3 4 6 [10]								7_25.0-26.5
	26														
	27														
	28		At 28 feet dark greenish gray; 70% low plasticity, slow dilatancy fines; 30% fine sand.												
20	29														
	30			X	8	100	3 4 4 [8]								8_30.0-31.5
	31														
	32														
	33		SANDY SILT (ML); dark greenish gray; wet; 55% no plasticity fines; 45% fine sand.												
15	34														
	35			X	9	100	3 4 5 [9]						57	PA HD	9_35.0-36.5
	36														
	37														
	38		SILTY SAND with Gravel (SM); very dense; greenish black; moist; 65% sand; 20% low plasticity fines; 15% gravel.												
10	39														
	40			X	10	89	22 26 50 [76]								10_40.0-41.5
	41														
	42														
	43		SILT (ML); dark greenish gray; moist; 95% low plasticity, slow dilatancy fines; 5% fine sand.												
5	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,144,618.92 **Easting:** 6,671,968.30
Latitude: 39.05047 **Longitude:** -121.61159
Levee Station or Milepost: 665+84 **Levee Mile:**
Levee Segment Reach 9
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011B
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45													
	46			11	100	4 7 12 [19]								11_45.0-46.5
	47													
	48	SILT with Sand (ML); dark greenish gray; moist; 75% low plasticity, rapid dilatancy fines; 25% fine sand.												
0	49													
	50			12	94	3 9 17 [26]								12_50.0-51.5
	51													
	52													
	53	Poorly Graded SAND (SP); dense; very dark greenish gray; wet; 95% fine to medium sand; 5% no plasticity fines.												
-5	54													
	55			13	100	10 17 17 [34]								13_55.0-56.5
	56													
	57													
	58	LEAN CLAY (CL); dark greenish gray; moist; 95% medium plasticity, no dilatancy fines; 5% fine sand.												
-10	59													
	60			14		4 8 16 [24]								14_60.0-61.5
	61													
	62													
	63	SILTY SAND (SM); medium dense; dark greenish gray; wet; 55% fine sand; 45% no plasticity fines.												
-15	64													
	65			15		4 9 16 [25]								15_65.0-66.5
	66													
	67													
	68													
-20	69													
	70													

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,144,618.92 **Easting:** 6,671,968.30
Latitude: 39.05047 **Longitude:** -121.61159
Levee Station or Milepost: 665+84 **Levee Mile:**
Levee Segment Reach 9
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011B
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70				16		7 10 13 [23]								16_70.0-71.5
	71														
	72														
	73		Poorly Graded SAND (SP); medium dense; very dark greenish gray; wet; 95% fine to medium sand; 5% no plasticity fines.												
-25	74														
	75				17 18		7 10 23 [33]								17_75.0-76.0 18_76.0-76.5
	76		LEAN CLAY (CL); dark greenish gray; moist; 95% high plasticity, no dilatancy fines; 5% fine sand.												
	77														
	78				19 20										19_78.0-79.0 20_79.0-79.5
-30	79		SANDY SILT (ML); dark greenish gray; wet; 70% low plasticity, rapid dilatancy fines; 30% fine sand.												
	80														
	81														
	82														
	83		LEAN CLAY (CL); dark greenish gray; moist; 95% medium plasticity, no dilatancy fines; 5% fine sand.												
-35	84														
	85														
	86		SILTY GRAVEL with Sand (GM); dark greenish gray; wet; 60% gravel; 25% medium to coarse sand; 15% no plasticity fines.		21 22	78	18 25 28 [53]								21_85.0-85.5 22_85.5-86.0
	87		End of boring at 86.5'. Backfilled with cement bentonite grout. 5-47 lb. bags cement, 50 gallons water, 1/4 bag of bentonite (50 lb. bag)												
	88														
-40	89														
	90														
	91														
	92														
	93														
-45	94														
	95														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,144,618.92 **Easting:** 6,671,968.30
Latitude: 39.05047 **Longitude:** -121.61159
Levee Station or Milepost: 665+84 **Levee Mile:**
Levee Segment Reach 9
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011B
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/11/11	8/12/11	48.8 ft	NAVD 88	90.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Robert	Rob/Brandon Moses	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Versa Drill V100M	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	Matt Weil

[X] VERTICAL [ ] INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Automatic, 140 lbs / 30-inch drop	85.1%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Neat cement grout	25 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY (CL); brown; moist; 90% slow dilatancy fines; 10% fine sand.												
	1														
	2				1										1_2.0-3.0
	3														
45	4				2										2_4.0-5.0
	5														
	6				3A 3B	83	6 13 20 [33]			16	34	17		UW	3A_5.5-6.0 2B_6.0-6.5
	7														
	8				4A 4B	78	7 20 31 [51]								4A_8.0-8.5 4B_8.5-9.0
40	9														
	10		LEAN CLAY (CL); olive brown; moist; 90% low plasticity, slow dilatancy fines; 10% fine sand; mildly indurated.												
	11				5	94	6 13 17 [30]								5A_10.5-11.0 5B_11.0-11.5
	12														
	13				6A 6B	89	6 13 16 [29]								6A_13.0-13.5 6B_13.5-14.0
35	14														
	15				7A 7B	78	5 10 14 [24]						29	PA	7A_15.5-16.0 7B_16.0-16.5
	16		SILTY SAND (SM); medium dense; grayish brown; moist; 75% fine sand; 25% no plasticity fines.												
	17														
	18		LEAN CLAY (CL); olive brown; moist; 85% low plasticity, slow dilatancy fines; 15% fine sand; mildly indurated.		8	56	3 6 7 [13]	18							8_17.5-19.0
30	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Sutter
Coordinates: Northing: 2,150,101.23 **Easting:** 6,672,343.18
Latitude: 39.06552 **Longitude:** -121.61018
Levee Station or Milepost: 720+71 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_010B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20			9A 9B	94	5 10 14 [24]								9A_20.5-21.0 9B_21.0-21.5
	21													
	22													
	23			10A 10B	50	4 7 9 [16]								10A_23.0-23.5 10B_23.5-24.0
25	24	SILTY SAND (SM); medium dense; brown; moist; 55% fine sand; 45% no plasticity fines.												
	25			11A 11B	100	4 8 20 [28]								11A_25.5-26.0 11B_26.0-26.5
	26	Poorly Graded SAND with Silt (SP-SM); medium dense; very dark brown; wet; 85% fine sand; 15% no plasticity fines.												
	27													
	28			12	72	9 12 15 [27]	38							12_27.5-29.0
20	29	CLAYEY SAND (SC); dense; grayish brown; wet; 70% fine to medium sand; 30% low plasticity fines.												
	30			13A 13B 13C	72	8 9 12 [21]	30							13A_30.0-30.5 13B_30.5-31.0 13C_31.0-31.5
	31	SILT with Sand (ML); brown; wet; 85% no plasticity, rapid dilatancy fines; 15% fine sand.												
	32	Poorly Graded SAND with Silt (SP-SM); dense; gray; wet; 90% fine to medium sand; 10% no plasticity fines.												
	33			14	67	8 12 14 [26]	37					7	PA	14_32.5-34.0
15	34													
	35													
	36													
	37													
	38			15	50	8 12 14 [26]	37							15_37.5-39.0
10	39													
	40													
	41	Poorly Graded GRAVEL with Silt and Sand (GP-GM); dense; bluish gray; wet; 60% gravel; 30% sand; 10% fines.												
	42													
	43			16	61	11 17 18 [35]	50							16_42.5-44.0
5	44													
	45													

Final Report Version

SUTTER BUTTE FLOOD CONTROL AGENCY

Borehole Location: West Levee Landside Field **County:** Sutter
Coordinates: Northing: 2,150,101.23 **Easting:** 6,672,343.18
Latitude: 39.06552 **Longitude:** -121.61018
Levee Station or Milepost: 720+71 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_010B
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45														Drill chattering
	46														
	47														
	48			X	17	50	12 19 20 [39]	55							17_47.5-49.0
0	49														
	50														
	51														
	52														
	53			X	18	17	4 10 12 [22]	31							18_52.5-54.0
-5	54														
	55														
	56		LEAN CLAY with Gravel (CL); bluish gray; wet; 55% no dilatancy fines; 45% coarse gravel.												
	57														
	58			X	19	22	8 10 7 [17]	24							19_57.5-59.0
-10	59														
	60														
	61														
	62														
	63			X	20A 20B	78	2 7 15 [22]			31	40	14		UW	20A_63.0-63.5 20B_63.5-64.0
-15	64														
	65														
	66		CLAYEY SAND (SC); loose to medium dense; gray; wet; 55% fine sand; 45% low plasticity fines.												
	67														
	68			X	21A 21B	78	7 5 4 [9]								21A_68.0-68.5 21B_65.5-69.0
-20	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Sutter
Coordinates: **Northing:** 2,150,101.23 **Easting:** 6,672,343.18
Latitude: 39.06552 **Longitude:** -121.61018
Levee Station or Milepost: 720+71 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_010B
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														
	71														
	72														
	73				22A 22B	67	3 5 12 [17]								22A_73.0-73.5 22B_73.5-74.0
-25	74														
	75														
	76		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 55% subrounded gravel; 35% fine to coarse sand; 10% low plasticity fines.												Drill chattering
	77														
	78				23	56	10 44 50/5" [94/ 11"]								23_77.5-79.0
-30	79														
	80														
	81														
	82														
	83														
-35	84														
	85														
	86														
	87														Hole continues to cave in.
	88														
-40	89														Driller noted change cuttings show clay at 89'.
	90		End of boring at 90'. Backfilled with neat cement grout. 22-47 lb. bags cement, 50 gallons water												
	91														
	92														
	93														
-45	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Sutter
Coordinates: Northing: 2,150,101.23 **Easting:** 6,672,343.18
Latitude: 39.06552 **Longitude:** -121.61018
Levee Station or Milepost: 720+71 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_010B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/12/11 **DATE COMPLETED** 10/13/11	**GROUND ELEVATION** 51.6 ft **ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 51.5 ft
DRILLING CONTRACTOR Cascade	**DRILLER'S NAME** Amador Arroyo **HELPER'S NAME** Gerry Woods		**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA, Mud Rotary	**DRILL RIG MAKE AND MODEL** CME 75 HT		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) Drag Bit/8" HSA	**DRILLING ROD TYPE AND DIAMETER** NWJ 2-5/8" OD		**FIELD LOGGER** M. Weil
☒ **VERTICAL** ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 8" HSA		**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, MCal(2.5"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Automatic, 140 lbs / 30-inch drop		**HAMMER EFFICIENCY** 75%
BOREHOLE BACKFILL OR COMPLETION Cement, grout	**GROUNDWATER READING:** **DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY (CL); medium dense; dark yellowish brown; moist; 86% low plasticity fines; 14% fine sand.												
50	1														
	2														
	3				1					8	26	12			1_3.0-3.5
	4														
	5		At 5 feet hard.												
	6														
45	7														
	8				2	61	17 26 39 [65]	81		14	41	21	86	PA	2_7.0-7.5
	9														
	10				3A 3B	50	25 50/6" [50/6"]		>5P						3A_9.5-10.0 3B_10.0-10.5
	11														
40	12				4A 4B	61	15 48 50/2" [98/8"]								4A_12.0-12.5 4B_12.5-13.0
	13														
	14														
	15				5A 5B	44	16 50/6" [50/6"]								5A_14.5-15.0 5B_15.0-15.5
	16														
35	17				6A 6B	61	25 50/5" [50/5"]								6A_17.0-17.5 6B_17.5-18.0
	18														
	19		SANDY LEAN CLAY (CL); stiff; olive; moist; 60% low plasticity, no dilatancy fines; 40% fine to medium sand.												
	20				7A	89	13								7A_20.0-20.5

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,154,114.76 **Easting:** 6,673,338.29
Latitude: 39.07652 **Longitude:** -121.60662
Levee Station or Milepost: 762+40 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_012B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20				7B 7A 7B	89	28 21 [49]								7B_20.5-21.0
30	22		CLAYEY SAND (SC); medium dense; olive; moist; 55% fine to medium sand; 45% low plasticity fines.		8	100	6 13 14 [27]	34					43	PA HD	8_22.0-23.5
	24		At 24.5 feet dark olive gray; wet; 80% fine to medium sand; 20% low plasticity fines.		9A 9B	100	5 11 12 [23]	29							9A_24.0-24.5 9B_24.5-25.5
25	26 27 28 29														
	30				10A 10B	56	3 8 11 [19]	24							10A_30.5-31.0 10B_31.0-31.5
20	31 32		Poorly Graded GRAVEL with Sand (GP); medium dense; wet; 60% fine, subangular gravel; 40% coarse sand.												
	33 34		LEAN CLAY (CL); hard; dark greenish gray; moist; 86% low plasticity fines; 14% fine sand; indurated.												
	35				11	61	6 7 15 [22]	28		42	49	25	87	PA	11_35.0-36.5
15	37 38 39														
	40				12A 12B	61	15 32 50 [82]								12A_40.5-41.0 12B_41.0-41.5
10	42 43 44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,154,114.76 **Easting:** 6,673,338.29
Latitude: 39.07652 **Longitude:** -121.60662
Levee Station or Milepost: 762+40 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_012B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		SANDY SILT (ML); hard; very dark greenish gray; moist; 60% low plasticity, slow dilatancy fines; 40% fine sand.		13A 13B	61	22 50/5"		>5P						13A_45.5-46.0 13B_46.0-46.5
5	46														
	47						[50/ 5"]								
	48														
	49		LEAN CLAY (CL); hard; dark greenish gray; wet; 95% medium plasticity, no dilatancy fines; 5% fine sand.												
	50														
	51				14A 14B		13 16 30		>5P						14A_50.5-51.0 14B_51.0-51.5
0	52						[46]								
	53		End of boring at 51.5'. Backfilled with cement bentonite grout. 4-47 lb. bags cement, and 45 gallons water.												
	54														
	55														
	56														
-5	57														
	58														
	59														
	60														
	61														
-10	62														
	63														
	64														
	65														
	66														
-15	67														
	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,154,114.76 **Easting:** 6,673,338.29
Latitude: 39.07652 **Longitude:** -121.60662
Levee Station or Milepost: 762+40 **Levee Mile:**
Levee Segment Reach 10
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_012B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/11	10/13/11	78.6 ft	NAVD 88	26.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	Amador Arroyo	Gerry Woods	24 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME 75	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Hollow Stem Auger with drag bit	NWJ 2" OD	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Hollow Stem Auger	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Shelby(2.87")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion CPT SL0001_033C for lithology.												Bulk Sample #1
75	5														
	6														Bulk Sample #2
70	9									14	24	7	48	UW, CP, CU, PA	
	12														
65	14				1										1_14.0_16.0 1500 psi
	16														
60	19				2									UW,	2_19.0_21.0 800 psi
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: **Northing:** 2,159,255.88 **Easting:** 6,674,837.91
Latitude: 39.09062 **Longitude:** -121.60126
Levee Station or Milepost: 818+13 **Levee Mile:**
Levee Segment Reach 11
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_012A
Sheet 1 of 2

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20				2					18	27	11	81	CU, PA	
	21														
	22														
	23														
FILL															
55	24														
	25				3					20	32	11		UW, CN, CU	3_24.0_26.0 500 psi
	26		End of boring at 26'. Backfilled with cement bentonite grout using 3-47 lb. bags cement and 35 gallons water.												
50	27														
	28														
	29														
	30														
	31														
	32														
	33														
45	34														
	35														
	36														
	37														
	38														
40	39														
	40														
	41														
	42														
	43														
35	44														
	45														

Final Report Version

Borehole Location: Feather River West Levee **County:** Sutter
Coordinates: Northing: 2,159,255.88 **Easting:** 6,674,837.91
Latitude: 39.09062 **Longitude:** -121.60126
Levee Station or Milepost: 818+13 **Levee Mile:**
Levee Segment Reach 11
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_012A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/22/11	7/22/11	65.7 ft	NAVD 88	56.5 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Gregg Drilling & Testing, Inc.		Erik Santellan	Martin Soto	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
HSA		Marl M-10		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
8" Carbide Auger, 4" Tricone		NWJ Rod 2-5/8" OD		Gyeong T. Hong
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 8" Auger		**FIELD LOG REVIEWER** E. WILSON
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, MCal(2.5"), SPT(1.375")		Marl, automatic, 140 lbs / 30-inch drop		87.7%
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			23 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
65	0		SILTY CLAY (CL-ML); dark yellowish brown; moist; 90% no dilatancy fines; 10% fine sand.												
	1														
	2														
	3				1	100									1_3.0-3.5
	4														
	5														
60	6				2A 2B	89	10 22 38 [60]		1.8P	20	28	6		UW	2A_5.5-6.0 2B_6.0-6.5
	7														
	8		SILTY SAND (SM); dense; yellowish brown; moist; 70% fine sand; 30% no plasticity fines.		3A 3B	94	10 18 29 [47]						40	PA	3A_8.0-8.5 3B_8.5-9.0
	9														
	10														
55	11				4A 4B	89	16 21 23 [44]								4A_10.5-11.0 4B_11.0-11.5
	12														
	13		LEAN CLAY with Sand (CL); very stiff; yellow; moist; 85% medium plasticity, no dilatancy fines; 15% fine sand.		5A 5B	100	19 31 45 [76]		4.0P						5A_13.0-13.5 5B_13.5-14.0
	14														
	15														
50	16				6A 6B	100	12 21 24 [45]		3.5P						6A_15.5-16.0 6B_16.0-16.5
	17														
	18				7A 7B	100	8 13 16 [29]		2.5P	37	47	16		UW	7A_18.0-18.5 7B_18.5-19.0
	19		LEAN CLAY (CL); very stiff; brownish yellow; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.												
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,187,151.03 **Easting:** 6,668,542.25
Latitude: 39.16729 **Longitude:** -121.62303
Levee Station or Milepost: 1125+00 **Levee Mile:**
Levee Segment Reach 17
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011A
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
45	20													
	21	SILTY SAND (SM); olive brown; moist; 70% fine sand; 30% no plasticity fines.		8A 8B	100	10 12 16 [28]								8A_20.5-21.0 8B_21.0-21.5
	22													
	23			9A 9B	94	8 12 15 [27]								9A_23.5-24.0 9B_24.0-24.5
	24													
40	25	SILTY SAND (SM); medium dense; dark greenish brown; wet; 85% sand; 15% no plasticity fines.		10	67	5 10 12 [22]	32					22	PA	10_25.0-26.5
	26													
	27	LEAN CLAY (CL); very stiff; light olive brown; 90% no dilatancy fines; 10% fine sand.												
	28			11	72	12 17 18 [35]	51							11_27.5-29.0
	29													
	30			12A 12B	83	14 19 21 [40]		3.5P	22	35	16		UW	12A_30.5-31.0 12B_31.0-31.5
35	31													
	32													
	33	LEAN CLAY (CL); very stiff; brown; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.		13A 13B	89	11 17 22 [39]		4.0P						13A_33.0-33.5 13B_33.5-34.0
	34													
	35	SILTY SAND (SM); dense; dark yellowish brown; wet; 70% fine sand; 30% no plasticity fines.		14A 14B	94	14 19 22 [41]								14A_35.5-36.0 14B_36.0-36.5
30	36													
	37													
	38	Well-Graded SAND with Silt (SW-SM); dense; dark yellowish brown; wet; 95% sand; 5% no plasticity fines.		15A 15B	100	11 15 18 [33]						6	PA	15A_38.0-38.5 15B_38.5-39.0
	39													
	40			16	44	8 14 16 [30]	44							16_40.0-41.5
25	41													
	42													
	43			17	61	10 14 20 [34]	50							17_42.5-44.0
	44													
	45													

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,187,151.03 **Easting:** 6,668,542.25
Latitude: 39.16729 **Longitude:** -121.62303
Levee Station or Milepost: 1125+00 **Levee Mile:**
Levee Segment Reach 17
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011A
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
20	45													
	46	Poorly Graded SAND with Silt (SP-SM); medium dense; very dark greenish brown; wet; 90% sand; 10% fines.		18A 18B	83	5 8 10 [18]	26							18A_45.5-46.0 18B_46.0-46.5
	47													
	48													
	49													
	50													
15	51	SILTY SAND (SM); dense; yellowish red; wet; 70% fine sand; 30% no plasticity fines.		19	67	8 12 19 [31]	45							19_50.5-51.5
	52													
	53													
	54													
	55													
10	56	Poorly Graded SAND with Silt (SP-SM); dense; greenish gray; wet; 90% sand; 10% no plasticity fines.		20	33	7 11 15 [26]	38							20_55.0-56.5
	57													
	58	End of boring at 56.5'. Backfilled with cement bentonite grout. 12-47 lb. bags cement, 115 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	59													
	60													
5	61													
	62													
	63													
	64													
	65													
0	66													
	67													
	68													
	69													
	70													

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Sutter
Coordinates: Northing: 2,187,151.03 **Easting:** 6,668,542.25
Latitude: 39.16729 **Longitude:** -121.62303
Levee Station or Milepost: 1125+00 **Levee Mile:**
Levee Segment Reach 17
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0001_011A
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 7/12/11 **DATE COMPLETED** 7/12/11	**GROUND ELEVATION** 86.9 ft **ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 36.5 ft
DRILLING CONTRACTOR Gregg Drilling & Testing, Inc.	**DRILLER'S NAME** Erik Santellan **HELPER'S NAME** Louie Wens		**TOTAL DEPTH OF FILL** 23.5 ft
DRILLING METHOD HSA	**DRILL RIG MAKE AND MODEL** Marl M-10		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" Carbide Auger	**DRILLING ROD TYPE AND DIAMETER** NWJ Rod 2-5/8" OD		**FIELD LOGGER** Mehrzad, Matt
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 8" Auger		**FIELD LOG REVIEWER** E. WILSON
SAMPLER TYPE(S) Bag, MCal(2.5"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Automatic, 140 lbs / 30-inch drop		**HAMMER EFFICIENCY** 87.7%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING:** **DURING DRILLING** Not encountered	**AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel (8").												0-5' Hand auger
	1		[LEVEE FILL] SANDY LEAN CLAY (CL); dark brown; moist; 65% slow dilatancy fines; 35% fine sand.												
85	2				1										1_2.0-3.0
	3														
	4														
	5				2A 2B	78	3 6 9 [15]			17	27	4	64	UW, PA	2A_5.5-6.0 2B_6.0-6.5
	6														
80	7		[LEVEE FILL] CLAYEY SAND (SC); loose to medium dense; dark brown; moist; 55% fine to medium sand; 45% low plasticity fines.												
	8				3A 3B	83	3 4 3 [7]								3A_8.0-8.5 3B_8.5-9.0
	9														
	10				4	28	2 3 4 [7]	10							4_10.0-11.5
	11														
75	12														
	13				5	22	4 4 4 [8]	12							5_12.5-14.0
	14														
	15				6	33	3 3 4 [7]	10							6_15.0-16.5
	16														
70	17		[LEVEE FILL] LEAN CLAY with Sand (CL); dark brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.												
	18				7	50	2 3 4 [7]	10							7_17.5-19.0
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,189,246.98 **Easting:** 6,668,812.82
Latitude: 39.17304 **Longitude:** -121.62204
Levee Station or Milepost: 1146+00 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21				8	44	3 4 4 [8]	12							8_20.0-21.5
65	22														
←FILL	23				9	61	10 35 49 [84]	123							9_22.5-24.0
	24		LEAN CLAY (CL); olive brown; moist; 90% low plasticity, no dilatancy fines; 10% fine sand.												
	25				10	78	16 35 23 [58]	85							10_25.0-26.5
60	26														
	27		SILTY SAND (SM); very dense; brown; moist; 70% fine sand; 30% no plasticity fines.												
	28				11A 11B	67	9 29 37 [66]	96							11A_28.0-28.5 11B_28.5-29.0
	29		Poorly Graded SAND with Silt (SP-SM); very dense; brown; moist; 90% fine sand; 10% no plasticity fines.												
	30				12	67	16 19 16 [35]	51		2			7	PA	12_30.0-31.5
	31		Poorly Graded SAND with Silt (SP-SM); very dense; dark brown; moist; 95% fine to medium sand; 5% no plasticity fines.												
55	32														
	33		LEAN CLAY (CL); olive brown; moist; 90% low plasticity, slow dilatancy fines; 10% fine sand.		13	56	10 19 21 [40]	58							13_32.5-34.0
	34														
	35				14	56	8 12 12 [24]	35							14_35.0-36.5
	36														
50	37		End of boring at 36.5'. Backfilled with cement bentonite grout. 12-47 lb. bags cement, 105 gallons water, 60 lb. of bentonite												
	38														
	39														
	40														
	41														
45	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,189,246.98 **Easting:** 6,668,812.82
Latitude: 39.17304 **Longitude:** -121.62204
Levee Station or Milepost: 1146+00 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/11	10/13/11	86.9 ft	NAVD 88	25.5 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
Cascade		Amador Arroyo	Gerry Woods	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
HSA		CME 75		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
8" Hollow Stem Auger with drag bit		NWJ Rod 2" OD		M. Weil
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		8" HSA		RN
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Shelby(2.87")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			NA	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion hollow stem auger boring SL0009_004A for lithology.												
85	1														
	2														
	3									15	26	6	74	UW, CP, CU, PA	Bulk Sample #1
	4														
	5														
	6														
80	7														
	8									14	26	18	58	UW, CP, CU, PA	Bulk Sample #2
	9														
	10														
	11														
75	12														
	13														
	14														
	15														
	16														
70	17														
	18				1	0									No Recovery. See notes at end of log.
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,189,246.98 **Easting:** 6,668,812.82
Latitude: 39.17304 **Longitude:** -121.62204
Levee Station or Milepost: 1146+17 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_005A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21				2	100				17	27	11	81	UW, CN, CU, PA	2_20.0_22.0 125 psi
65	22														
	23														
	24				3	71									3_23.0_25.0 1000 psi
	25				4	100									No Recovery 1000 psi (Tube damaged. Not saved)
	26		End of boring at 25.5'. Backfilled with cement bentonite grout. 4-94 lb. bags cement and 35 gallons water.												
60	27		A second supplemental boring was drilled adjacent to SL0009_005A to collect a sample between 17 and 19 feet. The attempt from 17 to 19 feet returned no material. We then pushed a Shelby tube from 19 to 21 feet and recovered 16 of 24" under 35 psi. This sample is identified as 1_19.0_21.0												
	28														
	29														
	30														
	31														
55	32														
	33														
	34														
	35														
	36														
50	37														
	38														
	39														
	40														
	41														
45	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,189,246.98 **Easting:** 6,668,812.82
Latitude: 39.17304 **Longitude:** -121.62204
Levee Station or Milepost: 1146+17 **Levee Mile:**
Levee Segment Reach 18
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_005A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/13/11	7/15/11	88.3 ft	NAVD 88	131.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Louie Wens	22 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA/Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	Mehrzad, Matt, GT

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	42 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel (1 foot).												Hand augered to 5' Switched to HSA
	1		[LEVEE FILL] LEAN CLAY (CL); dark brown; moist; 90% low plasticity, slow dilatancy fines; 10% fine sand.												
	2				1										1_2.0-5.0
85	3														
	4														
	5				2A 2B	83	9 12 14 [26]								2A_5.5-6.0 2B_6.0-6.5
	6		[LEVEE FILL] LEAN CLAY with Sand (CL); dark brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.												
	7														
80	8				3A 3B	94	4 6 7 [13]			25				UW	3A_8.0-8.5 3B_8.5-9.0
	9														
	10				4A 4B	39	2 3 4 [7]	10							4A_10.0-10.2 4B_10.2-10.5
	11		[LEVEE FILL] SILTY SAND (SM); loose; dark brown; moist; 60% fine to medium sand; 40% no plasticity fines.												
	12		[LEVEE FILL] LEAN CLAY (CL); very dark brown; moist; 95% slow dilatancy fines; 5% fine sand.												
75	13				5	56	2 3 4 [7]	10							5_12.5-14.0
	14														
	15				6A 6B	61	3 3 5 [8]			29				UW	6A_15.5-16.0 6B_16.0-16.5
	16														
	17														
70	18				7A 7B	78	4 4 4 [8]			17	24	7		UW	7A_18.0-18.5 7B_18.5-19.0
	19														
	20		[LEVEE FILL]												

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+00 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004B
Sheet 1 of 6

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20		LEAN CLAY with Sand (CL); dark brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.		8A 8B	89	3 5 5 [10]			17				UW	8A_20.5-21.0 8B_21.0-21.5
FILL	21														
	22		LEAN CLAY (CL); light olive brown; moist; 90% low plasticity, no dilatancy fines; 10% fine sand; moderately indurated.												
65	23				9A 9B	61	28 62/6" [62/6"]			22				UW	9A_22.5-23.0 9B_23.0-23.5
	24														
	25				10	44	14 23 24 [47]	69							10_25.0-26.5
	26														
	27		SILTY SAND (SM); dense; brown; moist; 80% fine sand; 20% no plasticity fines.												
60	28				11	67	6 11 11 [22]	32							11_27.5-29.0
	29														
	30				12	44	6 9 12 [21]	31							12_30.0-31.5
	31														
	32		LEAN CLAY (CL); light olive brown; moist; 90% low plasticity, no dilatancy fines; 10% fine sand; moderately indurated.												
55	33				13	33	16 18 21 [39]	57							13_32.5-34.0
	34														
	35		SILTY SAND (SM); medium dense to dense; dark olive brown; moist; 75% fine sand; 25% no plasticity fines.												
	36				14A 14B	100	10 14 17 [31]								14A_35.5-360 14B_36.0-36.5
	37														
	38		At 37.5 feet medium dense.		15	100	5 12 12 [24]	35							15_37.5-39.0
50	39														
	40		Poorly Graded SAND (SP); dense; dark olive brown; moist; 95% fine sand; 5% no plasticity fines.		16	83	8 11 12 [23]	34							16_40.0-41.5
	41														
	42														Switched to Mud rotary
45	43				17		5 11 12 [23]	34							17_42.5-44.0
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+00 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004B
Sheet 2 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45														
	46														
	47		Poorly Graded SAND with Silt (SP-SM); dense; olive brown; wet; 90% fine to medium sand; 10% no plasticity fines.												
40	48														
	49														
	50			X	18	50	11 13 15 [28]	41								18_50.0-51.5
	51														
	52														
35	53														
	54														
	55		Well-Graded SAND with Silt and Gravel (SW-SM); very dense; olive brown; wet; 60% fine to coarse sand; 30% fine, subrounded gravel; 10% no plasticity fines.												
	56														
	57														
30	58														
	59														
	60			X	19	67	15 41 23 [64]	94								19_60.0-61.5
	61														
	62														
25	63														
	64														
	65														
	66														
	67														
20	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+00 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004B
Sheet 3 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70			X	20	67	22 32 49 [81]	118							20_70.0-71.5
	71														
	72														
15	73														
	74														
	75														
	76		Well-Graded GRAVEL with Silt and Sand (GW-GM); very dense; wet; 60% fine to coarse, subrounded gravel; 30% fine to coarse sand; 10% no plasticity fines.												Difficult drilling
	77														
10	78														
	79														
	80			X	21	33	23 54/5" [54/ 5"]								21_80.0-81.5
	81														
	82														
5	83														
	84														
	85			X	22	56	20 26 35 [61]	89							22_85.0-86.5 Stopped drilling at 85'. End of day 7/13/11. Difficult drilling, lost 700 gal mud at 87'.
	86														
	87														
0	88														
	89														
	90			X	23	33	40 38 20 [58]	85							23_90.0-91.5
	91														
	92														
-5	93														
	94														Difficult drilling
	95														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+00 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004B
Sheet 4 of 6

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	95			X	24	22	19 25 39 [64]	94							24_95.0-96.5
-10	96 97 98 99														
	100			X	25	17	16 18 25 [43]	63							25_100.0-101.5
-15	101 102 103 104														Difficult drilling
	105			X	26	22	9 29 50/2" [79/8"]								26_105.0-106.5
-20	106 107 108 109														
	110			X	27	17	10 50/3" [50/3"]								27_110.0-111.5
-25	111 112 113 114														Rock in shoe
	115														
-30	116 117 118		SILTY SAND (SM); very dense; very dark greenish gray; moist; 70% fine sand; 30% no plasticity fines.												Easier drilling at 118'.
	119 120														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+00 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004B
Sheet 5 of 6

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	120														
	121				28	17	17 27 39	96					40	PA	28_120.0-121.5
	122						[66]								
-35	123														
	124														
	125														
	126		SANDY LEAN CLAY (CL); dark greenish gray; moist; 70% low plasticity, no dilatancy fines; 30% fine sand.		29	17	25 32 34			29	42	17	56	PA	29_125.0-126.5 Stopped drilling. End of day 7/14/11.
	127						[66]								
-40	128														
	129														
	130														
	131				30	39	19 32 33			31				UW	30_130.0-131.5
	132						[65]								
	133		End of boring at 131.5'. Backfilled with cement bentonite grout. 24-47 lb. bags cement, 250 gallons water, 1 bag of bentonite (50 lb. bag)												
-45	134														
	135														
	136														
	137														
-50	138														
	139														
	140														
	141														
	142														
-55	143														
	144														
	145														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+00 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_004B
Sheet 6 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/12	10/13/12	88.3 ft	NAVD 88	27.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	Amador Arroyo	Gerry Woods	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME 75	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Hollow Stem Auger with drag bit	NWJ Rod 2" OD	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" HSA	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Shelby(2.87")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion mud rotary boring SL0009_004B for lithology.												
	1														
	2														
85	3														
	4														Bulk Sample #1
	5														
	6														
	7														
80	8														
	9														
	10														Bulk Sample #2
	11														
	12														
75	13				1					22	31	7		UW, CN	1_12.0_14.0 800 psi
	14														
	15														
	16				2					24	38	9		CU	2_15.0_17.0
	17														
70	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+15 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_006A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21														
	22														
65	23														Damaged Shelby tube 1000 psi
	24														
	25														Damaged Shelby tube 1000 psi
	26														
	27		End of boring at 27'. Backfilled with cement bentonite grout.												
60	28														
	29														
	30														
	31														
	32														
55	33														
	34														
	35														
	36														
	37														
50	38														
	39														
	40														
	41														
	42														
45	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Sutter
Coordinates: Northing: 2,198,409.39 **Easting:** 6,667,234.78
Latitude: 39.19822 **Longitude:** -121.62748
Levee Station or Milepost: 1244+15 **Levee Mile:**
Levee Segment Reach 19
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SL0009_006A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/18/11	7/18/11	102.1 ft	NAVD 88	81.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	8 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	Mehrzad, GT

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger, 33'	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	29 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel (3 inches).												0-5' Hand augered
	1		[LEVEE FILL] SANDY SILT (ML); dark yellowish brown; moist; 60% no plasticity fines; 40% fine sand.												
100	2														
	3				1	100									1_3.0-3.5
	4														
	5				2	44	2 4 4 [8]	12					56	PA	2_5.0-6.5
	6														
FILL 95	7														
	8		SILTY SAND (SM); dense; very dark brown; moist; 70% fine sand; 30% no plasticity fines; trace organics.		3	50	6 10 11 [21]	31							3_7.5-9.0
	9														
	10				4	67	7 10 19 [29]	42							4_10.0-11.5
	11														
90	12		Poorly Graded SAND (SP); medium dense; very dark greenish gray; moist; 95% fine sand; 5% no plasticity fines.												
	13				5	72	6 7 8 [15]	22							5_12.5-14.0
	14														
	15				6	83	5 8 9 [17]	25							6_15.0-16.5
	16														
85	17														
	18		SANDY LEAN CLAY (CL); brown; moist; 70% no plasticity fines; 30% fine sand.		7	56	8 15 19 [34]	50		19	39	20	69	PA	7_17.5-19.0
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,252,596.63 **Easting:** 6,666,275.49
Latitude: 39.34701 **Longitude:** -121.63008
Levee Station or Milepost: 1815+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011B
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21				8	78	8 13 17 [30]	44		18	32	14	7	PA	8_20.0-21.5
80	22														
	23		Poorly Graded SAND with Silt (SP-SM); medium dense; dark brown; moist; 90% fine sand; 10% no plasticity fines.		9A 9B	94	8 4 11 [15]								9A_23.0-23.5 9B_23.5-24.0
	24														
	25														
	26		LEAN CLAY (CL); dark yellowish brown; moist; 90% low plasticity, no dilatancy fines; 10% fine sand.		10	89	14 20 21 [41]	60							10_25.0-26.5
75	27														
	28														
	29														
	30														
	31				11	83	25 28 43 [71]	104							11_30.0-31.5
70	32														
	33														At 33' switched from HSA to Mud rotary.
	34														
	35														
	36				12A 12B	89	12 23 37 [60]								12A_35.5-36.0 12B_36.0-36.5
65	37														
	38														
	39														
	40														
	41		SILTY CLAY with Sand (CL-ML); strong brown; moist; 75% low plasticity, no dilatancy fines; 25% fine sand.		13A 13B	100	16 33 43 [76]								13A_40.5-44.0 13B_41.0-41.5
60	42														
	43														
	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,252,596.63 **Easting:** 6,666,275.49
Latitude: 39.34701 **Longitude:** -121.63008
Levee Station or Milepost: 1815+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011B
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														
	46				14A 14B	100	21 37 39 [76]								14A_45.5-46.0 14B_46.0-46.5
55	47														
	48														
	49														
	50		LEAN CLAY with Sand (CL); yellowish brown; moist; 85% low plasticity fines; 15% fine sand.		15A 15B	100	14 25 41 [66]								15A_50.5-51.0 15B_51.0-51.5
	51														
50	52														
	53														
	54														
	55				16A 16B	100	19 32 42 [74]								16A_55.5-56.0 16B_56.0-56.5
	56														
45	57														
	58														
	59														
	60				17	56	20 22 34 [56]	82							17_60.0-61.5
	61														
40	62														
	63														
	64														
	65		SILTY SAND (SM); very dense; very dark grayish brown; moist; 70% fine sand; 30% no plasticity fines.		18	61	13 20 25 [45]	66							18_65.0-66.5
	66														
35	67														
	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,252,596.63 **Easting:** 6,666,275.49
Latitude: 39.34701 **Longitude:** -121.63008
Levee Station or Milepost: 1815+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011B
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70			X	19	61	14 16 19 [35]	51							19_70.0-71.5
30	71														
	72														
	73														
	74														
	75		Poorly Graded SAND (SP); very dense; very dark greenish gray; moist; 95% fine sand; 5% no plasticity fines.	X	20	67	11 16 19 [35]	51							20_75.0-76.5
25	76														
	77														
	78														
	79														
	80			X	20		12 20 17 [37]	54							20_80.0-81.5
20	81														
	82		End of boring at 81.5'. Backfilled with cement bentonite grout. 12-47 lb. bags cement, 95 gallons water, 1 bag of bentonite (50 lb. bag)												
	83														
	84														
	85														
	86														
15	87														
	88														
	89														
	90														
	91														
	92														
10	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,252,596.63 **Easting:** 6,666,275.49
Latitude: 39.34701 **Longitude:** -121.63008
Levee Station or Milepost: 1815+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011B
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
11/10/11	11/11/11	95.2 ft	NAVD 88	75.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	Jason Klipfel	Craig Chaffeo, Gage Kramer	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	CME 75	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Hollow Stem Auger	NWJ 2-5/8" OD	M. Turner

[X] VERTICAL [ ] INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
	8" HSA	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Auto Hammer, 140 lbs / 30-inch drop	75%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	20.5 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
95	0		SILTY SAND (SM); very dark grayish brown (10YR 3/2); moist; 55% fine sand; 45% no plasticity fines; with rootlets.		1A										1A_0-1 Hand Auger to 5' Hollow Stem Auger to 75.5'
	1														
	2		SANDY SILT (ML); stiff; brown (10YR 4/3); moist; 60% no plasticity fines; 40% fine sand.												
	3				2A								54	PA	2A_3-3.5
	4														
90	5				3A		7			10	23	1	59	PA	3A_5.5-6
	6				3B	100	6 6 [12]		1.25P						3B_6-6.5
	7														
	8		At 8 feet, very stiff.		4A	100	9 10								4A_8-8.5
	9				4B		10 [20]		2.25P						4B_8.5-9
85	10														
	11		At 10.5 feet, fine sand.		5A	100	9 9		2.25P						5A_10.5-11
	12				5B		10 [19]		2.5P						5B_11-11.5
	13		At 13 feet, trace rootlets.		6A	100	3 6		2.25P						6A_13-13.5
	14				6B		9 [15]								6B_13.5-14
80	15														
	16		At 15.5 feet, stiff; 25% sand. At 16 feet, very stiff; 20% sand.		7A 7B	100	6 12 14 [26]		1.75P 2.25P						7A_16-16.5 7B_16.5-17
	17		SILTY SAND (SM); loose; brown (10YR 4/3); moist.												
	18				8A	100	6 9								8A_18-18.5
	19		At 19 feet, 15% fines.		8B		13 [22]								8B_18.5-19
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 6,662,738.11 **Easting:** 2,257,883.69
Latitude: 39.36156 **Longitude:** -121.64252
Levee Station or Milepost: 1883+02 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018A
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
75	20														
	21		At 21 feet, 31% fines; wet.		9A	94	3 4 5 [9]	11					31	PA	9A_20-21.5
	22														
	23														
	24														
70	25		At 25 Feet, medium dense; dark grayish brown (2.5Y, 4/2); wet; 48% fine sand; 52% non-plastic fines.		10A	100	4 8 9 [17]	21					52	PA	10A_25-26.5
	26														
	27		Poorly Graded GRAVEL with Silt and Sand (GP-GM); very dense; very dark grayish brown (2.5Y 3/2); moist; 55% fine to coarse, subrounded gravel, max. 2.5 in.; 35% fine to coarse sand; 10% no plasticity fines.												
	28														
	29														
65	30				11A	100	50/6"								11A_30-30.5
	31				12A	100									12A_30.5-31
	32														
	33														
	34														
60	35				13A	75	18 50/6"								13A_35-36
	36														
	37						[50/ 6"]								
	38		Poorly Graded GRAVEL with Silt and Sand (GP-GM); very dense; very dark grayish brown (2.5Y 3/2); moist; 53% fine to coarse, subrounded gravel, max. 1.5 in.; 38% fine to coarse sand; 9% no plasticity fines.												
	39														
55	40				14A	100	22 34 44 [78]	98					9	HD, PA	14A_40-41.5
	41														
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 6,662,738.11 **Easting:** 2,257,883.69
Latitude: 39.36156 **Longitude:** -121.64252
Levee Station or Milepost: 1883+02 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018A
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
50	45			15A	56	34 40 36 [76]	95							15A_45-47
	46													
	47	LEAN CLAY (CL); very dark grayish green; moist; 95% low plasticity fines; 5% fine sand.												
	48													
	49													
45	50	SILT (ML); hard; very dark grayish green; moist; 90% no to low plasticity fines; 10% fine sand.		16A	89	50 20 29	61	4.5+P						
	51													16A_50-51.5
	52	LEAN CLAY (CL); hard; very dark grayish green; moist; 95% low plasticity fines; 5% fine sand.		16B		[49]								16B_51.75-52
	53													
	54													
40	55	CLAYEY SAND (SC); very dense; very dark grayish green; moist; 40% fine to coarse sand; 30% fine to coarse, subrounded gravel; 30% low to medium plasticity fines.		17A	100	18 36 45	101							17A_55-56
	56	LEAN CLAY (CL); hard; very dark grayish green; moist; 90% fine sand; 90% medium plasticity fines.		17B		[81]		3.25P						17B_56-57
	57													
	58													
	59	FAT CLAY with Sand (CH); hard; very dark grayish green; moist; 54% high plasticity fines; 41% fine sand; 5% fine to coarse, subrounded gravel.												
35	60			18A	50	7 11 20			26	54	32	54	PA	
	61			18B				4.5+P						18A_60.5-61
	62					[31]								18B_61-61.5
	63	LEAN CLAY (CL); very stiff; greenish gray; moist; 90% medium plasticity fines; 10% fine sand.												
	64			19A	6	5 40 50/5		2.5P						
30	65					[90/ 11"]								19A_64.5-65
	66	SANDY SILT (ML); hard; very dark grayish green; moist; 80% no plasticity fines; 20% fine sand.		20A	83	15 27		4.5+P						20A_66-66.5
	67					50/5 [77/ 11"]								
	68													
	69	SILTY SAND (SM); very dense; very dark grayish green; moist; 55% fine sand; 45% no plasticity fines.												
	70													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 6,662,738.11 **Easting:** 2,257,883.69
Latitude: 39.36156 **Longitude:** -121.64252
Levee Station or Milepost: 1883+02 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018A
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
25	70			21A	100	18 29 36 [65]	81							21A_71-71.5
	71													
	72													
	73	SILTY SAND with Gravel (SM); very dense; very dark grayish green; moist; 45% fine to coarse sand; 40% fine to coarse, subrounded gravel, max. 1.75 in.; 15% no plasticity fines.												
	74			22A	100									22A_74-74.5 (bagged sluff)
	75	Poorly Graded GRAVEL with Sand (GP); very dense; very dark grayish green; moist; 45% fine to coarse, subrounded gravel, max. 2.875 in.; 40% fine to coarse sand; 5% no plasticity fines.		23A	100	100/5								23A_75-75.5
20	76													
	77	End of boring at 75.5'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 74 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	78													
	79													
15	80													
	81													
	82													
	83													
	84													
10	85													
	86													
	87													
	88													
	89													
5	90													
	91													
	92													
	93													
	94													
	95													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 6,662,738.11 **Easting:** 2,257,883.69
Latitude: 39.36156 **Longitude:** -121.64252
Levee Station or Milepost: 1883+02 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018A
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/22/11	8/23/11	106.2 ft	NAVD 88	86.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	11 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	32.5 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel 2 inches.												0-5' Hand auger
105	1		[LEVEE FILL] SILT with Sand (ML); yellowish brown; moist; 75% slow dilatancy fines; 25% fine sand.												
	2														
	3				1	100									1_3.0-3.5
	4														
	5				2A	83	7			25	32	5	80	UW, PA	2A_5.5-6.0
100	6				2B		14								2B_6.0-6.5
	7						16 [30]								
	8				3A	89	10						67	PA	3A_8.0-8.5
	9				3B		16							HD	3B_8.5-9.0
	10						17 [33]								
FILL															
95	11		LEAN CLAY with Sand (CL); yellowish brown; moist; 85% high plasticity, no dilatancy fines; 15% fine sand.		4A	89	6								4A_10.5-11.0
	12				4B		8								4B_11.0-11.5
	13						12 [20]								
					5A	94	6			24				UW	5A_13.0-13.5
	14		SILT with Sand (ML); yellowish brown; moist; 80% low plasticity, slow dilatancy fines; 20% fine sand.		5B		9			26				UW	5B_13.5-14.0
	15						15 [24]								
					6	28	14								6_16.0-16.5 Low recovery caught in the cobble high blow count.
90	16						30								
	17						32 [62]								
	18				7	11	20								7_18.5-19.0 Low recovery caught in the cobble high blow count.
	19						22								
	20						22 [44]								

Final Report Version

Borehole Location: West Levee Crown **County:** Butte

Coordinates: Northing: 2,258,429.25 **Easting:** 6,662,105.99

Latitude: 39.36306 **Longitude:** -121.64475

Levee Station or Milepost: 1891+58 **Levee Mile:**

Levee Segment Reach 30

Survey Method: GPS **Coord. System:** CA State Plane Zone II

Channel / River Name / Feature: Feather River

LOG OF BORING

SM0007_007A

Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
85	21				8	67	4 6 7 [13]	19					77	PA HD	8_20.0-21.5
	22														
	23				9	50	8 10 10 [20]	29					69	PA HD	9_22.5-24.0
	24														
	25														
80	26														
	27														
	28				10	28	24 31 32 [63]								10_27.5-29.0 Cobble at bottom.
	29														
	30														
75	31														
	32														
	33		FAT CLAY (CH); light yellowish brown; moist; 90% high plasticity, no dilatancy fines; 10% fine sand.		11A 11B	72	8 10 15 [25]	37							11A_32.5-33.0 11B_33.0-34.0
	34														
	35														
70	36														
	37		Well-Graded GRAVEL with Silt (GW-GM); dark yellowish brown; wet; 65% gravel; 30% sand; 5% no plasticity fines.		12	67	10 27 32 [59]	86					8	PA	12_37.5-39.0
	38														
	39														
	40														
65	41														
	42														
	43				13	56	18 23 36 [59]	86							13_42.5-44.0
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,429.25 **Easting:** 6,662,105.99
Latitude: 39.36306 **Longitude:** -121.64475
Levee Station or Milepost: 1891+58 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007A
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														
	46														
60	47														
	48		Poorly Graded GRAVEL with Sand (GP); olive brown; wet; 75% gravel; 20% sand; 5% no plasticity fines.		14	22	24 50/4" [50/4"]								14_47.5-49.0 Cobbles at bottom.
	49														
	50														
	51														
55	52														
	53					0	50/3" [REF]								No recovery due to cobble (>3").
	54				15	17	50/4" [REF]								15_54.0-54.5
	55														
50	56														
	57														
	58					0	26 36 39 [75]								No recovery due to cobble (>3").
	59														
	60				16	22	44 50/2" [50/2"]								16_60.0-61.0 With plastic catcher.
45	61														
	62														
	63														
	64														
	65				17	17	50/4" [REF]								17_65.0-66.0 With plastic catcher. Cobble size >4".
40	66														
	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,429.25 **Easting:** 6,662,105.99
Latitude: 39.36306 **Longitude:** -121.64475
Levee Station or Milepost: 1891+58 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007A
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70														
35	71			X	18	39	13 37 39 [76]	111							18_70.0-71.5
	72														
	73		FAT CLAY (CH); greenish gray; moist; 90% high plasticity, no dilatancy fines; 10% fine sand.												
	74														
	75			X	19	67	19 47 48 [95]	139		28	51	27	84	PA	19_75-76.5
30	76														
	77														
	78														
	79														
	80														
25	81			X	20	33	43 50/2" [50/2"]								20_81.0-81.5
	82														
	83														
	84														
	85														
20	86			X	21	50	48 50/4" [50/4"]								21_85.0-86.0
	87		End of boring at 86.5'. Backfilled with cement bentonite grout. 17-47 lb. bags cement, 180 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	88														
	89														
	90														
15	91														
	92														
	93														
	94														
	95														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,429.25 **Easting:** 6,662,105.99
Latitude: 39.36306 **Longitude:** -121.64475
Levee Station or Milepost: 1891+58 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007A
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/11	10/13/11	106.2 ft	NAVD 88	21.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger	NWJ Rod 2-5/8" OD	P. Navarjo

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" HSA	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Shelby(2.87")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
105	0		Supplemental strength test boring. Refer to companion hollow stem auger boring SM0007_007A for lithology.		1										Bulk Sample #1
	5				2					16	30	7	66	UW, CP, CU, PA	Bulk Sample #2
100	10														
95	14				3					12	21	2	45	UW, CN, PA	3_14.0_16.0 300 psi
90	19				4										4_19.0_21.0 300 psi
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,429.25 **Easting:** 6,662,105.99
Latitude: 39.36306 **Longitude:** -121.64475
Levee Station or Milepost: 1891+71 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20				4					24	25	4	68	PA	
85	21		End of boring at 21'. Backfilled with cement bentonite grout (20 gal). 4-47 lb. bags cement, 10 gallons water, 1/4 bag of bentonite (50 lb. bag)												
	22														
	23														
	24														
	25														
80	26														
	27														
	28														
	29														
	30														
75	31														
	32														
	33														
	34														
	35														
70	36														
	37														
	38														
	39														
	40														
65	41														
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,429.25 **Easting:** 6,662,105.99
Latitude: 39.36306 **Longitude:** -121.64475
Levee Station or Milepost: 1891+71 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/25/11	8/25/11	106.1 ft	NAVD 88	90.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Boart Longyear	Justin Kilgore	Casey King/Robert Leininger	22 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Prosonic Full Size Truck Mounted	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	Prosonic 300XL	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	35 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		12 inch road gravel.												
105	1		[LEVEE FILL] SILTY SAND TO SANDY SILT (SM/ML); dark brown; moist; 55% fine sand; 45% fines.												
	2														
	3														
	4														
	5														Run 1 5-7' 100% recovery
100	6				1					11	NP	NP	41	PA	1_6.0-7.0
	7														Run 2 7-27' 100% recovery
	8														
	9														
	10				2								53	PA HD	2_10.0-11.0
95	11														
	12		[LEVEE FILL] SILTY CLAY with Sand (CL-ML); dark brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.		3					13	22	2	56	PA	3_12.0-13.0
	13														
	14														
	15														
90	16														
	17														
	18				4					23	24	5			4_18.0-19.0
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,558.14 **Easting:** 6,662,179.66
Latitude: 39.36342 **Longitude:** -121.64449
Levee Station or Milepost: 1892+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
FILL	20														
85	21														
	22		Well-Graded GRAVEL with Clay and Sand (GW-GC); moist; 65% subrounded gravel; 25% sand; 10% low plasticity fines.		5								10	PA HD	5_22.0-23.0
	23														
	24														
	25														
80	26		CLAYEY GRAVEL with Sand (GC); moist; 55% fine to coarse, subrounded gravel; 30% low plasticity fines; 15% fine to medium sand.												
	27														Run 3 27-37' 100% recovery
	28				6										6_28.0-29.0
	29														
	30														
75	31		SANDY LEAN CLAY (CL); dark brown; moist; 65% low plasticity, slow dilatancy fines; 35% fine to medium sand.		7										7_31.0-32.0
	32														
	33		Well-Graded GRAVEL with Clay and Sand (GW-GC); moist; 55% subrounded gravel; 35% fine to coarse sand; 10% low plasticity fines.		8										8_33.0-34.0
	34														
	35		Well-Graded GRAVEL with Sand (GW); wet; 55% subrounded gravel; 45% fine to coarse sand.		9										9_35.0-36.0
70	36		Well-Graded GRAVEL with Clay (GW-GC); wet; 80% subrounded gravel; 10% fine to coarse sand; 10% low plasticity fines.		10										10_36.0-37.0
	37		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 60% subrounded gravel; 30% fine to coarse sand; 10% low plasticity fines.												Run 4 37-47'
	38														
	39														
	40				11										11_40.0-41.0
65	41														
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,558.14 **Easting:** 6,662,179.66
Latitude: 39.36342 **Longitude:** -121.64449
Levee Station or Milepost: 1892+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45				12										12_45.0-46.0
60	46														
	47														Run 5 47-57' 100% recovery
	48														
	49														
	50				13										13_50.0-51.0
55	51														
	52														
	53														
	54														
	55				14										14_55.0-56.0
50	56														
	57														Run 6 57-77' 100% recovery
	58														
	59														
	60				15										15_60.0-61.0
45	61		CLAYEY SAND (SC); dark olive gray; wet; 80% fine to medium sand; 20% low plasticity fines.		16										16_61.0-62.0
	62														
	63		CLAYEY GRAVEL with Sand (GC); wet; 60% subrounded gravel; 20% sand; 20% low plasticity fines.		17										17_62.5-63.5
	64		LEAN CLAY with Sand (CL); dark greenish gray; wet; 85% low to medium plasticity, no dilatancy fines; 15% fine sand.		18										18_64.0-65.0
	65														
40	66														
	67		CLAYEY GRAVEL with Sand (GC); wet; 60% subrounded gravel; 25% sand; 15% low plasticity fines.		19										19_67.0-68.0
	68														
	69		FAT CLAY with Sand (CH); dark greenish gray; wet; 85% medium to high plasticity, no dilatancy fines; 15%												
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,558.14 **Easting:** 6,662,179.66
Latitude: 39.36342 **Longitude:** -121.64449
Levee Station or Milepost: 1892+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001S
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70		fine sand.		20					25	54	28			20_70.0-71.0
35	71														
	72														
	73														
	74														
	75				21										21_75.0-76.0
30	76														
	77														Run 7 77-90' 100% recovery
	78														
	79				22										22_79.0-80.0
	80		CLAYEY SAND (SC); very dark greenish gray; wet; 75% fine sand; 25% low plasticity fines.												
25	81														
	82				23										23_82.0-83.0
	83														
	84														
	85				24										24_85.0-86.0
20	86														
	87														
	88														
	89				25										25_89.0-90.0
	90		End of boring at 90'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 90 gallons water, 1 bag of bentonite (100 lb. bag)												
15	91														
	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,558.14 **Easting:** 6,662,179.66
Latitude: 39.36342 **Longitude:** -121.64449
Levee Station or Milepost: 1892+00 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/11	10/13/11	106.1 ft	NAVD 88	21.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Hollow Stem Auger with drag bit	NWJ Rod 2-5/8" OD	P. Navarjo

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" HSA	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Shelby(2.87")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion sonic boring SM0007_001S for lithology.												
105	1				1										Bulk Sample #1
	2														
	3														
	4														
	5														Bulk Sample #2
100	6														
	7				2					16	24	3	46	UW, CP, CU, PA	
	8														
	9														
	10														
95	11														
	12														
	13														
	14														3_14.0_16.0
	15				3					13				UW FWK	
90	16														
	17														
	18														
	19														3_19.0_21.0
	20				4					21	29	11	82	CU, PA	

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,258,558.14 **Easting:** 6,662,179.66
Latitude: 39.36342 **Longitude:** -121.64449
Levee Station or Milepost: 1892+14 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20				4										
85	21									20				UW, CN	
	22		End of boring at 21'. Backfilled with cement bentonite grout. 4-47 lb. bags cement, 10 gallons water, 1/4 bag of bentonite (50 lb. bag)												
	23														
	24														
	25														
80	26														
	27														
	28														
	29														
	30														
75	31														
	32														
	33														
	34														
	35														
70	36														
	37														
	38														
	39														
	40														
65	41														
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: **Northing:** 2,258,558.14 **Easting:** 6,662,179.66
Latitude: 39.36342 **Longitude:** -121.64449
Levee Station or Milepost: 1892+14 **Levee Mile:**
Levee Segment Reach 30
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/19/11	7/19/11	107.9 ft	NAVD 88	61.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	8 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	Matt, GT

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	NWJ Rod 2-5/8" OD	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	33 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel (3 inches).												
	1		[LEVEE FILL] LEAN CLAY (CL); very soft; dark brown; moist; 90% fines; 10% fine sand.												
	2														
105	3				1										1_3.0-4.0
	4														
	5				2A 2B	83	2 1 2 [3]		<0.25P	25	42	22		UW	2A_5.5-6.0 2B_6.0-6.5
	6														
FILL	7														
100	8		LEAN CLAY with Sand (CL); grayish brown; moist; 80% medium plasticity fines; 20% fine sand.		3										3_7.5-9.5 500 PSI pushing Shelby
	9														
	10				4A 4B	100	3 9 12 [21]								4A_10.5-11.0 4B_11.0-11.5
	11														
	12														
95	13		LEAN CLAY (CL); medium stiff; brown; moist; 85% low to medium plasticity fines; 15% fine sand.		5A 5B	100	4 4 4 [8]		1.0P						5A_130-13.5 5B_13.5-14.0
	14														
	15				6A 6B	100	6 11 13 [24]								6A_15.5-16.0 6B_16.0-16.5
	16														
	17		SANDY SILT TO SILTY SAND (ML/SM); brown; moist; 50% fine sand; 50% no plasticity fines.												
90	18				7A 7B	100	3 6 11 [17]						51	PA	7A_18.0-18.5 7B_19.0-19.5
	19														
	20		SILT with Sand (ML); medium dense; brown; moist;												

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,260,187.74 **Easting:** 6,661,060.38
Latitude: 39.36790 **Longitude:** -121.64842
Levee Station or Milepost: 1912+00 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		70% no plasticity fines; 30% fine sand.												
	21				8	39	6 7 14 [21]	31					74	PA	8_20.0-21.5
	22														
85	23														
	24														
	25				9	78	9 11 11 [22]	32							9_25.0-26.5
	26														
	27														
80	28														
	29														
	30				10	78	5 7 8 [15]	22					69	PA	10_30.0-31.5
	31														
	32														
75	33		Well-Graded GRAVEL with Silt and Sand (GW-GM); very dense; wet; 60% gravel; 30% fine to coarse sand; 10% no plasticity fines.												
	34														
	35				11	83	31 34 35 [69]	101							11_35.0-36.5
	36														
	37														
70	38														
	39														
	40				12	61	29 42 46 [88]	129					10	PA	12_40.0-41.5
	41														
	42														
65	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,260,187.74 **Easting:** 6,661,060.38
Latitude: 39.36790 **Longitude:** -121.64842
Levee Station or Milepost: 1912+00 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45			X	13	44	23 27 29 [56]	82							13_45.0-46.5
	46														
	47														2.5 hour through gravel with caving and no samples.
60	48														
	49														
	50														
	51														
	52														
55	53														
	54		LEAN CLAY (CL); hard; olive brown; moist; 85% medium plasticity, no dilatancy fines; 15% fine sand.												Clay as identified by driller at 54'.
	55														
	56														
	57														
50	58														
	59														
	60			X	14A 14B	33	31 35 42 [77]	113		23	34	13	59	PA	14A_61.0-61.5 14B_61.5-61.7
	61														
	62		End of boring at 61.5'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 90 gallons water, 1 bag of bentonite (50 lb. bag)												
45	63														
	64														
	65														
	66														
	67														
40	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: **Northing:** 2,260,187.74 **Easting:** 6,661,060.38
Latitude: 39.36790 **Longitude:** -121.64842
Levee Station or Milepost: 1912+00 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012B
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/12	10/13/12	107.9 ft	NAVD 88	15.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Hollow Stem Auger with drag bit	NWJ Rod 2-5/8" OD	P. Navarjo

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" HSA	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Shelby(2.87")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion mud rotary boring SM0007_012B for lithology.												
	1														Bulk Sample #1
	2														
105	3				1					14 16	31	11		UW, CP, CU	
	4														
	5														2_5.0_7.0 700 psi
	6				2										
	7														Bulk Sample #2
100	8														
	9				3										
	10														
	11														
	12														
95	13														
	14				4					36 25	48	22	96	PA UW, CN, DS	4_13.0_15.0 400 psi
	15														
	16		End of boring at 15'. Backfilled with cement bentonite grout. 4-47 lb. bags cement, 10 gallons water, 1/4 bag of bentonite (50 lb. bag)												
	17														
90	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,260,187.74 **Easting:** 6,661,060.38
Latitude: 39.36790 **Longitude:** -121.64842
Levee Station or Milepost: 1912+14 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013A
Sheet 1 of 1

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/20/11	7/20/11	109.2 ft	NAVD 88	66.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Martin Soto	8 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger, 52'	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	35 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel (2 inches).												0-5' Hand auger
	1		[LEVEE FILL] SANDY LEAN CLAY (CL); yellowish brown; moist; 70% no dilatancy fines; 30% fine sand.												
	2														
	3				1	100									1_3.0-3.5
105	4														
	5				2					16	30 30 33	6 9 12	65 65 83	PA UW, CU, PA PA	2_5.0-7.0 300 psi
	6														
FILL	7														
	8		LEAN CLAY (CL); stiff to very stiff; dark yellowish brown; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.		3A 3B	89	8 14 16		1.5P						3A_8.0-8.5 3B_8.5-9.0
100	9						[30]								
	10				4A 4B	94	6 10 13		2.0P	20				UW	4A_10.5-11.0 4B_11.0-11.5
	11						[23]								
	12				5A 5B	94	5 9 13		3.0P						5A_13.0-3.5 5B_13.5-14.0
95	13						[22]								
	14				6A 6B	61	6 8 7		1.7P	26				UW	6A_15.5-16.0 6B_16.0-16.5
	15						[15]								
	16														
	17		SANDY SILT TO SILTY SAND (ML/SM); dark yellowish brown; moist; 50% fine sand; 50% no plasticity fines.												
	18				7					33 19 20 21	 NP NP NP	 NP NP NP	 34 55 55	UW, CN UW, PA UW, CU, PA UW, PA	7_17.5-19.5 200 psi
90	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,262,196.64 **Easting:** 6,660,540.60
Latitude: 39.37342 **Longitude:** -121.65023
Levee Station or Milepost: 1933+00 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21		SILTY SAND (SM); medium dense; dark greenish gray; moist; 85% fine sand; 15% no plasticity fines.		8A 8B	100	7 9 9 [18]								8A_20.5-21.0 8B_21.0-21.5
	22												23	PA	
	23														
85	24														
	25		LEAN CLAY (CL); brown; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.		9	83	6 10 13 [23]	34							9_25.0-26.5
	26														
	27														
	28														
80	29														
	30		LEAN CLAY with Sand (CL); dark yellowish brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.		10	100	7 10 16 [26]	38		30	27	NP	50	PA	10_30.0-31.5
	31														
	32														
	33														
	34														
75	35		Poorly Graded SAND (SP); medium dense; dark yellowish brown; moist; 95% fine sand; 5% no plasticity fines.		11A 11B	94	5 9 14 [23]								11A_35.5-36.0 11B_36.0-36.5
	36														
	37		Poorly Graded GRAVEL with Silt (GP-GM); dark greenish gray; 60% gravel; 35% fine to coarse sand; 5% no plasticity fines.												
	38														
	39														
70	40				12A 12B	72	13 33 39 [72]						5	PA	12A_40.5-41.0 12B_41.0-41.5
	41														
	42														
	43														
	44														
65	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,262,196.64 **Easting:** 6,660,540.60
Latitude: 39.37342 **Longitude:** -121.65023
Levee Station or Milepost: 1933+00 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45				13	17	33 50/5" [50/5"]								13_45.0-46.5
60	50				14	28	18 19 19 [38]	56							14_50.0-51.5
	52		SANDY LEAN CLAY (CL); very stiff; yellowish brown; moist; 70% medium plasticity, slow dilatancy fines; 30% fine sand.												At 52' switch to Mud rotary
55	55				15	33	10 25 38 [63]		3.5P						15_56.0-56.5
50	60				16A 16B	50	15 18 19 [37]		2.5P						16A_60.5-61.0 16B_61.0-61.5
45	65		SILTY SAND (SM); very dense; yellowish brown; moist; 65% fine sand; 35% no plasticity fines.		17A 17B	67	15 22 33 [55]		2.0P						17A_65.5-66.0 17B_66.0-66.5
40	67		End of boring at 66.5'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 90 gallons water, 1 bag of bentonite (50 lb. bag)												
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,262,196.64 **Easting:** 6,660,540.60
Latitude: 39.37342 **Longitude:** -121.65023
Levee Station or Milepost: 1933+00 **Levee Mile:**
Levee Segment Reach 31
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013B
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 11/11/11 **DATE COMPLETED** 11/14/11	**GROUND ELEVATION** 93.6 ft	**ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 66.0 ft
DRILLING CONTRACTOR Cascade	**DRILLER'S NAME** Jason Klipfel	**HELPER'S NAME** Craig Chaffeo, Gage Kramer	**TOTAL DEPTH OF FILL** 4.5 ft
DRILLING METHOD HSA	**DRILL RIG MAKE AND MODEL** CME 75		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" Hollow Stem Auger	**DRILLING ROD TYPE AND DIAMETER** NWJ 2-5/8" OD		**FIELD LOGGER** M. Turner
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 8" HSA		**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, MCal(2.5"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** Auto Hammer, 140 lbs / 30-inch drop		**HAMMER EFFICIENCY** 75%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING:** **DURING DRILLING** 11 ft	**AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] LEAN CLAY (CL); dark brown (7.5YR 3/2); moist; 95% low plasticity fines; 5% fine sand.		1A										Hand Auger to 5' Hollow Stem Auger to 75.5' Owner says this area was rolling and they graded it flat to plant the orchard
	1														
	2		[LEVEE FILL] LEAN CLAY (CL); dark brown (7.5YR 3/2); moist; 85% low plasticity fines; 15% fine sand; mottled with black and brown.												
FILL 90	3				2A										
	4														
	5		SANDY SILT (ML); dark brown (10YR 3/3); moist; 55% no plasticity fines; 45% fine sand.												
	6				3A 3B	100	4 7 8		3.75P 2.25P						
	7		At 6.6 feet, 35% sand.				[15]								
85	8														
	9														
	10				4A		1		0P						
	11		ELASTIC SILT (MH); very soft; greenish black; moist; 92% low plasticity fines; 8% fine sand; trace organic (wood fragments 1/2" x 1/2" x 1").		4B	100	2 2 [4]	5	0P	65	55	20	92	PA	
	12														
	13		SILTY SAND (SM); loose; dark gray (5Y 4/1); wet; 78% fine to medium sand; 22% no plasticity fines.												
80	14														
	15						5								
	16				5A 5B	100	5 7						22	PA	
	17						[12]								
	18														
75	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,660,876.13 **Easting:** 2,264,880.44
Latitude: 39.38079 **Longitude:** -121.64901
Levee Station or Milepost: 1961+47 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_019A
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21				6A 6B	100	5 7 7 [14]								
	22														
	23														
70	24		SILTY GRAVEL with Sand (GM); very dense; olive brown (2.5Y 4/3); wet; 43% fine to coarse, subrounded gravel; 41% fine to coarse sand; 16% no plasticity fines.												
	25				7A	100	22 27 33 [60]	75					16	PA	
	26														
	27														
	28														
65	29														
	30														
	31														
	32														
	33														
60	34														
	35				8A	100	8 6 39 [45]	56	4.5+P						
	36		LEAN CLAY (CL); hard; dark grayish brown (2.5Y 4/2); moist; 85% medium plasticity fines; 15% fine sand.		8B										
	37														
	38														
55	39														
	40														
	41														
	42														
	43		SILTY SAND (SM); medium dense; olive brown (2.5Y 4/3); moist; 60% fine sand; 40% no plasticity fines.												
50	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 6,660,876.13 **Easting:** 2,264,880.44
Latitude: 39.38079 **Longitude:** -121.64901
Levee Station or Milepost: 1961+47 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_019A
Sheet 2 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45			9A 9B	100	4 15 23 [38]								
	46													
	47													
	48													
45	49													
	50													
	51													
	52													
	53													
40	54	At 55 feet, dense; light olive brown (2.5Y, 4/4); low plasticity fines.												
	55			10A 10B	83	33 39 50/5 [89/11"]		4.5+P	37	50	17	40	PA	
	56	CLAYEY SAND (SC); very dense; olive brown (2.5Y 4/4); moist; 60% fine sand; 40% medium plasticity fines.												
	57													
	58													
35	59	LEAN CLAY with Sand (CL); stiff; light olive brown (2.5Y 5/3); moist; 85% medium plasticity fines; 15% fine sand.												
	60			11A 11B 11C	83	33 50 50/3 [100/9"]		4.5+P				39	PA	
	61	SILTY SAND (SM); very dense; brown (10YR 4/3); moist; 70% fine sand; 30% no plasticity fines. At 61 feet, 39% low plastic fines; 61% fine sand.												
	62													
	63													
30	64													
	65			12A 12B	100	38 50/5 [50/5"]		4.5+P 4.5+P						
	66	LEAN CLAY (CL); hard; light olive brown (2.5Y 5/3); moist; 90% low plasticity fines; 10% fine sand.												
	67	SILTY SAND (SM); very dense; olive brown (2.5Y 4/4); moist; 75% fine sand; 25% no plasticity fines.												
	68	End of boring at 66'. Backfilled with cement bentonite grout. 12-47 lb. bags cement and 1/4 bag of bentonite (50 lb. bag)												
25	69													
	70													

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 6,660,876.13 **Easting:** 2,264,880.44
Latitude: 39.38079 **Longitude:** -121.64901
Levee Station or Milepost: 1961+47 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_019A
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/25/11	7/26/11	93.6 ft	NAVD 88	61.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Josh Reisch	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	13 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		LEAN CLAY (CL); very soft; dark yellowish brown; 90% medium plasticity, no dilatancy fines; 10% fine sand.												0-5' Hand auger
	1														
	2														
	3				1										1_3.0-3.5
90	4														
	5				2A 2B	100	2 1 2 [3]		<0.25P						2A_5.5-6.0 2B_6.0-6.5
	6														
	7									38				UW	
	8				3	11	2 2 2 [4]								3_8.5-9.0
85	9														
	10														
	11				4	100				47	40	14	88	UW, CN, DS, PA	4_10.0-12.0 50 psi
	12														
	13		Poorly Graded SAND with Silt (SP-SM); medium dense; dark greenish gray; wet; 90% sand; 10% no plasticity fines.												
80	14				5A 5B	100	4 8 8 [16]								5A_13.5-14.0 5B_14.0-14.5
	15														
	16		Poorly Graded SAND (SP); medium dense; greenish black; wet; 95% sand; 5% no plasticity fines.		6	44	3 6 7 [13]	19							6_15.5-17.0
	17														
	18		Well-Graded GRAVEL with Sand (GW); very dense; very dark greenish gray; wet; 65% gravel; 31% sand; 4% no plasticity fines.		7	28	17 31 35 [66]	96							7_17.5-19.0
75	19														
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,264,998.66 **Easting:** 6,661,772.33
Latitude: 39.38111 **Longitude:** -121.64584
Levee Station or Milepost: 1970+98 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014B
Sheet 1 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21				8	11	22 35 40 [75]	110					3	PA	8_20.0-21.5
	22														
	23														
70	24														
	25				9	33	26 38 44 [82]								9_26.0-26.5
	26														
	27														
	28														
65	29														
	30		Poorly Graded SAND (SP); medium dense; greenish gray; wet; 95% sand; 5% no plasticity fines.		10A 10B	100	7 8 19 [27]								10A_30.5-31.0 10B_31.0-31.5
	31														
	32														
	33		Well-Graded GRAVEL (GW); dark yellowish brown; wet; 60% gravel; 35% sand; 5% fines.			0	50/4" [REF]								No recovery cobble
60	34														
	35				11A 11B	56	17 20 24 [44]		2.0P						11A_35.5-36.0 11B_36.0-36.5
	36		LEAN CLAY with Sand (CL); stiff; olive yellow; moist; 80% medium plasticity, no dilatancy fines; 20% fine sand.												
	37														
	38				12A 12B	67	10 17 20 [37]		2.0P	45 40	37	7	48	UW PA	12A_38.0-38.5 12B_38.5-39.0
55	39														
	40														
	41														
	42					0	31 38 10 [48]								No recovery
	43														
50	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,264,998.66 **Easting:** 6,661,772.33
Latitude: 39.38111 **Longitude:** -121.64584
Levee Station or Milepost: 1970+98 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014B
Sheet 2 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		LEAN CLAY with Sand (CL); hard; dark yellowish brown; moist; 80% low to medium plasticity, no dilatancy fines; 20% fine sand.		13A 13B	83	18 26 36 [62]		>4.0P						13A_45.5-46.0 13B_46.0-46.5
	46														
	47														At 47' switched to Mud rotary
45	48				14A 14B	100	20 49 48 [97]		>4.0P						14A_48.0-48.5 14B_48.5-49.0
	49														
	50				15A 15B	100	28 50/4" [50/4"]		>4.0P						15A_50.5-51.0 15B_51.0-51.5
	51														
	52														
	53														
40	54														
	55		CLAYEY SAND (SC); very dense; hard; dark yellowish brown; moist; 55% fine sand; 45% low plasticity, slow dilatancy fines.		16A 16B	83	28 31 50/4" [81/10"]		>4.0P						16A_55.5-56.0 16B_56.0-56.5
	56														
	57														
	58														
35	59														
	60		Poorly Graded SAND with Silt (SP-SM); very dense; dark brown; 90% sand; 10% no plasticity fines.		17A 17B		21 36 25 [61]								17A_60.5-61.0 17B_61.0-61.5
	61														
	62		End of boring at 61.5'. Backfilled with cement bentonite grout. 12-47 lb. bags cement, 80 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	63														
30	64														
	65														
	66														
	67														
	68														
25	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,264,998.66 **Easting:** 6,661,772.33
Latitude: 39.38111 **Longitude:** -121.64584
Levee Station or Milepost: 1970+98 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014B
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/26/11	7/28/11	91.2 ft	NAVD 88	61.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Josh Reisch	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger to 14'	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	11 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
90	0		SILTY SAND (SM); dark yellowish brown; moist; 75% fine sand; 25% no plasticity, rapid dilatancy fines.												Hand auger 5' bgs
	1														
	2														
	3				1										1_3.0-3.5
	4														
	5		Poorly Graded GRAVEL with Sand (GP); dark yellowish brown; moist; 60% gravel; 35% sand; 5% fines.			0	7 11 9 [20]								No recovery
85	6														
	7														
	8				2	11	7 11 9 [20]								2_8.0-9.0
	9														
	10														
80	11		Poorly Graded SAND (SP); medium dense; olive brown; wet; 95% sand; 5% fines.		3A 3B	44	6 10 11 [21]								3A_10.5-11.0 3B_11.0-11.5
	12														
	13				4A 4B	89	5 13 18								4A_13.0-13.5 4B_13.5-14.0
	14						[31]								At 14' switch to Mud rotary
75	15														
	16														
	17														
	18		Poorly Graded GRAVEL (GP); dark greenish black; wet; 75% gravel; 25% sand.		5A 5B	61	13 18 30								5A_18.0-18.5 5B_18.5-19.0
	19						[48]								
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,265,059.69 **Easting:** 6,662,771.91
Latitude: 39.38126 **Longitude:** -121.64230
Levee Station or Milepost: 1980+99 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015B
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
70	20				6A 6B	72	17 31 45 [76]								6A_20.5-21.0 6B_21.0-21.5
	21														
	22														
	23														
	24														
65	25				7A 7B	67	7 19 21 [40]								7A_25.5-26.0 7B_26.0-26.5
	26														
	27														At 27' hard to drill due to hard cobbles. Switch back to HSA.
	28														
	29														
60	30				8A 8B	100	21 22 32 [54]								8A_30.5-31.0 8B_31.0-31.5
	31														
	32														
	33														
	34														
55	35		Poorly Graded SAND (SP); dense; dark greenish gray; wet; 95% sand; 5% no plasticity fines.		9A 9B	100	15 16 20 [36]								9A_35.5-36.0 9B_36.0-36.5
	36														
	37														At 36.5' switch to Mud rotary.
	38		CLAYEY SAND (SC); very dense; olive yellow; moist; 68% sand; 32% medium plasticity, no dilatancy fines.		10A 10B	44	12 29 39 [68]		>4.0P	36			32	PA UW	10A_38.0-38.5 10B_38.5-39.0
	39														
50	40		FAT CLAY with Sand (CH); hard; olive yellow; moist; 76% medium plasticity fines; 24% fine sand.		11	22	19 27 30 [57]		4.0P				76	PA	11_41.0-41.5
	41														
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,265,059.69 **Easting:** 6,662,771.91
Latitude: 39.38126 **Longitude:** -121.64230
Levee Station or Milepost: 1980+99 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015B
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
45	45		FAT CLAY with Sand (CH); very stiff; strong brown; moist; 80% high plasticity, no dilatancy fines; 20% fine sand.		12	28	21 31 40 [71]		3.5P				81	PA	12_46.0-46.5
	46														
	47														
	48														
	49														
40	50				13A 13B	56	12 19 30 [49]		4.0P						13A_50.5-51.5 13B_51.0-51.5
	51														
	52														
	53														
	54														
35	55				14A 14B	67	14 35 40 [75]								14A_55.5-56.0 14B_56.0-56.5 Disturbed sample, no pp test.
	56														
	57														
	58														
	59														
30	60		SILTY SAND (SM); dense; dark yellowish brown; wet; 75% sand; 25% no plasticity fines.		15A 15B	83	23 24 24 [48]								15A_60.5-61.0 15B_61.0-61.5
	61														
	62		End of boring at 61.5'. Backfilled with cement bentonite grout. 9-47 lb. bags cement, 80 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	63														
	64														
25	65														
	66														
	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,265,059.69 **Easting:** 6,662,771.91
Latitude: 39.38126 **Longitude:** -121.64230
Levee Station or Milepost: 1980+99 **Levee Mile:**
Levee Segment Reach 32
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015B
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/1/11	10/2/11	101.5 ft	NAVD 88	75.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Justin Lake	Scott Adam, Rick Smedley	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Geoprobe 8140LC	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	3-5/8" OD Rod	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	23 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILT (ML); dark yellowish brown; moist; 90% no plasticity, rapid dilatancy fines; 10% fine sand.												Hand Auger to 5'
100	1														
	2														
	3														
	4				1								87	PA HD	1_4.0-5.0
	5														Run 1 5 - 10' 100% Recovery
95	6														
	7														
	8				2										2_8.0-9.0
	9														
	10		SANDY SILT (ML); very dark greenish brown; moist; 55% no plasticity fines; 45% fine sand.		3								60	PA	3_10.0-11.0 Run 2 10 - 15' 100% Recovery
90	11														
	12		SILTY SAND (SM); very dark greenish brown; moist; 55% fine sand; 45% no plasticity fines; At 11.5 feet dark yellowish brown; 85% fine sand; 15% no plasticity fines.		4								46	PA HD	4_12.0-13.0
	13														
	14														
	15														Run 3 15 - 20' 100% Recovery
	16														
85	17				5										5_16.0-17.0
	18														
	19		SILTY SAND (SM); dark yellowish brown; wet; 85% fine to medium sand; 15% no plasticity fines.												
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,266,416.19 **Easting:** 6,664,810.10
Latitude: 39.38496 **Longitude:** -121.63507
Levee Station or Milepost: 2011+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT\SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20				6										6_20.0-21.0 Run 4 20 - 25' 100% Recovery
	21														
80	22		Poorly Graded GRAVEL with Silt and Sand (GP-GM); greenish gray; wet; 70% gravel; 25% sand; 5% no plasticity fines.												
	23				7								8	PA	7_23.0-24.0
	24														
	25														Run 5 25 - 30' 100% Recovery
75	26														
	27				8										8_27.0-28.0
	28														
	29														
	30														Run 6 30 - 35' 100% Recovery
70	31														
	32				9										9_32.0-33.0
	33														
	34														
	35														Run 7 35 - 40' 100% Recovery
65	36														
	37				10										10_37.0-38.0
	38														
	39														
	40														Run 8 40 - 45' 100% Recovery
60	41														
	42				11										11_42.0-43.0
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,266,416.19 **Easting:** 6,664,810.10
Latitude: 39.38496 **Longitude:** -121.63507
Levee Station or Milepost: 2011+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		SILTY GRAVEL with Sand (GM); greenish gray; wet; 65% gravel; 20% low plasticity fines; 15% medium to coarse sand.												Run 9 45 - 50' 100% Recovery
55	46														12_46.0-47.0
	47				12										
	48														
	49		Poorly Graded GRAVEL with Sand (GP); greenish gray; wet; 60% gravel; 35% medium to coarse sand; 5% no plasticity fines.												
	50														Run 10 50 - 55' 100% Recovery
50	51														
	52				13										13_52.0-53.0
	53														
	54														
	55														Run 11 55 - 60' 100% Recovery
45	56														
	57				14										14_57.0-58.0
	58														
	59														
	60		Well-Graded SAND with Clay (SW-SC); dark greenish gray; wet; 85% fine to coarse sand; 10% low plasticity fines; 5% fine gravel.												Run 12 60 - 65' 100% Recovery
40	61				15										15_61.0-62.0
	62														
	63		CLAYEY GRAVEL with Sand (GC); moist; 40% subrounded gravel; 35% fine to coarse sand; 25% low plasticity fines.		16								29	PA	16_63.0-64.0
	64														
	65														Run 13 65 - 70' 100% Recovery
	66		At 66 feet wet; 60% subrounded gravel; 25% fine to coarse sand; 15% low plasticity fines.												
35	67				17								7	PA	17_67.0-68.0
	68		At 68 feet; 40% subrounded gravel; 35% fine to coarse sand; 25% low plasticity fines.												
	69				18								16	PA	18_69.0-70.0
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,266,416.19 **Easting:** 6,664,810.10
Latitude: 39.38496 **Longitude:** -121.63507
Levee Station or Milepost: 2011+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70														Run 14 70 - 75' 100% Recovery
30	71														
	72				19					6	23	9			19_72.0-73.0
	73														
	74														
	75														
	76		End of boring at 75'. Backfilled with cement bentonite grout. 16-47 lb. bags cement, 60 gallons water, 1 bag of bentonite (50 lb. bag)												
25	77														
	78														
	79														
	80														
	81														
20	82														
	83														
	84														
	85														
	86														
15	87														
	88														
	89														
	90														
	91														
10	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,266,416.19 **Easting:** 6,664,810.10
Latitude: 39.38496 **Longitude:** -121.63507
Levee Station or Milepost: 2011+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_006S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/19/11	9/20/11	102.8 ft	NAVD 88	80.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	G. Becker	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Weil
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			20 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); very dark brown; moist; 60% fine sand; 40% no plasticity fines.												Hand Auger to 5'
	1														
	2														
100	3														
	4				1										1_4.0-4.5
	5														Run 1 5 - 10' 100% Recovery
	6														
	7														
95	8														
	9				2										2_9.0-9.5
	10		LEAN CLAY with Sand (CL); very dark brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.												Run 2 10 - 15' 100% Recovery
	11				3										3_11.0-12.0
	12														
90	13														
	14		SILTY SAND (SM); very dark brown; moist; 60% fine sand; 40% no plasticity fines.		4										4_14.0-15.0
	15														Run 3 15 - 20' 100% Recovery
	16		At 16 feet 85% fine sand; 15% no plasticity fines.												
	17														
85	18				5										5_18.0-19.0
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,267,884.80 **Easting:** 6,666,123.80
Latitude: 39.38898 **Longitude:** -121.63040
Levee Station or Milepost: 2030+80 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		At 20 feet wet; 55% fine sand; 45% no plasticity fines.		6										6_20.0-21.0 Run 4 20 - 25' 100% Recovery
	21														
	22		Well-Graded SAND with Gravel (SW); very dark gray; wet; 70% fine to coarse sand; 25% subrounded gravel; 5% no plasticity fines.												
80	23				7										7_23.0-24.0
	24														
	25		Well-Graded SAND with Clay (SW-SC); very dark grayish brown; wet; 90% fine to coarse sand; 10% low plasticity fines.												Run 5 25 - 30' 100% Recovery
	26				8										8_26.0-27.0
	27														Encountered flowing sands.
75	28														
	29		Well-Graded GRAVEL (GW); wet; 95% subrounded gravel; 5% coarse sand.		9										9_29.0-30.0
	30														Run 6 30 - 35' 100% Recovery
	31		Well-Graded SAND with Gravel (SW); 75% fine to coarse sand; 20% fine gravel; 5% low plasticity fines.		10										10_31.0-32.0
	32		Poorly Graded SAND (SP); very dark grayish brown; wet; 95% medium to coarse sand; 5% low plasticity fines.												
70	33														
	34														
	35				11										11_35.0-36.0 Run 7 35 - 40' 100% Recovery
	36														
	37														
65	38														
	39		Well-Graded GRAVEL with Clay (GW-GC); wet; 85% subrounded gravel; 10% low plasticity fines; 5% coarse sand.		12										12_39.0-40.0
	40														Run 8 40 - 45' 100% Recovery
	41														
	42														
60	43		Poorly Graded GRAVEL (GP); very dark greenish gray; wet; 95% gravel; 5% fine sand.		13										13_43.0-44.0
	44		SILTY GRAVEL (GM); wet; 70% gravel; 30% no plasticity fines.		14					7	14	NP	20	PA	14_44.0-45.0
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,267,884.80 **Easting:** 6,666,123.80
Latitude: 39.38898 **Longitude:** -121.63040
Levee Station or Milepost: 2030+80 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45														Run 9 45 - 50' 100% Recovery
	46														
	47														
55	48														
	49				15										15_49.0-50.0
	50		SILTY SAND (SM); greenish brown; wet; 85% fine to coarse sand; 15% no plasticity fines.												Run 10 50 - 55' 100% Recovery
	51														
	52				16										16_52.0-53.0
50	53														
	54		Poorly Graded GRAVEL with Silt and Sand (GP-GM); wet; 60% gravel; 30% fine sand; 10% no plasticity fines.		17										17_54.0-55.0
	55														Run 11 55 - 60' 100% Recovery
	56														
	57				18										18_57.0-58.0
45	58														
	59														
	60		CLAYEY SAND with Gravel (SC); very dark grayish brown; wet; 60% fine to coarse sand; 20% subrounded gravel, max. 2 in.; 20% low plasticity fines.		19										19_60.0-61.0 Run 12 60 - 65' 100% Recovery
	61														
	62		Well-Graded GRAVEL with Silt and Sand (GW-GM); wet; 60% subrounded gravel, max. 3 in.; 30% fine to medium sand; 10% no plasticity fines.												
40	63				20										20_63.0-64.0
	64														
	65														Run 13 65 - 70' 100% Recovery
	66														
	67		SILTY SAND (SM); dark gray; wet; 75% medium sand; 25% no plasticity fines.		21										21_67.0-68.0
35	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,267,884.80 **Easting:** 6,666,123.80
Latitude: 39.38898 **Longitude:** -121.63040
Levee Station or Milepost: 2030+80 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70														Run 14 70 - 75' 100% Recovery
	71		CLAYEY SAND (SC); very dark greenish gray; moist; 51% fine sand; 49% low plasticity fines; moderately indurated.		22					24	32	13	49	PA	22_71.0-72.0
	72														
30	73														
	74														
	75														Run 15 75 - 80' 100% Recovery
	76														
	77														
25	78														
	79				23										23_79.0-80.0
	80		End of boring at 80'. Backfilled with cement bentonite grout. 14-47 lb. bags cement, 105 gallons water.												
	81														
	82														
20	83														
	84														
	85														
	86														
	87														
15	88														
	89														
	90														
	91														
	92														
10	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,267,884.80 **Easting:** 6,666,123.80
Latitude: 39.38898 **Longitude:** -121.63040
Levee Station or Milepost: 2030+80 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/18/11	8/18/11	100.7 ft	NAVD 88	79.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Louie Wens	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" HSA	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	16.5 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
100	0		SANDY SILT (ML); stiff; strong brown; moist; 70% low plasticity, slow dilatancy fines; 30% fine sand.												
	1														
	2														
	3				1	100									1_3.0-3.5
	4														
	5														
95	6				2A 2B	83	5 5 4 [9]		1.8P				51	PA	2A_5.5-6.0 2B_6.0-6.5
	7														
	8		SILTY SAND (SM); loose; yellowish brown; moist; 80% fine sand; 20% no plasticity fines.		3A 3B	78	4 4 4 [8]								3A_8.0-8.5 3B_8.5-9.0
	9														
	10														
90	11		SILTY SAND (SM); loose; strong brown; moist; 70% fine sand; 30% low plasticity fines.		4A 4B	67	8 5 6 [11]								4A_10.5-11.0 4B_11.0-11.5
	12														
	13		SILTY SAND (SM); medium dense; dark yellowish brown; moist; 80% fine sand; 20% no plasticity fines.		5	22	4 5 7 [12]	18							5_12.5-14.0
	14														
	15														
85	16				6	33	5 5 5 [10]	15							6_15.0-16.5
	17														
	18		Poorly Graded SAND with Silt (SP-SM); medium dense; brown; wet; 90% sand; 10% no plasticity fines.		7	56	2 4 5 [9]	13							7_17.5-19.0
	19														
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,268,802.67 **Easting:** 6,666,572.35
Latitude: 39.39150 **Longitude:** -121.62880
Levee Station or Milepost: 2041+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008A
Sheet 1 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
80	20														
	21		Poorly Graded GRAVEL with Sand (GP); greenish gray; wet; 70% gravel; 25% sand; 5% no plasticity fines.		8	61	3 3 39 [42]	61							8_20.0-21.0 No sample 21-21.5'
	22														
	23				9	56	20 29 30 [59]	86							9_22.5-24.0
	24														
75	25														
	26														
	27														
	28					0	50/2" [REF]								No recovery due to hard cobble.
	29														
	30														
70	31				10	44	29 29 31 [60]	88							10_30.0-31.5
	32														
	33														
	34														
	35														
65	36				11	44	41 47 49 [96]	140							11_35.0-36.5
	37		FAT CLAY (CH); very stiff; brown; moist; 80% high plasticity, no dilatancy fines; 20% fine sand.												
	38														
	39														
	40														
60	41				12	11	31 50/2" [50/2"]			32				UW	12_41.0-41.5 Unable to pp test due to sample disturbed.
	42														
	43				13A 13B		35 41 50/2"								13A_43.0-43.5 13B_43.5-44.0 Unable to pp test due to sample disturbed.
	44						[91/8"]								
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,268,802.67 **Easting:** 6,666,572.35
Latitude: 39.39150 **Longitude:** -121.62880
Levee Station or Milepost: 2041+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008A
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
55	45														
	46														
	47														
	48		SILTY SAND (SM); very dense; olive brown; wet; 80% sand; 20% low plasticity fines.		14A 14B	94	45 46 39 [85]								14A_48.0-48.5 14B_48.5-49.0
	49														
50	50														
	51														
	52														
	53		Poorly Graded SAND with Silt (SP-SM); very dense; olive brown; wet; 90% sand; 10% no plasticity fines.		15	83	30 21 21 [42]	61							15_52.5-54.0
	54														
	55														
45	56														
	57														
	58		Poorly Graded SAND (SP); very dense; very dark gray; wet; 95% sand; 5% no plasticity fines.		16	44	21 24 25 [49]	72							16_57.5-59.0
	59														
	60														
40	61														
	62														
	63				17	22	14 16 17 [33]	48							17_62.5-64.0
	64														
	65														
35	66														
	67														
	68		Well-Graded SAND with Clay (SW-SC); very dense; greenish black; moist; 90% sand; 10% low plasticity fines.		18	33	44 50/2" [50/2"]								18_67.5-69.0
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,268,802.67 **Easting:** 6,666,572.35
Latitude: 39.39150 **Longitude:** -121.62880
Levee Station or Milepost: 2041+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008A
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
30	70														
	71														
	72														
	73		LEAN CLAY (CL); greenish gray; moist; 90% no dilatancy fines; 10% fine sand.	X	19	67	46 45 50/5"			18	39	17			19_72.5-74.0
	74						[95/ 11"]								
25	75														
	76														
	77														
	78		FAT CLAY with Gravel (CH); dark greenish gray; wet; 60% high plasticity, no dilatancy fines; 25% gravel; 15% sand.	X	20	11	50/4"								20_77.5-79.0
	79						REF								
	80		End of boring at 79'. Backfilled with cement bentonite grout. 15-47 lb. bags cement, 150 gallons water, 1/2 bag of bentonite (50 lb. bag)												
20	81														
	82														
	83														
	84														
	85														
15	86														
	87														
	88														
	89														
	90														
10	91														
	92														
	93														
	94														
	95														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,268,802.67 **Easting:** 6,666,572.35
Latitude: 39.39150 **Longitude:** -121.62880
Levee Station or Milepost: 2041+00 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008A
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/17/11	8/18/11	102.1 ft	NAVD 88	71.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Louie Wens	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	16 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); yellowish red; moist; 75% fine sand; 25% no plasticity fines.												Hand auger 0-5'
	1														
100	2														
	3				1	100							37	PA	1_3.0-3.5
	4														
	5				2A		3						21	PA	2A_5.5-6.0
	6		Poorly Graded SAND with Silt (SP-SM); loose; brownish yellow; moist; 90% fine sand; 10% no plasticity fines.		2B	56	4 4 [8]	12					18	PA	2B_6.0-6.5
95	7														
	8														
	9														
	10		SANDY SILT (ML); yellowish red; moist; 70% no plasticity fines; 30% fine sand.		3	56	1 1 0 [1]	1		23			68	PA HD	3_10.0-11.5
90	12														
	13														
	14														
	15		SILTY SAND (SM); loose; yellowish red; wet; 80% fine sand; 20% no plasticity fines.		4	72	2 2 4 [6]	9					42	PA	4_15.0-16.5
	16														
85	17														
	18														
	19														At 19' switch to Mud rotary
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,270,163.04 **Easting:** 6,667,439.65
Latitude: 39.39522 **Longitude:** -121.62571
Levee Station or Milepost: 2057+02 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001A
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21		Well-Graded GRAVEL (GW); dense; greenish gray; wet; 95% gravel; 5% no plasticity fines.		5	6	6 18 22	58							5_20.5-22.0
80	22						[40]								
	23				6	33	10 13 20								6_22.5-24.0
	24						[33]								
	25		Poorly Graded GRAVEL with Silt (GP-GM); dense; greenish gray; wet; 90% gravel; 10% no plasticity fines.		7A 7B	67	10 21 29								7A_25.5-26.0 7B_26.0-26.5
	26														
75	27						[50]								
	28														
	29														
	30					0	23 26 27								No recovery
	31														
70	32						[53]								
	33														
	34														
	35				8	17	13 17 19	53							8_35.0-36.5
	36						[36]								
65	37		LEAN CLAY (CL); very stiff; yellowish brown; moist; 75% medium plasticity, no dilatancy fines; 25% fine sand.												At 36.5 switch to HSA
	38														
	39														
	40				9A 9B	100	21 39 44		3.5P						9A_40.5-41.0 9B_41.0-41.5
	41						[83]								
60	42														
	43				10A 10B	50	31 50/3"								10A_43.0-43.5 10B_43.5-44.0
	44		Poorly Graded SAND with Silt (SP-SM); very dense; dark yellowish brown; wet; 90% sand; 10% no plasticity fines.				[50/ 3"]								
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,270,163.04 **Easting:** 6,667,439.65
Latitude: 39.39522 **Longitude:** -121.62571
Levee Station or Milepost: 2057+02 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001A
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		Well-Graded GRAVEL with Silt (GW-GM); dark greenish brown; wet; 60% gravel; 30% sand; 10% no plasticity fines.		11	61	31 50/4" [50/4"]								11_45.0-46.5
55	46														
	47														
	48														
	49														
	50				12	61	39 50/3" [50/3"]								12_50.0-51.5
50	51														
	52														
	53														
	54														
	55		SILTY SAND (SM); very dense; dark greenish gray; wet; 80% fine sand; 20% no plasticity fines.		13	94	19 39 49 [88]	129							13_55.0-56.5
	56														
45	57														
	58														
	59														
	60				14	67	31 50/3" [50/3"]								14_60.0-61.5
	61														
40	62														
	63														
	64														
	65		At 65 feet fines increase to 30%.		15	72	12 22 31 [53]	77					30	PA	15_65.0-66.5
	66														
35	67														
	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,270,163.04 **Easting:** 6,667,439.65
Latitude: 39.39522 **Longitude:** -121.62571
Levee Station or Milepost: 2057+02 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001A
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70		Very dense; SILTY SAND TO SANDY SILT (SM/ML); greenish gray; moist; 50% fines; 50% fine sand.		16		13 33 45 [78]	114		55	33	7	47	PA	16_70.0-71.5
30	71														
	72		End of boring at 71.5'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 110 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	73														
	74														
	75														
	76														
25	77														
	78														
	79														
	80														
	81														
20	82														
	83														
	84														
	85														
	86														
15	87														
	88														
	89														
	90														
	91														
10	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,270,163.04 **Easting:** 6,667,439.65
Latitude: 39.39522 **Longitude:** -121.62571
Levee Station or Milepost: 2057+02 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_001A
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/10/11	10/10/11	107.0 ft	NAVD 88	62.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	S. Adam	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Weil
☒ VERTICAL ☐ INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout				

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); very dark brown; moist; 55% fine sand; 45% no plasticity, rapid dilatancy fines.												Hand Auger to 5'
105	1														
	2														
	3				1								46	PA	1_3.0-4.0
	4														
	5														Run 1 5 - 10' 100% Recovery
	6														
100	7														
	8														
	9		SANDY SILT (ML); very dark brown; moist; 65% no plasticity, rapid dilatancy fines; 35% fine sand.		2										2_9.0-10.0
	10														
	11														Run 2 10 - 15' 100% Recovery
95	12														
	13														
	14				3								64	PA	3_14.0-15.0
	15														Run 3 15 - 20' 100% Recovery
	16														
90	17		SILTY SAND (SM); olive brown; wet; 75% fine to medium sand; 25% no plasticity fines.		4								22	PA	4_17.0-18.0
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,272,223.79 **Easting:** 6,665,874.72
Latitude: 39.40090 **Longitude:** -121.63122
Levee Station or Milepost: 2091+01 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_031S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														Run 4 20 - 25' 100% Recovery
	21														
85	22		Well-Graded SAND (SW); very dark gray; wet; 97% fine to coarse sand; 3% no plasticity fines.												
	23				5										5_22.0-23.0
	24		Poorly Graded GRAVEL with Sand (GP); wet; 65% coarse gravel; 30% medium to coarse sand; 4% low plasticity fines; cobbles < 2.5".												
	25														Run 5 25 - 30' 100% Recovery
	26														
80	27														
	28				6								3	PA HD	6_27.0-28.0
	29														
	30														Run 6 30 - 35' 100% Recovery
	31														
75	32														
	33														
	34				7										7_34.0-35.0
	35														Run 7 35 - 40' 100% Recovery
	36		Well-Graded SAND (SW); wet; 95% fine to coarse sand; 5% low plasticity fines.												
70	37				8										8_37.0-38.0
	38														
	39		Poorly Graded GRAVEL with Clay and Sand (GP-GC); wet; 75% gravel; 15% medium to coarse sand; 10% low plasticity fines; cobbles < 3".												
	40														Run 8 40 - 45' 100% Recovery
	41														
65	42														
	43				9										9_43.0-44.0
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,272,223.79 **Easting:** 6,665,874.72
Latitude: 39.40090 **Longitude:** -121.63122
Levee Station or Milepost: 2091+01 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_031S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														Run 9 45 - 50' 100% Recovery
	46														
60	47														
	48														
	49														
					10										10_49.0-50.0
	50														Run 10 50 - 55' 100% Recovery
	51														
55	52														
	53														
					11										11_53.0-54.0
	54		SANDY LEAN CLAY (CL); olive brown; wet; 70% low plasticity fines; 30% fine sand; indurated clay and sand.		12					35	44	15	59	PA	12_54.0-55.0
	55														Run 11 55 - 62' 100% Recovery
	56														
50	57														
	58														
	59														
	60														
					13										13_60.0-61.0
	61														
45	62		End of boring at 62'. Backfilled with cement bentonite grout. 14-47 lb. bags cement, 50 gallons water, 1 bag of bentonite (50 lb. bag)												
	63														
	64														
	65														
	66														
40	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,272,223.79 **Easting:** 6,665,874.72
Latitude: 39.40090 **Longitude:** -121.63122
Levee Station or Milepost: 2091+01 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_031S
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/19/11	8/19/11	108.5 ft	NAVD 88	69.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Louie Wens	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger	NWJ Rod 2-5/8" OD	GT Hong

[X] VERTICAL [ ] INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
	8" Auger	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	17.5 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); dark brown; moist; 70% no plasticity, slow dilatancy fines; 30% fine sand.												
	1														
	2														
	3				1	100									1_3.0-3.5
105	4														
	5				2A 2B	100	2 2 3 [5]		1.0P				61	PA HD	2A_5.5-6.0 2B_6.0-6.5
	6														
	7														
	8				3A 3B	89	3 2 3 [5]		1.0P						3A_8.0-8.5 3B_8.5-9.0
100	9														
	10		SILTY SAND (SM); loose to medium dense; dark yellowish brown; moist; 60% fine sand; 40% fines.												
	11				4	100				12	NP	NP	36	UW, CU, PA	4_10.0-12.0 50 PSI pushing Shelby
	12														
	13				5A 5B	94	4 4 5 [9]		1.0P						5A_13.0-13.5 5B_13.5-14.0
95	14														
	15				6A 6B	89	4 5 5 [10]			13			29	PA	6A_15.5-16.0 6B_16.0-16.5
	16														
	17														
	18				7	78	4 6 9 [15]	22					44	PA	7_17.5-19.0
90	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,273,449.57 **Easting:** 6,665,858.03
Latitude: 39.40426 **Longitude:** -121.63126
Levee Station or Milepost: 2103+27 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009A
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21				8	33	3 6 7 [13]								8_21.0-21.5
	22														
	23		Poorly Graded GRAVEL with Silt and Sand (GP-GM); dark yellowish brown; wet; 65% gravel; 30% sand; 5% no plasticity fines.		9	22	18 39 20 [59]	86							9_22.5-24.0
85	24														
	25					0	39 20 11								No recovery
	26						[31]								
	27				10	50	7 9 12	31					5	PA	10_26.5-28.0
	28						[21]								
80	29														
	30														
	31														
	32				11	39	41 50/1"								11_31.5-33.0
	33						[50/ 1"]								
75	34														
	35														
	36														
	37					0	16 30 22	76							No recovery
	38						[52]								
70	39				12	22	17 27 28								12_39.0-39.5 3-7" cobble sample
	40						[55]								
	41														
	42														
	43		Well-Graded GRAVEL with Clay (GW-GC); greenish black; wet; 60% gravel; 30% sand; 10% low plasticity fines.		13	67	37 33 50/3"								13_42.5-444.0
65	44						[83/ 9"]								
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,273,449.57 **Easting:** 6,665,858.03
Latitude: 39.40426 **Longitude:** -121.63126
Levee Station or Milepost: 2103+27 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009A
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														
	46														
	47														
	48		Poorly Graded GRAVEL with Sand (GP); greenish gray; wet; 60% gravel; 35% sand; 5% no plasticity fines.		14	33	49 50/1" [50/1"]								14_47.5-49.0
60	49														
	50														
	51														
	52														
	53				15A 15B	94	41 47 22 [69]	101		42	57	21	71	PA	15A_52.5-53.0 15B_53.0-54.0
55	54		FAT CLAY with Sand (CH); yellowish brown; moist; 75% no dilatancy fines; 25% fine sand.												
	55														
	56														
	57														
	58				16A 16B		15 28 30 [58]			39			49	UW, PA	16A_58.0-58.5 16B_58.5-59.0
50	59		SANDY SILT TO SILTY SAND (ML/SM); dense; yellowish brown; moist; 50% low plasticity, slow dilatancy fines; 50% fine sand.												
	60														
	61														
	62														
	63		LEAN CLAY (CL); yellowish brown; moist; 75% medium to high plasticity, no dilatancy fines; 25% fine sand.		17A 17B	50	45 50/4" [50/4"]								17A_63.0-63.5 17B_63.5-64.0
45	64														
	65														
	66														
	67		Poorly Graded SAND (SP); dense; dark brown; wet; 95% sand; 5% no plasticity fines.												
	68				18A 18B		21 22 24 [46]								18A_68.0-68.5 18B_68.5-69.0
40	69		End of boring at 69'. Backfilled with cement bentonite grout.												
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,273,449.57 **Easting:** 6,665,858.03
Latitude: 39.40426 **Longitude:** -121.63126
Levee Station or Milepost: 2103+27 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009A
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	70		15-47 lb. bags cement, 120 gallons water, 1/2 bag of bentonite (50 lb. bag)								
	71										
	72										
	73										
35	74										
	75										
	76										
	77										
	78										
30	79										
	80										
	81										
	82										
	83										
25	84										
	85										
	86										
	87										
	88										
20	89										
	90										
	91										
	92										
	93										
15	94										
	95										

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,273,449.57 **Easting:** 6,665,858.03
Latitude: 39.40426 **Longitude:** -121.63126
Levee Station or Milepost: 2103+27 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009A
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
11/15/11	11/16/11	106.5 ft	NAVD 88	75.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	Joe Roberts, Rick Smedley	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Turner
☒ VERTICAL ☐ INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			21 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); brown (10YR 4/3); moist; 60% fine sand; 40% no plasticity fines.												Hand Auger to 5' Run 1 0 - 5'
105	1														
	2														
	3														
	4				1A										1A_4-4.5
	5														Run 2 5 - 10' 63% Recovery
100	6														
	7														
	8		SANDY SILT (ML); brown (10YR 4/3); moist; 70% no plasticity fines; 30% fine sand.		2A										2A_7.5-8
	9		SANDY SILTY CLAY (CL-ML); brown (10YR 4/3); moist; 55% low plasticity fines; 45% fine sand.		2B				2.25P	13	23	5	55	PA	2B_9-9.5
	10														Run 3 10 - 15' 90% Recovery
	11														
95	12		At 11.5 feet, very stiff.												
	13		SILTY SAND (SM); brown (10YR 4/3); moist; 55% fine sand; 45% no plasticity fines.												
	14		At 14 feet, 40% fines.		3A										3A_14-14.5
	15														Run 4 15 - 20' 80% Recovery 4A_15.5-16
	16		SANDY SILT (ML); brown (10YR 4/3); moist; 60% fine sand; 60% no plasticity fines.		4A										
90	17		SILTY SAND (SM); brown (10YR 4/3); moist; 60% fine sand; 40% no plasticity fines.		4B										4B_17-17.5
	18		SILTY SAND with Gravel (SM); brown (10YR 4/3); moist; 50% fine to coarse sand; 25% fine to coarse, subrounded gravel; 25% no plasticity fines.		4C										4C_18-19
	19		At 19.5 feet, 5% subrounded cobble up to 4"; 45% sand.												
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,665,157.81 **Easting:** 2,273,445.70
Latitude: 39.40426 **Longitude:** -121.63374
Levee Station or Milepost: 2112+05 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_026S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		LEAN CLAY with Sand (CL); stiff; brown (10YR 4/3); moist; 85% medium plasticity fines; 15% fine sand.		5A				1.5P						5A_20-20.5
	21				5B										Run 5 20 - 25' 73% Recovery 5B_21.5-22.5
85	22		Poorly Graded GRAVEL with Silt and Sand (GP-GM); brown (10YR 4/3); wet; 55% fine to coarse, subrounded gravel, max. 2.875 in.; 40% fine to coarse sand; 15% no plasticity fines.												
	23		Well-Graded GRAVEL with Sand (GW); brown (10YR 4/3); wet; 72% fine to coarse, subrounded gravel, max. 3.5 in.; 28% fine to coarse sand; 0 fines; trace cobble.		5C								0	PA	5C_23.5-24.5
	24														
	25														Run 6 25 - 30' 20% Recovery 6A_26-27
	26		Poorly Graded GRAVEL with Sand (GP); very dark greenish gray; wet; 45% fine to coarse, subrounded gravel, max. 5 in.; 45% fine to coarse sand; 5% cobbles or boulders; 5% no plasticity fines.		6A										
80	27														
	28														
	29														
	30		At 30 feet, 18% sand; 58% gravel; 24% cobble up to 4".												Run 7 30 - 35' 30% Recovery 7A_31-32
	31				7A								0	PA	
75	32														
	33														
	34														
	35		Poorly Graded SAND (SP); very dark greenish gray; wet; 90% fine to coarse sand; 5% fine to coarse, subrounded gravel; 5% no plasticity fines.		8A										8A_35-36 Run 8 35 - 40' 50% Recovery
	36														
70	37														
	38		Poorly Graded GRAVEL (GP); very dark greenish gray; wet; 80% fine to coarse, subrounded gravel, max. 3.25 in.; 10% cobbles or boulders; 10% fine to coarse sand.												
	39				8B										8B_39-40
	40														Run 9 40 - 45' 80% Recovery 9A_40.5-41 9B_41-42
	41		Poorly Graded SAND (SP); very dark greenish gray; wet; 95% fine to medium sand; 5% no plasticity fines.		9A										
65	42		Well-Graded GRAVEL with Sand (GW); very dark greenish gray; wet; 83% fine to coarse, subrounded gravel, max. 1.5 in.; 17% fine to coarse sand; 5% cobbles or boulders; 0 fines.		9B								0	PA	
	43														
	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,665,157.81 **Easting:** 2,273,445.70
Latitude: 39.40426 **Longitude:** -121.63374
Levee Station or Milepost: 2112+05 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_026S
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		Poorly Graded GRAVEL with Silt (SP-SM); very dark greenish gray; wet; 80% fine to coarse sand; 10% fine to coarse, subrounded gravel, max. 3 in.; 10% no plasticity fines.		10A										10A_45-46 Run 10 45 - 50' 73% Recovery
60	46														
	47		SILTY CLAYEY GRAVEL (GC-GM); very dark greenish gray; wet; 39% fine to coarse, subrounded gravel, max. 3.25 in.; 35% fine to coarse sand; 27% low plasticity fines; 5% cobbles or boulders.		10B						23	7	27	PA	10B_47-48
	48														
	49		Poorly Graded GRAVEL with Silt and Sand (GP-GM); very dark greenish gray; wet; 45% fine to coarse, subrounded gravel, max. 3.5 in.; 40% fine to coarse sand; 10% no plasticity fines; 5% cobbles or boulders.		10C										10C_49-50
	50		SILTY GRAVEL with Sand (GM); very dark greenish gray; wet; 50% fine to coarse, subrounded gravel, max. 4.5 in.; 30% fine to coarse sand; 15% no plasticity fines; 5% cobbles or boulders.												Run 11 50 - 55' 100% Recovery
55	51				11A										11A_50.5-51.5
	52		At 52 feet, 20% low plasticity fines.												
	53														
	54		At 53.5 Feet, 15% non-plastic fines.												
	55														Run 12 55 - 60' 88% Recovery
	56														
50	57		At 56.5 feet, 20% fines.		12A										12A_56-57
	58														
	59														
	60														Run 13 60 - 65' 100% Recovery
	61		SANDY LEAN CLAY (CL); very stiff; yellowish brown (10YR 5/6); moist; 70% medium plasticity fines; 30% fine sand.		13A									70	PA	13A_60.5-61
45	62		CLAYEY SAND (SC); yellowish brown (10YR 5/6); moist; 70% fine sand; 30% medium plasticity fines.		13B											13B_61.5-62
	63		SILTY SAND (SM); brown (10YR 4/3); moist; 80% fine to medium sand; 20% no plasticity fines.		13C										13C_63-64
	64														
	65		At 65 feet, low plasticity fines.												Run 14 65 - 70' 100% Recovery
	66		LEAN CLAY with Sand (CL); stiff; brown (10YR 4/3); moist; 85% medium plasticity fines; 15% fine sand.		14A				1P						14A_65.5-66
40	67								1P						
	68		LEAN CLAY (CL); very stiff; brown (10YR 4/3); moist; 90% medium plasticity fines; 10% fine sand.		14B										14B_68-68.5 Run 15 70 - 75' 100% Recovery
	69								2.5P						
	70														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,665,157.81 **Easting:** 2,273,445.70
Latitude: 39.40426 **Longitude:** -121.63374
Levee Station or Milepost: 2112+05 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_026S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70		At 70.5 feet, hard.												
	71				15A				2.5P						15A_71-71.5
35	72		At 72.5 feet, very stiff.												
	73		LEAN CLAY with Sand (CL); stiff; brown (10YR 4/3); moist; 85% low plasticity fines; 15% fine sand.		15B										15B_73-73.5
	74														
	75								4.0P						
	76		End of boring at 75'. Backfilled with cement bentonite grout. 12-47 lb. bags cement, 50 gallons water, 1/4 bag of bentonite (50 lb. bag)												
30	77														
	78														
	79														
	80														
	81														
25	82														
	83														
	84														
	85														
	86														
20	87														
	88														
	89														
	90														
	91														
15	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,665,157.81 **Easting:** 2,273,445.70
Latitude: 39.40426 **Longitude:** -121.63374
Levee Station or Milepost: 2112+05 **Levee Mile:**
Levee Segment Reach 33
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_026S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/27/11	9/28/11	107.3 ft	NAVD 88	90.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	Scott Adam, Rick Smedley	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		GT Hong/M. Weil
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			20 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); brown; moist; 70% no plasticity fines; 30% fine sand.												Hand Auger to 5'
105	1														
	2														
	3														
	4														Hand augered 5'
					1								65	PA HD	1_4.0-5.0
	5														Run 1 5 - 10' 100% Recovery
	6														
100	7														
					2										2_7.0-8.0
	8														
	9		SILTY SAND (SM); dark yellowish brown; moist; 70% sand; 30% no plasticity fines.												
	10														Run 2 10 - 15' 100% Recovery
	11														
					3								31	PA HD	3_11.0-12.0
95	12														
	13														
	14		SANDY SILT (ML); dark brown; moist; 70% low plasticity, rapid dilatancy fines; 30% fine sand.												
	15														
					4								57	PA	4_15.0-16.0
	16														Run 3 15 - 20' 100% Recovery
	17														
90	18		Poorly Graded GRAVEL with Sand (GP); dark greenish gray; wet; 60% gravel; 40% medium to coarse sand.												
					5								4	PA	5_18.0-19.0
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,274,536.76 **Easting:** 6,664,017.71
Latitude: 39.40727 **Longitude:** -121.63776
Levee Station or Milepost: 2131+98 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														Run 4 20 - 25' 100% Recovery
	21														
	22														
85	23				6										6_22.0-23.0
	24														
	25														Run 5 25 - 30' 100% Recovery
	26														
	27														
80	28				7										7_27.0-28.0
	29														
	30														Run 6 30 - 35' 100% Recovery
	31				8										8_32.0-33.0
75	32														
	33														
	34		Poorly Graded SAND (SP); dark greenish gray; wet; 95% medium to coarse sand; 5% no plasticity fines.		9										9_34.0-35.0
	35														Run 7 35 - 40' 100% Recovery
	36														
	37														
70	38		Well-Graded GRAVEL with Sand (GW); wet; 75% fine to coarse, subrounded gravel, max. 3 in.; 20% coarse sand; 5% no plasticity fines.		10										10_37.0-38.0
	39		Poorly Graded SAND (SP); olive gray; wet; 98% medium to coarse sand; 2% no plasticity fines.		11										11_38.0-39.0
	40														Run 8 40 - 45' 100% Recovery
	41														
65	42														
	43														
	44				12										12_44.0-45.0
	45														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,274,536.76 **Easting:** 6,664,017.71
Latitude: 39.40727 **Longitude:** -121.63776
Levee Station or Milepost: 2131+98 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		Well-Graded GRAVEL with Sand (GW); wet; 70% fine to coarse, subrounded gravel; 25% medium to coarse sand; 5% low plasticity fines.												Run 9 45 - 50' 100% Recovery
	46														
	47														
60	48				13										13_47.0-48.0 (missing)
	49														
	50														Run 10 50 - 55' 100% Recovery
	51														
	52														
55	53				14										14_52.0-53.0
	54		Well-Graded SAND (SW); olive gray; wet; 98% fine to coarse sand; 2% no plasticity fines.												
	55				15										15_55.0-56.0 Run 11 55 - 60' 100% Recovery
	56														
	57		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 70% fine to coarse, subrounded gravel, max. 3 in.; 20% medium to coarse sand; 10% low plasticity fines.												
50	58				16										16_58.0-59.0
	59														
	60														Run 12 60 - 65' 100% Recovery
	61														
	62														
45	63		CLAYEY SAND (SC); olive gray; wet; 85% fine to medium sand; 15% low plasticity fines.												
	64				17										17_64.0-65.0
	65														Run 13 65 - 70' 100% Recovery
	66		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 70% fine to coarse, subrounded gravel, max. 3 in.; 20% medium to coarse sand; 10% low plasticity fines.												
40	67														
	68				18										18_68.0-69.0
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,274,536.76 **Easting:** 6,664,017.71
Latitude: 39.40727 **Longitude:** -121.63776
Levee Station or Milepost: 2131+98 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008S
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70		Poorly Graded SAND with Clay (SP-SC); olive gray; wet; 90% fine to medium sand; 10% low plasticity fines.												Run 14 70 - 75' 100% Recovery
	71				19										19_71.0-72.0
35	72														
	73		Well-Graded GRAVEL (GW); wet; 90% fine to coarse gravel, max. 3 in.; 5% medium to coarse sand; 5% low plasticity fines.		20										20_73.0-74.0
	74														
	75		SANDY LEAN CLAY (CL); dark yellowish brown; moist; 70% medium to high plasticity fines; 30% fine sand.												Run 15 75 - 80' 100% Recovery
	76														
	77														
30	78				21					20	40	21	65	PA	21_77.0-78.0
	79														
	80														Run 16 80 - 85' 100% Recovery
	81														
	82		FAT CLAY (CH); dark greenish gray; moist; 95% high plasticity, no dilatancy fines; 5% fine sand.		22										22_82.0-83.0
25	83														
	84														
	85														Run 17 85 - 90' 100% Recovery
	86				23										23_86.0-87.0
20	87														
	88														
	89				24										24_89.0-90.0
	90		End of boring at 90'. Backfilled with cement bentonite grout. 16-47 lb. bags cement, 80 gallons water, 1 bag of bentonite (50 lb. bag)												
	91														
	92														
15	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 2,274,536.76 **Easting:** 6,664,017.71
Latitude: 39.40727 **Longitude:** -121.63776
Levee Station or Milepost: 2131+98 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/21/11	9/22/11	109.3 ft	NAVD 88	75.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Justin Lake	Gerald Becker	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Geoprobe 8140LC	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	3-5/8" OD Rod	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	20 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); dark reddish brown; moist; 60% low plasticity, rapid dilatancy fines; 40% fine sand.												Hand Auger to 5'
105	5				1								59	PA HD	1_4.0-5.0
	5														Run 1 5 - 10'
	7				2										2_7.0-8.0
100	10		Poorly Graded GRAVEL with Silt and Sand (GP); yellowish brown; moist; 60% gravel; 36% fine to medium sand; 4% no plasticity fines.												Run 2 10 - 15'
	12				3								3	PA HD	3_12.0-13.0
95	15		Well-Graded SAND (SW); yellowish brown; moist; 95% sand; 5% no plasticity fines.												Run 3 15 - 20'
	16				4										4_16.0-17.0
	19		Poorly Graded GRAVEL (GP); dark greenish gray; wet; 90% gravel; 10% fine to medium sand.												
90	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,292.13 **Easting:** 6,664,415.58
Latitude: 39.40934 **Longitude:** -121.63634
Levee Station or Milepost: 2141+03 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20													Run 4 20 - 25' 30% Recovery
	21													
	22													
	23													
	24			5										5_23.0-24.0
85	25	CLAYEY GRAVEL (GC); dark greenish gray; wet; 70% gravel; 20% medium plasticity fines; 10% medium sand.												
	26													Run 5 25 - 30' 45% Recovery
	27													
	28			6					3	16	2	22	PA	6_27.0-28.0
80	29													
	30													
	31			7										7_30.0-31.0 Run 6 30 - 35' 60% Recovery
	32													
	33													
	34													
75	35													
	36													Run 7 35 - 40' 100% Recovery
	37													
	38			8										8_37.0-38.0
	39													
70	40	Well-Graded GRAVEL with Silt (GW-GM); brown; wet; 60% gravel; 30% fine to medium sand; 10% low plasticity fines.												
	41													Run 8 40 - 45' 100% Recovery
	42			9										9_41.0-42.0
	43													
	44	CLAYEY GRAVEL (GC); greenish gray; moist; 60% gravel; 25% medium plasticity fines; 15% fine sand.												
65	45			10										10_44.0-45.0

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,292.13 **Easting:** 6,664,415.58
Latitude: 39.40934 **Longitude:** -121.63634
Levee Station or Milepost: 2141+03 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009S
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		Poorly Graded GRAVEL with Sand (GP); greenish gray; wet; 60% gravel; 35% medium to coarse sand; 5% no plasticity fines.												Run 9 45 - 50' 15% Recovery Poor recovery due to loose sand and cobbles >3.5". No sieve analysis. 11_47.0-48.0
	46														
	47														
	48				11										
	49														
60	50														Run 10 50 - 55' 100% Recovery
	51														
	52				12										12_52.0-53.0
	53														
55	54														
	55														Run 11 55 - 60' 100% Recovery
	56														
	57				13										13_57.0-58.0
	58														
50	59														
	60														Run 12 60 - 65' 100% Recovery
	61														
	62														
	63				14										14_63.0-64.0
	64														
45	65														Run 13 65 - 70' 85% Recovery
	66														
	67														
	68														
	69		LEAN CLAY (CL); reddish brown; moist; 95% low to medium plasticity, no dilatancy fines; 5% fine sand.		15					21	25	10			15_69.0-70.0
40	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,292.13 **Easting:** 6,664,415.58
Latitude: 39.40934 **Longitude:** -121.63634
Levee Station or Milepost: 2141+03 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														Run 14 70 - 75' 100% Recovery
	71		FAT CLAY with Sand (CH); reddish brown; moist; 75% high plasticity, no dilatancy fines; 25% fine to medium sand.												
	72				16										16_72.0-73.0
	73														
35	74														
	75		End of boring at 75'. Backfilled with cement bentonite grout. 21-47 lb. bags cement, 150 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	76														
	77														
	78														
	79														
30	80														
	81														
	82														
	83														
	84														
25	85														
	86														
	87														
	88														
	89														
20	90														
	91														
	92														
	93														
	94														
15	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,292.13 **Easting:** 6,664,415.58
Latitude: 39.40934 **Longitude:** -121.63634
Levee Station or Milepost: 2141+03 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_009S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/22/11 **DATE COMPLETED** 9/23/11	**GROUND ELEVATION** 109.9 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 70.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Justin Lake **HELPER'S NAME** Gerald Becker	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** Geoprobe 8140LC	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4" Core Barrel	**DRILLING ROD TYPE AND DIAMETER** 3-5/8" OD Rod	**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** 20 ft	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); dark reddish brown; moist; 70% low plasticity, slow dilatancy fines; 30% fine sand.												Hand Auger to 5'
	1														
	2														
	3														
	4														
105	5				1								66	PA	1_4.0-5.0
	6														Run 1 5 - 10' 80% Recovery
	7														
	8				2										2_8.0-9.0
	9														
100	10		LEAN CLAY with Sand (CL); dark yellowish brown; moist; 80% medium plasticity, no dilatancy fines; 20% fine sand.												Run 2 10 - 15' 80% Recovery
	11														
	12				3										3_12.0-13.0
	13														
	14														
95	15														Run 3 15 - 20' 100% Recovery
	16														
	17														
	18		Well-Graded SAND with Silt (SW-SM); brown; wet; 90% sand; 10% no plasticity fines.		4										4_18.0-19.0
	19														
90	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,750.46 **Easting:** 6,664,776.69
Latitude: 39.41059 **Longitude:** -121.63506
Levee Station or Milepost: 2151+01 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINT:SBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														Run 4 20 - 25' 80% Recovery
	21		FAT CLAY with Sand (CH); brown; moist; 75% high plasticity, no dilatancy fines; 25% fine to medium sand.		5										5_21.0-22.0
	22														
	23		Poorly Graded GRAVEL with Sand (GP); dark greenish brown; wet; 60% gravel; 40% coarse sand.												
	24				6										6_24.0-25.0
85	25														Run 5 25 - 30' 100% Recovery
	26														
	27														
	28				7										7_28.0-29.0
	29														
80	30														Run 6 30 - 35' 30% Recovery Poor recovery due to heaving.
	31														
	32														
	33				8										8_33.0-34.0
	34		Poorly Graded SAND (SP); very dark greenish gray; wet; 95% fine to coarse sand; 5% no plasticity fines.												
75	35														Run 7 35 - 40' 100% Recovery
	36				9										9_36.0-37.0
	37														
	38		Poorly Graded GRAVEL with Sand (GP); dark yellowish brown; wet; 60% gravel; 35% medium to coarse sand; 5% no plasticity fines.												
	39				10										10_39.0-40.0
70	40														Run 8 40 - 45' 90% Recovery
	41														
	42														
	43				11										11_43.0-44.0
	44														
65	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,750.46 **Easting:** 6,664,776.69
Latitude: 39.41059 **Longitude:** -121.63506
Levee Station or Milepost: 2151+01 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010S

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45	At 45 feet greenish gray; 70% gravel; 25% medium to coarse sand; 5% no plasticity fines.												Run 9 45 - 50' 60% Recovery Poor recovery due to heaving.
	46													
	47			12										12_47.0-48.0
	48													
	49													
60	50	SILTY GRAVEL with Sand (GM); greenish gray; wet; 60% gravel; 20% coarse sand; 20% low plasticity fines.												Run 10 50 - 55' 100% Recovery
	51													
	52			13										13_52.0-53.0
	53													
	54													
55	55													Run 11 55 - 60' 100% Recovery
	56			14										14_56.0-57.0
	57													
	58	SANDY FAT CLAY (CH); yellowish brown; moist; 70% high plasticity, no dilatancy fines; 30% medium to coarse sand.												
	59			15					45	65	35	59	PA	15_59.0-60.0
50	60													Run 12 60 - 65' 50% Recovery Missed bottom of sample.
	61													
	62	SILTY CLAY (CL-ML); dark yellowish brown; moist; 85% medium plasticity, no dilatancy fines; 15% fine sand.		16										16_62.0-63.0
	63													
	64													
45	65	SANDY FAT CLAY (CH); yellowish brown; moist; 70% high plasticity, no dilatancy fines; 30% medium to coarse sand.												Run 13 65 - 70'
	66													
	67			17										17_67.0-68.0
	68													
	69													
40	70													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,750.46 **Easting:** 6,664,776.69
Latitude: 39.41059 **Longitude:** -121.63506
Levee Station or Milepost: 2151+01 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010S
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	70										
	71		End of boring at 70'. Backfilled with cement bentonite grout. 16-47 lb. bags cement, 100 gallons water, 1/2 bag of bentonite (50 lb. bag)								
	72										
	73										
	74										
35	75										
	76										
	77										
	78										
	79										
30	80										
	81										
	82										
	83										
	84										
25	85										
	86										
	87										
	88										
	89										
20	90										
	91										
	92										
	93										
	94										
15	95										

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,275,750.46 **Easting:** 6,664,776.69
Latitude: 39.41059 **Longitude:** -121.63506
Levee Station or Milepost: 2151+01 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/2/11 **DATE COMPLETED** 10/2/11	**GROUND ELEVATION** 110.6 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 85.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Justin Lake **HELPER'S NAME** R. Smedley, S. Adam	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** Geoprobe 8140LC	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4" Core Barrel	**DRILLING ROD TYPE AND DIAMETER** 3-5/8" OD Rod	**FIELD LOGGER** M. Weil
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** 17 ft	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
110	0		SILTY SAND (SM); dark brown; moist; 60% fine sand; 40% no plasticity fines.												Hand Auger to 5'
	1														
	2														
	3				1								49	PA HD	1_3.0-3.5
	4														
105	5														Run 1 5 - 10' 100% Recovery
	6														
	7														
	8														
	9		SANDY SILT (ML); dark brown; moist; 51% no plasticity fines; 49% fine sand.		2								51	PA	2_9.0-10.0
100	10														Run 2 10 - 15' 100% Recovery
	11														
	12														
	13														
	14				3										3_14.0-15.0
	15														Run 3 15 - 20' 100% Recovery
95	16		Poorly Graded GRAVEL (GP); wet; 85% subrounded gravel; 11% medium to coarse sand; 4% low plasticity fines.												
	17				4								2	PA	4_17.0-18.0
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,276,642.22 **Easting:** 6,665,109.14
Latitude: 39.41304 **Longitude:** -121.63387
Levee Station or Milepost: 2161+04 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_025S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
90	20														Run 4 20 - 25' 100% Recovery
	21														
	22														
	23														
	24				5										5_24.0-25.0
	25														Run 5 25 - 30' 100% Recovery
85	26														
	27		Poorly Graded SAND (SP); dark gray; wet; 95% medium to coarse sand; 5% no plasticity fines.		6										6_27.0-28.0
	28														
	29		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 75% fine to coarse, subrounded gravel; 15% medium to coarse sand; 10% low plasticity fines.												
	30														Run6 30 - 35' 100% Recovery
80	31														
	32				7										7_32.0-33.0
	33														
	34														
	35														Run 7 35 - 40' 100% Recovery
75	36														
	37														
	38														
	39				8										8_39.0-40.0
	40														Run 8 40 - 45' 100% Recovery
70	41		CLAYEY GRAVEL with Sand (GC); wet; 65% fine to coarse gravel; 20% low plasticity fines; 15% medium to coarse sand.												
	42				9										9_42.0-43.0
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,276,642.22 **Easting:** 6,665,109.14
Latitude: 39.41304 **Longitude:** -121.63387
Levee Station or Milepost: 2161+04 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_025S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
65	45	Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 75% fine to coarse, subrounded gravel; 15% medium to coarse sand; 10% low plasticity fines.												Run 9 45 - 50' 100% Recovery
	46													
	47			10										10_47.0-48.0
	48													
	49													
	50	Well-Graded SAND (SW); olive; wet; 95% fine to coarse sand; 5% low plasticity fines.												Run 10 50 - 55' 100% Recovery
60	51			11										11_51.0-52.0
	52													
	53	Well-Graded GRAVEL with Sand (GW); wet; 80% fine to coarse gravel; 15% medium to coarse sand; 5% low plasticity fines.												
	54			12										12_54.0-55.0
	55	Well-Graded SAND (SW); olive brown; wet; 95% fine to coarse sand; 5% low plasticity fines.												Run 11 55 - 60' 100% Recovery
55	56			13										13_56.0-57.0
	57	Well-Graded GRAVEL with Sand (GW); wet; 80% fine to coarse gravel; 15% medium to coarse sand; 5% low plasticity fines.												
	58			14										14_58.0-59.0
	59													
	60	Well-Graded SAND (SW); olive brown; wet; 95% fine to coarse sand; 5% low plasticity fines.												Run 12 60 - 65' 100% Recovery
50	61			15										15_61.0-62.0
	62													
	63	Well-Graded GRAVEL with Sand (GW); wet; 80% fine to coarse gravel; 15% medium to coarse sand; 5% low plasticity fines.		16										16_63.0-64.0
	64													
	65	Well-Graded SAND (SW); olive brown; wet; 95% fine to coarse sand; 5% low plasticity fines.												Run 13 65 - 70' 100% Recovery
45	66			17										17_66.0-67.0
	67													
	68	Well-Graded GRAVEL with Sand (GW); wet; 80% fine to coarse gravel; 15% medium to coarse sand; 5% low plasticity fines.		18										18_68.0-69.0
	69													
	70													

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,276,642.22 **Easting:** 6,665,109.14
Latitude: 39.41304 **Longitude:** -121.63387
Levee Station or Milepost: 2161+04 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_025S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
40	70		CLAYEY SAND (SC); olive brown; wet; 70% fine to medium sand; 30% low plasticity fines.												Run 14 70 - 75' 100% Recovery
	71				19					75	25	6	24	PA	19_71.0-72.0
	72														
	73														
	74		LEAN CLAY with Sand (CL); light olive brown; wet; 80% medium plasticity, no dilatancy fines; 20% fine sand.		20										20_74.0-75.0
35	75		CLAYEY SAND with Gravel (SC); light olive brown; wet; 40% fine to coarse sand; 35% low plasticity fines; 25% subrounded gravel; cemented.												Run 15 75 - 80' 100% Recovery
	76				21								27	PA	21_76.0-77.0
	77														
	78														
	79														
	80														Run 16 80 - 85' 100% Recovery
30	81														
	82				22										22_82.0-83.0
	83														
	84														
	85		End of boring at 85'. Backfilled with cement bentonite grout. 18-47 lb. bags Portland cement, 80 gallons water, 1-50 lb bag of bentonite.												
25	86														
	87														
	88														
	89														
	90														
20	91														
	92														
	93														
	94														
	95														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,276,642.22 **Easting:** 6,665,109.14
Latitude: 39.41304 **Longitude:** -121.63387
Levee Station or Milepost: 2161+04 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_025S
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/7/11	10/12/11	110.7 ft	NAVD 88	74.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	B. Bosworth	G. Woods III, A. Arroyo	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Geoprobe 8040 DT/DitchWitch 148	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
3-1/4" Mud Rotary / 8" Hollow Stem Auger	NA	GT Hong

[X] VERTICAL [ ] INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
	PW 3"	

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), SPT(1.375")	Auto Hammer, 140 lbs / 30-inch drop	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Grout	NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
110	0		SILTY SAND (SM); dark brown; moist; 80% sand; 20% no plasticity fines.												
	1														
	2														
	3														5' Hand augered
					1	100									1_3'-4'
	4														
	5														
105	6				2 3	100	3 3 3 [6]								2_5'-6' 3_6'-6.5'
			Poorly Graded SAND (SP); very dark brown; moist; 90% fine to medium sand; 5% no plasticity fines.												
	7														
	8														
	9		SILTY SAND (SM); very dark brown; moist; 60% sand; 40% low plasticity fines.												
	10														
100	11				4	83	2 2 3 [5]						49	PA	4_10'-11.5'
	12														
	13		SANDY SILT (ML); dark brown; wet; 60% low plasticity, rapid dilatancy fines; 40% fine sand.												
	14														
	15														
95	16		SILTY SAND (SM); very dark brown; wet; 80% sand; 20% no plasticity fines.		5 6	83	3 3 4 [7]								5_15'-16' 6_16'-16.5'
	17		Poorly Graded GRAVEL with Sand (GP); dark brown; wet; 70% gravel; 25% sand; 5% no plasticity fines.												
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,277,082.76 **Easting:** 6,665,495.43
Latitude: 39.41424 **Longitude:** -121.63249
Levee Station or Milepost: 2170+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011A
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
90	20														
	21			X	7	17	50/3"								7_20'-21.5'
	22						[REF]								No recovery Only one cobble sample
	23														
	24														
85	25														
	26			X	8	0	18 24 50/5"						5	PA	8_25'-26.5'
	27						[74/ 11"]								
	28														
	29														
80	30														
	31			X	9	11	16 50/3"								9_30'-31.5' No recovery due to cobble
	32						[50/ 3"]								
	33														
	34														
75	35														
	36			X	10	39	30 40 40								10_35'-36.5'
	37						[80]								Switch rig from Mud Rotary and Ditch Witch 1481 to Hollow Stem Auger (Geoprobe 8040DT) at 37'
	38		Well-Graded GRAVEL with Sand (GW); yellowish brown; wet; 75% gravel; 20% sand; 5% no plasticity fines.												
	39														
70	40														
	41			X	11	50	49 37 35								11_40'-41.5'
	42						[72]								
	43														
	44		SILTY GRAVEL (GM); olive brown; wet; 45% gravel; 40% sand; 15% low plasticity fines.												
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,277,082.76 **Easting:** 6,665,495.43
Latitude: 39.41424 **Longitude:** -121.63249
Levee Station or Milepost: 2170+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011A
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
65	45			X	12	56	17 19 35 [54]								12_45'-46.5'
	46														
	47														
	48														
	49														
	50			X	13	50	15 50/5" [50/5"]								13_50'-51.5'
60	51														
	52														
	53														
	54														
	55			X		0	50/1"								No recovery due to cobble
55	56														
	57														
	58														
	59														
	60			X		0	50/2"								No recovery due to cobble
50	61														
	62														
	63														
	64		SILTY SAND (SM); yellowish brown; wet; 55% fine sand; 45% no plasticity fines.												
	65			X	14	44	20 7 5 [12]						48	PA	14_65'-66.5'
45	66														
	67														
	68		SANDY SILT (ML); yellowish brown; wet; 60% medium plasticity, slow dilatancy fines; 40% fine sand.												
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,277,082.76 **Easting:** 6,665,495.43
Latitude: 39.41424 **Longitude:** -121.63249
Levee Station or Milepost: 2170+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011A
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
40	70				15	94	27 15 15			29	21	NP	60	PA	15_70'-71.5'
	71														
	72		SANDY LEAN CLAY (CL); yellowish brown; moist; 65% medium plasticity, no dilatancy fines; 35% fine sand.		16	89	[30] 50 33 18								16_73'-74.5'
	73		CLAYEY GRAVEL (GC); greenish gray; moist; 75% gravel; 25% medium plasticity fines.		17	83	[51]								17_73'-74.5' 5' long Geoprobe sample Hard to push at 74.5'
	74														
	75		End of boring at 74.5 '. Backfilled with cement bentonite grout. 19-47 lb. bags cement, 160 gallons water, 1-50 lb bag of bentonite grout.												
35	76														
	77														
	78														
	79														
	80														
30	81														
	82														
	83														
	84														
	85														
25	86														
	87														
	88														
	89														
	90														
20	91														
	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,277,082.76 **Easting:** 6,665,495.43
Latitude: 39.41424 **Longitude:** -121.63249
Levee Station or Milepost: 2170+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011A
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/6/11	10/7/11	111.0 ft	NAVD 88	70.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	S. Adam/R. Smedley	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Weil
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout				

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
110	0		SANDY SILT (ML); dark yellowish brown; moist; 60% no plasticity, slow dilatancy fines; 40% fine sand.												Hand Auger to 5'
	1														
	2														
	3				1										1_3.0-4.0
	4														
	5														Run 1 5 - 10' 100% Recovery
105	6														
	7														
	8														
	9				2										2_9.0-10.0
	10														Run 2 10 - 15' 100% Recovery
100	11														
	12														
	13				3										3_13.0-14.0
	14		Well-Graded GRAVEL with Sand (GW); wet; 75% fine to coarse gravel; 20% fine to coarse sand; 5% no plasticity fines; cobbles <3".												
	15				4										4_15.0-16.0
95	16														Run 3 15 - 20' 100% Recovery
	17														
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,277,770.69 **Easting:** 6,665,232.84
Latitude: 39.41613 **Longitude:** -121.63341
Levee Station or Milepost: 2181+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														Run 4 20 - 25' 100% Recovery
90	21														
	22														
	23				5										5_23.0-24.0
	24														
	25														Run 5 25 - 30' 100% Recovery
85	26														
	27														
	28														
	29				6										6_29.0-30.0
	30														Run6 30 - 35' 100% Recovery
80	31														
	32		Poorly Graded SAND (SP); dark gray; wet; 95% fine to medium sand; 5% no plasticity fines.												
	33				7										7_33.0-34.0
	34														
	35		Well-Graded GRAVEL with Sand (GW); wet; 80% fine to coarse gravel; 15% fine to coarse sand; 5% no plasticity fines; cobbles <2".		8										8_35.0-36.0 Run 7 35 - 40' 100% Recovery
75	36														
	37		LEAN CLAY (CL); yellowish brown; wet; 95% low plasticity fines; 5% fine sand; mildly indurated.												
	38				9										9_38.0-39.0
	39														
	40		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 50% fine to coarse, subrounded gravel; 40% fine to coarse sand; 10% low plasticity fines.												Run 8 40 - 45' 100% Recovery
70	41				10										10_41.0-42.0
	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,277,770.69 **Easting:** 6,665,232.84
Latitude: 39.41613 **Longitude:** -121.63341
Levee Station or Milepost: 2181+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012S

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45													Run 9 45 - 50' 100% Recovery
65	46													
	47													
	48	SANDY LEAN CLAY (CL); light olive brown; wet; 70% low plasticity fines; 30% fine sand.		11					29	38	17	54	PA	11_48.0-49.0
	49													
	50													Run 10 50 - 55' 100% Recovery
60	51													
	52													
	53			12										12_53.0-54.0
	54													
	55	CLAYEY SAND (SC); olive brown; wet; 70% fine to medium sand; 30% low plasticity fines.												Run 11 55 - 60' 100% Recovery
55	56			13					25	NP	NP	14	PA	13_56.0-57.0
	57													
	58													
	59									65	35			
	60													Run 12 60 - 65' 100% Recovery
50	61													
	62	Well-Graded SAND (SW); dark olive gray; wet; 95% fine to coarse sand; 5% low plasticity fines.		14										14_62.0-_63.0
	63	LEAN CLAY with Sand (CL); dark yellowish brown; wet; 80% medium plasticity fines; 20% fine sand.												
	64			15										15_4.0-65.0
	65													Run 13 65 - 70' 100% Recovery
45	66													
	67			16										16_67.0-68.0
	68													
	69													
	70													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,277,770.69 **Easting:** 6,665,232.84
Latitude: 39.41613 **Longitude:** -121.63341
Levee Station or Milepost: 2181+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012S
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	70										
40	71		End of boring at 70'. Backfilled with cement bentonite grout. 15-47 lb. bags cement, 50 gallons water, 1 bag of bentonite (50 lb. bag)								
	72										
	73										
	74										
	75										
35	76										
	77										
	78										
	79										
	80										
30	81										
	82										
	83										
	84										
	85										
25	86										
	87										
	88										
	89										
	90										
20	91										
	92										
	93										
	94										
	95										

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,277,770.69 **Easting:** 6,665,232.84
Latitude: 39.41613 **Longitude:** -121.63341
Levee Station or Milepost: 2181+97 **Levee Mile:**
Levee Segment Reach 34
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_012S
Sheet 4 of 4

SBFCA Feather River West Levee

DATE STARTED 9/26/11	**DATE COMPLETED** 9/27/11	**GROUND ELEVATION** 113.0 ft	**ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 80.0 ft
DRILLING CONTRACTOR WDC		**DRILLER'S NAME** Justin Lake	**HELPER'S NAME** Scott Adam, Rick Smedley	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic		**DRILL RIG MAKE AND MODEL** Geoprobe 8140LC		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4" Core Barrel		**DRILLING ROD TYPE AND DIAMETER** 3-5/8" OD Rod		**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing		**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, Sonic(4")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA		**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout		**GROUNDWATER READING:**	**DURING DRILLING** 20 ft	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILTY SAND (SM); dark brown; moist; 55% fine sand; 45% no plasticity, rapid dilatancy fines.												Hand auger to 7.5'.
	1														
	2														
110	3														
	4				1								38	PA HD	1_4.0-5.0
	5														
	6														
	7														
105	8				2										Run 1 7.5 - 10' 100% Recovery 2_8.0-9.0
	9														
	10														Run 2 10 - 15' 100% Recovery
	11														
	12		Well-Graded GRAVEL with Sand (GW-GM); greenish gray; moist; 60% gravel; 30% medium sand; 10% no plasticity fines.												
100	13				3										3_13.0-14.0
	14														
	15		Poorly Graded GRAVEL with Sand (GP); dark greenish gray; moist; 65% gravel; 31% medium to coarse sand; 4% no plasticity fines.												Run 3 15 - 20' 80% Recovery
	16														
	17				4								0	PA	4_17.0-18.0
95	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,279,352.10 **Easting:** 6,664,691.60
Latitude: 39.42048 **Longitude:** -121.63531
Levee Station or Milepost: 2201+66 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														Run 4 20 - 25' 50% Recovery
	21														
	22														Poor recovery due to loose sand.
90	23														
					5										5_23.0-24.0
	24														
	25														Run 5 25 - 30' 40% Recovery
	26														
	27														
85	28														
					6										6_28.0-29.0
	29														
	30														Run 6 30 - 35' 15% Recovery
	31														
	32														
					7										7_32.0-33.0
80	33														Poor recovery due to gravel and loose sand mixture.
	34														
	35														Run 7 35 - 40' 100% Recovery
	36														
	37														
75	38		Poorly Graded SAND (SP); dark yellowish brown; wet; 95% medium to coarse sand; 5% no plasticity fines.		8										8_38.0-39.0
	39		CLAYEY SAND (SC); dark yellowish brown; wet; 60% fine sand; 40% low plasticity fines.		9										9_39.0-40.0
	40		CLAYEY GRAVEL (GC); greenish gray; wet; 65% gravel; 25% medium to high plasticity fines; 10% medium sand.												Run 8 40 - 45' 100% Recovery
	41														
	42				10								17	PA	10_42.0-43.0
70	43														
	44		FAT CLAY with Sand (CH); olive brown; moist; 80% high plasticity, no dilatancy fines; 20% fine to coarse		11					40	57	29			11_44.0-45.0
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,279,352.10 **Easting:** 6,664,691.60
Latitude: 39.42048 **Longitude:** -121.63531
Levee Station or Milepost: 2201+66 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		sand.												Run 9 45 - 50' 100% Recovery
	46														
	47														
65	48				12										12_48.0-49.0
	49														
	50		Well-Graded SAND (SW); olive brown; wet; 95% sand; 5% no plasticity fines.												Run 10 50 - 55' 100% Recovery
	51														
	52				13										13_52.0-53.0
60	53														
	54		SANDY LEAN CLAY (CL); yellowish brown; moist; 70% medium plasticity, no dilatancy fines; 30% fine to medium sand.												
	55														Run 11 55 - 60' 100% Recovery
	56				14					20	34	16			14_56.0-57.0
	57														
55	58														
	59														
	60		CLAYEY SAND (SC); olive brown; wet; 70% fine to medium sand; 30% medium plasticity fines.												Run 12 60 - 65' 100% Recovery
	61				15										15_61.0-62.0
	62														
50	63		SANDY LEAN CLAY (CL); olive brown; moist; 70% medium plasticity, no dilatancy fines; 30% medium to coarse sand.												
	64				16										16_64.0-64.0
	65														Run 13 65 - 70' 95% Recovery
	66														
	67				17										17_67.0-68.0
45	68		CLAYEY SAND (SC); yellowish brown; moist; 60% medium to coarse sand; 40% medium plasticity fines.												
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,279,352.10 **Easting:** 6,664,691.60
Latitude: 39.42048 **Longitude:** -121.63531
Levee Station or Milepost: 2201+66 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013S
Sheet 3 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70				18										18_70.0-71.0 Run 14 70 - 75' 95% Recovery
	71														
	72														
40	73														
	74														
	75		Poorly Graded SAND (SP); dark olive gray; wet; 95% sand; 5% no plasticity fines.												Run 15 75 - 80' 50% Recovery
	76														
	77				19										19_77.0-78.0
35	78														
	79														
	80		End of boring at 80'. Backfilled with cement bentonite grout. 21-47 lb. bags cement, 110 gallons water, 1 bag of bentonite (50 lb. bag)												
	81														
	82														
30	83														
	84														
	85														
	86														
	87														
25	88														
	89														
	90														
	91														
	92														
20	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,279,352.10 **Easting:** 6,664,691.60
Latitude: 39.42048 **Longitude:** -121.63531
Levee Station or Milepost: 2201+66 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_013S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
11/22/11	11/23/11	115.1 ft	NAVD 88	80.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Justin Lake	Joe Roberts, Rick Smedley	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Geoprobe 8140LC	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	3-5/8" OD Rod	M. Turner

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	18.5 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
115	0		SANDY SILT (ML); very stiff; dark brown (10YR 3/3); moist; 70% no plasticity fines; 30% fine sand.		1A				3.5P						1A_0-0.5 Hand Auger to 5' Run 1 0 - 5'
	1														
	2														
	3														
	4				1B										1B_4-4.5
110	5														Run 2 5 - 10' 60% Recovery
	6				2A				.5P						2A_6-7
	7		At 6.5 feet, 40% sand; with rootlets.												
	8		SANDY SILTY CLAY (CL-ML); dark brown (10YR 3/3); moist; 62% low plasticity fines; 38% fine sand.												
	9				2B				.5P	10	23	4	62	PA	2B_9-10
105	10														Run 3 10 - 15' 70% Recovery
	11		At 11 feet, 45% sand, non-plastic fines.		3A										3A_11-12
	12														
	13														
	14				3B										3B_14-15
100	15		14.5 feet, 30% sand. SILTY SAND (SM); strong brown (7.5YR 5/6); moist; 70% fine sand; 30% no plasticity fines; with rootlets.						1.25P						Run 4 15 - 20' 75% Recovery
	16				4A				1P						4A_16-17
	17														
	18		At 17.5 feet, 45% fines. Poorly Graded SAND with Silt (SP-SM); dark yellowish brown (10YR 4/6); moist; 90% fine sand; 10% no plasticity fines.		4B										4B_18-18.5
	19				4C										4C_18.5-19
	20		SILTY SAND (SM); strong brown (7.5YR 5/6); wet; 70% fine sand; 30% no plasticity fines.												

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,663,613.85 **Easting:** 2,280,851.54
Latitude: 39.42461 **Longitude:** -121.63910
Levee Station or Milepost: 2223+02 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_027S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
95	20		At 19.5 feet, 2" layer of SP-SM; 25% fines.												Run 5 20 - 25' 30% Recovery
	21		SANDY SILT (ML); strong brown (7.5YR 5/6); moist; 67% no plasticity fines; 33% fine sand.												
	22				5A								67	PA	5A_22-23
	23		At 22.5 feet, 20% fines.												
	24														
90	25				6A										6A_25-25.5
			Poorly Graded SAND with Silt (SP-SM); dark grayish brown (2.5Y 4/2); wet; 85% fine to coarse sand; 10% no plasticity fines; 5% fine to coarse, subrounded gravel.		6B										Run 6 25 - 30' 80% Recovery 6B_25.5-26
	26														
	27		SILTY GRAVEL (GM); dark grayish brown (2.5Y 4/2); wet; 35% fine to coarse, subrounded gravel, max. 3.5 in.; 35% fine to coarse sand; 20% no plasticity fines; 10% cobbles or boulders.		6C										6C_27-28
	28														
	29														
85	30		SILTY SAND with Gravel (SM); dark gray (5Y 4/1); wet; 55% fine to coarse sand; 30% fine to coarse, subrounded gravel, max. 3.75 in.; 15% no plasticity fines.		7A										7A_30-31 Run 7 30 - 35' 90% Recovery
	31														
	32		Poorly Graded SAND with Silt (SP-SM); very dark grayish brown (2.5Y 3/2); wet; 93% fine sand; 7% no plasticity fines.		7B								7	PA	7B_32-33
	33														
	34														
80	35		SILTY GRAVEL with Sand (GM); very dark grayish brown (2.5Y 3/2); wet; 45% fine to coarse, subrounded gravel, max. 1.75 in.; 35% fine to medium sand; 20% no plasticity fines.		7C										7C_34.5-35
					8A										8A_35-36 Run 8 35 - 40'
	36		SILTY SAND (SM); very dark grayish brown (2.5Y 3/2); wet; 85% fine sand; 15% no plasticity fines.												90% Recovery
	37		SILTY GRAVEL with Sand (GM); dark grayish brown (2.5Y 4/2); wet; 45% fine to coarse, subrounded gravel; 35% fine to coarse sand; 15% no plasticity fines; 5% cobbles or boulders.		8B										8B_36.5-37.5
	38														
			Poorly Graded SAND with Silt (SP-SM); dark grayish brown (2.5Y 4/2); wet; 90% fine sand; 10% no plasticity fines.		8C										8C_38.5-39
	39														
			SILTY SAND (SM); dark grayish brown (2.5Y 4/2); wet; 70% fine sand; 30% no plasticity fines; trace fine to coarse gravel up to 1.5".		8D										8D_39.5-40
75	40														Run 9 40 - 45' 75% Recovery 9A_41-42
			Poorly Graded SAND (SP); dark grayish brown (2.5Y 4/2); wet; 95% fine sand; 5% no plasticity fines.		9A										
	41														
	42														
	43														
	44														
			Poorly Graded GRAVEL (GP); dark grayish brown (2.5Y 4/2); wet; 95% fine to coarse, subrounded gravel, max.		9B								0	PA	9B_44-45
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,663,613.85 **Easting:** 2,280,851.54
Latitude: 39.42461 **Longitude:** -121.63910
Levee Station or Milepost: 2223+02 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_027S
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
70	45		4 in.; 20% cobbles or boulders; 5% fine sand; trace sand.												Run 10 40 - 45' 80% Recovery
	46		Poorly Graded SAND (SP); very dark gray (10YR 3/1); wet; 95% fine sand; 5% no plasticity fines.		10A										10A_45.5-46.5
	47														
	48		Poorly Graded GRAVEL (GP); dark grayish brown (2.5Y 4/2); wet; 85% fine to coarse, subrounded gravel, max. 3.5 in.; 15% cobbles or boulders; trace sand.		10B										10B_47.5-48.5
	49		SILTY GRAVEL with Sand (GM); grayish brown (2.5Y 5/2); wet; 60% fine to coarse, subrounded gravel, max. 4 in.; 15% fine sand; 15% no plasticity fines; 5% cobbles or boulders.		10C										10C_49-50
65	50		Poorly Graded SAND with Gravel (SP); dark grayish brown (2.5Y 4/2); wet; 65% fine to medium sand; 30% fine to coarse, subrounded gravel, max. 1.5 in.; 5% no plasticity fines.		11A										11A_50-51 Run 11 45 - 50' 97% Recovery
	51														
	52		Poorly Graded GRAVEL with Sand (GP); dark grayish brown (2.5Y 4/2); wet; 50% fine to coarse, subrounded gravel, max. 3.5 in.; 40% fine to coarse sand; 5% cobbles or boulders; 5% no plasticity fines.		11B										11B_51.5-52.5
	53		SILTY GRAVEL with Sand (GM); dark grayish brown (2.5Y 4/2); wet; 45% fine to coarse, subrounded gravel, max. 3 in.; 40% fine to coarse sand; 15% no plasticity fines.		11C										11C_52.5-53.5
	54														
	55		SANDY ELASTIC SILT (MH); brown (10YR 5/3); moist; 62% low plasticity fines; 38% fine sand.		11D				3.5P						11D_54.5-55
60	56								2.5P						Run 12 50 - 55' 100% Recovery
	57				12A					47	52	22	62	PA	12A_56.5-57.5
	58								1.25P						
	59		At 58.5 feet, stiff; medium plasticity fines.		12B				2.5P						12B_59-60
55	60		At 60 feet, stiff.		13A				3.5P						13A_60-60.5 Run 13 60 - 65' 100% Recovery
	61														
	62		SANDY LEAN CLAY (CL); brown (10YR 4/3); moist; 70% medium plasticity fines; 30% fine sand.		13B				4.5P						13B_61.5-62
	63		SILTY SAND (SM); brown (10YR 4/3); moist; 55% fine sand; 45% no plasticity fines. At 63.5 feet, 30% fines.		13C										13C_62.5-63
	64														
	65		CLAYEY SAND (SC); dark grayish brown (10YR 4/2); moist; 61% fine sand; 24% low plasticity fines; 15% fine to coarse, subrounded gravel. At 64.5 feet, 40% fines; 5% gravel.		13D				2.5P				24	PA	13D_64-64.5
50	65				14A										14A_65-66 Run 14 65 - 68' 100% Recovery
	66		CLAYEY GRAVEL with Sand (GC); yellowish brown (10YR 5/4); moist; 40% fine to coarse, subrounded gravel, max. 3.75 in.; 30% fine to medium sand; 30% medium plasticity fines.												
	67		At 66.5 feet, 25% low plastic fines; 45% gravel.												
	68		Poorly Graded SAND with Gravel (SP); yellowish brown (10YR 5/4); moist; 52% fine to coarse sand; 46% fine to coarse, subrounded gravel, max. 3.5 in.; 2% no plasticity fines.		15A								2	PA	15A_68-69 Run 15 68 - 70' 100% Recovery
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,663,613.85 **Easting:** 2,280,851.54
Latitude: 39.42461 **Longitude:** -121.63910
Levee Station or Milepost: 2223+02 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_027S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
45	70														Run 16 70 - 75' 87% Recovery
	71														
	72														
	73				16A										16A_73-73
	74														
40	75														Run 17 75 - 80' 90% Recovery
	76														
	77														
	78														
	79														
35	80		End of boring at 80'. Backfilled with cement bentonite grout. 16-47 lb. bags cement, 60 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	81														
	82														
	83														
	84														
30	85														
	86														
	87														
	88														
	89														
25	90														
	91														
	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 6,663,613.85 **Easting:** 2,280,851.54
Latitude: 39.42461 **Longitude:** -121.63910
Levee Station or Milepost: 2223+02 **Levee Mile:**
Levee Segment Reach 35
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_027S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
11/21/11	11/22/11	115.0 ft	NAVD 88	45.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Justin Lake	Joe Roberts, Rick Smedley	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Geoprobe 8140LC	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	3-5/8" OD Rod	M. Turner

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	21 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
115	0		SANDY SILT (ML); dark brown (10YR 3/3); moist; 70% no plasticity fines; 30% fine sand.		1A										1A_0-0.5 Hand Auger to 5' Run 1 0 - 5'
	1														
	2														
	3														
	4				1B										1B_4-4.5
110	5		SILT with Sand (ML); dark yellowish brown (10YR 4/4); moist; 80% no plasticity fines; 20% fine sand.												Run 2 5 - 10' 47% Recovery
	6				2A										2A_6-7
	7		At 7.5 feet, hard; 10% sand.						4P						
	8				2B										2B_8-9
	9														
105	10		SANDY SILTY CLAY (CL-ML); medium stiff; dark brown (10YR 3/3); moist; 59% low plasticity fines; 41% fine sand.		3A					23	25	5	59	PA	3A_10-11 Run 3 10 - 15' 53% Recovery
	11														
	12														
	13				3B										3B_13-14
	14														
100	15		SILT (ML); stiff; dark brown (10YR 3/3); moist; 95% low plasticity fines; 5% fine sand.		4A										4A_15-16 Run 4 15 - 20' 92% Recovery
	16														
	17		Well-Graded GRAVEL with Sand (GW); dark brown (10YR 3/3); moist; 66% fine to coarse, subrounded gravel, max. 3.25 in.; 34% fine to coarse sand; 0 fines.												
	18				4B								0	PA	4B_18-19
	19														
95	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,663,583.00 **Easting:** 2,281,507.03
Latitude: 39.42641 **Longitude:** -121.63920
Levee Station or Milepost: 2229+49 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_028S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
95	20													Run 5 20 - 25' 67% Recovery
	21	SILTY GRAVEL with Sand (GM); grayish brown (2.5Y 5/2); wet; 45% fine to coarse, subrounded gravel, max. 4 in.; 35% fine to coarse sand; 15% no plasticity fines; 5% cobbles or boulders.												
	22													
	23			7A										7A_23-24
	24													
90	25													Run 6 25 - 30' 67% Recovery
	26													
	27			8A										8A_27-28
	28	At 27.5 feet, 10% cobble up to 4".												
	29													
85	30													Run 7 30 - 35' 80% Recovery
	31	At 31 feet, 20% fines; 5% cobble.		9A										9A_30.5-31.5
	32	Poorly Graded GRAVEL with Silt and Sand (GP-GM); grayish brown (2.5Y 5/2); wet; 40% fine to coarse, subrounded gravel, max. 4 in.; 10% cobbles or boulders; 10% fine to coarse sand; 10% no plasticity fines.		9B										9B_32-33
	33			9C										9C_33-34
	34	SILTY GRAVEL with Sand (GM); grayish brown (2.5Y 5/2); wet; 45% fine to coarse, subrounded gravel, max. 5 in.; 30% fine to coarse sand; 15% no plasticity fines; 10% cobbles or boulders.		9D										9D_34-35
80	35													
	36	Poorly Graded GRAVEL with Sand (GP); grayish brown (2.5Y 5/2); wet; 50% fine to coarse, subrounded gravel, max. 2.5 in.; 45% fine to medium sand; 5% no plasticity fines.		10A				1P	29	54	33	77	PA	Run 8 35 - 37' 92% Recovery 10A_35.5-36.5
	37	FAT CLAY with Sand (CH); stiff; brown (10YR 5/3); moist; 71% high plasticity fines; 23% fine sand; trace gravel and cobble up to 3.5".						1.5P						Run 9 37 - 40' 100% Recovery 11A_37.5-38.5
	38	SANDY FAT CLAY (CH); hard; brown (10YR 5/3); moist; 64% high plasticity fines; 36% fine sand.		11A				4.5+P	30	58	34	64	PA	
	39							4.5+P						
75	40	SILTY SAND (SM); olive brown (2.5Y 4/4); moist; 59% fine sand; 41% low plasticity fines.		11B					20	32	10	41	PA	11B_39.5-40
	41													Run 10 40 - 45' 100% Recovery
	42			12A										12A_42-43
	43													
	44													
70	45													

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,663,583.00 **Easting:** 2,281,507.03
Latitude: 39.42641 **Longitude:** -121.63920
Levee Station or Milepost: 2229+49 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_028S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
70	45		CLAYEY SAND (SC); olive brown (2.5Y 4/4); moist; 70% fine sand; 30% low to medium plasticity fines.		12B						12B_44.75-45
	46										
	47		End of boring at 45'. Backfilled with cement bentonite grout. 7-47 lb. bags cement, 25 gallons water, 1/4 bag of bentonite (50 lb. bag)								
	48										
	49										
65	50										
	51										
	52										
	53										
	54										
60	55										
	56										
	57										
	58										
	59										
55	60										
	61										
	62										
	63										
	64										
50	65										
	66										
	67										
	68										
	69										
45	70										

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,663,583.00 **Easting:** 2,281,507.03
Latitude: 39.42641 **Longitude:** -121.63920
Levee Station or Milepost: 2229+49 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_028S
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
11/21/11	11/21/11	114.6 ft	NAVD 88	45.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	Joe Roberts, Rick Smedley	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Turner
☒ VERTICAL ☐ INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing		**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, Sonic(4")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA		**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout		**GROUNDWATER READING:**	**DURING DRILLING** 20 ft	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); stiff; dark brown (10YR 3/3); moist; 70% no plasticity fines; 30% fine sand.		1A				2.0P						1A_0-0.5 Hand Auger to 5' Run 1 0 - 5'
	1														
	2														
	3														
	4				1B										1B_4-4.5
110	5		At 4.5 feet, dark yellowish brown (10YR, 4/4).												Run 2 5 - 10' 50% Recovery
	6														
	7		SILT (ML); dark yellowish brown (10YR 3/4); moist; 95% low plasticity fines; 5% fine sand.												
	8				2A				0.5P	25	24	3	95	PA	2A_8-9
	9														
105	10														Run 3 10 - 15' 67% Recovery
	11				3A				1.5P						3A_11-12
	12		At 11.5 feet, stiff; 30% sand; non-plastic.												
	13														
	14		SILTY SAND (SM); dark yellowish brown (10YR 4/4); moist; 70% fine sand; 30% no plasticity fines.		3B										3B_14-15
100	15				4A										4A_15-16 Run 4 15 - 20'
	16		SANDY SILT (ML); medium stiff; brown (10YR 5/3); moist; 75% low plasticity fines; 25% fine sand.		4B				0.75P						87% Recovery 4B_16-17
	17		CLAYEY GRAVEL with Sand (GC); grayish brown (2.5Y 5/2); moist; 55% fine to coarse, subrounded gravel;		4C										4C_17-17.75
	18		20% fine to medium sand; 20% low plasticity fines; 5% cobbles or boulders.		4D										4D_17.75-18
	19		SILTY SAND (SM); olive brown (2.5Y 4/4); moist; 85% fine sand; 15% no plasticity fines.												
95	20		Poorly Graded GRAVEL with Sand (GP); dark grayish brown (2.5Y 4/2); wet; 62% fine to coarse, subrounded		4E								0	PA	4E_19-20

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,662,486.98 **Easting:** 2,281,509.99
Latitude: 39.42643 **Longitude:** -121.64308
Levee Station or Milepost: 2238+73 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_029S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		gravel, max. 3.75 in.; 38% fine to coarse sand; 0 fines.												Run 5 20 - 25' 93% Recovery
	21														
	22		At 21.5 feet, 20% fines; 5% cobble up to 3.5"; 35% sand; 40% gravel.												
	23		At 22.5 feet, 3" layer of SM.												
	24		At 23.5 feet, 6" layer with 10% fines.												
90	25		At 24.5 feet, 15% fines; cobble up to 5".		5A										5A_24-25
	26		Poorly Graded GRAVEL with Silt and Sand (GP-GM); olive brown (2.5Y 4/3); wet; 50% fine to coarse, subrounded gravel, max. 3.25 in.; 35% fine to coarse sand; 10% no plasticity fines; 5% cobbles or boulders.												Run 6 25 - 30' 73% Recovery
	27				6A										6A_27-28
	28														
	29														
85	30														Run 7 30 - 35' 60% Recovery
	31														
	32		SILTY GRAVEL with Sand (GM); grayish brown (2.5Y 5/2); wet; 45% fine to coarse, subrounded gravel, max. 3.5 in.; 30% no plasticity fines; 20% fine to coarse sand; 5% cobbles or boulders.												
	33				7A										7A_33-34
	34														
80	35														
	36		FAT CLAY (CH); very stiff; light olive brown (2.5Y 5/4); moist; 85% high plasticity fines; 15% fine sand.		8A				3.0P	32	59	36	85	PA	8A_35-36 Run 8 35 - 40' 100% Recovery
	37		At 36 feet, hard.												
	38														
	39		At 38.5 feet, very stiff.						3.0P						
75	40		At 39.5 feet, stiff; 10% sand; low plastic fines.		8B				1.5P						8B_39-40
	41		SILTY SAND (SM); very dark grayish brown (10YR 3/2); moist; 82% fine sand; 18% no plasticity fines.		9A								18	PA	Run 9 40 -45' 100% Recovery 9A_40.5-41.5
	42														
	43		At 42.5 feet, 35% fines.												
	44		At 43.5 feet, 1' fine gravel stringer.												
70	45		SILTY SAND with Gravel (GM); dark grayish brown (2.5Y 4/2); moist; 40% fine to coarse, subrounded		9B								24	PA	9B_44.25-45

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 6,662,486.98 **Easting:** 2,281,509.99
Latitude: 39.42643 **Longitude:** -121.64308
Levee Station or Milepost: 2238+73 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_029S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	45		gravel, max. 1.75 in.; 36% fine to medium sand; 24% low plasticity fines.								
	46										
	47		End of boring at 45'. Backfilled with cement bentonite grout. 8-47 lb. bags cement, 30 gallons water, 1/4 bag of bentonite (50 lb. bag)								
	48										
	49										
65	50										
	51										
	52										
	53										
	54										
60	55										
	56										
	57										
	58										
	59										
55	60										
	61										
	62										
	63										
	64										
50	65										
	66										
	67										
	68										
	69										
45	70										

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 6,662,486.98 **Easting:** 2,281,509.99
Latitude: 39.42643 **Longitude:** -121.64308
Levee Station or Milepost: 2238+73 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_029S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 1/12/12	**DATE COMPLETED** 1/12/12	**GROUND ELEVATION** 114.0 ft	**ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 65.0 ft
DRILLING CONTRACTOR Cascade		**DRILLER'S NAME** Kevin Rogers	**HELPER'S NAME** Jason Jones, Brandon Maple		**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic		**DRILL RIG MAKE AND MODEL** Sonic Core SDC 500			**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4-3/8 Stainless Steel Core Barrel		**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF			**FIELD LOGGER** M. Turner
X VERTICAL ☐ **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 5-7/8" OD			**FIELD LOG REVIEWER** RN
SAMPLER TYPE(S) Bag, Sonic(4")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA			**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout		**GROUNDWATER READING:**	**DURING DRILLING** 21 ft	**AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); dark brown (7.5YR 3/3); moist; 60% no plasticity fines; 40% fine sand.												Hand auger to 5'
	1														
	2														
	3				1										1_3.0-3.5
110	4														Run 1 5-15' 70% recovery
	5														
	6														
	7		At 7 feet 45% fine sand.		2										2_7.0-7.5
	8														
105	9		SILTY SAND (SM); dark brown (7.5YR 3/3); moist; 55% fine sand; 45% no plasticity fines.												
	10				3										3_10.0-10.5
	11														
	12				4										4_12.0-12.5
	13														
100	14		Poorly Graded GRAVEL with Silt and Sand (GP-GM); brown (10YR 4/3); moist; 45% fine to coarse, subrounded gravel; 40% fine to coarse sand; 10% no plasticity fines; 5% cobbles, max. 3-3/4 in.		5										5_13.5-14.5
	15														Run 2 15-35' 50% recovery
	16														
	17														
	18														
95	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,282,212.47 **Easting:** 6,662,362.75
Latitude: 39.42836 **Longitude:** -121.64351
Levee Station or Milepost: 2248+15 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_032S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20			6										6_20.0-21.0
	21	CLAYEY GRAVEL with Sand (GC); brown (10YR 4/3); wet; 45% fine to coarse, subrounded gravel; 25% fine to medium sand; 25% medium plasticity fines; 5% cobbles, max. 4-3/4 in.		7										7_21.0-22.0
	22													
	23			8										8_23.0-24.0
90	24													
	25	Poorly Graded GRAVEL with Silt and Sand (GP-GM); dark grayish brown (2.5Y 4/2); wet; 50% fine to coarse, subrounded gravel; 35% fine to coarse sand; 10% no plasticity fines; 5% cobbles, max. 4 in.		9										9-25.5-26.5
	26													
	27													
	28	Poorly Graded GRAVEL with Sand (GP); dark grayish brown (2.5Y 4/2); wet; 50% fine to coarse, subrounded gravel, max. 2 in.; 45% medium to coarse sand; 5% fines.		10										10_28.0-29.0
85	29	SILTY GRAVEL with Sand (GM); dark grayish brown (2.5Y 4/2); wet; 65% fine to coarse, subrounded gravel; 15% fine to coarse sand; 15% no plasticity fines; 5% cobbles, max. 3-1/2 in.		11										11_29.0-30.0
	30													
	31	Poorly Graded SAND with Gravel (SP); olive brown (2.5Y 4/4); wet; 50% fine to coarse sand; 40% fine to coarse, subrounded gravel; 5% no plasticity fines; 5% cobbles, max. 3-1/2 in.		12										12_31.0-32.0
	32													
	33	SILTY GRAVEL with Sand (GM); olive gray (5Y 5/2); wet; 50% fine to coarse, subrounded gravel, max. 2-1/2 in.; 35% fine to coarse sand; 15% no plasticity fines.		13										13_32.5-33.5
80	34	LEAN CLAY (CL); stiff; olive brown (2.5Y 4/4); moist; low plasticity fines; 5% fine sand.		14										14_34.0-35.0
	35	SANDY LEAN CLAY (CL); stiff; olive brown (2.5Y 4/4); moist; 70% low plasticity fines; 30% fine sand.		15										Run 3 35-45' 75% recovery 15_35.0-36.0
	36													
	37													
	38	SILTY SAND (SM); olive brown (2.5Y 4/3); moist; 65% fine sand; 35% no plasticity fines.		16						38	6	33	PA	16_37.5-38.5
75	39	At 39 feet 30% fines; 5% fine to coarse, subrounded gravel, max. 1-1/2 in.		17										17_39.0-40.0
	40	CLAYEY GRAVEL with Sand (GC); dark grayish brown (2.5Y 4/2); moist; 40% fine to coarse, subrounded gravel, max. 2-1/2 in.; 30% fine to medium sand; 30% low plasticity fines.		18										18_40.0-41.0
	41													
	42													
	43													
70	44	At 43.5 feet wet; 35% gravel; 5% cobbles, max. 3-1/2 in.; medium plasticity fines.		19										19_43.5-44.5
	45													

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,282,212.47 **Easting:** 6,662,362.75
Latitude: 39.42836 **Longitude:** -121.64351
Levee Station or Milepost: 2248+15 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_032S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45														Run 4 45-65' 72% recovery
	46														
	47				20										20_46.0-47.0
	48														
65	49				21										21_48.0-49.0
	50														
	51														
	52														
	53				22										22_53.0-54.0
60	54														
	55														
	56														
	57														
	58		At 58 feet low plasticity fines; no cobbles; 40% gravel, max. 3 in.		23										23_58.0-59.0
55	59														
	60														
	61														
	62														
	63		At 63 feet 5% cobbles, max. 3-1/2 in.		24										24_63.0-64.0
50	64														
	65		End of boring at 65'.												
	66														
	67														
	68														
45	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,282,212.47 **Easting:** 6,662,362.75
Latitude: 39.42836 **Longitude:** -121.64351
Levee Station or Milepost: 2248+15 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_032S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
1/12/12	1/12/12	113.9 ft	NAVD 88	42.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	Kevin Rogers	Jason Jones, Brandon Maple	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Sonic Core SDC 500	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4-3/8 Stainless Steel Core Barrel		M. Turner

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" OD	R. NIXON

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout		

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		See companion log SM0007_032S for lithology 0-30 feet. This supplemental boring was drilled to confirm clay between 34-37.5 feet.												Run 1 0-10' Hand auger to 5'
	1														
	2														
	3														
110	4														
	5														
	6														
	7														
	8														
105	9														
	10														Run 2 10-30'
	11														
	12														
	13														
100	14														
	15														
	16														
	17														
	18														
95	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,282,212.40 **Easting:** 6,662,356.73
Latitude: 39.42836 **Longitude:** -121.64353
Levee Station or Milepost: 2248+20 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_033S
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
90	20														
	21														
	22														
	23														
	24														
	25														
	26														
	27														
	28														
85	29														
	30		LEAN CLAY (CL); very stiff; olive brown (2.5Y 4/4); low plasticity fines; 10% fine sand.		1										1_30.0-31.0 Run 3 30-42' 73% recovery
	31														
	32				2										2_31.5-32.5
	33				3										3_32.5-33.0
80	34		LEAN CLAY with Sand (CL); olive brown (2.5Y 4/4); low plasticity fines; 15% fine sand.		4										4_34.0-35.0
	35				5										5_35.0-36.0
	36														
	37		SANDY LEAN CLAY (CL); olive brown (2.5Y 4/4); 60% low plasticity fines; 40% fine sand.		6										6_36.5-37.5
	38				7										7_37.5-38.5
75	39														
	40				8										8_39.0-40.0
	41		SILTY SAND (SM); olive brown (2.5Y 4/3); 55% fine sand; 45% no plasticity fines.		9										9_40-0-41.0
	42				10										10_4.15-42.5
	43		End of boring at 42.5'.												
70	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 2,282,212.40 **Easting:** 6,662,356.73
Latitude: 39.42836 **Longitude:** -121.64353
Levee Station or Milepost: 2248+20 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_033S
Sheet 2 of 2

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
11/16/11	11/17/11	112.9 ft	NAVD 88	50.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	Joe Roberts, Rick Smedley	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Turner
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout			15 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); dark brown (10YR 3/3); moist; 70% no plasticity fines; 30% fine sand; with rootlets.		1A										1A_0-.5 Hand Auger to 5' Run 1 0 - 5'
	1														
	2														
110	3														
	4		At4 feet, dark yellowish brown (10YR, 3/4).		1B										1B_4-4.5
	5		SILTY SAND (SM); dark yellowish brown (10YR 3/4); moist; 50% fine sand; 50% no plasticity fines.												Run 2 5 - 10' 60% Recovery
	6				2A				3.75P	12			50	PA	2A_6-7
	7														
105	8														
	9														
	10		LEAN CLAY (CL); very stiff; brown (10YR 4/3); moist; 95% low plasticity fines; 5% fine sand.		3A										3A10-10.5 Run 3 10 - 15' 70% Recovery
	11								3.0P						
	12		Poorly Graded GRAVEL with Silt and Sand (GP-GM); olive brown (2.5Y 4/3); moist; 45% fine to coarse, subrounded gravel, max. 3.75 in.; 40% fine to coarse sand; 10% no plasticity fines; 5% cobbles or boulders.												
100	13				3B										3B_13-14
	14														
	15		Poorly Graded GRAVEL with Sand (GP); olive brown (2.5Y 4/3); wet; 60% fine to coarse, subrounded gravel, max. 3.25 in.; 40% fine to coarse sand; 0 fines.												Run 4 15 - 20' 93% Recovery
	16				4A								0	PA	4A_16-17
	17														
95	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte

Coordinates: Northing: 2,282,745.88 **Easting:** 6,661,852.24

Latitude: 39.42983 **Longitude:** -121.64531

Levee Station or Milepost: 2255+00 **Levee Mile:**

Levee Segment Reach 36

Survey Method: GPS **Coord. System:** CA State Plane Zone II

Channel / River Name / Feature: Feather River

LOG OF BORING

SM0007_030S

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														Run 5 20 - 25' 80% Recovery 5A_21-22
	21														
	22														
90	23		Poorly Graded GRAVEL with Sand (GP); grayish brown (2.5Y 5/2); wet; 70% fine to coarse, subrounded gravel, max. 4.25 in.; 30% fine to coarse sand; 0 fines.		5A										
	24				5B								0	PA	5B_23-24
	25														Run 6 25 - 30' 60% Recovery
	26														
	27		Poorly Graded SAND (SP); grayish brown (2.5Y 5/2); wet; 85% fine to coarse sand; 10% fine to coarse, subrounded gravel, max. 2.5 in.; 5% no plasticity fines.		6A										6A_27-28
85	28														
	29		Poorly Graded GRAVEL with Silt and Sand (GP-GM); grayish brown (2.5Y 5/2); wet; 50% fine to coarse, subrounded gravel, max. 3.5 in.; 35% fine to coarse sand; 10% no plasticity fines; 5% cobbles or boulders.		6B										6B_29-30
	30														Run 7 30 - 35' 50% Recovery
	31		At 31 feet, cobble up to 4.5" in maximum dimension.												
	32														
80	33														
	34		FAT CLAY with Sand (CH); very stiff; olive brown (2.5Y 4/4); moist; 71% high plasticity fines; 29% fine sand.		7A				2.75P	32	52	28	71	PA	7A_34-35
	35														Run 8 35 - 40' 100% Recovery
	36		At 36 feet, occasional cobble up to 5" in maximum dimension.						2.0P						
	37														
75	38		At 38 feet, hard; weak cementation.												
	39								4.5+P						
	40				8A										8A_39-40
	41		CLAYEY GRAVEL with Sand (GC); dark grayish brown (2.5Y 4/2); moist; 45% fine to coarse, subrounded gravel, max. 3.25 in.; 33% fine to coarse sand; 17% medium plasticity fines; 5% cobbles or boulders.		9A								17	PA	Run 9 40 -45' 80% Recovery 9A_40.5-41.5
	42														
70	43		At 43 feet, dark gray (2.5Y,4/1).												
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,282,745.88 **Easting:** 6,661,852.24
Latitude: 39.42983 **Longitude:** -121.64531
Levee Station or Milepost: 2255+00 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_030S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45														Run 10 40 - 45' 97% Recovery
	46														
	47														
65	48				10A										10A_47-48
	49														
	50														
	51		End of boring at 50'. Backfilled with cement bentonite grout. 8-47 lb. bags cement, 30 gallons water, 1/8 bag of bentonite (50 lb. bag)												
	52														
60	53														
	54														
	55														
	56														
	57														
55	58														
	59														
	60														
	61														
	62														
50	63														
	64														
	65														
	66														
	67														
45	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,282,745.88 **Easting:** 6,661,852.24
Latitude: 39.42983 **Longitude:** -121.64531
Levee Station or Milepost: 2255+00 **Levee Mile:**
Levee Segment Reach 36
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_030S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/3/11 **DATE COMPLETED** 10/3/11	**GROUND ELEVATION** 121.0 ft **ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 85.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Mike Wilkerson **HELPER'S NAME** R. Jimenez, J. Socey		**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** GUS PECH 400		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" Button Bit	**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF Pin and Box		**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 5-7/8" OD		**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA		**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING:** **DURING DRILLING** 21 ft	**AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel.												
120	1														
	2		SILTY GRAVEL (GM); yellowish brown; moist; 70% gravel; 30% low plasticity fines.												Run 1 1.5 - 5'
	3														
	4														
	5				1								26	PA	1_5.0-6.0 Run 2 5 - 15' 100% Recovery
115	6		SILT (ML); dark yellowish brown; moist; 90% low plasticity, slow dilatancy fines; 10% fine sand.												
	7														
	8														
	9														
	10														
110	11				2										2_11.0-12.0
	12														
	13														
	14														
	15														Run 3 15 - 35' 100% Recovery
105	16														
	17				3										3_17.0-18.0
	18														
	19														
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,283,532.76 **Easting:** 6,661,700.32
Latitude: 39.43199 **Longitude:** -121.64584
Levee Station or Milepost: 2262+19 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014S
Sheet 1 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
100	21		Poorly Graded SAND (SP); dark brown; wet; 100% medium to coarse sand.												
	22														
	23				4										4_23.0-24.0
	24														
	25		Poorly Graded GRAVEL (GP); greenish gray; wet; 90% gravel; 10% medium sand.												
95	26														
	27														
	28														
	29				5										5_29.0-30.0
	30														
90	31														
	32		LEAN CLAY (CL); yellowish brown; moist; 90% medium plasticity, no dilatancy fines; 10% fine sand.												
	33				6					35	47	26			6_33.0-34.0
	34														
	35		SANDY LEAN CLAY (CL); yellowish brown; moist; 60% low plasticity, no dilatancy fines; 40% fine sand.												Run 4 35 - 45'
85	36				7								63	PA	7_36.0-37.0
	37														
	38		Well-Graded GRAVEL with Sand (GW); very dark greenish gray; moist; 65% gravel; 25% medium sand; 10% low plasticity fines.		8										8_38.0-39.0
	39														
	40		At 40 feet greenish gray; 80% gravel; 15% sand; 5% low plasticity fines.												
80	41														
	42														
	43				9										9_43.0-44.0
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,283,532.76 **Easting:** 6,661,700.32
Latitude: 39.43199 **Longitude:** -121.64584
Levee Station or Milepost: 2262+19 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014S
Sheet 2 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														Run 5 45 - 50'
75	46														
	47														
	48														
	49														
	50														Run 6 50 - 55' 100% Recovery
70	51														
	52				10										10_52.0-53.0
	53														
	54														
	55		CLAYEY GRAVEL with Sand (GC); greenish gray; moist; 60% gravel; 20% fine to medium sand; 20% low plasticity fines.												Run 7 55 - 65' 100% Recovery
65	56														
	57				11					4	26	9	22	PA	11_57.0-58.0
	58														
	59														
	60														
60	61														
	62				12										12_62.0-63.0
	63														
	64														
	65		At 65 feet dark grayish brown; 40% gravel 35% medium plasticity fines; 25% medium to coarse sand.												Run 8 65 - 75'
55	66														
	67														
	68				13										13_68.0-69.0
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,283,532.76 **Easting:** 6,661,700.32
Latitude: 39.43199 **Longitude:** -121.64584
Levee Station or Milepost: 2262+19 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70		At 73 feet dark gray; 40% poorly graded gravel; 30% medium to coarse sand; 30% low plasticity fines.												
50	71														
	72														
	73														
	74														
	75														Run 9 75 - 85'
45	76														
	77				14										14_77.0-78.0
	78														
	79														
	80														
40	81														
	82														
	83		CLAYEY SAND (SC); greenish gray; moist; 60% fine to medium sand; 40% low plasticity fines.		15										15_83.0-84.0
	84														
	85		End of boring at 85'. Backfilled with cement bentonite grout. 25-47 lb. bags cement, 250 gallons water, 3 bags of bentonite (50 lb. bag)												
35	86														
	87														
	88														
	89														
	90														
30	91														
	92														
	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,283,532.76 **Easting:** 6,661,700.32
Latitude: 39.43199 **Longitude:** -121.64584
Levee Station or Milepost: 2262+19 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 11/17/11 **DATE COMPLETED** 11/18/11	**GROUND ELEVATION** 115.2 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 95.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Justin Lake **HELPER'S NAME** Joe Roberts, Rick Smedley	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** Geoprobe 8140LC	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4" Core Barrel	**DRILLING ROD TYPE AND DIAMETER** 3-5/8" OD Rod	**FIELD LOGGER** M. Turner
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** 20 ft	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
115	0		SANDY SILT (ML); very stiff; dark brown (10YR 3/3); moist; 70% no plasticity fines; 30% fine sand.		1A				6P 2.5P						1A_0-0.5 Hand auger to 5' Run 1 0 - 5'
	1														
	2														
	3														
	4				1B										1B_4-4.5
			At 4.5 feet, dark yellowish brown (10YR, 3/4).												
110	5														Run 2 5 - 10' 60% Recovery
	6		SANDY SILT (ML); soft; brown (10YR 4/3); moist; 55% low plasticity fines; 45% fine sand.		2A				0.5P	24	22	2	55	PA	2A_6-6.5
	7														
	8														
	9		At 9 feet, 20% fine sand.												
	10		LEAN CLAY with Sand (CL); hard; brown (10YR 4/3); moist; 85% low plasticity fines; 15% fine sand; moderate cementation.		2B				4.5+P						2B_9.5-10
105			SANDY SILT (ML); brown (10YR 4/3); moist; 55% no plasticity fines; 45% fine sand.												Run 3 10 - 15' 60% Recovery
	11														
	12														
	13				3A										3A_13-14
	14														
	15														
100			LEAN CLAY (CL); soft; dark yellowish brown (10YR 4/4); moist; 95% low plasticity fines; 5% fine sand.		4A				0.5P						4A_15-16 Run 4 15 - 20' 90% Recovery
	16								0.5P						
	17														
	18		SILTY SAND (SM); dark gray (5Y 4/1); moist; 85% fine sand; 15% no plasticity fines.		4B										4B_18-18.5
					4C										4C_18.5-19
	19		Poorly Graded SAND (SP); dark gray (5Y 4/1); moist; 95% fine to medium sand; 5% no plasticity fines.		4D										4D_19-20
	20		SANDY SILT (ML); dark gray (5Y 4/1); moist; 70% fine						0.5P						

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,284,318.16 **Easting:** 6,661,549.53
Latitude: 39.43415 **Longitude:** -121.64636
Levee Station or Milepost: 2270+03 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011S
Sheet 1 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
95	20		sand; 30% no plasticity fines; ml.												
	21		SILTY SAND (SM); very dark gray (5Y 3/1); wet; 65% fine to medium sand; 35% no plasticity fines.		5A										5A_20-21 Run 5 20 - 25' 80% Recovery
	22														
	23		SILTY GRAVEL with Sand (GM); dark gray (5Y 4/1); moist; 55% fine to coarse, subrounded gravel, max. 3 in.; 25% no plasticity fines; 20% fine to coarse sand.		5B										5B_23-24
	24														
90	25														Run 6 25 - 30' 100% Recovery
	26				6A										6A_26-27
	27		At 26.5 feet, 5% cobble up to 3.5 inches; 50% gravel.												
	28														
	29		Poorly Graded GRAVEL with Sand (GP); dark gray (5Y 4/1); wet; 50% fine to coarse, subrounded gravel, max. 3 in.; 45% fine to coarse sand; 5% no plasticity fines.		6B										6B_28.5-29.5
	30		Poorly Graded GRAVEL with Silt and Sand (GP-GM); dark gray (5Y 4/1); wet; 60% fine to coarse, subrounded gravel, max. 3 in.; 30% fine to coarse sand; 10% no plasticity fines.		6C										6C_29.5-30
85	31														Run 7 30 - 35' 100% Recovery
	32		Poorly Graded GRAVEL (GP); dark gray (5Y 4/1); wet; 50% fine to coarse, subrounded gravel, max. 3 in.; 49% fine to coarse sand; 1% no plasticity fines.		7A								1	PA	7A_32-33
	33														
	34		At 34 feet, light olive brown (2.5Y, 5/4).												
80	35														Run 8 35 - 40' 97% Recovery
	36		SANDY LEAN CLAY (CL); very stiff; dark yellowish brown (10YR 4/4); moist; 59% low plasticity fines; 41% fine sand.		8A				3.0P		42	22	59	PA	8A_36-36.5
	37														
	38								2.0P						
	39		CLAYEY SAND (SC); olive brown (2.5Y 4/4); moist; 75% fine sand; 25% low plasticity fines; trace fine gravel up to 1/2" maximum dimension.		8B										8B_39-39.5
75	40		CLAYEY GRAVEL (GC); grayish brown (2.5Y 5/2); moist; 50% fine to coarse, subrounded gravel, max. 3 in.; 25% fine to coarse sand; 25% medium plasticity fines.												Run 9 40 - 45' 97% Recovery
	41				9A										9A_41-42
	42														
	43														
	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,284,318.16 **Easting:** 6,661,549.53
Latitude: 39.43415 **Longitude:** -121.64636
Levee Station or Milepost: 2270+03 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011S
Sheet 2 of 5

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
70	45														Run 10 45 - 50' 90% Recovery
	46														
	47		At 46.5 feet, with cobble up to 3-3/4" in maximum dimension.												
	48				10A										10A_47-48
	49														
65	50														Run 11 50 - 55' 800% Recovery
	51														
	52				11A										11A_52-53
	53														
	54														
60	55		SILTY GRAVEL (GM); grayish brown (2.5Y 5/2); wet; 45% fine to coarse, subrounded gravel, max. 3.5 in.; 30% fine to coarse sand; 20% no plasticity fines; 5% cobbles or boulders.												Run 12 55 - 60' 87% Recovery
	56				12A										12A_56-57
	57														
	58														
	59														
55	60		CLAYEY GRAVEL (GC); grayish brown (2.5Y 5/2); wet; 50% fine to coarse, subrounded gravel, max. 2 in.; 25% fine to coarse sand; 25% medium plasticity fines.		12B								25	PA	12B_59.5-60
	61														Run 13 60 - 65' 93% Recovery
	62														
	63		At 63 feet, moist.												
	64		SILTY CLAYEY GRAVEL (GC-GM); grayish brown (2.5Y 5/2); wet; 40% fine to coarse, subrounded gravel, max. 2 in.; 35% low plasticity fines; 25% fine to coarse sand.												
50	65				13A						22	7	35	PA	13A_64-65
	66				14A										Run 14 65 - 67.5' 100% Recovery 14A_66-67
	67														
	68		CLAYEY GRAVEL (GC/SC); olive brown (2.5Y 4/4); moist; 40% fine to coarse, subrounded gravel, max. 2 in.; 40% fine to coarse sand; 20% medium plasticity fines.		15A										Run 15 67.5 - 70' 100% Recovery 15A_68-69
	69		CLAYEY GRAVEL (GC); olive brown (2.5Y 4/4); moist;		15B										15B_69-70
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,284,318.16 **Easting:** 6,661,549.53
Latitude: 39.43415 **Longitude:** -121.64636
Levee Station or Milepost: 2270+03 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011S
Sheet 3 of 5

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
45	70		40% fine to coarse, subrounded gravel, max. 3 in.; 30% fine to medium sand; 30% low plasticity fines.												Run 16 70 - 75' 100% Recovery
	71														
	72		At 71.5 feet, medium plastic fines; 25% sand; 45% gravel.		16A										16A_72-73
	73														
	74														
40	75														Run 17 75 - 78.5' 57% Recovery
	76		At 75.5 feet, 30% sand; 40% gravel.												
	77														
	78		At 77.5 feet, 25% sand; 45% gravel.		17A										17A_77.5-78.5
	79														Run 18 78.5 - 80' 18A_79-80
					18A										
35	80														Run 19 80 - 85' 100% Recovery
	81														
	82														
	83		CLAYEY SAND (SC); light olive brown (2.5Y 5/4); moist; 60% fine to medium sand; 40% medium plasticity fines.		19A										19A_83-84
	84		At 84 feet, 45% fines.												
	85				20A										20A_85-86 Run 20 85 - 90'
30	86		SILTY SAND (SM); dark gray (2.5Y 4/1); moist; 75% fine sand; 25% no plasticity fines.												80% Recovery
	87														
	88				20B										20B_88-89
	89														
25	90				21A										21A_90-91 Run 21 90 - 95' 80% Recovery
	91		At 90.5 feet, 20% fines, fine to coarse sand.												
	92														
	93		CLAYEY SAND (SC); dark grayish brown (2.5Y 4/2); moist; 80% fine sand; 20% low plasticity fines; moderate cementation.												
	94				21B										21B_94-95
	95														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,284,318.16 **Easting:** 6,661,549.53
Latitude: 39.43415 **Longitude:** -121.64636
Levee Station or Milepost: 2270+03 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011S
Sheet 4 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
20	95		End of boring at 95'. Backfilled with cement bentonite grout. 17-47 lb. bags cement, 60 gallons water, 1/2 bag of bentonite (50 lb. bag)								
	96										
	97										
	98										
	99										
15	100										
	101										
	102										
	103										
	104										
10	105										
	106										
	107										
	108										
	109										
5	110										
	111										
	112										
	113										
	114										
0	115										
	116										
	117										
	118										
	119										
	120										

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 2,284,318.16 **Easting:** 6,661,549.53
Latitude: 39.43415 **Longitude:** -121.64636
Levee Station or Milepost: 2270+03 **Levee Mile:**
Levee Segment Reach 37
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_011S
Sheet 5 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
7/28/11	7/29/11	117.3 ft	NAVD 88	41.5 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Gregg Drilling & Testing, Inc.	Erik Santellan	Josh Reisch	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA, Mud Rotary	Marl M-10	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger, 4" Tricone	NWJ Rod 2-5/8" OD	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED		TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, MCal(2.5"), Shelby(2.87"), SPT(1.375")	Marl, automatic, 140 lbs / 30-inch drop	87.7%

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	17 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY SILT (ML); very soft; yellowish red; moist; 65% slow dilatancy fines; 35% fine sand.												
115	1														
	2														
	3				1	100							63	PA HD	1_3.0-3.5
	4														
	5				2A 2B	94	3 3 3 [6]		<0.25P	15	24	4	71	PA UW	2A_5.5-6.0 2B_6.0-6.5
	6														
110	7														
	8				3	50				17				UW	3_7.5-8.5 Hard to push at 8.5'
	9														
	10														
	11		Poorly Graded GRAVEL with Sand (GP); very dense; grayish green; moist; 75% gravel; 21% sand; 4% no plasticity fines.		4	22	29 50/5" [50/5"]						3	PA	4_11.0-11.5
105	12														
	13					0	50/4"								No recovery due to large cobbles (>3").
	14						[REF]								
	15				5	11	27 50/2" [50/2"]								5_15.0-16.5
	16														
100	17														
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,286,405.46 **Easting:** 6,661,653.85
Latitude: 39.43988 **Longitude:** -121.64596
Levee Station or Milepost: 2291+02 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20					0	50/3"								No recovery due to large cobbles (>3").
	21						[REF]								
95	22														
	23		Poorly Graded GRAVEL with Sand (GP); very dense; grayish green; moist; 60% gravel; 40% sand.		6	11	19 33 45	114							6_22.5-24.0
	24						[78]								
	25														
	26														
90	27				7	28	50/5"						1	PA	7_27-27.5
	28						[REF]								
	29														
	30														
	31														
85	32				8	17	50/3"								8_32.0-32.5
	33						[REF]								
	34														
	35				9A 9B	50	14 19 29						4	PA	9A_35.5-36.0 9B_36.0-36.5
	36														
80	37						[48]								
	38														
	39														
	40				10	17	50/3"								10_40.0-40.5
	41						[REF]								
75	42		End of boring at 41.5'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 90 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,286,405.46 **Easting:** 6,661,653.85
Latitude: 39.43988 **Longitude:** -121.64596
Levee Station or Milepost: 2291+02 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_010A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/18/11	8/19/11	133.0 ft	NAVD 88	147.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Boart Longyear	Justin Kilgore	Casey King/Robert Leininger	17 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Prosonic Full Size Truck Mounted	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	Prosonic 300 XL	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	33 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		6 inches road gravel.												Hand Auger to 5'
	1		[LEVEE FILL] CLAYEY SAND (SC); dark brown; moist; 70% fine sand; 30% low plasticity fines.												
130	2														
	3														
	4														
	5				1								34	PA	1_4.5-5.0
	6														Run 1 5 - 15' 100% Recovery
	7														
125	8														
	9														
	10		[LEVEE FILL] SANDY SILT (ML); dark brown; moist; 70% low plasticity fines; 30% fine sand.		2					21	28	6	69	PA	2_10.0-11.0
	11														
	12														
120	13														
	14														
	15														Run 2 15 - 25' 100% Recovery
FILL	16														
	17		SILTY SAND (SM); dark brown; moist; 55% fine sand; 45% low plasticity fines.		3								47	PA	3_17.0-8.0
115	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 1 of 7

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		SANDY SILT (ML); dark brown; moist; 60% low plasticity fines; 40% fine sand.		4								60	PA HD	4_20.0-21.0
	21														
	22														
110	23														
	24														
	25		Well-Graded GRAVEL with Sand (GW); moist; 60% subrounded gravel; 36% fine sand; 4% low plasticity fines.		5								4	PA HD	5_25.0-26.0 Run 3 25 - 35' 100% Recovery
	26														
	27														
105	28														
	29														
	30														
	31														
	32														
100	33				6										6_33.0-34.0
	34				7								2	PA	7_34.0-35.0
	35														Run 4 35 - 45' 100% Recovery
	36														
	37														
95	38														
	39														
	40				8										8_40.0-41.0
	41														
	42														
90	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 2 of 7

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45			9										9_45.0-46.0 Run 5 45 - 55' 100% Recovery
	46													
	47	Poorly Graded SAND (SP); very dark grayish brown; wet; 95% medium sand; 5% low plasticity fines.		10										10_47.0-48.0
85	48													
	49	Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 70% subrounded gravel, max. 2 in.; 20% fine sand; 10% low plasticity fines; cobbles.		11										11_48.5-49.5
	50													
	51													
	52													
80	53													
	54	Well-Graded SAND with Clay and Gravel (SW-SC); very dark grayish brown; wet; 55% fine to coarse sand; 35% subrounded gravel; 10% low plasticity fines.		12										12_54.0-55.0
	55	Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 70% subrounded gravel, max. 2 in.; 20% medium sand; 10% low plasticity fines; cobbles.		13										13_55.0-56.0 Run 6 55 - 65' 100% Recovery
	56													
	57													
75	58													
	59													
	60													
	61													
	62													
70	63	CLAYEY SAND with Gravel (SC); olive brown; wet; 65% fine to coarse sand; 20% subrounded gravel, max. 2 in.; 15% low plasticity fines; cobbles.		14								13	PA	14_630-64.0
	64													
	65	SILTY GRAVEL with Sand (GM); moist; 60% subrounded gravel; 20% fine to coarse sand; 20% low plasticity fines.		15								19	PA	15_65.0-66.0 Run 7 65 -75' 100% Recovery
	66	CLAYEY GRAVEL with Sand (GC); wet; 65% subrounded gravel; 20% low plasticity fines; 15% fine to coarse sand.		16								19	PA	16_66.0-67.0
	67	At 67 feet 70% subrounded gravel; 15% fine to coarse sand; 15% low plasticity fines.		17								15	PA	17_67.0-68.0
65	68													
	69													
	70													

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 3 of 7

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70														
	71														
	72														
60	73		Well-Graded SAND with Clay and Gravel (SW-SC); wet; 60% fine to coarse sand; 20% subrounded gravel; 10% fines.		18					11	40	16	8	PA	18_72.0-73.0
	74														
	75														Run 8 75 - 85' 100% Recovery
	76														
	77														
55	78		CLAYEY GRAVEL with Sand (GC); moist; 60% subrounded gravel; 25% fine to coarse sand; 15% low plasticity fines.		19										19_77.0-78.0
	79														
	80														
	81														
	82				20										20_82.0-83.0
50	83														
	84														
	85														Run 9 85 - 95' 100% Recovery
	86														
	87				21										21_87.0-88.0
45	88														
	89														
	90														
	91														
	92				22										22__92.0-93.0
40	93														
	94														
	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 4 of 7

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	95														Run 10 95 - 105' 100% Recovery
	96														
	97														
35	98				23										23_98.0-99.0
	99														
	100		SILTY SAND (SM); very dark brown; wet; 75% fine sand; 25% no plasticity fines; cemented.		24										24_100.0-101.0
	101														
	102														
30	103														
	104														
	105														Run 11 105 - 115' 100% Recovery
	106														
	107				25										25_107.0-108.0
25	108														
	109														
	110														
	111														
	112				26										26_112.0-113.0
20	113														
	114														
	115														Run 12 115 -125' 100% Recovery
	116														
	117		CLAYEY SAND (SC); dark yellowish brown; wet; 60% fine sand; 40% low plasticity fines; cemented.		27										27_117.0-118.0
15	118														
	119														
	120														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 5 of 7

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
10	120														
	121														
	122														
	123														
	124														
	125				28										28_125.0-126.0 Run 13 125 - 135' 100% Recovery
	126														
	127		CLAYEY GRAVEL with Sand (GC); wet; 60% subangular gravel; 20% fine to coarse sand; 20% low plasticity fines.		29										29_127.0-128.0
5	128														
	129														
	130														
	131		CLAYEY SAND (SC); very dark brown; wet; 85% medium sand; 15% low plasticity fines.		30										30_131.0-132.0
	132		CLAYEY GRAVEL with Sand (GC); wet; 60% subangular gravel; 25% fine to coarse sand; 15% low plasticity fines.		31										31_132.0-133.0
0	133														
	134														
	135		Poorly Graded SAND with Clay (SP-SC); very dark brown; wet; 90% medium sand; 10% low plasticity fines.		32										32_135.0-136.0 Run 14 135 -147' 100% Recovery
	136														
	137														
-5	138														
	139														
	140				33										33_140.0-141.0
	141														
	142														
-10	143														
	144														
	145														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 6 of 7

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	145														
	146														
	147		CLAYEY SAND (SC); very dark brown; wet; 80% medium sand; 20% low plasticity fines; cemented.		34										34_146.0-147.0
-15	148		End of boring at 147'. Backfilled with cement bentonite grout. 39-47 lb. bags cement, 300 gallons water, 1 bag of bentonite (100 lb. bag)												
	149														
	150														
	151														
	152														
-20	153														
	154														
	155														
	156														
	157														
-25	158														
	159														
	160														
	161														
	162														
-30	163														
	164														
	165														
	166														
	167														
-35	168														
	169														
	170														

Final Report Version

SUTTER BUTTE FLOOD CONTROL AGENCY

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_002S
Sheet 7 of 7

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/11	10/13/11	133.0 ft	NAVD 88	10.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	Brett Arrenas	Brandon Bosworth	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Geoprobe 8040DT	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger	NA	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	NA	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion sonic boring SM0007_002S for lithology.												Bulk Sample #1
	1														
	2				1										
130	3														
	4														
	5														Bulk Sample #2
	6														
	7														
	8				2					12	24	1	51	UW, CP, CU, PA	
125	9														
	10		End of boring at 10'. Backfilled with cement bentonite grout. 4-47 lb. bags cement, 40 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	11														
	12														
120	13														
	14														
	15														
	16														
	17														
115	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,312.65 **Easting:** 6,661,877.95
Latitude: 39.43962 **Longitude:** -121.64517
Levee Station or Milepost: 2293+14 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_014A
Sheet 1 of 1

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/29/11	9/30/11	128.3 ft	NAVD 88	65.0 ft
DRILLING CONTRACTOR		**DRILLER'S NAME**	**HELPER'S NAME**	**TOTAL DEPTH OF FILL**
WDC		Justin Lake	Scott Adam, Rick Smedley	
DRILLING METHOD		**DRILL RIG MAKE AND MODEL**		**CONSULTANT COMPANY**
Sonic		Geoprobe 8140LC		URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER)		**DRILLING ROD TYPE AND DIAMETER**		**FIELD LOGGER**
4" Core Barrel		3-5/8" OD Rod		M. Weil
[X] VERTICAL [ ] INCLINED		**CASING TYPE, DIAMETER, INSTALLATION DEPTH**		**FIELD LOG REVIEWER**
		6" Casing		TK
SAMPLER TYPE(S)		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP**		**HAMMER EFFICIENCY**
Bag, Sonic(4")		NA		
BOREHOLE BACKFILL OR COMPLETION		**GROUNDWATER READING:**	**DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**
Cement, bentonite grout				

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Poorly Graded GRAVEL (GP); moist; 95% coarse gravel, max. 3 in.; 5% medium sand.		1										1_0.0-0.5 Hand Auger to 5'
	1														
	2														
125	3														Casing dropped 2" into hole.
	4														
	5														Run 1 5 - 10' No recovery due to core barrel displacing gravels. Classification based on driller observations and rig performance.
	6														
	7														
120	8														
	9														
	10														Run 2 10 - 15' No Recovery
	11														
	12														
115	13														
	14														
	15														Run 3 15 - 20' No Recovery
	16														
	17														
110	18														
	19														Cobble in tip
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,286,519.25 **Easting:** 6,662,224.30
Latitude: 39.44019 **Longitude:** -121.64394
Levee Station or Milepost: 2296+50 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														Run 4 20 - 25' No Recovery
	21														
	22														
105	23														
	24														
	25														Run 5 25 - 30' 60% Recovery
	26														
	27														
	28				2										2_27.0-28.0
100			SILTY SAND (SM); dark grayish brown; moist; 80% fine sand; 20% no plasticity fines.												
	29				3								21	PA	3_29.0-30.0
	30														Run 6 30 - 35' 100% Recovery
	31		Well-Graded SAND with Silt (SW-SM); olive; wet; 90% fine to coarse sand; 10% no plasticity fines.												
	32														
95	33														
	34				4								9	PA	4_34.0-35.0
	35														Run 7 35 - 40' 100% Recovery
	36		At 36 feet 85% fine to coarse sand; 10% fine gravel; 5% no plasticity fines.												
	37														
90	38														
	39				5								10	PA	5_39.0-40.0
	40														Run 8 40 - 45' 100% Recovery
	41														
	42														
85	43														
	44				6										6_44.0-45.0
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,286,519.25 **Easting:** 6,662,224.30
Latitude: 39.44019 **Longitude:** -121.64394
Levee Station or Milepost: 2296+50 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015S
Sheet 2 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														Run 9 45 - 50' 100% Recovery
	46														
	47														
80	48														
	49				7										7_49.0-50.0
	50														Run 10 50 - 55' 100% Recovery
	51														
	52														
75	53														
	54		Well-Graded SAND with Gravel (SW); olive; wet; 80% fine to coarse sand; 15% fine to coarse gravel, max. 2 in.; 5% no plasticity fines.		8										8_54.0-55.0
	55														Run 11 55 - 60' 100% Recovery
	56														
	57														
70	58		SILTY SAND (SM); dark brown; wet; 55% fine to medium sand; 45% low plasticity, no dilatancy fines.		9										9_58.0-59.0
	59														
	60				10					22	19	NP	47	PA	10_60.0-61.0 Run 12 60 - 65' 100% Recovery
	61														
	62		CLAYEY SAND with Gravel (SC); very dark brown; wet; 40% fine to coarse sand; 35% low plasticity fines; 25% fine to coarse gravel, max. 1.5 in..												
65	63				11								19	PA	11_63.0-64.0
	64														
	65		End of boring at 65'. Backfilled with 16-50 lb. bags of bentonite chips.												
	66														
	67														
60	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,286,519.25 **Easting:** 6,662,224.30
Latitude: 39.44019 **Longitude:** -121.64394
Levee Station or Milepost: 2296+50 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/18/11	8/18/11	134.4 ft	NAVD 88	100.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Boart Longyear	Justin Kilgore	Casey King/Robert Leininger	25 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Prosonic Full Size Truck Mounted	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	Prosonic 300 XL	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	E. WILSON

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	27 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel (6 inches).												Hand auger refusal at 3' on cobble.
	1		[LEVEE FILL] SANDY SILT (ML); dark brown; moist; 70% slow dilatancy fines; 30% fine sand.												
	2														
	3														Run 1 3 - 10' 100% Recovery
130	4														
	5				1					16	26	3			1_5.0-6.0
	6														
	7														
	8														
	9														
125	10				2								56	PA HD	2_9.0-10.0
	11														Run 2 10 - 20' 100% Recovery
	12														
	13														
	14														
120	15				3						33	7	63	PA	3_15.0-16.0
	16														
	17														
	18														
	19														
115	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003S
Sheet 1 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20				4								63	PA HD	4_20.0-21.0 Run 3 20 - 30' 100% Recovery
	21														
	22														
	23														
FILL 110	24														
	25		SANDY SILT (ML); dark brown; moist; 55% slow dilatancy fines; 45% fine sand; At 25 feet 55% fines; 45% fine sand.		5					20	NP	NP	58	PA	5_25.0-26.0
	26														
	27														
	28														
105	29														
	30														Run 4 30 - 40' 100% Recovery
	31		CLAYEY GRAVEL with Sand (GC); wet; 55% subangular gravel; 30% fine sand; 15% low plasticity fines.		6								21	PA HD	6_31.0-32.0
	32														
	33		Poorly Graded SAND with Clay and Gravel (SP-SC); dark olive brown; wet; 70% medium sand; 20% subrounded gravel; 10% low plasticity fines.		7								6	PA	7_33.0-34.0
100	34														
	35		Poorly Graded SAND with Clay (SP-SC); dark olive brown; wet; 90% medium sand; 10% low plasticity fines.		8								8	PA	8_35.0-36.0
	36														
	37														
	38														
	39														
95	40		Well-Graded SAND with Clay (SW-SC); dark olive brown; wet; 90% fine to coarse sand; 10% low plasticity fines.		9								7	PA	9_40.0-41.0 Run 5 40 - 50' 100% Recovery
	41														
	42														
	43														
	44														
90	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003S
Sheet 2 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														
	46														
	47				10										10_47.0-48.0
	48														
	49														
85	50														Run 6 50 - 60' 100% Recovery
	51														
	52		Well-Graded GRAVEL with Sand (GW); wet; 80% subrounded gravel; 15% medium sand; 5% low plasticity fines.		11										11_52.0-53.0
	53														
	54		Well-Graded SAND (SW); dark olive brown; wet; 95% fine to coarse sand; 5% low plasticity fines.		12										12_54.0-55.0
80	55														
	56														
	57		CLAYEY GRAVEL (GC); wet; 75% subrounded gravel; 15% low plasticity fines; 10% medium sand.		13										13_57.0-58.0
	58		CLAYEY SAND (SC); very dark gray; wet; 50% medium sand; 45% low plasticity fines; 5% subrounded gravel.		14										14_58.0-59.0
75	59														
	60		CLAYEY SAND with Gravel (SC); very dark gray; wet; 50% fine sand; 30% low plasticity fines; 20% subrounded gravel.		15										15_60.0-61.0 Run 7 60 -70' 100% Recovery
	61														
	62		SANDY SILT (ML); very dark gray; wet; 60% slow dilatancy fines; 40% fine sand.		16					35	26	NP	55	PA	16_62.0-63.0
	63														
70	64														
	65														
	66														
	67														
	68		CLAYEY GRAVEL with Sand (GC); wet; 60% subrounded gravel, max. 2 in.; 25% fine to coarse sand; 15% low plasticity fines.		17										17_68.0-69.0
65	69														
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003S
Sheet 3 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														Run 8 70 - 80' 100% Recovery
	71				18										18_71.0-72.0
	72														
	73														
	74														
60	75														
			Well-Graded GRAVEL with Clay and Sand (GW-GC); moist; 65% subrounded gravel; 25% medium sand; 10% low plasticity fines.		19										19_75.0-76.0
	76				20										20_76.0-77.0
	77				21										21_77.0-78.0
	78														
	79														
55			CLAYEY GRAVEL with Sand (GC); wet; 50% subrounded gravel; 35% fine to coarse sand; 15% low plasticity fines.		22										22_79.0-80.0
	80														Run 9 80 - 90' 100% Recovery
	81														
	82														
	83				23										23_83.0-84.0
	84														
50	85														
	86														
	87				24										24_87.0-88.0
	88														
	89														
45	90				25										25_90.0-91.0 Run 10 90 - 100' 100% Recovery
	91														
	92				26										26_92.0-93.0
	93														
	94														
40	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003S
Sheet 4 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	95														
	96														
	97														
	98														
	99														
35	100				27										27_99.0-100.0
	101		End of boring at 100'. Backfilled with cement bentonite grout. 39-47 lb. bags cement, 300 gallons water, 1/2 bag of bentonite (100 lb. bag)												
	102														
	103														
	104														
30	105														
	106														
	107														
	108														
	109														
25	110														
	111														
	112														
	113														
	114														
20	115														
	116														
	117														
	118														
	119														
15	120														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+00 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_003S
Sheet 5 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/13/11	10/13/11	134.4 ft	NAVD 88	25.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Cascade	Brett Arrenas	Brandon Bosworth	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
HSA	Geoprobe 8040DT	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
8" Carbide Auger	NA	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	NA	RN

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Shelby(2.87")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion sonic boring SM0007_003S for lithology.												Hand auger 5' bgs
	1														
	2														Bulk Sample #1
	3				1										
	4														
130	5														
	6														Bulk Sample #2
	7				2					15	23	2	48	UW, CP, CU, PA	
	8														
	9														
125	10														
	11				3	100									3_10.0_12.0
	12														
	13														
	14														
120	15				4	100				18			56	UW, PA FWK	4_14.0_16.0
	16														
	17														
	18				5	100									5_18.0_19.0
	19														
115	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+16 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21														
	22														
	23														6_23.0_25.0
110	24				6	100				15			79	PA	
	25		End of boring at 25'. Backfilled with cement bentonite grout. 4-47 lb. bags cement, 50 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	26														
	27														
	28														
105	29														
	30														
	31														
	32														
	33														
100	34														
	35														
	36														
	37														
	38														
95	39														
	40														
	41														
	42														
	43														
90	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: **Northing:** 2,286,326.25 **Easting:** 6,662,577.79
Latitude: 39.43965 **Longitude:** -121.64269
Levee Station or Milepost: 2300+16 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_015A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
9/26/11	9/26/11	122.8 ft	NAVD 88	60.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Mike Williamson	T. Chadwick, J. Socey	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	GUS PECH 400	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" Button Bit	2-3/8" IF Pin and Box	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	5-7/8" OD	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout		

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Well-Graded GRAVEL (GW); 90% fine to coarse gravel, max. 2 in.; 5% coarse sand; 5% no plasticity fines; wet from driller not grout water.												Hand Auger to 5'
120	1														
	2														
	3														
	4														
	5														Run 1 5 - 15' 10% Recovery 1_6.0-7.0
	6				1								4	PA	
	7														
115	8														
	9														
	10														
	11														
	12														
110	13														
	14														
	15														Run 2 15 - 25' No recovery. Redistributing gravel (voids?). Casing fell 5-6'. Classification based on driller observatiosns and rig performance.
	16														
	17														
105	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,286,433.89 **Easting:** 6,662,728.83
Latitude: 39.43995 **Longitude:** -121.64216
Levee Station or Milepost: 2301+53 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_016S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21														
	22														
100	23														
	24														
	25														Run 3 25 - 35' No Recovery
	26														
	27														
95	28														
	29														
	30														
	31														
	32														
90	33														
	34														
	35		Well-Graded SAND with Silt (SW-SM); dark olive gray; wet; 95% fine to coarse sand; 5% no plasticity fines.												Run 4 35 - 45' 100% Recovery
	36														
	37				2								5	PA	2_37.0-38.0
85	38														
	39														
	40		SILT with Sand (ML); dark grayish brown; wet; 85% low plasticity, slow dilatancy fines; 15% fine sand.												
	41				3										3_41.0-42.0
	42														
80	43		Well-Graded SAND (SW); dark olive gray; wet; 98% fine to coarse sand; 2% no plasticity fines.		4										4_43.0-44.0
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,286,433.89 **Easting:** 6,662,728.83
Latitude: 39.43995 **Longitude:** -121.64216
Levee Station or Milepost: 2301+53 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_016S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		SANDY SILT (ML); dark grayish brown; wet; 70% no plasticity, slow dilatancy fines; 30% fine sand.												Run 5 45 - 55' 100% Recovery
	46														
	47				5					30	26	NP	60	PA	5_46.0-47.0
75	48														
	49														
	50														
	51				6										6_51.0-52.0
	52														
70	53														
	54														
	55														
	56														
	57				7								49	PA	7_57.0-58.0
65	58		Well-Graded GRAVEL (GW); wet; 85% fine to coarse gravel, max. 3 in.; 10% coarse sand; 5% low plasticity fines.												
	59				8										8_59.0-60.0
	60														
	61		End of boring at 60'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 110 gallons water, 3/4 bag of bentonite (50 lb. bag)												
	62														
60	63														
	64														
	65														
	66														
	67														
55	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,286,433.89 **Easting:** 6,662,728.83
Latitude: 39.43995 **Longitude:** -121.64216
Levee Station or Milepost: 2301+53 **Levee Mile:**
Levee Segment Reach 38
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_016S
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED 9/30/11 **DATE COMPLETED** 9/30/11	**GROUND ELEVATION** 124.7 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 55.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Mike Wilkerson **HELPER'S NAME** T. Chadwick, J. Socey	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** GUS PECH 400	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" Button Bit	**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF Pin and Box	**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 5-7/8" OD	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Poorly Graded GRAVEL and Cobbles with Sand; dark brown; moist; 60% gravel; 40% fine to medium sand..												
120	5														Run 1 5'-15' 5% Recovery. Poor recovery due to loose sand, cobbles and boulders. 1_6.0-6.5
	6				1										
115	10														
110	15		Poorly Graded GRAVEL with Silt and Sand (GP-GM); dark brown; wet; 70% gravel; 20% sand; 10% low plasticity fines.												Run 2 15 - 35' 30% Recovery Poor recovery due very loose sand, cobbles and boulders. Liquified sand washed out when pulling sampler back up.
105	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,287,924.56 **Easting:** 6,662,730.24
Latitude: 39.44404 **Longitude:** -121.64213
Levee Station or Milepost: 2319+51 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017S
Sheet 1 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														Assumed sample depth.
100	25				2										2_25.0-26.0
	30		Poorly Graded GRAVEL with Silt and Sand (GP-GM); dark brown; wet; 70% gravel; 19% sand; 11% low plasticity fines.		3								11	PA HD	3_30.0-31.0 Assumed
95	35		Poorly Graded SAND with Silt (SP-SM); very loose; dark brown; wet.												Run 3 35 - 45' No recovery due to very loose sand, cobbles and boulder. Liquified sand washed out.
90	40														
85	45														
80															

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,287,924.56 **Easting:** 6,662,730.24
Latitude: 39.44404 **Longitude:** -121.64213
Levee Station or Milepost: 2319+51 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017S
Sheet 2 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														Run 4 45 - 55'
	46														
	47		SILTY GRAVEL with Sand (GM); dark greenish brown; wet; 70% gravel; 15% medium sand; 15% low plasticity fines.		4										4_47.0-48.0 Assumed depth
	48														
	49														
75	50				5										5_50.0-51.0 Assumed depth
	51														
	52														
	53														
	54														
70	55		End of boring at 55'. Backfilled with cement bentonite grout. 10-47 lb. bags cement, 40 gallons water, 13 bags of bentonite (50 lb. bag)												
	56														
	57														
	58														
	59														
65	60														
	61														
	62														
	63														
	64														
60	65														
	66														
	67														
	68														
	69														
55	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: **Northing:** 2,287,924.56 **Easting:** 6,662,730.24
Latitude: 39.44404 **Longitude:** -121.64213
Levee Station or Milepost: 2319+51 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017S
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/22/11	8/24/11	136.9 ft	NAVD 88	60.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Boart Longyear	Justin Kilgore	Casey King/Robert Leininger	26 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Prosonic Full Size Truck Mounted	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	Prosonic 300XL	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	39 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] Well-Graded GRAVEL (GW); moist; 95% subrounded gravel; 5% fine sand.												Hand Auger to 5'
135	1														
	2														
	3														
	4														
	5				1								1	PA	1_5.0-6.0 Run 1 5 - 15' 100% Recovery
	6														
130	7														
	8														
	9														
	10														
	11														
125	12														
	13														
	14														
	15				2										2_15.0-16.0 Run 2 15 - 25' 100% Recovery
	16														
120	17														
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,288,373.34 **Easting:** 6,662,723.29
Latitude: 39.44527 **Longitude:** -121.64215
Levee Station or Milepost: 2324+00 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21														
115	22				3								3	PA	3_21.0-22.0
	23														
	24														
← FILL	25														
	26		Poorly Graded SAND with Silt (SP-SM); dark yellowish brown; moist; 90% fine sand; 10% low plasticity fines.		4					6	NP	NP	10	PA	Run 3 25 - 35' 100% Recovery 4_26.0-27.0
110	27		Well-Graded GRAVEL (GW); moist; 95% subrounded gravel; 5% fine sand.												
	28				5								1	PA	5_25.0-29.0
	29														
	30														
	31														
105	32														
	33														
	34														
	35		CLAYEY SAND (SC); olive; moist; 80% fine to coarse sand; 20% low plasticity fines.		6										6_35.0-36.0 Run 4 35 - 45' 100% Recovery
	36														
100	37		Well-Graded GRAVEL with Sand (GW); moist; 80% subrounded gravel; 15% fine sand; 5% low plasticity fines.												
	38				7										7_38.0-39.0
	39		Well-Graded SAND (SW); olive brown; wet; 95% fine to coarse sand; 5% low plasticity fines.												
	40				8										8_40.0-41.0
	41														
95	42														
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,288,373.34 **Easting:** 6,662,723.29
Latitude: 39.44527 **Longitude:** -121.64215
Levee Station or Milepost: 2324+00 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45	CLAYEY SAND (SC); dark olive brown; wet; 70% fine sand; 30% low plasticity fines.		9										9_45.0-46.0 Run 5 45 - 60' 100% Recovery
	46	SILTY SAND (SM); dark olive brown; wet; 85% fine to medium sand; 15% fines.												
90	47													
	48			10					16	NP	NP	12	PA	10_48.0-49.0
	49													
	50													
	51													
85	52													
	53	CLAYEY SAND (SC); dark olive brown; wet; 70% fine sand; 30% low plasticity fines.												
	54			11								41	PA HD	11_54.0-55.0
	55													
	56													
80	57													
	58	CLAYEY SAND with Gravel (SC); dark olive brown; wet; 70% sand; 15% subrounded gravel; 15% low plasticity fines.		12										12_25.0-59.0
	59	CLAYEY SAND (SC); dark olive brown; wet; 60% fine sand; 40% low plasticity fines.		13										13_59.0-60.0
	60													
	61	End of boring at 60'. Backfilled with cement bentonite grout. 8-94 lb. bags cement, 60 gallons water, 1 bag of bentonite (50 lb. bag)												
75	62													
	63													
	64													
	65													
	66													
70	67													
	68													
	69													
	70													

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,288,373.34 **Easting:** 6,662,723.29
Latitude: 39.44527 **Longitude:** -121.64215
Levee Station or Milepost: 2324+00 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_004S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/29/11 **DATE COMPLETED** 9/30/11	**GROUND ELEVATION** 120.1 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 170.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Mike Wilkerson **HELPER'S NAME** T. Chadwick, J. Socey	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** GUS PECH 400	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" Button Bit	**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF Pin and Box	**FIELD LOGGER** GT Hong
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** NA **AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
120	0		Poorly Graded GRAVEL with Sand (GP); brown; moist; 60% gravel; 35% sand; 5% no plasticity fines.												Run 1 0 - 5'
	1														
	2														
	3		Poorly Graded SAND with Gravel (SP); dark brown; 80% medium sand; 15% gravel; 5% no plasticity fines.												
	4														
115	5														Run 2 5 - 10' 5% Recovery Poor recovery due to very loose sand and cobble (>3"). MIssed 95% of the liquified soil samples during pulling sampler back. 1_7.0-8.0
	6														
	7				1										
	8														
	9														
110	10														Run 3 10 - 15' 5% Recovery
	11														
	12														
	13														
	14														
105	15														Run 4 15 - 20' 5% Recovery
	16														
	17														
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 1 of 8

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
100	20		SILTY SAND (SM); dark brown; wet; 87% sand; 13% no plasticity fines.												Run 5 20 - 25' 50% Recovery
	21														
	22				2								15	PA	2_22.0-23.0
	23														
	24														
95	25														Run 6 25 - 30' 100% Recovery
	26				3										3_26.0-27.0
	27														
	28														
	29		Well-Graded SAND with Silt (SW-SM); dark yellowish brown; wet; 90% sand; 10% no plasticity fines.												
90	30				4										4_30.0-31.0 Run 7 30 - 35' 100% Recovery
	31														
	32		SANDY SILT (ML); dark yellowish brown; wet; 60% low plasticity, rapid dilatancy fines; 40% fine sand.												
	33				5								70	PA	5_33.0-34.0
	34														
85	35		Poorly Graded GRAVEL with Clay (GP-GC); greenish gray; wet; 60% gravel; 30% sand; 10% medium plasticity fines.												Run 8 35 - 40' 100% Recovery
	36														
	37				6					7	26	8			6_37.0-38.0
	38														
	39														
80	40														Run 9 40 - 45' 100% Recovery
	41														
	42				7										7_42.0-43.0
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 2 of 8

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
75	45														Run 10 45 - 50' 100% Recovery
	46														
	47														
	48				8										8_47.0-48.0
	49														
70	50														Run 11 50 - 55' 100% Recovery
	51														
	52														
	53				9										9_52.0-53.0
	54														
65	55														Run 12 55 - 60' 100% Recovery
	56														
	57		CLAYEY SAND (SC); brown; moist; 55% medium to coarse sand; 45% high plasticity, no dilatancy fines.												
	58				10					44	69	29	43	PA	10_58.0-59.0
	59														
60	60														Run 13 60 - 65' 100% Recovery
	61														
	62				11										11_62.0-63.0
	63														
	64														
55	65		SANDY SILT (ML); dark yellowish brown; moist; 70% low plasticity, slow dilatancy fines; 30% medium to coarse sand.												Run 14 65 - 70' 100% Recovery
	66														
	67				12										12_67.0-68.0
	68														
	69														
	70														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 3 of 8

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
50	70													Run 15 70 - 75' 100% Recovery
	71													
	72													
				13										13_72.0-73.0
	73													
	74													
45	75	Poorly Graded SAND with Gravel (SP); very dark gray; wet; 85% medium to coarse sand; 15% gravel.												Run 16 75 - 80' 100% Recovery
	76													
	77													
				14										14_77.0-78.0
	78													
	79													
40	80													Run 17 80 - 85' 100% Recovery
	81													
	82													
				15										15_82.0-83.0
	83													
	84													
35	85	Poorly Graded SAND (SP); black; wet; 90% fine to medium sand; 5% gravel; 5% no plasticity fines.												Run 18 85 - 90' 100% Recovery
	86													
	87													
				16										16_87.0-88.0
	88													
	89													
30	90	SILTY SAND (SM); brown; moist; 60% medium sand; 40% low plasticity fines.												Run 19 90 - 95' 100% Recovery
	91													
	92													
				17										17_92.0-93.0
	93													
	94													
		Poorly Graded SAND (SP); black; wet; 90% fine to medium sand; 5% gravel; 5% no plasticity fines.		18										18_94.0-95.0
	95													

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 4 of 8

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
25	95		SILTY SAND with Gravel (SM); brown; wet; 60% medium to coarse sand; 20% gravel; 20% low plasticity fines.												Run 20 95 - 100' 100% Recovery
	96														
	97				19										19_97.0-98.0
	98														
	99		SILTY SAND (SM); dark brown; wet; 70% sand; 25% low plasticity fines; 5% gravel.												
20	100														Run 21 100 - 105' 100% Recovery
	101														
	102				20										20_102.0-103.0
	103														
	104														
15	105														Run 22 105 - 110' 100% Recovery
	106														
	107														
	108														
	109		At 109 feet greenish gray; moist; 60% fine sand; 40% no plasticity fines.												
10	110				21										21_110.0-111.0 Run 23 110 - 115' 100% Recovery
	111														
	112														
	113		SILT with Sand (ML); dark brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.		22										22_113.0-114.0
	114		Poorly Graded SAND (SP); black; wet; 90% medium sand; 5% gravel; 5% no plasticity fines.												
5	115														Run 24 115 - 120' 100% Recovery
	116														
	117				23										23_117.0-118.0
	118														
	119														
	120														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 5 of 8

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
0	120	Poorly Graded SAND with Silt (SP-SM); black; wet; 85% fine sand; 15% no plasticity fines.												Run 25 120 - 125' 100% Recovery
	121													
	122													
	123			24										24_122.0-123.0
	124													
-5	125													Run 26 125 - 130' 100% Recovery
	126													
	127													
	128													
	129													
-10	130	Poorly Graded SAND (SP); black; wet; 95% fine to medium sand; 5% no plasticity fines.												Run 27 130 - 135' 100% Recovery
	131													
	132													
	133			25										25_132.0-133.0
	134													
-15	135	Poorly Graded SAND with Silt (SP-SM); black; wet; 90% fine to medium sand; 10% no plasticity fines.												Run 28 135 - 140' 100% Recovery
	136													
	137													
	138			26										26_135.0-136.0
	139													
-20	140													Run 29 140 - 145' 100% Recovery
	141													
	142													
	143													
	144													
	145													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
-25	145				27										27_145.0-146.0 Run 30 145 - 150' 100% Recovery
	146														
	147														
	148														
	149														
-30	150														Run 31 150 - 155' 100% Recovery
	151														
	152														
	153														
	154														
-35	155				28										28_155.0-156.0 Run 32 155 - 160' 100% Recovery
	156														
	157														
	158														
	159														
-40	160														Run 33 160 - 165' 100% Recovery
	161														
	162														
	163		Poorly Graded SAND (SP); black; wet; 95% fine to medium sand; 5% no plasticity fines.												
	164														
-45	165				29										29_165.0-166.0 Run 34 165 - 170' 100% Recovery
	166														
	167														
	168														
	169														
	170														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 7 of 8

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
-50	170		End of boring at 170'. Backfilled with cement bentonite grout. 45-47 lb. bags cement, 100 gallons water, 2 bags of bentonite (50 lb. bag)								
	171										
	172										
	173										
	174										
-55	175										
	176										
	177										
	178										
	179										
-60	180										
	181										
	182										
	183										
	184										
-65	185										
	186										
	187										
	188										
	189										
-70	190										
	191										
	192										
	193										
	194										
	195										

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 2,289,336.97 **Easting:** 6,662,666.85
Latitude: 39.44792 **Longitude:** -121.64233
Levee Station or Milepost: 2333+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_018S
Sheet 8 of 8

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
8/25/11	8/25/11	114.0 ft	NAVD 88	50.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
Boart Longyear	Justin Kilgore	Casey King/Robert Leininger	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Prosonic Full Size Truck Mounted	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	Prosonic 300XL	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	7 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Horse manure.												Hand Auger to 5'
	1		Well-Graded GRAVEL (GW); moist; 90% gravel; 5% medium sand; 5% low plasticity fines; cobbles.												
110	2														
	3														
	4														
	5														Run 1 5 - 7' 100% Recovery 1_6.0-7.0
	6				1										
	7		CLAYEY SAND (SC); wet; 70% fine to coarse sand; 30% low plasticity fines.												Run 2 7 - 27' 45% Recovery wet flowing consistency
105	8														
	9														
	10				2										2_10.0-11.0
	11														
	12														
	13														
100	14														
	15														
	16														
	17		SANDY LEAN CLAY (CL); wet; 55% low plasticity, slow dilatancy fines; 45% fine sand.												
95	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,290,258.79 **Easting:** 6,662,837.40
Latitude: 39.45045 **Longitude:** -121.64172
Levee Station or Milepost: 2343+43 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20														
	21														
	22														
	23														
90	24														
	25														
	26														
					3										3_26.0-27.0
	27														Run 3 27- 40' 38% Recovery wet flowing consistency
	28														
85	29														
	30														
	31														
	32														
	33														
80	34														
	35		Well-Graded GRAVEL with Sand (GW); wet; 80% gravel; 15% fine to coarse sand; 5% low plasticity fines.		4										4_35.0-36.0
	36		SANDY LEAN CLAY (CL); wet; 60% low plasticity, slow dilatancy fines; 40% fine sand.												
	37				5										5_37.0-38.0
	38														
75	39				6										6_39.0-40.0
	40														Run 4 40 -45' 100% Recovery
	41		CLAYEY GRAVEL with Sand (GC); wet; 60% fine to coarse gravel; 20% fine to coarse sand; 20% low plasticity fines; cobbles.		7								16	PA	7_41.0-42.0
	42														
	43														
70	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,290,258.79 **Easting:** 6,662,837.40
Latitude: 39.45045 **Longitude:** -121.64172
Levee Station or Milepost: 2343+43 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	45														Run 5 45 - 50
	46														
	47				8										8_46.0-47.0
	48														
65	49														
	50														
	51		End of boring at 50'. Backfilled with cement bentonite grout. 8-47 lb. bags cement, 75 gallons water, 1 bag of bentonite (94 lb. bag)												
	52														
	53														
60	54														
	55														
	56														
	57														
	58														
55	59														
	60														
	61														
	62														
	63														
50	64														
	65														
	66														
	67														
	68														
45	69														
	70														

Final Report Version

SUTTER BUTTE FLOOD CONTROL AGENCY

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,290,258.79 **Easting:** 6,662,837.40
Latitude: 39.45045 **Longitude:** -121.64172
Levee Station or Milepost: 2343+43 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_005S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 8/1/11 **DATE COMPLETED** 8/2/11	**GROUND ELEVATION** 114.0 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 34.0 ft
DRILLING CONTRACTOR Gregg Drilling & Testing, Inc.	**DRILLER'S NAME** James **HELPER'S NAME** Malakai	**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA, Mud Rotary	**DRILL RIG MAKE AND MODEL** CME 55	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 3-1/4" Tricone	**DRILLING ROD TYPE AND DIAMETER** NWJ Rod 2-5/8" OD	**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 8" Auger to 19'	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) MCal(2.5"), SPT(1.375")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** CME Auto	**HAMMER EFFICIENCY** 76.8%
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** 8 ft **AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Fill material (animal waste).												Hand auger 0-1.5'
	1														
	2		Poorly Graded GRAVEL with Silt (GP-GM); medium dense; pale green; dry; 85% gravel; 10% sand; 5% no plasticity fines.												Hard to hand auger at 1.5' due to cobble. No sample
110	3														
	4														
	5			X	1	22	30 16 8 [24]	31					8	PA	1_5.0-6.5
	6														
	7														
	8		SILTY SAND (SM); loose; strong brown; wet; 80% sand; 20% no plasticity fines.	X		0	19 4 5 [9]	12							No recovery
105	9														
	10														
	11					0	9 4 3 [7]								Hard to catch sample within soft layer due to cobbles at sampler's tip.
	12														
	13				2	17	2 5 4 [9]						19	PA	2_13.5-14.0
100	14														
	15														
	16				3	33	4 6 5								3_16.0-16.5
	17						[11]								
	18		Poorly Graded SAND (SP); medium dense; strong brown; wet; 95% sand; 5% no plasticity fines.		4A 4B	50	4 4 9								4A_18.0-18.5 4B_18.5-19.0
95	19						[13]								At 19' switch to Mud rotary
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,290,258.79 **Easting:** 6,662,837.40
Latitude: 39.45045 **Longitude:** -121.64172
Levee Station or Milepost: 2343+43 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017B
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		SILTY SAND (SM); loose; strong brown; wet; 80% sand; 20% no plasticity fines.												
	21				5	39	3 4 4 [8]	10					19	PA	5_20.0-21.5
	22														
	23				6A 6B	67	2 1 0 [1]	1							6A_23.0-23.5 6B_23.5-24.0
90	24														
	25														
	26				7	39	3 1 1 [2]	3		26	NP	NP			7_25.0-26.5
	27														
	28														
85	29														
	30		Poorly Graded GRAVEL (GP).												
	31				8	11	8 7 12 [19]	24							8_31.0-31.5
	32														
	33				9	17	4 2 3 [5]	6							9_33.5-34.0
80	34		CLAYEY SAND (SC); strong brown; wet; 80% fine sand; 20% low plasticity fines.												
	35		End of boring at 34'. Backfilled with cement bentonite grout.												
	36														
	37														
	38														
75	39														
	40														
	41														
	42														
	43														
70	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,290,258.79 **Easting:** 6,662,837.40
Latitude: 39.45045 **Longitude:** -121.64172
Levee Station or Milepost: 2343+43 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017B
Sheet 2 of 2

SBFCA Feather River West Levee

DATE STARTED 9/30/11 **DATE COMPLETED** 9/30/11	**GROUND ELEVATION** 121.6 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 45.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Justin Lake **HELPER'S NAME** S. Adam/R. Smedley	**TOTAL DEPTH OF FILL**
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** Geoprobe 8140LC	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4" Core Barrel	**DRILLING ROD TYPE AND DIAMETER** 3-5/8" OD Rod	**FIELD LOGGER** M. Weil
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** RN
SAMPLER TYPE(S) Bag, Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Poorly Graded GRAVEL (GP); dry; 98% coarse gravel; 2% fines; cobbles <3".												Hand Auger to 5' Wet from driller's water, not groundwater.
120	1														
	2														
	3														
	4				1										1_4.0-5.0
	5														Run 1 5 - 10' No recovery, loose gravel/cobbles redistributing the cobbles.
115	6														
	7														
	8														
	9														
	10		CLAYEY SAND with Gravel (SC); olive; moist; 50% fine to coarse sand; 30% fine to coarse gravel; 20% low plasticity fines; cobbles <2".												Run 2 10 - 15' 100% Recovery
110	11														
	12														
	13														
	14				2								25	PA HD	2_14.0-15.0
	15		Well-Graded SAND with Silt (SW-SM); dark grayish brown; wet; 95% fine to coarse sand; 5% low plasticity fines.												Run 3 15 - 20' 100% Recovery
105	16														
	17														
	18														
	19				3								9	PA	3_19.0-20.0
	20														

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,291,041.65 **Easting:** 6,663,029.07
Latitude: 39.45259 **Longitude:** -121.64103
Levee Station or Milepost: 2350+96 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_019S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														Run 4 20 - 25' 100% Recovery
100	21														
	22														
	23														
	24				4										4_24.0-25.0
	25														Run 5 25 - 30' 100% Recovery
	26														
95	27		CLAYEY SAND (SC); yellowish brown; wet; 85% fine to coarse sand; 15% low plasticity fines.												
	28														
	29				5								16	PA	5_29.0-30.0
	30														Run 6 30 - 35' 100% Recovery
	31														
90	32		Well-Graded SAND (SW); dark grayish brown; wet; 95% fine to coarse sand; 5% low plasticity fines.		6										6_32.0-33.0
	33														
	34		SILT with Sand (ML); brown; wet; 80% low plasticity, rapid dilatancy fines; 20% fine sand.												
	35				7										7_35.0-36.0 Run 7 35 - 40'
	36														100% Recovery
85	37														
	38														
	39														
	40														Run 8 40 - 45' 100% Recovery
	41														
80	42														
	43				8										8_43.0-44.0
	44														
	45														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: Northing: 2,291,041.65 **Easting:** 6,663,029.07
Latitude: 39.45259 **Longitude:** -121.64103
Levee Station or Milepost: 2350+96 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_019S
Sheet 2 of 3

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
75	45		End of boring at 45'. Backfilled with cement bentonite grout. 0-47 lb. bags cement, 60 gallons water, 21 bag of bentonite (50 lb. bag)								
	46										
	47										
	48										
	49										
	50										
	51										
70	52										
	53										
	54										
	55										
	56										
65	57										
	58										
	59										
	60										
	61										
60	62										
	63										
	64										
	65										
	66										
55	67										
	68										
	69										
	70										

Final Report Version

Borehole Location: West Levee Landside Field **County:** Butte
Coordinates: **Northing:** 2,291,041.65 **Easting:** 6,663,029.07
Latitude: 39.45259 **Longitude:** -121.64103
Levee Station or Milepost: 2350+96 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_019S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/27/11	**DATE COMPLETED** 9/27/11	**GROUND ELEVATION** 138.6 ft	**ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 95.0 ft
DRILLING CONTRACTOR WDC		**DRILLER'S NAME** Mike Williamson	**HELPER'S NAME** T. Chadwick, J. Socey		**TOTAL DEPTH OF FILL** 11 ft
DRILLING METHOD Sonic		**DRILL RIG MAKE AND MODEL** GUS PECH 400			**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" Button Bit		**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF Pin and Box			**FIELD LOGGER** M. Weil
☒ **VERTICAL** ☐ **INCLINED**		**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 5-7/8" OD			**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Sonic(4")		**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA			**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout		**GROUNDWATER READING:**	**DURING DRILLING**		**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] Well-Graded GRAVEL (GW); moist; 95% fine to coarse gravel; 5% medium to coarse sand.												Hand Auger to 5'
135	5		[LEVEE FILL] SANDY LEAN CLAY (CL); dark brown; moist; 70% low plasticity, no dilatancy fines; 30% fine sand.												Run 1 5 - 15' 100% Recovery
	6				1					15	26	10	66	PA	1_6.0-7.0
130	10														
FILL	11		LEAN CLAY with Sand (CL); dark yellowish brown; moist; 80% medium plasticity, no dilatancy fines; 20% fine sand.												
125	13				2					21	36	19	80	PA	2_13.0-14.0
	15														Run 2 15 - 25' 100% Recovery
120	19		At 19 feet dark grayish brown.		3					20	28	12	78	PA	3_19.0-20.0
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+47 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020S
Sheet 1 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21														
	22														
	23														
115	24		At 23.5 feet dark yellowish brown.												
	25														
					4										4_25.0-26.0 Run 3 25 - 35' 100% Recovery
	26														
	27		At 27 feet very dark gray; 75% low plasticity, no dilatancy fines; 25% fine sand.												
	28														
110	29														
					5										5_29.0-30.0
	30														
	31														
	32														
	33														
105	34														
					6					20	25	6	75	PA	6_34.0-35.0
	35														
	36		Poorly Graded GRAVEL (GP); wet; 95% coarse, rounded gravel; 3% low plasticity fines; 2% coarse sand.												Run 4 35 - 45' No Recovery Gravels and voids. Poor sample recovery due to redistributing gravel. Classification based on driller observations and rig performance.
	37														
	38														
100	39														
	40														
	41														
	42														
	43														
95	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+47 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020S
Sheet 2 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														Run 5 45 - 55' 10% Recovery
	46														
	47														
	48														
90	49														
	50														
	51														
	52														
	53														
85	54				7										7_54.0-55.0
	55		Poorly Graded SAND with Clay (SP-SC); dark olive brown; wet; 90% fine to medium sand; 10% low plasticity fines.												Run 6 55 - 65' 100% Recovery
	56				8										8_56.0-57.0
	57														
	58		SANDY LEAN CLAY (CL); dark brown; wet; 60% low plasticity, slow dilatancy fines; 40% fine sand.												
80	59														
	60				9					31	26	5	64	PA	9_60.0-61.0
	61														
	62														
	63														
75	64														
	65				10										10_65.0-66.0 Run 7 65 - 75' 100% Recovery
	66														
	67														
	68		CLAYEY SAND (SC); dark olive brown; wet; 85% fine to medium sand; 15% low plasticity fines.												
70	69				11										11_69.0-70.0
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+47 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020S
Sheet 3 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														
	71														
	72		At 71.5 feet olive brown; 75% fine to medium sand; 25% low plasticity fines.												
	73														
65	74				12										12_73.0-74.0
	75														Run 8 75 - 85' 100% Recovery
	76				13										13_76.0-77.0
	77														
	78														
60	79		CLAYEY GRAVEL (GC); wet; 60% coarse, subrounded gravel, max. 3 in.; 30% low plasticity fines; 10% medium to coarse sand.												
	80														
	81														
	82				14										14_82.0-83.0
	83														
55	84														
	85														Run 9 85 - 95' 100% Recovery
	86														
	87				15										15_87.0-88.0
	88														
50	89		At 89 feet moist.												
	90				16										16_90.0-91.0
	91		At 91 feet wet.												
	92														
	93														
45	94				17										17_93.0-94.0
	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+47 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020S
Sheet 4 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	95										Casing siezed. Refusal with equipment on site.
	96		End of boring at 95'. Backfilled with cement bentonite grout. 20-47 lb. bags cement, 70 gallons water, 2 bags of bentonite (50 lb. bag)								
	97										
	98										
40	99										
	100										
	101										
	102										
	103										
35	104										
	105										
	106										
	107										
	108										
30	109										
	110										
	111										
	112										
	113										
25	114										
	115										
	116										
	117										
	118										
20	119										
	120										

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: **Northing:** 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+47 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_020S
Sheet 5 of 5

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/11/11	10/11/11	125.0 ft	NAVD 88	57.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Justin Lake	Charlie Scott	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	Geoprobe 8140LC	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4" Core Barrel	3-5/8" OD Rod	M. Weil

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	6" Casing	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag, Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout		

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
125	0		Well-Graded GRAVEL (GW); moist; 90% fine to coarse, rounded gravel; 5% medium sand; 5% low plasticity fines.												Hand Auger to 5'
	1														
	2				1										1_2.0-3.0
	3														
	4														Cobble lodged in tip.
120	5														Run 1 5 - 10' 100% Recovery
	6														
	7														
	8				2									PA	2_8.0-9.0
	9														
115	10														Run 2 10 - 15' 100% Recovery
	11		CLAYEY GRAVEL with Sand (GC); wet; 60% fine to coarse gravel; 25% medium to coarse sand; 15% low plasticity fines.		3								64	PA HD	3_11.0-12.0
	12														
	13														
	14		CLAYEY SAND with Gravel (SC); yellowish brown; wet; 50% fine sand; 32% fine to coarse, subrounded gravel; 18% low plasticity fines.												
110	15														Run 3 15 - 20' No Recovery
	16														
	17														
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,291,726.54 **Easting:** 6,663,128.03
Latitude: 39.45447 **Longitude:** -121.64067
Levee Station or Milepost: 2358+49 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_021S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
105	20														Run 4 20 - 25' No recovery (switching to flapper bit).
	21														
	22														
	23														
	24														
100	25				4								18	PA HD	4_25.0-26.0 Run 5 25 - 30' 100% Recovery Flowing sand
	26														
	27														
	28														
	29														
95	30				5										5_30.0-31.0 Run 6 30 - 35' 100% Recovery
	31														
	32														
	33														
	34														
90	35														Run 7 35 - 40' 100% Recovery
	36		SILTY SAND (SM); yellowish brown; wet; 65% fine sand; 25% low plasticity fines; 10% fine gravel.		6										6_36.0-37.0
	37														
	38														
	39		At 39 feet 60% fine sand; 40% low plasticity fines.												
85	40														Run 8 40 - 45' 100% Recovery
	41														
	42				7										7_42.0-43.0
	43														
	44														
	45														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,291,726.54 **Easting:** 6,663,128.03
Latitude: 39.45447 **Longitude:** -121.64067
Levee Station or Milepost: 2358+49 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_021S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
80	45														Run 9 45 - 50' 100% Recovery
	46														
	47														
	48														
	49														
75	50		CLAYEY SAND with Gravel (SC); olive gray; wet; 35% medium to coarse sand; 35% low plasticity fines; 30% fine to coarse gravel.		8										8_50.0-51.0
	51														Run 10 50 - 57' 100% Recovery
	52		Well-Graded GRAVEL (GW); wet; 90% fine to coarse, subrounded gravel; 5% coarse sand; 5% low plasticity fines.		9										9_51.5-52.5
	53														
	54		CLAYEY SAND with Gravel (SC); olive gray; wet; 35% medium to coarse sand; 35% low plasticity fines; 30% fine to coarse gravel.												
70	55				10										10_55.0-56.0
	56														
	57														
	58		End of boring at 57'. Backfilled with cement bentonite grout. 8-47 lb. bags cement, 20 gallons water, 1 bag of bentonite (50 lb. bag)												
	59														
65	60														
	61														
	62														
	63														
	64														
60	65														
	66														
	67														
	68														
	69														
	70														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,291,726.54 **Easting:** 6,663,128.03
Latitude: 39.45447 **Longitude:** -121.64067
Levee Station or Milepost: 2358+49 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_021S
Sheet 3 of 3

SBFCA Feather River West Levee

DATE STARTED 10/14/11 **DATE COMPLETED** 10/14/11	**GROUND ELEVATION** 138.6 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 20.5 ft
DRILLING CONTRACTOR Cascade	**DRILLER'S NAME** Brett Arrenas **HELPER'S NAME** Brandon Bosworth	**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA	**DRILL RIG MAKE AND MODEL** Geoprobe 8040DT	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" Carbide Auger	**DRILLING ROD TYPE AND DIAMETER** NA	**FIELD LOGGER** GT Hong
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** NA	**FIELD LOG REVIEWER** RN
SAMPLER TYPE(S) Bag, Shelby(2.87")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** NA	**AFTER DRILLING (DATE-TIME)** NA

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion sonic boring SM0007_021S for lithology.												Bulk Samples #1 and 2
	1														
	2														
135	3														
	4														
	5														
	6				1	100									1_6.0_7.5
	7														
	8														
130	9				2	100									2_9.0_9.5
	10														
	11				3	100				19	29	12	76	UW, CN, PA	3_10.0_11.5
	12														
	13														
125	14				4	100									4_13.0_14.5
	15														
	16														
	17				5	100									5_16.0_17.5
	18														
120	19				6	100				19	30	13	80	UW, CU, PA	6_18.5_20.5
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_016A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	20				6	100									
	21		End of boring at 20.5'. Backfilled with cement bentonite grout. 5-47 lb. bags cement, 40 gallons water, 1/2 bag of bentonite (50 lb. bag)												
	22														
	23														
115	24														
	25														
	26														
	27														
	28														
110	29														
	30														
	31														
	32														
	33														
105	34														
	35														
	36														
	37														
	38														
100	39														
	40														
	41														
	42														
	43														
95	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,701.37 **Easting:** 6,663,222.65
Latitude: 39.45440 **Longitude:** -121.64033
Levee Station or Milepost: 2358+64 **Levee Mile:**
Levee Segment Reach 40
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_016A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/4/11	10/4/11	139.0 ft	NAVD 88	55.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME	HELPER'S NAME	TOTAL DEPTH OF FILL
WDC	Mike Wilkerson	R. Jimenez, T. Chadwick	15 ft

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Sonic	GUS PECH 400	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
4.5" Button Bit	2-3/8" IF Pin and Box	GT Hong

	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
[X] VERTICAL [ ] INCLINED	5-7/8" OD	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Sonic(4")	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road Gravel.												Hand auger to 5'
135	4		[LEVEE FILL] LEAN CLAY with Sand (CL); dark yellowish brown; moist; 80% medium plasticity, no dilatancy fines; 20% fine sand.												Run 1 5 - 15'
	6				1					12	33	17	78	PA	1_6.0-7.0
130	9														
	12				2										2_12.0-13.0
FILL 125	14														
	15		SANDY LEAN CLAY (CL); dark yellowish brown; moist; 60% low to medium plasticity fines; 40% fine sand.												Run 2 15 - 35'
	17				3					23	32	15	54	PA	3_17.0-18.0
120	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,841.47 **Easting:** 6,663,277.86
Latitude: 39.45479 **Longitude:** -121.64014
Levee Station or Milepost: 2360+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_022S
Sheet 1 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20		SANDY LEAN CLAY (CL); dark yellowish brown; moist; 70% medium plasticity, no dilatancy fines; 30% fine sand.												
	21														
	22														
	23				4					13	29	11	63	PA	4_23.0-24.0
115	24														
	25														
	26														
	27														
	28		LEAN CLAY (CL); brown; moist; 90% medium to high plasticity, no dilatancy fines; 10% fine sand.												
110	29														
	30				5					19	32	16			5_30.0-31.0
	31														
	32														
	33														
105	34														
	35		Poorly Graded GRAVEL with Sand (GP); dark olive brown; wet; 75% gravel; 25% medium to coarse sand.												Run 3 35 - 45'
	36														
	37				6								4	PA	6_37.0-38.0
	38														
100	39														
	40		At 40 feet, 75% gravel; 20% medium to coarse sand; 5% low plasticity fines.												
	41														
	42														
	43				7										7_43.0-44.0
95	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,841.47 **Easting:** 6,663,277.86
Latitude: 39.45479 **Longitude:** -121.64014
Levee Station or Milepost: 2360+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_022S
Sheet 2 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45				8										8_45.0-46.0 Run 4 45 - 55'
	46														
	47														
	48		CLAYEY GRAVEL with Sand (GC); dark olive brown; moist; 65% gravel; 20% medium plasticity fines; 15% medium to coarse sand.		9										9_48.0-49.0
90	49														
	50														
	51				10										10_51.0-52.0
	52														
	53		SILTY GRAVEL with Sand (GM); greenish gray; moist; 60% fine to coarse gravel; 20% coarse sand; 20% low plasticity fines.		11										11_53.0-54.0
85	54														
	55														
	56		End of boring at 55'. Backfilled with cement bentonite grout. 12-47 lb. bags cement, 140 gallons water, 1 bag of bentonite (50 lb. bag)												
	57														
	58														
80	59														
	60														
	61														
	62														
	63														
75	64														
	65														
	66														
	67														
	68														
70	69														
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,291,841.47 **Easting:** 6,663,277.86
Latitude: 39.45479 **Longitude:** -121.64014
Levee Station or Milepost: 2360+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_022S
Sheet 3 of 3

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/4/11	10/4/11	122.1 ft	NAVD 88	8.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME / HELPER'S NAME	TOTAL DEPTH OF FILL
	GT Hong	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Hand Auger	NA	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
3"	NA	GT Hong

[X] VERTICAL [ ] INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
	NA	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout		

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SILT (ML); strong brown; moist; 90% low plasticity, slow dilatancy fines; 10% fine sand.												
120	1														
	2														
	3				1										1_3.0-4.0
	4														
	5														
	6		SANDY LEAN CLAY (CL); dark yellowish brown; moist; 60% low plasticity, slow dilatancy fines; 40% fine sand.												
115	7				2					19	29	13	69	PA	2_7.0-8.0
	8		End of boring at 8'. Backfilled with cement bentonite grout. 1-47 lb. bag cement, 10 gallons water, 10 lbs. of bentonite.												
	9														
	10														
110	11														
	12														
	13														
	14														
	15														
105	16														
	17														
	18														
	19														
	20														

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,292,112.84 **Easting:** 6,663,264.91
Latitude: 39.45553 **Longitude:** -121.64018
Levee Station or Milepost: 2362+54 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_007H
Sheet 1 of 1

SBFCA Feather River West Levee

DATE STARTED	DATE COMPLETED	GROUND ELEVATION	ELEVATION DATUM	TOTAL DEPTH OF BORING
10/4/11	10/4/11	121.9 ft	NAVD 88	10.0 ft

DRILLING CONTRACTOR	DRILLER'S NAME / HELPER'S NAME	TOTAL DEPTH OF FILL
	GT Hong	

DRILLING METHOD	DRILL RIG MAKE AND MODEL	CONSULTANT COMPANY
Hand Auger	NA	URS Corporation

DRILL BIT SIZE AND TYPE (HOLE DIAMETER)	DRILLING ROD TYPE AND DIAMETER	FIELD LOGGER
3"	NA	GT Hong

[X] VERTICAL [ ] INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH	FIELD LOG REVIEWER
	NA	TK

SAMPLER TYPE(S)	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP	HAMMER EFFICIENCY
Bag	NA	

BOREHOLE BACKFILL OR COMPLETION	GROUNDWATER READING: DURING DRILLING	AFTER DRILLING (DATE-TIME)
Cement, bentonite grout	9 ft	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		SANDY LEAN CLAY (CL); strong brown; moist; 80% low to medium plasticity, slow dilatancy fines; 20% fine sand.												
120	1														
	2														
	3				1					10	28	11	81	PA	1_3.0_4.0
	4														
	5														
	6														
115	7		SANDY LEAN CLAY (CL); dark yellowish brown; moist; 75% low plasticity, slow dilatancy fines; 25% fine sand.												
	8				2					23	31	13	76	PA	2_8.0-9.0
	9				3										3_9.0-10.0
	10		End of boring at 10'. Backfilled with cement bentonite grout. 1-47 lb. bag cement, 10 gallons water, 10 lbs. of bentonite.												
110	11														
	12														
	13														
	14														
	15														
	16														
105	17														
	18														
	19														
	20														

Final Report Version

Borehole Location: West Levee Landside Toe **County:** Butte
Coordinates: Northing: 2,292,340.70 **Easting:** 6,663,349.11
Latitude: 39.45616 **Longitude:** -121.63988
Levee Station or Milepost: 2364+97 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_008H
Sheet 1 of 1

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 9/27/11 **DATE COMPLETED** 9/28/11	**GROUND ELEVATION** 139.1 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 120.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Mike Wilkerson **HELPER'S NAME** T. Chadwick, J. Socey	**TOTAL DEPTH OF FILL** 15 ft
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** GUS PECH 400	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4.5" Button Bit	**DRILLING ROD TYPE AND DIAMETER** 2-3/8" IF Pin and Box	**FIELD LOGGER** GT Hong/M. Weil
☒ **VERTICAL** ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING** NA **AFTER DRILLING (DATE-TIME)**	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Road gravel.												Hand Auger to 5'
	1														
	2														
	3		[LEVEE FILL] SANDY LEAN CLAY (CL); brown; moist; 60% low to medium plasticity, no dilatancy fines; 40% fine to coarse sand.												
135	4														
	5				1					23	33	14	50	PA	1_5.0-6.0 Run 1 5 - 15' 100% Recovery
	6														
	7														
	8														
130	9														
	10				2								61	PA HD	2_10.0-11.0
	11														
	12		At 12 feet olive gray; 65% low to medium plasticity, no dilatancy fines; 35% fine to medium sand.												
	13				3										3_13.0-14.0
125	14														
FILL	15		SANDY LEAN CLAY (CL); dark gray; moist; 70% medium plasticity, no dilatancy fines; 30% fine to medium sand.												Run 2 15 - 25' 100% Recovery
	16				4					22	31	14			4_16.0-17.0
	17														
	18														
120	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+01 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_023S
Sheet 1 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21														
	22														
					5								84	PA	5_22.0-23.0
	23														
115	24														
	25		At 25 feet yellowish brown; 65% low plasticity, no dilatancy fines; 35% fine sand.												Run 3 25 - 35' 100% Recovery
	26														
	27														
					6					21	33	16	70	PA	6_27.0-28.0
	28														
110	29														
	30														
	31														
	32		SILTY GRAVEL with Sand (GM); olive brown; moist; 60% gravel; 27% medium to coarse sand; 13% no plasticity fines.		7								14	PA	7_32.0-33.0
	33														
105	34														
	35														Run 4 35 - 45' 100% Recovery Driller notes gravel.
	36		Poorly Graded GRAVEL with Sand (GP); dark olive brown; wet; 80% gravel; 15% medium to coarse sand; 5% low plasticity fines.												
	37				8										8_37.0-38.0
	38														
100	39														
	40														
	41														
	42				9										9_42.0-43.0
	43														
95	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+01 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_023S
Sheet 2 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45														Run 5 45 - 55' 100% Recovery
	46														
	47														
	48														
90	49				10										10_49.0-50.0
	50														
	51														
	52														
	53														
85	54		Well-Graded SAND with Gravel (SW); strong brown; wet; 75% sand; 25% gravel.		11										11_54.0-55.0
	55														Run 6 55 - 65' 100% Recovery
	56														
	57				12										12_57.0-58.0
	58														
80	59		CLAYEY GRAVEL (GC); yellowish brown; moist; 60% gravel; 25% medium plasticity fines; 15% medium sand.												
	60														
	61														
	62				13					8	45	26	17	PA	13_62.0-63.0
	63														
75	64														
	65														Run 7 65 - 75' 100% Recovery
	66														
	67				14								28	PA	14_67.0-68.0
	68														
70	69														
	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+01 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_023S
Sheet 3 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	70														
	71														
	72				15										15_72.0-73.0
	73														
65	74														
	75		CLAYEY GRAVEL with Sand (GC); dark greenish gray; moist; 60% gravel; 20% medium to coarse sand; 20% medium plasticity fines.												Run 8 75 - 85' 100% Recovery
	76														
	77				16					8	35	17	19	PA	16_77.0-78.0
	78														
60	79														
	80														
	81														
	82				17								23	PA	17_82.0-83.0
	83														
55	84														
	85														Run 9 85 - 95' 100% Recovery
	86														
	87				18										18_87.0-88.0
	88		Poorly Graded GRAVEL with Silt and Sand (GP-GM); greenish gray; wet; 70% gravel; 20% medium to coarse sand; 10% no plasticity fines.												
50	89				19										19_89.0-90.0
	90		SANDY SILT (ML); dark grayish brown; moist; 70% low plasticity, rapid dilatancy fines; 30% medium to coarse sand.												
	91														
	92				20										20_92.0-93.0
	93														
45	94														
	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+01 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_023S
Sheet 4 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	95													Run 10 95 - 105' 100% Recovery
	96													
	97			21										21_97.0-98.0
	98													
40	99													
	100													
	101													
	102			22										22_102.0-103.0
	103													
35	104													
	105	SILTY SAND (SM); strong brown; wet; 70% sand; 20% medium plasticity fines; 10% gravel.												Run 11 105 - 120' 100% Recovery
	106													
	107			23										23_107.0-108.0
	108													
30	109													
	110	Poorly Graded SAND with Silt (SP-SM); dark brown; wet; 85% fine to medium sand; 15% no plasticity fines.												
	111			24										24_111.0-112.0
	112													
	113													
25	114													
	115			25										25_115.0-116.0
	116													
	117	SANDY SILT (ML); strong brown; moist; 70% low plasticity, slow dilatancy fines; 30% fine sand.												
	118			26										26_118.0-119.0
	119													
20	120													

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+01 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_023S
Sheet 5 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, % / Liquid Limit / Plasticity Index / Fines, % < #200 / Other Lab Tests	REMARKS
	120		End of boring at 120'. Backfilled with cement bentonite grout. 30-47 lb. bags cement, 300 gallons water, 2 bags of bentonite (50 lb. bag)								
	121										
	122										
	123										
15	124										
	125										
	126										
	127										
	128										
10	129										
	130										
	131										
	132										
	133										
5	134										
	135										
	136										
	137										
	138										
0	139										
	140										
	141										
	142										
	143										
-5	144										
	145										

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: **Northing:** 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+01 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_023S
Sheet 6 of 6

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/14/11 **DATE COMPLETED** 10/14/11	**GROUND ELEVATION** 139.1 ft **ELEVATION DATUM** NAVD 88		**TOTAL DEPTH OF BORING** 22.0 ft
DRILLING CONTRACTOR Cascade	**DRILLER'S NAME** Brett Arrenas **HELPER'S NAME** Brandon Bosworth		**TOTAL DEPTH OF FILL**
DRILLING METHOD HSA	**DRILL RIG MAKE AND MODEL** Geoprobe 8040DT		**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 8" Carbide Auger	**DRILLING ROD TYPE AND DIAMETER** NA		**FIELD LOGGER** GT Hong
[X] **VERTICAL** [ ] **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** NA		**FIELD LOG REVIEWER** RN
SAMPLER TYPE(S) Bag, Shelby(2.87")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA		**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING:** **DURING DRILLING** NA	**AFTER DRILLING (DATE-TIME)** NA	

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		Supplemental strength test boring. Refer to companion sonic boring SM0007_023S for lithology.												
	1														
	2														Bulk Samples #1 and 2
	3														
135	4														
	5														
	6														
	7														
	8														
130	9				1	100									1_8.0_10.0
	10				2	100									2_10.0_11.0
	11														
	12														
	13				3	100									3_12.0_13.5
125	14														
	15				4	100									4_14.0_15.0
	16														
	17				5	100									5_16.0_18.0
	18														
120	19														
	20														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+16 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017A
Sheet 1 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20														
	21				6	100				16	32	15	87	UW, CN, CU, PA	6_20.0_22.0
	22														
	23		End of boring at 22'. Backfilled with cement bentonite grout. 9-47 lb. bags cement, 70 gallons water, 1/2 bag of bentonite (50 lb. bag) for two boreholes												
115	24														
	25														
	26														
	27														
	28														
110	29														
	30														
	31														
	32														
	33														
105	34														
	35														
	36														
	37														
	38														
100	39														
	40														
	41														
	42														
	43														
95	44														
	45														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,317.52 **Easting:** 6,663,433.06
Latitude: 39.45609 **Longitude:** -121.63958
Levee Station or Milepost: 2365+16 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_017A
Sheet 2 of 2

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

DATE STARTED 10/4/11 **DATE COMPLETED** 10/5/11	**GROUND ELEVATION** 139.6 ft **ELEVATION DATUM** NAVD 88	**TOTAL DEPTH OF BORING** 93.0 ft
DRILLING CONTRACTOR WDC	**DRILLER'S NAME** Justin Lake **HELPER'S NAME** S. Adam/R. Smedley	**TOTAL DEPTH OF FILL** 9 ft
DRILLING METHOD Sonic	**DRILL RIG MAKE AND MODEL** Geoprobe 8140LC	**CONSULTANT COMPANY** URS Corporation
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 4" Core Barrel	**DRILLING ROD TYPE AND DIAMETER** 3-5/8" OD Rod	**FIELD LOGGER** M. Weil
X VERTICAL ☐ **INCLINED**	**CASING TYPE, DIAMETER, INSTALLATION DEPTH** 6" Casing	**FIELD LOG REVIEWER** TK
SAMPLER TYPE(S) Bag, Sonic(4")	**HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP** NA	**HAMMER EFFICIENCY**
BOREHOLE BACKFILL OR COMPLETION Cement, bentonite grout	**GROUNDWATER READING: DURING DRILLING**	**AFTER DRILLING (DATE-TIME)**

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	0		[LEVEE FILL] CLAYEY SAND with Gravel (SC); dark yellowish brown; wet; 40% low plasticity fines; 35% fine to coarse sand; 25% subrounded gravel.												Hand Auger to 5' Wet from driller's water, not groundwater.
	1														
	2														
	3				1										1_3.0-4.0
	4														
135	5														
	5		[LEVEE FILL] Poorly Graded GRAVEL (GP); wet; 98% coarse gravel; 2% coarse sand; cobbles <3".												Run 1 5 - 10' 100% Recovery
	6				2										2_6.0-7.0
	7														
FILL	8														
	9														
130	9		SANDY LEAN CLAY (CL); dark yellowish brown; wet; 65% low to medium plasticity fines; 35% fine sand.												
	10				3					23	36	18	53	PA	3_10.0-11.0
	11														Run 2 10 - 15' 100% Recovery
	12														
	13														
	14														
125	15														Run 3 15 - 20' 100% Recovery
	16		At 16 feet very dark gray; 75% low plasticity fines; 25% fine sand.		4										4_16.0-17.0
	17														
	18		At 18 feet dark yellowish brown; 75% medium plasticity, no dilatancy fines; 25% fine sand.												
	19														
120	20				5					17	33	17			5_19.0-20.0

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,603.74 **Easting:** 6,663,518.54
Latitude: 39.45688 **Longitude:** -121.63927
Levee Station or Milepost: 2368+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_024S
Sheet 1 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	20													Run 4 20 - 25' 100% Recovery
	21													
	22													
	23													
	24													
115	25			6								73	PA HD	6_24.0-25.0
	26													Run 5 25 - 30' 100% Recovery
	27	Poorly Graded SAND with Silt and Gravel (SP-SM); dark yellowish brown; wet; 70% fine to medium sand; 20% subrounded gravel; 10% no plasticity fines; cobbles <1.5".		7								10	PA	7_27.0-28.0
	28													
	29													
110	30	At 30 feet dark grayish brown; 60% fine to medium sand; 30% coarse, subrounded gravel; 10% no plasticity fines; cobbles <2".												Run 6 30 - 35' 100% Recovery
	31			8										8_31.0-32.0
	32													
	33													
	34	Well-Graded GRAVEL (GW); wet; 90% fine to coarse, subrounded gravel; 5% coarse sand; 5% no plasticity fines.												
105	35													Run 7 35 - 40' 100% Recovery
	36			9										9_36.0-37.0
	37													
	38													
	39													
100	40	SILTY CLAYEY SAND (SC-SM); olive gray; wet; 35% fine to coarse sand; 35% low plasticity fines; 30% subrounded gravel.												Run 8 40 - 45' 100% Recovery
	41			10					7	19	5	22	PA	10_41.0-42.0
	42													
	43													
	44													
95	45													

Final Report Version

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,603.74 **Easting:** 6,663,518.54
Latitude: 39.45688 **Longitude:** -121.63927
Levee Station or Milepost: 2368+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_024S
Sheet 2 of 4

SBFCA Feather River West Levee

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60}(ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	Liquid Limit	Plasticity Index	Fines, % < #200	Other Lab Tests	REMARKS
	45		Well-Graded GRAVEL with Clay (GW-GC); wet; 85% fine to coarse, subrounded gravel; 10% low plasticity fines; 5% medium sand.												Run 9 45 - 50' 100% Recovery
	46														
	46				11								7	PA	11_46.0-47.0
	47														
	48														
	49														
90	50														
	50		Well-Graded SAND (SW); olive; wet; 95% fine to coarse sand; 5% low plasticity fines.		12										12_50.0-51.0 Run 10 50 - 55' 100% Recovery
	51														
	52		Well-Graded GRAVEL with Clay (GW-GC); wet; 85% fine to coarse, subrounded gravel; 10% low plasticity fines; 5% medium to coarse sand; cobbles <3".												
	53				13										13_53.0-54.0
	54														
85	55														
	55		Poorly Graded SAND (SP); dark gray; wet; 95% fine to medium sand; 5% low plasticity fines.		14										14_55.0-56.0 Run 11 55 - 60'
	56		Well-Graded GRAVEL with Clay (GW-GC); wet; 80% fine to coarse, subrounded gravel; 10% fine to medium sand; 10% low plasticity fines; cobbles <3".												100% Recovery
	57				15										15_57-58.0
	58														
	59														
80	60														
	60		CLAYEY SAND (SC); dark yellowish brown; wet; 85% fine to coarse sand; 15% low plasticity fines.		16										16_60.0-61.0 Run 12 60 - 65'
	61														100% Recovery
	62		Well-Graded GRAVEL with Clay and Sand (GW-GC); wet; 65% coarse, subrounded gravel; 25% medium to coarse sand; 10% low plasticity fines.		17										17_62.0-63.0
	63														
	64														
75	65														
	65		Well-Graded SAND with Clay (SW-SC); light olive brown; wet; 60% fine to coarse sand; 30% fine to coarse gravel; 10% low plasticity fines; cobbles <3.5".												Run 13 65 - 70' 100% Recovery
	66				18								10	PA	18_66.0-67.0
	67														
	68		CLAYEY GRAVEL with Sand (GC); wet; 40% fine to coarse, subrounded gravel; 35% medium to coarse sand; 25% low plasticity fines.												
	69														
70	70														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,603.74 **Easting:** 6,663,518.54
Latitude: 39.45688 **Longitude:** -121.63927
Levee Station or Milepost: 2368+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_024S
Sheet 3 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

Elevation, feet	Depth, feet	Material Graphics	CLASSIFICATION OF MATERIALS (Description)	Sample Location	Sample Number	Recovery, %	Blows per 6 in. [Blows per ft]	N_{60} (ASTM)	PP or TV, tsf	LABORATORY DATA: Water Content, %	LABORATORY DATA: Liquid Limit	LABORATORY DATA: Plasticity Index	LABORATORY DATA: Fines, % < #200	LABORATORY DATA: Other Lab Tests	REMARKS
	70														Run 14 70 - 75' 100% Recovery 19_71.0-72.0
	71														
	72				19								15	PA	
	73														
	74														
65	75														Run 15 75 - 80' 100% Recovery 20_76.0-77.0
	76				20					8	27	8			
	77														
	78														
	79														
60	80														Run 16 80 - 85' 100% Recovery 21_81.0-82.0
	81				21								24	PA	
	82														
	83														
	84														
55	85														Run 17 85 - 93' 100% Recovery
	86														
	87														
	88		At 88 feet 70% fine to coarse gravel; 15% medium to coarse sand; 15% low plasticity fines; cobbles <3".												
	89														
50	90				22										22_89.0-90.0
	91														
	92														
	93				23										23_92.0-93.0
	94		End of boring at 93'. Backfilled with cement bentonite grout. 24-47 lb. bags cement, 90 gallons water, 1/4 bag of bentonite (50 lb. bag)												
45	95														

Final Report Version

Borehole Location: West Levee Crown **County:** Butte
Coordinates: Northing: 2,292,603.74 **Easting:** 6,663,518.54
Latitude: 39.45688 **Longitude:** -121.63927
Levee Station or Milepost: 2368+00 **Levee Mile:**
Levee Segment Reach 41
Survey Method: GPS **Coord. System:** CA State Plane Zone II
Channel / River Name / Feature: Feather River

LOG OF BORING
SM0007_024S
Sheet 4 of 4

SBFCA Feather River West Levee

SUTTER BUTTE SOIL LOG REV1; GINTSBFCA; SUTTERBUTTELIBRARY09142012.GLB; 10/10/12

APPENDIX G

Task Order 2 and Task Order 4
Hammer Energy Measurement Information

July 28, 2011

Patrick Liu
URS
901 P St.
Sacramento, CA

Re: Standard Penetration Energy Measurements
Automatic Hammer on Gregg Drilling's Marl M-10 Drill Rig, D-44
DCIF-DH-005

Dear Mr. Liu,

This report offers results of energy measurements and related calculations made on June 7, 2011 during Standard Penetration Testing (SPT) on Gregg Drilling's Marl M10, D-44 drill rig. Dynamic tests were performed on an instrumented section of NWJ drill rod attached to the sampler rod string. All dynamic measurements were obtained and recorded using a Pile Driving Analyzer®.

Equipment:

SPT energy measurements were made on SPT and Modified California samplers driven by the hammer/anvil system on the Gregg Drilling drill rig on June 7, 2011. The rig was tested on boring DCIF-DH-005. In total, 4 energy measurements were collected corresponding to 4 different samples at increasing depth.

Gregg used a Model PAK Pile Driving Analyzer (PDA) to acquire and process measurements of force and velocity with every impact of the automatic hammer on the sample rods. Gregg follows the procedure outlined in ASTM D4633. Two strain gauges mounted on a two foot section of NWJ rod measured force, while two piezoresistive accelerometers bolted on the same rod measured acceleration. The gauges were mounted approximately 6" from the top of the rod.
Analog signals from the gauges and accelerometers were collected, digitized, displayed in real-time, and stored by the PDA. Selected output from the PDA for each recorded impact of the hammer included:

- Maximum force in the rod (FMX)
- Maximum velocity in the rod (VMX)
- Maximum calculated transferred energy (EMX)
- Blows per minute (BPM)
- Energy transferred to the rods (ETR)

Data and Calculations:

The purpose of testing was to measure the energy transferred from the hammer to the drill rod and to calculate the energy efficiency of the hammer. The PDA measurements of force and velocity were reviewed after field testing and analyzed to calculate the transferred energy (EMX).

The maximum energy transferred past the gauge location, EMX, is computed by the PDA using force (F) and velocity (V) records as follows:

$$EMX = \int_a^b F(t)\, V(t)\, dt$$

The time "a" corresponds to the start of the record when the energy transfer begins and "b" is the time at which energy transferred to the rod reaches a maximum value. The energy transferred is defined as ETR, and is usually used to define the efficiency of the hammer/anvil system.

Results:

Table 1 summarizes the average calculated energies for each sample tested as well as the type of sample and depth. It is shown that the overall average (ETR) energy for this system is 88%. Appendix A provides plots and tables of PDA results for all hammer blows at each sampling depth. The plots and tables present selected measured and calculated results as a function of blow number. The results include:

- the blow number
- depth
- BLC (blow count in blows per foot)
- FMX (maximum rod force)
- VMX (maximum rod velocity)
- EMX (maximum transferred energy)
- BPM (blows per minute)
- ETR (energy transferred in percent of maximum)

At the end of each table is a statistical evaluation of the results for each variable including the average, standard deviation, maximum, and what blow number this maximum occurred.

If you have any questions or comments on this report, please do not hesitate to call our office at (562) 427-6899.

Sincerely,



Peter Robertson
Technical Advisor
Gregg Drilling & Testing

Client:	URS
Boring:	DCIF-DH-005
Date:	6/7/2011
Rig:	D-44

Table 1 - SPT Sample Summary

Sample #	Sampler	Length of Sample Rod (ft)	Sampler Length (ft)	Total Rod Length* (ft)	Depth of Sample (below Mudline) (ft)	Total Blows Analyzed by PDA	Average Energy Transferred to Rods (% of Theoretical Max.)	Maximum Efficiency Recorded (%)	Standard Deviation
1	SPT	21	3.80	24.8	17.5	5	87.1	95.0	7
2	SPT	26	3.80	29.8	23	4	86.9	95.0	6
3	SPT	47	3.80	50.8	43	7	86.9	89.8	3
4	SPT	50	3.80	53.8	48	9	89.9	96.5	5
						Average	87.7		

* Total rod length includes, sampler, rod, adaptors, and instrumented section below gauges

Appendix A

DHCCP - DCIF-DH-005 @ 17.5ft
OP: G. Trumm

140lb Auto Hammer
Test date: 7-Jun-2011

AR: 1.40 in^2
LE: 24.80 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	0.00	0.3	0.0	0.3	12.2	78.8
3	0.00	0.3	0.0	0.3	13.0	93.4
4	0.00	0.3	0.0	0.3	12.0	77.8
5	0.00	0.3	48.7	0.3	13.2	90.8
6	0.00	0.3	48.2	0.3	13.2	95.0
	Average	0.3	48.5	0.3	12.7	87.1
	Std. Dev.	0.0	0.3	0.0	0.5	7.4
	Maximum	0.3	48.7	0.3	13.2	95.0
	@ Blow#	6	5	6	6	6

Total number of blows analyzed: 5

Time Summary

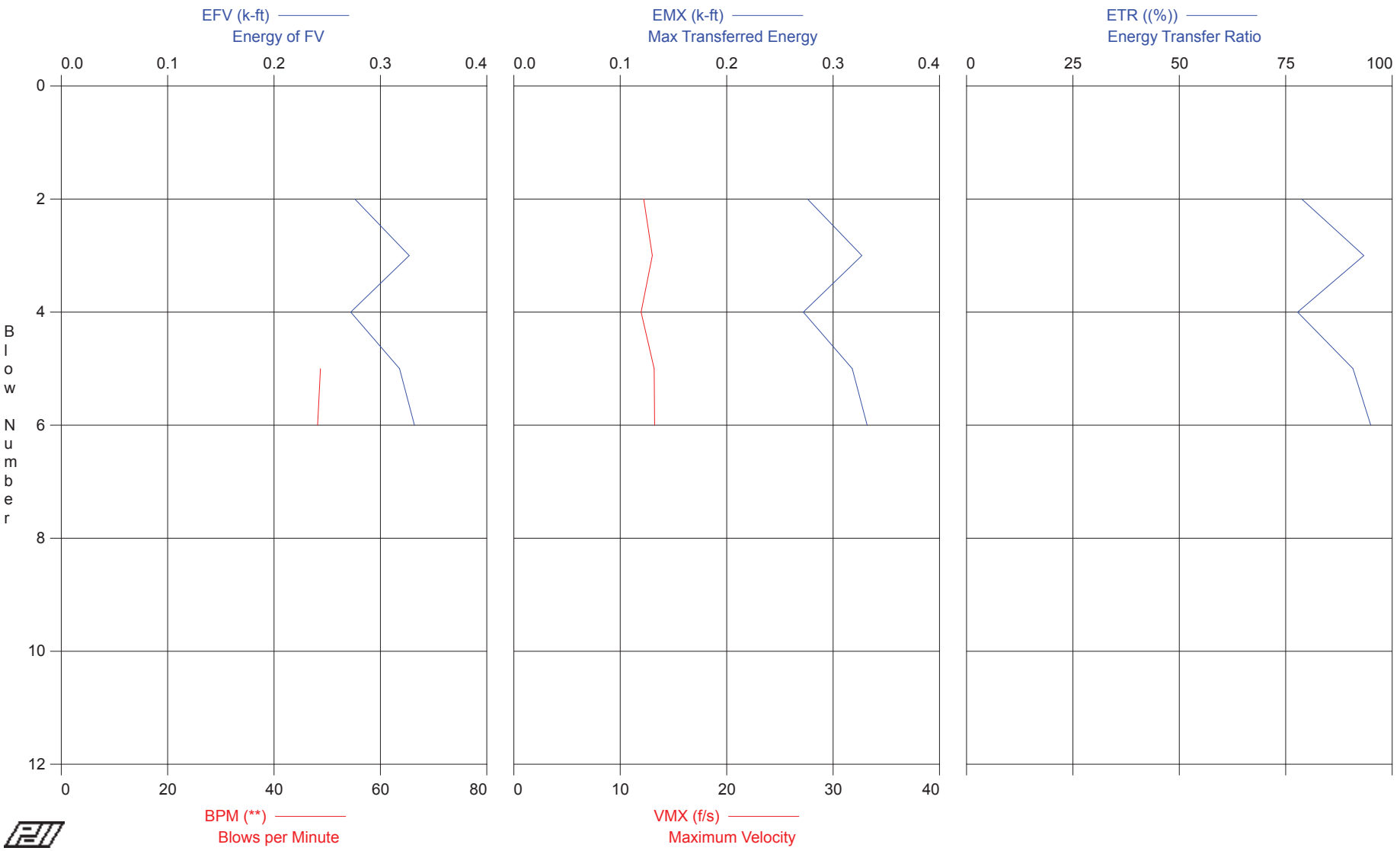
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 28-Jul-2011

Test date: 7-Jun-2011

DHCCP - DCIF-DH-005 @ 17.5ft



DHCCP - DCIF-DH-005 @ 23ft
OP: G. Trumm

140lb Auto Hammer
Test date: 7-Jun-2011

AR: 1.40 in^2
LE: 29.80 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	0.00	0.3	0.0	0.3	12.2	78.5
3	0.00	0.3	0.0	0.3	13.0	85.2
4	0.00	0.3	23.1	0.3	12.8	88.8
5	0.00	0.3	49.1	0.3	13.8	95.0
	Average	0.3	36.1	0.3	13.0	86.9
	Std. Dev.	0.0	13.0	0.0	0.6	6.0
	Maximum	0.3	49.1	0.3	13.8	95.0
	@ Blow#	5	5	5	5	5

Total number of blows analyzed: 4

Time Summary

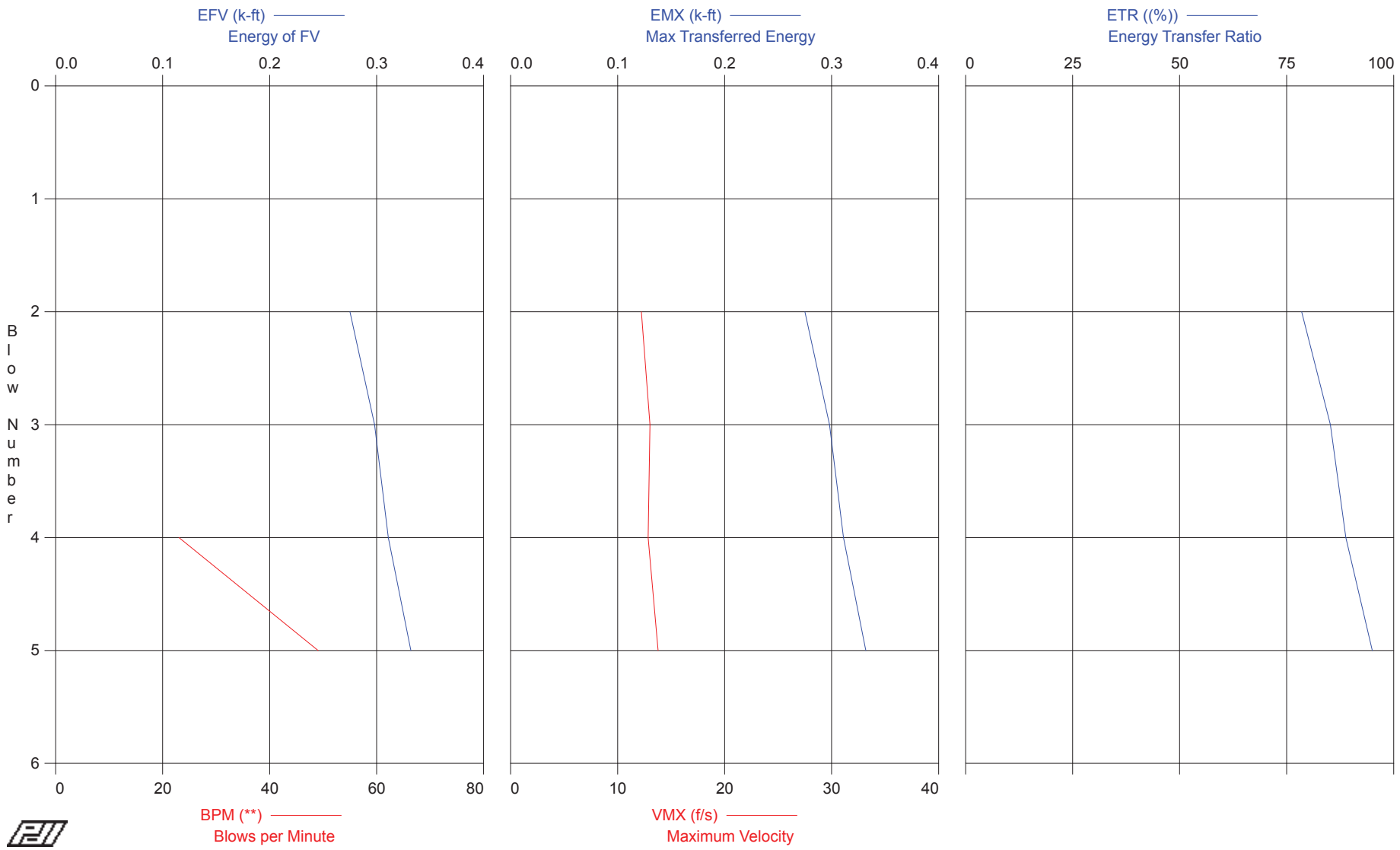
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 28-Jul-2011

Test date: 7-Jun-2011

DHCCP - DCIF-DH-005 @ 23ft



DHCCP - DCIF-DH-005 @ 43ft
OP: G. Trumm

140lb Auto Hammer
Test date: 7-Jun-2011

AR: 1.40 in^2
LE: 50.80 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	3.00	0.3	0.0	0.3	13.7	82.3
3	0.00	0.3	0.0	0.3	14.3	89.5
4	0.00	0.3	48.3	0.3	14.5	88.0
5	0.00	0.3	47.9	0.3	14.4	85.5
6	0.00	0.3	48.5	0.3	14.8	88.4
7	0.00	0.3	49.5	0.3	14.3	85.1
8	0.00	0.3	46.3	0.3	14.4	89.8
	Average	0.3	48.1	0.3	14.3	86.9
	Std. Dev.	0.0	1.0	0.0	0.3	2.5
	Maximum	0.3	49.5	0.3	14.8	89.8
	@ Blow#	8	7	8	6	8

Total number of blows analyzed: 7

Time Summary

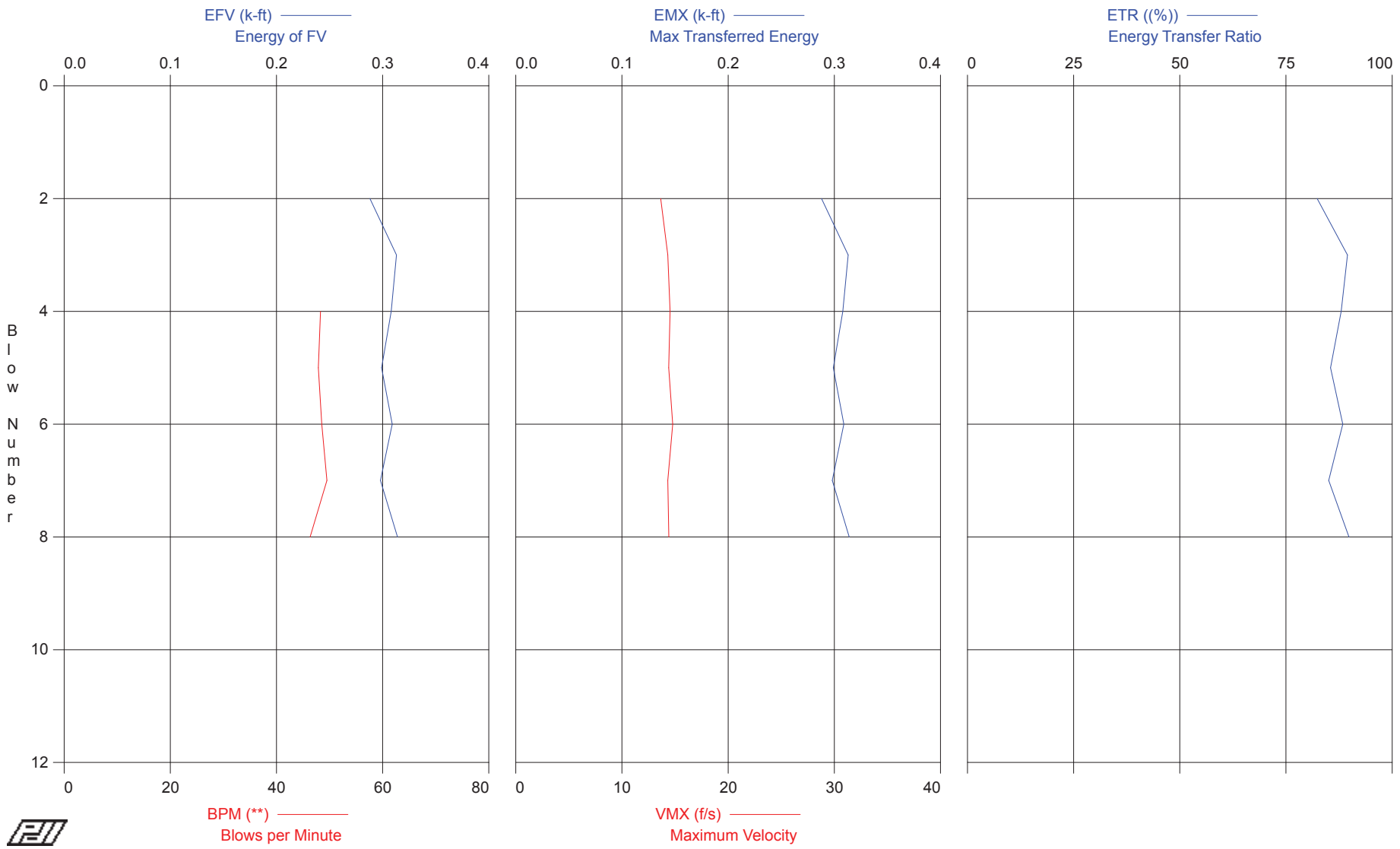
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 28-Jul-2011

Test date: 7-Jun-2011

DHCCP - DCIF-DH-005 @ 43ft



DHCCP - DCIF-DH-005 @ 48ft
OP: G. Trumm

140lb Auto Hammer
Test date: 7-Jun-2011

AR: 1.40 in^2
LE: 53.80 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	0.00	0.3	0.0	0.3	14.0	89.9
3	0.00	0.3	0.0	0.3	14.3	87.7
4	0.00	0.3	50.0	0.3	14.7	90.5
5	0.00	0.3	48.1	0.3	14.7	93.9
6	0.00	0.3	49.8	0.3	14.1	80.2
7	0.00	0.3	47.7	0.3	14.1	85.9
8	0.00	0.3	48.6	0.3	14.7	88.3
9	0.00	0.3	48.7	0.3	14.7	96.0
10	0.00	0.3	48.1	0.3	15.3	96.5
	Average	0.3	48.7	0.3	14.5	89.9
	Std. Dev.	0.0	0.8	0.0	0.4	4.9
	Maximum	0.3	50.0	0.3	15.3	96.5
	@ Blow#	10	4	10	10	10

Total number of blows analyzed: 9

Time Summary

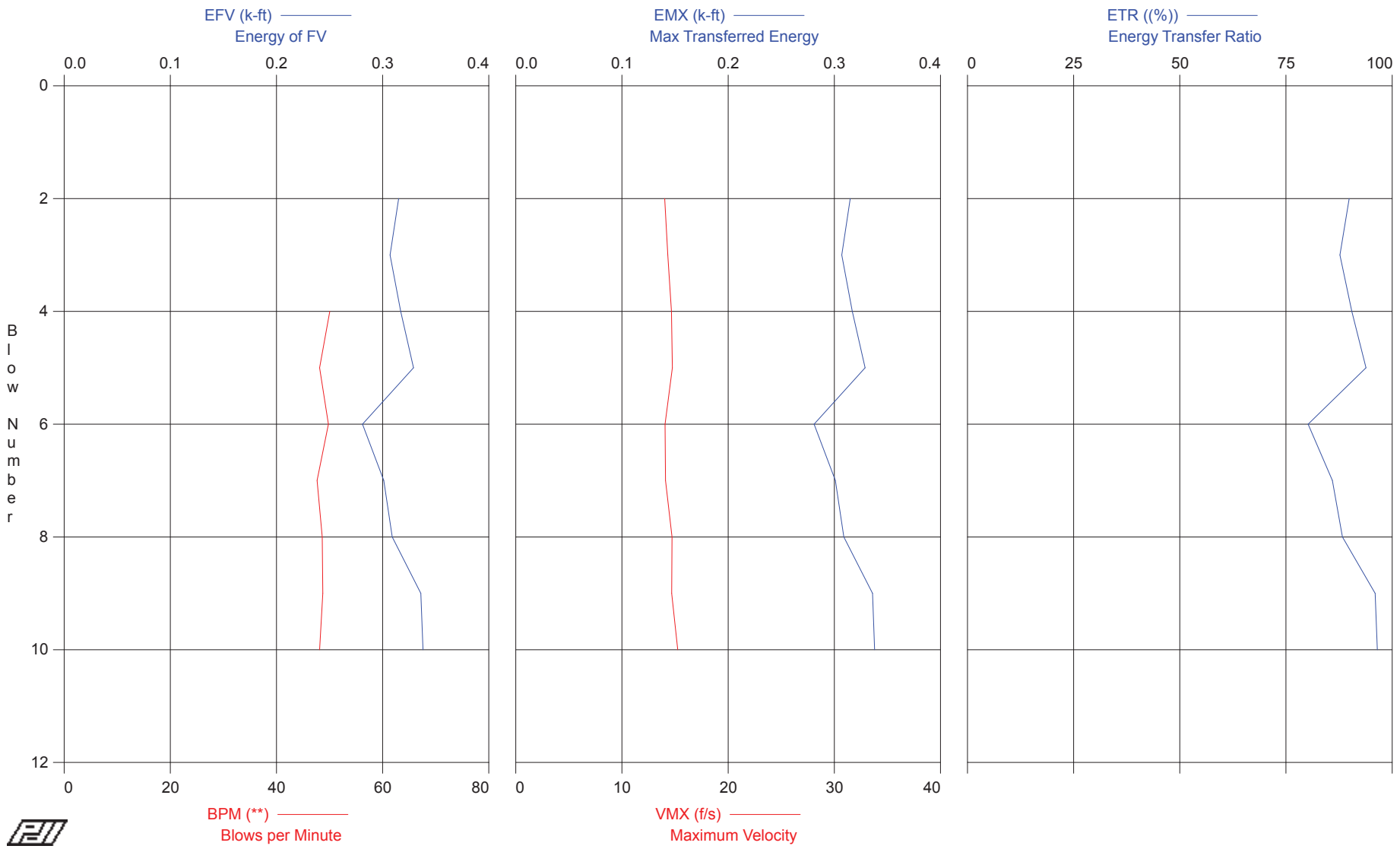
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 28-Jul-2011

Test date: 7-Jun-2011

DHCCP - DCIF-DH-005 @ 48ft



August 12, 2011

Matthew Weil
URS
2870 Gateway Oaks Dr., Suite 150
Sacramento, California 95833

Re: Standard Penetration Energy Measurements
Automatic Hammer on Mud Rotary Drill Rig, D-20
Boring 720+71

Dear Mr. Weil,

This report offers results of energy measurements and related calculations made on August 11, 2011 during Standard Penetration Testing (SPT) on Gregg Drilling's Versa Drill, D-20 mud rotary drill rig. Dynamic tests were performed on an instrumented section of NWJ drill rod attached to the sampler rod string. All dynamic measurements were obtained and recorded using a Pile Driving Analyzer®.

Equipment:

SPT energy measurements were made on SPT and Modified California samplers driven by the hammer/anvil system on the Gregg Drilling drill rig on August 11, 2011. The rig was tested on Boring 720+71. In total, 8 energy measurements were collected corresponding to 8 different samples at increasing depth.

Gregg used a Model PAK Pile Driving Analyzer (PDA) to acquire and process measurements of force and velocity with every impact of the automatic hammer on the sample rods. Gregg follows the procedure outlined in ASTM D4633. Two strain gauges mounted on a two foot section of NWJ rod measured force, while two piezoresistive accelerometers bolted on the same rod measured acceleration. The gauges were mounted approximately 6" from the top of the rod.
Analog signals from the gauges and accelerometers were collected, digitized, displayed in real-time, and stored by the PDA. Selected output from the PDA for each recorded impact of the hammer included:

- Maximum force in the rod (FMX)
- Maximum velocity in the rod (VMX)
- Maximum calculated transferred energy (EMX)
- Blows per minute (BPM)
- Energy transferred to the rods (ETR)

Data and Calculations:

The purpose of testing was to measure the energy transferred from the hammer to the drill rod and to calculate the energy efficiency of the hammer. The PDA measurements of force and velocity were reviewed after field testing and analyzed to calculate the transferred energy (EMX).

The maximum energy transferred past the gauge location, EMX, is computed by the PDA using force (F) and velocity (V) records as follows:

$$EMX = \int_a^b F(t)\, V(t)\, dt$$

The time "a" corresponds to the start of the record when the energy transfer begins and "b" is the time at which energy transferred to the rod reaches a maximum value. The energy transferred is defined as ETR, and is usually used to define the efficiency of the hammer/anvil system.

Results:

Table 1 summarizes the average calculated energies for each sample tested as well as the type of sample and depth. It is shown that the overall average (ETR) energy for this system is 85%. Appendix A provides plots and tables of PDA results for all hammer blows at each sampling depth. The plots and tables present selected measured and calculated results as a function of blow number. The results include:

- the blow number
- depth
- BLC (blow count in blows per foot)
- FMX (maximum rod force)
- VMX (maximum rod velocity)
- EMX (maximum transferred energy)
- BPM (blows per minute)
- ETR (energy transferred in percent of maximum)

At the end of each table is a statistical evaluation of the results for each variable including the average, standard deviation, maximum, and what blow number this maximum occurred.

If you have any questions or comments on this report, please do not hesitate to call our office at (562) 427-6899.

Sincerely,



Peter Robertson
Technical Advisor
Gregg Drilling & Testing

Client: URS
Boring: 720+71
Date: 8/11/2011

Table 1 - SPT Sample Summary

Sample #	Sampler	Length of Sample Rod (ft)	Sampler Length (ft)	Total Rod Length* (ft)	Depth of Sample (below Mudline) (ft)	Total Blows Analyzed by PDA	Average Energy Transferred to Rods (% of Theoretical Max.)	Maximum Efficiency Recorded (%)	Standard Deviation
1	Mod. Cal	5	3.60	8.6	5	41	83.8	88.0	3
2	Mod. Cal	10	3.60	13.6	7.5	59	85.5	88.3	2
3	Mod. Cal	10	3.60	13.6	10	36	81.3	85.9	3
4	Mod. Cal	15	3.60	18.6	12.5	35	83.5	85.2	1
5	Mod. Cal	15	3.60	18.6	15	28	82.3	85.4	2
6	SPT	20	4.20	24.2	17.5	16	84.4	85.7	1
7	Mod. Cal	20	3.60	23.6	20	30	85.9	87.0	1
8	Mod. Cal	25	3.60	28.6	22.5	19	93.8	96.6	2
						Average	85.1		

* Total rod length includes, sampler, rod, adaptors, and instrumented section below gauges

Appendix A

Feather River West Levee - 720+71 @ 5ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 1-Aug-2011

AR: 1.40 in^2
LE: 8.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	0.00	0.3	0.0	0.3	17.3	75.3
3	0.00	0.3	0.0	0.3	17.3	78.0
4	0.00	0.3	39.5	0.3	17.1	78.4
5	0.00	0.3	39.4	0.3	16.6	80.1
6	0.00	0.3	39.5	0.3	16.4	80.8
7	0.00	0.3	39.5	0.3	16.5	82.1
8	0.00	0.3	39.5	0.3	15.9	83.4
9	0.00	0.3	39.6	0.3	15.7	81.5
10	0.00	0.3	39.6	0.3	15.7	83.8
11	0.00	0.3	39.6	0.3	15.6	81.2
12	0.00	0.3	39.6	0.3	15.2	80.4
13	0.00	0.3	39.6	0.3	14.9	81.4
14	0.00	0.3	39.7	0.3	14.7	83.5
15	0.00	0.3	39.7	0.3	15.1	83.6
16	0.00	0.3	39.7	0.3	15.4	83.5
17	0.00	0.3	39.7	0.3	15.0	83.1
18	0.00	0.3	39.7	0.3	15.1	83.1
19	0.00	0.3	39.6	0.3	15.3	82.8
20	0.00	0.3	39.7	0.3	14.5	86.0
21	0.00	0.3	39.7	0.3	14.8	83.1
22	0.00	0.3	39.6	0.3	14.5	84.4
23	0.00	0.3	39.7	0.3	14.5	84.6
24	0.00	0.3	39.7	0.3	14.7	85.3
25	0.00	0.3	39.7	0.3	14.6	85.2
26	0.00	0.3	39.7	0.3	14.5	85.6
27	0.00	0.3	39.7	0.3	14.5	84.8
28	0.00	0.3	39.7	0.3	14.5	85.3
29	0.00	0.3	39.7	0.3	14.4	85.1
30	0.00	0.3	39.7	0.3	14.6	85.0
31	0.00	0.3	39.7	0.3	14.6	87.7
32	0.00	0.3	39.7	0.3	14.4	85.1
33	0.00	0.3	39.7	0.3	14.6	85.6
34	0.00	0.3	39.7	0.3	14.5	86.1
35	0.00	0.3	39.7	0.3	14.6	86.2
36	0.00	0.3	39.8	0.3	14.6	86.1
37	0.00	0.3	39.7	0.3	14.6	85.4
38	0.00	0.3	39.7	0.3	14.4	86.4
39	0.00	0.3	39.7	0.3	14.6	85.6
40	0.00	0.3	39.7	0.3	14.5	87.8
41	0.00	0.3	39.7	0.3	14.8	87.6
42	0.00	0.3	39.7	0.3	14.5	88.0
	Average	0.3	39.7	0.3	15.1	83.8
	Std. Dev.	0.0	0.1	0.0	0.8	2.7
	Maximum	0.3	39.8	0.3	17.3	88.0
	@ Blow#	42	36	42	2	42

Total number of blows analyzed: 41

Time Summary

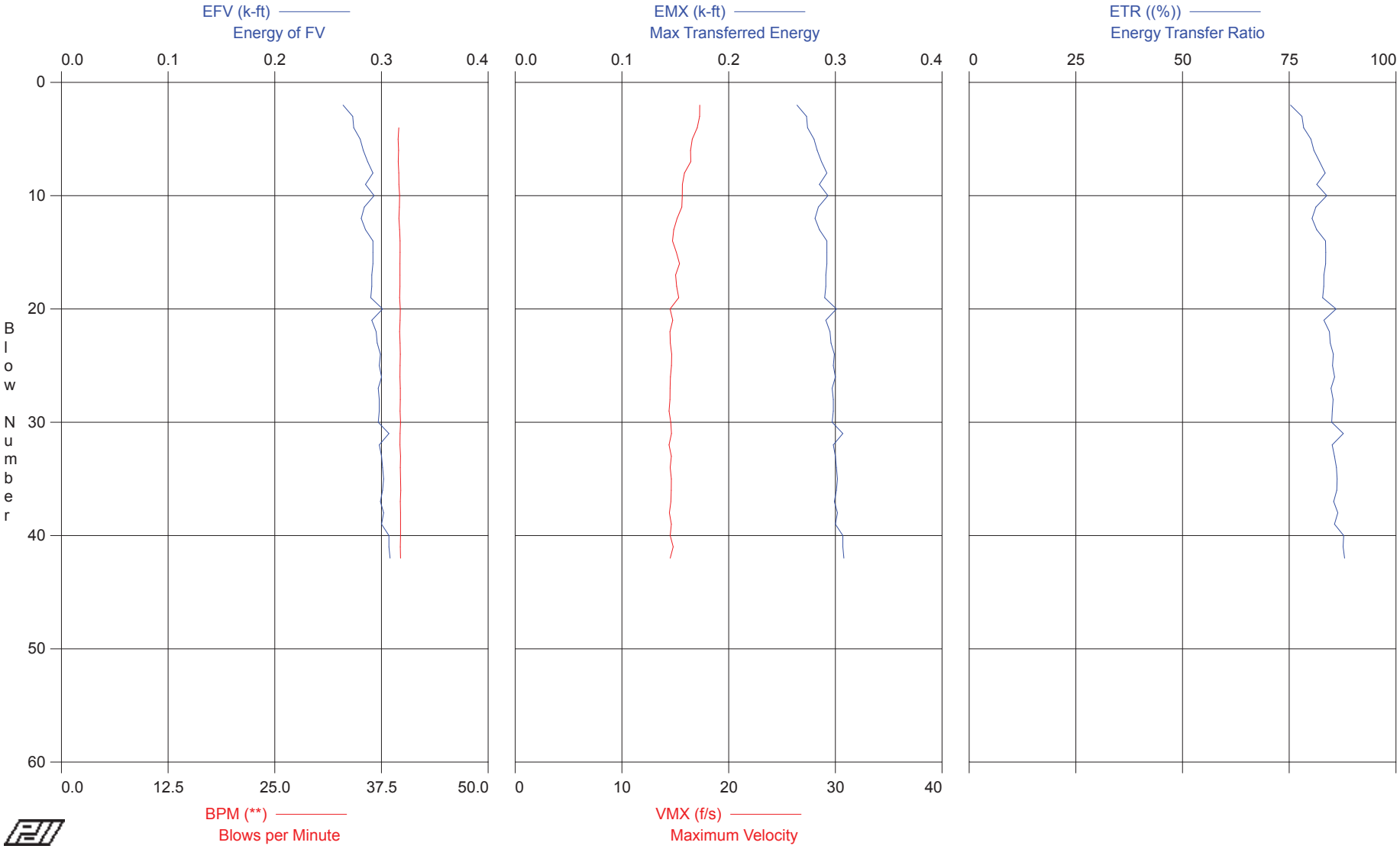
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 1-Aug-2011

Feather River West Levee - 720+71 @ 5ft



Feather River West Levee - 720+71 @ 7.5ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.40 in^2
LE: 13.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	0.00	0.3	0.0	0.3	15.6	75.8
3	0.00	0.3	0.0	0.3	15.6	79.3
4	0.00	0.3	32.7	0.3	15.4	81.6
5	0.00	0.3	32.8	0.3	15.6	82.6
6	0.00	0.3	33.1	0.3	15.6	83.7
7	0.00	0.3	34.5	0.3	15.5	82.3
8	0.00	0.3	35.8	0.3	15.6	83.4
9	0.00	0.3	36.0	0.3	15.4	83.7
10	0.00	0.3	36.2	0.3	15.6	84.2
11	0.00	0.3	36.3	0.3	15.3	83.4
12	0.00	0.3	36.3	0.3	15.3	82.9
13	0.00	0.3	36.4	0.3	15.4	83.5
14	0.00	0.3	36.4	0.3	15.6	84.8
15	0.00	0.3	37.1	0.3	15.6	85.0
16	0.00	0.3	37.7	0.3	15.5	85.7
17	0.00	0.3	38.0	0.3	15.6	85.4
18	0.00	0.3	38.0	0.3	15.5	85.4
19	0.00	0.3	38.2	0.3	15.5	86.3
20	0.00	0.3	38.2	0.3	15.6	86.0
21	0.00	0.3	38.3	0.3	15.7	86.5
22	0.00	0.3	38.3	0.3	15.5	86.6
23	0.00	0.3	38.4	0.3	15.6	85.9
24	0.00	0.3	38.3	0.3	15.5	86.2
25	0.00	0.3	38.4	0.3	15.5	86.3
26	0.00	0.3	38.4	0.3	15.1	84.5
27	0.00	0.3	38.4	0.3	15.6	86.4
28	0.00	0.3	38.4	0.3	14.9	85.9
29	0.00	0.3	38.4	0.3	15.6	86.8
30	0.00	0.3	38.5	0.3	15.7	87.0
31	0.00	0.3	38.4	0.3	15.4	85.8
32	0.00	0.3	38.5	0.3	15.6	84.5
33	0.00	0.3	38.5	0.3	15.6	86.1
34	0.00	0.3	38.5	0.3	15.6	85.6
35	0.00	0.3	38.5	0.3	15.6	85.5
36	0.00	0.3	38.6	0.3	15.7	86.3
37	0.00	0.3	38.5	0.3	15.5	86.1
38	0.00	0.3	38.5	0.3	15.7	86.5
39	0.00	0.3	38.5	0.3	15.6	85.9
40	0.00	0.3	38.5	0.3	15.5	86.1
41	0.00	0.3	38.5	0.3	15.6	85.8
42	0.00	0.3	38.5	0.3	15.7	85.9
43	0.00	0.3	38.5	0.3	15.6	86.3
44	0.00	0.3	38.5	0.3	15.7	86.6
45	0.00	0.3	38.6	0.3	15.7	86.6
46	0.00	0.3	38.5	0.3	15.6	86.7
47	0.00	0.3	38.6	0.3	15.7	87.1
48	0.00	0.3	38.6	0.3	15.6	86.7
49	0.00	0.3	38.6	0.3	15.7	87.1
50	0.00	0.3	38.5	0.3	15.6	86.8
51	0.00	0.3	38.5	0.3	15.1	85.9
52	0.00	0.3	38.5	0.3	15.7	87.7
53	0.00	0.3	38.6	0.3	15.8	88.3
54	0.00	0.3	38.5	0.3	15.8	88.3
55	0.00	0.3	38.5	0.3	15.9	88.2
56	0.00	0.3	38.5	0.3	15.8	87.0
57	0.00	0.3	38.6	0.3	15.7	87.1
58	0.00	0.3	38.6	0.3	15.9	87.6
59	0.00	0.3	38.5	0.3	15.8	86.8
60	0.00	0.3	38.6	0.3	15.8	87.3
	Average	0.3	37.8	0.3	15.6	85.5
	Std. Dev.	0.0	1.5	0.0	0.2	2.1
	Maximum	0.3	38.6	0.3	15.9	88.3
	@ Blow#	53	49	53	55	53

Total number of blows analyzed: 59

Time Summary

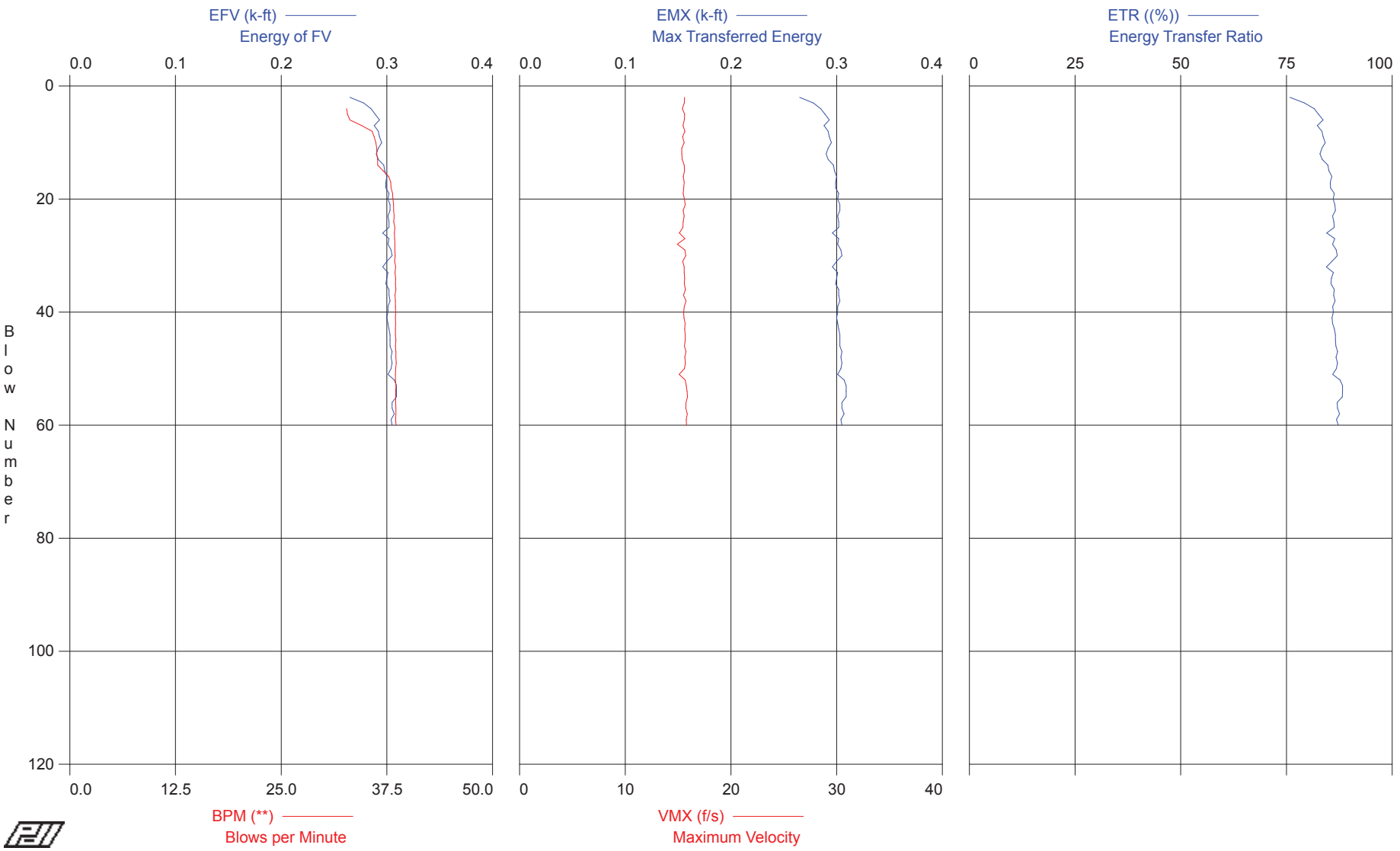
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 7.5ft



Feather River West Levee - 720+71 @ 10ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.40 in^2
LE: 13.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
2	0.00	0.3	0.0	0.3	16.5	73.9
3	0.00	0.3	0.0	0.3	16.4	72.8
4	0.00	0.3	28.2	0.3	15.4	79.2
5	0.00	0.3	28.5	0.3	16.3	76.8
6	0.00	0.3	31.4	0.3	15.5	77.9
7	0.00	0.3	32.2	0.3	15.6	78.0
8	0.00	0.3	32.4	0.3	15.4	78.9
9	0.00	0.3	32.5	0.3	15.4	79.0
10	0.00	0.3	32.6	0.3	15.7	80.4
11	0.00	0.3	36.2	0.3	15.9	83.1
12	0.00	0.3	42.9	0.3	15.5	81.0
13	0.00	0.3	40.7	0.3	15.5	83.6
14	0.00	0.3	37.4	0.3	15.5	79.5
15	0.00	0.3	33.8	0.3	15.5	79.5
16	0.00	0.3	33.8	0.3	15.6	79.5
17	0.00	0.3	33.7	0.3	15.6	80.2
18	0.00	0.3	33.6	0.3	15.6	78.8
19	0.00	0.3	33.7	0.3	15.5	82.0
20	0.00	0.3	33.6	0.3	15.5	78.4
21	0.00	0.3	33.9	0.3	15.6	80.2
22	0.00	0.3	38.1	0.3	15.8	81.3
23	0.00	0.3	39.7	0.3	15.7	81.9
24	0.00	0.3	39.8	0.3	15.7	82.7
25	0.00	0.3	39.8	0.3	15.9	84.2
26	0.00	0.3	39.9	0.3	15.5	83.3
27	0.00	0.3	39.8	0.3	15.8	84.3
28	0.00	0.3	40.0	0.3	15.9	83.4
29	0.00	0.3	39.9	0.3	16.0	83.6
30	0.00	0.3	39.9	0.3	15.9	84.4
31	0.00	0.3	39.8	0.3	15.9	84.3
32	0.00	0.3	39.9	0.3	16.0	85.7
33	0.00	0.3	40.0	0.3	16.0	85.2
34	0.00	0.3	39.9	0.3	15.9	84.1
35	0.00	0.3	40.0	0.3	15.9	85.8
36	0.00	0.3	39.9	0.3	15.5	85.7
37	0.00	0.3	39.9	0.3	15.5	85.9
	Average	0.3	36.7	0.3	15.7	81.3
	Std. Dev.	0.0	3.9	0.0	0.3	3.2
	Maximum	0.3	42.9	0.3	16.5	85.9
	@ Blow#	37	12	37	2	37

Total number of blows analyzed: 36

Time Summary

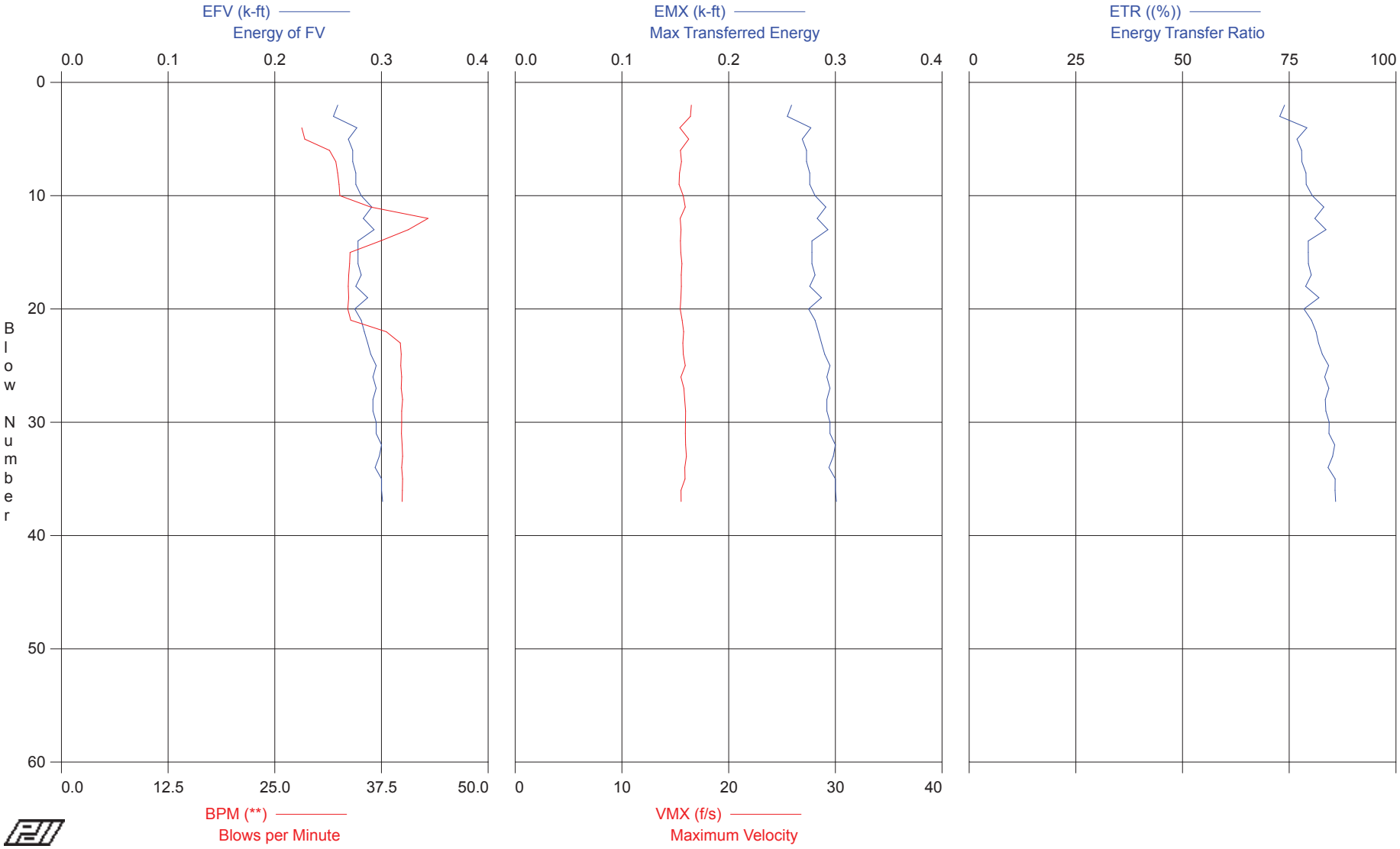
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 10ft



Feather River West Levee - 720+71 @ 12.5ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.40 in^2
LE: 18.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
4	0.00	0.3	0.0	0.3	14.2	79.0
5	0.00	0.3	0.0	0.3	14.4	80.4
6	0.00	0.3	30.7	0.3	14.1	80.9
7	0.00	0.3	33.7	0.3	14.3	81.5
8	0.00	0.3	36.8	0.3	14.6	82.9
9	0.00	0.3	37.2	0.3	14.5	82.8
10	0.00	0.3	37.3	0.3	14.2	82.6
11	0.00	0.3	37.5	0.3	14.5	83.2
12	0.00	0.3	37.6	0.3	14.5	83.3
13	0.00	0.3	37.7	0.3	14.5	83.3
14	0.00	0.3	37.7	0.3	14.6	83.6
15	0.00	0.3	37.8	0.3	14.6	83.5
16	0.00	0.3	37.8	0.3	14.6	84.1
17	0.00	0.3	37.9	0.3	14.4	83.2
18	0.00	0.3	37.8	0.3	14.6	84.3
19	0.00	0.3	37.9	0.3	14.6	84.6
20	0.00	0.3	37.9	0.3	14.7	84.4
21	0.00	0.3	37.9	0.3	14.5	84.1
22	0.00	0.3	37.9	0.3	14.6	84.0
23	0.00	0.3	37.9	0.3	14.4	83.3
24	0.00	0.3	37.9	0.3	14.4	84.1
25	0.00	0.3	38.0	0.3	14.6	84.1
26	0.00	0.3	37.9	0.3	14.6	84.5
27	0.00	0.3	38.0	0.3	14.5	84.4
28	0.00	0.3	37.9	0.3	14.5	84.5
29	0.00	0.3	38.0	0.3	14.4	83.8
30	0.00	0.3	38.0	0.3	14.6	85.2
31	0.00	0.3	37.9	0.3	14.4	83.4
32	0.00	0.3	38.0	0.3	14.6	84.7
33	0.00	0.3	38.0	0.3	14.5	84.5
34	0.00	0.3	38.0	0.3	14.7	84.9
35	0.00	0.3	37.9	0.3	14.6	84.6
36	0.00	0.3	38.0	0.3	14.5	84.0
37	0.00	0.3	38.0	0.3	14.6	84.2
38	0.00	0.3	38.1	0.3	14.4	83.8
	Average	0.3	37.5	0.3	14.5	83.5
	Std. Dev.	0.0	1.4	0.0	0.1	1.3
	Maximum	0.3	38.1	0.3	14.7	85.2
	@ Blow#	30	38	30	20	30

Total number of blows analyzed: 35

Time Summary

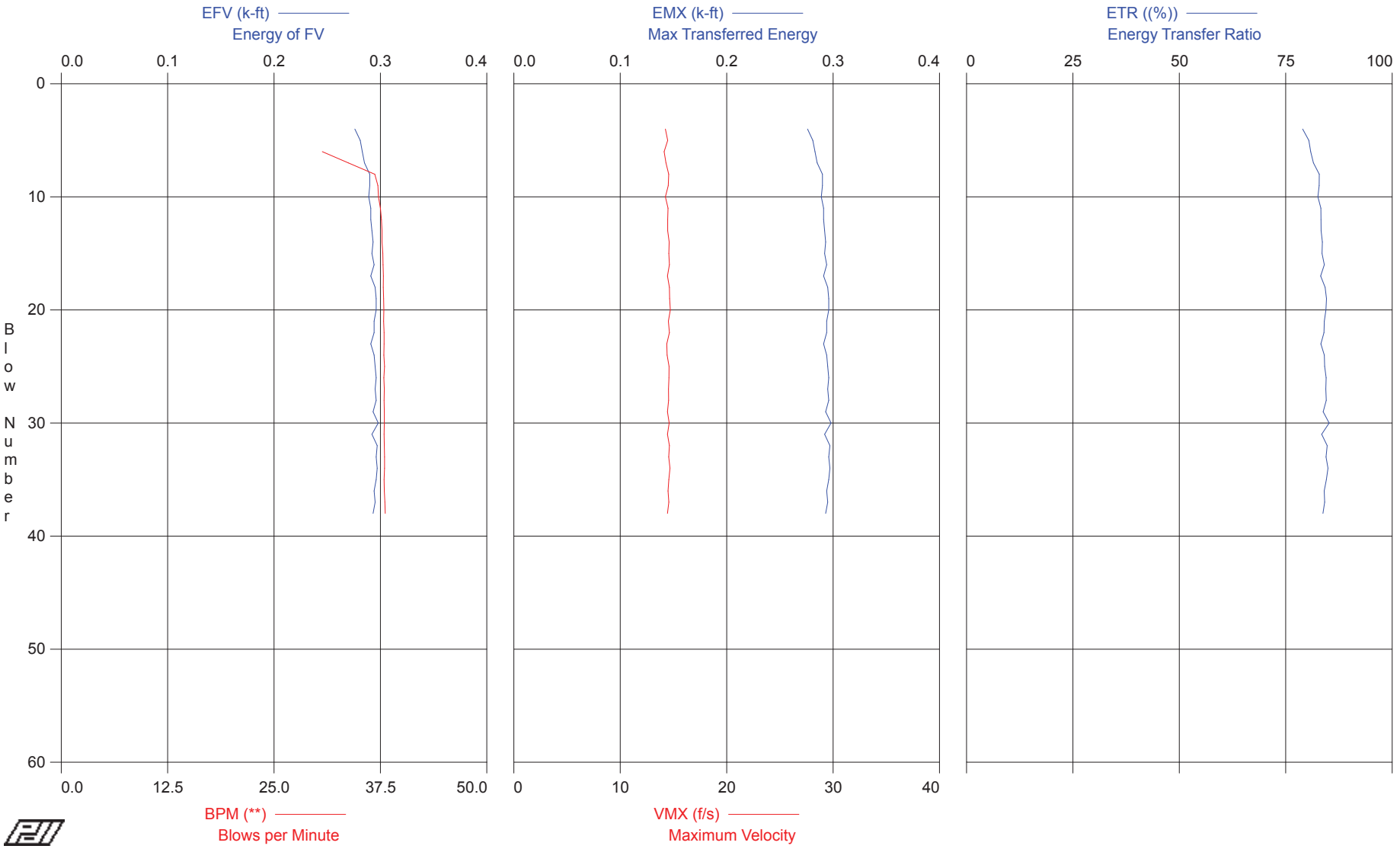
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 12.5ft



Feather River West Levee - 720+71 @ 15ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.40 in^2
LE: 18.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
3	0.00	0.3	0.0	0.3	16.7	77.1
4	0.00	0.3	0.0	0.3	16.0	78.4
5	0.00	0.3	35.0	0.3	15.9	79.5
6	0.00	0.3	35.7	0.3	16.1	81.5
7	0.00	0.3	35.8	0.3	15.3	81.1
8	0.00	0.3	36.4	0.3	14.2	79.4
9	0.00	0.3	36.8	0.3	15.2	82.4
10	0.00	0.3	36.9	0.3	15.3	81.6
11	0.00	0.3	37.2	0.3	15.8	82.4
12	0.00	0.3	38.3	0.3	15.5	82.6
13	0.00	0.3	38.4	0.3	15.0	81.8
14	0.00	0.3	38.6	0.3	15.1	82.2
15	0.00	0.3	38.7	0.3	14.7	81.9
16	0.00	0.3	38.8	0.3	15.0	83.0
17	0.00	0.3	38.9	0.3	15.4	83.1
18	0.00	0.3	38.9	0.3	14.9	82.3
19	0.00	0.3	39.0	0.3	15.1	84.1
20	0.00	0.3	39.1	0.3	14.3	82.9
21	0.00	0.3	39.1	0.3	14.0	81.9
22	0.00	0.3	39.5	0.3	14.5	83.7
23	0.00	0.3	40.7	0.3	14.3	83.6
24	0.00	0.3	40.9	0.3	13.8	82.3
25	0.00	0.3	41.1	0.3	14.6	84.6
26	0.00	0.3	41.2	0.3	14.4	84.4
27	0.00	0.3	41.3	0.3	14.6	85.4
28	0.00	0.3	41.4	0.3	14.5	84.8
29	0.00	0.3	41.4	0.3	14.2	83.2
30	0.00	0.3	41.5	0.3	14.4	83.8
	Average	0.3	38.9	0.3	15.0	82.3
	Std. Dev.	0.0	1.9	0.0	0.7	1.9
	Maximum	0.3	41.5	0.3	16.7	85.4
	@ Blow#	27	30	27	3	27

Total number of blows analyzed: 28

Time Summary

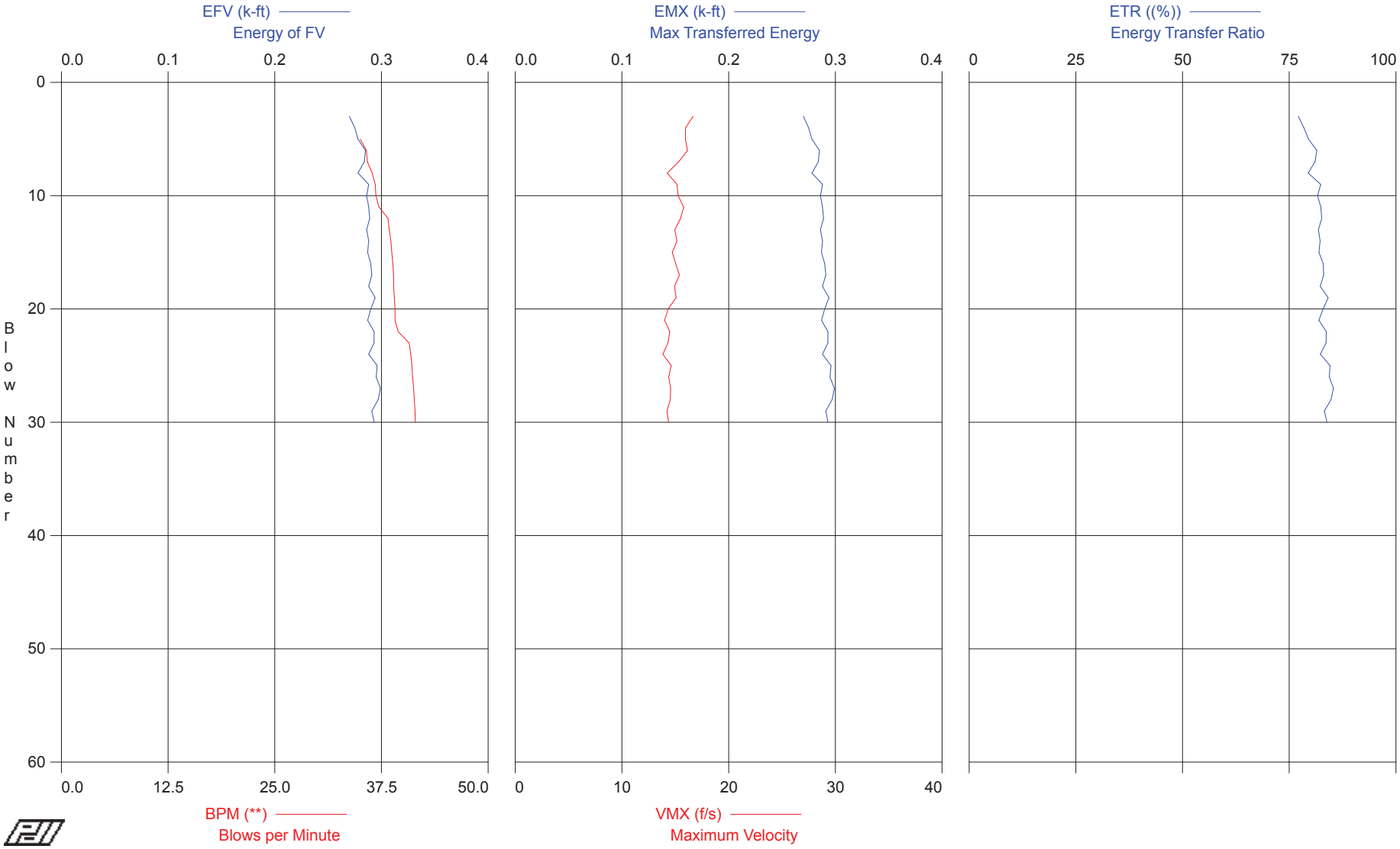
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 15ft



Feather River West Levee - 720+71 @ 17.5ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.40 in^2
LE: 24.20 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
4	0.00	0.3	0.0	0.3	16.0	83.3
5	0.00	0.3	0.0	0.3	15.3	82.2
6	0.00	0.3	33.1	0.3	15.8	84.3
7	0.00	0.3	33.2	0.3	15.7	83.7
8	0.00	0.3	33.4	0.3	15.1	81.8
9	0.00	0.3	34.7	0.3	15.6	83.6
10	0.00	0.3	35.8	0.3	15.7	84.2
11	0.00	0.3	36.0	0.3	15.7	84.9
12	0.00	0.3	36.1	0.3	15.6	84.9
13	0.00	0.3	36.2	0.3	15.7	85.4
14	0.00	0.3	37.5	0.3	15.6	85.6
15	0.00	0.3	38.0	0.3	15.5	85.0
16	0.00	0.3	38.1	0.3	15.5	85.3
17	0.00	0.3	38.2	0.3	15.7	85.7
18	0.00	0.3	38.3	0.3	15.5	84.9
19	0.00	0.3	38.4	0.3	15.7	85.0
	Average	0.3	36.2	0.3	15.6	84.4
	Std. Dev.	0.0	1.9	0.0	0.2	1.1
	Maximum	0.3	38.4	0.3	16.0	85.7
	@ Blow#	14	19	14	4	17

Total number of blows analyzed: 16

Time Summary

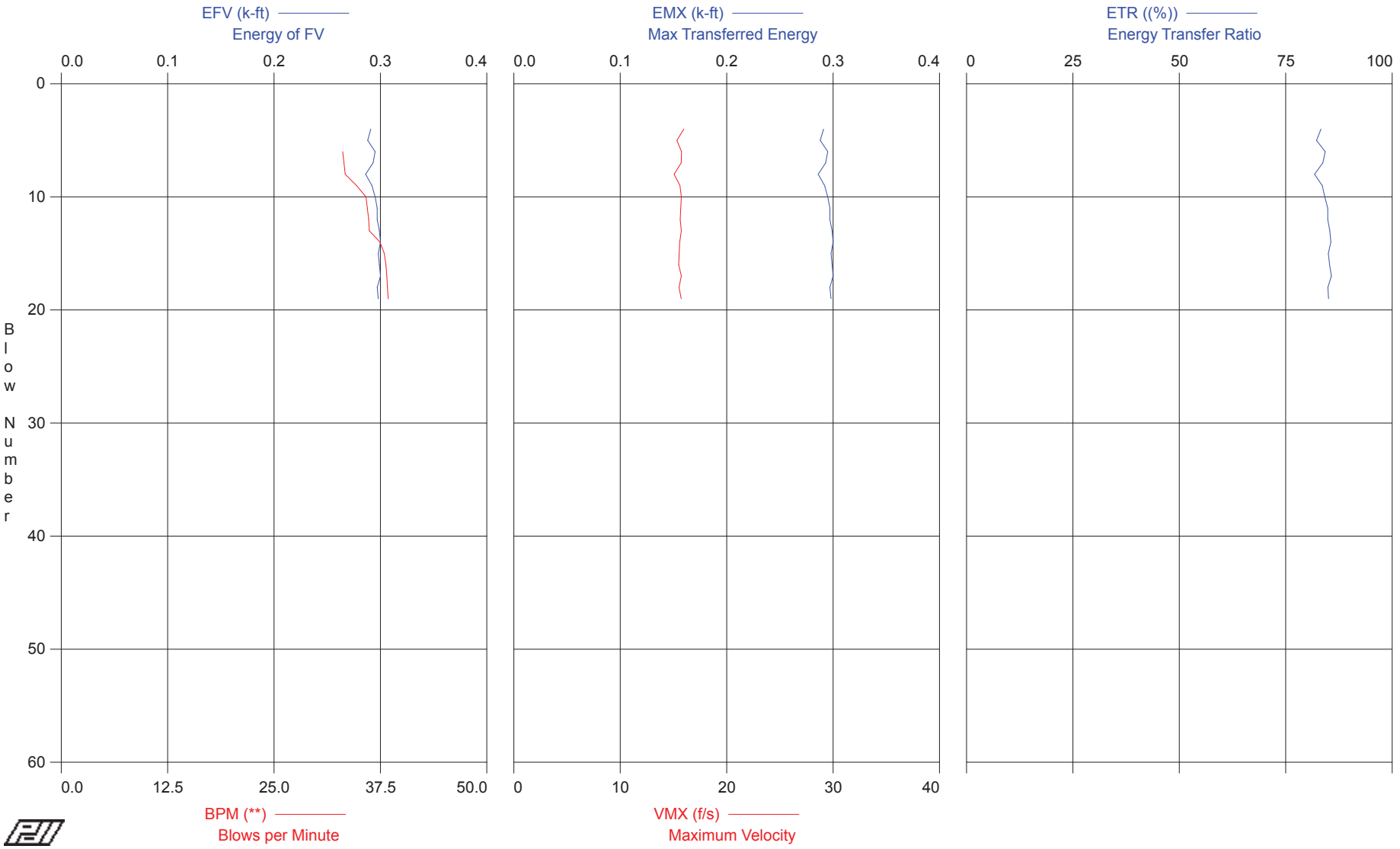
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 17.5ft



Feather River West Levee - 720+71 @ 20ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.40 in^2
LE: 23.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
3	0.00	0.3	0.0	0.3	15.4	82.6
4	0.00	0.3	0.0	0.3	15.6	82.9
5	0.00	0.3	31.0	0.3	15.7	83.7
6	0.00	0.3	37.7	0.3	15.8	86.2
7	0.00	0.3	39.4	0.3	16.0	86.6
8	0.00	0.3	39.6	0.3	15.8	85.8
9	0.00	0.3	39.7	0.3	15.8	86.0
10	0.00	0.3	39.7	0.3	15.9	86.5
11	0.00	0.3	39.7	0.3	15.8	86.3
12	0.00	0.3	39.8	0.3	15.7	86.4
13	0.00	0.3	39.8	0.3	15.9	87.0
14	0.00	0.3	39.9	0.3	15.8	86.3
15	0.00	0.3	39.9	0.3	15.8	86.7
16	0.00	0.3	39.9	0.3	15.7	85.5
17	0.00	0.3	39.9	0.3	15.7	86.3
18	0.00	0.3	39.9	0.3	15.8	86.9
19	0.00	0.3	39.9	0.3	15.9	86.7
20	0.00	0.3	39.9	0.3	15.9	87.0
21	0.00	0.3	39.9	0.3	15.7	86.3
22	0.00	0.3	40.0	0.3	15.9	86.5
23	0.00	0.3	40.0	0.3	15.7	86.3
24	0.00	0.3	39.9	0.3	15.7	86.0
25	0.00	0.3	40.0	0.3	15.8	85.8
26	0.00	0.3	39.9	0.3	15.7	85.6
27	0.00	0.3	40.0	0.3	15.7	85.2
28	0.00	0.3	39.9	0.3	15.9	85.8
29	0.00	0.3	40.0	0.3	15.5	85.0
30	0.00	0.3	39.9	0.3	15.7	86.0
31	0.00	0.3	39.9	0.3	15.8	86.3
32	0.00	0.3	40.6	0.3	15.8	86.6
	Average	0.3	39.5	0.3	15.8	85.9
	Std. Dev.	0.0	1.7	0.0	0.1	1.1
	Maximum	0.3	40.6	0.3	16.0	87.0
	@ Blow#	20	32	20	7	20

Total number of blows analyzed: 30

Time Summary

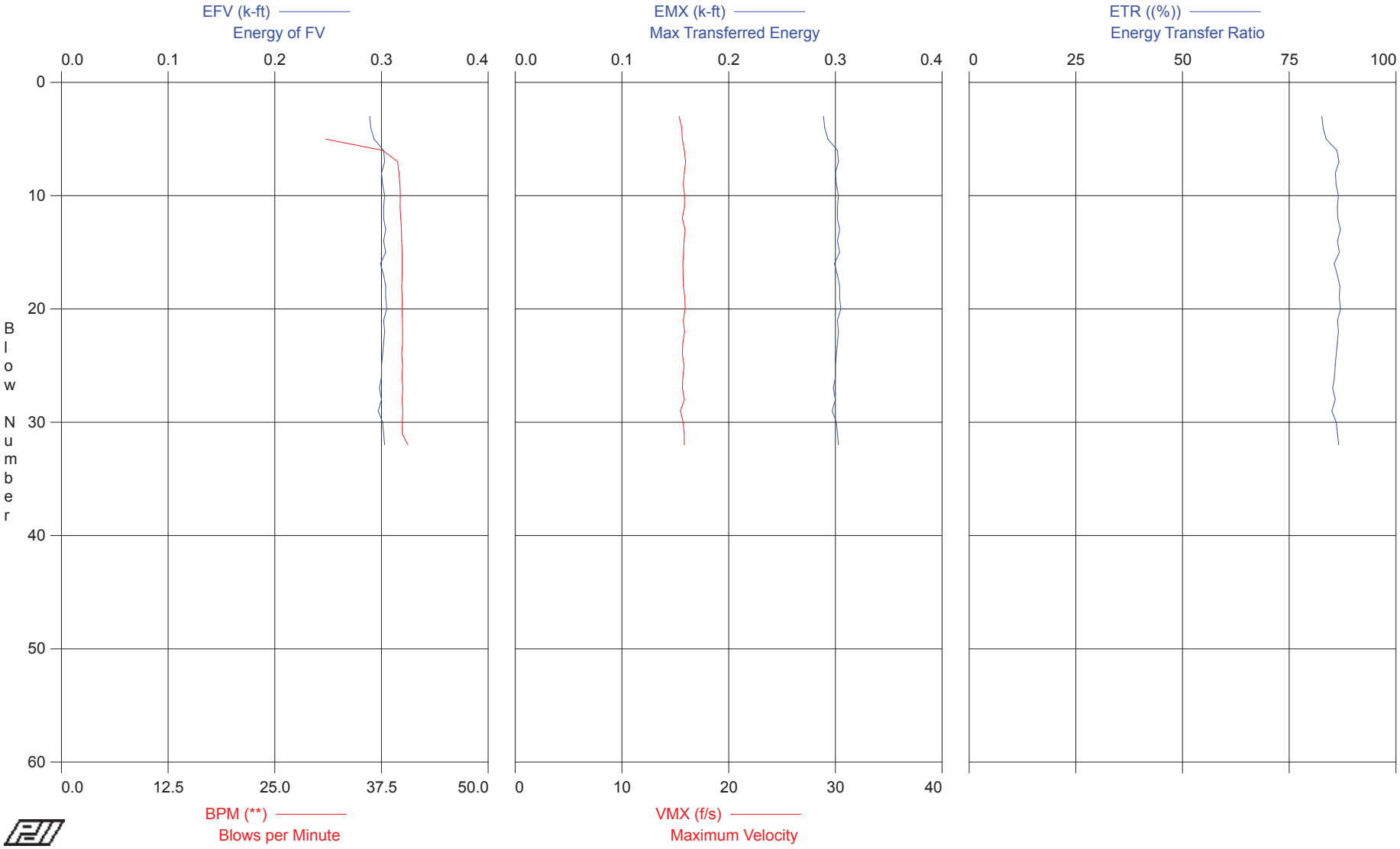
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 20ft



Feather River West Levee - 720+71 @ 22.5ft
OP: G. TRUMM

140lb Auto Hammer
Test date: 11-Aug-2011

AR: 1.44 in^2
LE: 28.60 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
4	0.00	0.3	0.0	0.3	19.8	89.4
5	0.00	0.3	39.6	0.3	19.2	89.8
6	0.00	0.3	39.7	0.3	17.4	90.0
7	0.00	0.3	39.6	0.3	17.2	90.9
8	0.00	0.3	39.7	0.3	16.9	91.4
9	0.00	0.3	39.7	0.3	16.4	92.6
10	0.00	0.3	39.8	0.3	15.9	94.0
11	0.00	0.3	39.8	0.3	16.1	96.0
12	0.00	0.3	39.7	0.3	15.9	96.6
13	0.00	0.3	39.7	0.3	15.9	92.6
14	0.00	0.3	39.7	0.3	16.0	95.9
15	0.00	0.3	39.7	0.3	16.1	95.4
16	0.00	0.3	39.7	0.3	16.2	95.1
17	0.00	0.3	39.7	0.3	15.9	94.8
18	0.00	0.3	39.7	0.3	16.1	95.8
19	0.00	0.3	39.8	0.3	16.1	94.8
20	0.00	0.3	39.8	0.3	16.0	95.5
21	0.00	0.3	39.8	0.3	16.2	96.3
22	0.00	0.3	39.8	0.3	15.9	95.7
	Average	0.3	39.7	0.3	16.6	93.8
	Std. Dev.	0.0	0.1	0.0	1.1	2.4
	Maximum	0.3	39.8	0.3	19.8	96.6
	@ Blow#	12	20	12	4	12

Total number of blows analyzed: 19

Time Summary

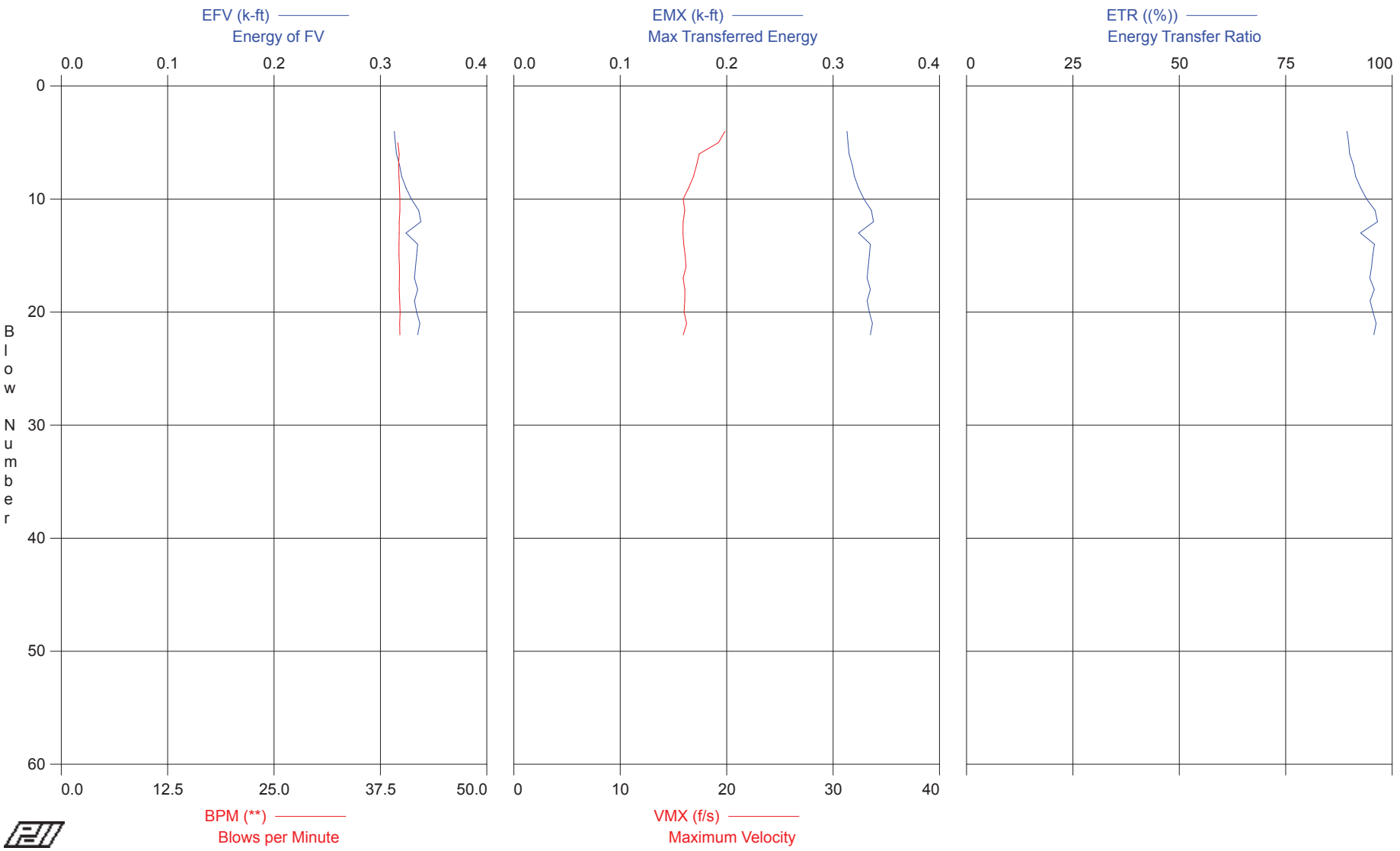
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Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 12-Aug-2011

Test date: 11-Aug-2011

Feather River West Levee - 720+71 @ 22.5ft



Taber
Since 1954

Summary of Field Results
SPT Energy Measurements

Project Name	South Port
Boring No.	BCI-11-B15
Client Proj. No.	1978.3
Date	10/3/11
Drill Rig	Cascade Rig# 156 CME 75
Hammer Type	Auto
SPT Analyzer Operator	Tim d'Arcy
Taber Project No.	D11-0175

Sampler Depth (ft)	Number of Blows Analyzed	Average Energy Transfer* ft-lbs	Average Transfer Efficiency* %	Hammer Operating Rate bpm
2.5-4	14	220	63	30
6.5-8	9	212	61	34
10.5-12	12	249	71	25
14.5-16	21	260	74	26
18.5-20	13	268	77	25
25-26.5	13	263	75	24
29-30.5	12	264	75	25
34-35.5	7	272	78	22
39-40.5	33	275	79	30
44-45.5	22	273	78	27
49-50.5	27	276	79	28
54-55.5	24	273	78	27
59-60.5	35	278	79	31
64-65.5	38	278	80	32
69-70.5	13	249	71	30
74-75.5	25	277	79	33
	Ave	262	75	28
	Max	278	80	34
	Min	212	61	22
	Std Dev	20	6	4

Note:
Transfer Efficiency is based on 350 ft-lbs, 140# hammer with a nominal 30-inch drop.

Abe Construction Services, Inc.

2230 Lariat Lane, Walnut Creek, CA 94596
PHONE: 925-944-6363 FAX: 925-476-1588
EMAIL: SA@AbeEngineering.com

October 23, 2011

Kleinfelder, Inc.
2001 Arch Airport Rd # 100
Stockton, CA 95206-4943

Attn: Adam Killinger & Pat Dell

Re: SPT Hammer Energy Measurements
DWR ULE
PITCHER CME55 PD56
Port of Stockton, CA
October 7, 2011

Job No. 11092

Dear Sir,

This report presents the results of SPT (Standard Penetration Test) energy measurements obtained for the above referenced project and drill rig on October 7, 2011. Dynamic measurements were made with a PDA (Pile Driving Analyzer) during SPT to determine the energy transfer ratio (ETR) or efficiency of the SPT systems, which is used to normalize the SPT N values to a standard efficiency of 60% (N_{60}).

DYNAMIC TESTING AND FIELD DETAILS

Drill Rig and SPT Hammer Description

The SPT samples were taken with NW rod and a split spoon sampler using a CME automatic hammer which has a 140 lb ram, a 30-inch nominal drop heights, and theoretical potential energy of 350 ft-lbs. Further details regarding the SPT equipment are beyond the scope of this report and should be obtained from the driller.

Dynamic Test Instrumentation

Dynamic measurements of strain and acceleration were taken on a 2-ft long section of NW rod, which was attached to the top of the sample rod string just below the hammer. The rod section was instrumented with two strain bridges and two piezoresistive accelerometers. By averaging the measurements taken from opposite sides of the rod, the effects of non-uniform hammer impacts to the recorded signals were minimized.

Strain and acceleration signals were conditioned and converted to force and velocity records by a PAX Model, Pile Driving Analyzer® (PDA). This dynamic testing equipment is the same equipment that is routinely used for conventional pile driving analysis. The dynamic force and velocity records were the basis of the computed energy results presented in this report.

Calculation of Energy Transfer

The energy transferred to the instrumented rod section was computed from the dynamic force and velocity records by the EFV method, which uses both the force and velocity records to calculate the maximum transferred energy as:

$$EFV = \int F(t)\, V(t)\, dt$$

The integration is performed over the time period from which the energy transfer begins (non-zero) and terminates at the time when the energy transfer reaches a maximum value. This method is theoretically correct for all rod lengths regardless of the 2L/c stress wave travel time (L is the rod length and c is the stress wave speed in the rod) and the number of non-uniform rod corrections. This calculation is the method we use to compute the energy transfer ratio, ETR, which is computed as:

$$ETR = EFV / \text{Rated Hammer Energy}$$

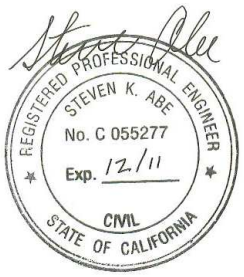
Dynamic Test Results

The PDA calculated results are given in Appendix A and include the energy transfer (EFV), the energy transfer ratio (ETR), the hammer blow rate (BPM), the maximum impact force (FMX), and the maximum rod velocity (VMX). For each sample depth interval, the average, maximum, minimum and standard deviation of each value are given in Appendix A. Other information includes the sample depth interval and the total number of blows for the reported depth interval. The average ETR for this hammer operating at an average rate of 34.6 BPM was 76.8 % for 28 hammer blows with a standard deviation of 4.1%.

I appreciate the opportunity to be of assistance to you on this project. Please contact me if you have any questions regarding this report, or if I may be of further service.

Regards,

Steven K. Abe, P.E.



APPENDIX A

Dynamic Measurement Results

Abe Construction Services, Inc.

Project: DWR ULE - WR0403-014B_1 **Rig: PITCHER CME55 PD56**
Test date: 7-Oct-2011

ETR: Energy Transfer Ratio VMX: Maximum Velocity
EFV: Energy of FV FMX: Maximum Force

BL# end	Depth ft	TYPE	ETR (%)	EFV k-ft	FMX kips	VMX f/s	BPM **
7	7.5	AV6	72.5	0.25	41	13.5	26.0
		STD	4.0	0.01	1	0.8	17.1
		MAX	78.5	0.28	42	14.8	38.3
		MIN	64.8	0.23	39	12.3	1.9
9	10	AV2	75.8	0.27	42	14.0	24.4
		STD	2.4	0.01	2	0.3	22.5
		MAX	78.2	0.27	44	14.3	46.8
		MIN	73.4	0.26	40	13.7	1.9
17	15	AV6	76.0	0.27	44	13.3	36.1
		STD	1.2	0.01	1	0.5	15.3
		MAX	77.6	0.27	45	14.1	43.0
		MIN	74.4	0.26	43	12.5	1.9
21	20	AV3	75.4	0.26	45	13.4	30.2
		STD	2.1	0.01	0	0.5	20.0
		MAX	78.3	0.27	45	13.8	44.5
		MIN	73.4	0.26	44	12.7	1.9
28	22.5	AV7	78.0	0.27	44	12.3	43.4
		STD	0.8	0.00	1	0.2	0.3
		MAX	78.8	0.28	45	12.5	43.7
		MIN	76.5	0.27	43	12.0	42.9
32	25	AV4	83.9	0.29	49	12.2	38.3
		STD	0.7	0.00	1	0.1	21.0
		MAX	84.7	0.30	50	12.3	51.2
		MIN	82.8	0.29	48	12.1	1.9

STATISTICS FOR ALL DATA					
Average	76.8	0.27	44	13.0	34.6
Std. Dev.	4.1	0.01	3	0.8	17.4
Maximum	84.7	0.30	50	14.8	51.2
Minimum	64.8	0.23	39	12.0	1.9

Total number of blows analyzed: 28

APPENDIX H

Task Order 2 and Task Order 4
CPT Logs

Table H-1. Summary of Task Order 2 and 4 Hand-Augered Cone Penetrometer Tests

Exploration ID	Date	Location	Interval (feet)	Total Depth	Soil Class	SBFCA Station	Northing	Easting	Task Order
MA 3									
SM0003_009C	8/2/2011	Landside Toe	0-3.5	5	SM	11+08	2089119.26	6670521.08	2
			3.5-5.0		CL				
SM0003_015C		Landside Toe	0.0-5.0	5	SM	92+17	2091789.19	6677322.09	2
SM0003_016C	11/14/2011	Landside Field	0.0-5.0	5	ML	159+73	2097506.47	6679929.98	2
SM0003_017C	11/14/2011	Landside Field	0.0-5.0	5	ML	171+47	2098623.98	6679830.58	2
SM0003_010C	8/1/2011	Landside Field	0.0-5.0	5	SM	198+74	2100600.12	6678157.29	2
SM0003_011C	7/21/2011	Levee Crest	0.0-5.0	5	SM	235+00	2104096.35	6678680.7	2
SM0003_012C	8/2/2011	Landside Field	0.0-5.0	5	ML	240+07	2104637.15	6678643.16	2
SM0003_013C	8/2/2011	Landside Toe	0-3.5	5	SM	255+02	2105984.51	6679259.37	2
			3.5-5.0		ML				
SM0003_014C	7/22/2011	Levee Crest	0.0-5.0	5	SM	275+00	2107937.93	6679394.44	2
LD 1									
SL0001_015C	8/3/2011	Landside Field	0.0-5.0	5	CL	280+00	2108475.15	6679280.99	2
SL0001_016C	7/22/2011	Levee Crest	0.0-5.0	5	SM	311+99	2111618.20	6679460.38	2
SL0001_042C	9/30/2011	Landside Toe	0.0-5.0	5	ML	401+00	2120221.11	6677580.00	2
SL0001_017C	8/2/2011	Landside Field	0.0-5.0	5	ML	461+00	2125892.72	6676054.40	2
SL0001_018C	7/20/2011	Levee Crest	0.0-5.0	5	SM	551+00	2133406.80	6672008.67	2
SL0001_019C	7/20/2011	Levee Crest	0.0-5.0	5	SM	561+00	2134334.14	6671644.45	2
SL0001_020C	7/20/2011	Levee Crest	0.0-5.0	5	SM	570+00	2135222.44	6671586.99	2
SL0001_021C	7/21/2011	Levee Crest	0.0-5.0	5	SM	580+00	2136220.58	6671553.37	2
SL0001_022C	7/21/2011	Levee Crest	0.0-5.0	5	SM	590+00	2137191.31	6671714.19	2
SL0001_023C	7/18/2011	Landside Field	0.0-5.0	5	CL	600+90	2138280.58	6671973.16	2
SL0001_024C	7/18/2011	Landside Field	0.0-5.0	5	CL	614+00	2139463.51	6671844.87	2
SL0001_025C	7/5/2011	Levee Crest	0.0-5.0	5	SM	634+00	2141466.64	6672045.65	2
SL0001_026C	7/18/2011	Landside Toe	0.0-5.0	5	CL	647+00	2142771.47	6672009.58	2
SL0001_027C	7/19/2011	Landside Field	0.0-5.0	5	SM	655+95	2143625.41	6672013.77	2
SL0001_028C	8/1/2011	Landside Toe	0.0-5.0	5	ML	661+05	2144138.96	6672062.90	2
SL0001_038C	9/21/2011	Levee Crest	0.0-5.0	5	SM	681+01	2146141.45	6672032.59	2
SL0001_029C	7/19/2011	Landside Toe	0.0-2.5	5	SP-SM	693+02	2147336.90	6671912.53	2
			2.5-5.0		CL-ML				
SL0001_030C	7/6/2011	Levee Crest	0.0-5.0	5	SM	711+00	2149119.05	6672148.92	2
SL0001_031C	7/6/2011	Levee Crest	0.0-5.0	5	ML	791+00	2156744.38	6673882.89	2
SL0001_032C	8/2/2011	Levee Waterside	0.0-5.0	5	SM	802+02	2157777.44	6674260.49	2
SL0001_043C	9/28/2011	Landside Field	0.0-5.0	5	CL-ML	802+55	2157898.17	6674054.10	2
SL0001_033C	7/6/2011	Levee Crest	0.0-5.0	5	SM	818+00	2159255.88	6674837.91	2
SL0001_034C	8/1/2011	Landside Toe	0.0-5.0	5	SM	889+00	2165707.69	6672999.45	2

Table H-1. Summary of Task Order 2 and 4 Hand-Augered Cone Penetrometer Tests

Exploration ID	Date	Location	Interval (feet)	Total Depth	Soil Class	SBFCA Station	Northing	Easting	Task Order
SL0001_035C	8/3/2011	Landside Toe	0.0-8.0	9	SP-SM	899+00	2166703.74	6673089.79	2
			8.0-9.0		SM				
SL0001_036C	8/4/2011	Landside Toe	0.0-4.5	5	SM	922+96	2168991.18	6673845.70	2
			4.5-5.0		ML				
SL0001_039C	9/21/2011	Levee Crest	0.0-5.0	5	ML	1007+00	2176671.64	6673016.17	2
SL0001_040C	9/23/2011	Levee Crest	0.0-5.0	5	SM	1026+40	2178470.77	6672423.77	2
SL0001_041C	9/23/2011	Landside Toe	0.0-5.0	5	SC	1026+45	2178498.35	6672356.48	2
SL0001_037C	8/4/2011	Landside Toe	0.0-5.0	5	ML	1083+08	2183243.09	6669855.25	2
LD 9									
SL0009_005C	7/19/2011	Landside Field	0.0-5.0	5	ML	1190+00	2193634.90	6668997.07	2
SL0009_006C	7/7/2011	Levee Crest	0.0-5.0	5	ML	1215+00	2196059.31	6668772.50	2
SL0009_007C	7/7/2011	Levee Crest	0.0-5.0	5	ML	1224+00	2196928.26	6668550.34	2
SL0009_008C	8/3/2011	Landside Toe	0.0-5.0	5	CL	1329+01	2206791.32	6666865.18	2
SL0009_009C	8/4/2011	Landside Field	0.0-5.0	5	ML	1399+83	2213425.84	6664754.11	2
SL0009_010C	8/3/2011	Landside Field	0.0-5.0	5	CL	1405+05	2213909.68	6664570.29	2
SL0009_011C	8/3/2011	Landside Field	0.0-5.0	5	CH	1413+13	2214620.62	6664218.72	2
MA 16									
SM0016_004C	8/1/2011	Landside Field	0.0-5.0	5	SM	1483+06	2221656.98	6664502.95	2
SM0016_005C	7/8/2011	Levee Crest	0.0-5.0	5	ML	1492+00	2222530.54	6664699.50	2
SM0016_006C	7/8/2011	Levee Crest	0.0-5.0	5	ML	1535+00	2226686.51	6665693.64	2
SM0016_007C	7/7/2011	Levee Crest	0.0-5.0	5	SM	1573+00	2230297.18	6666269.70	2
SM0016_010C	9/29/2011	Landside Toe	0.0-5.0	5	CL	1594+01	2232249.06	6665603.64	2
SM0016_011C	9/28/2011	Landside Field	0.0-5.0	5	CL	1604+00	2233059.87	6665175.15	2
SM0016_008C	7/19/2011	Levee Crest	0.0-4.0	5	ML	1622+01	2234216.20	6664080.28	2
			4.0-5.0		CL-ML				
SM0016_009C	7/19/2011	Canal West Embankment	0.0-5.0	5	ML	1622+02	2234177.54	6663987.22	2
MA 7									
SM0007_007C	9/20/2011	Landside Toe	0-5.5	5.5	ML	1994+00	2264939.10	6663979.54	2
SM0007_008C	9/20/2011	Landside Toe	0-5.5	5.5	SM	1999+47	2265408.37	6664225.90	2
SM0007_009C	9/19/2011	Landside Toe	0-5.5	5.5	ML	2020+85	2267132.39	6665519.74	2
SM0007_010C	9/19/2011	Landside Toe	0-5.5	5.5	SM	2051+99	2269764.97	6667132.27	2
SM0007_011C	9/29/2011	Landside Toe	0.0-5.0	5	SM	2116+95	2273412.51	6664670.55	2
SM0007_012C	11/14/2011	Landside Toe	0.0-5.0	5	SM	2122+11	2273530.39	6664128.45	4

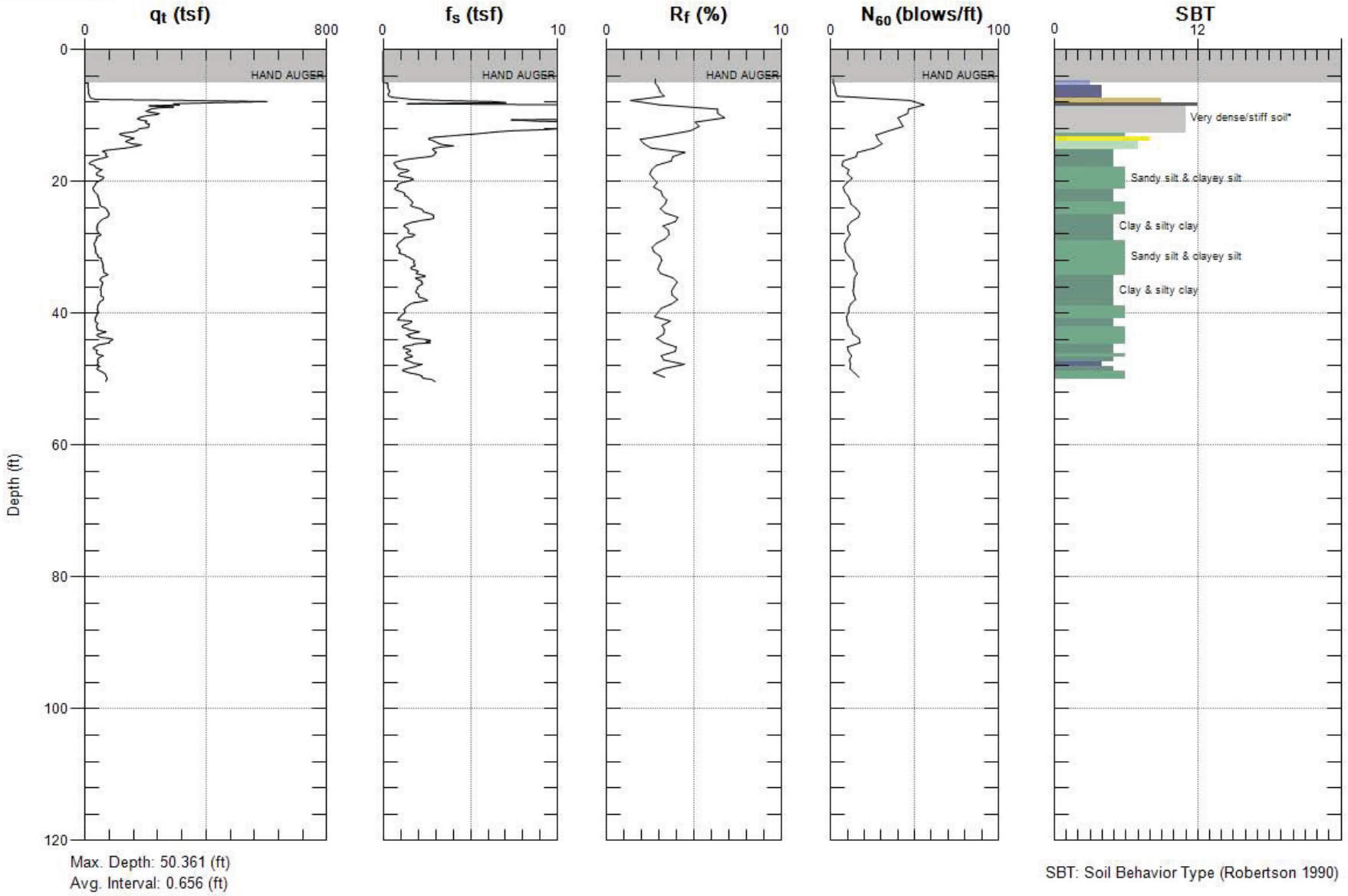
GREGG

URS

ID: SM0003_009C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-11+00 **Date: 8/2/2011 09:00**



Max. Depth: 50.361 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

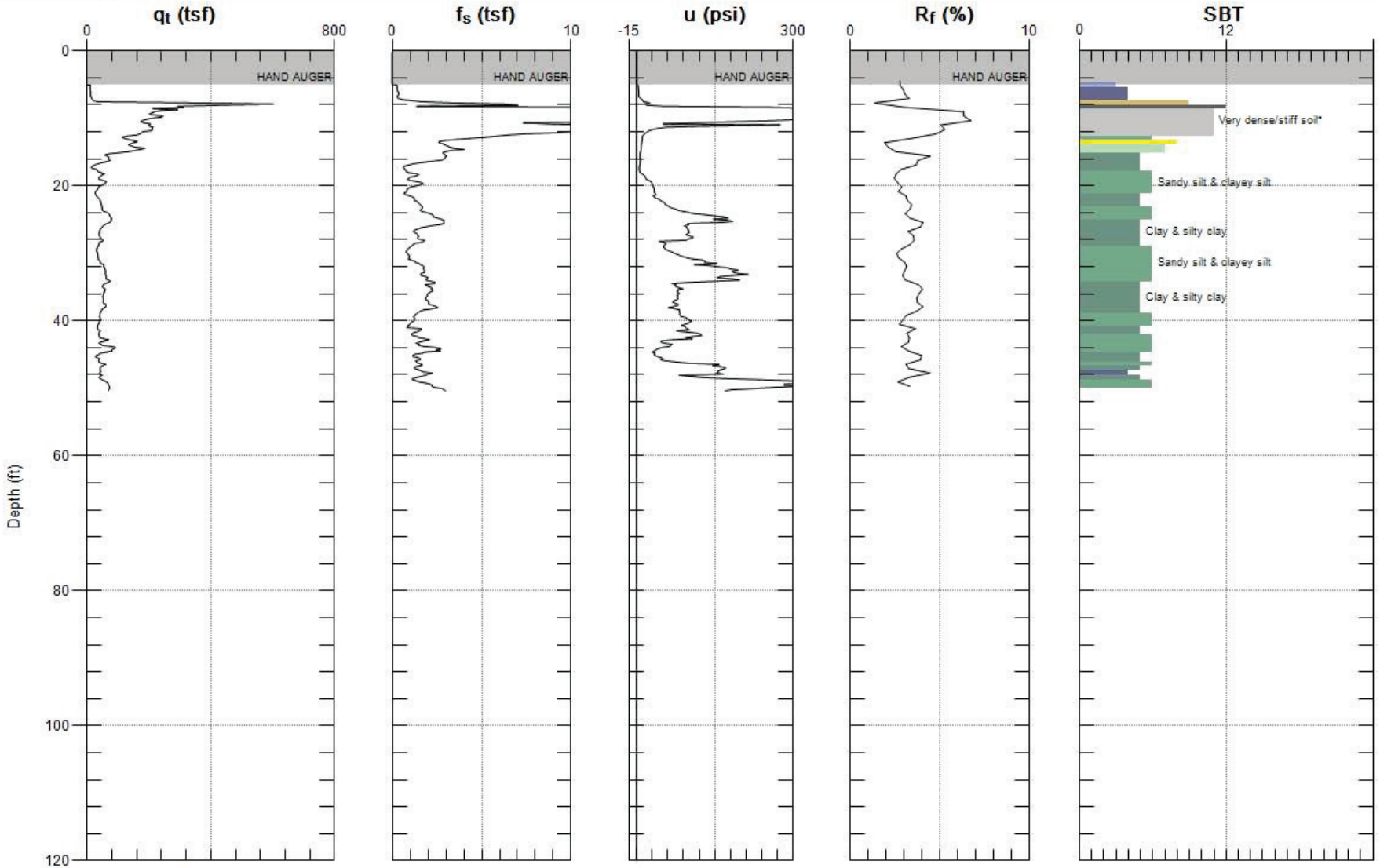
GREGG

URS

ID: SM0003_009C

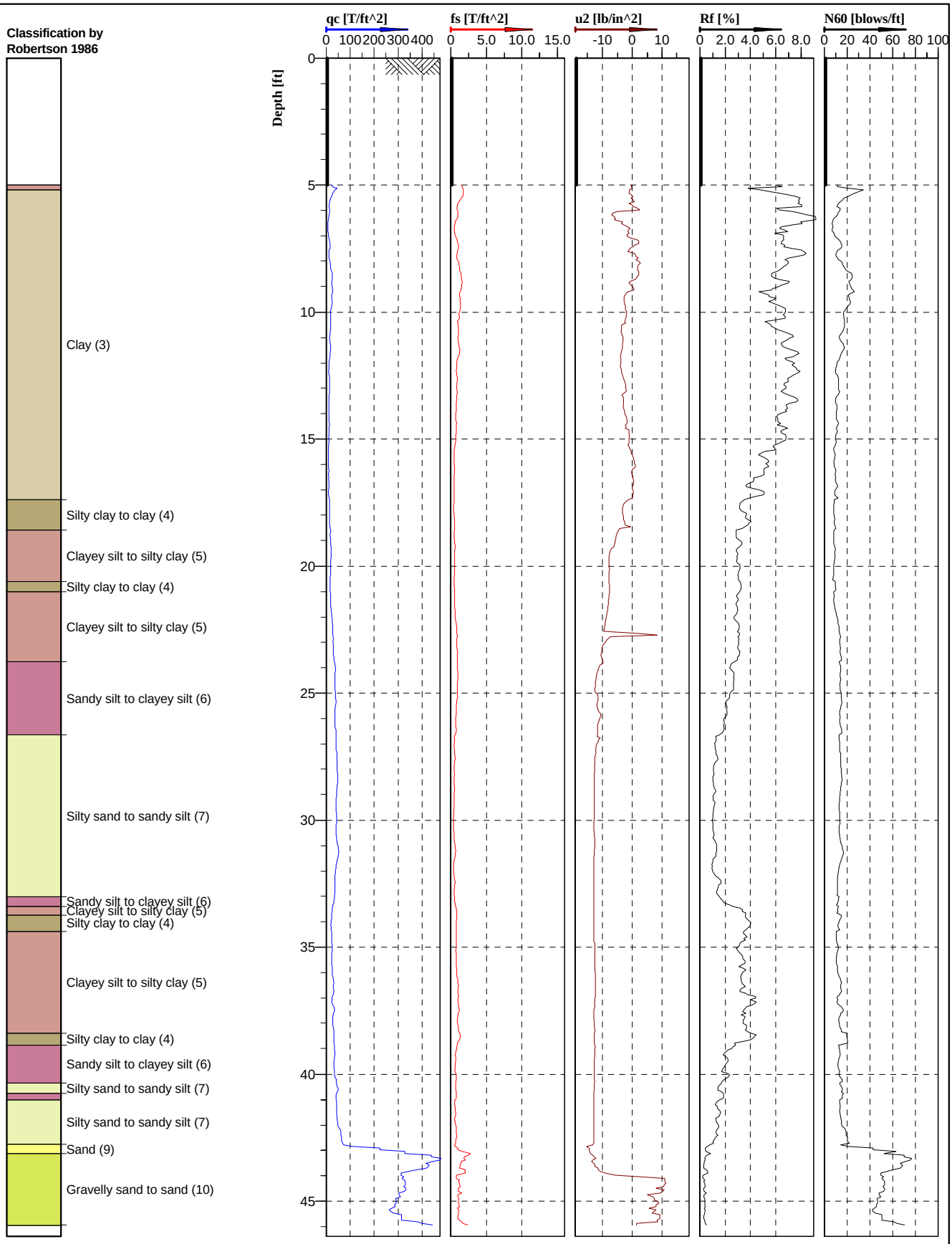
Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-11+00 **Date: 8/2/2011 09:00**



Max. Depth: 50.361 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

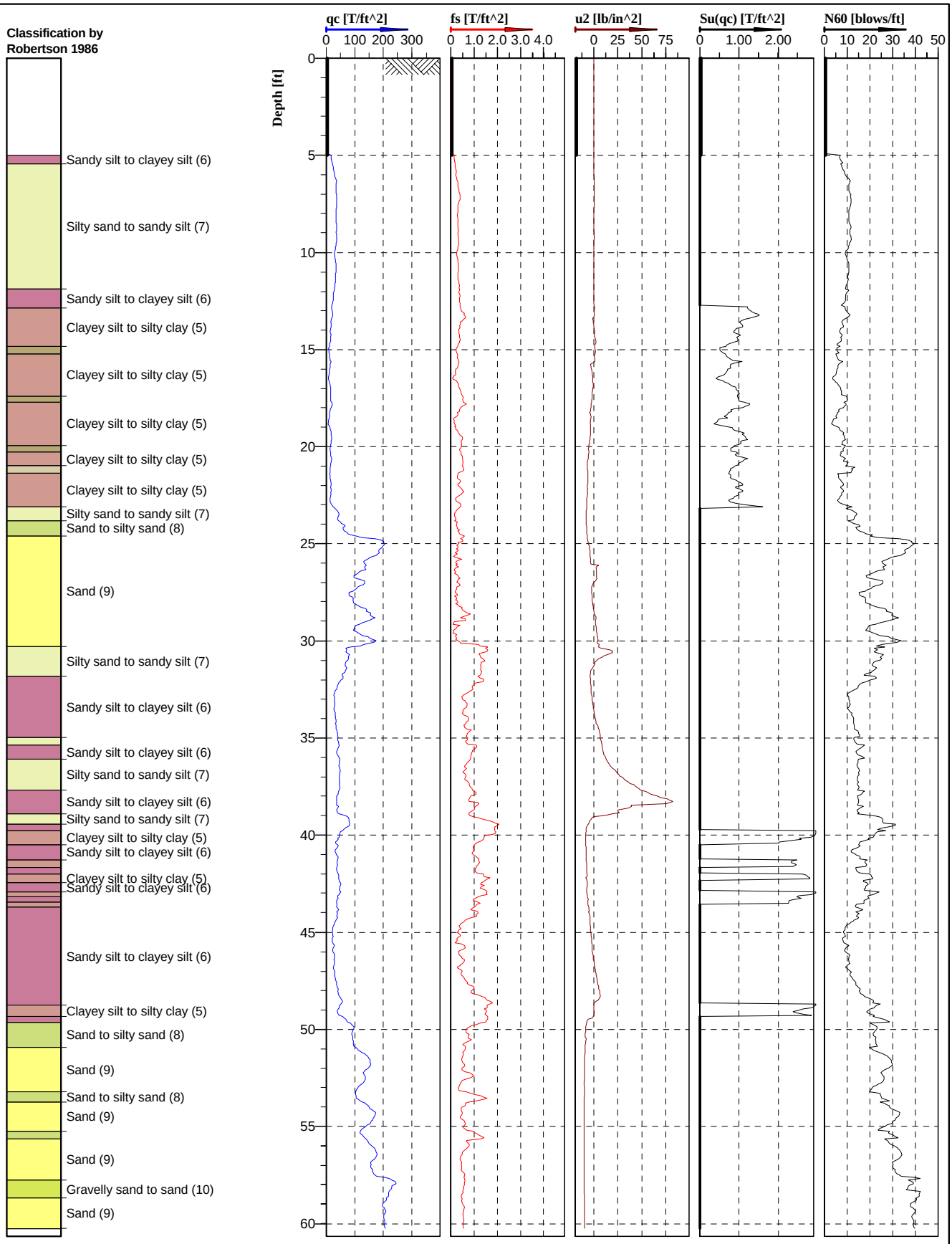


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SM0003_015C	Ground level:	Test no: 92_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/30/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 92_00_CPT.cpd	

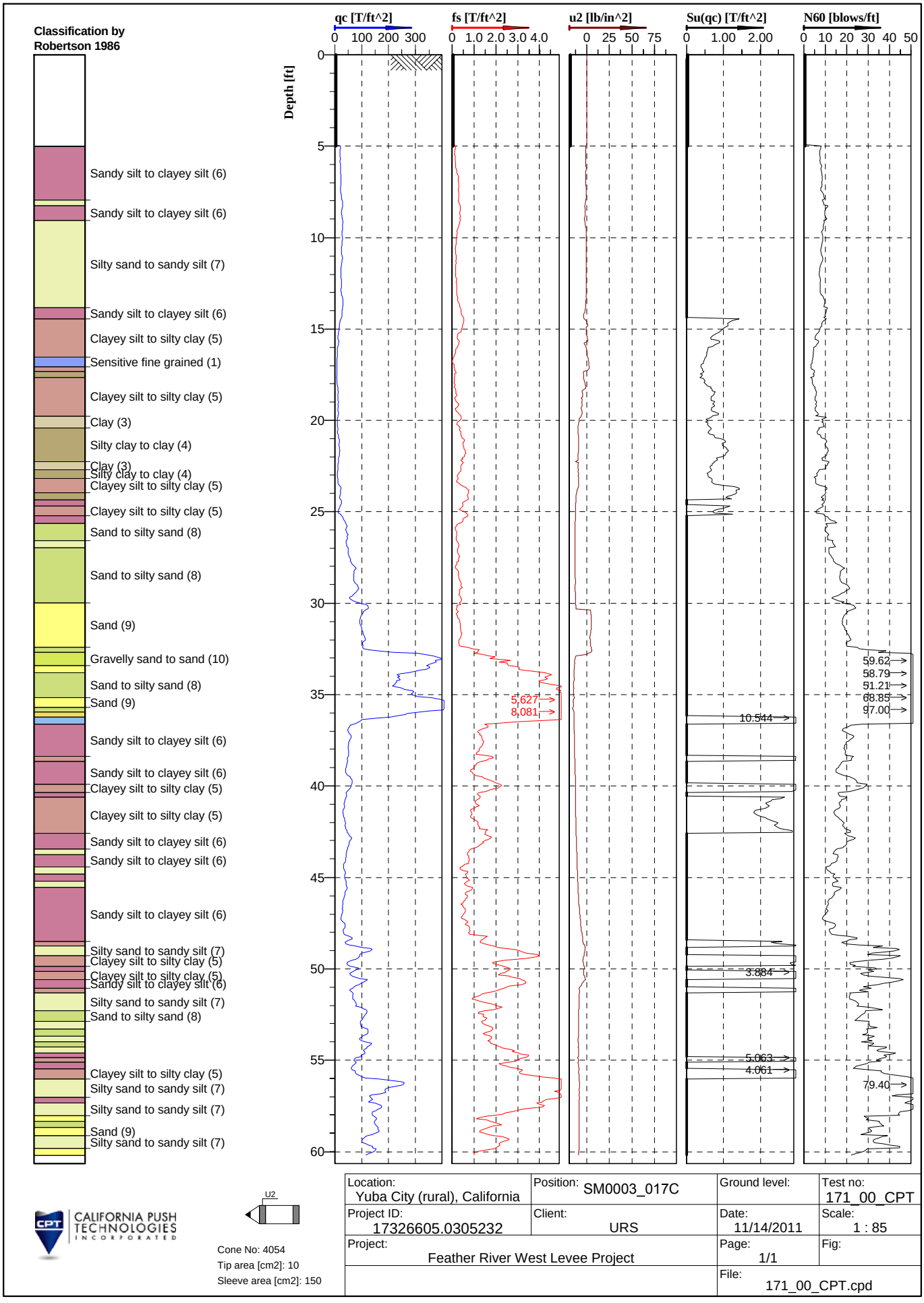


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4054
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SM0003_016C	Ground level:	Test no: 159_30_CPT
Project ID: 17326605.0305232	Client: URS	Date: 11/14/2011	Scale: 1 : 85
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 159_30_CPT.cpd	

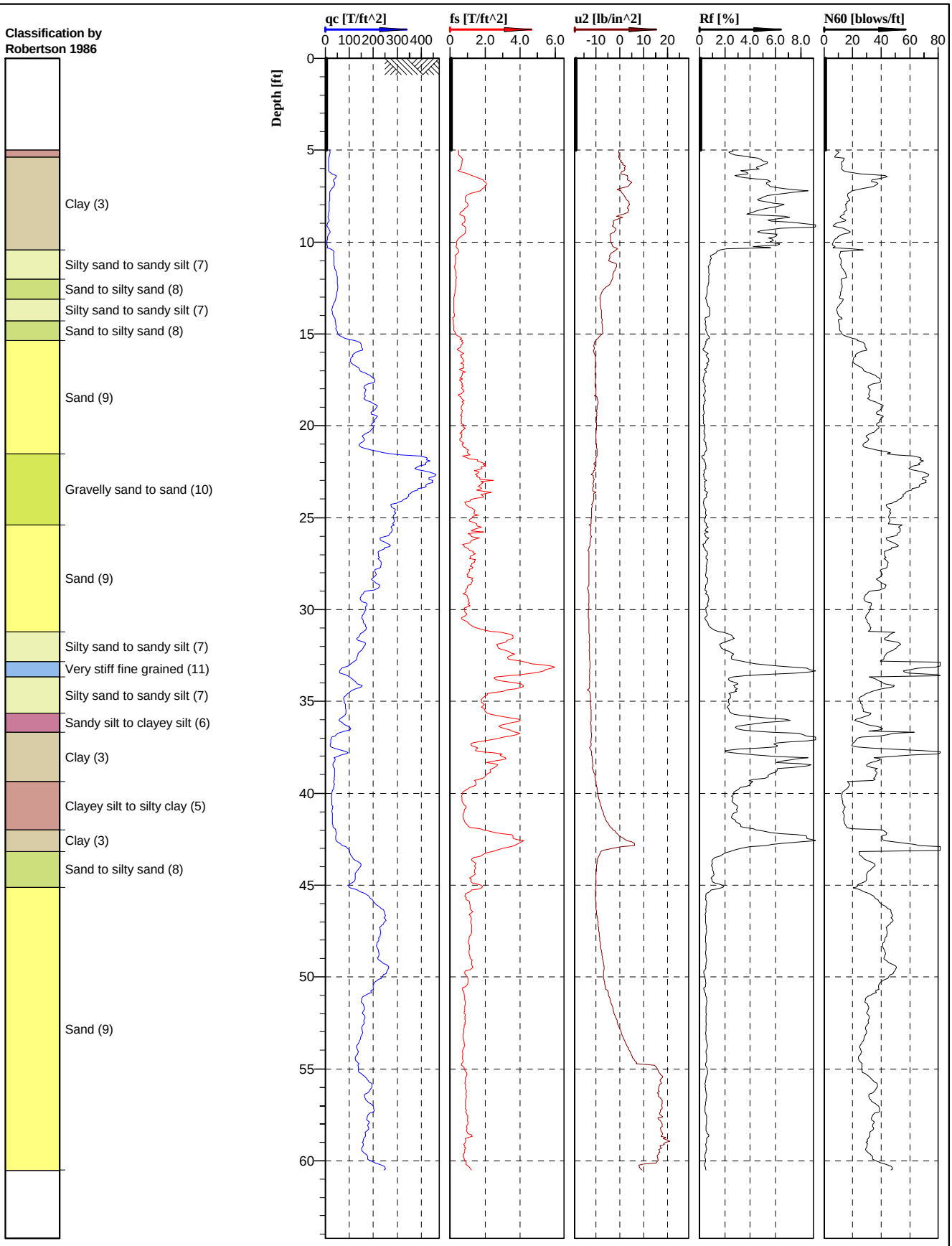


Location: Yuba City (rural), California	Position: SM0003_017C	Ground level:	Test no: 171_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 11/14/2011	Scale: 1 : 85
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 171_00_CPT.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4054
Tip area [cm2]: 10
Sleeve area [cm2]: 150



CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SM0003_010C	Ground level:	Test no: 198_00_CPT
Project ID: 1967.2	Client: Blackburn Consulting	Date: 8/1/2011	Scale: 1 : 90
Project: Feath River West Levee Project		Page: 1/1	Fig:
		File: 198_00_CPT.cpd	

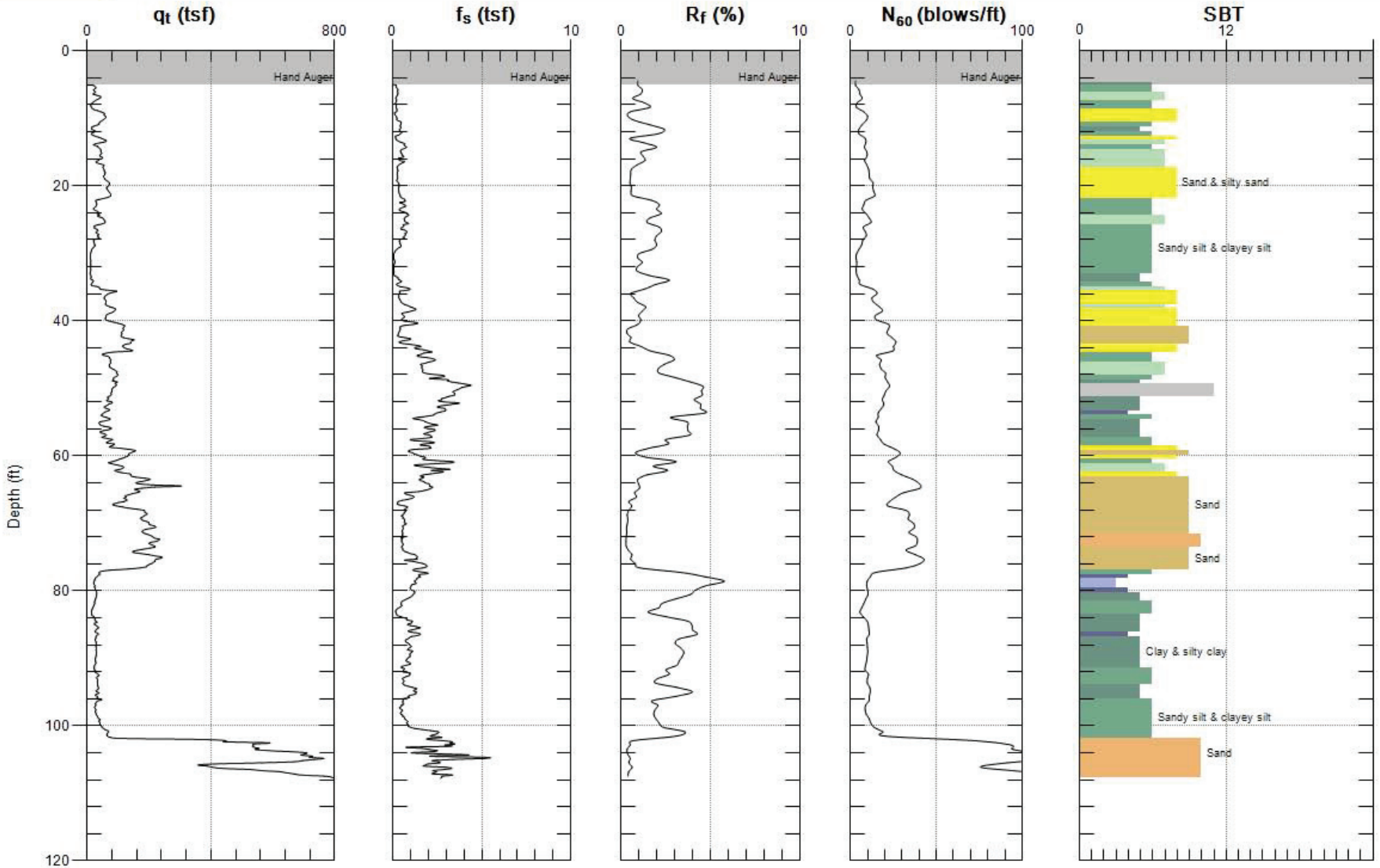
GREGG

URS

ID: SM0003_011C

Site: FEATHER RIVER WEST **Engineer: DAVID CASTRO**

Sounding: 235+00_CPT **Date: 7/21/2011 03:16**



Max. Depth: 107.776 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

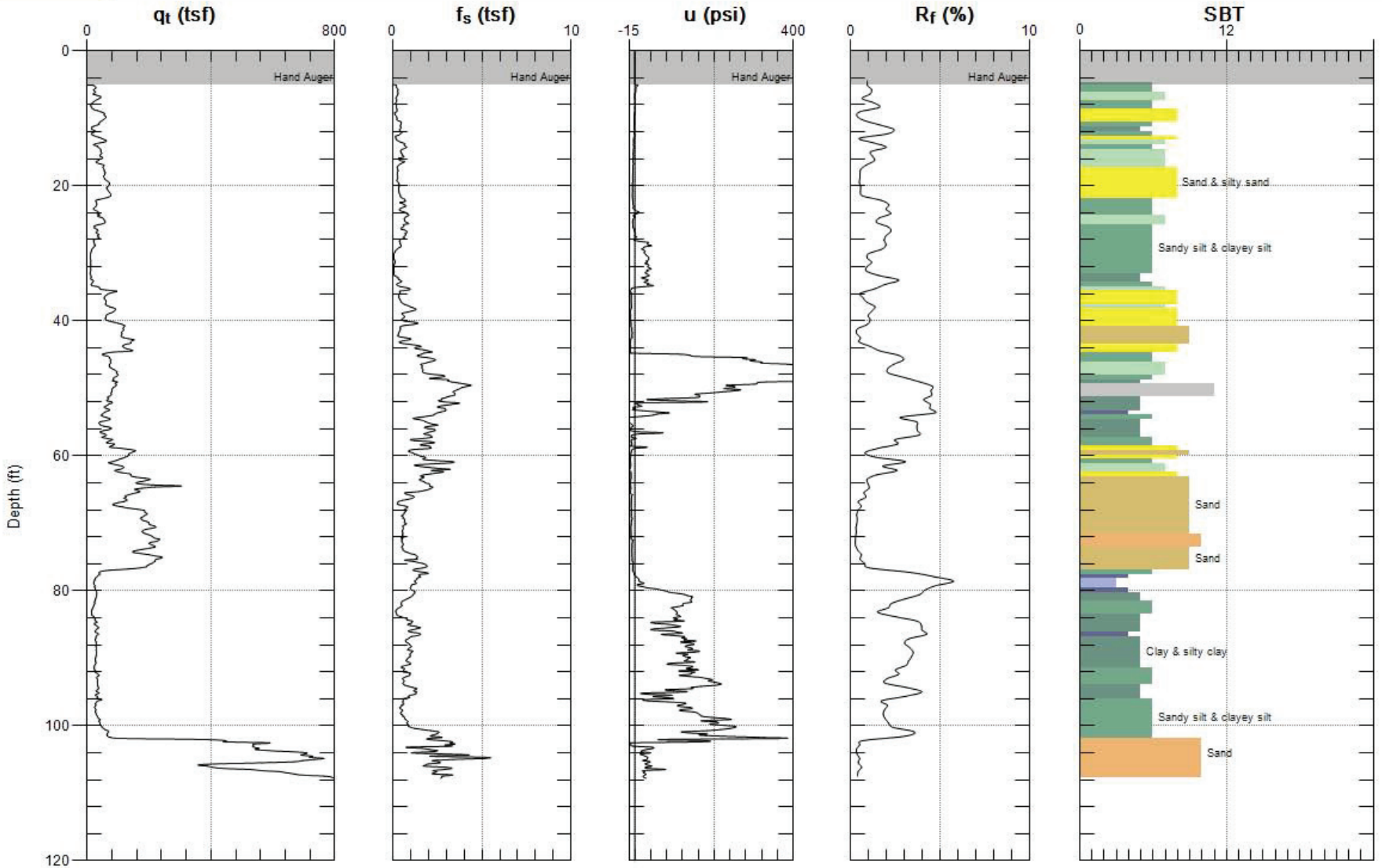
GREGG

URS

ID: SM0003_011C

Site: FEATHER RIVER WEST **Engineer: DAVID CASTRO**

Sounding: 235+00_CPT **Date: 7/21/2011 03:16**



Max. Depth: 107.776 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

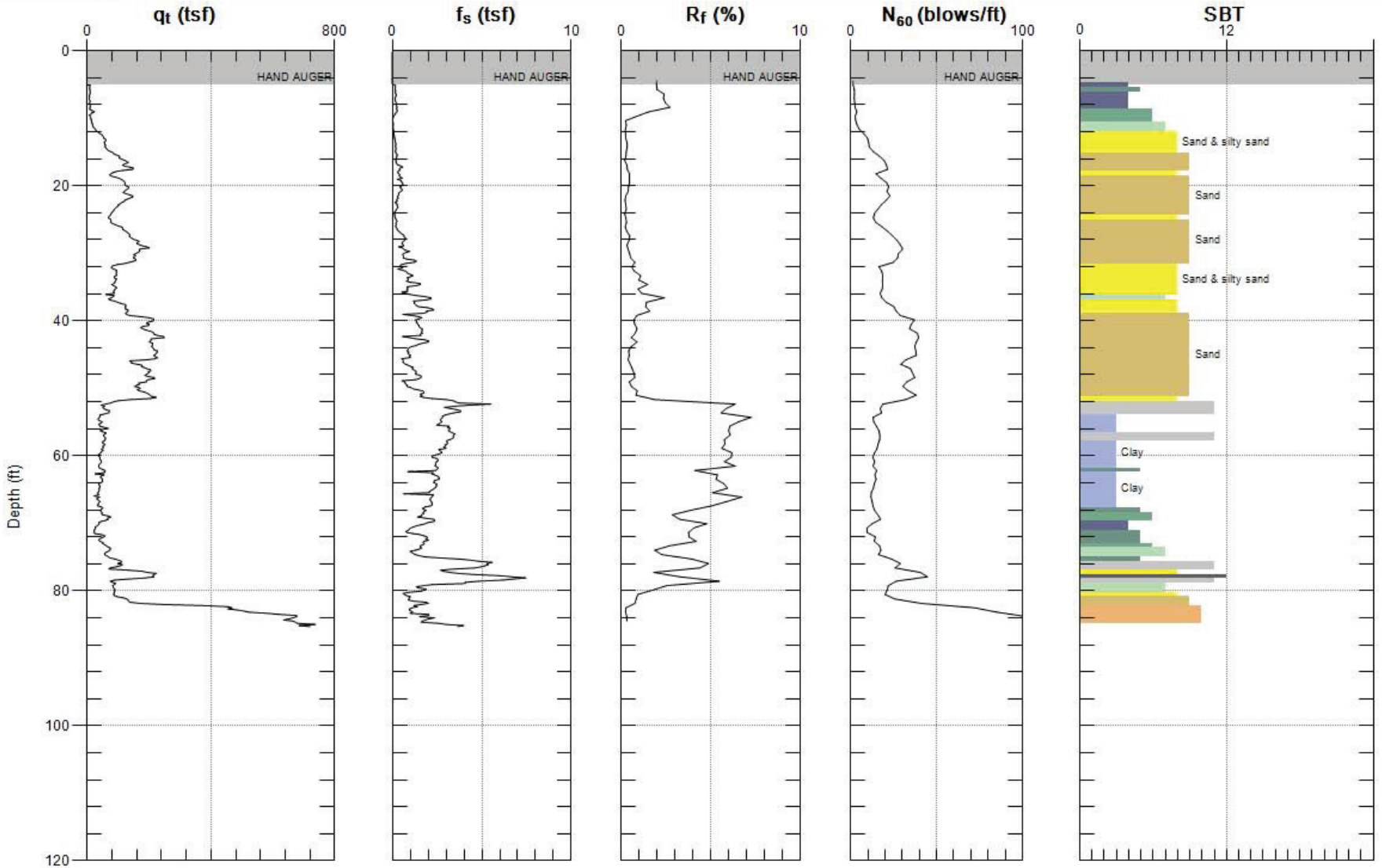
GREGG

URS

ID: SM0003_012C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-240+00 **Date: 8/2/2011 11:21**



Max. Depth: 85.302 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

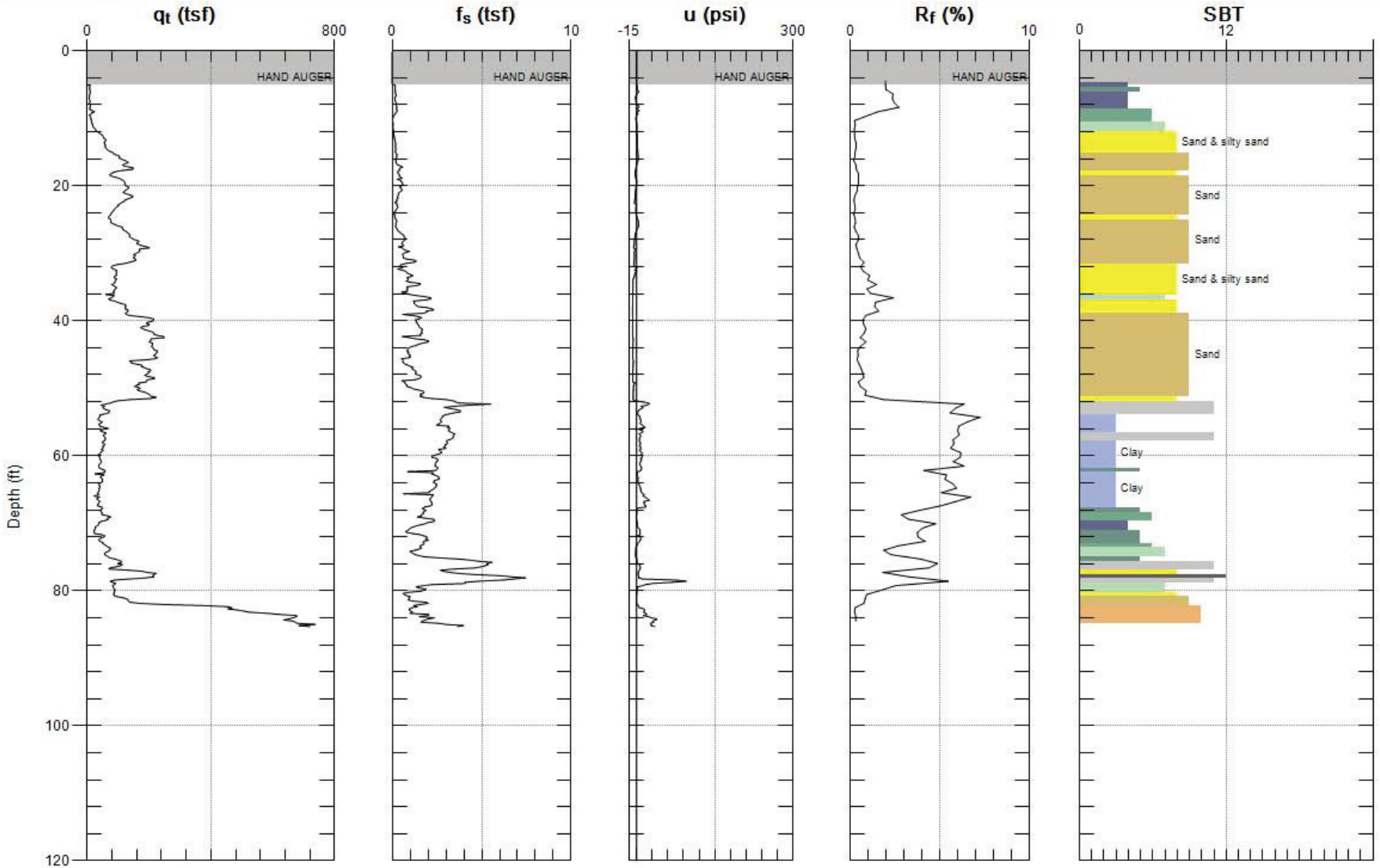
GREGG

URS

ID: SM0003_012C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-240+00 **Date: 8/2/2011 11:21**



Max. Depth: 85.302 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

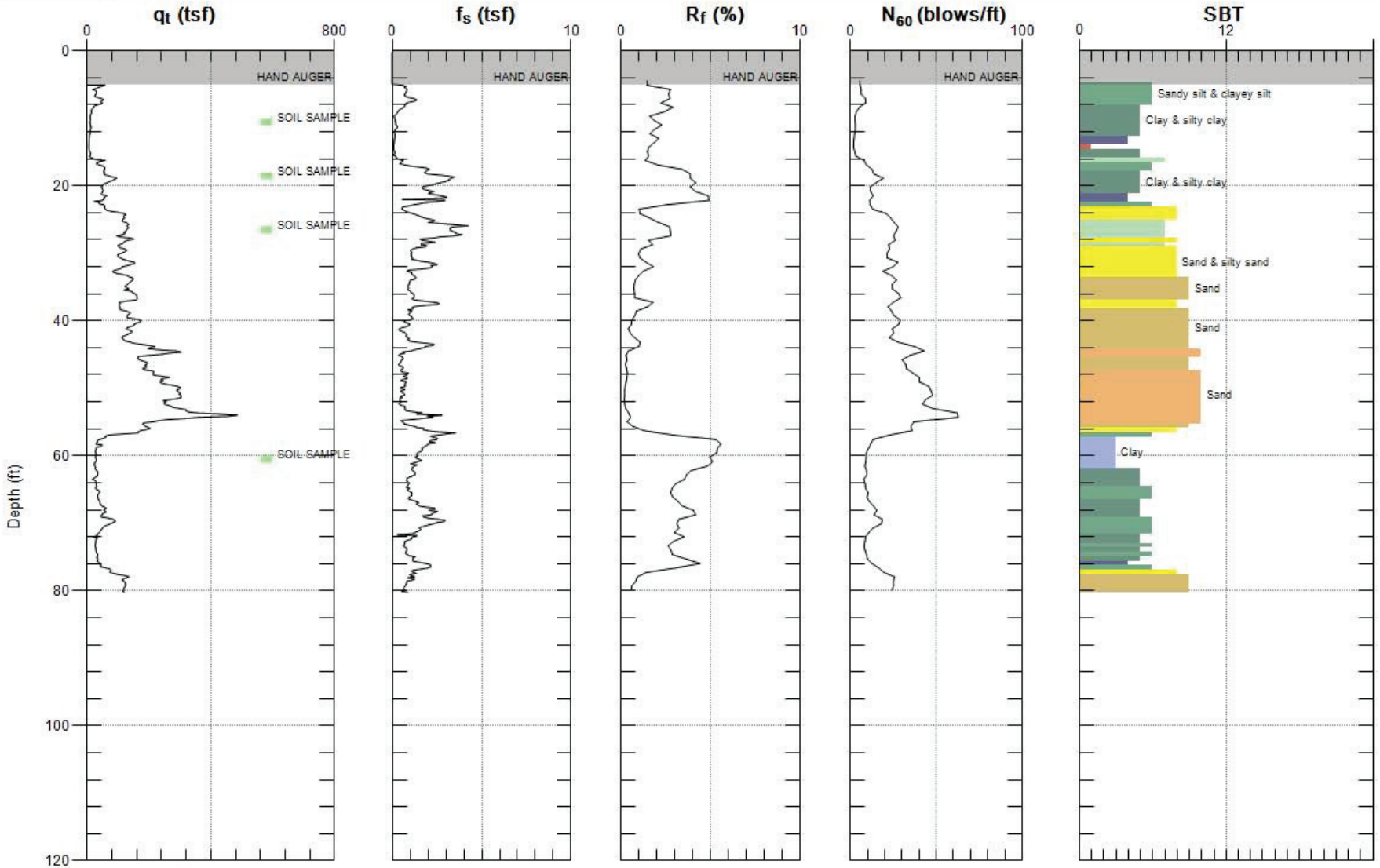
GREGG

URS

ID: SM0003_013C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-255+00 **Date: 8/2/2011 01:31**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

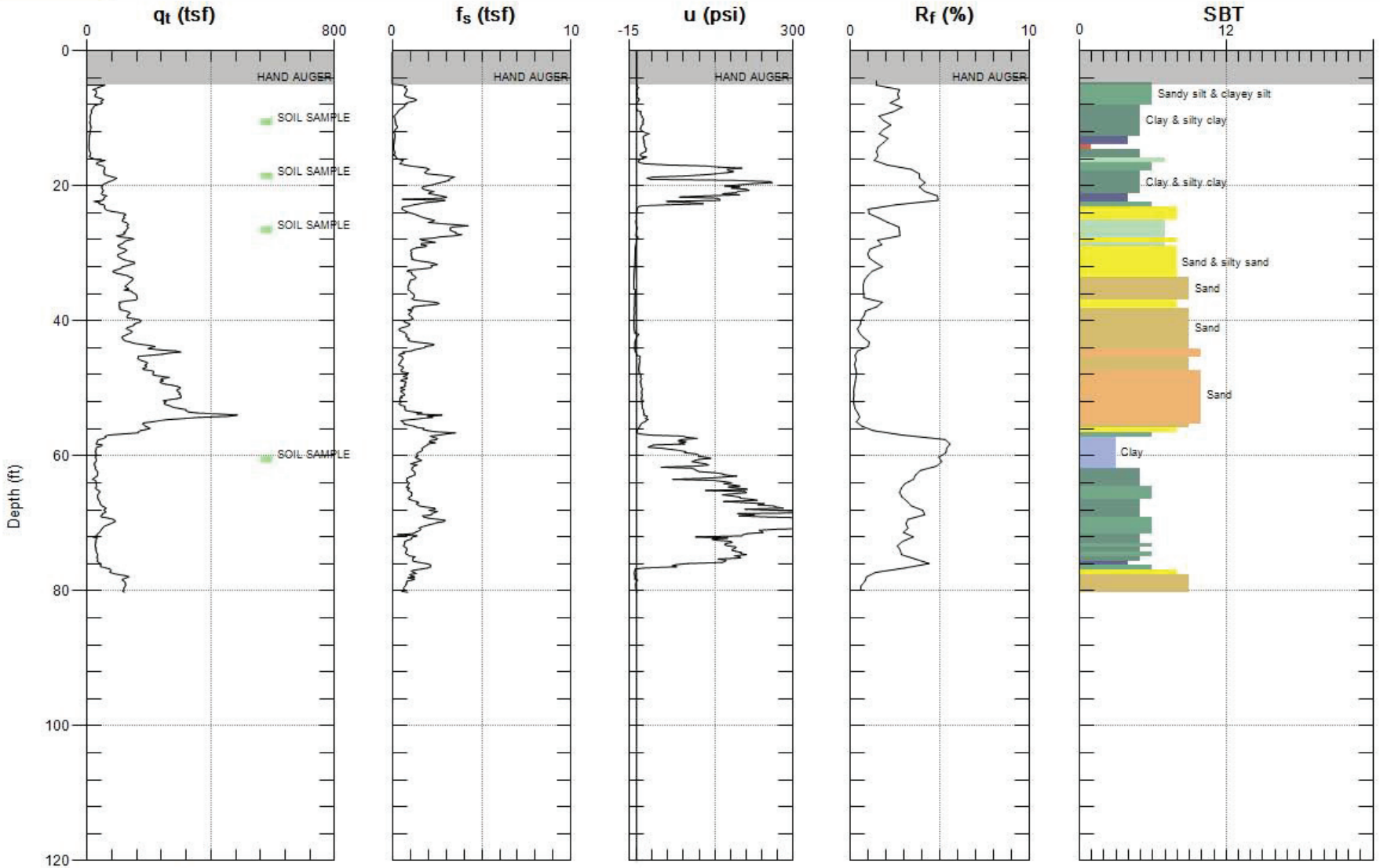
GREGG

URS

ID: SM0003_013C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-255+00 **Date: 8/2/2011 01:31**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

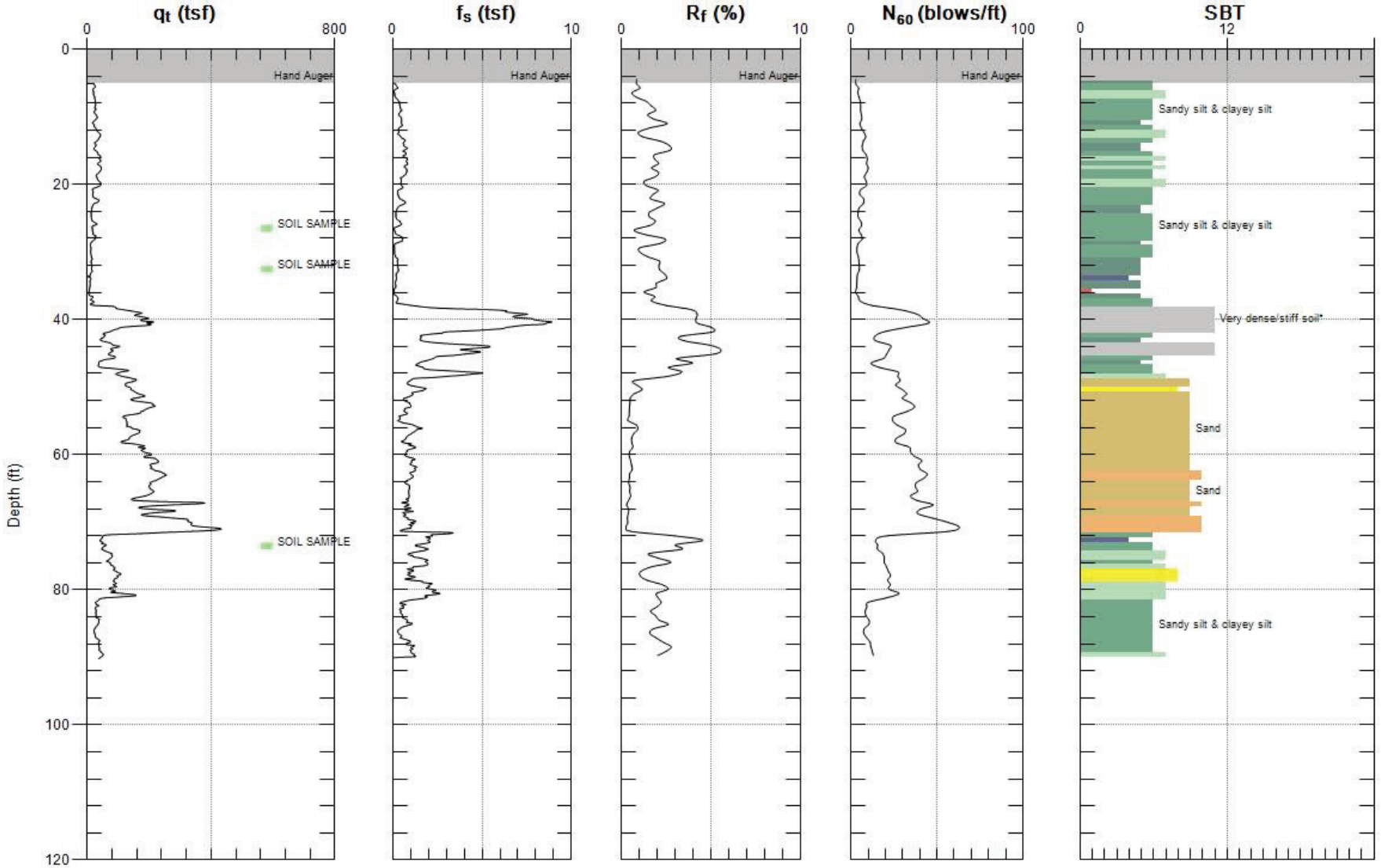
GREGG

URS

ID: SM0003_014C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 275+00_CPT **Date: 7/22/2011 08:28**



Max. Depth: 90.223 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

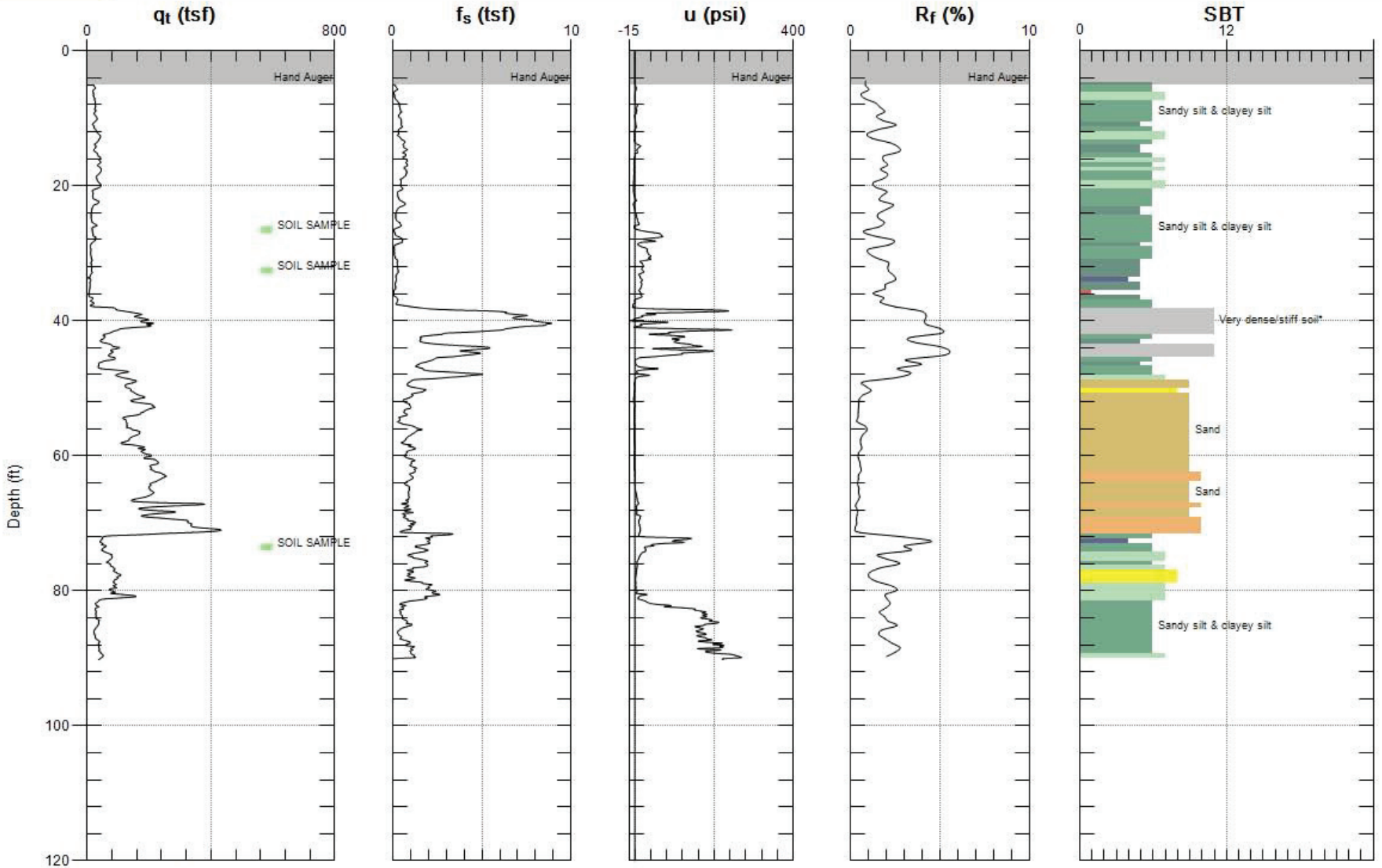
GREGG

URS

ID: SM0003_014C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 275+00_CPT **Date: 7/22/2011 08:28**



Max. Depth: 90.223 (ft)
Avg. Interval: 0.656 (ft)

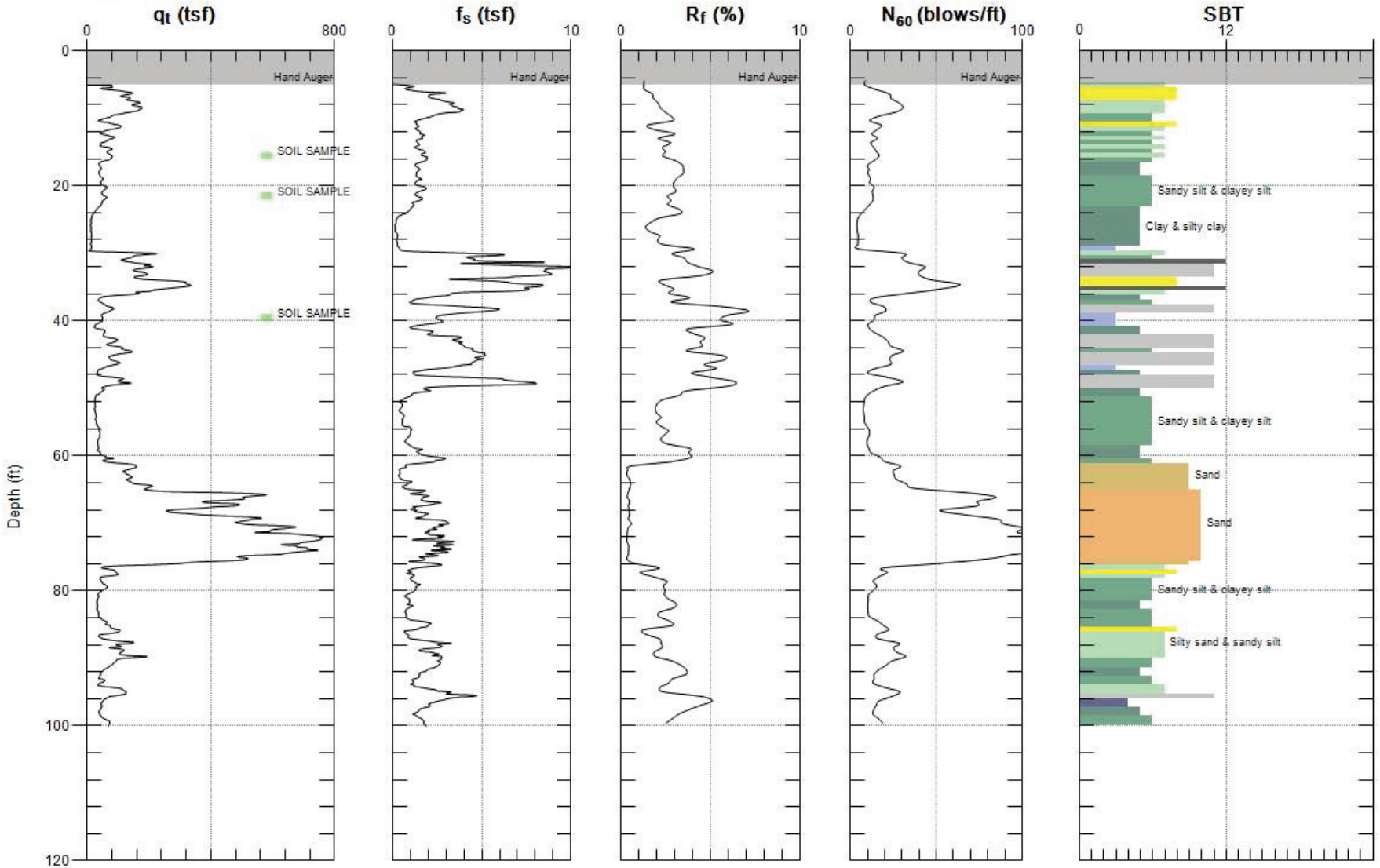
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_016C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 312+00_CPT **Date: 7/22/2011 11:28**



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

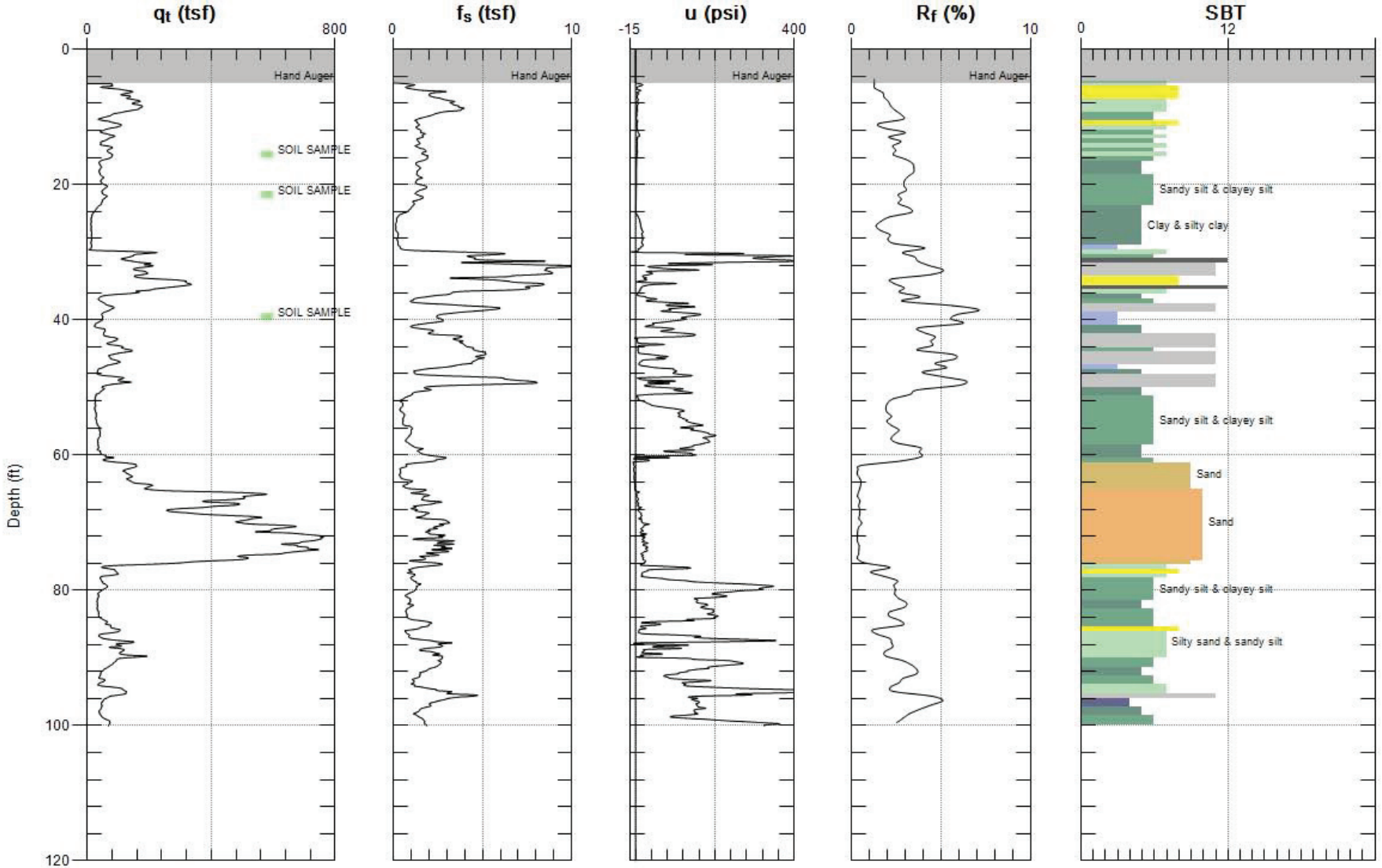
GREGG

URS

ID: SL0001_016C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 312+00_CPT **Date: 7/22/2011 11:28**



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

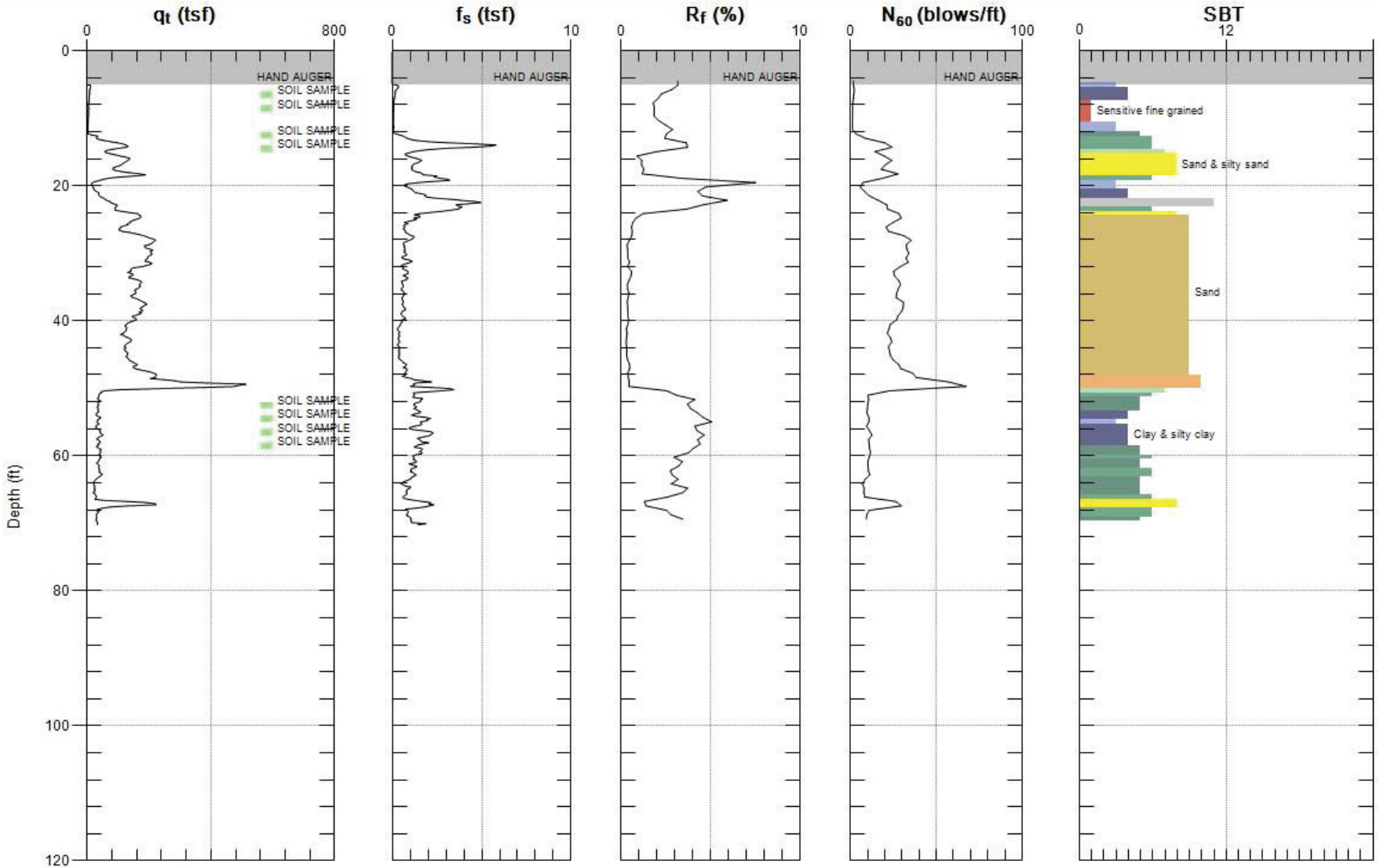
GREGG

URS

ID: SL0001_015C

Site: FEATHER RIVER LEVEE **Engineer: R.PICKARD**

Sounding: CPT-280+00 **Date: 8/3/2011 10:17**



Max. Depth: 70.210 (ft)
Avg. Interval: 0.656 (ft)

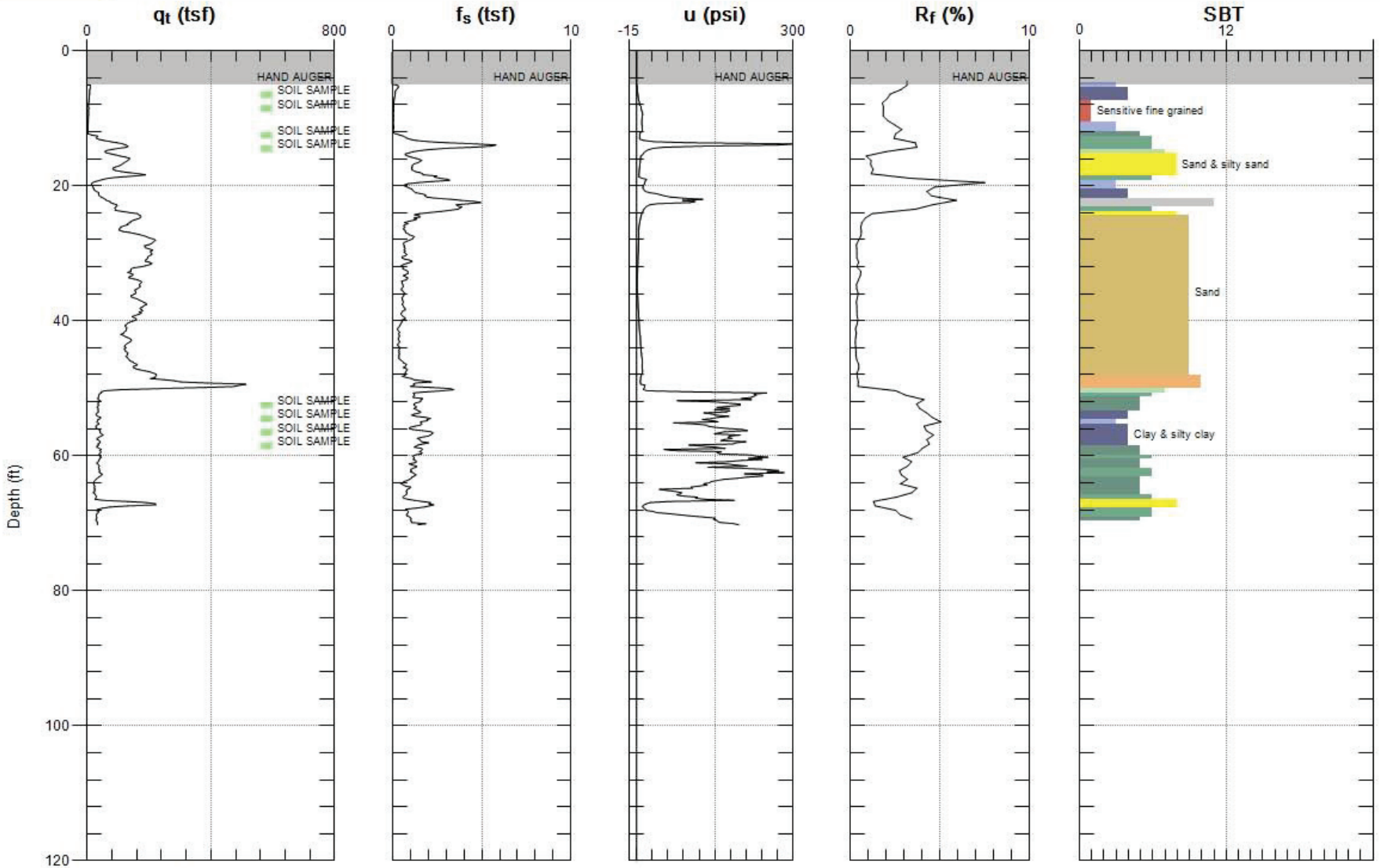
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_015C

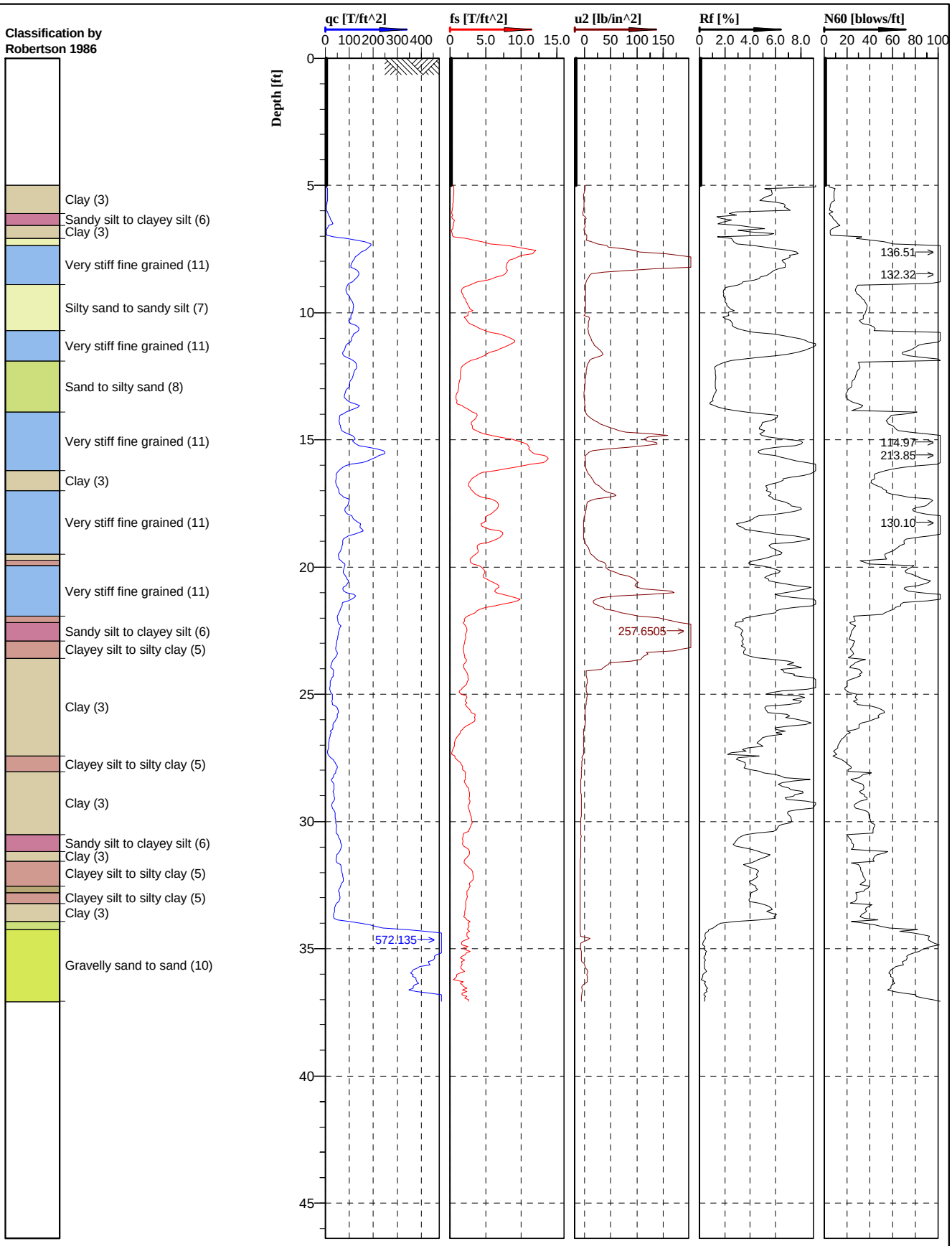
Site: FEATHER RIVER LEVEE **Engineer: R.PICKARD**

Sounding: CPT-280+00 **Date: 8/3/2011 10:17**



Max. Depth: 70.210 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)



Location: Yuba City (rural), California	Position: SL0001_42C	Ground level:	Test no: 401_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/30/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 401_00_CPT.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

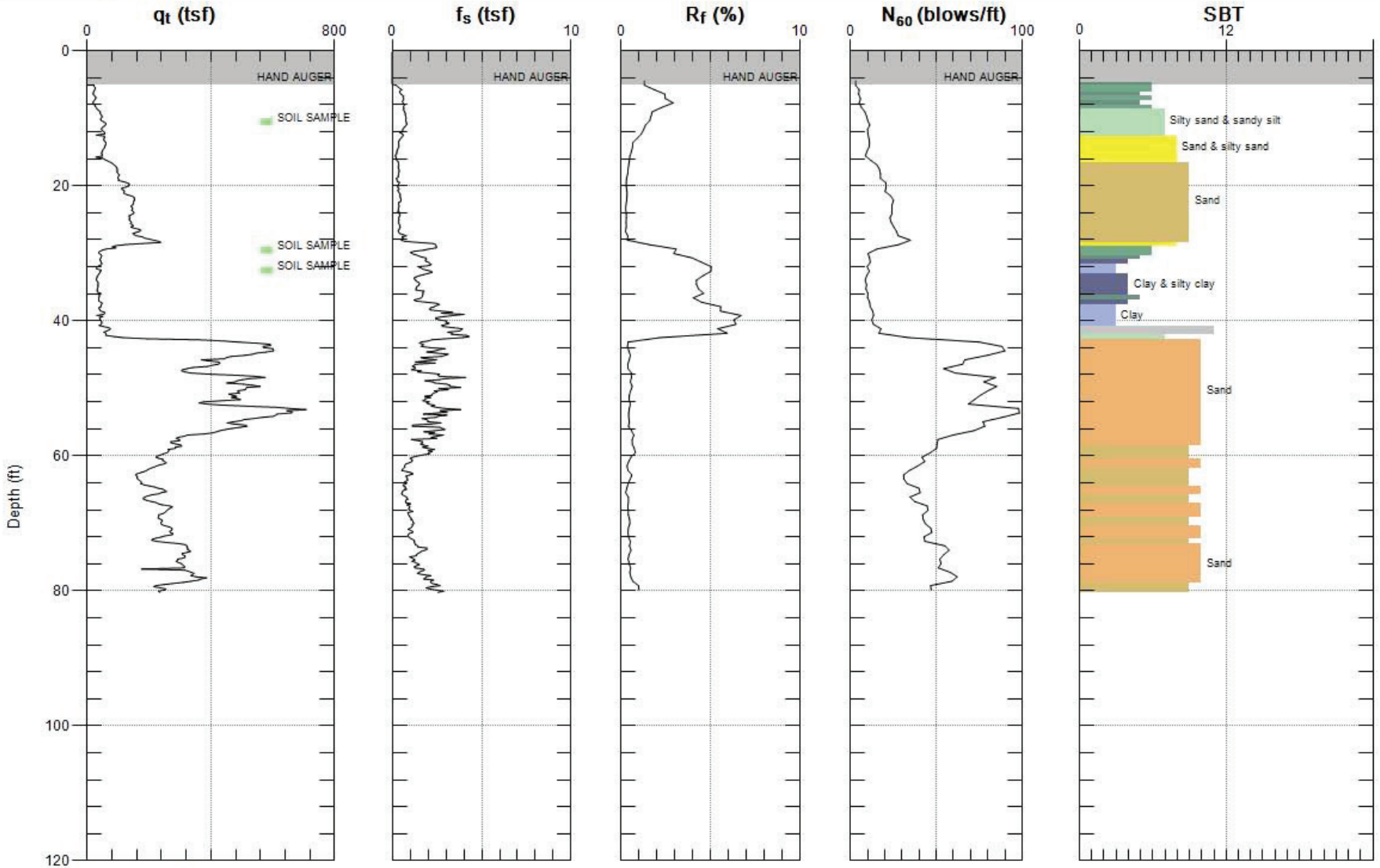
GREGG

URS

ID: SL0001_017C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-461+00 **Date: 8/2/2011 04:40**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

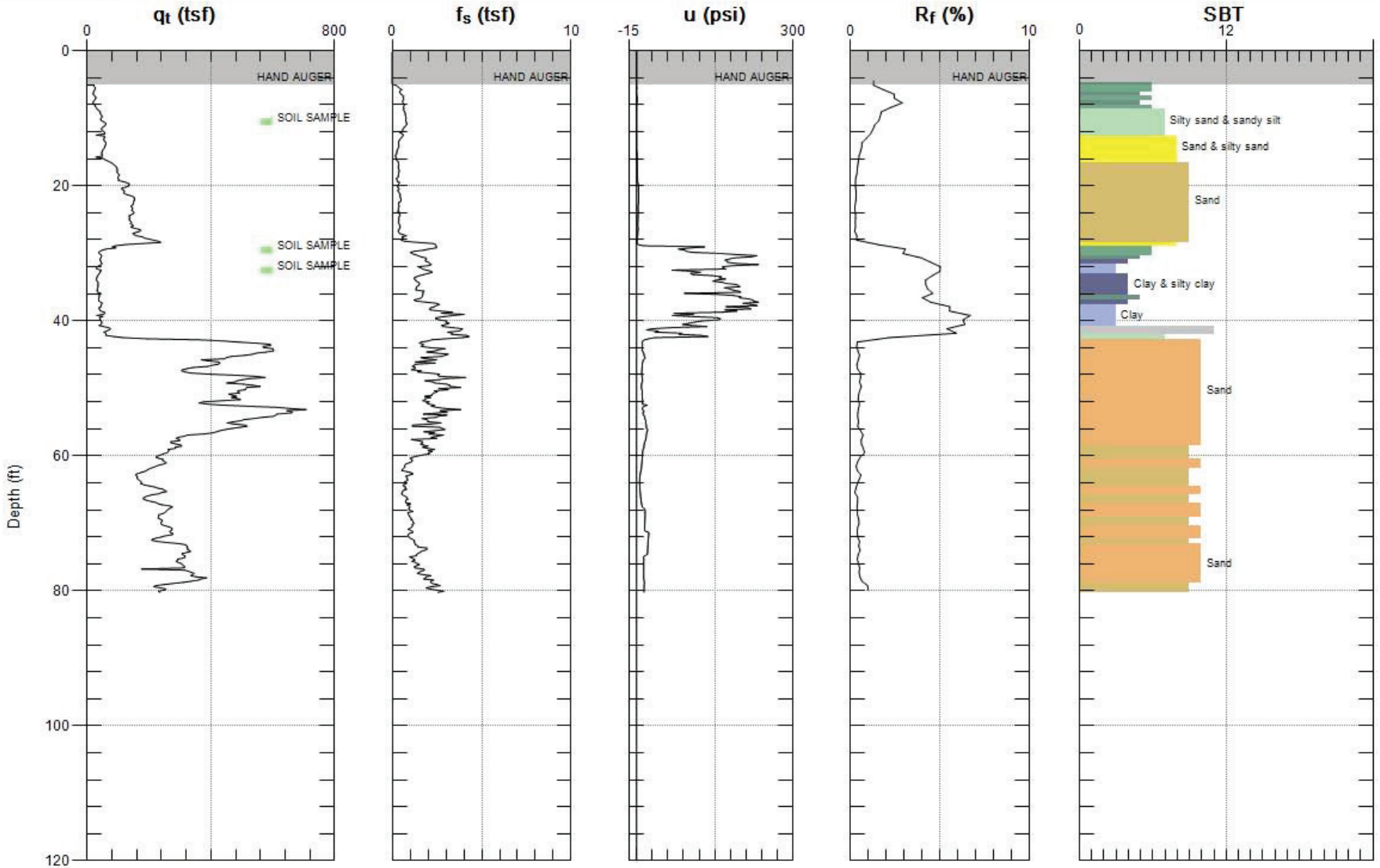
GREGG

URS

ID: SL0001_017C

Site: FEATHER RIVER LEVEE **Engineer: DAVID CASTRO**

Sounding: CPT-461+00 **Date: 8/2/2011 04:40**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

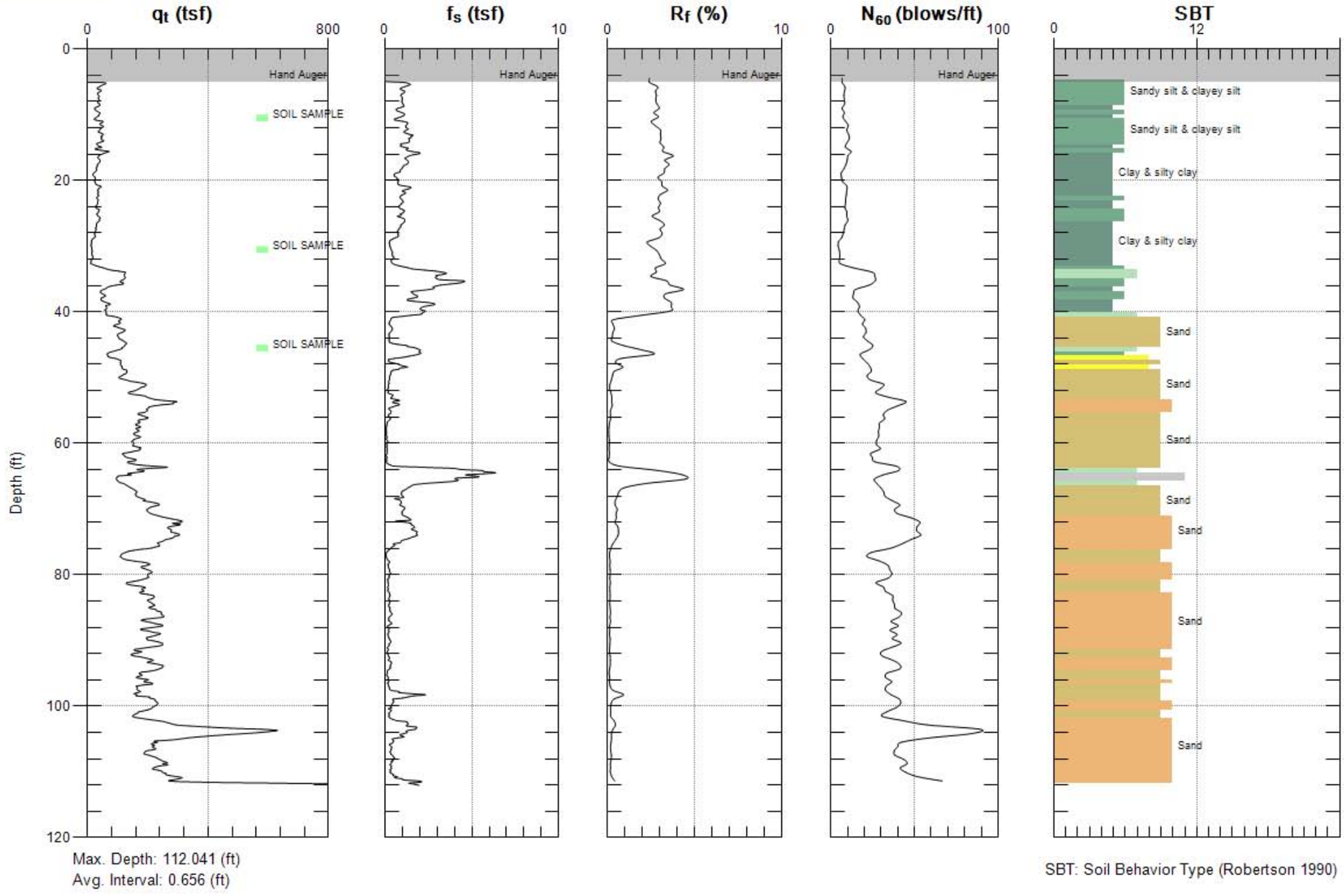
GREGG

URS

ID: SL0001_018C

Site: FEATHER RIVER WEST
Sounding: 551+00_CPT

Engineer: DANIEL BREMERMAN
Date: 7/20/2011 09:26



Max. Depth: 112.041 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

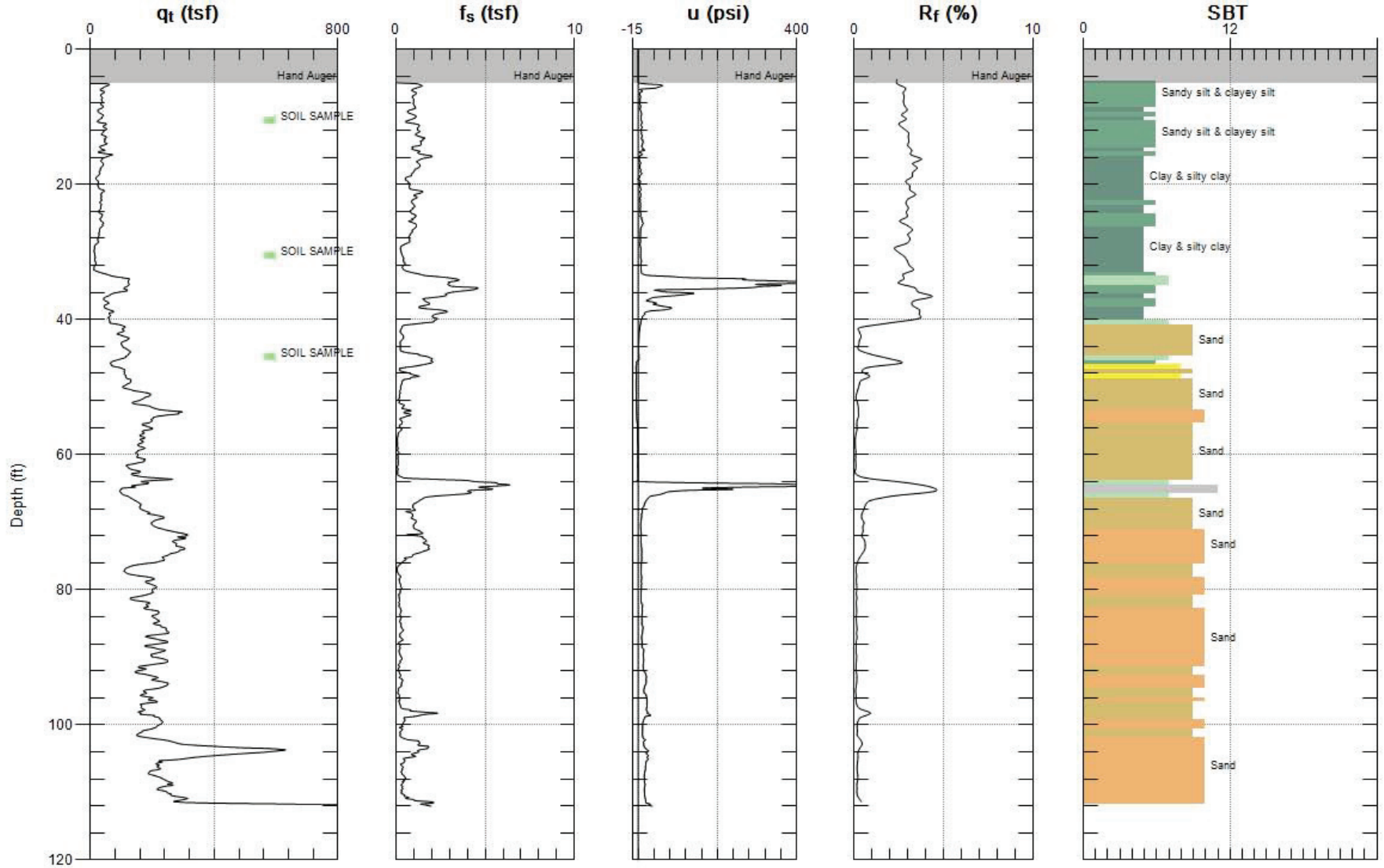
GREGG

URS

ID: SL0001_018C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 551+00_CPT **Date: 7/20/2011 09:26**



Max. Depth: 112.041 (ft)
Avg. Interval: 0.656 (ft)

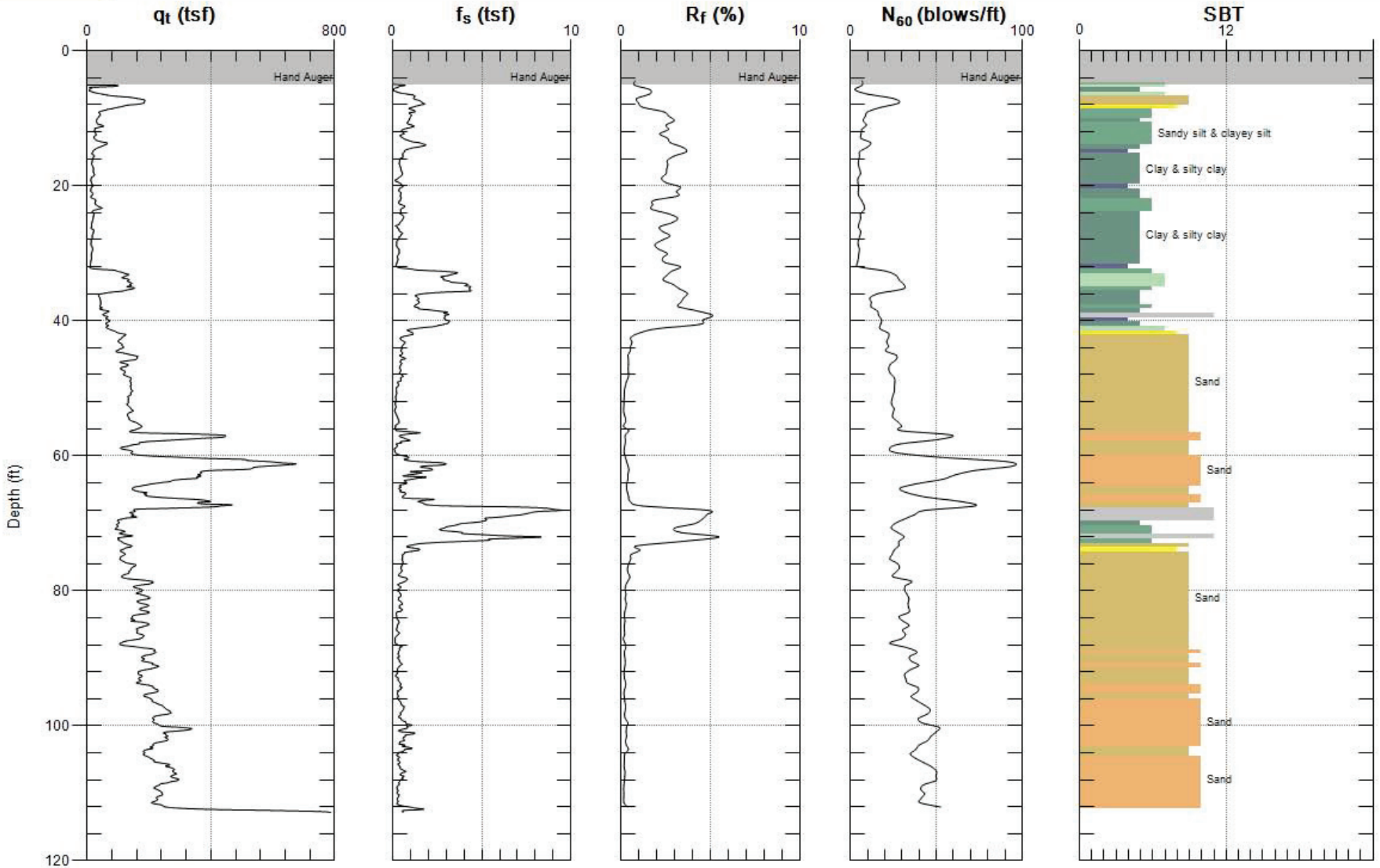
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_019C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 561+00_CPT **Date: 7/20/2011 12:06**



Max. Depth: 112.861 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

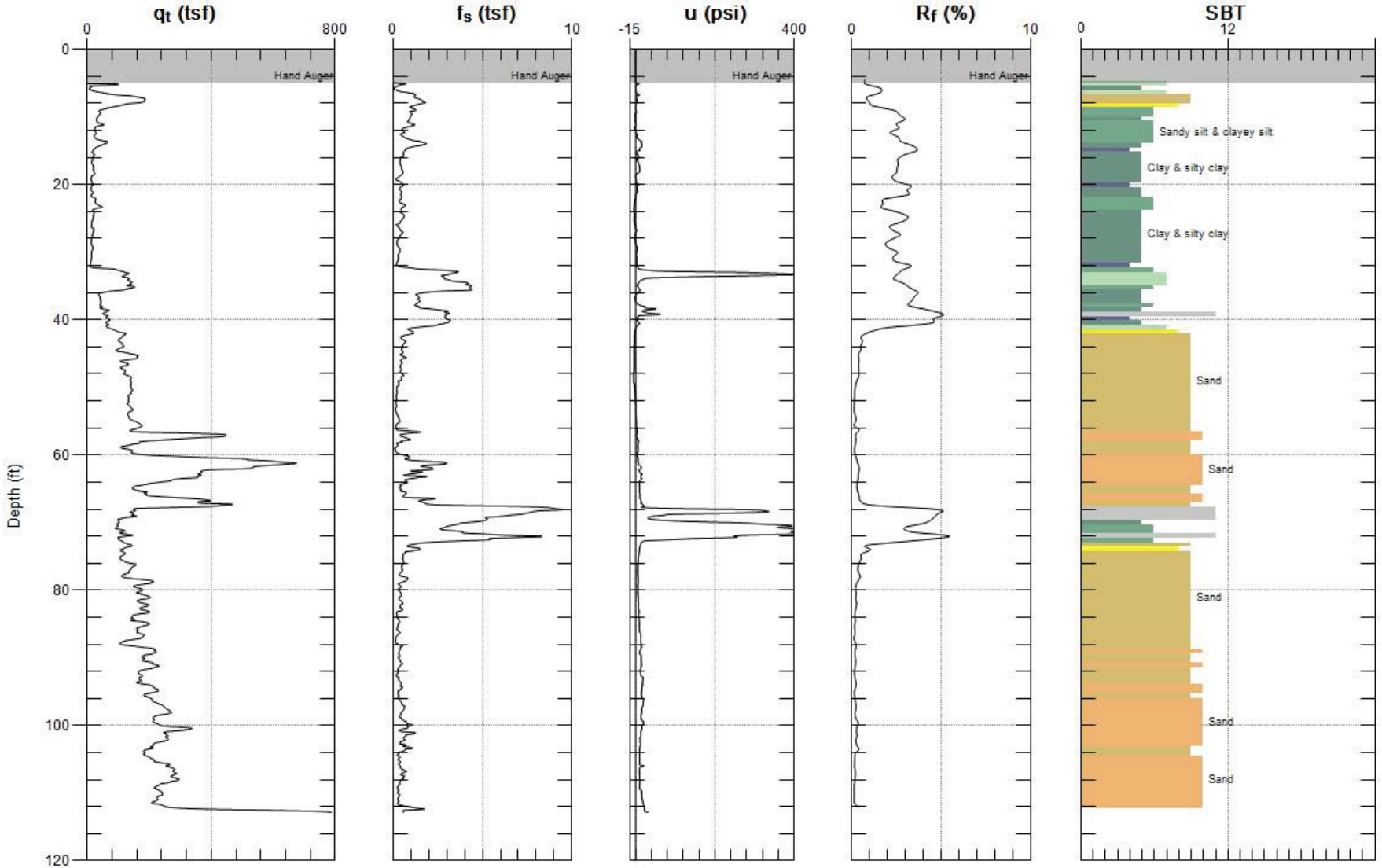
GREGG

URS

ID: SL0001_019C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 561+00_CPT **Date: 7/20/2011 12:06**



Max. Depth: 112.861 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

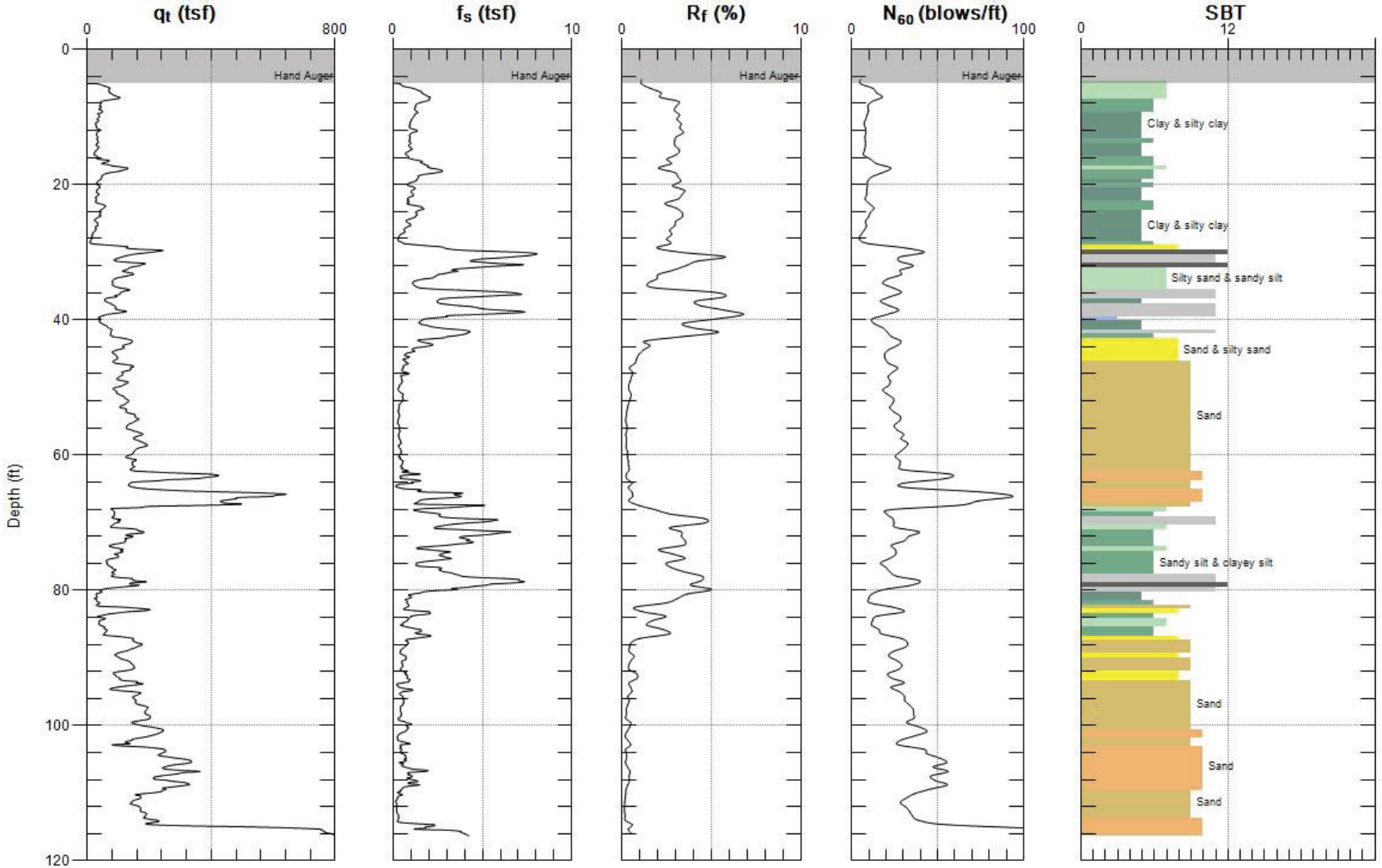
GREGG

URS

ID: SL0001_020C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 570+00_CPT **Date: 7/20/2011 02:40**



Max. Depth: 116.306 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

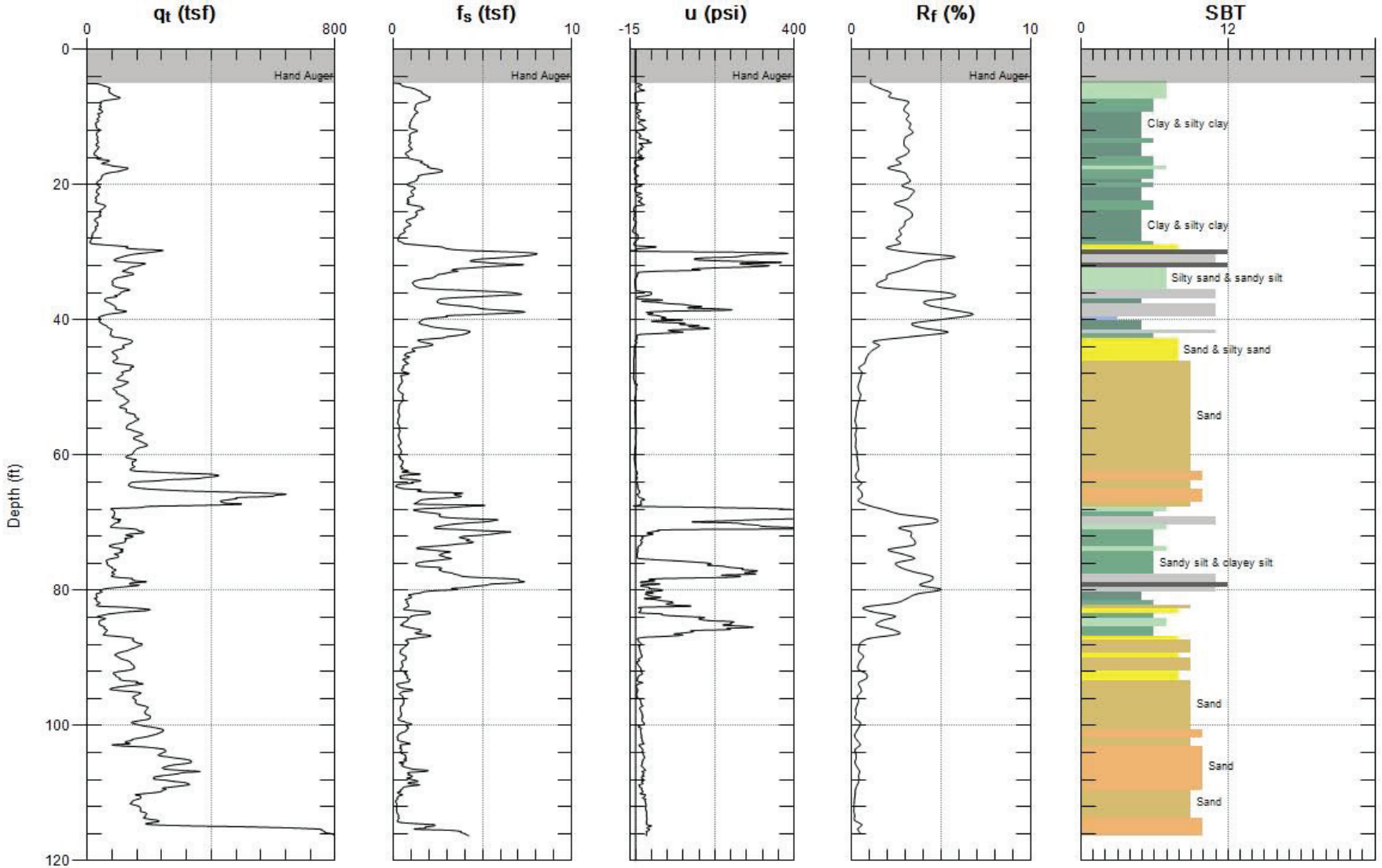
GREGG

URS

ID: SL0001_020C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 570+00_CPT **Date: 7/20/2011 02:40**



Max. Depth: 116.306 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

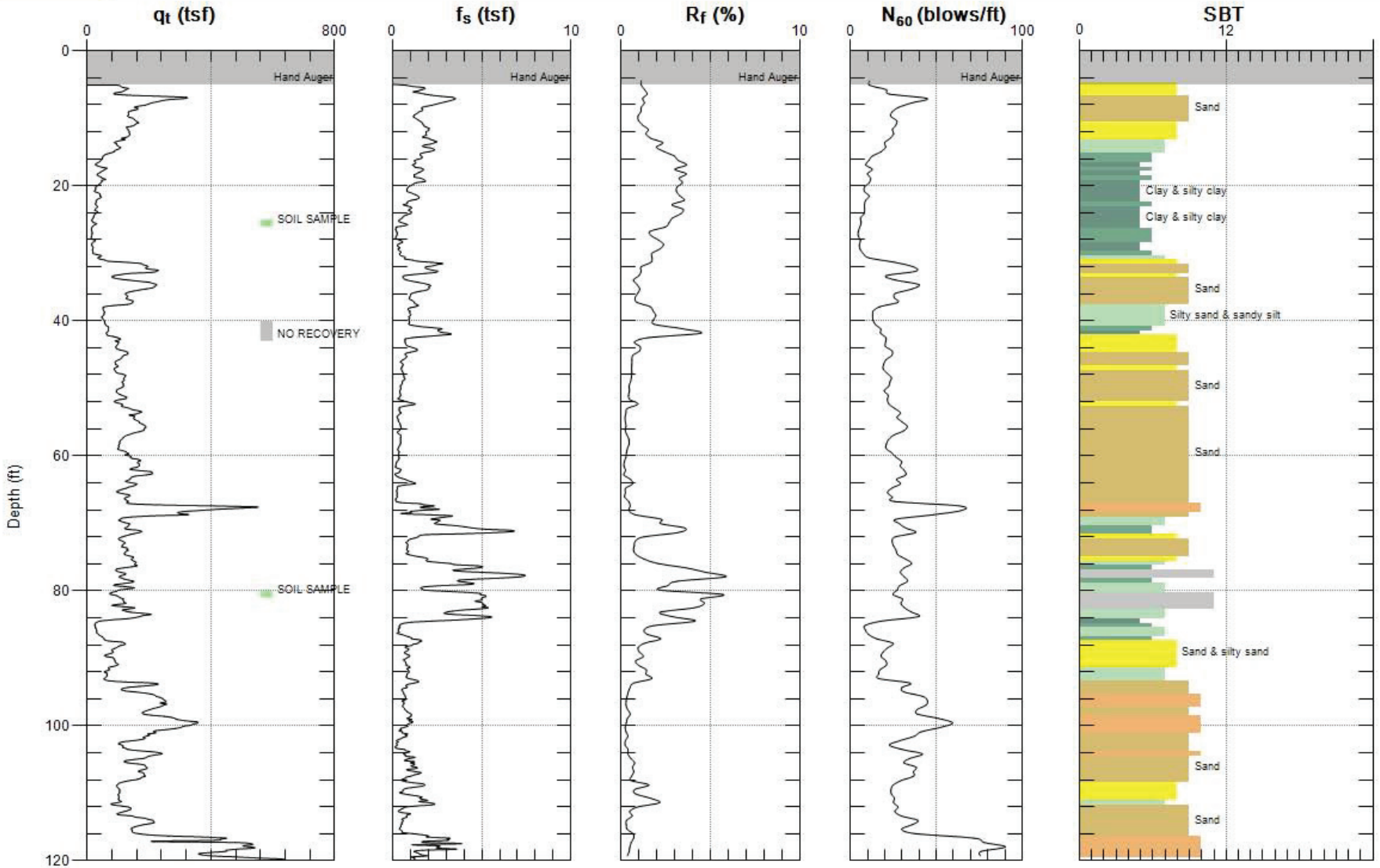
GREGG

URS

ID: SL0001_021C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 580+00_CPT **Date: 7/21/2011 08:25**



Max. Depth: 120.079 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

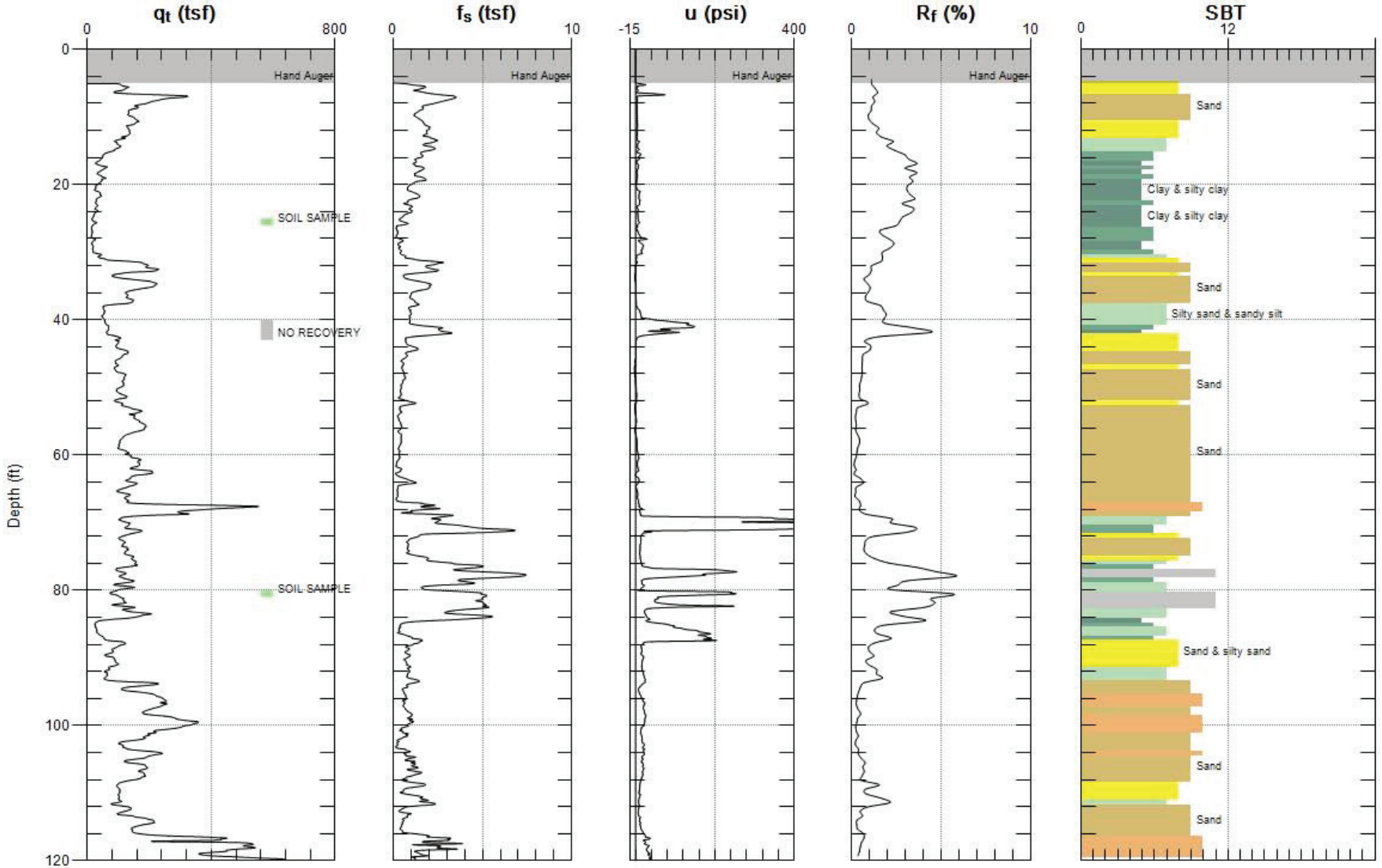
GREGG

URS

ID: SL0001_021C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 580+00_CPT **Date: 7/21/2011 08:25**



Max. Depth: 120.079 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

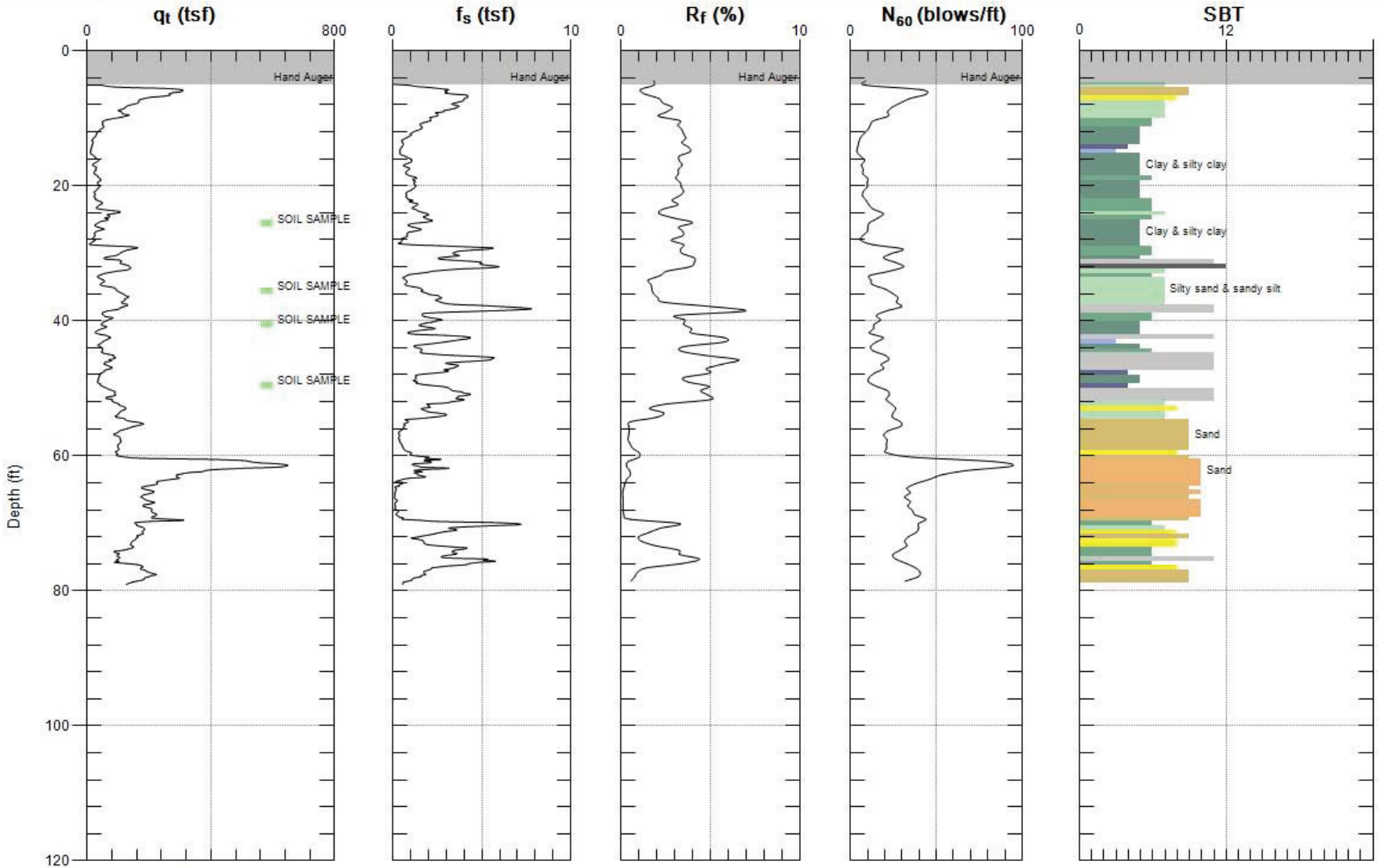
GREGG

URS

ID: SL0001_022C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 590+00_CPT **Date: 7/21/2011 12:39**



Max. Depth: 79.068 (ft)
Avg. Interval: 0.656 (ft)

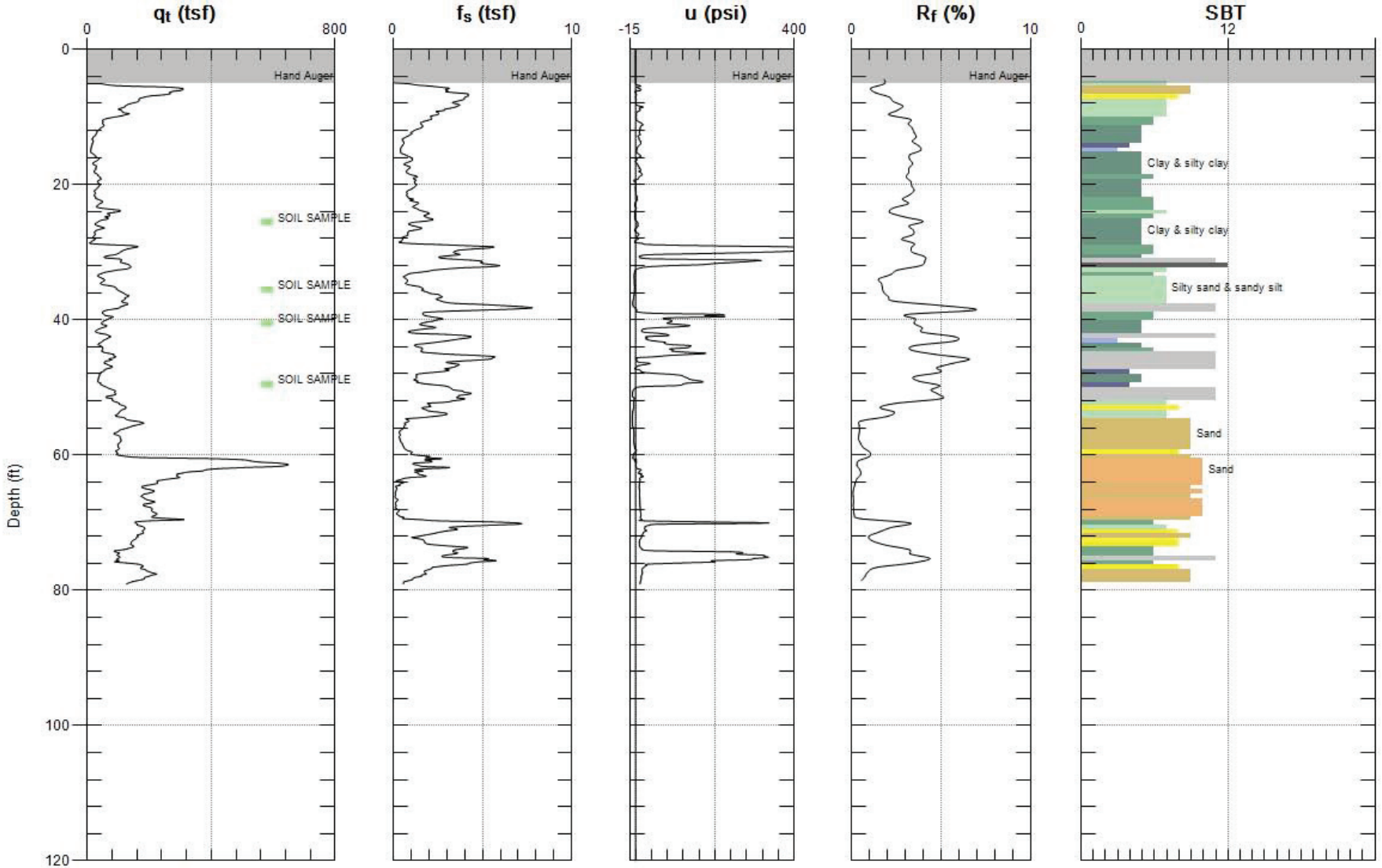
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_022C

Site: FEATHER RIVER WEST **Engineer: DANIEL BREMERMAN**

Sounding: 590+00_CPT **Date: 7/21/2011 12:39**



Max. Depth: 79.068 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

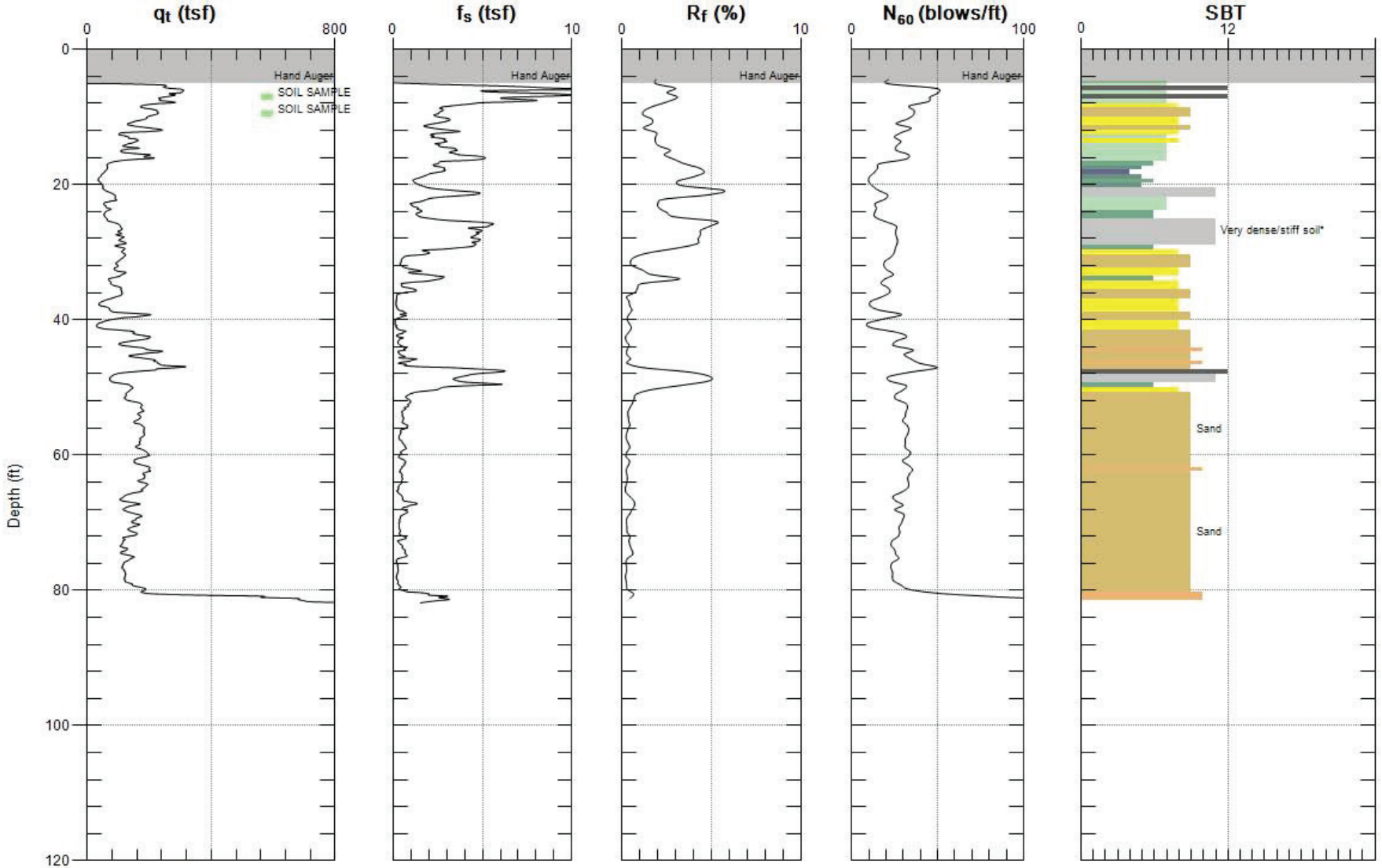
GREGG

URS

ID: SL0001_023C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 601+00_CPT **Date: 7/18/2011 10:07**



Max. Depth: 81.857 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

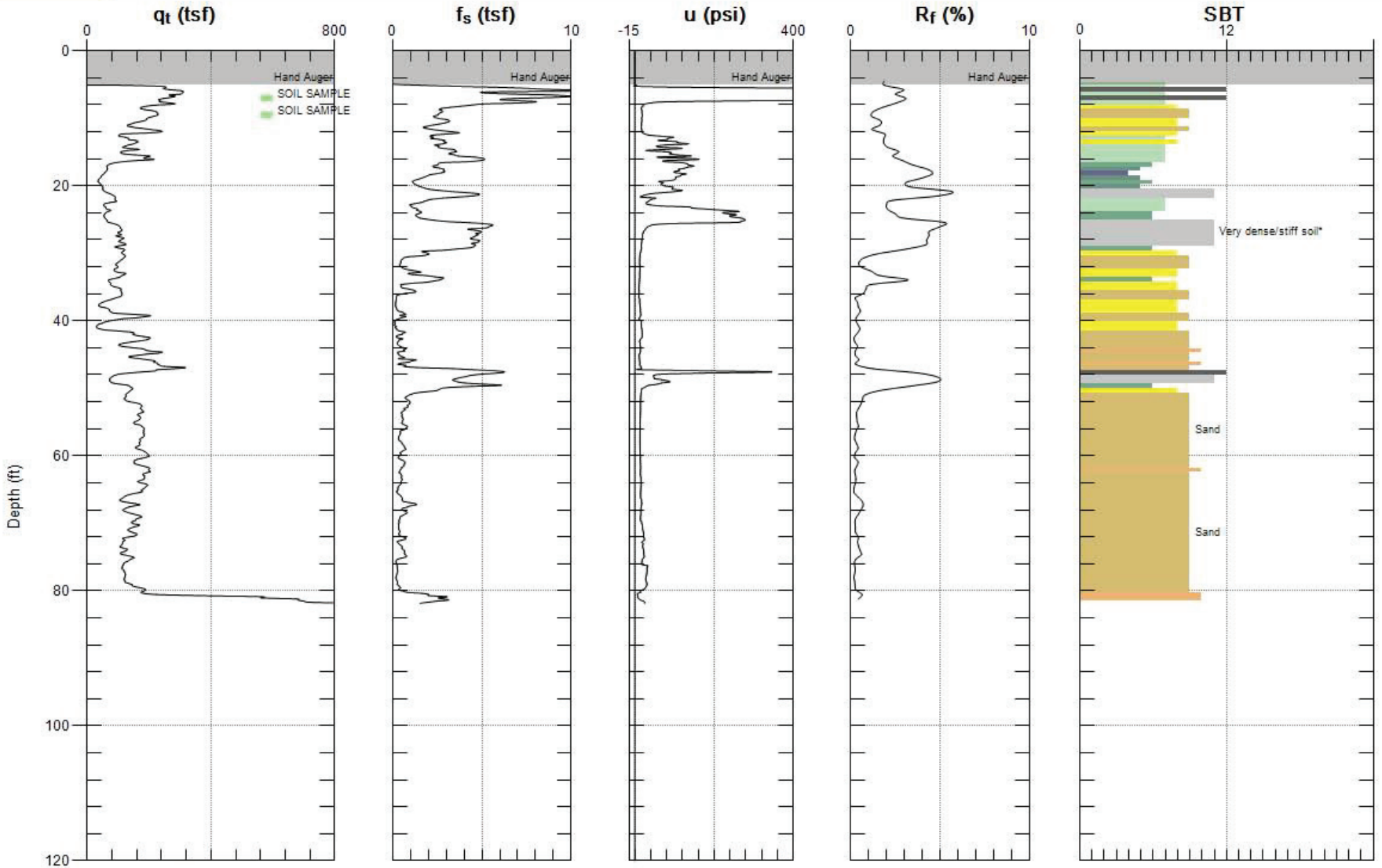
GREGG

URS

ID: SL0001_023C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 601+00_CPT **Date: 7/18/2011 10:07**



Max. Depth: 81.857 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

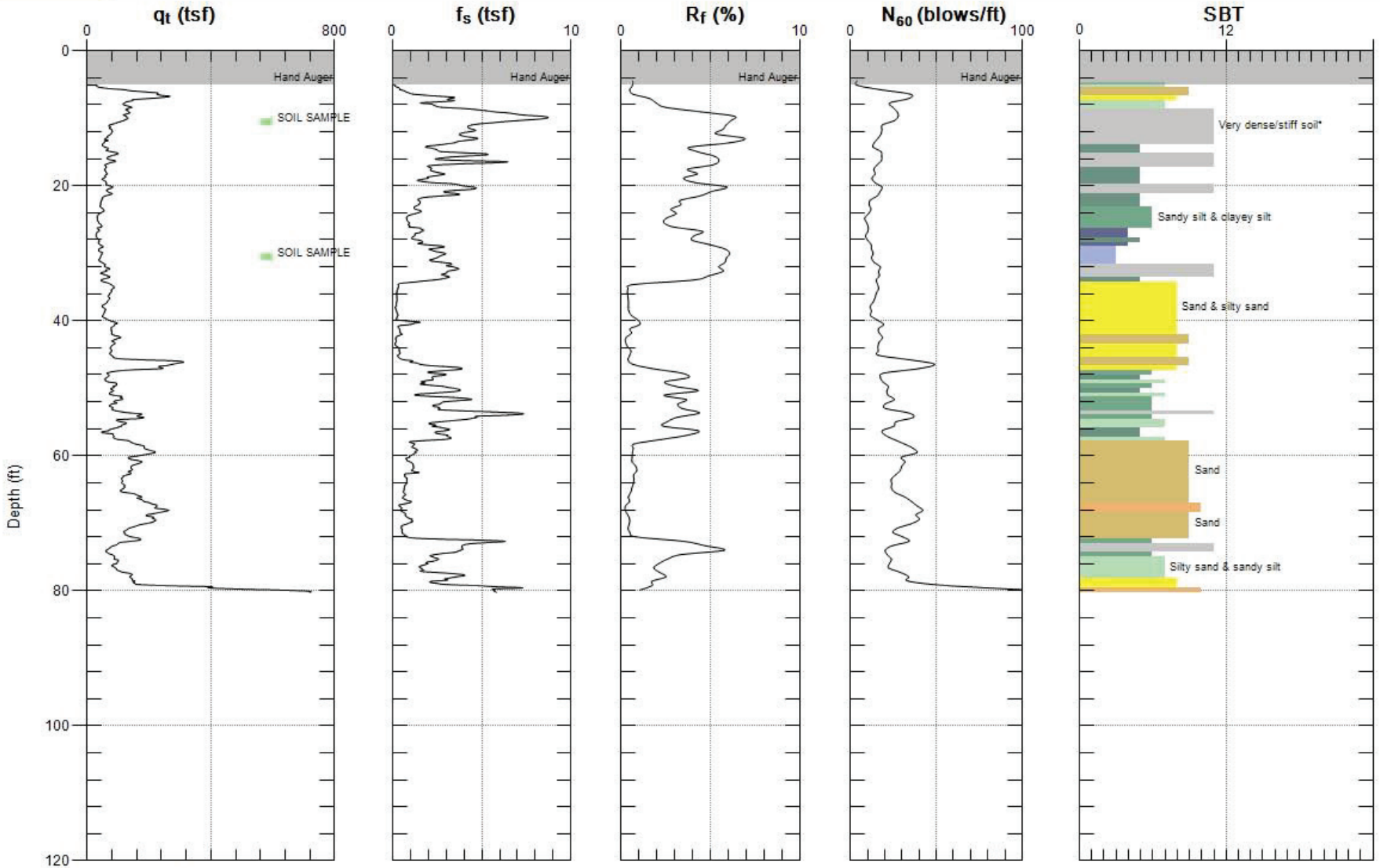
GREGG

URS

ID: SL0001_024C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 614+00_CPT **Date: 7/18/2011 01:14**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

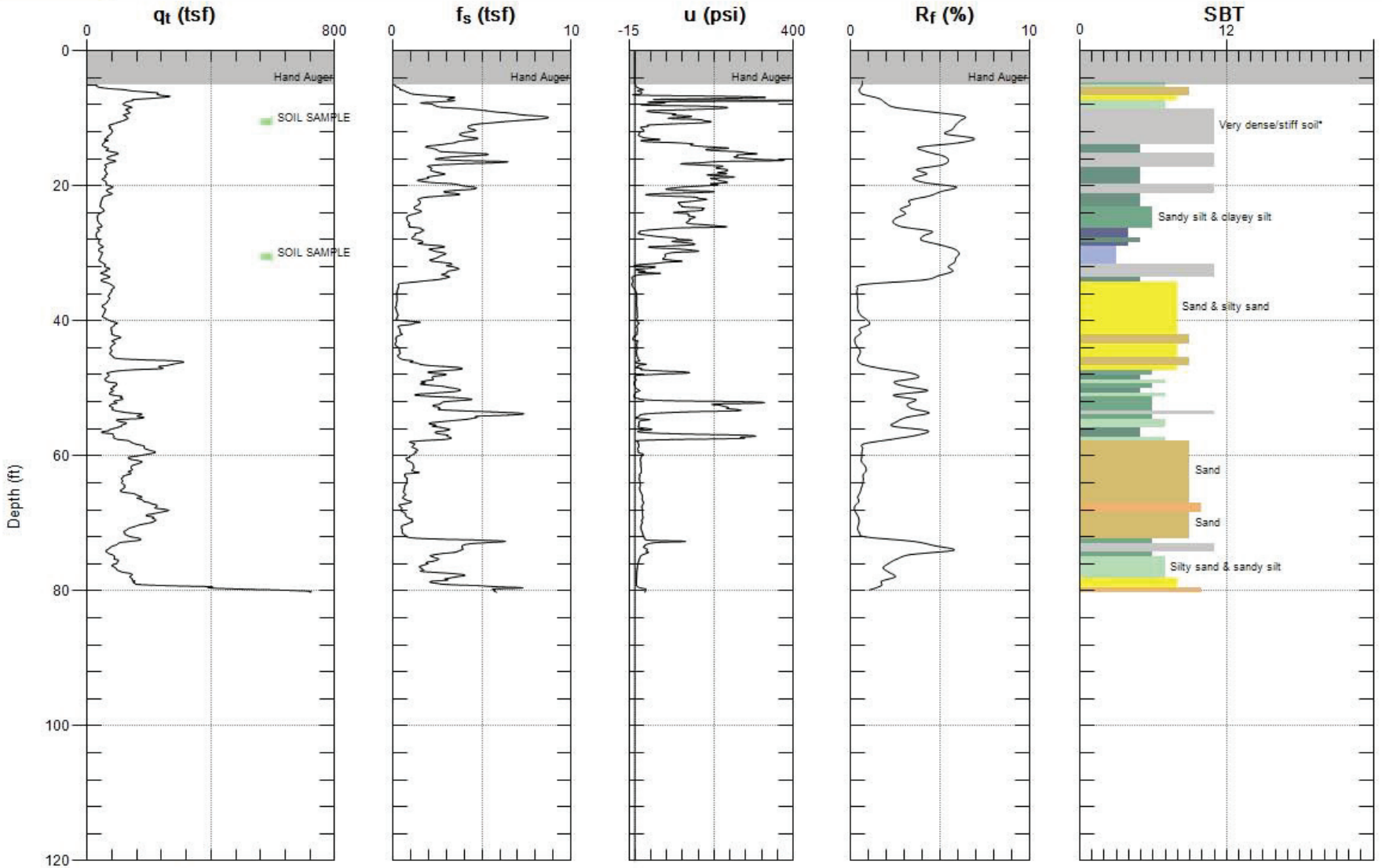
GREGG

URS

ID: SL0001_024C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 614+00_CPT **Date: 7/18/2011 01:14**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

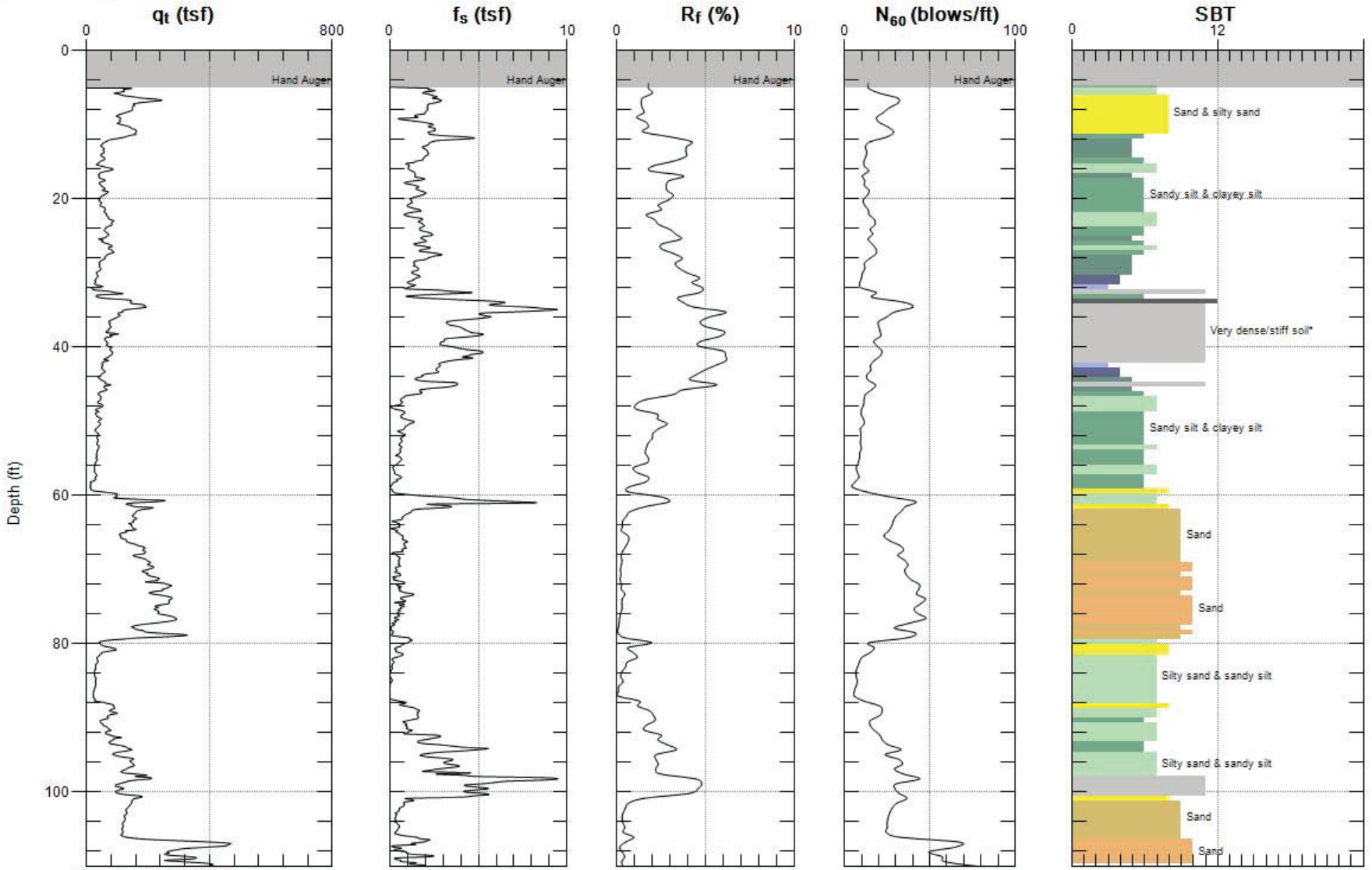
GREGG

URS

ID: SL0001_025C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 634+00_CPT **Date: 7/5/2011 02:22**



Max. Depth: 111.056 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

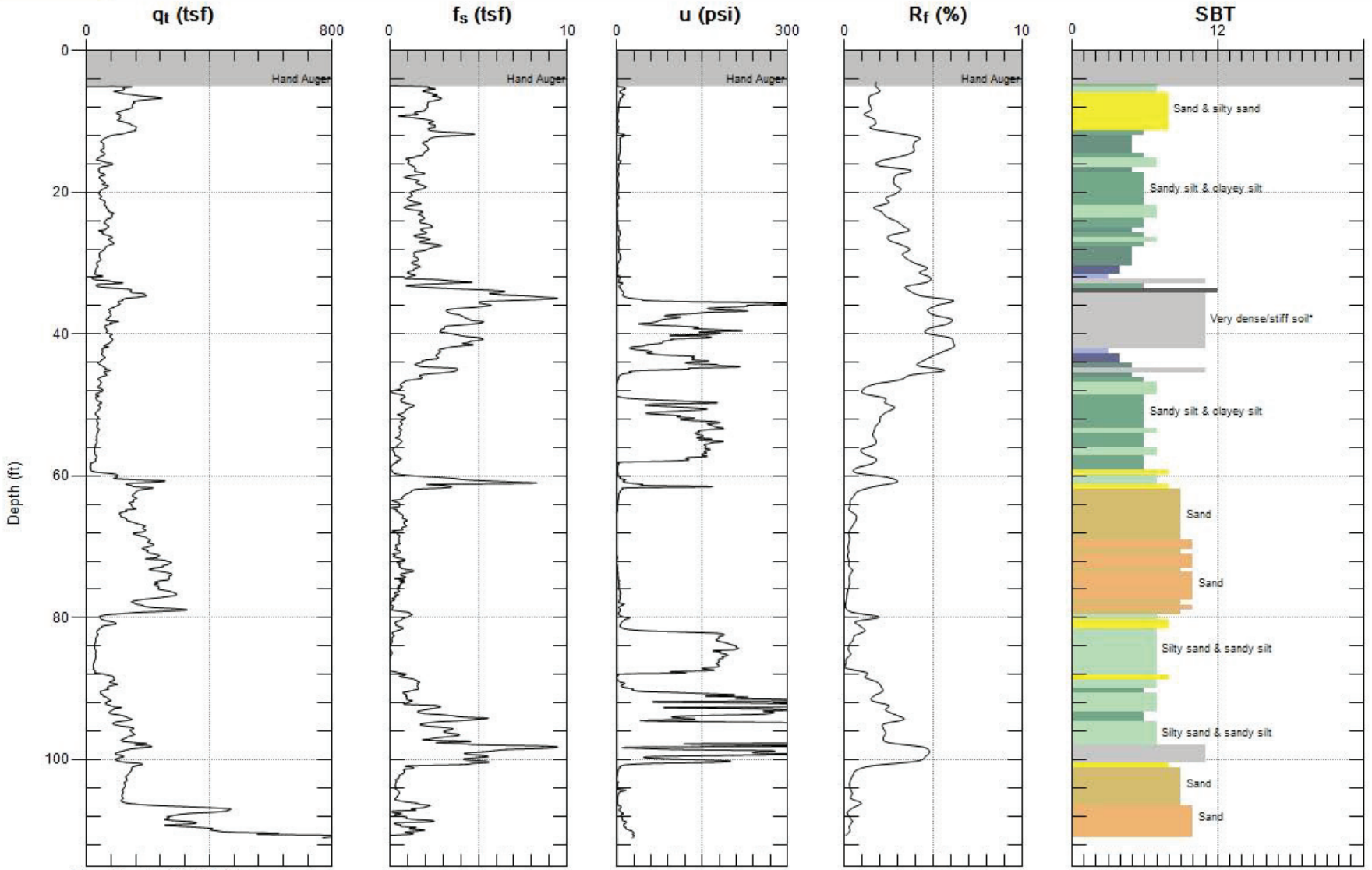
GREGG

URS

ID: SL0001_025C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 634+00_CPT **Date: 7/5/2011 02:22**



Max. Depth: 111.056 (ft)

Avg. Interval: 0.656 (ft)

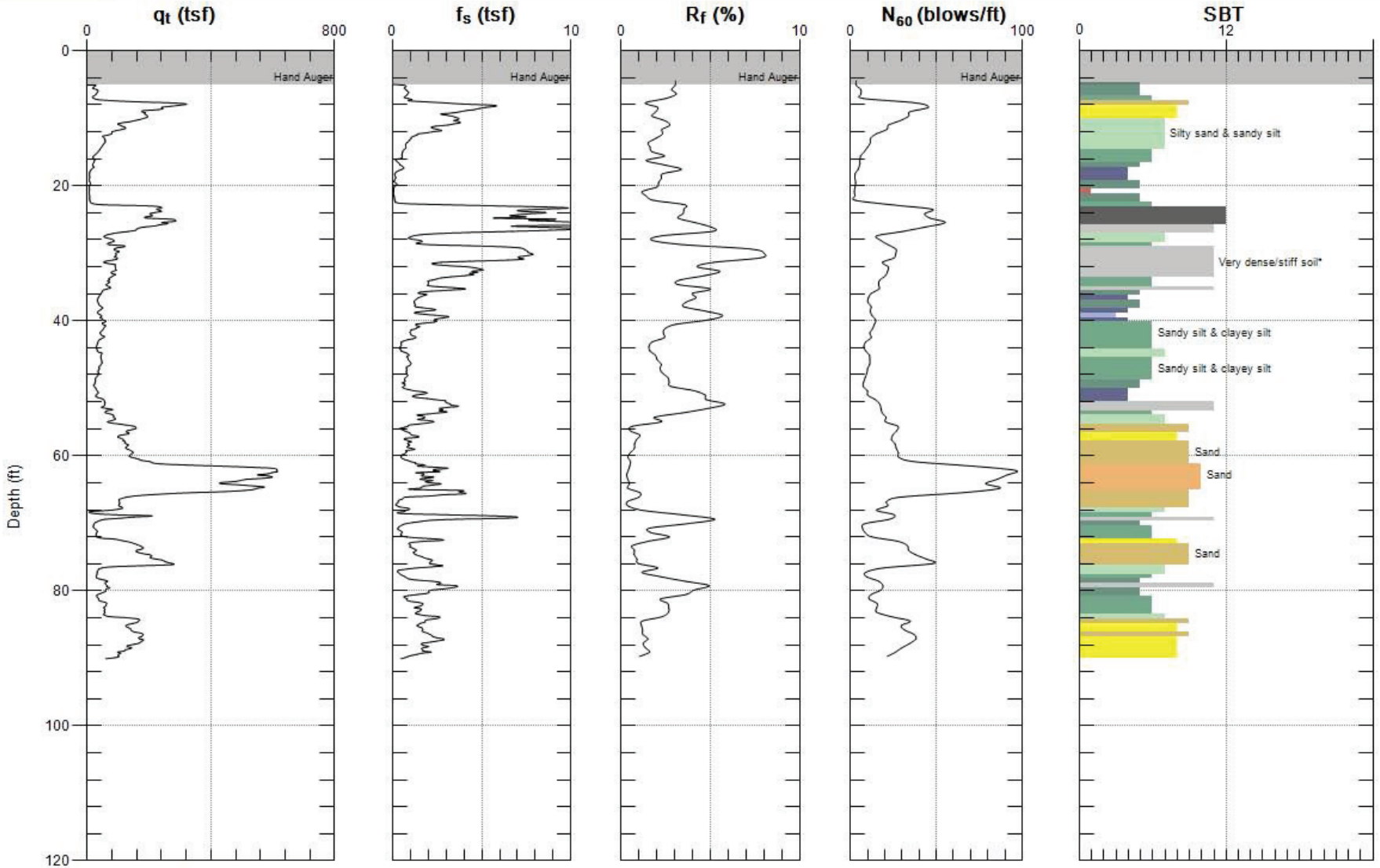
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_026C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 647+00_CPT **Date: 7/18/2011 03:36**



Max. Depth: 90.059 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

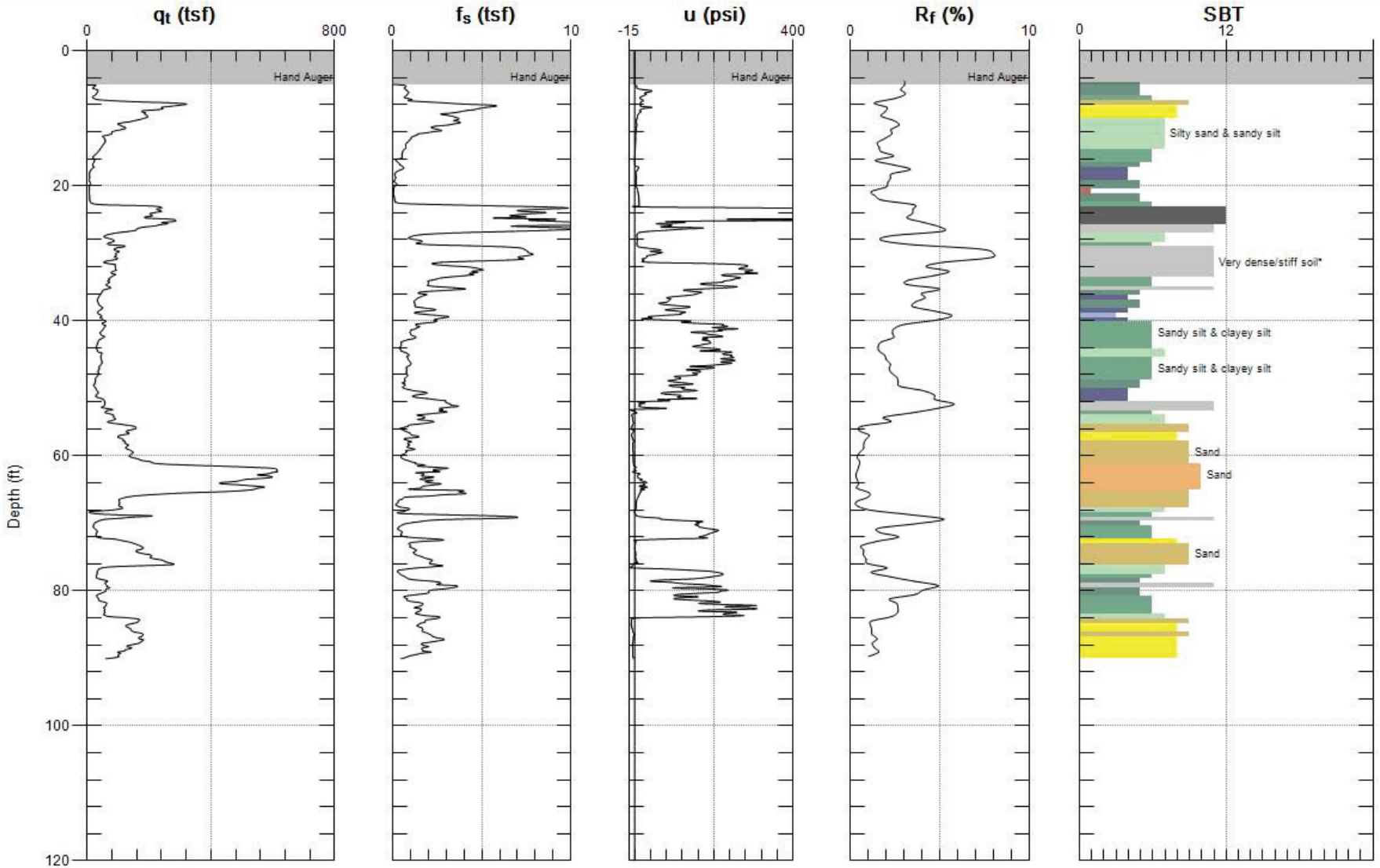
GREGG

URS

ID: SL0001_026C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 647+00_CPT **Date: 7/18/2011 03:36**



Max. Depth: 90.059 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

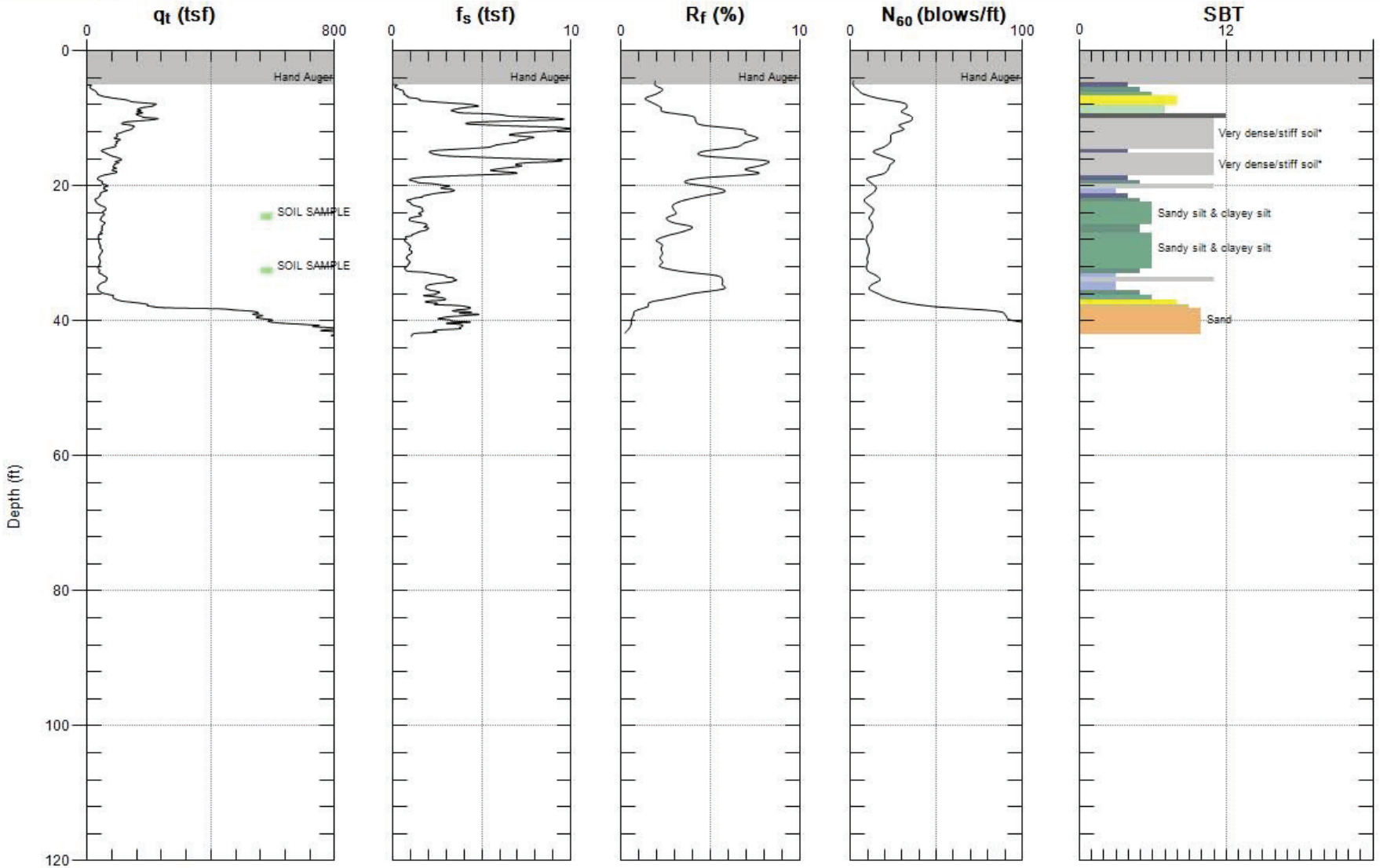
GREGG

URS

ID: SL0001_027C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 656+00_CPT **Date: 7/19/2011 08:52**



Max. Depth: 42.323 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

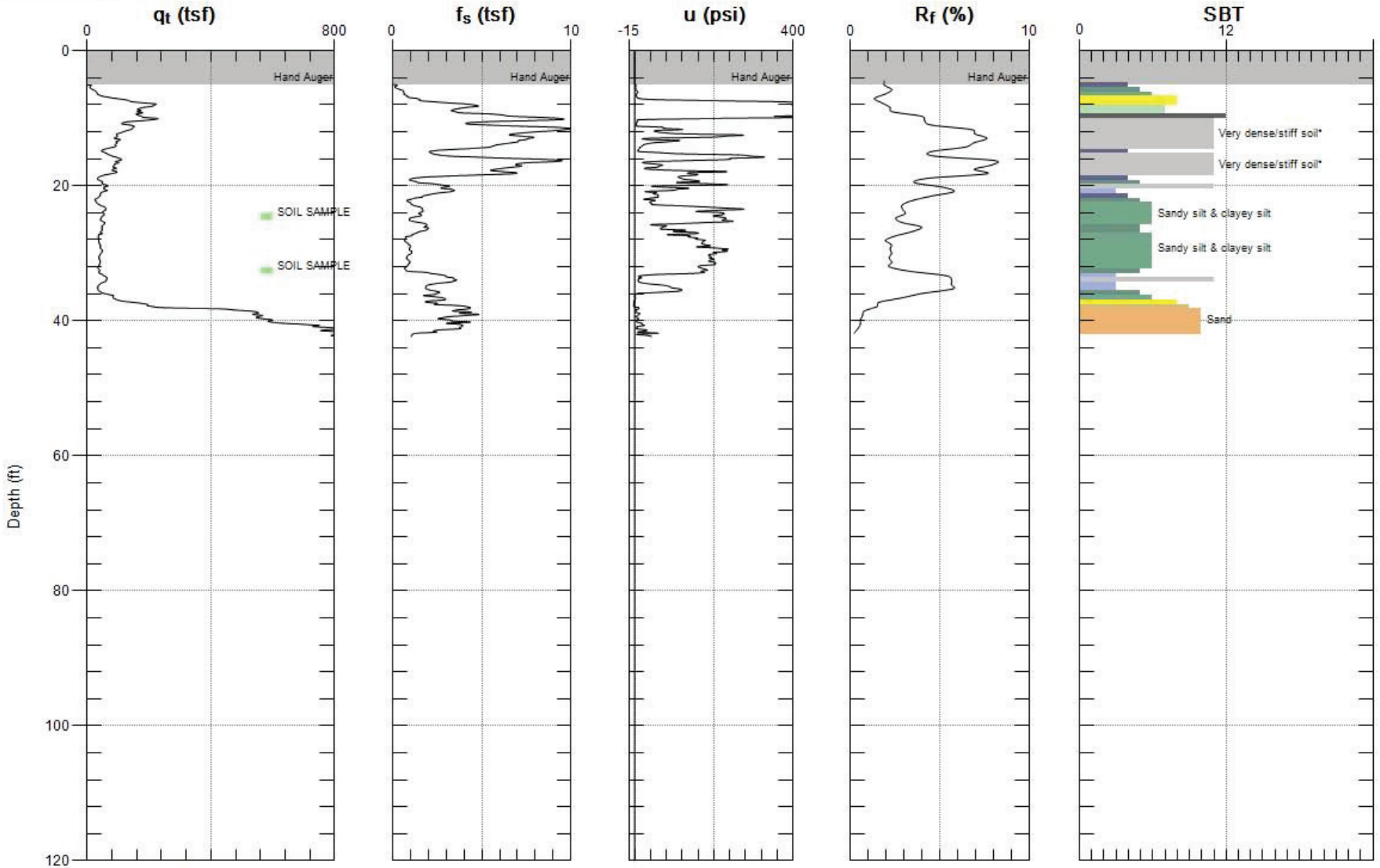
GREGG

URS

ID: SL0001_027C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 656+00_CPT **Date: 7/19/2011 08:52**



Max. Depth: 42.323 (ft)
Avg. Interval: 0.656 (ft)

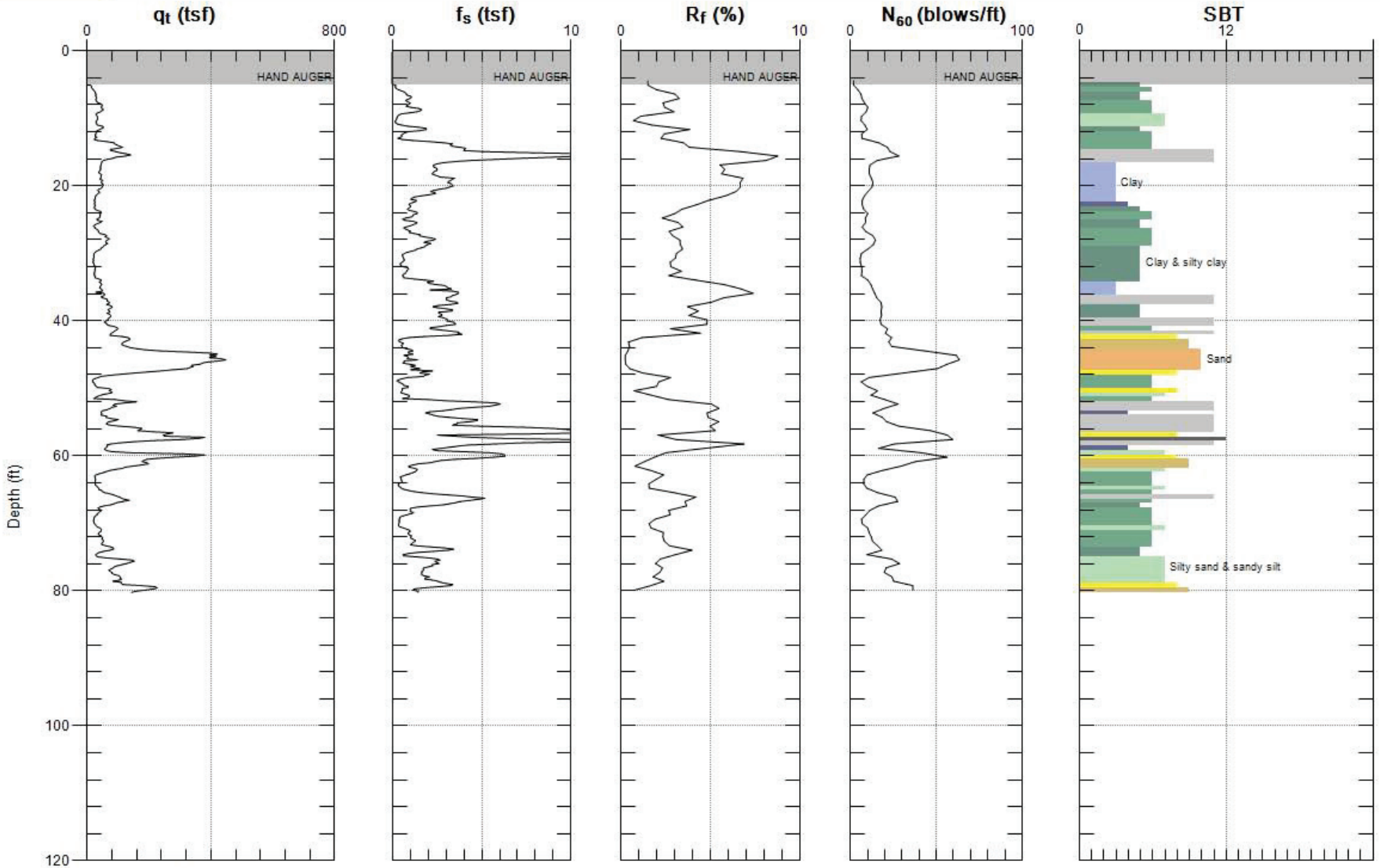
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_028C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-661+00 **Date: 8/1/2011 12:04**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

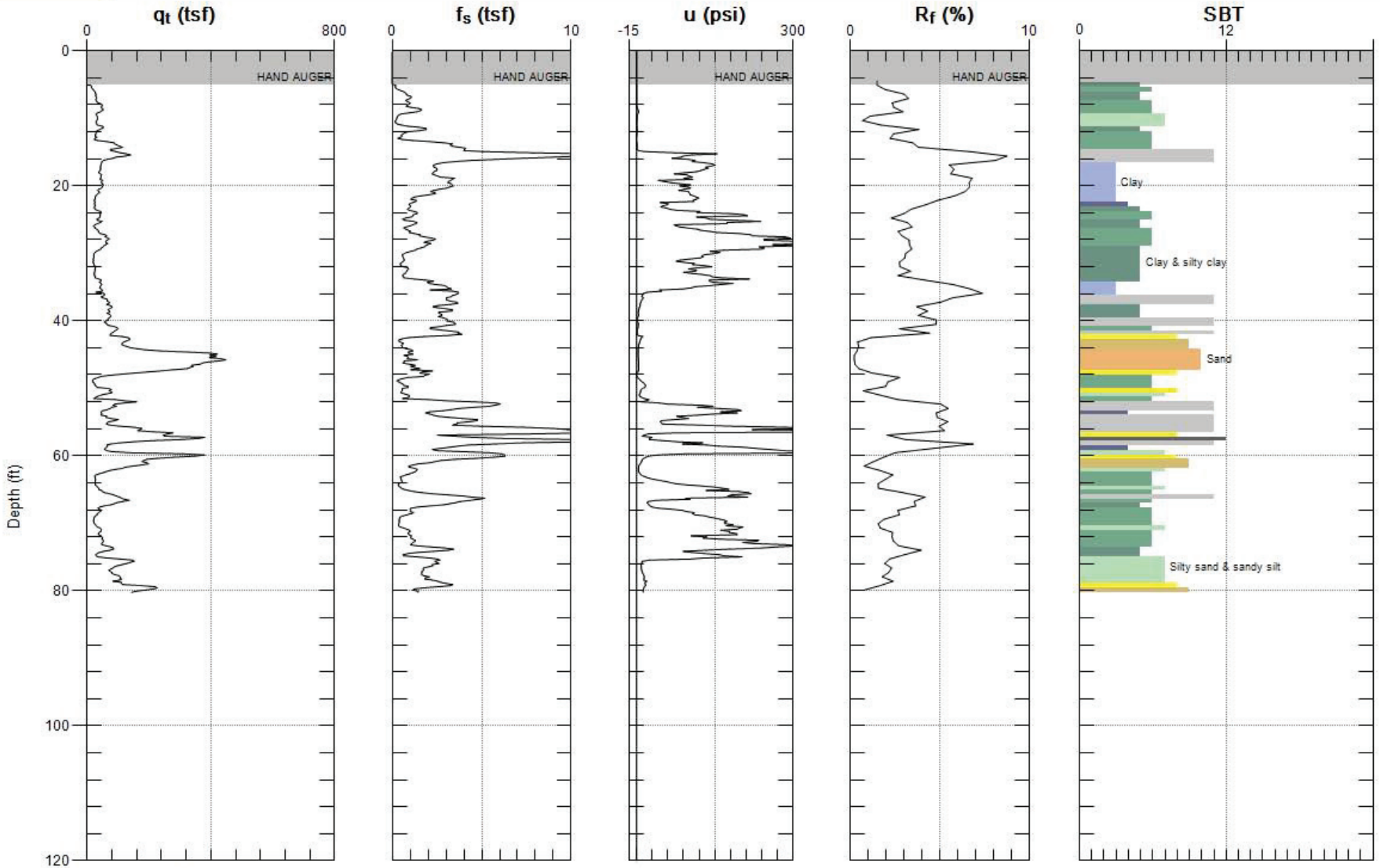
GREGG

URS

ID: SL0001_028C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-661+00 **Date: 8/1/2011 12:04**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

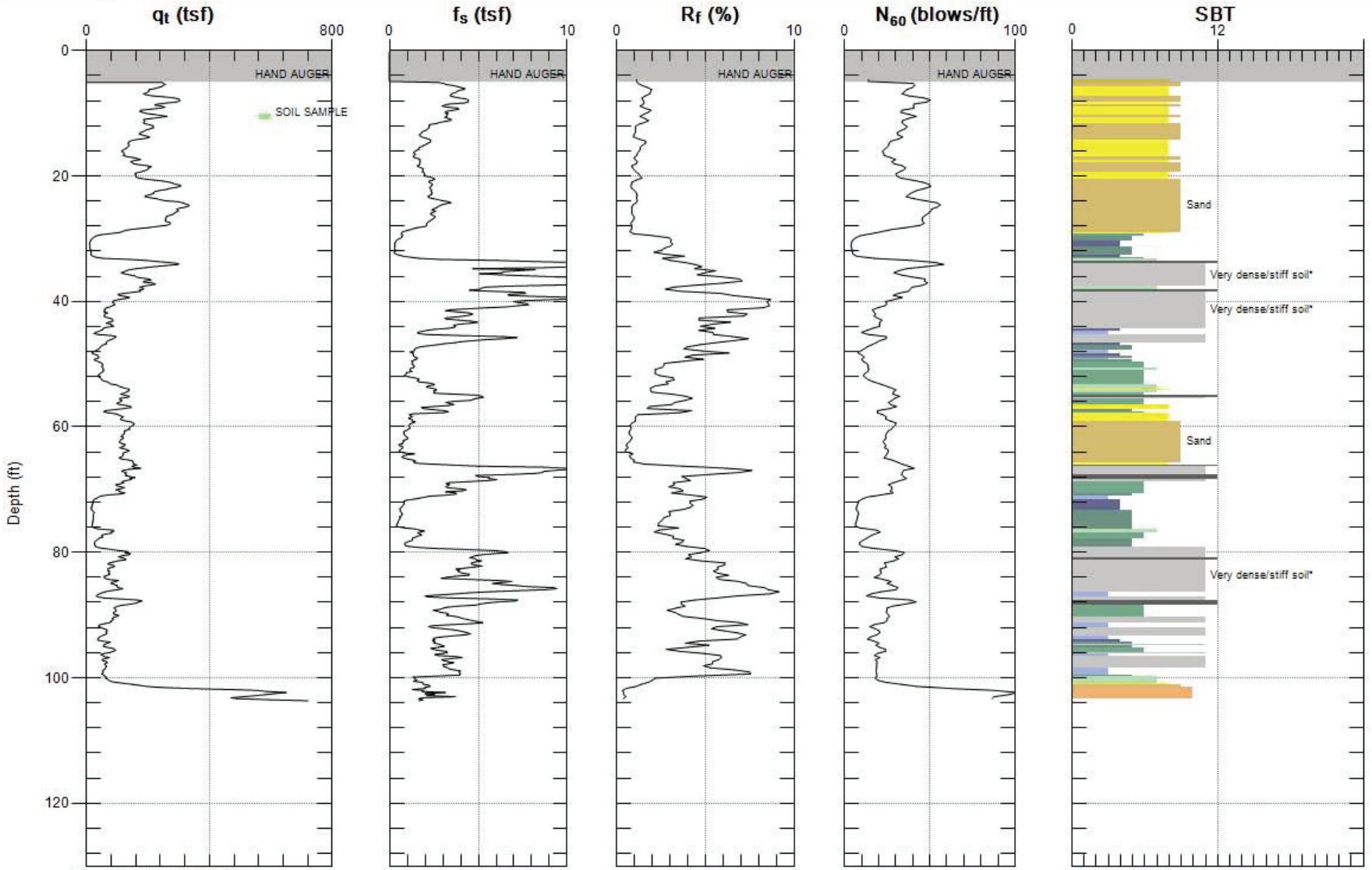
GREGG

URS

ID: SL0001_038C

Site: FEATHER RIVER
Sounding: 681-00-CPT

Engineer: G.HONG
Date: 9/22/2011 08:12



Max. Depth: 103.675 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

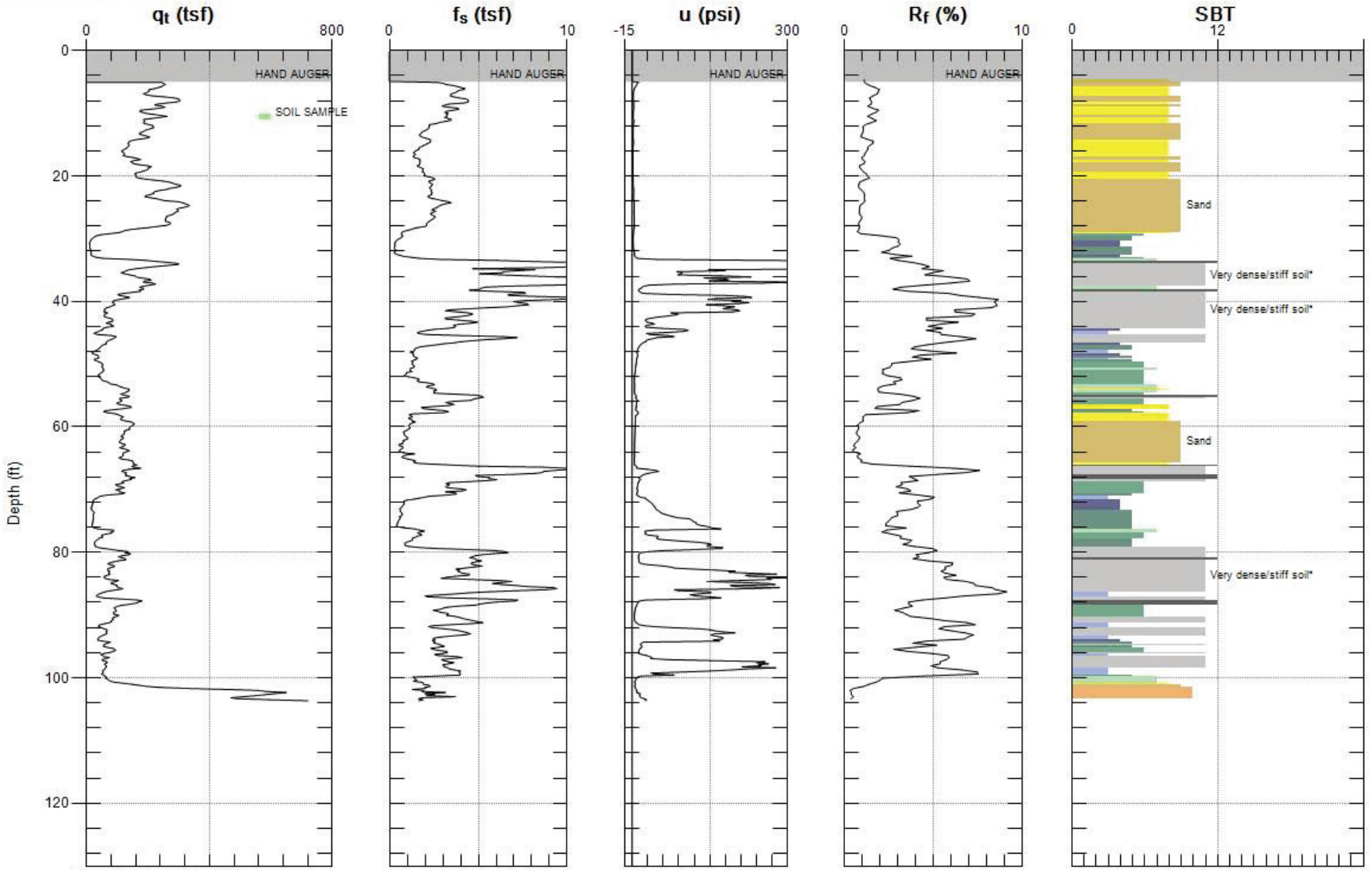
GREGG

URS

ID: SL0001_038C

Site: FEATHER RIVER
Sounding: 681-00-CPT

Engineer: G.HONG
Date: 9/22/2011 08:12



Max. Depth: 103.675 (ft)
Avg. Interval: 0.328 (ft)

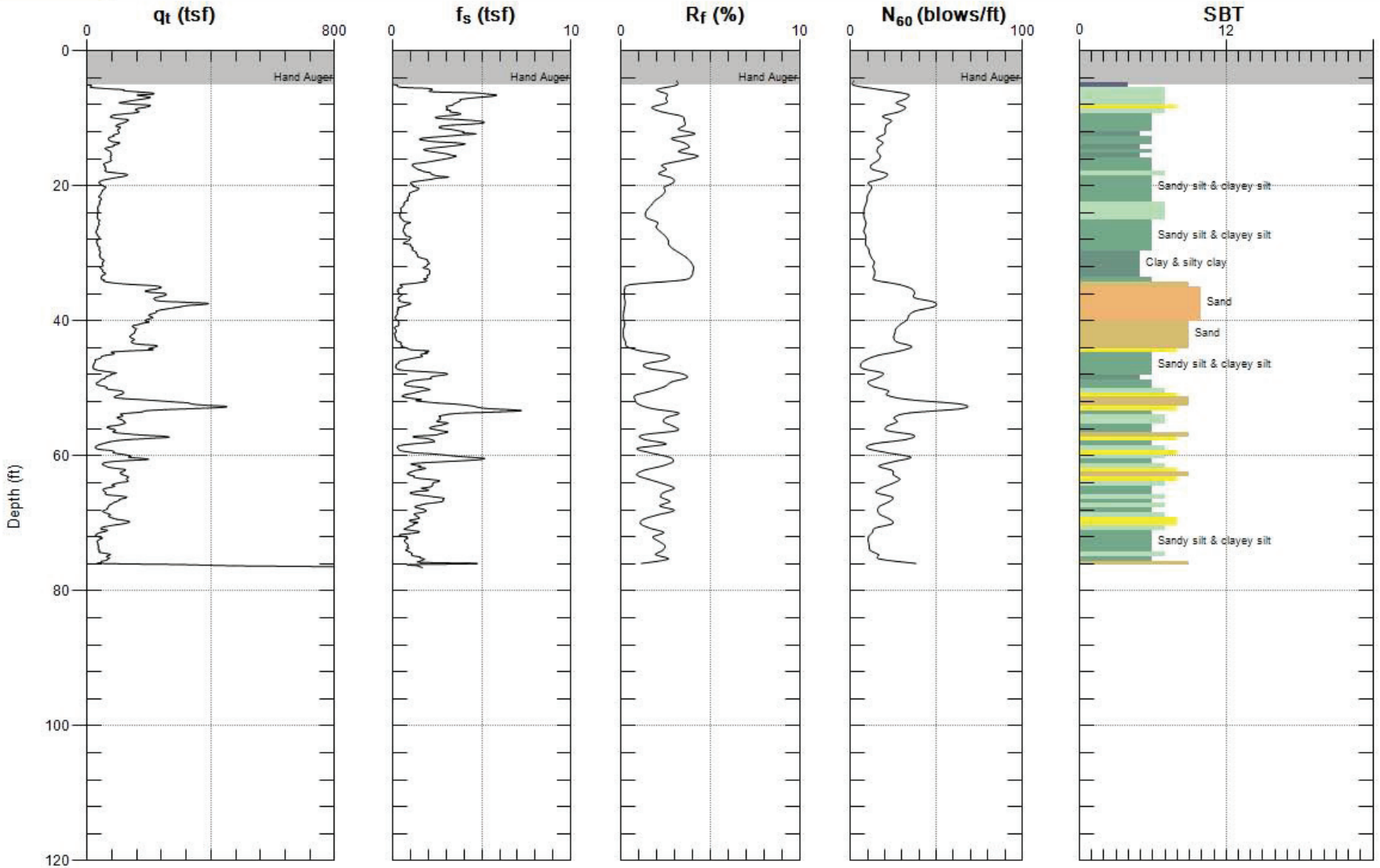
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_029C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 693+00_CPT **Date: 7/19/2011 10:16**



Max. Depth: 76.608 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

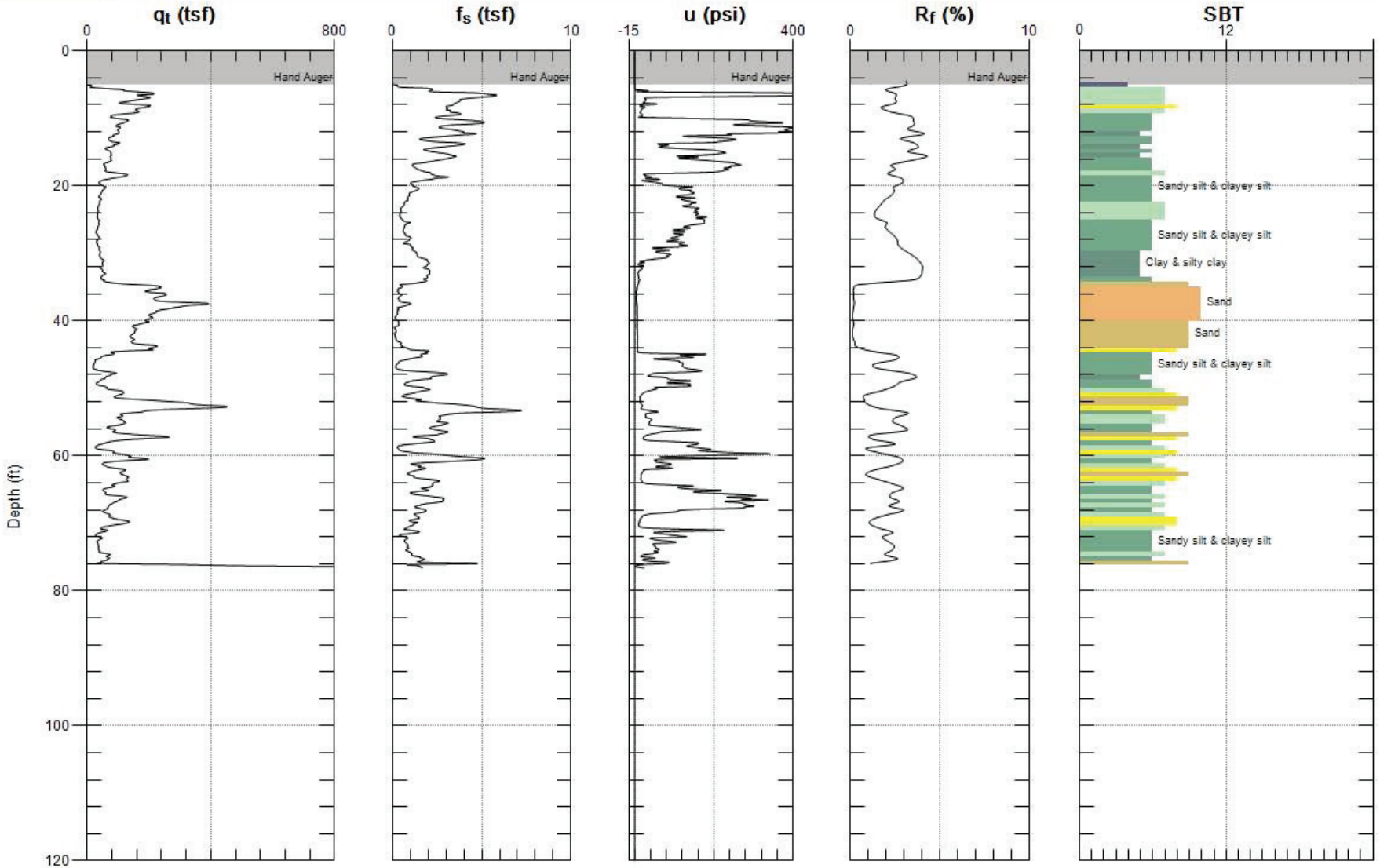
GREGG

URS

ID: SL0001_029C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 693+00_CPT **Date: 7/19/2011 10:16**



Max. Depth: 76.608 (ft)
Avg. Interval: 0.656 (ft)

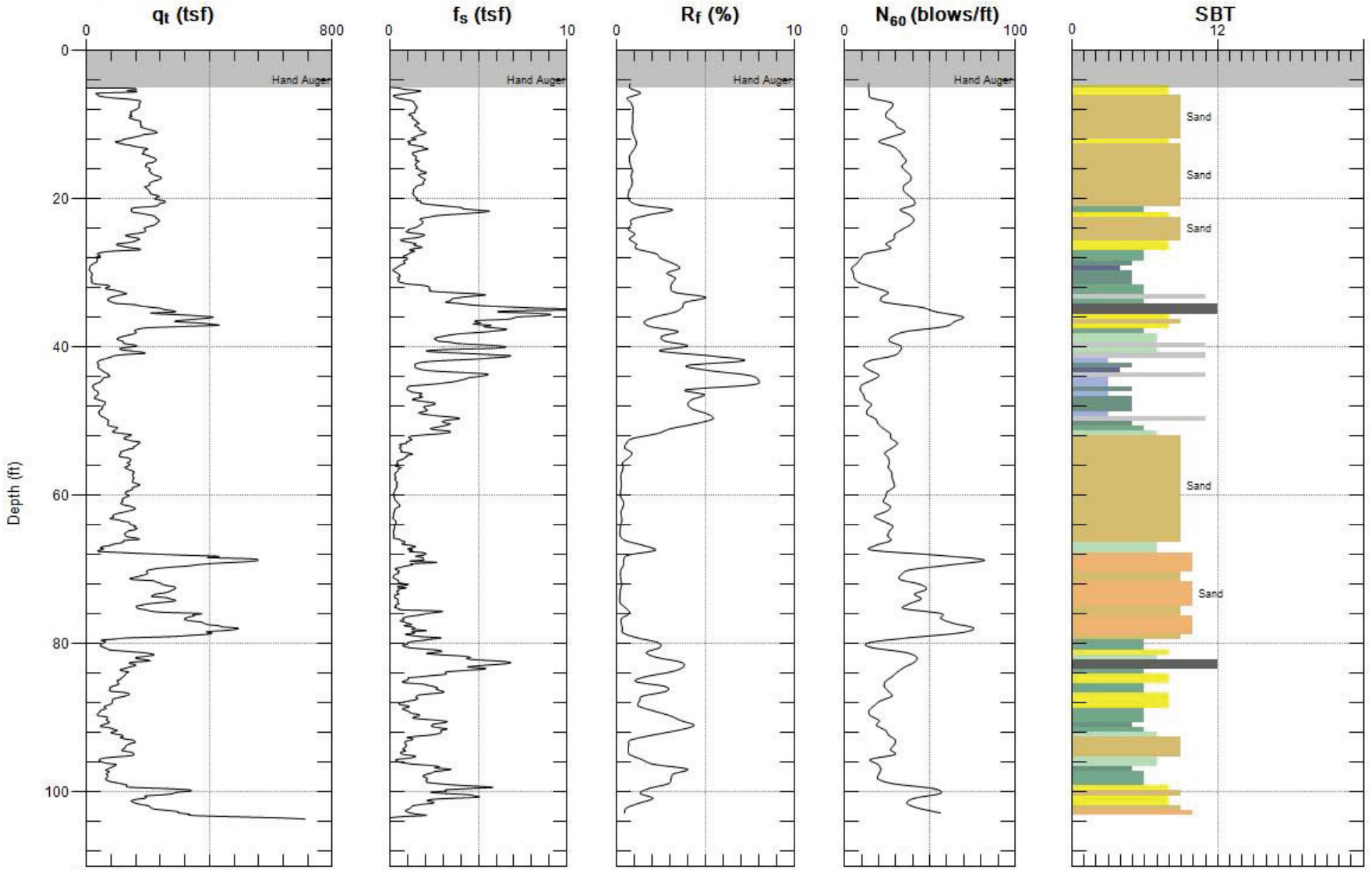
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_030C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 711+00_CPT **Date: 7/6/2011 09:32**



Max. Depth: 103.675 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

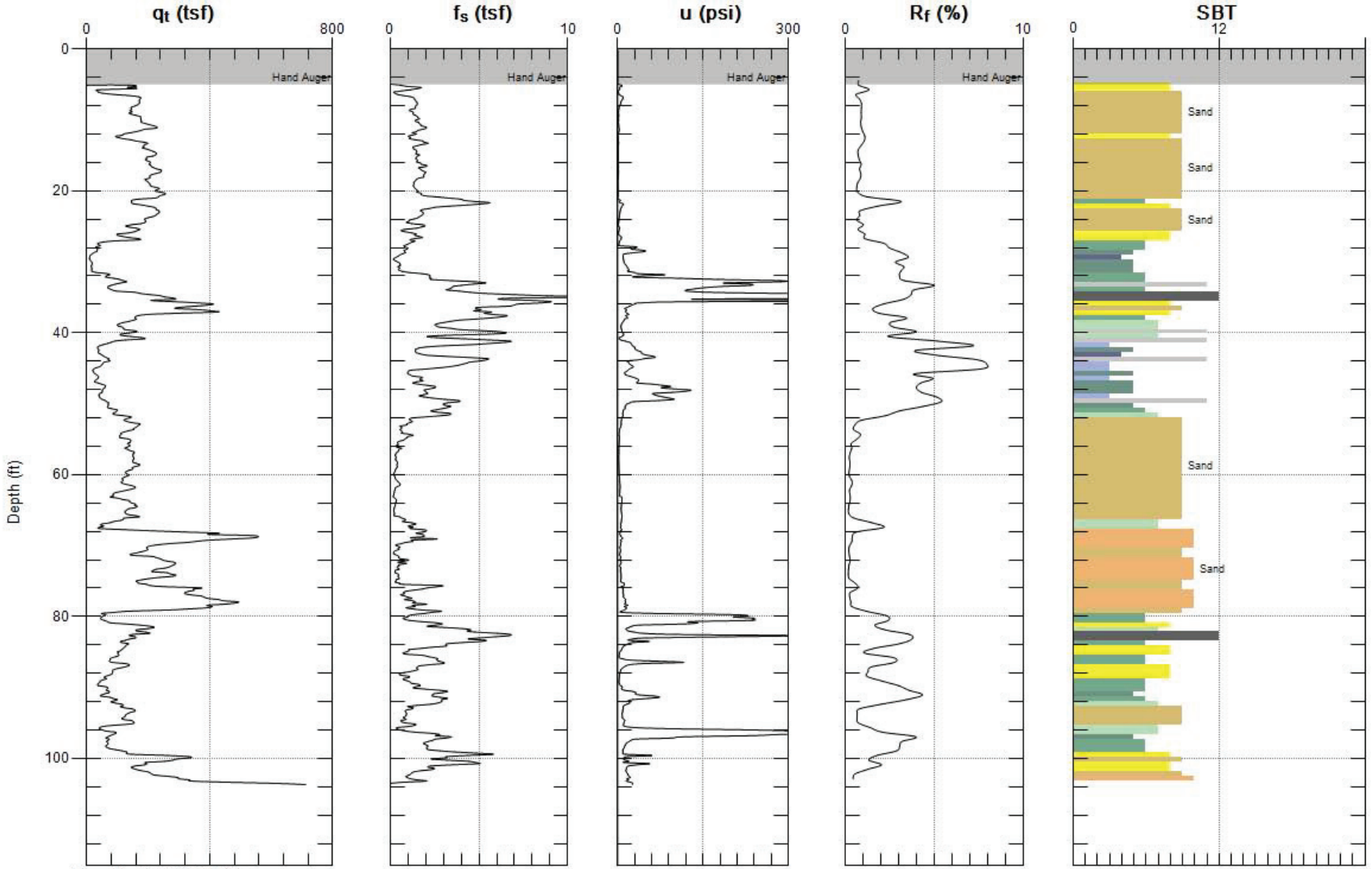
GREGG

URS

ID: SL0001_030C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 711+00_CPT **Date: 7/6/2011 09:32**



Max. Depth: 103.675 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

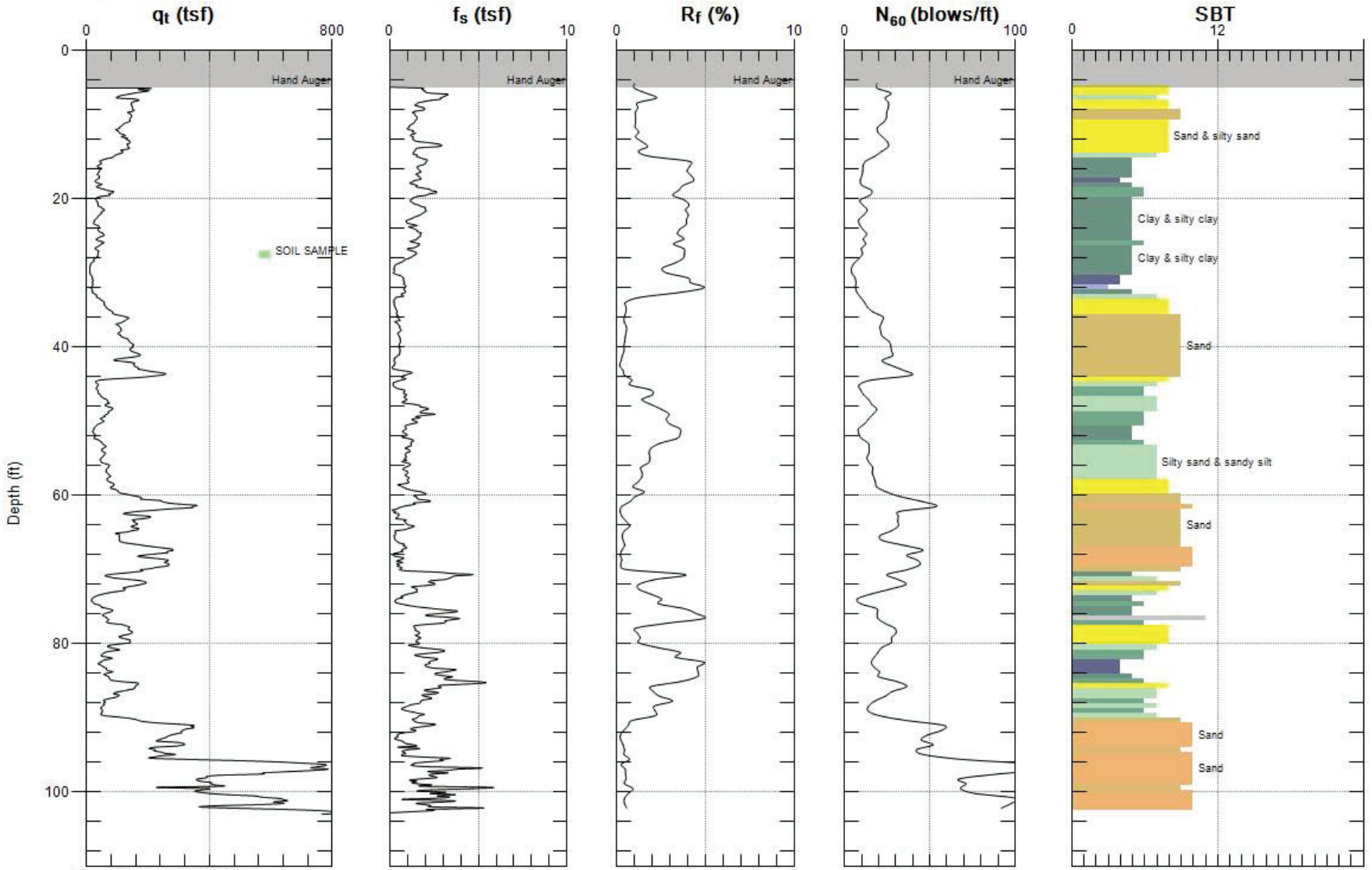
GREGG

URS

ID: SL0001_031C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 791+00_CPT **Date: 7/6/2011 12:25**



Max. Depth: 103.018 (ft)

Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

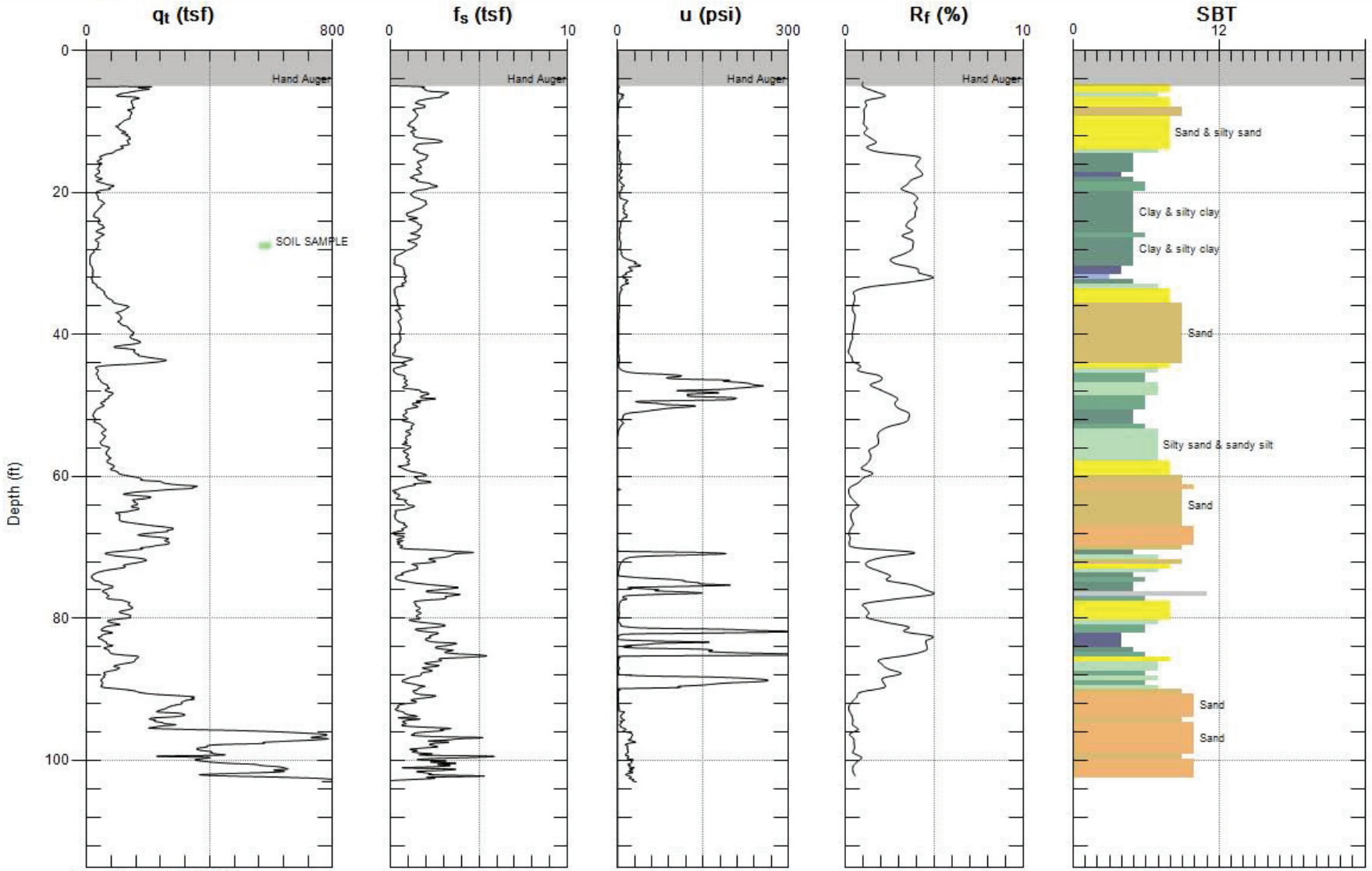
GREGG

URS

ID: SL0001_031C

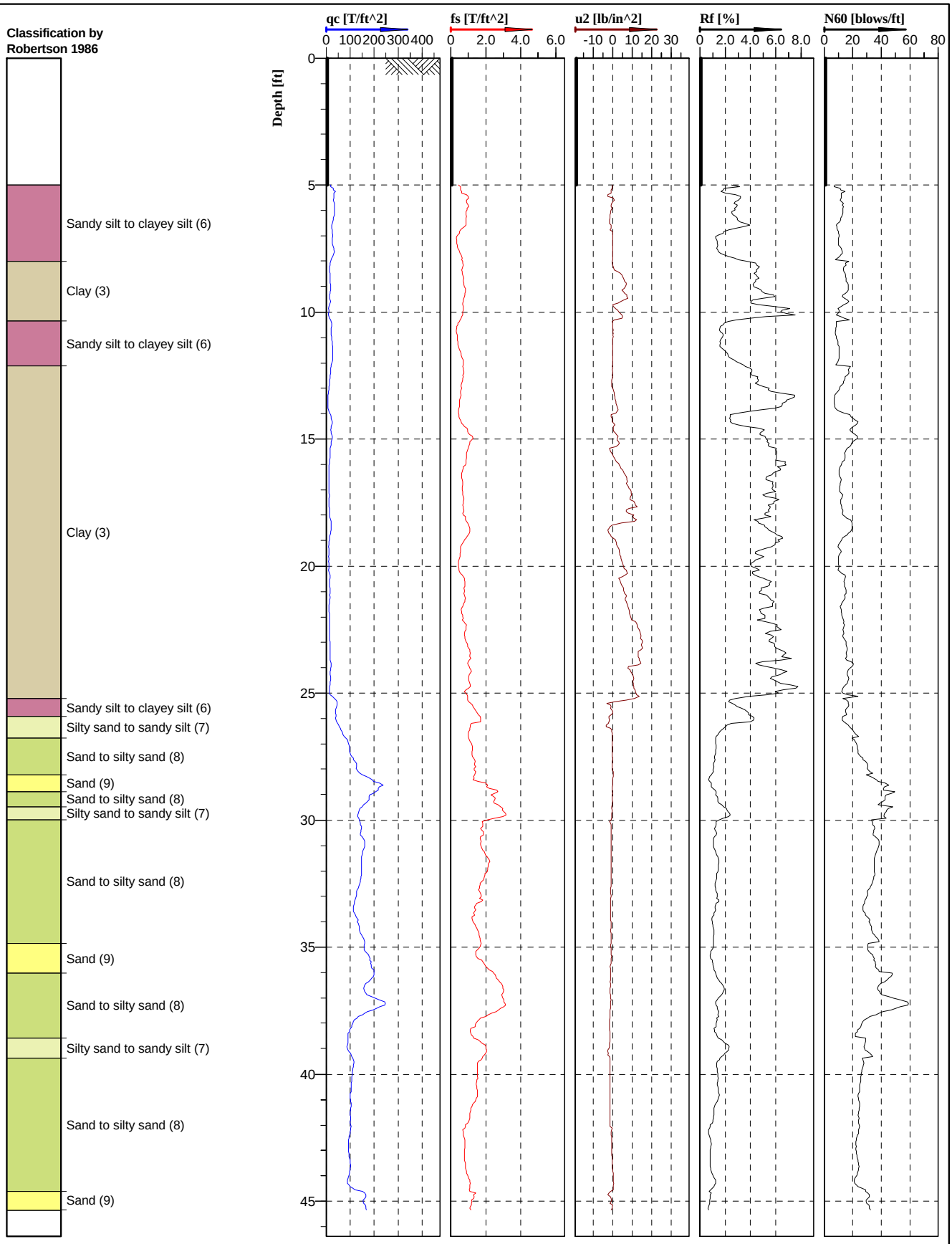
Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 791+00_CPT **Date: 7/6/2011 12:25**



Max. Depth: 103.018 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

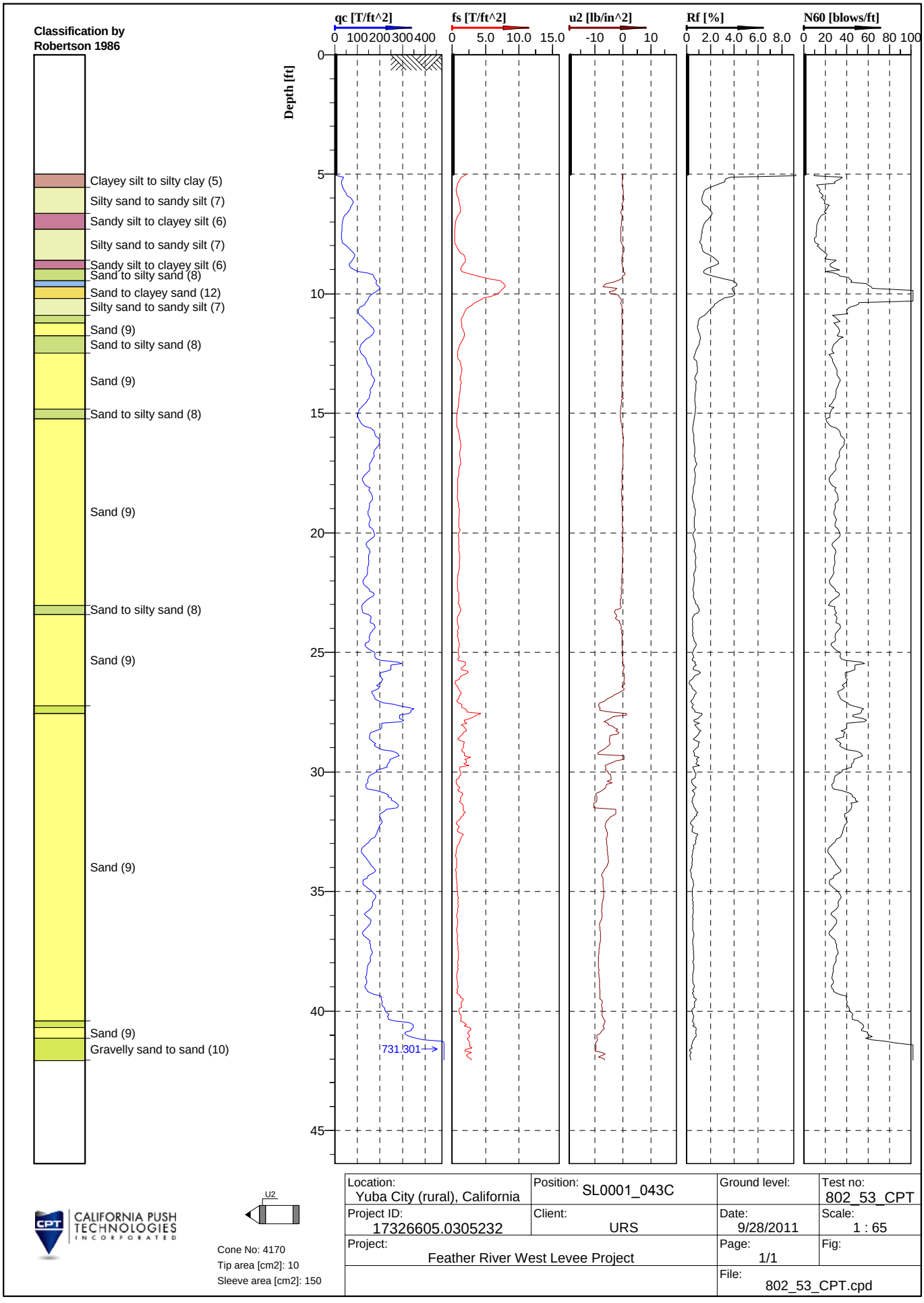


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SL0001_032C	Ground level:	Test no: 802_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 8/2/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 802_00_CPT.cpd	



CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SL0001_043C	Ground level:	Test no: 802_53_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/28/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 802_53_CPT.cpd	

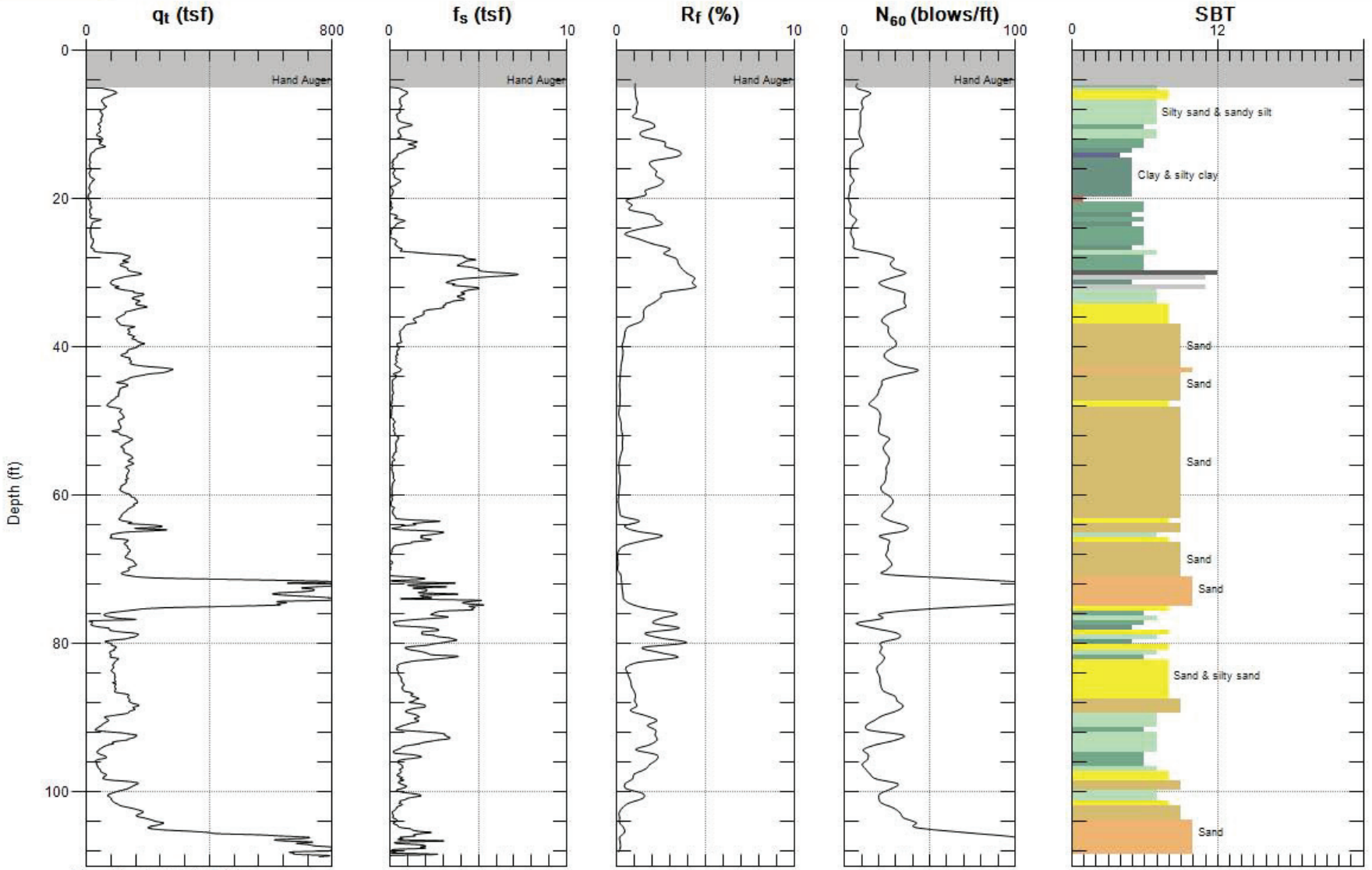
GREGG

URS

ID: SL0001_033C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 818+00_CPT **Date: 7/6/2011 03:17**



Max. Depth: 108.760 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

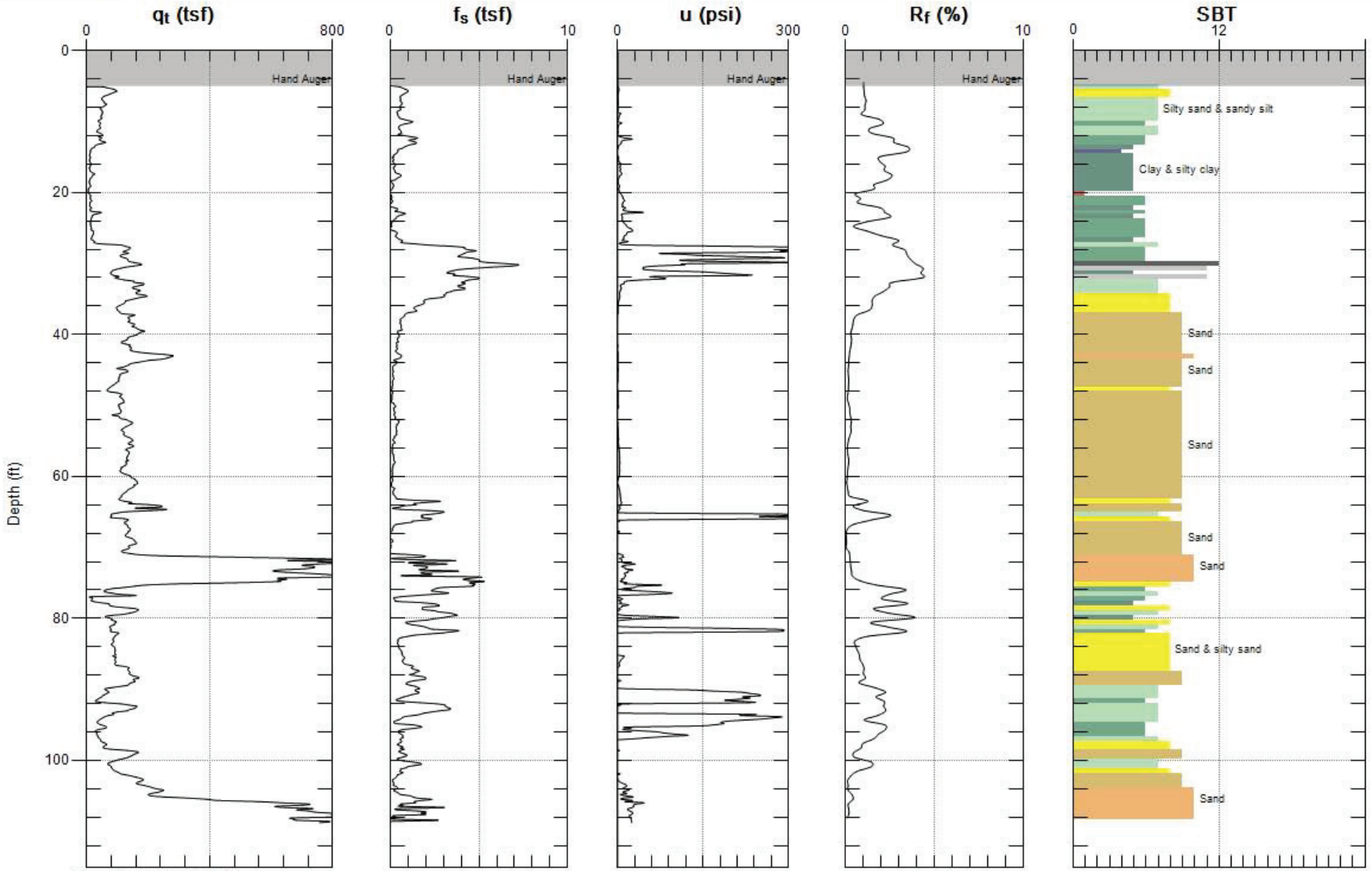
GREGG

URS

ID: SL0001_033C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 818+00_CPT **Date: 7/6/2011 03:17**



Max. Depth: 108.760 (ft)
Avg. Interval: 0.656 (ft)

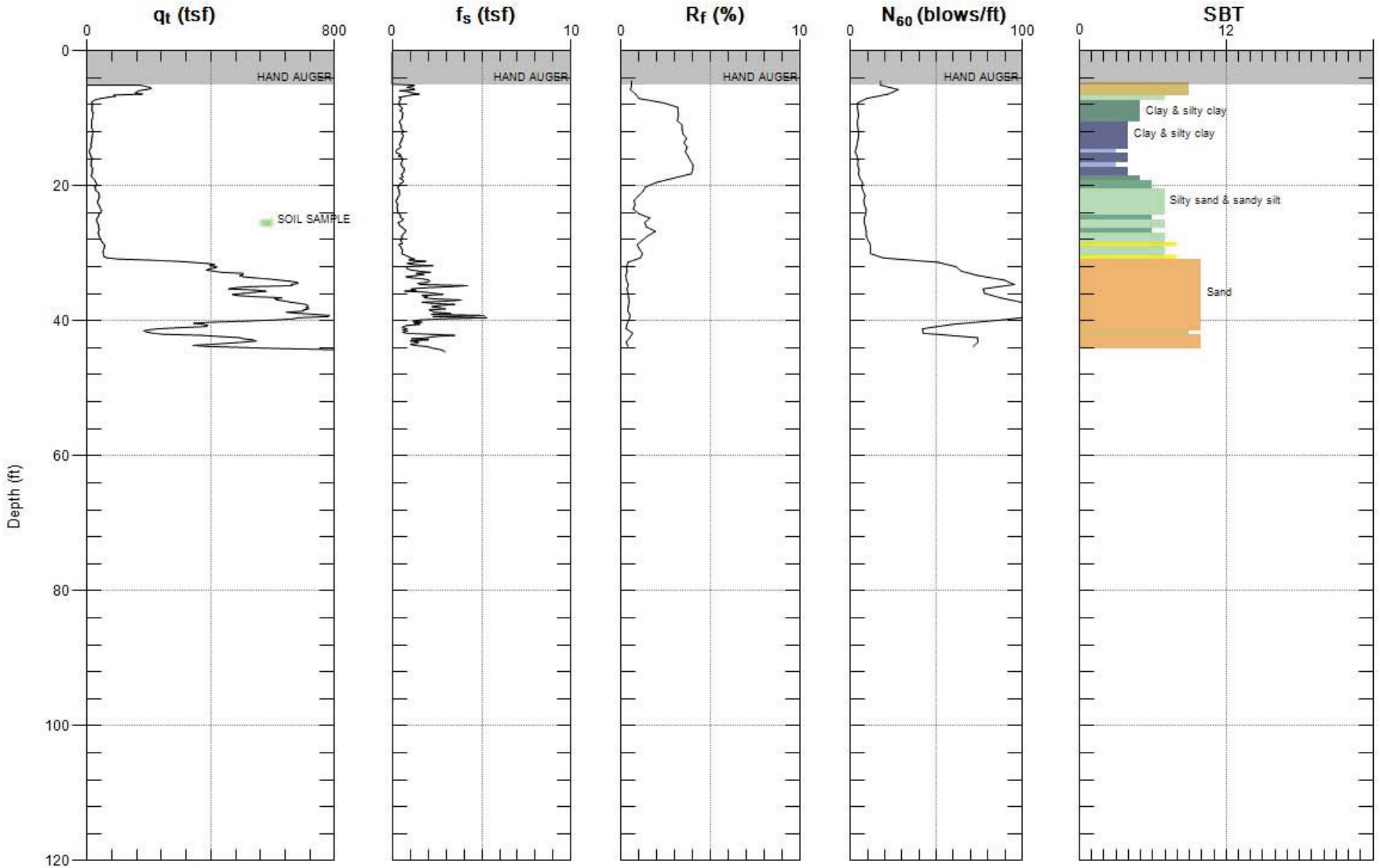
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_034C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-889+00 **Date: 8/1/2011 02:52**



Max. Depth: 44.619 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

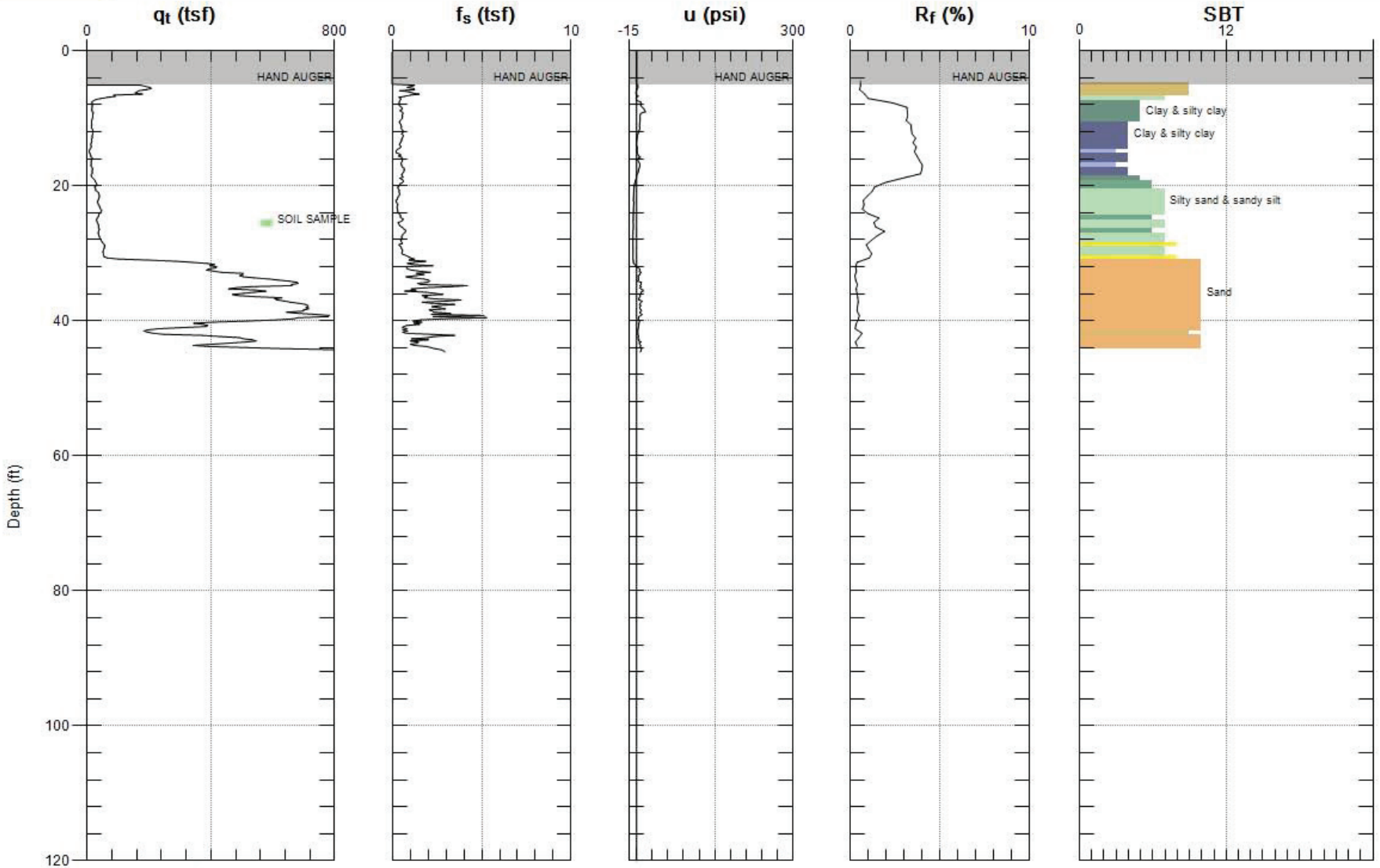
GREGG

URS

ID: SL0001_034C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-889+00 **Date: 8/1/2011 02:52**



Max. Depth: 44.619 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

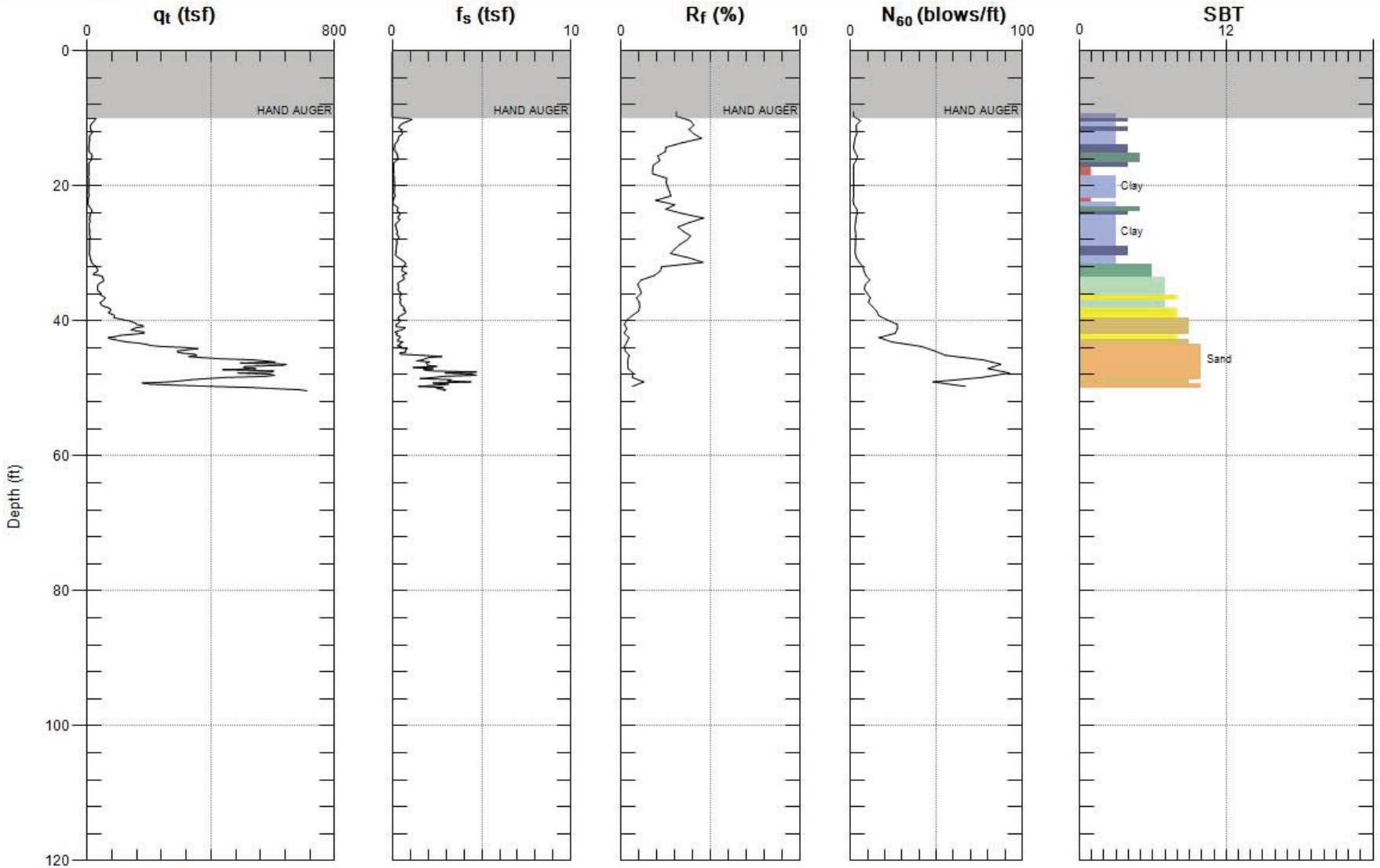
GREGG

URS

ID: SL0001_035C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-899+00 **Date: 8/3/2011 03:52**



Max. Depth: 50.361 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

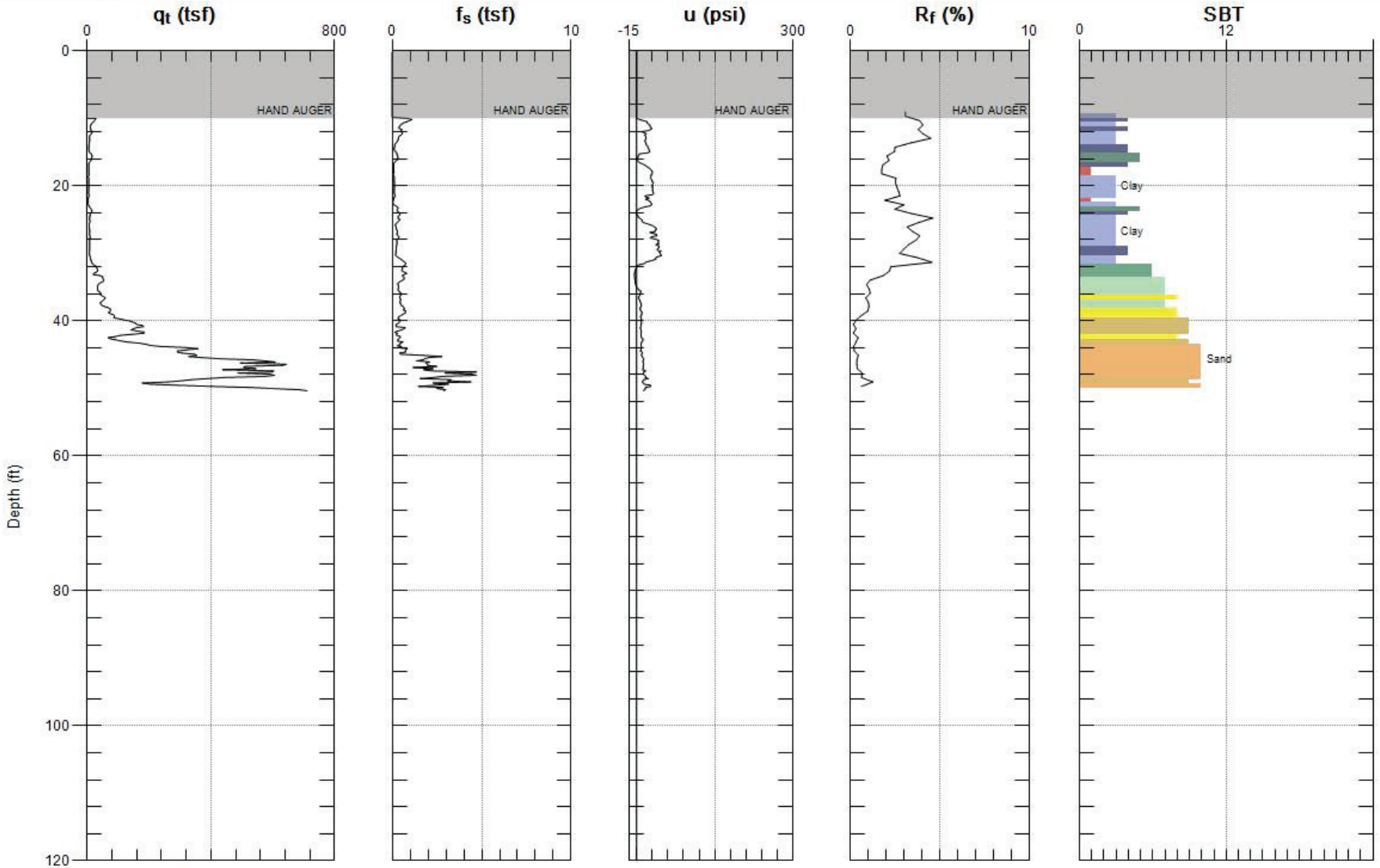
GREGG

URS

ID: SL0001_035C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-899+00 **Date: 8/3/2011 03:52**



Max. Depth: 50.361 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

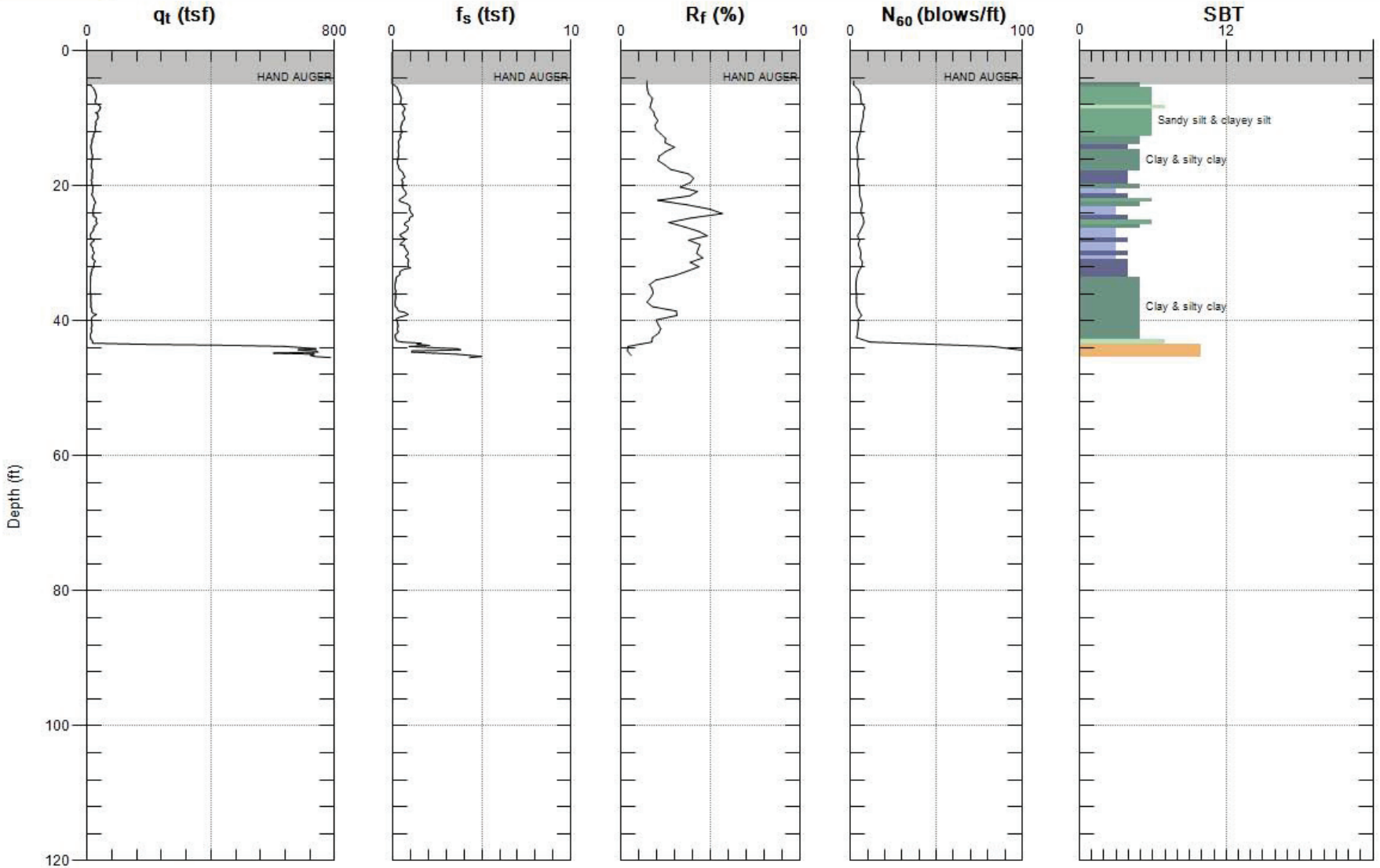
GREGG

URS

ID: SL0001_036C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-923+00 **Date: 8/4/2011 08:16**



Max. Depth: 45.440 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

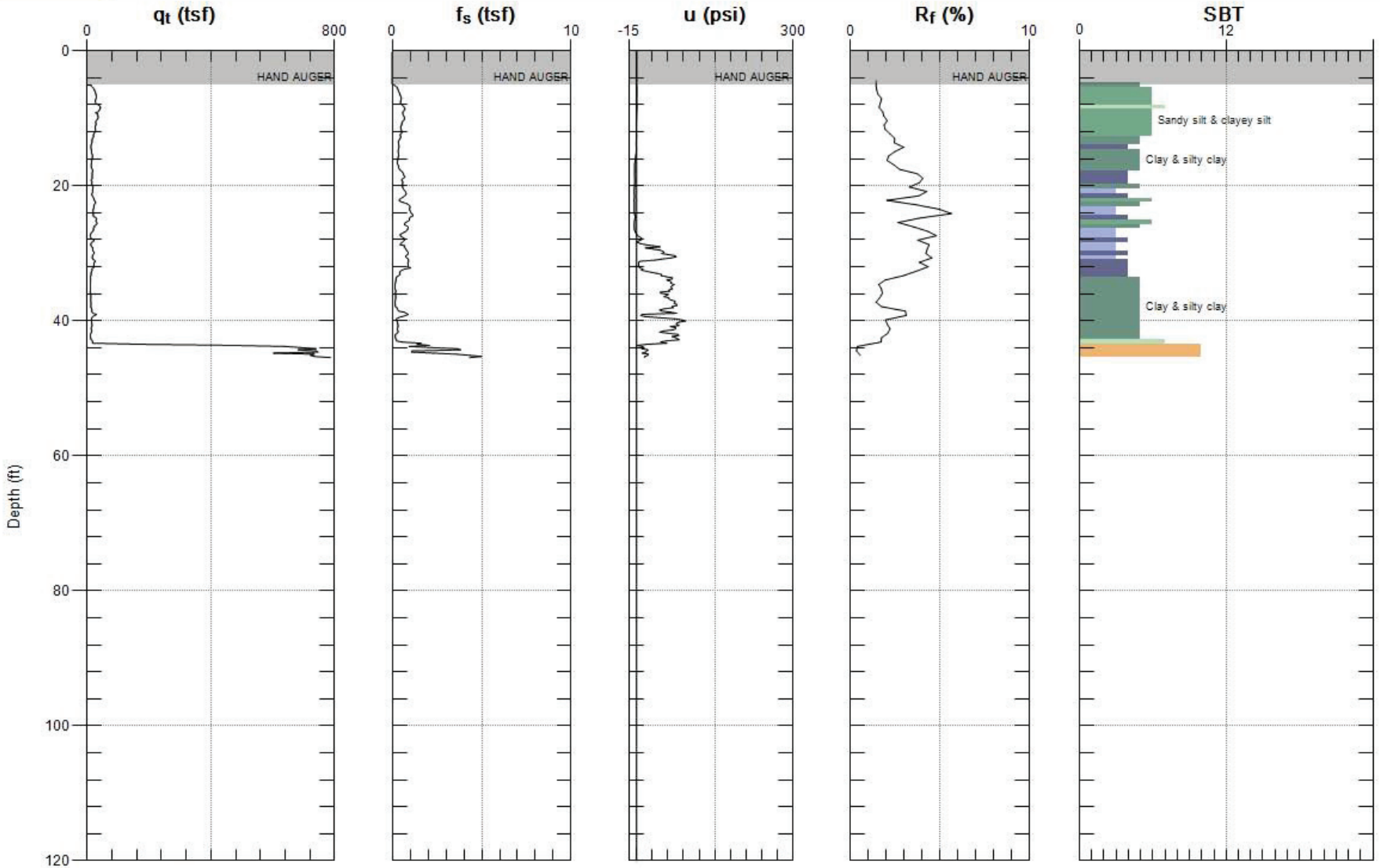
GREGG

URS

ID: SL0001_036C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-923+00 **Date: 8/4/2011 08:16**



Max. Depth: 45.440 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

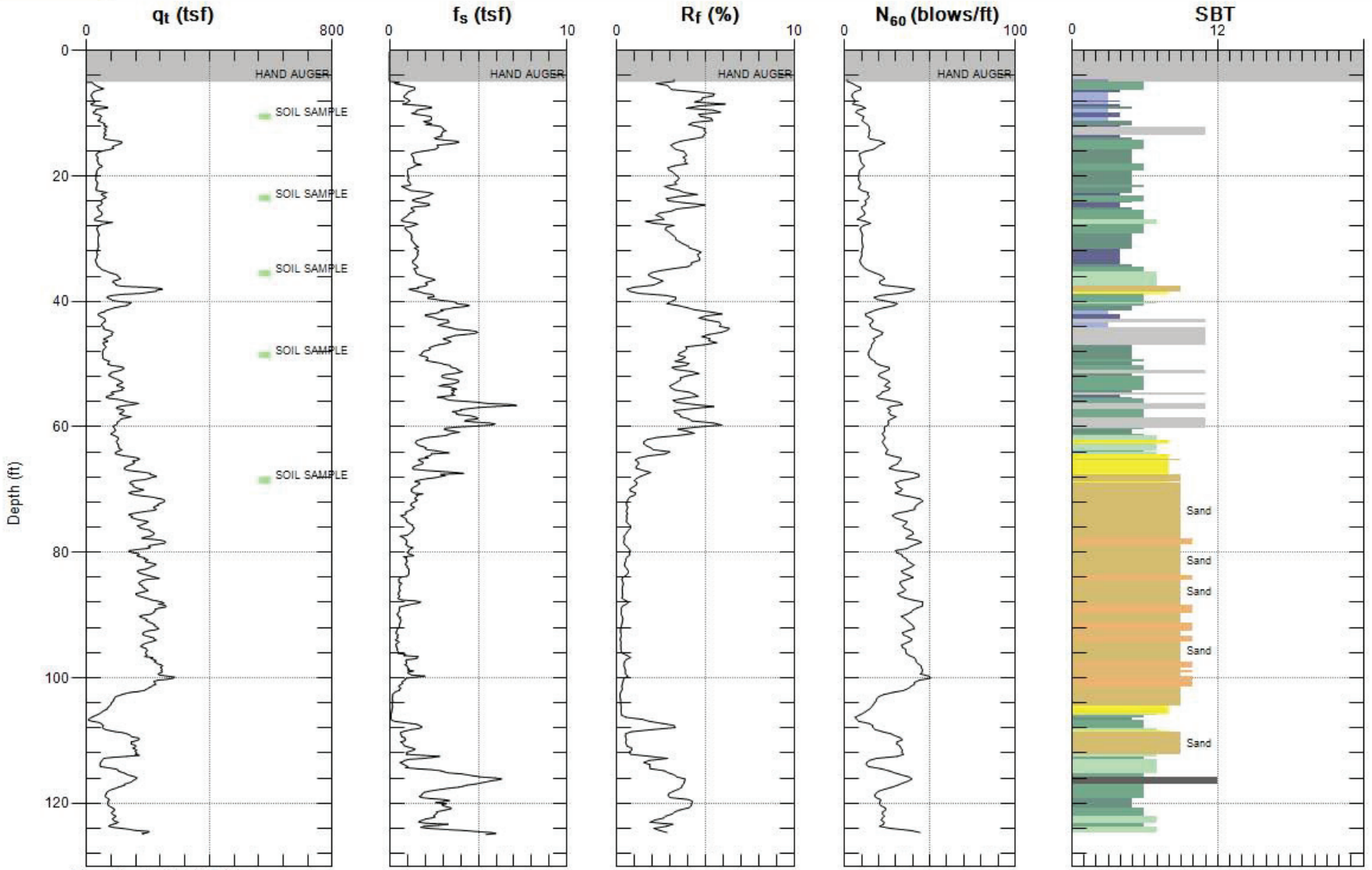
GREGG

URS

ID: SL0001_039C

Site: FEATHER RIVER
Sounding: 1007-00-CPT

Engineer: G.HONG
Date: 9/21/2011 10:45



Max. Depth: 125.000 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

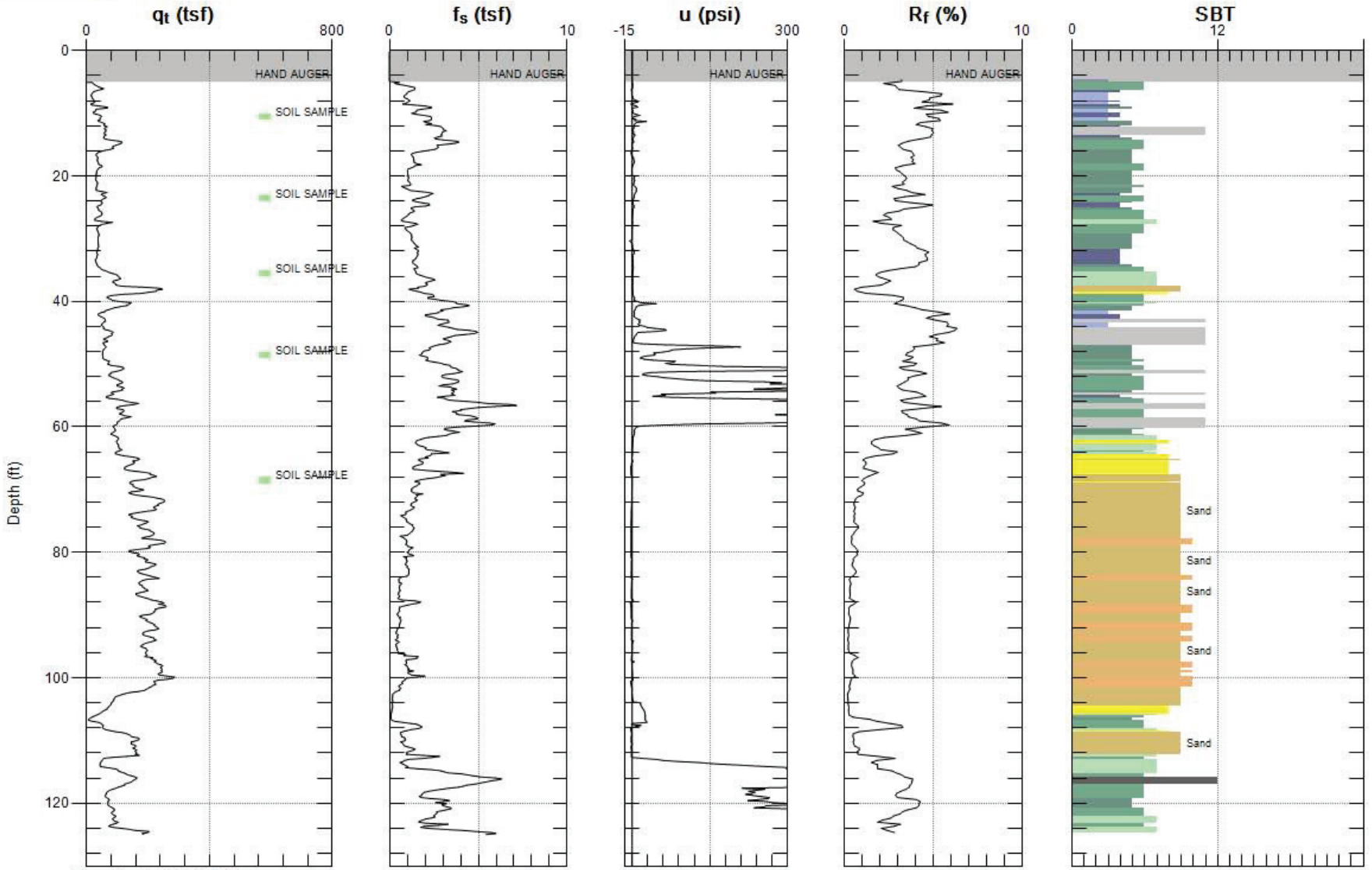
GREGG

URS

ID: SL0001_039C

Site: FEATHER RIVER
Sounding: 1007-00-CPT

Engineer: G.HONG
Date: 9/21/2011 10:45



Max. Depth: 125.000 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

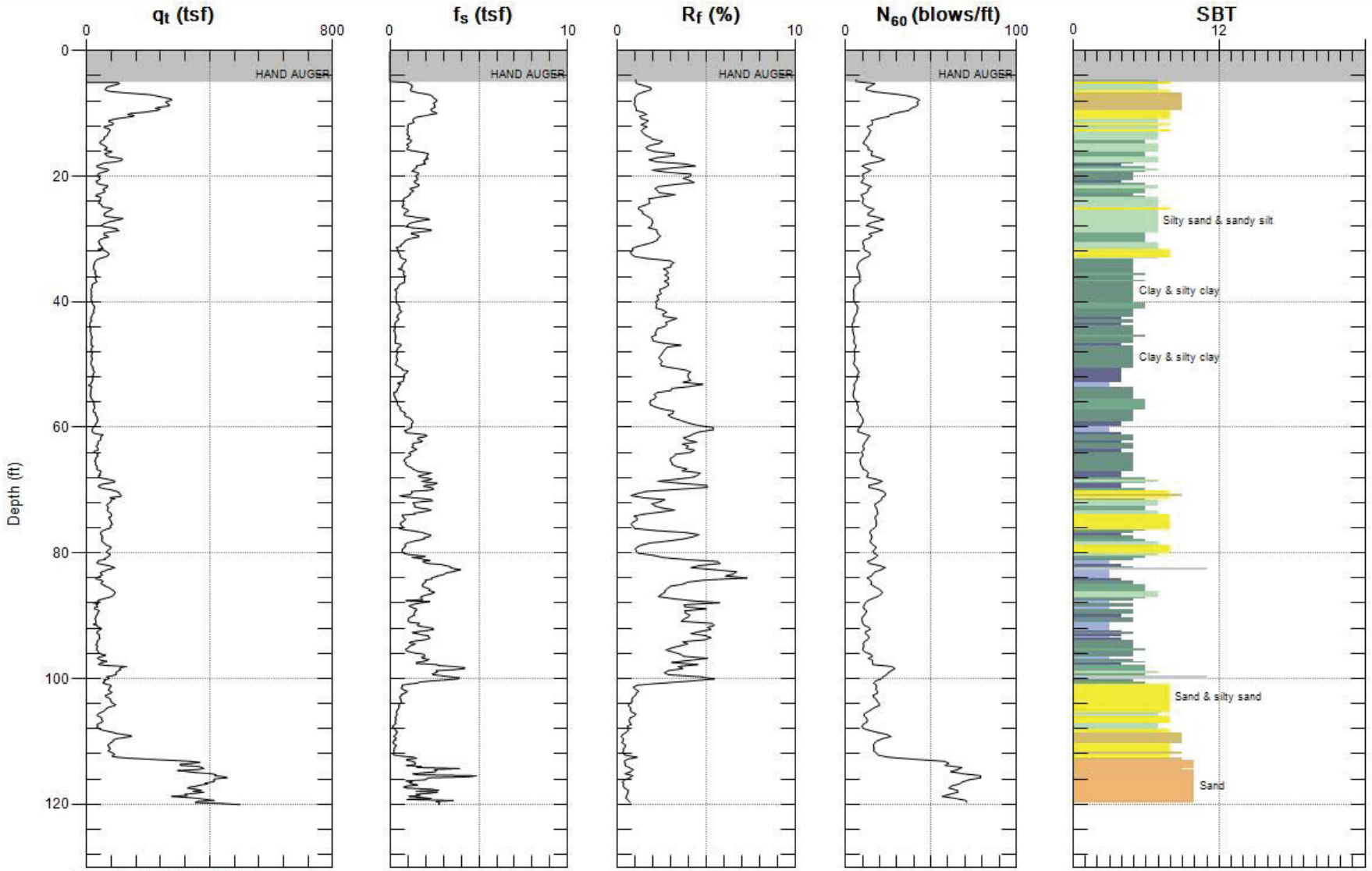
GREGG

URS

ID: SL0001_040C

Site: FEATHER RIVER
Sounding: 1026-40-CPTCR

Engineer: G.HONG
Date: 9/22/2011 12:55



Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

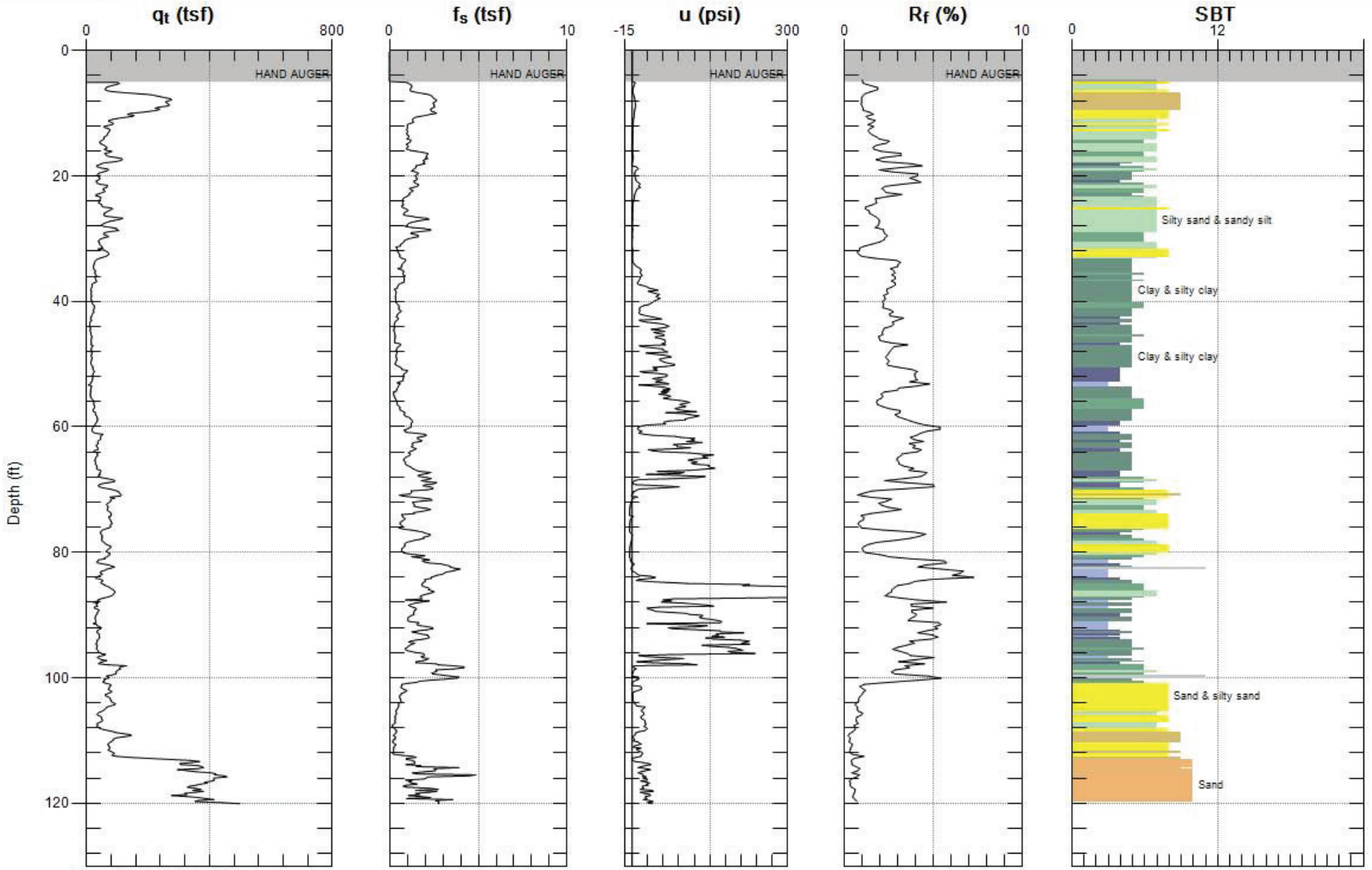
GREGG

URS

ID: SL0001_040C

Site: FEATHER RIVER **Engineer: G.HONG**

Sounding: 1026-40-CPTCR **Date: 9/22/2011 12:55**



Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

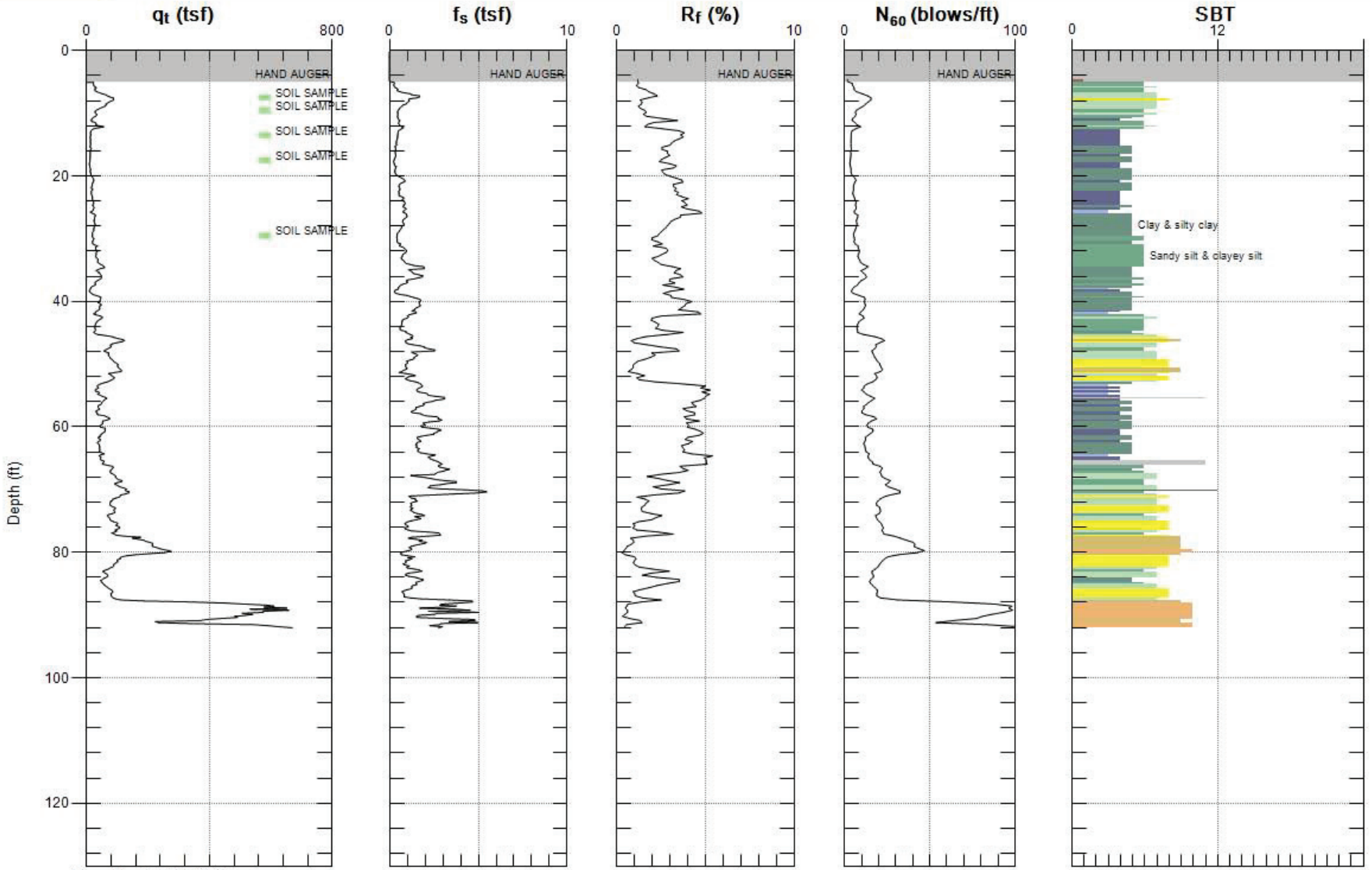
GREGG

URS

ID: SL0001_041C

Site: FEATHER RIVER **Engineer: G.HONG**

Sounding: 1026-40-CPTTOE **Date: 9/23/2011 08:15**



Max. Depth: 92.028 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

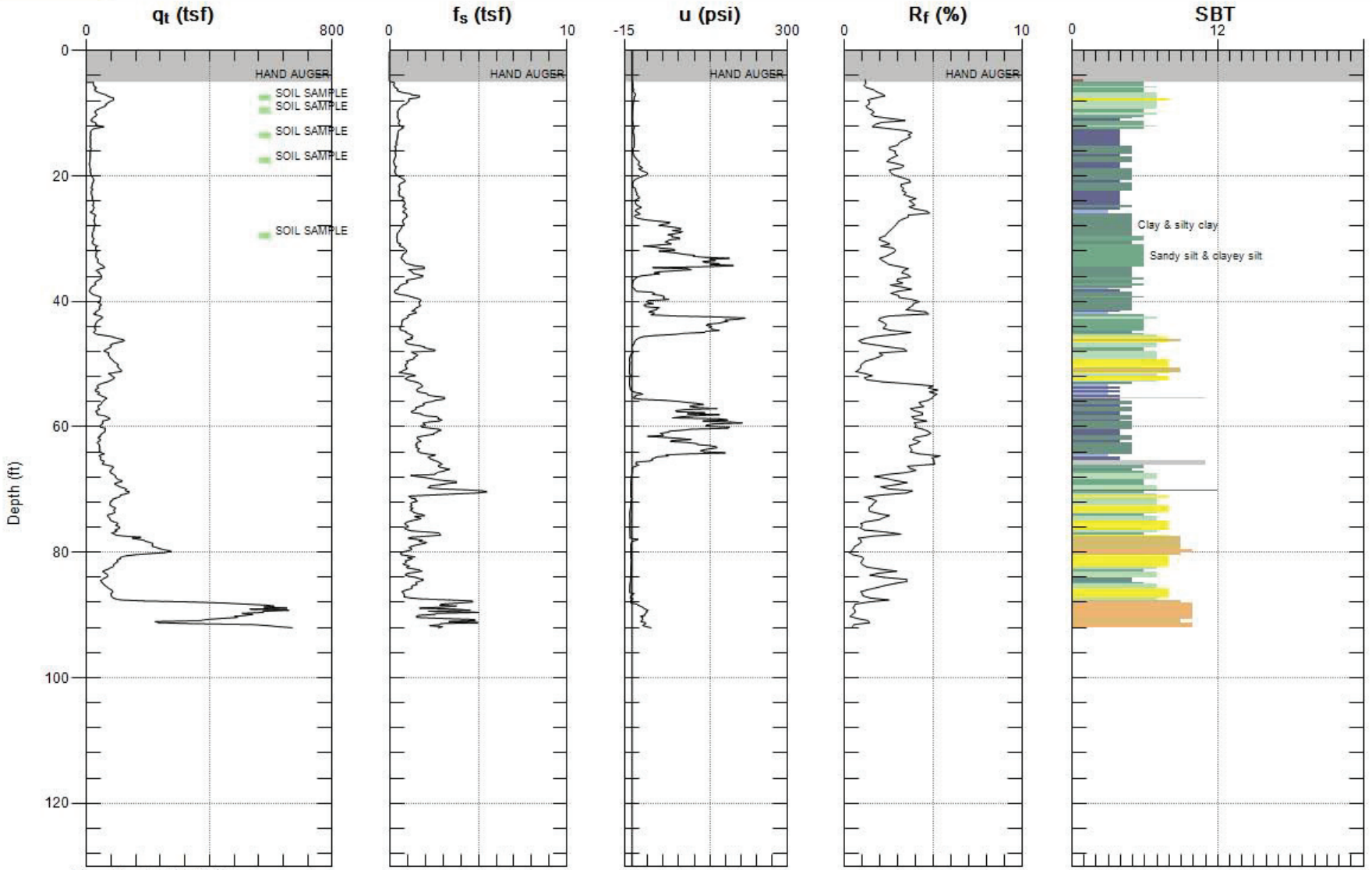
GREGG

URS

ID: SL0001_041C

Site: FEATHER RIVER **Engineer: G.HONG**

Sounding: 1026-40-CPTTOE **Date: 9/23/2011 08:15**



Max. Depth: 92.028 (ft)
Avg. Interval: 0.328 (ft)

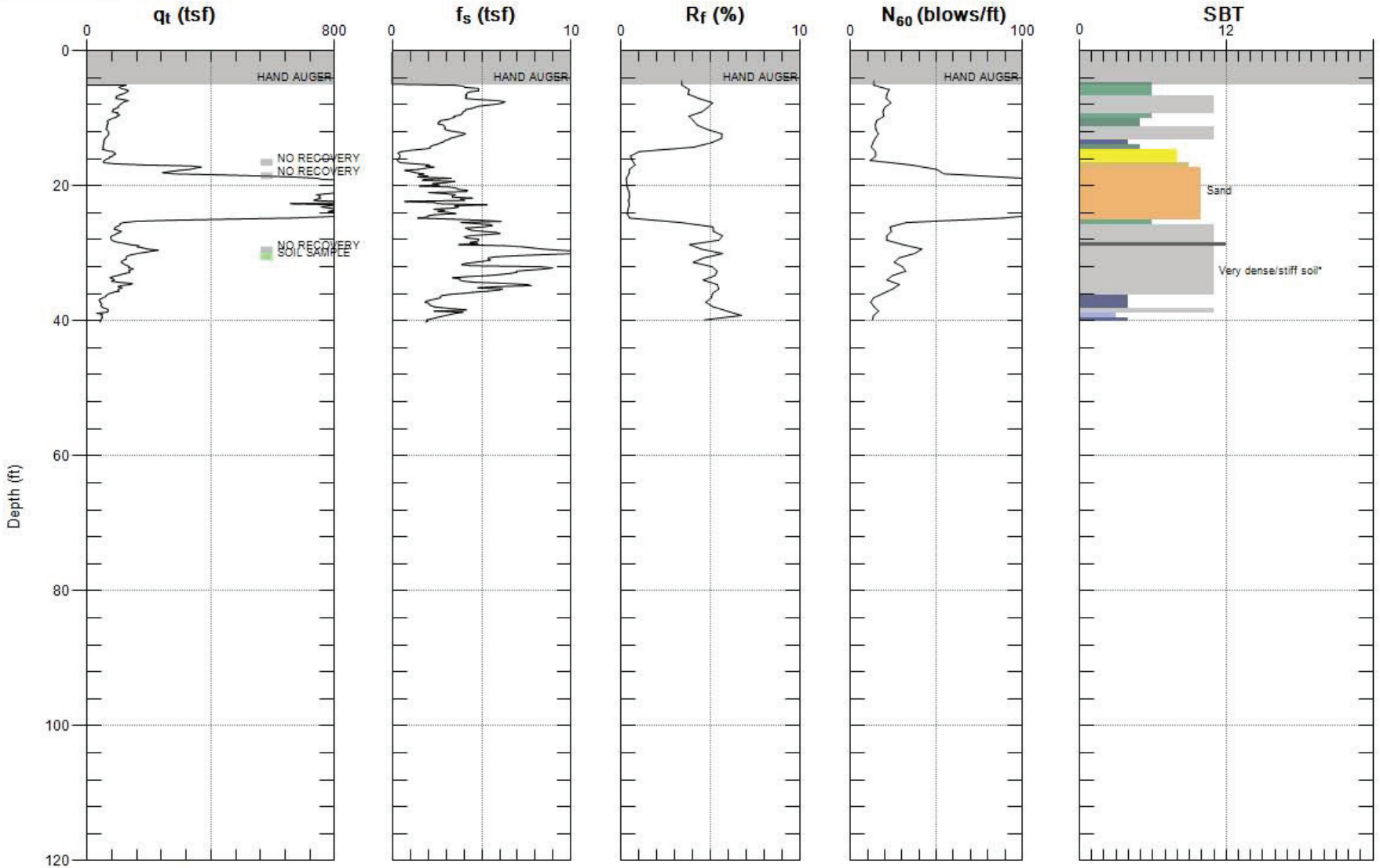
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0001_037C

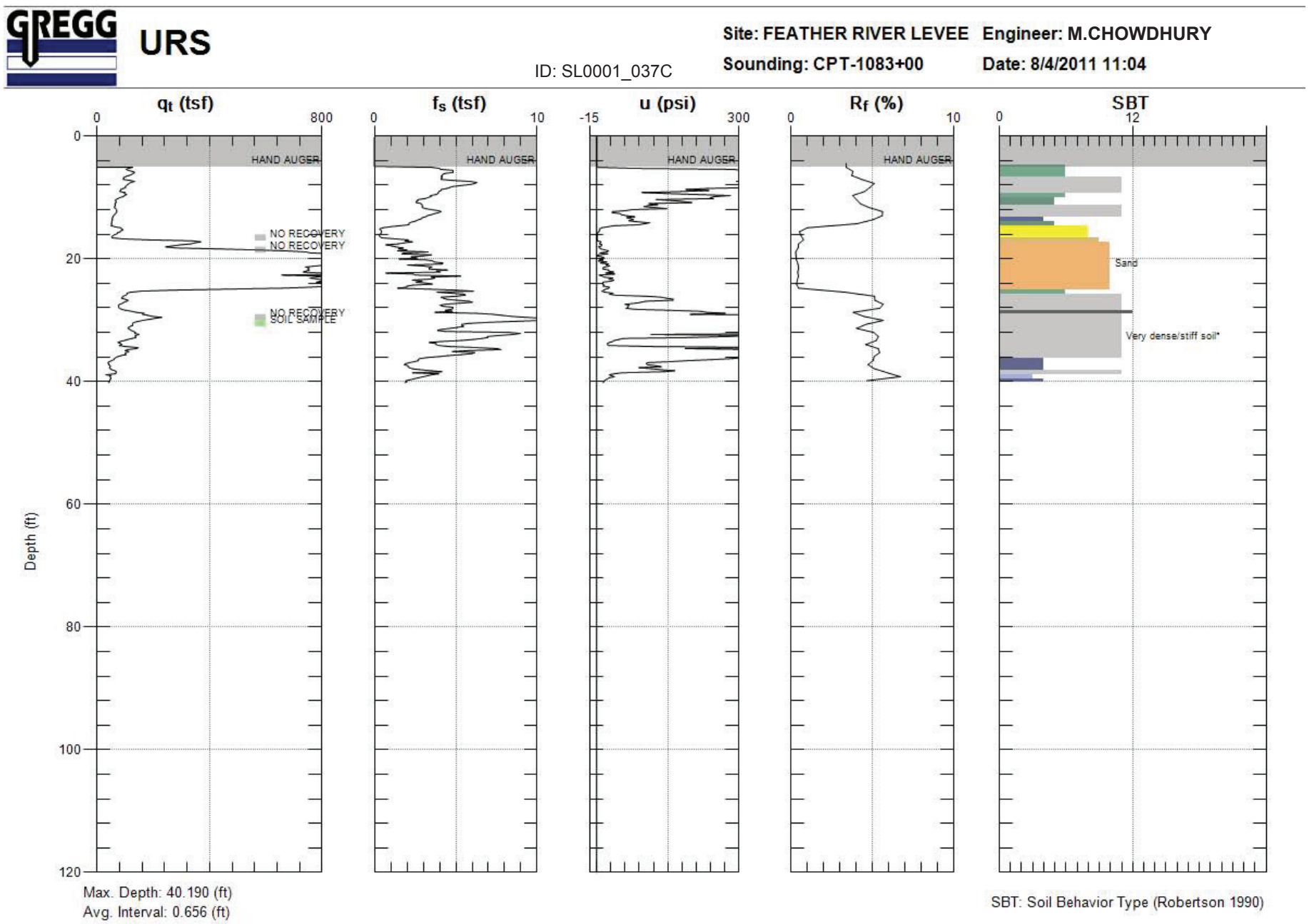
Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-1083+00 **Date: 8/4/2011 11:04**



Max. Depth: 40.190 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

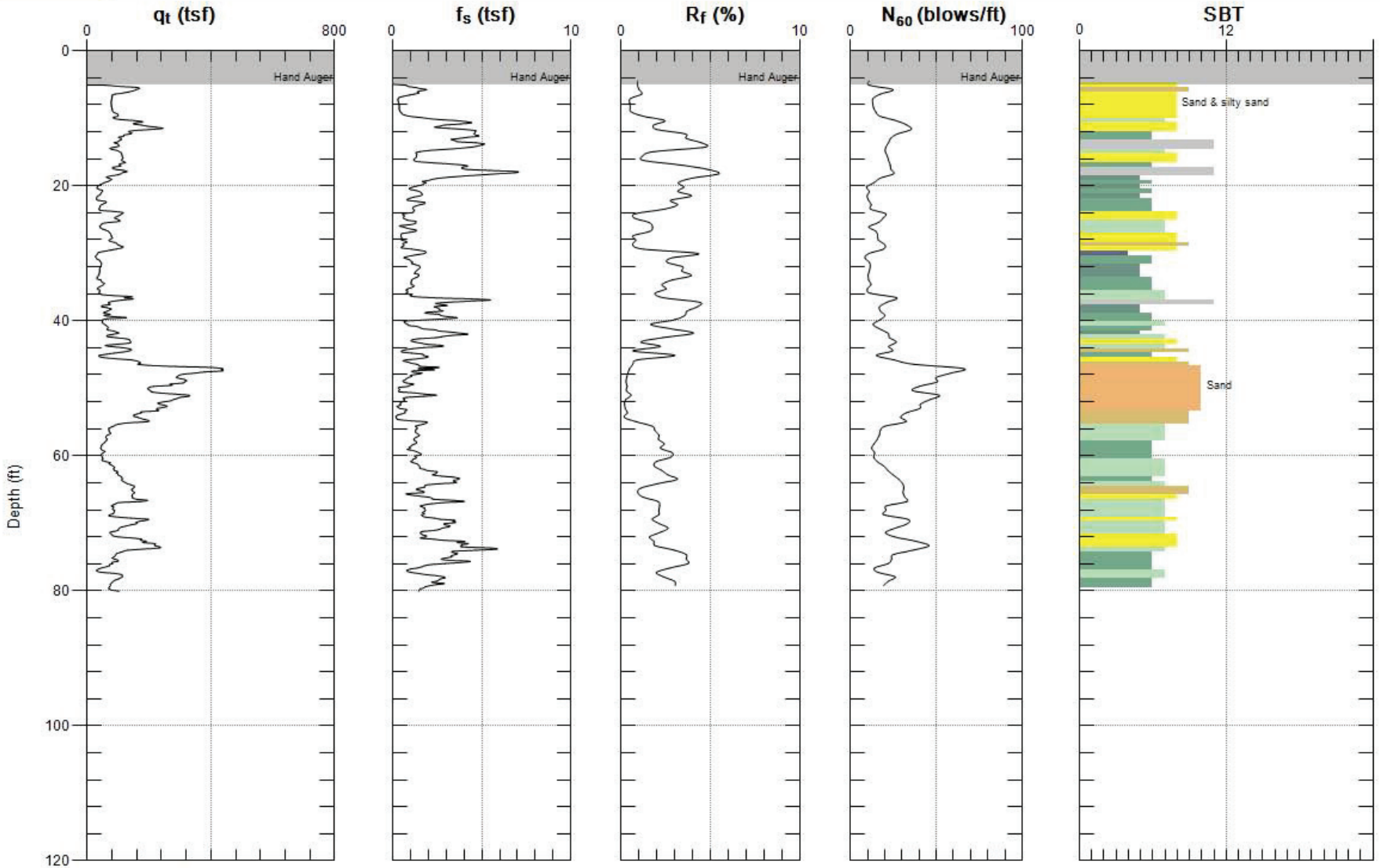

GREGG
URS
ID: SL0001_037C
Site: FEATHER RIVER LEVEE
Engineer: M.CHOWDHURY
Sounding: CPT-1083+00
Date: 8/4/2011 11:04
q_t (tsf)
f_s (tsf)
u (psi)
R_f (%)
SBT
HAND AUGER
NO RECOVERY
NO RECOVERY
NO RECOVERY
SOIL SAMPLE
Sand
Very dense/stiff soil*
Depth (ft)
Max. Depth: 40.190 (ft)
Avg. Interval: 0.656 (ft)
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0009_005C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1190+00_CPT **Date: 7/19/2011 01:30**



Max. Depth: 80.052 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

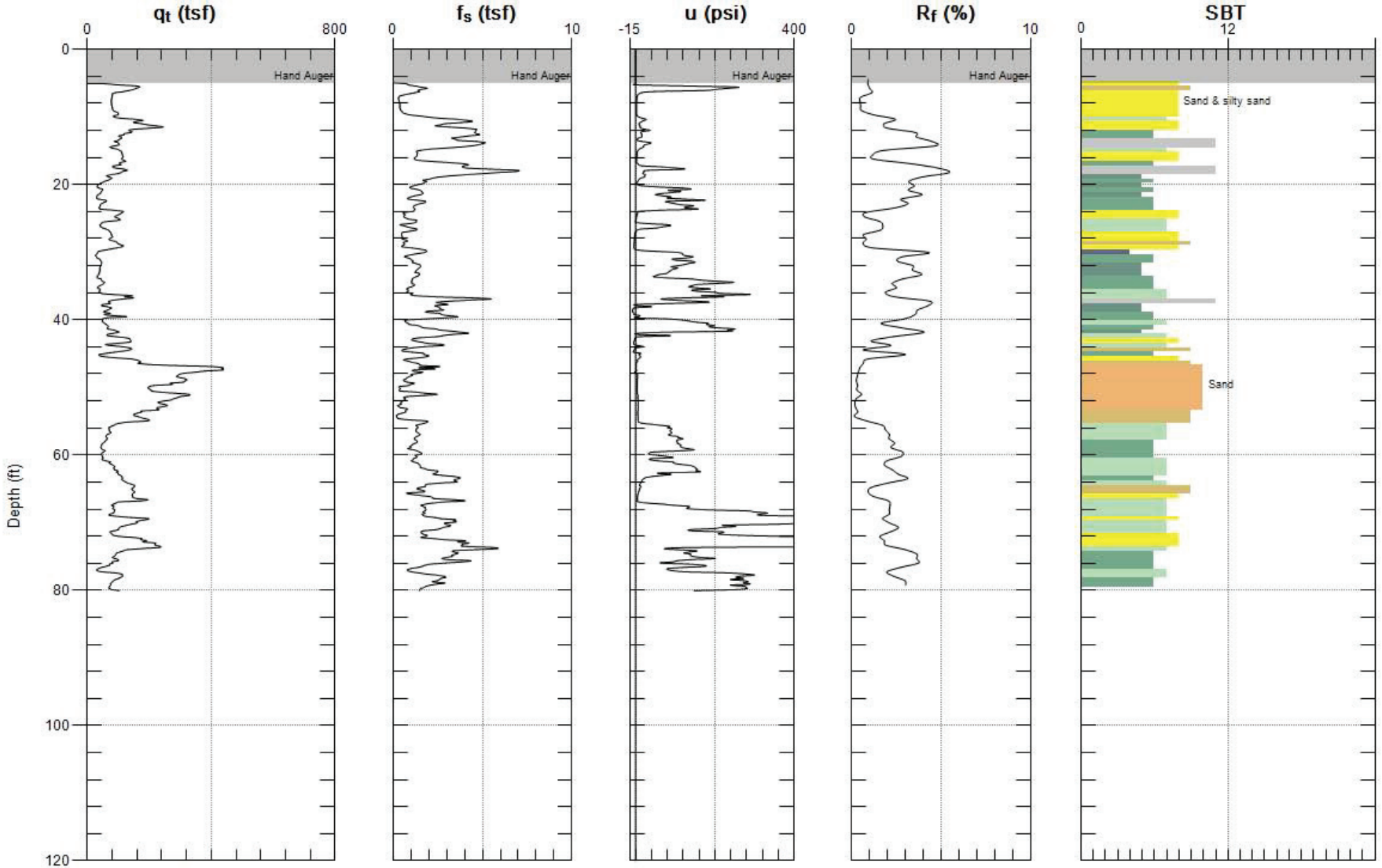
GREGG

URS

ID: SL0009_005C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1190+00_CPT **Date: 7/19/2011 01:30**



Max. Depth: 80.052 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

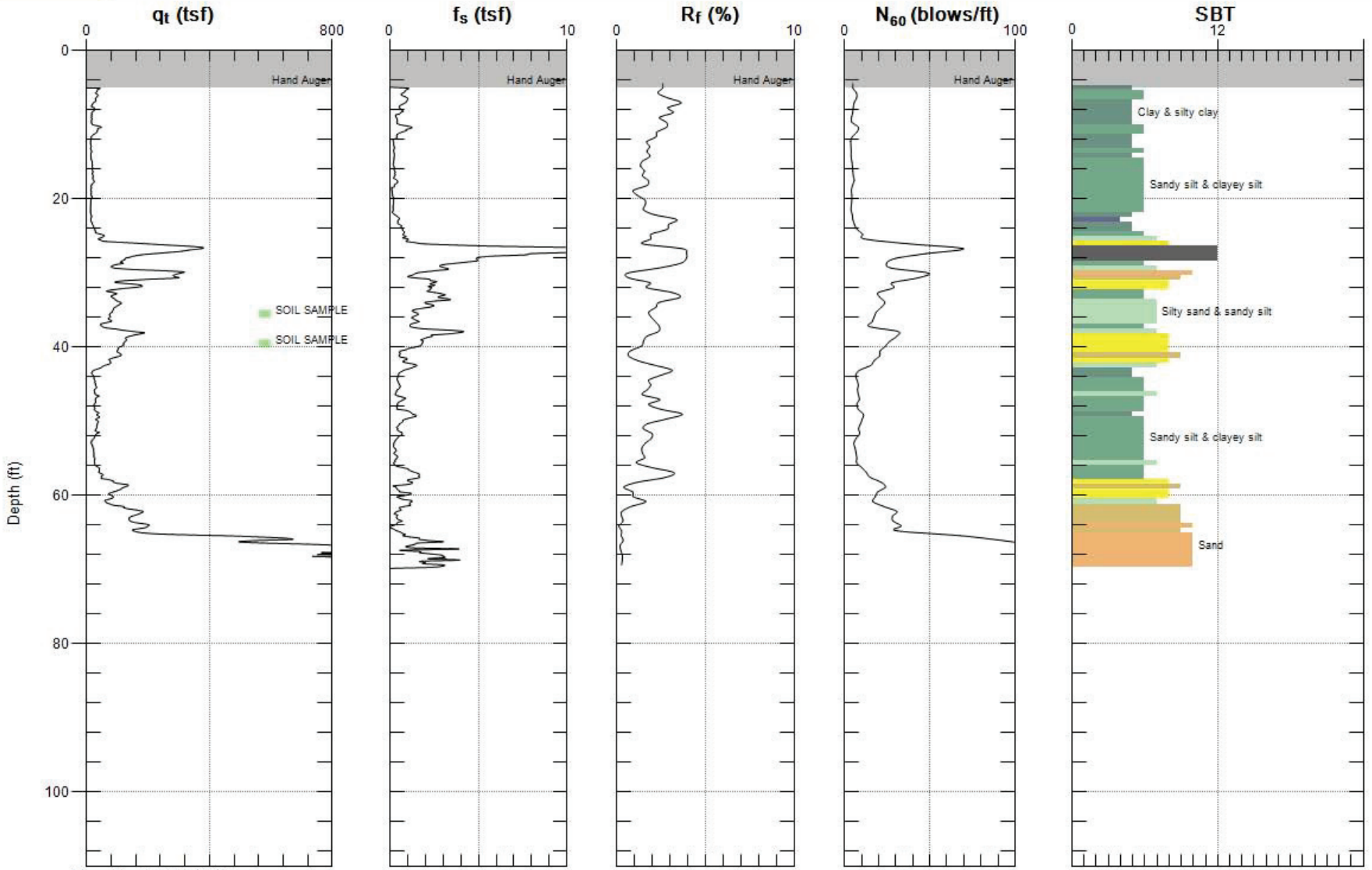
GREGG

URS

ID: SL0009_006C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1215+00_CPT **Date: 7/7/2011 08:18**



Max. Depth: 70.046 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

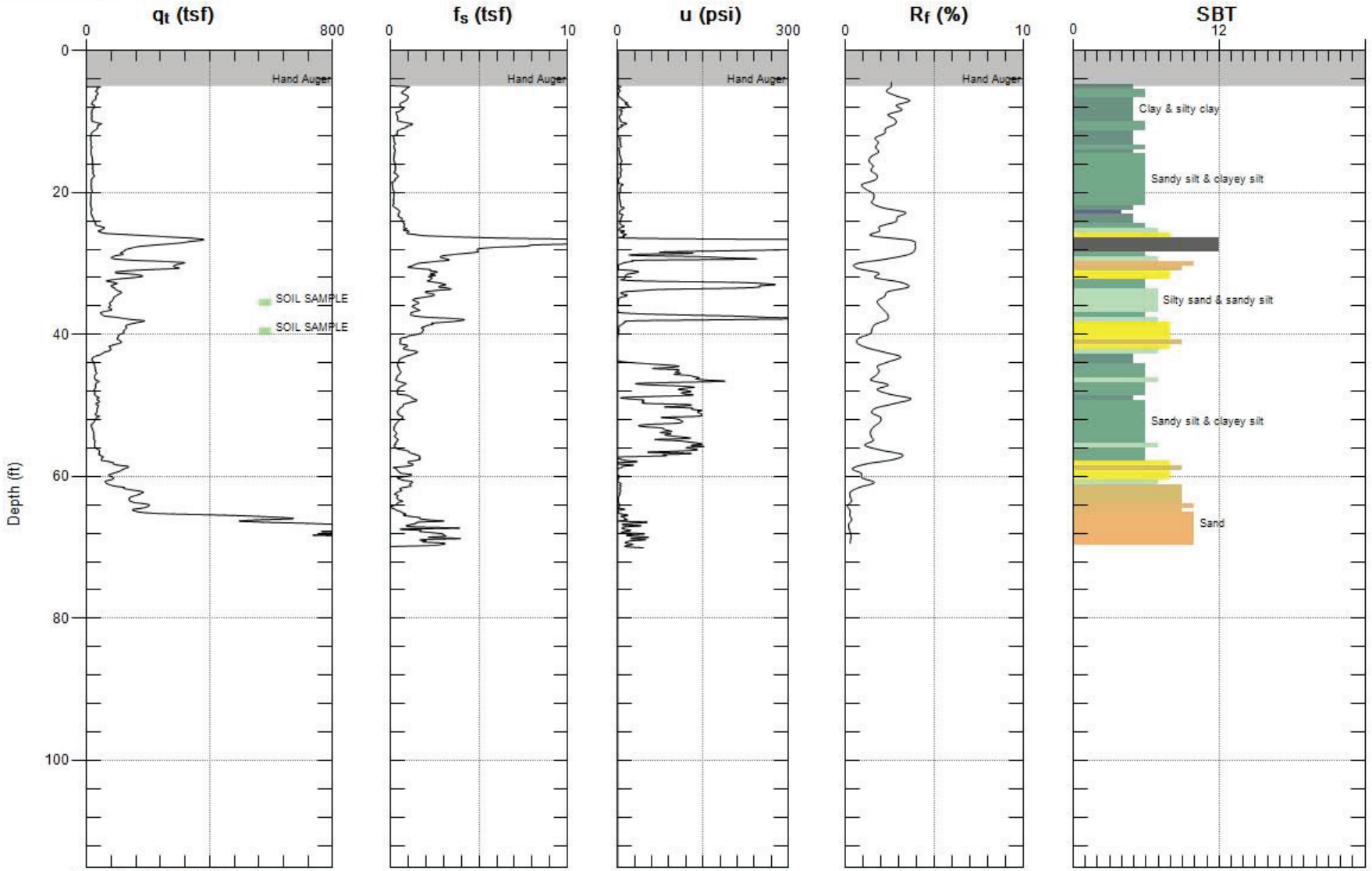
GREGG

URS

ID: SL0009_006C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1215+00_CPT **Date: 7/7/2011 08:18**



Max. Depth: 70.046 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

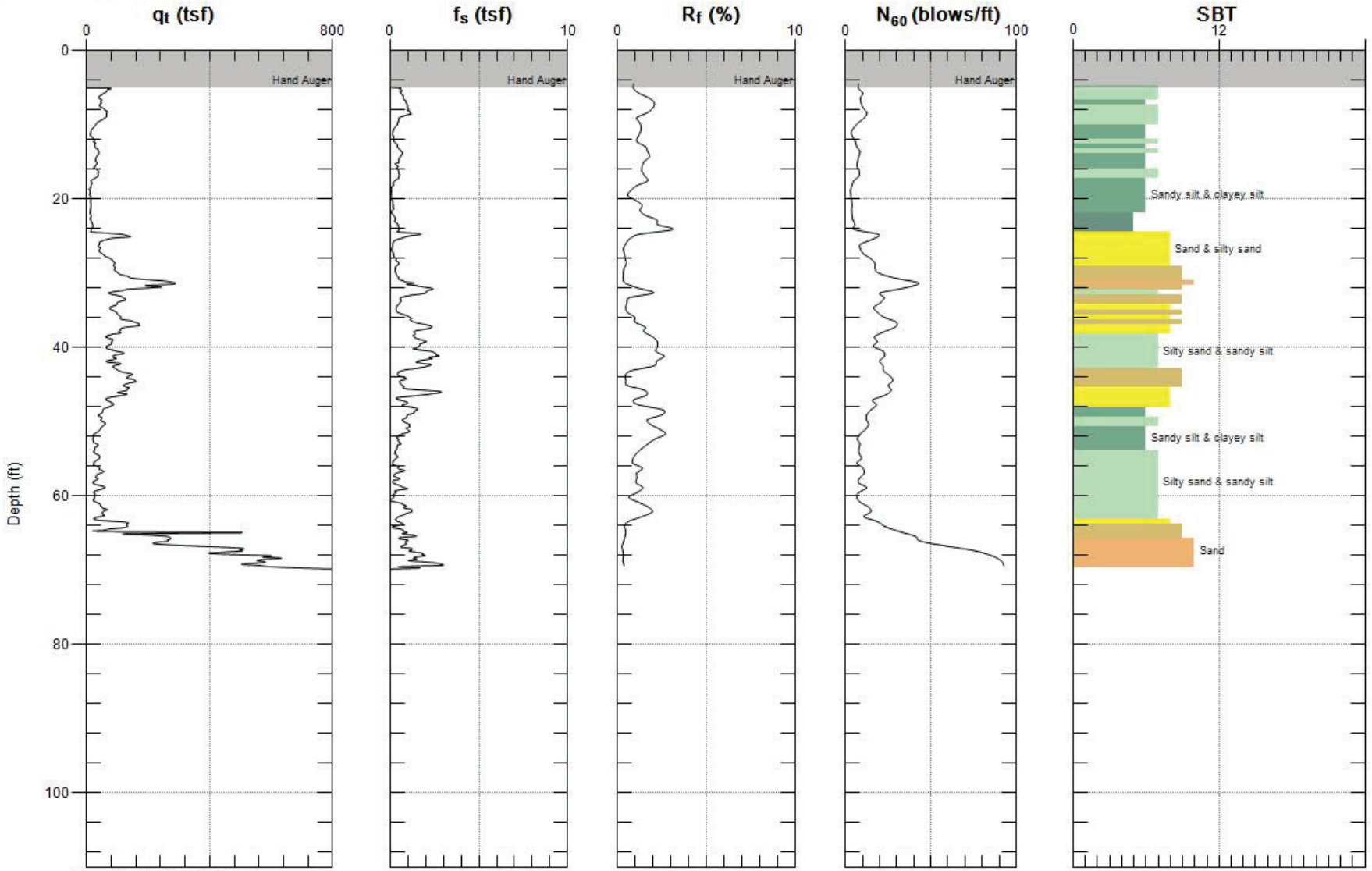
GREGG

URS

ID: SL0009_007C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1224+00_CPT **Date: 7/7/2011 09:49**



Max. Depth: 70.046 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

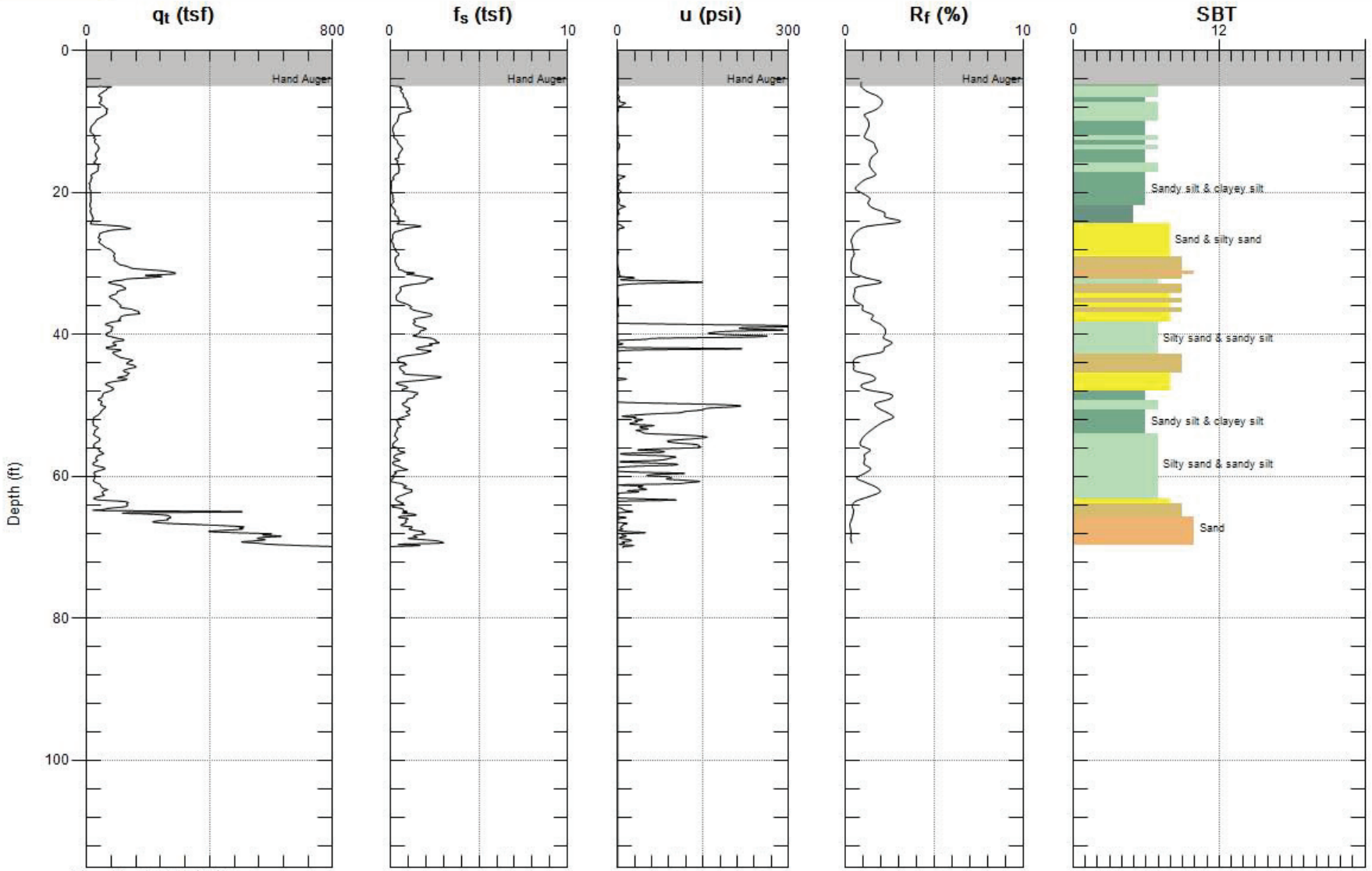
GREGG

URS

ID: SL0009_007C

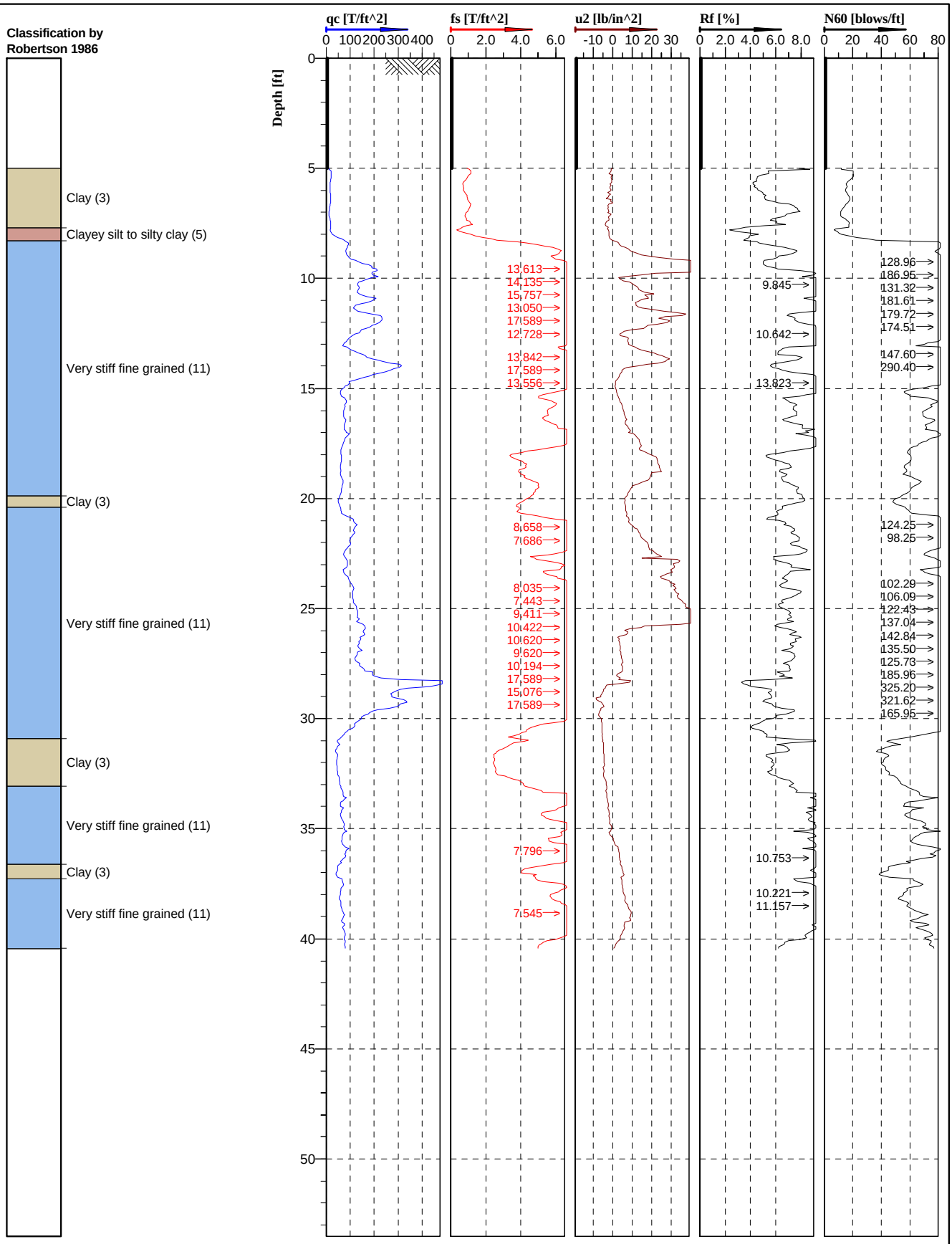
Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1224+00_CPT **Date: 7/7/2011 09:49**



Max. Depth: 70.046 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)



CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

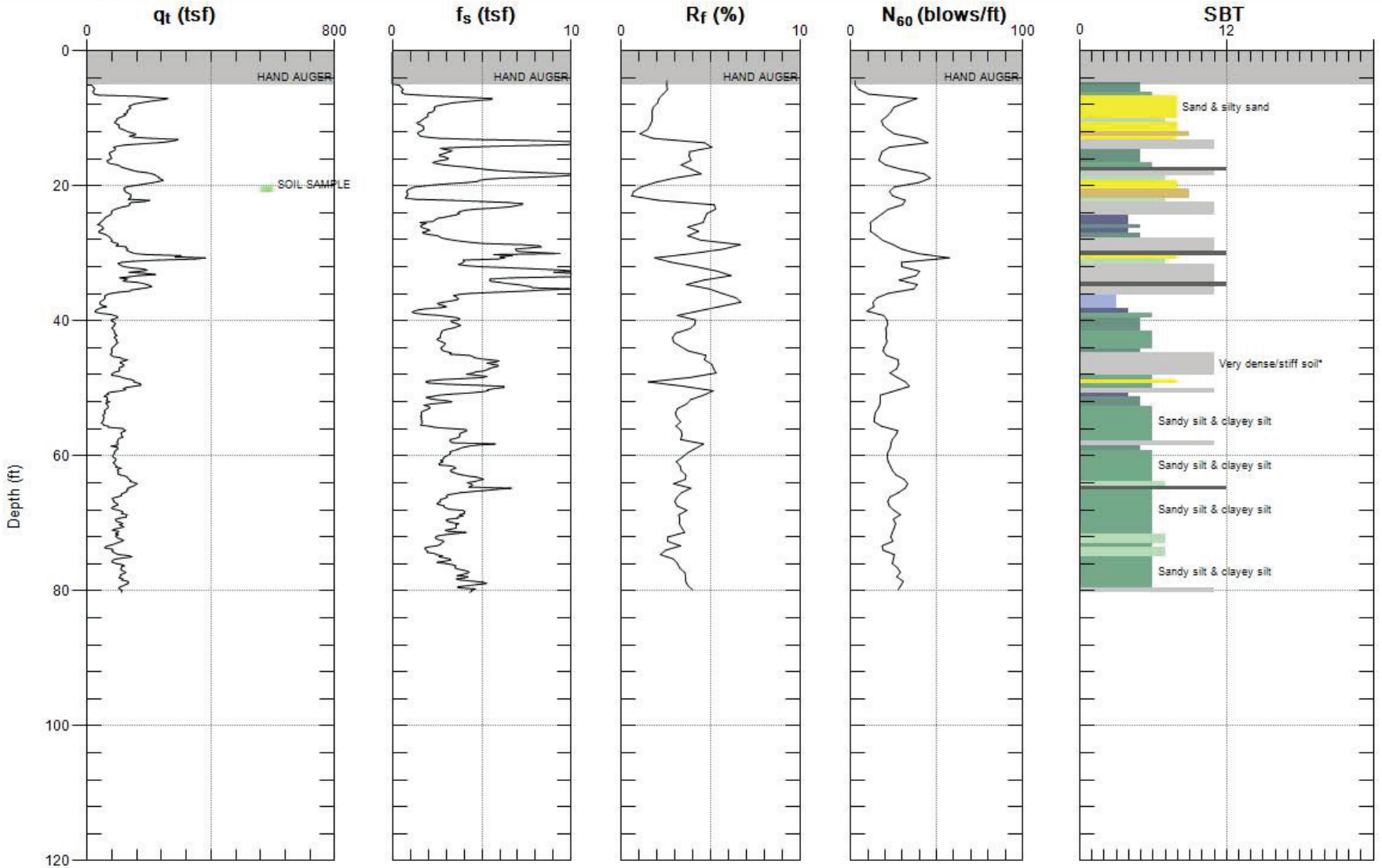
Location: Yuba City (rural), California	Position: SL0009_008C	Ground level:	Test no: 1329_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 8/3/2011	Scale: 1 : 75
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 1329_00_CPT.cpd	

GREGG **URS**

ID: SL0009_009C

Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-1399+00 **Date: 8/4/2011 01:55**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

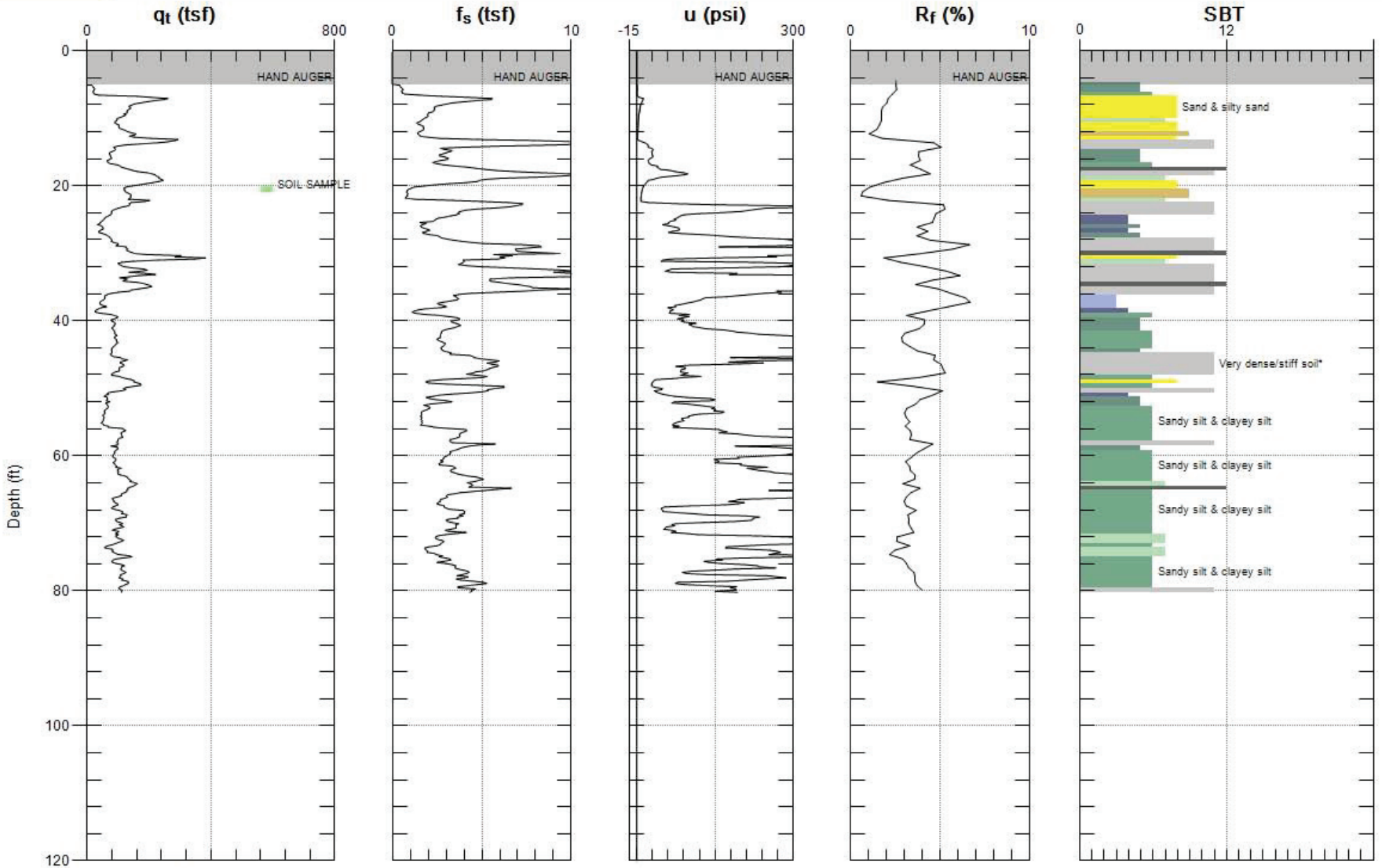
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SL0009_009C

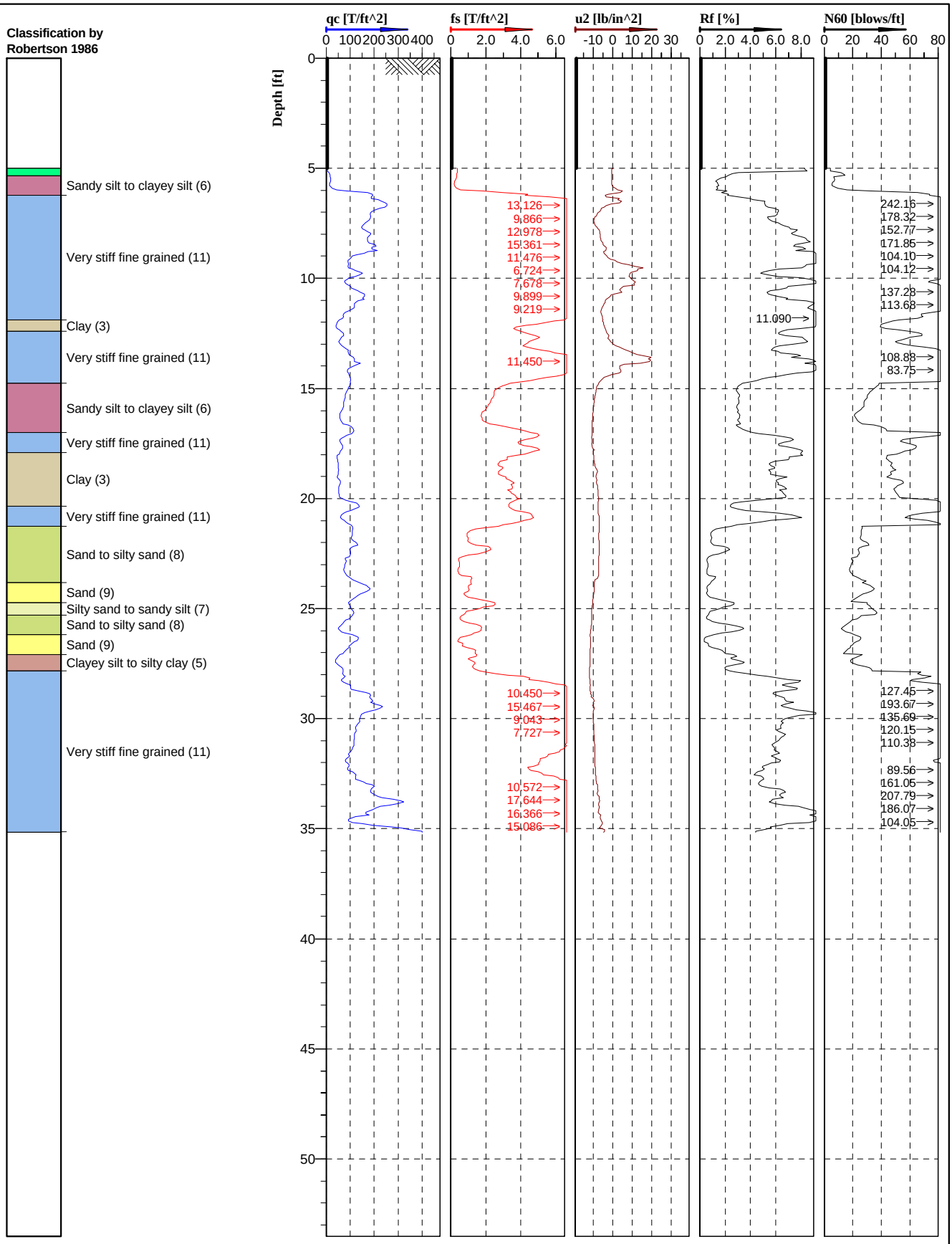
Site: FEATHER RIVER LEVEE **Engineer: M.CHOWDHURY**

Sounding: CPT-1399+00 **Date: 8/4/2011 01:55**



Max. Depth: 80.217 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

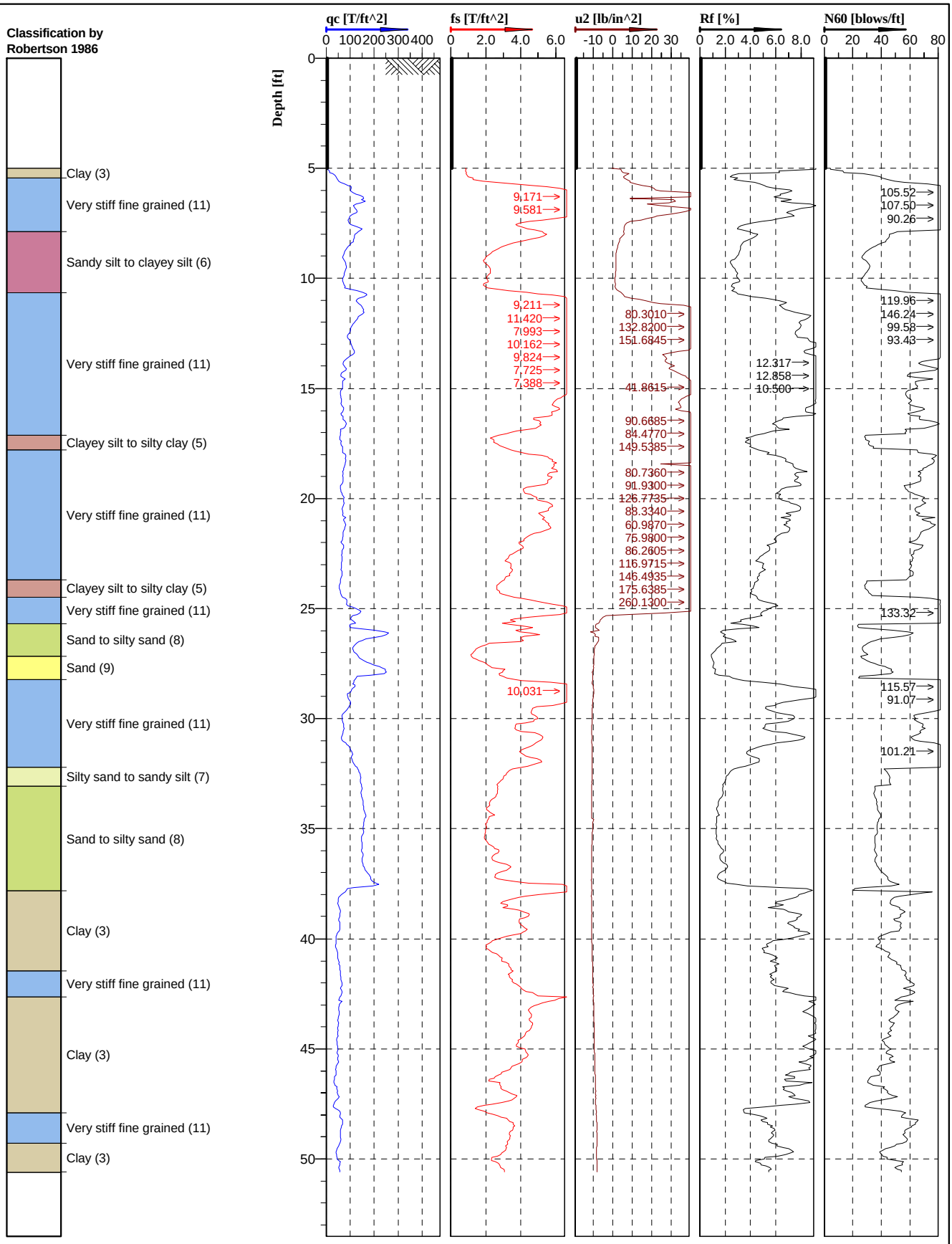


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SL0009_010C	Ground level:	Test no: 1405_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 8/3/2011	Scale: 1 : 75
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 1405_00_CPT.cpd	

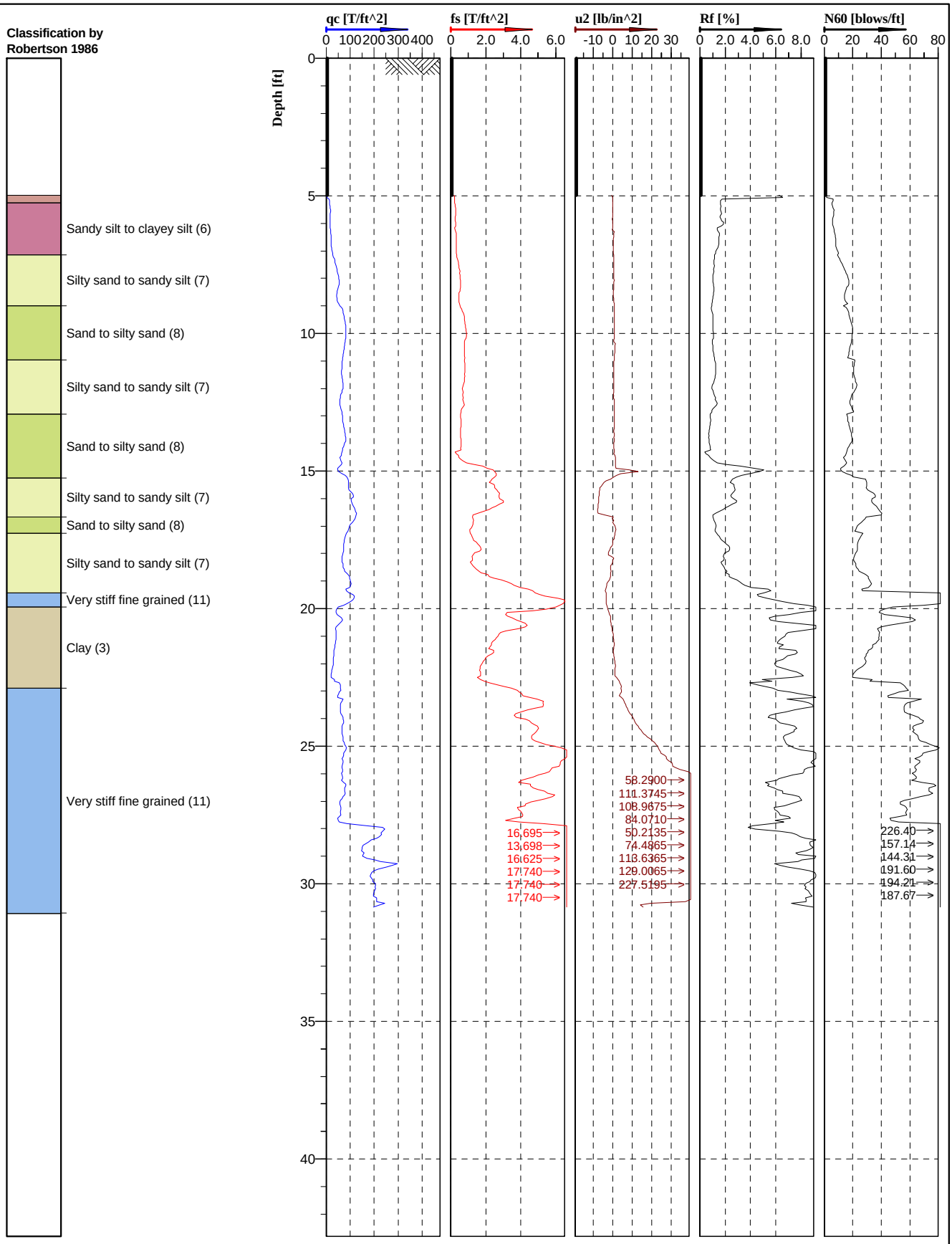


Location: Yuba City (rural), California	Position: SL0009_011C	Ground level:	Test no: 1413_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 8/3/2011	Scale: 1 : 75
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 1413_00_CPT.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

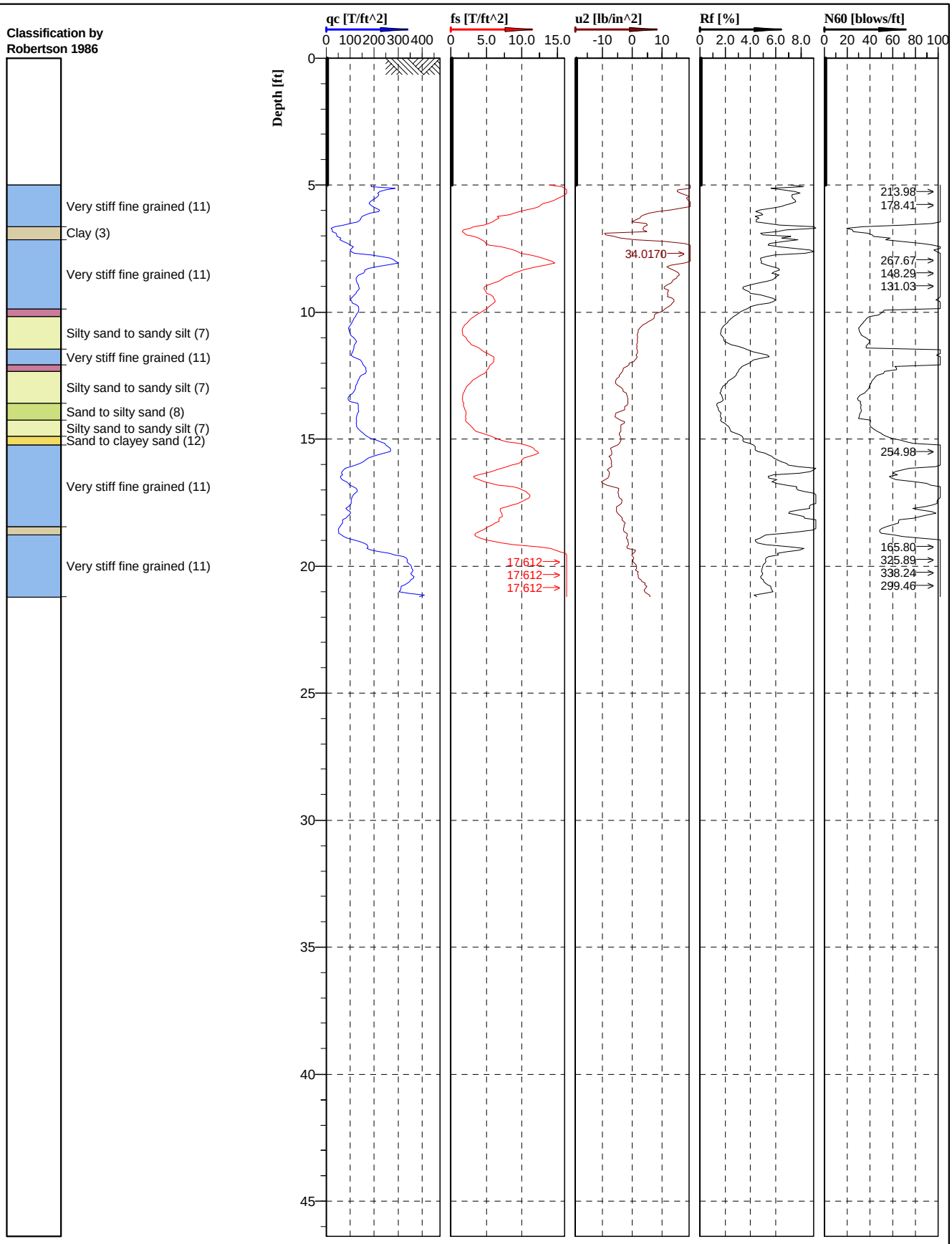


Location: Yuba City (rural), California	Position: SM0016_004C	Ground level:	Test no: 1483_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 8/1/2011	Scale: 1 : 60
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 1483_00_CPT.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150





Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SM0016_010C	Ground level:	Test no: 1594_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/29/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 1594_00_CPT.cpd	

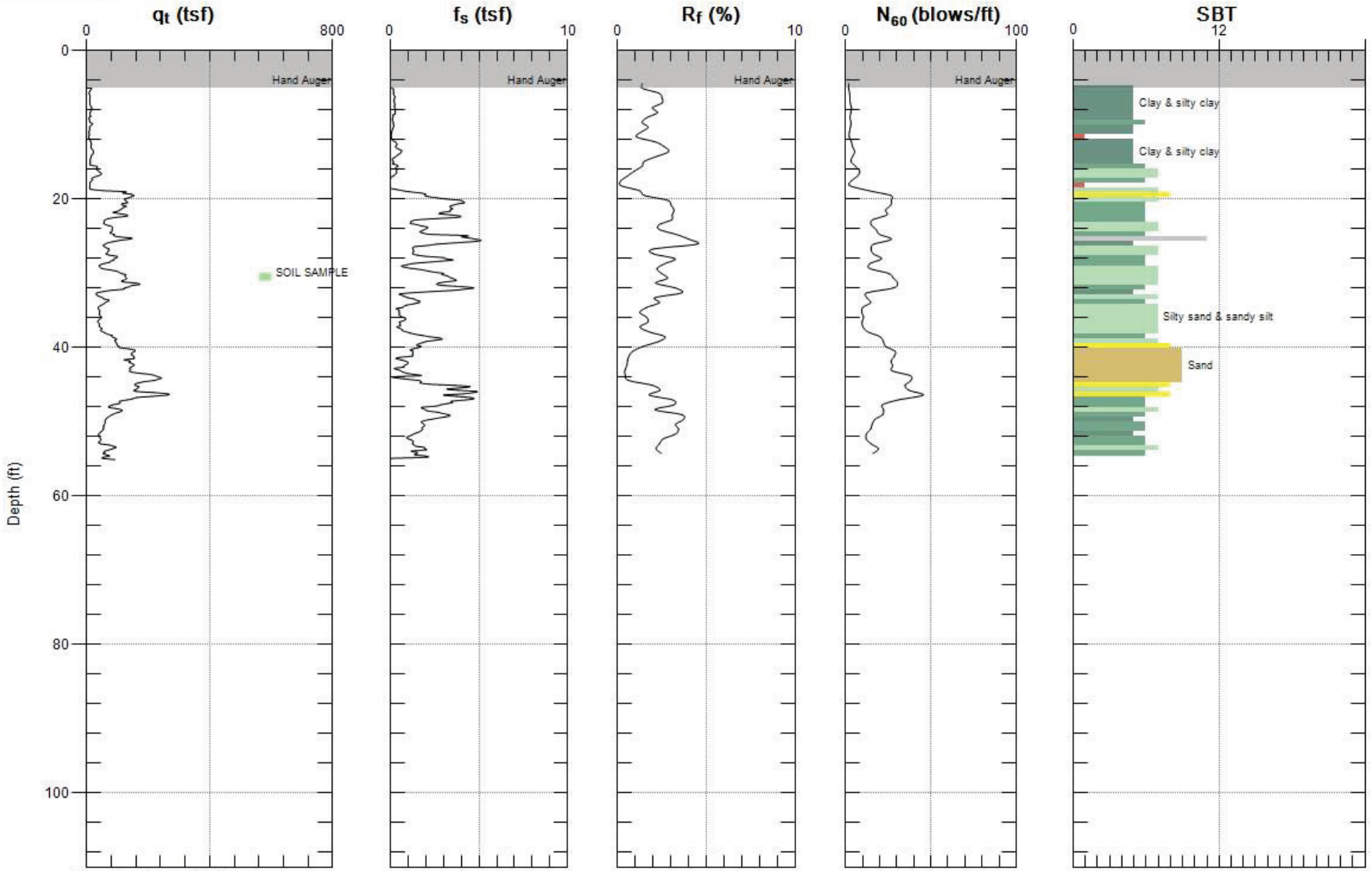
GREGG

URS

ID: SM0016_005C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1492+00_CPT **Date: 7/8/2011 12:52**



Max. Depth: 55.118 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

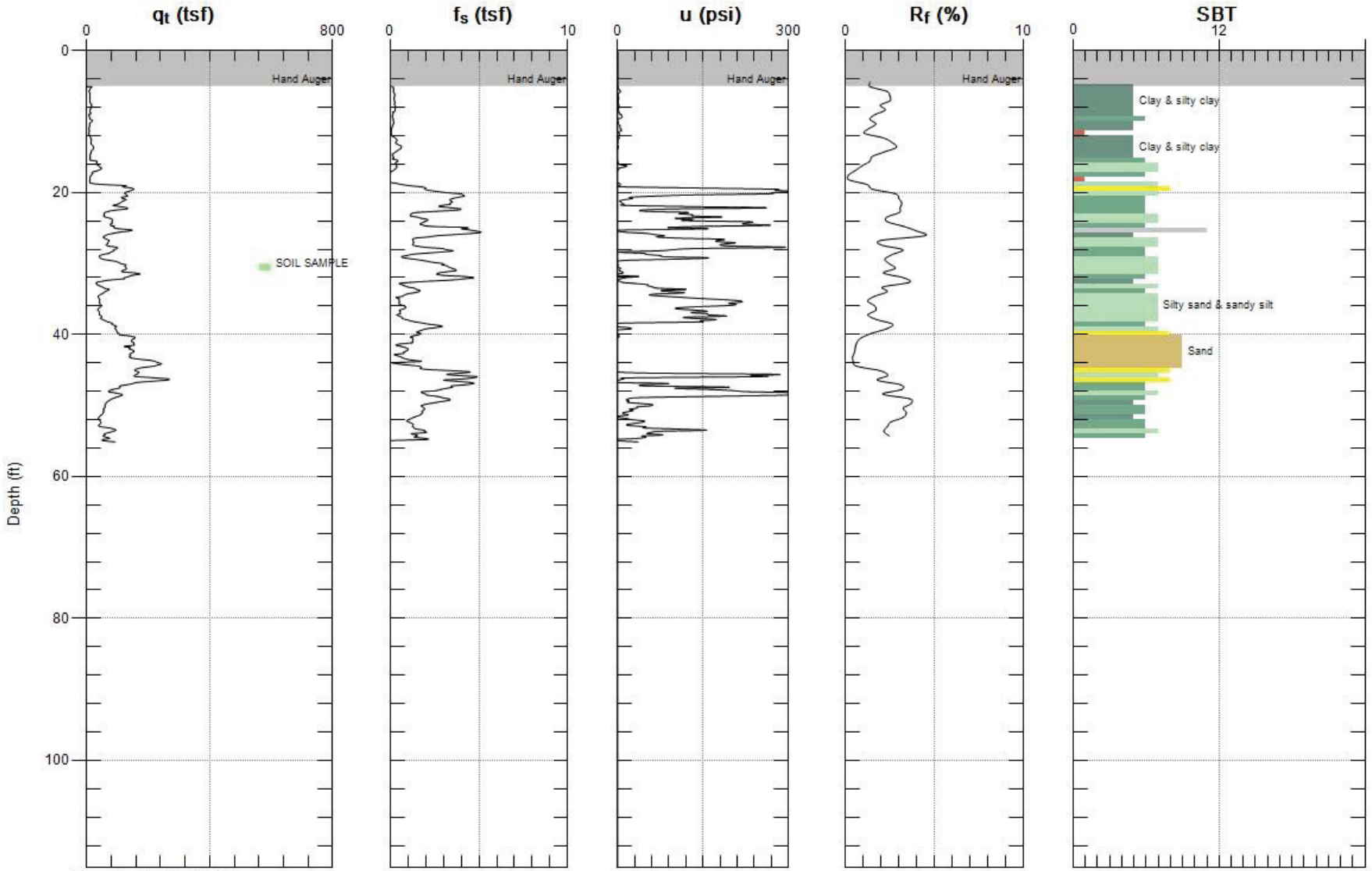
GREGG

URS

ID: SM0016_005C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1492+00_CPT **Date: 7/8/2011 12:52**



Max. Depth: 55.118 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

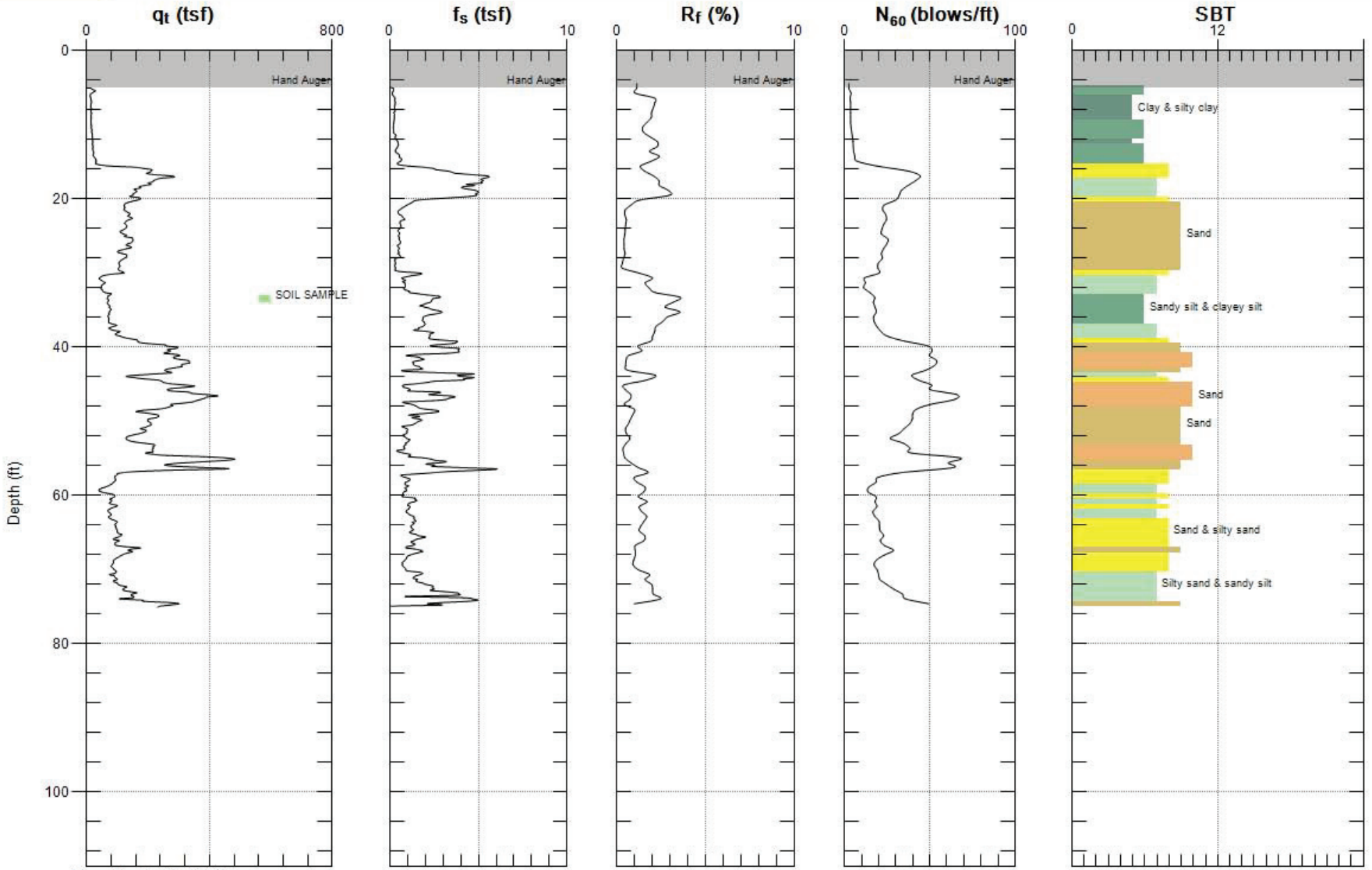
GREGG

URS

ID: SM0016_006C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1535+00_CPT **Date: 7/8/2011 09:59**



Max. Depth: 75.131 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

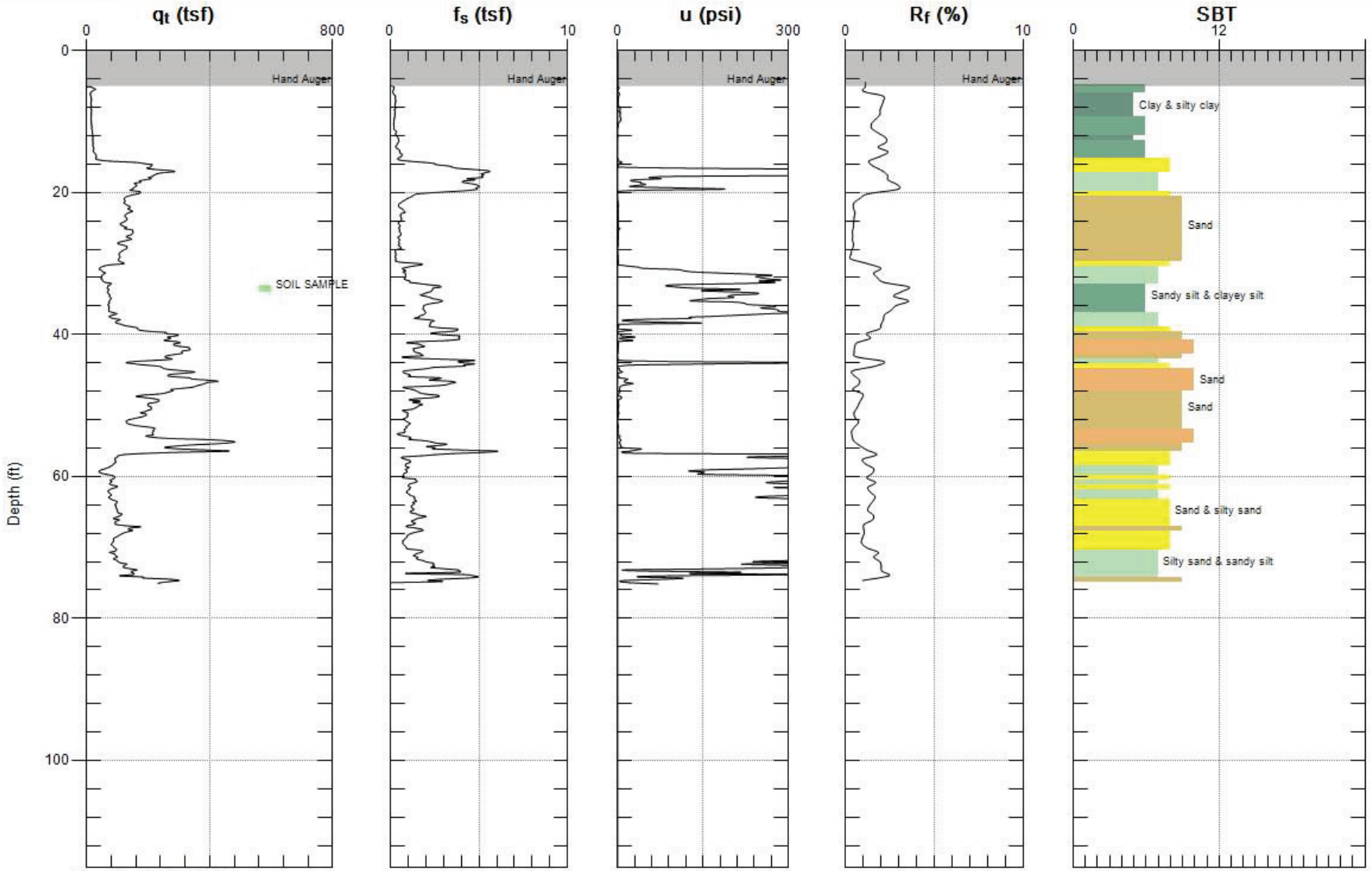
GREGG

URS

ID: SM0016_006C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1535+00_CPT **Date: 7/8/2011 09:59**



Max. Depth: 75.131 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

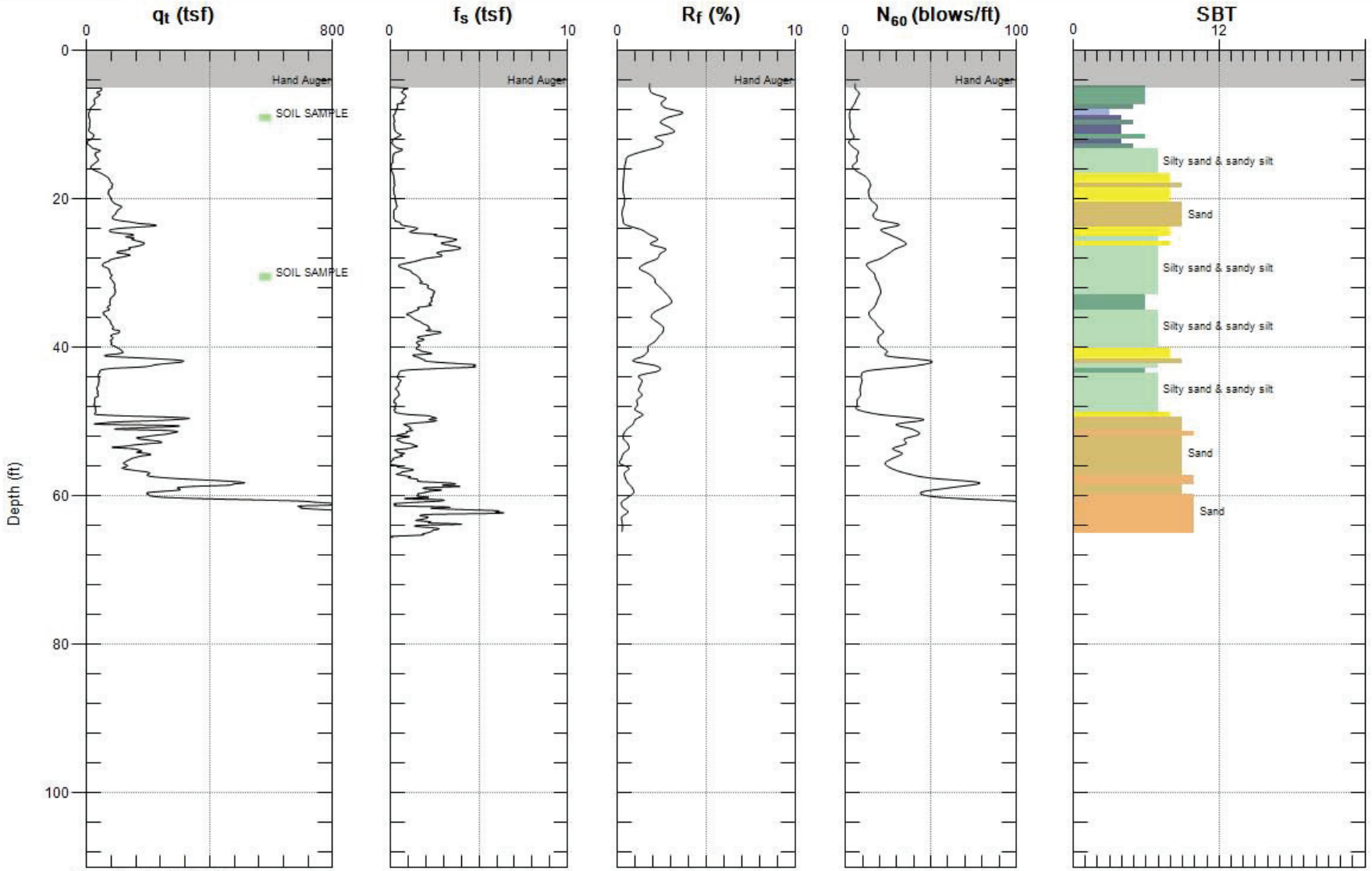
GREGG

URS

ID: SM0016_007C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1573+00_CPT **Date: 7/7/2011 03:31**



Max. Depth: 65.617 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

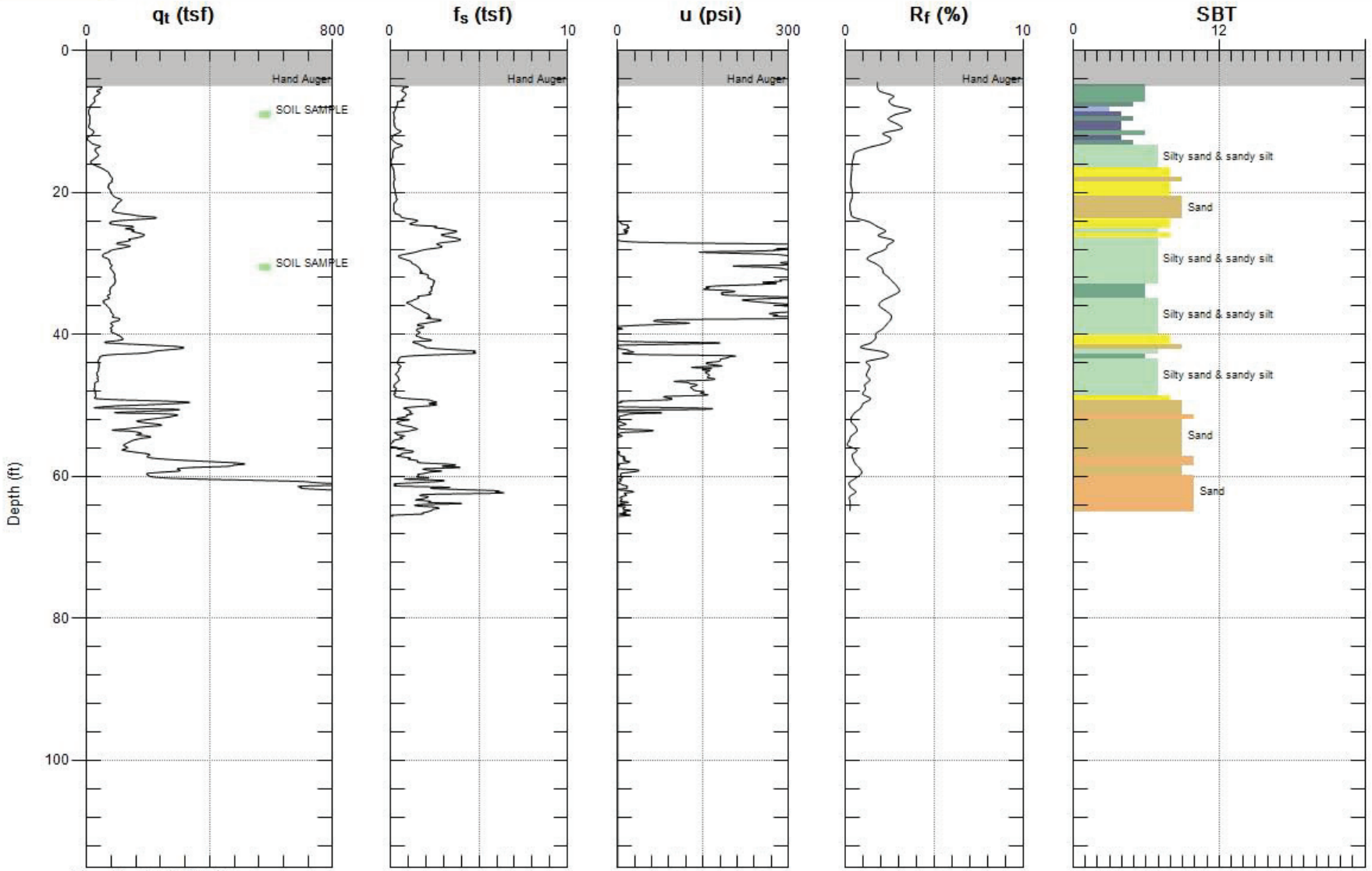
GREGG

URS

ID: SM0016_007C

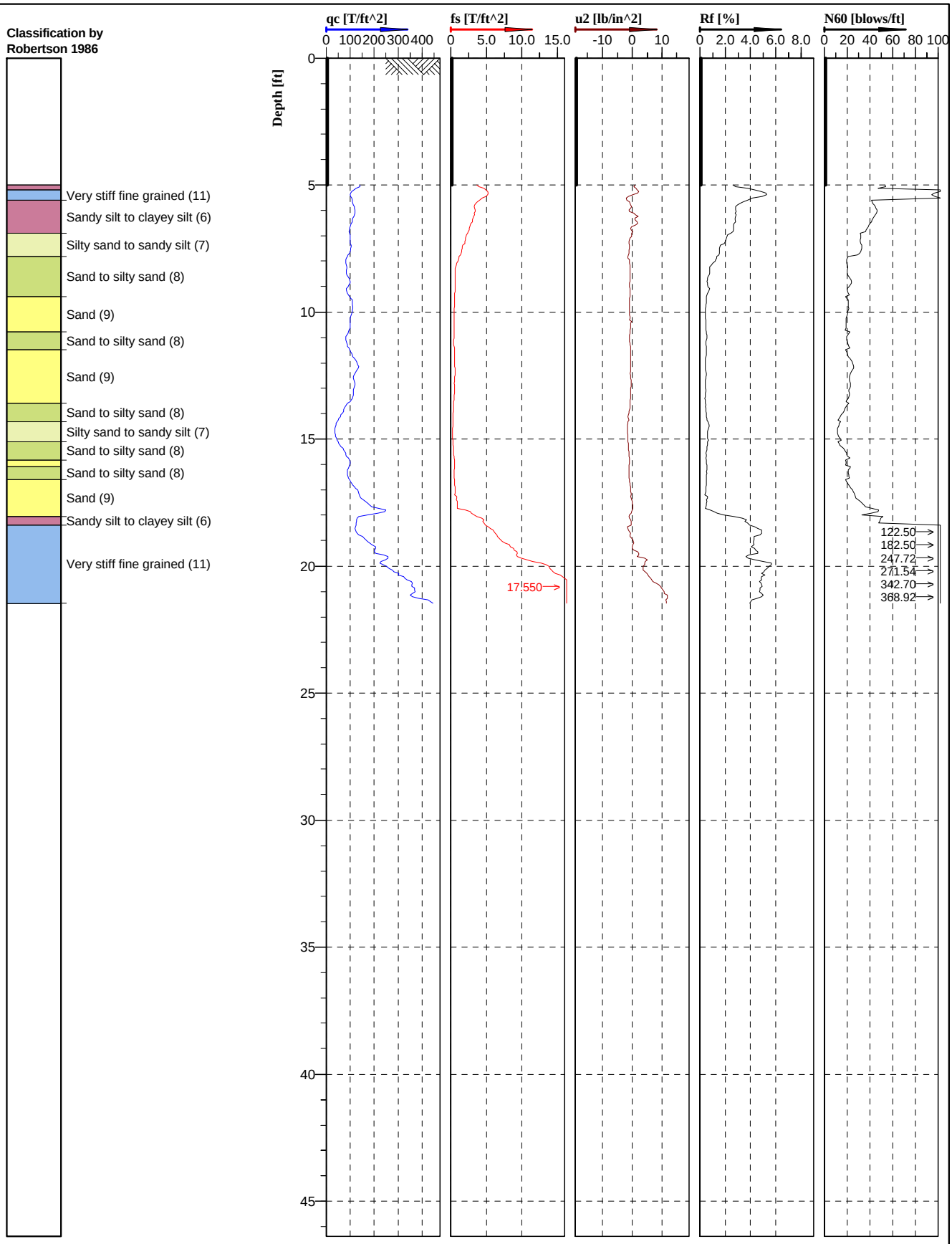
Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1573+00_CPT **Date: 7/7/2011 03:31**



Max. Depth: 65.617 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

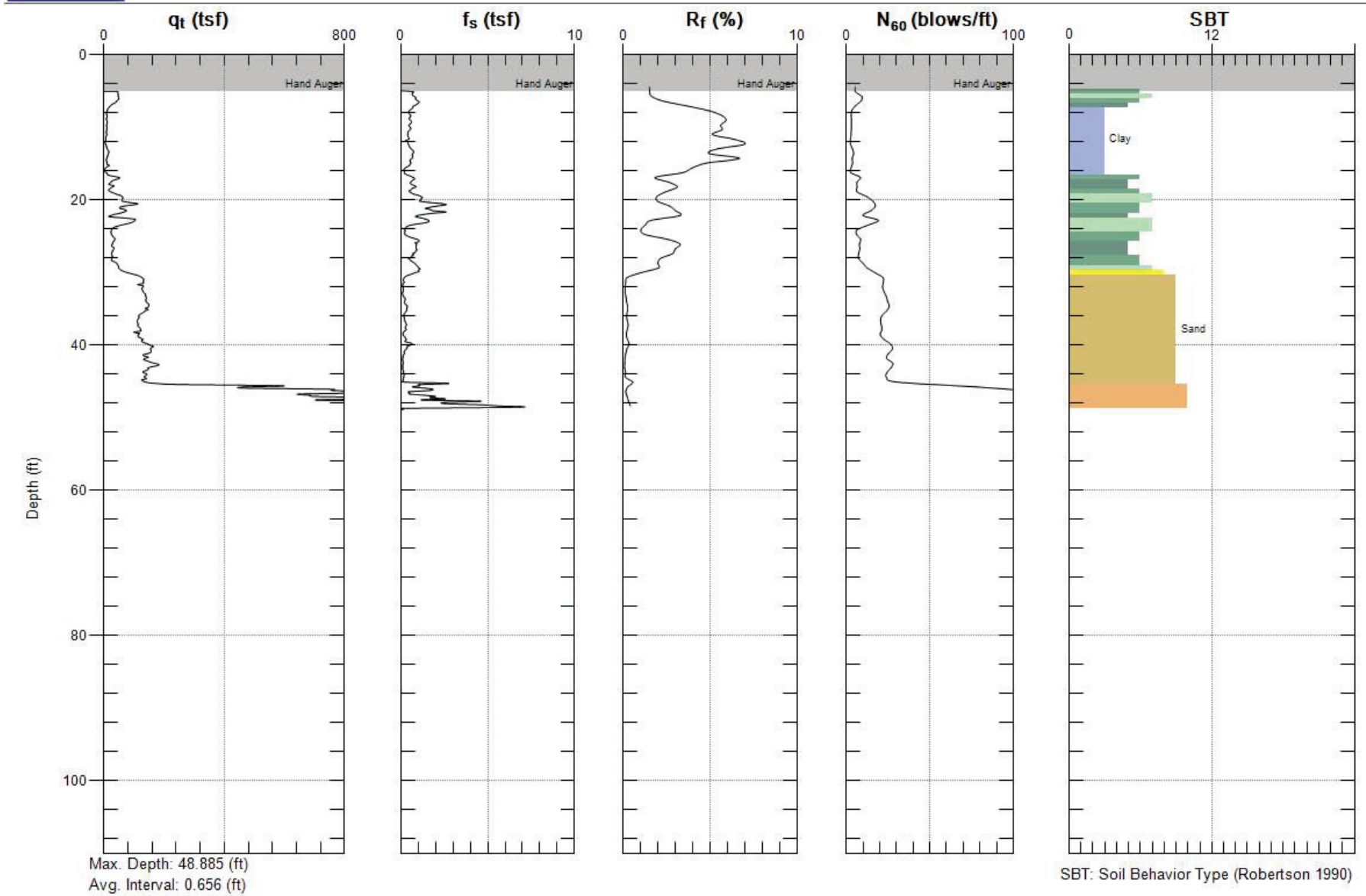


Location: Live Oak (rural), California	Position: SM0016_011C	Ground level:	Test no: 1604_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/28/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 1604_00_CPT.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150


GREGG
URS
ID: SM0016_009C
Site: FEATHER RIVER WEST
Sounding: 1622+00_CPT
Engineer: GYEONG TAEK HONG
Date: 7/8/2011 08:02
q_t (tsf)
f_s (tsf)
R_f (%)
N_{60} (blows/ft)
SBT
Hand Auger
Clay
Sand
Depth (ft)
Max. Depth: 48.885 (ft)
Avg. Interval: 0.656 (ft)
SBT: Soil Behavior Type (Robertson 1990)

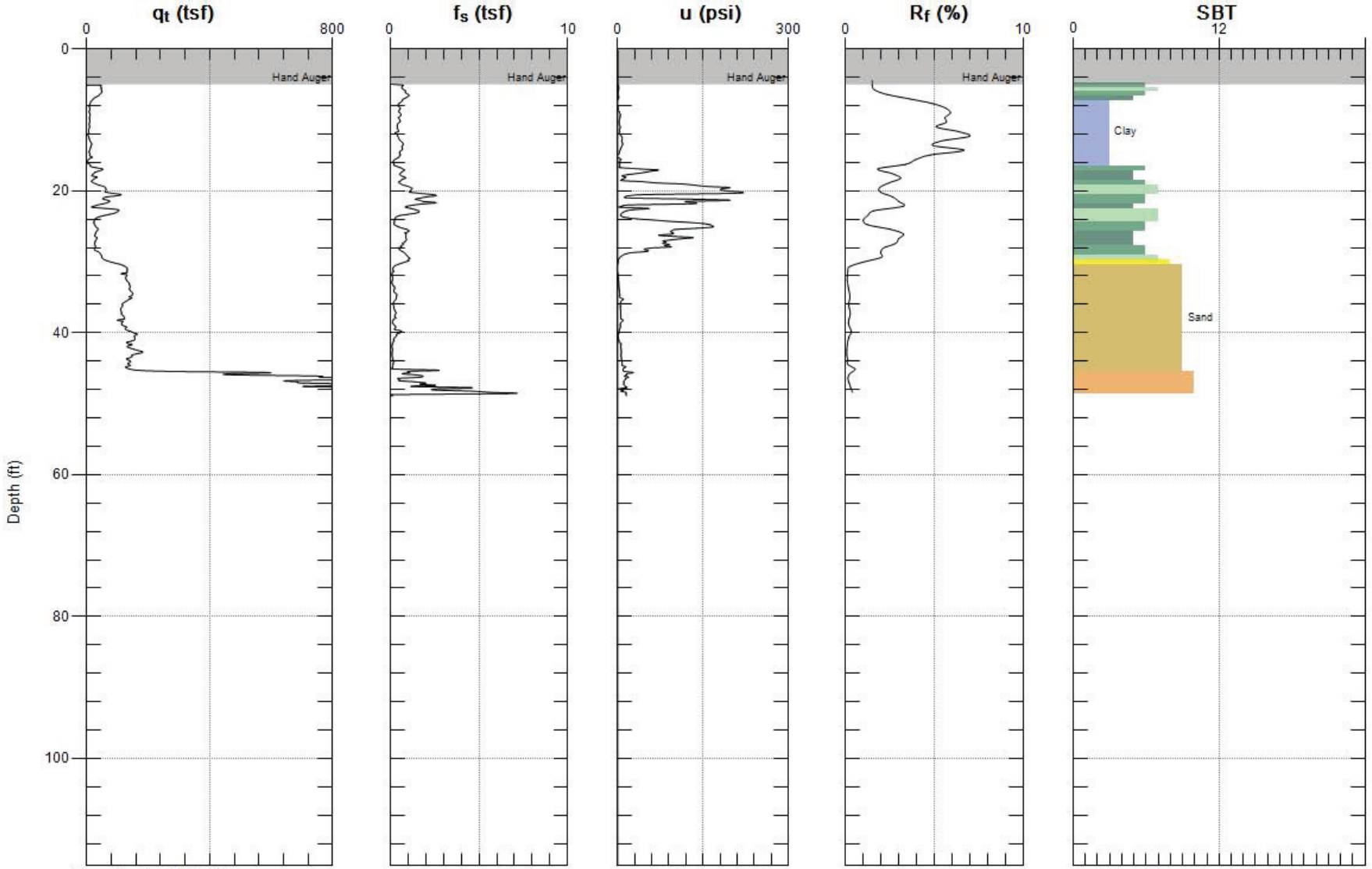
GREGG

URS

ID: SM0016_009C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1622+00_CPT **Date: 7/8/2011 08:02**



Max. Depth: 48.885 (ft)
Avg. Interval: 0.656 (ft)

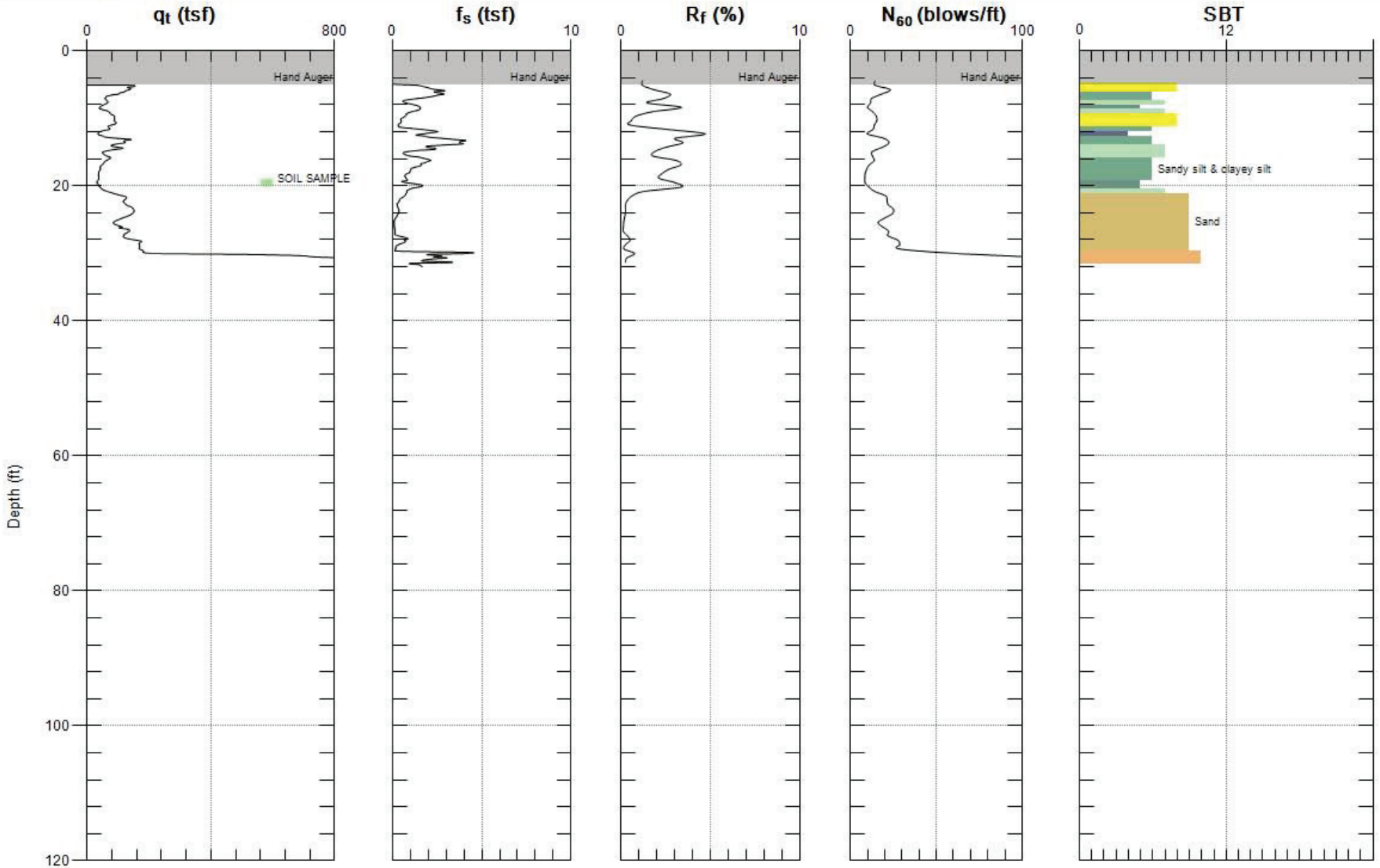
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SM0016_008C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1622+00_CPT **Date: 7/19/2011 03:51**



Max. Depth: 31.988 (ft)
Avg. Interval: 0.656 (ft)

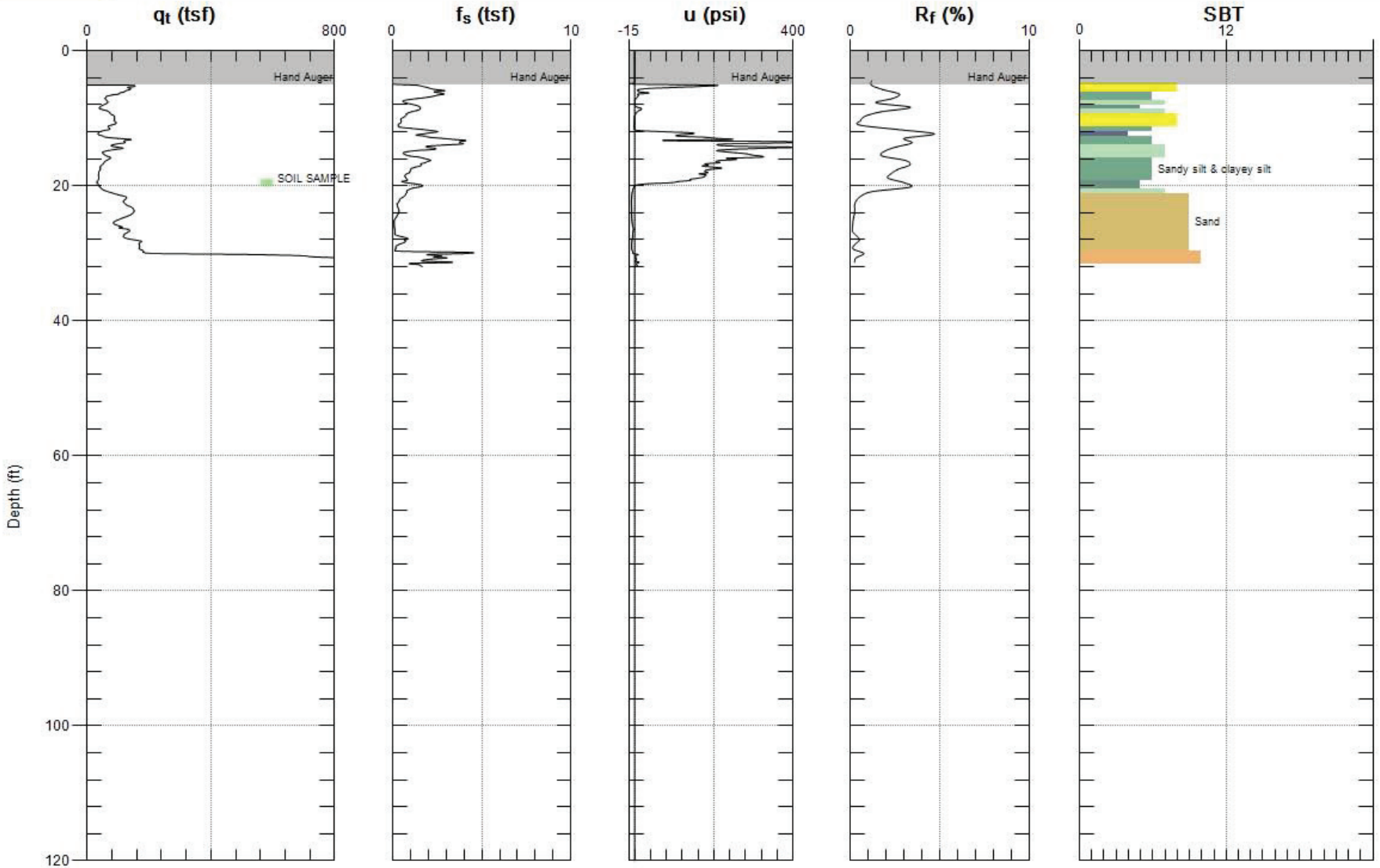
SBT: Soil Behavior Type (Robertson 1990)

GREGG **URS**

ID: SM0016_008C

Site: FEATHER RIVER WEST **Engineer: GYEONG TAEK HONG**

Sounding: 1622+00_CPT **Date: 7/19/2011 03:51**



Max. Depth: 31.988 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

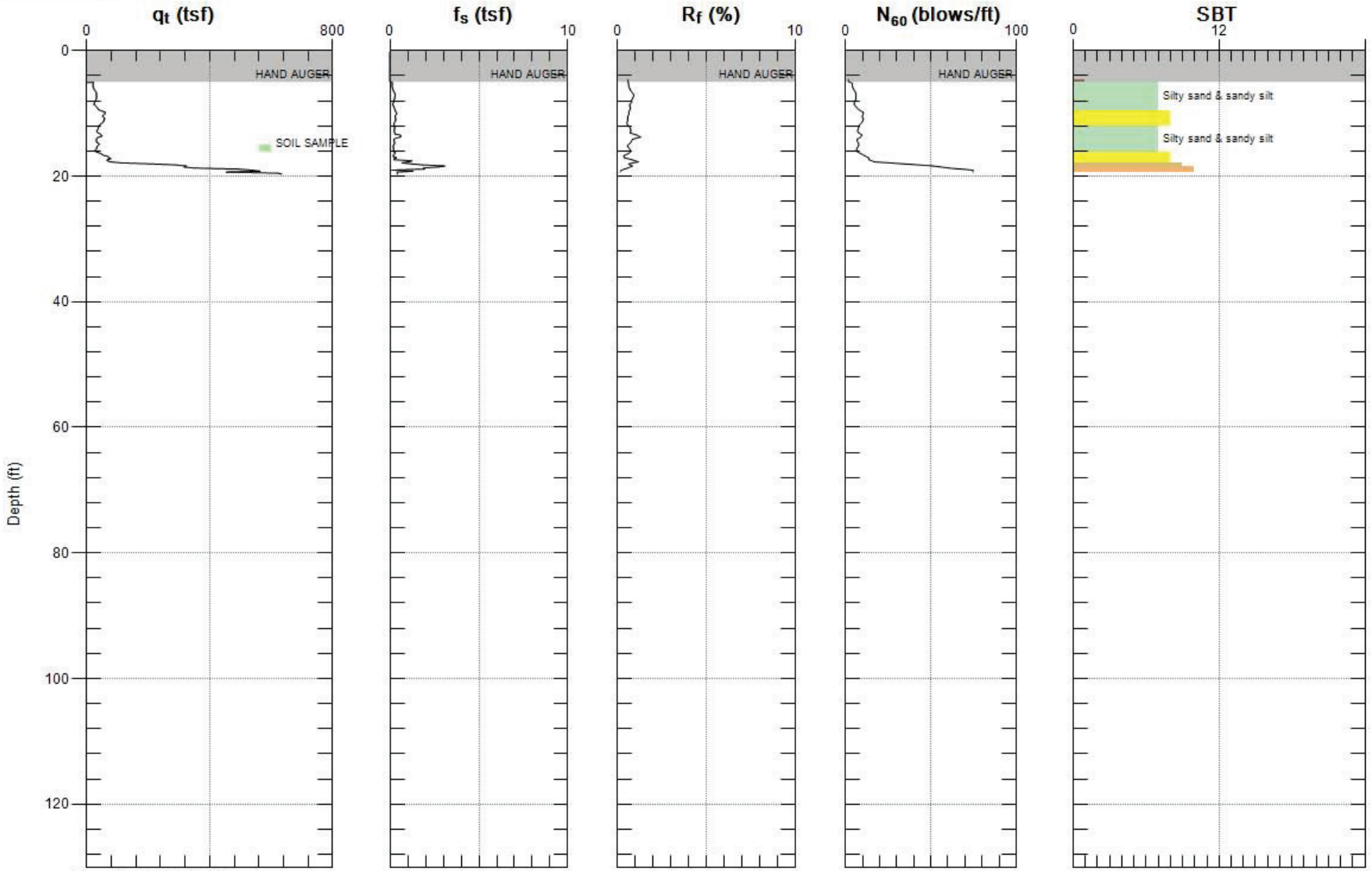
GREGG

URS

ID: SM0007_007C

Site: FEATHER RIVER
Sounding: 1994-00-CPT

Engineer: G.HONG
Date: 9/20/2011 10:58



Max. Depth: 19.685 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

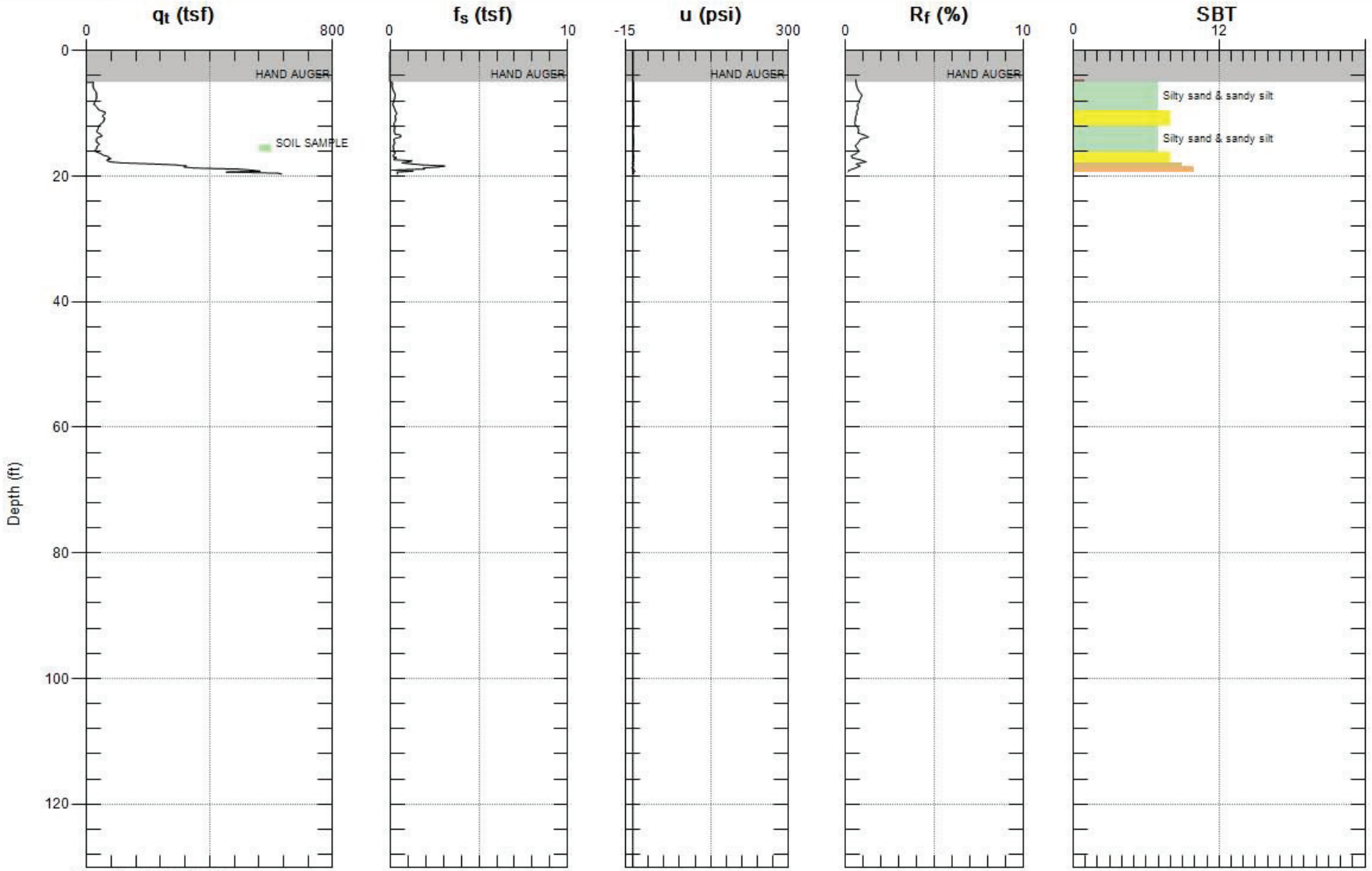
GREGG

URS

ID: SM0007_007C

Site: FEATHER RIVER **Engineer: G.HONG**

Sounding: 1994-00-CPT **Date: 9/20/2011 10:58**



Max. Depth: 19.685 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

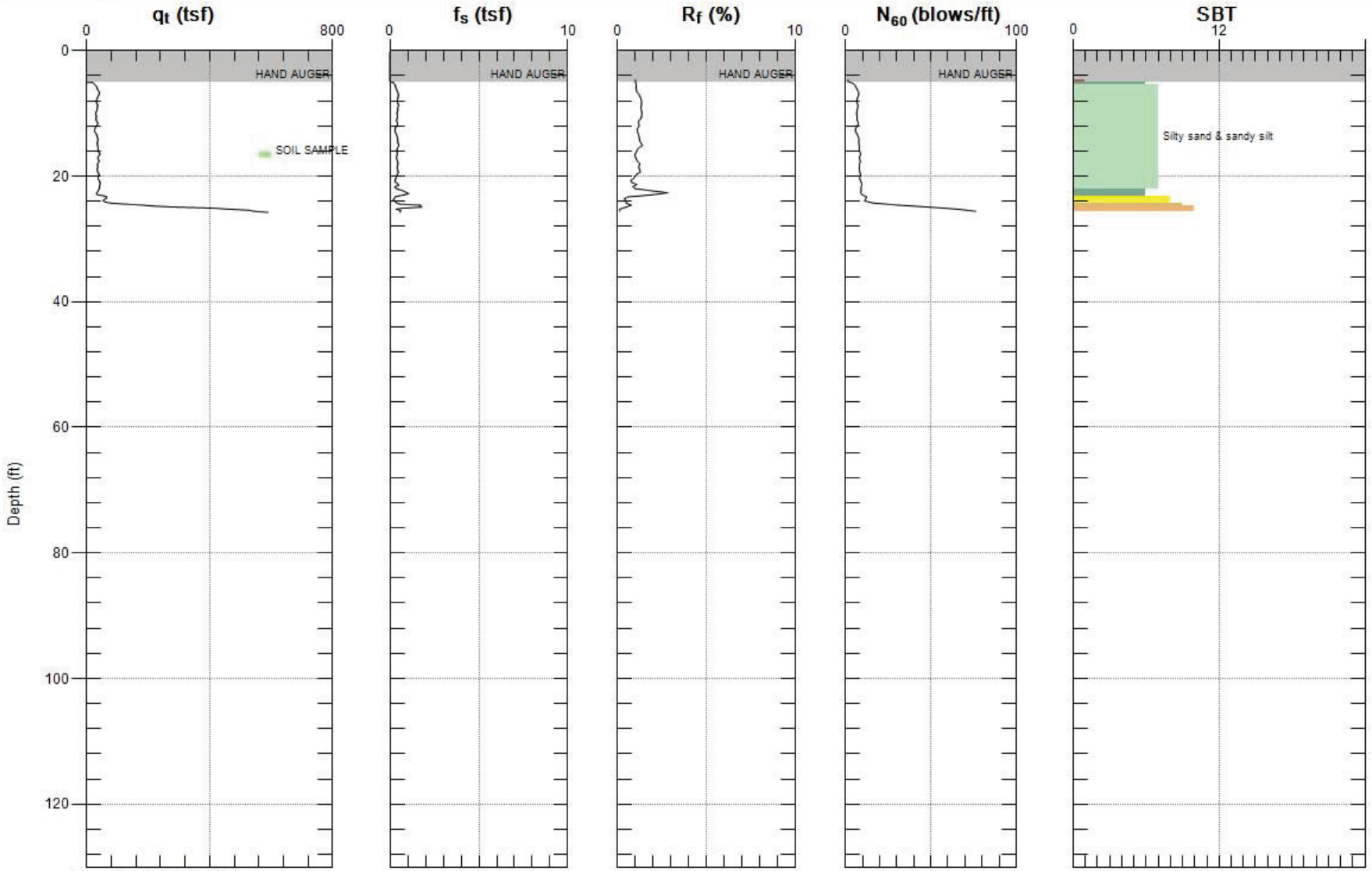
GREGG

URS

ID: SM0007_008C

Site: FEATHER RIVER
Sounding: 1999-50-CPT

Engineer: G.HONG
Date: 9/20/2011 08:52



Max. Depth: 25.755 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

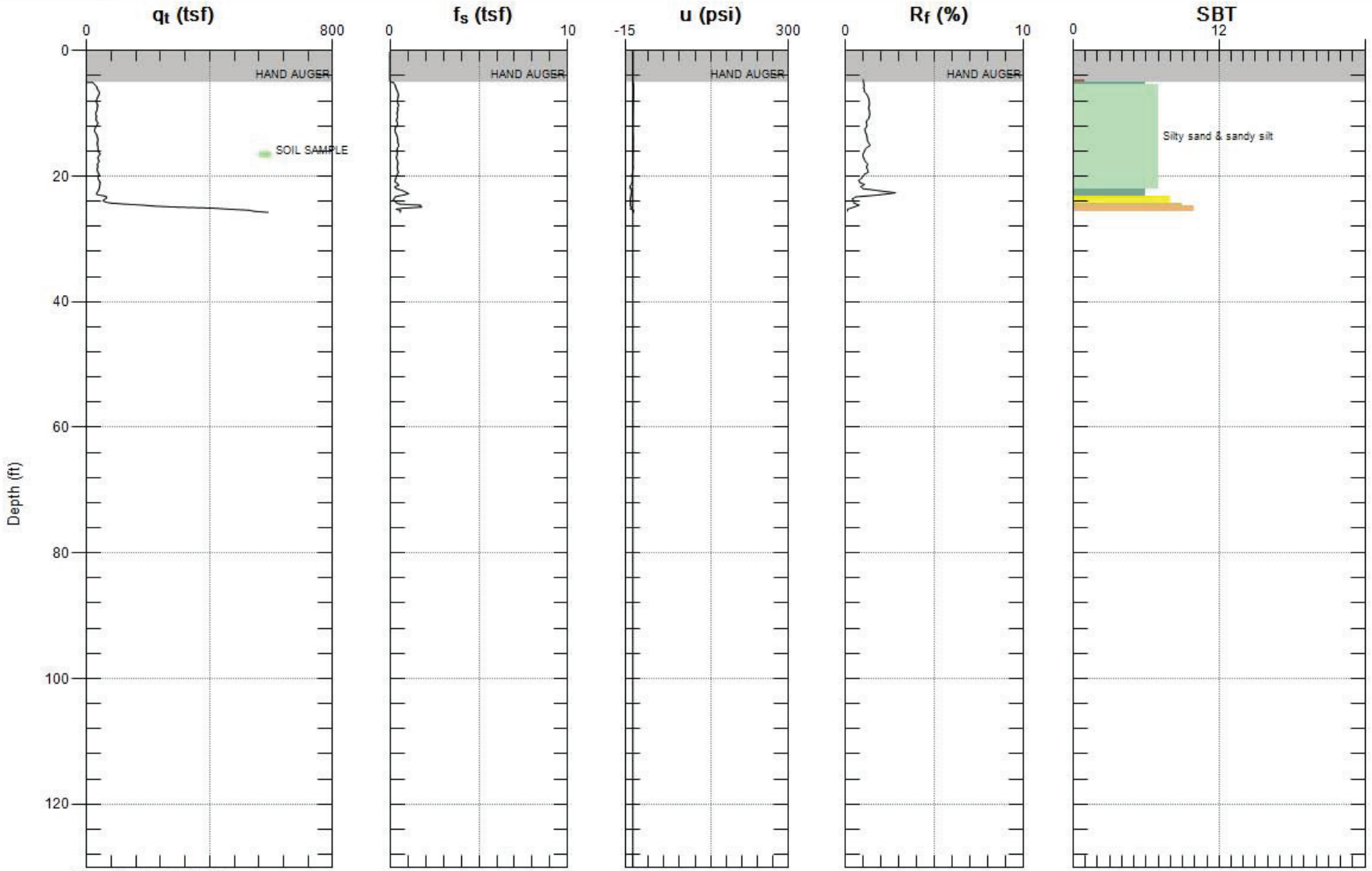
GREGG

URS

ID: SM0007_008C

Site: FEATHER RIVER
Sounding: 1999-50-CPT

Engineer: G.HONG
Date: 9/20/2011 08:52



Max. Depth: 25.755 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

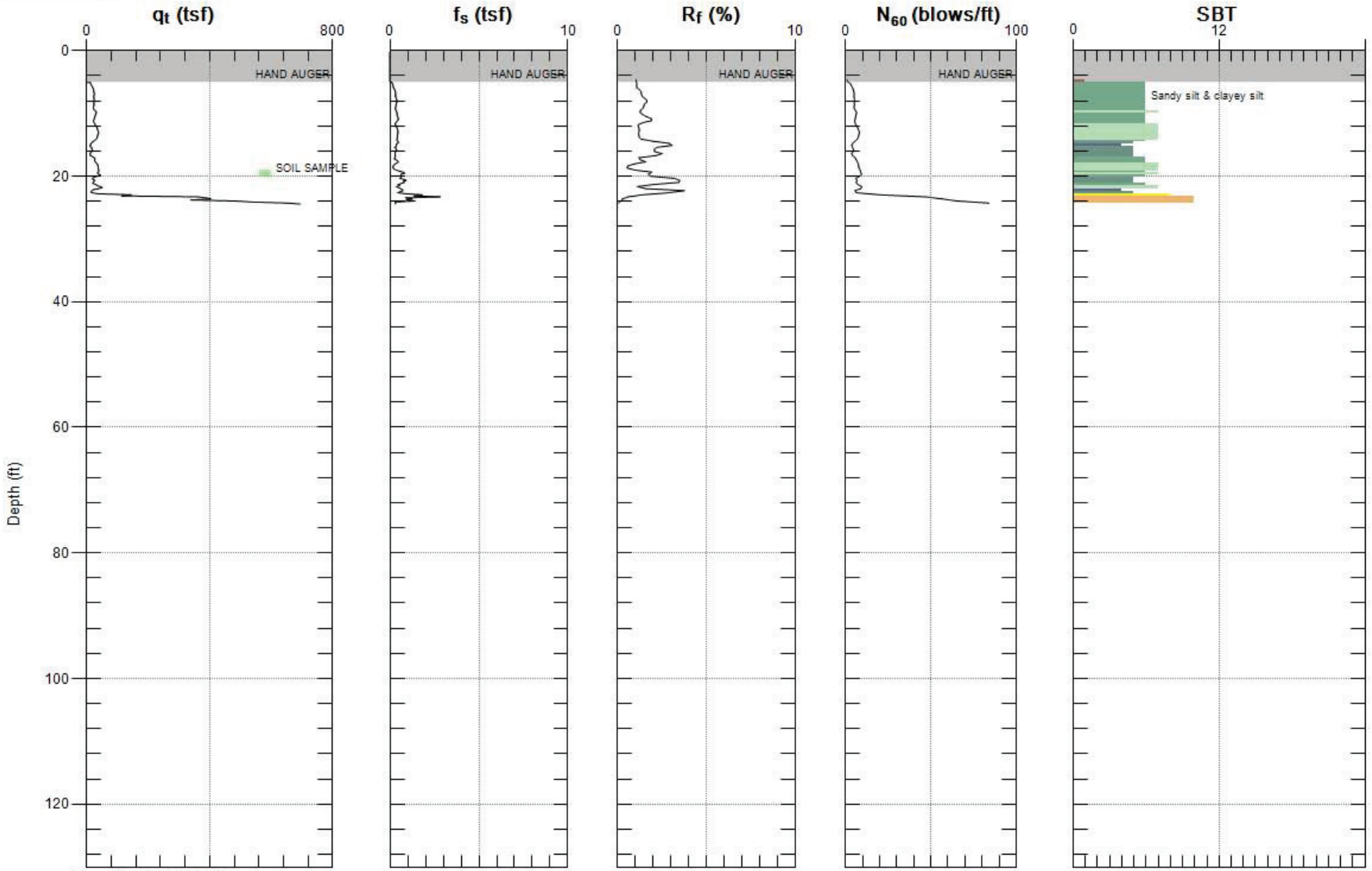
GREGG

URS

ID: SM0007_009C

Site: FEATHER RIVER
Sounding: 2021-00-CPT

Engineer: G.HONG
Date: 9/19/2011 09:09



Max. Depth: 24.442 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

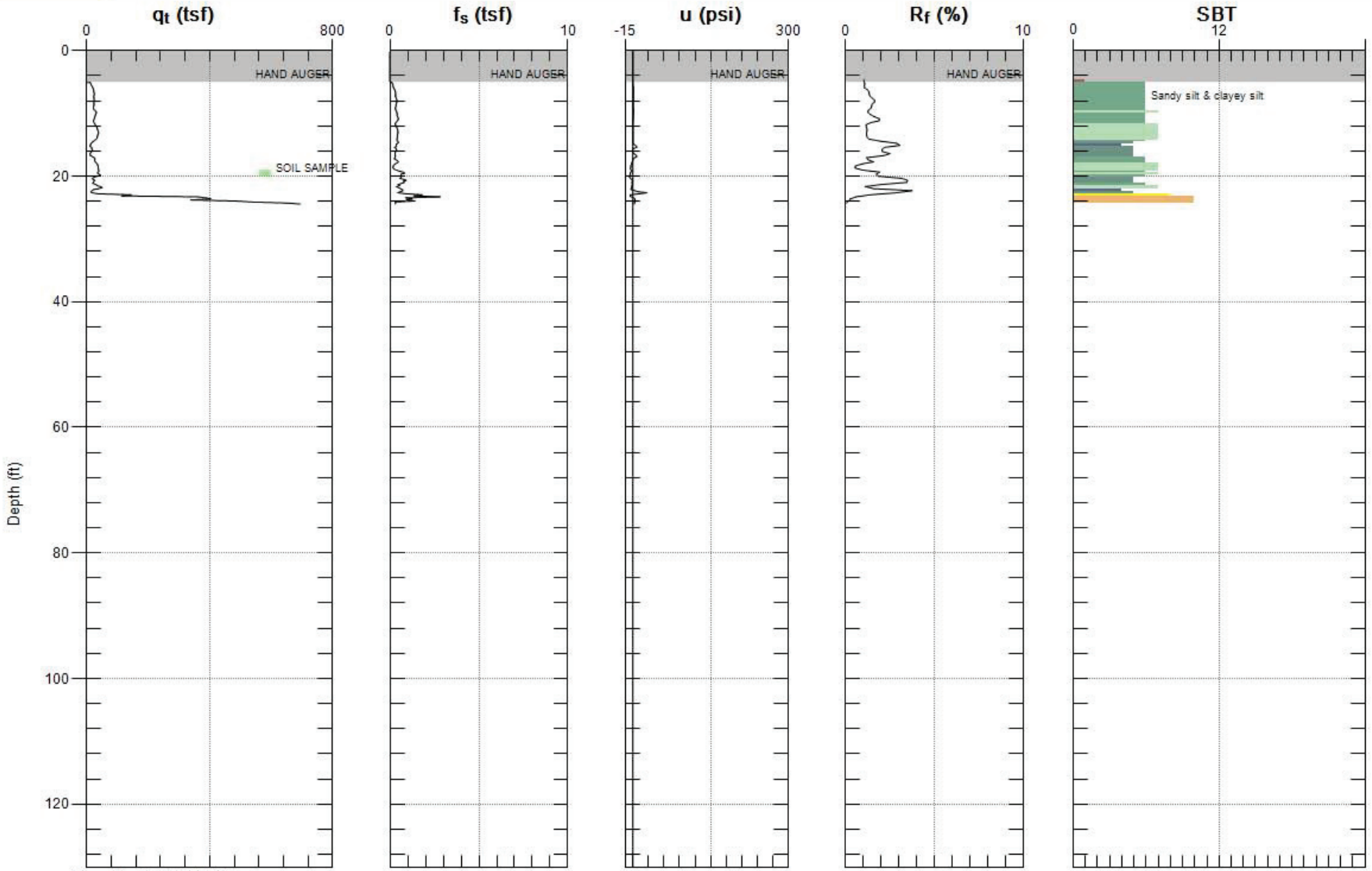
GREGG

URS

ID: SM0007_009C

Site: FEATHER RIVER **Engineer: G.HONG**

Sounding: 2021-00-CPT **Date: 9/19/2011 09:09**



Max. Depth: 24.442 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

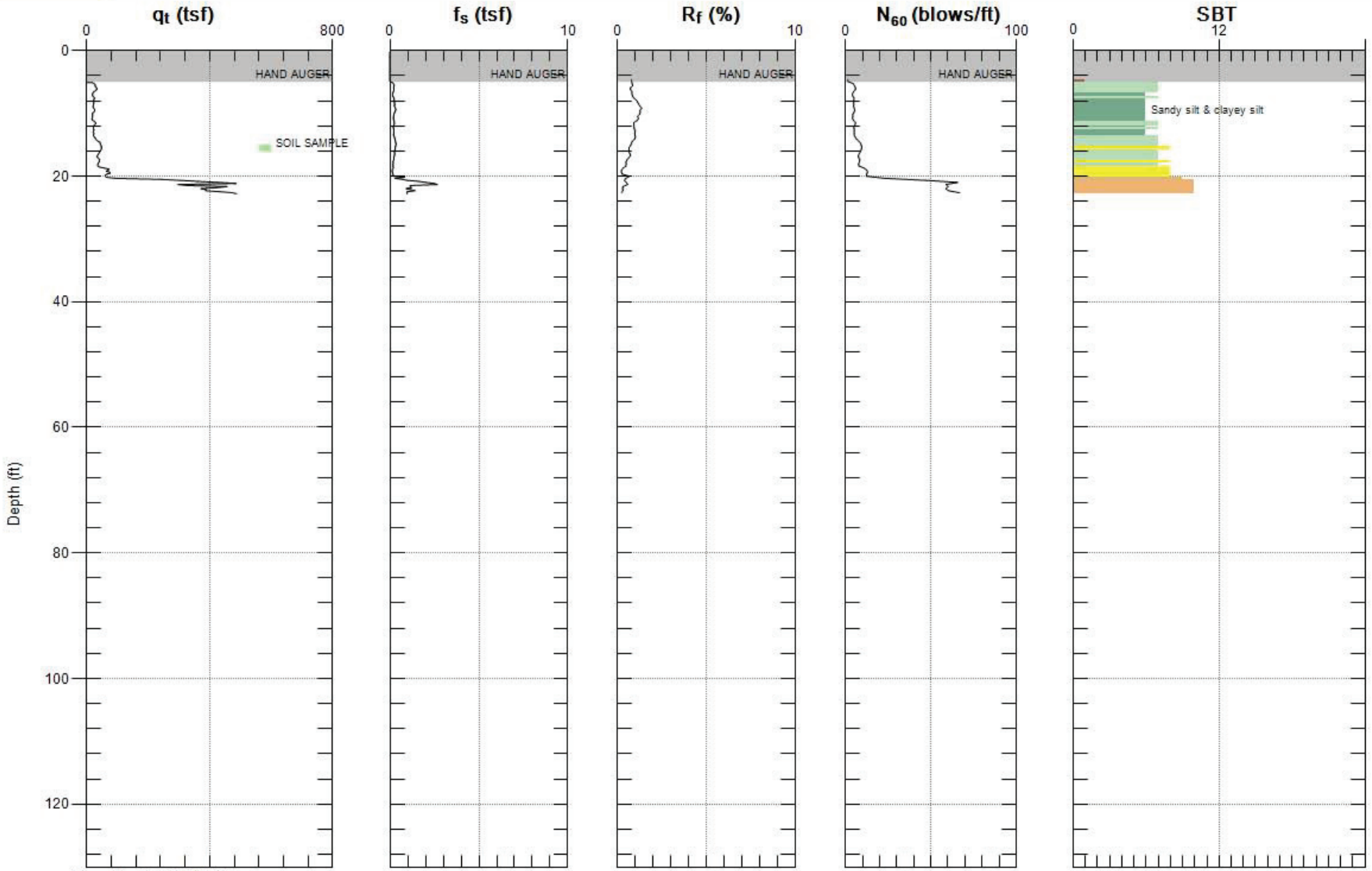
GREGG

URS

ID: SM0007_010C

Site: FEATHER RIVER
Sounding: 2052-00-CPT

Engineer: G.HONG
Date: 9/19/2011 11:57



Max. Depth: 22.802 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

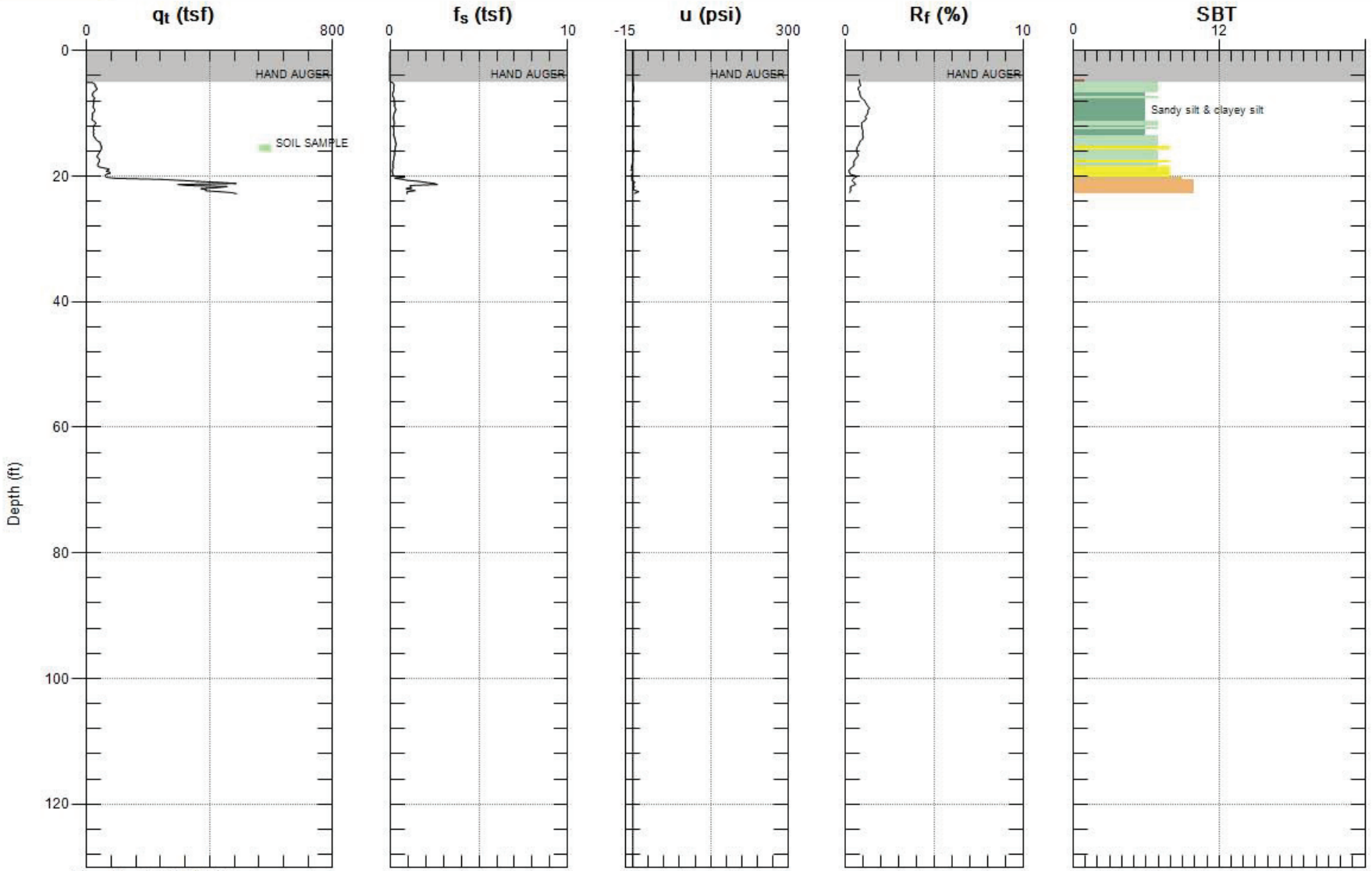
GREGG

URS

ID: SM0007_010C

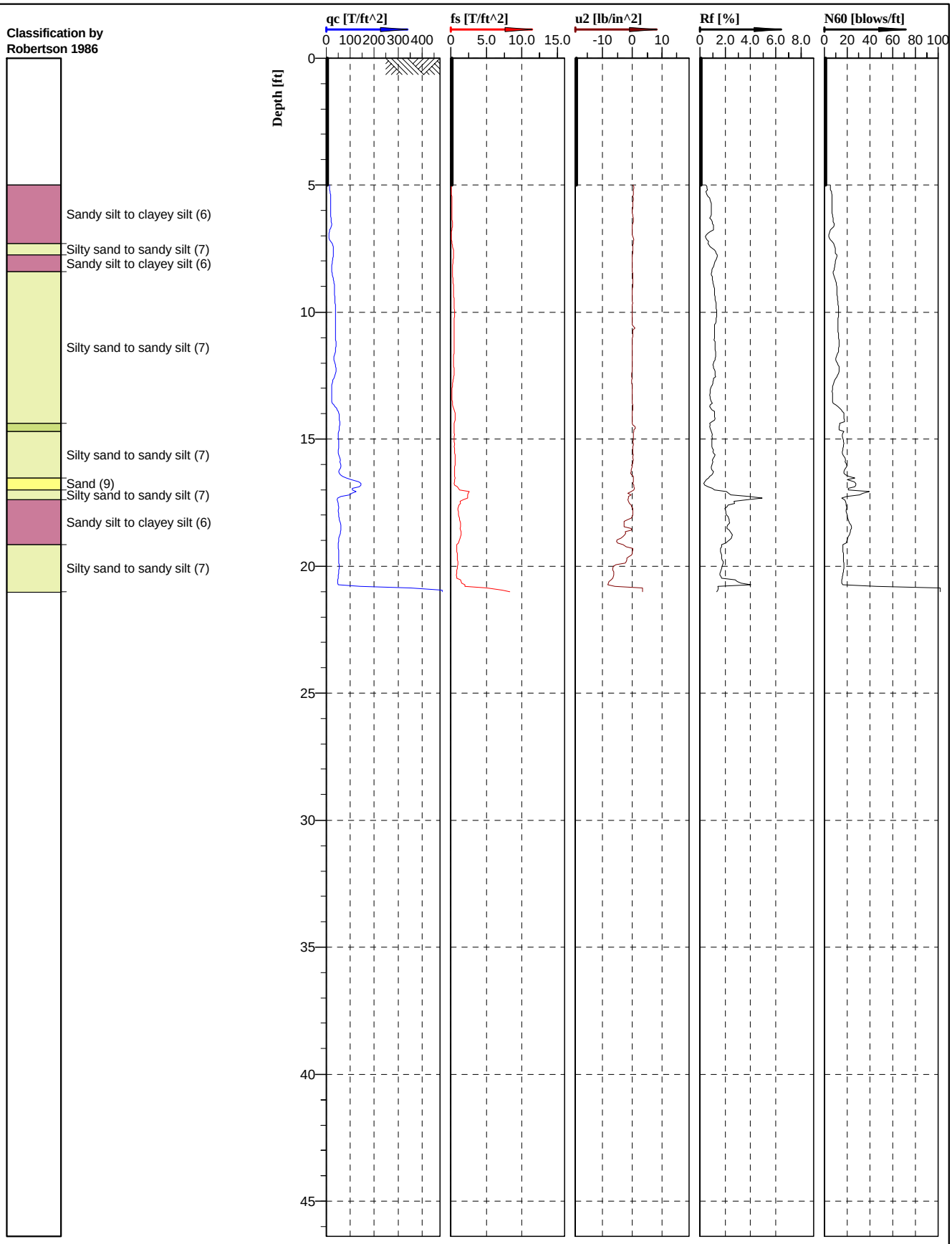
Site: FEATHER RIVER
Sounding: 2052-00-CPT

Engineer: G.HONG
Date: 9/19/2011 11:57



Max. Depth: 22.802 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

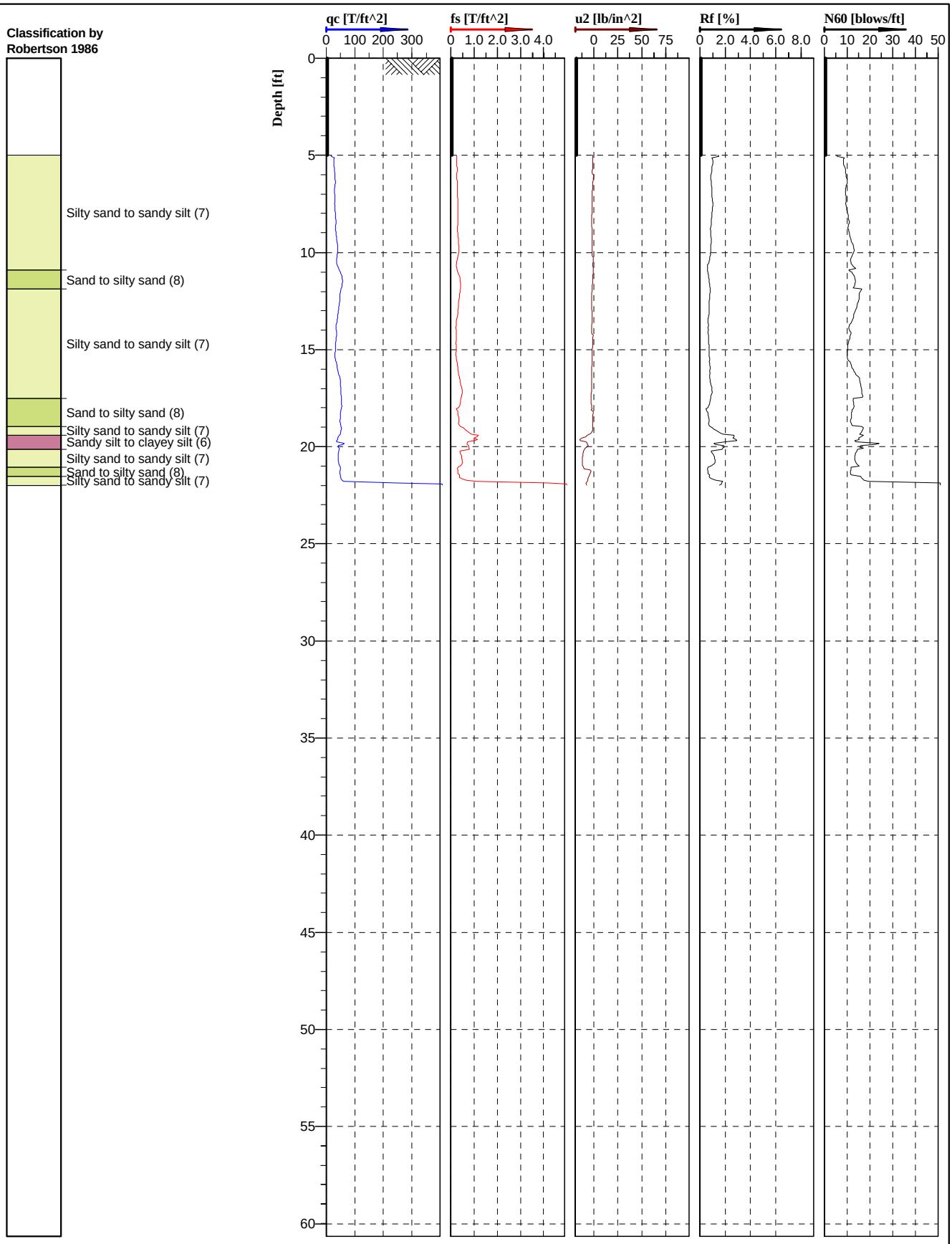


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Gridley (rural), California	Position: SM0007_011C	Ground level:	Test no: 2117_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/29/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 2117_00_CPT.cpd	



CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

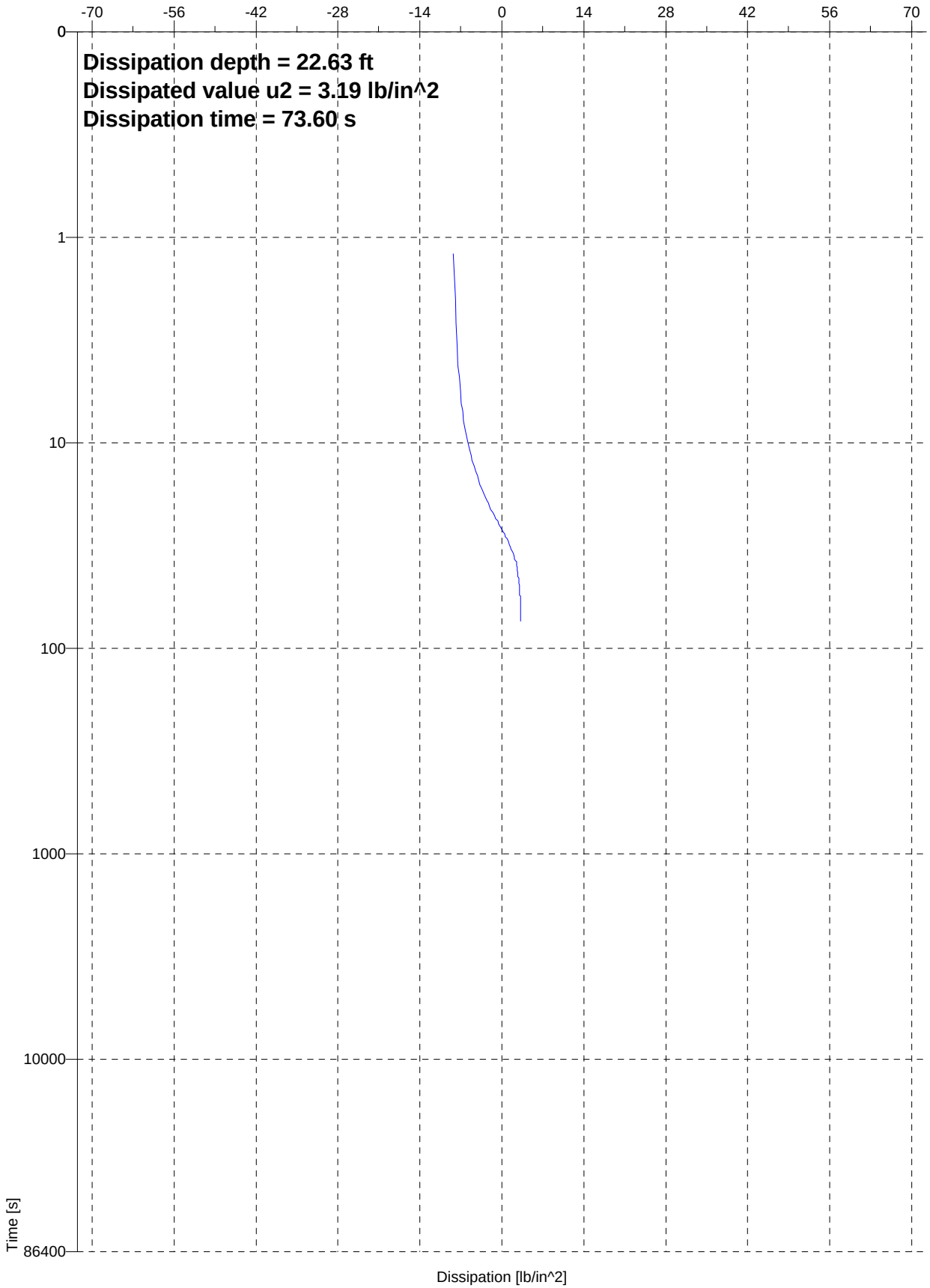
U2

Cone No: 4054
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SM0007_012C	Ground level:	Test no: 2122_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 11/14/2011	Scale: 1 : 85
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 2122_00_CPT.cpd	

APPENDIX I

Task Order 2 and Task Order 4
Pore Pressure Dissipation Test Results

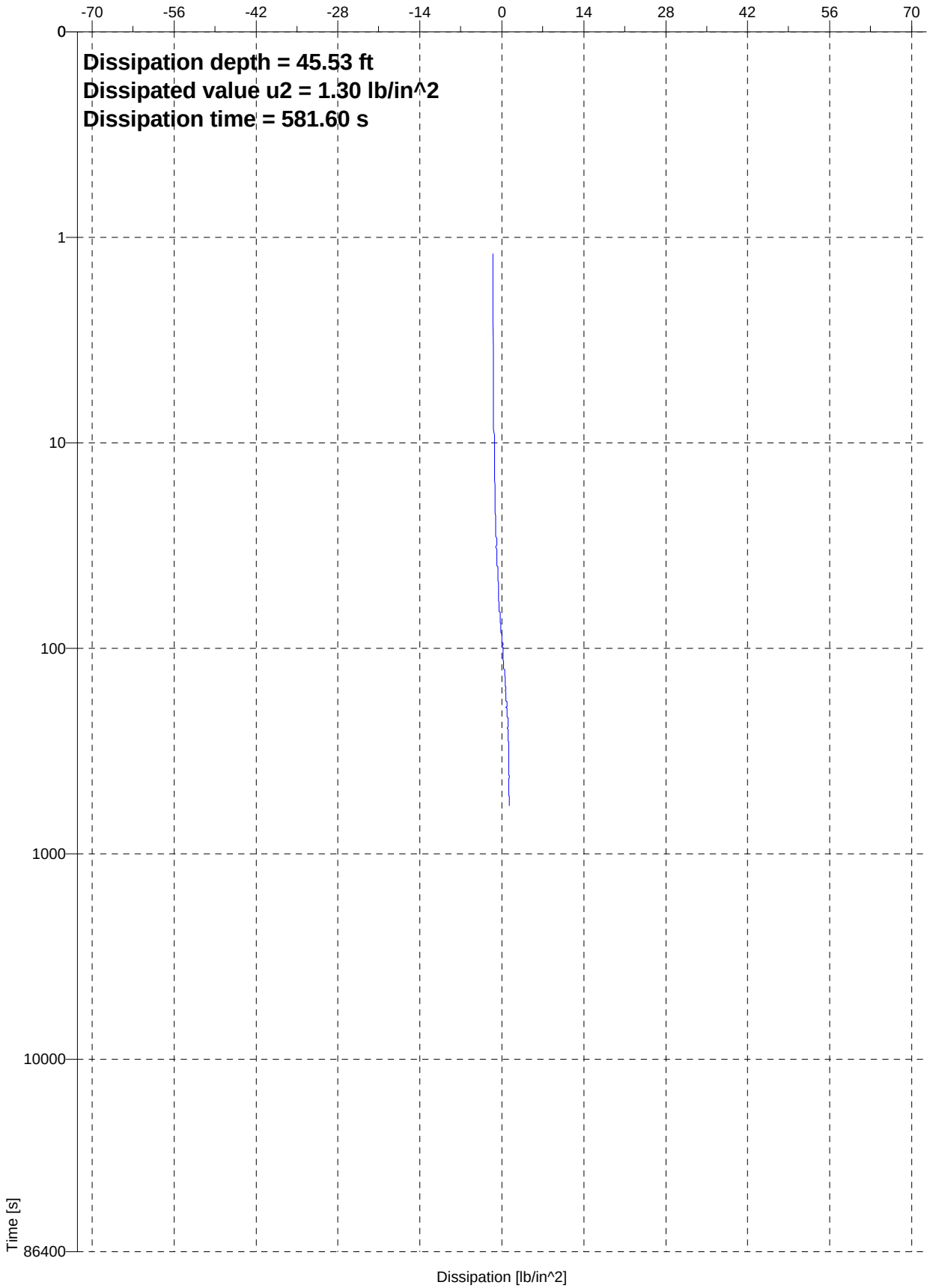


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SM0003_015C	Ground level:	Test no: 92_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/30/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 92_00_CPT.cpd	

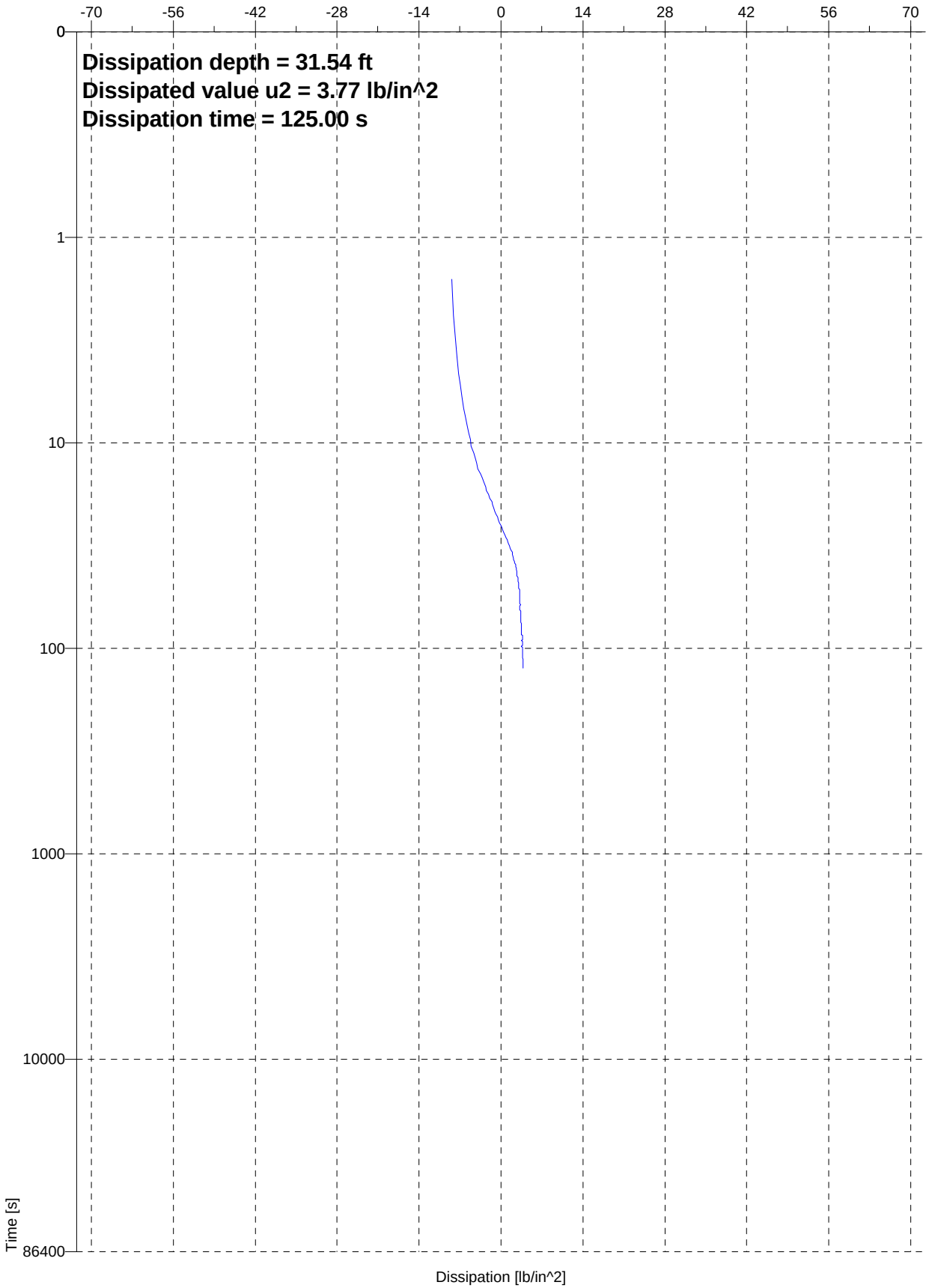


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SL0001_32C	Ground level:	Test no: 802_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 8/2/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 802_00_CPT.cpd	

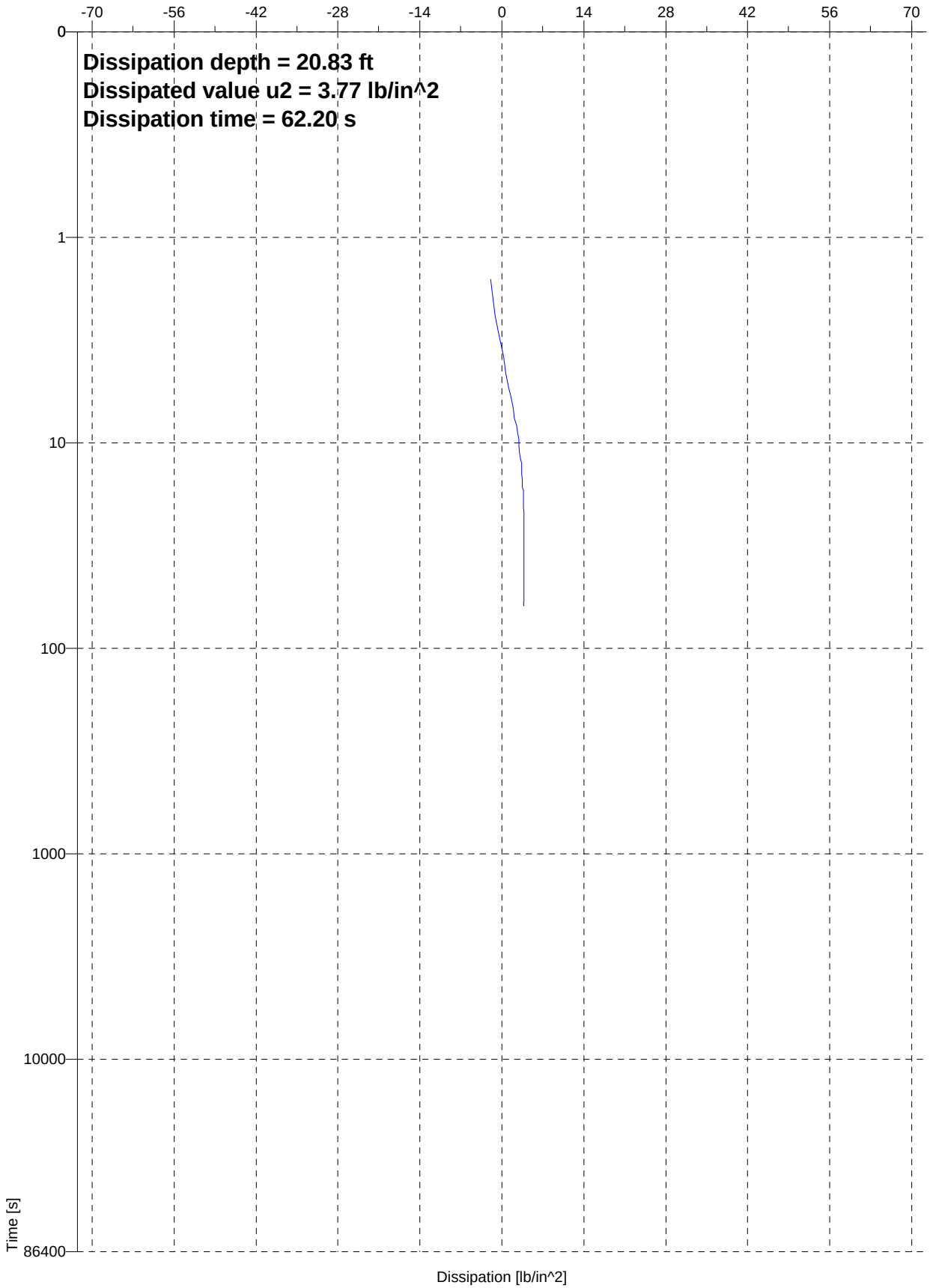


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED



Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Yuba City (rural), California	Position: SL0001_043C	Ground level:	Test no: 802_53_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/28/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 802_53_CPT.cpd	



CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

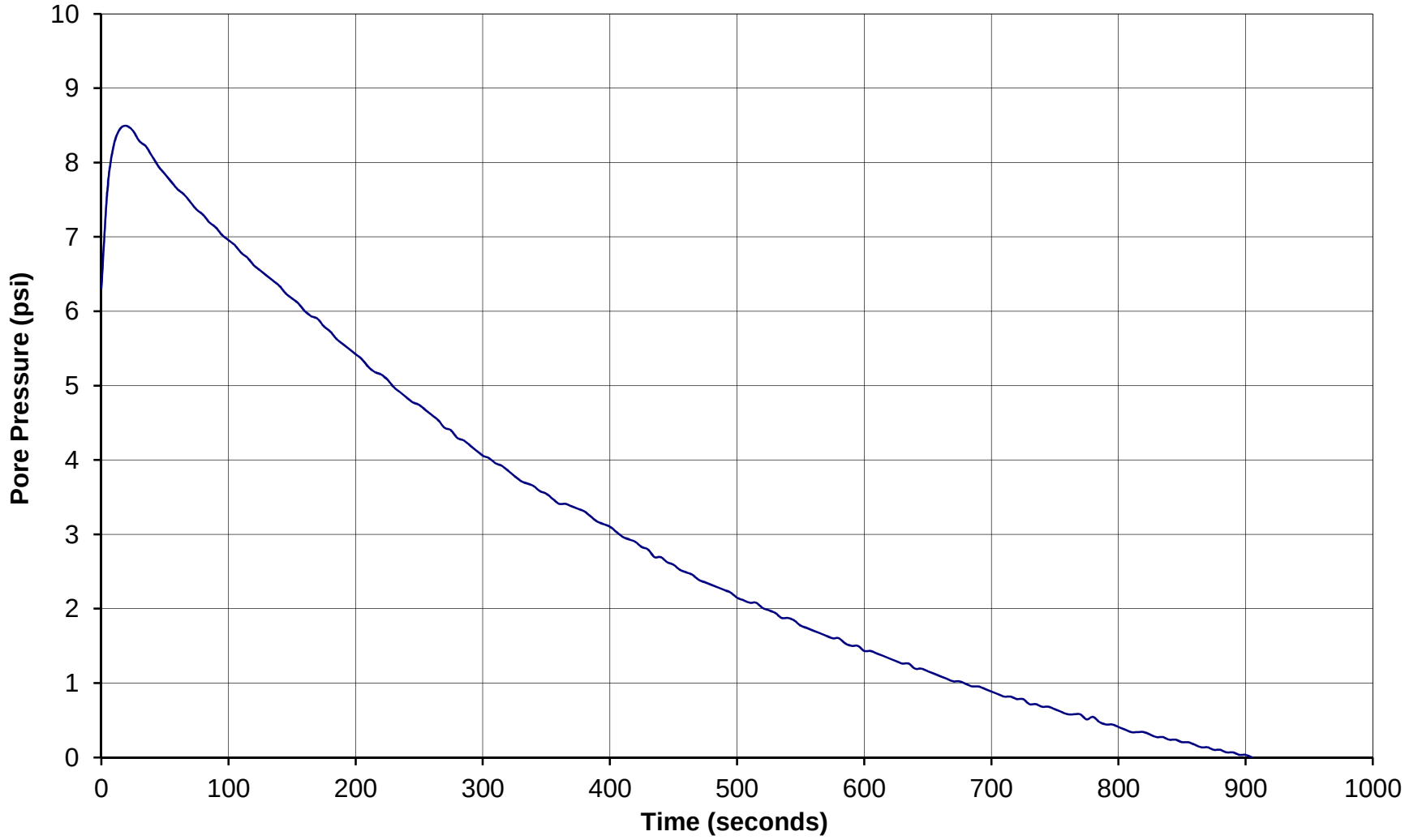
Cone No: 4170
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Gridley (rural), California	Position: SM0007_011C	Ground level:	Test no: 2117_00_CPT
Project ID: 17326605.0305232	Client: URS	Date: 9/29/2011	Scale: 1 : 65
Project: Feather River West Levee Project		Page: 1/1	Fig:
		File: 2117_00_CPT.cpd	

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

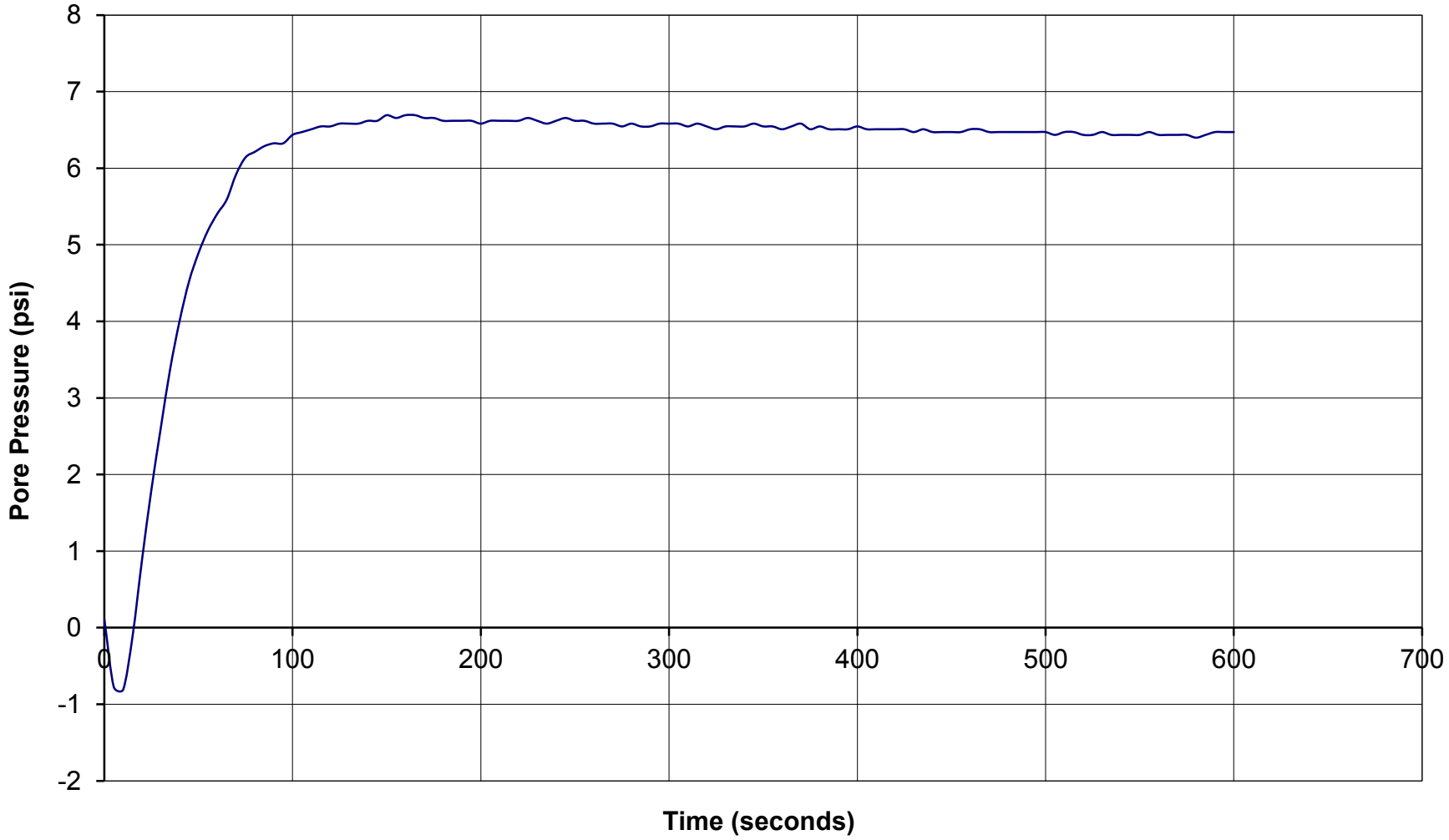
Station:	647+00_CPT
Depth:	75.8
ID:	SL0001_026C
Engineer:	GT HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

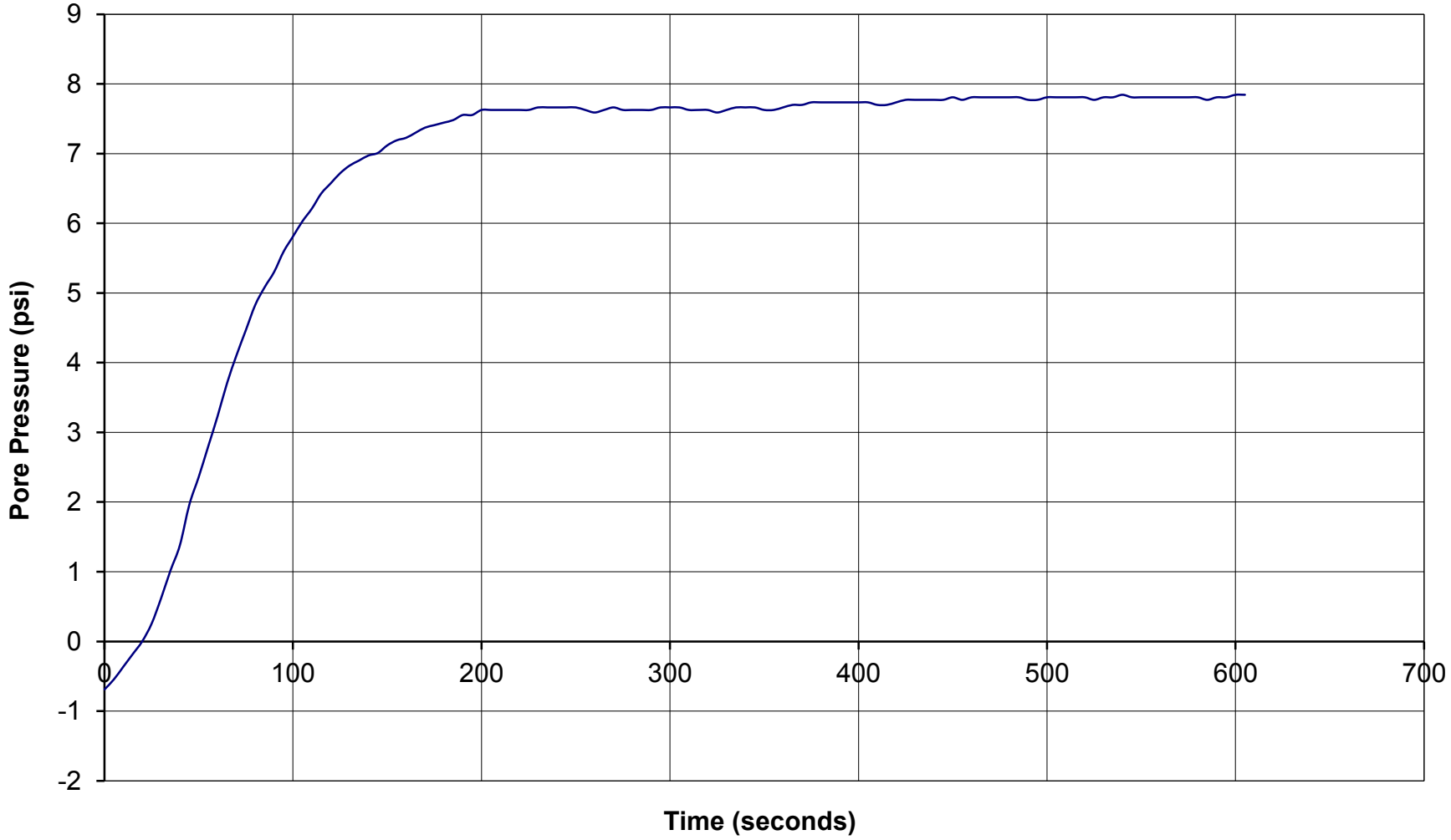
Station:	818+00
Depth:	66.3
ID:	SL0001_033C
Engineer:	GT HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

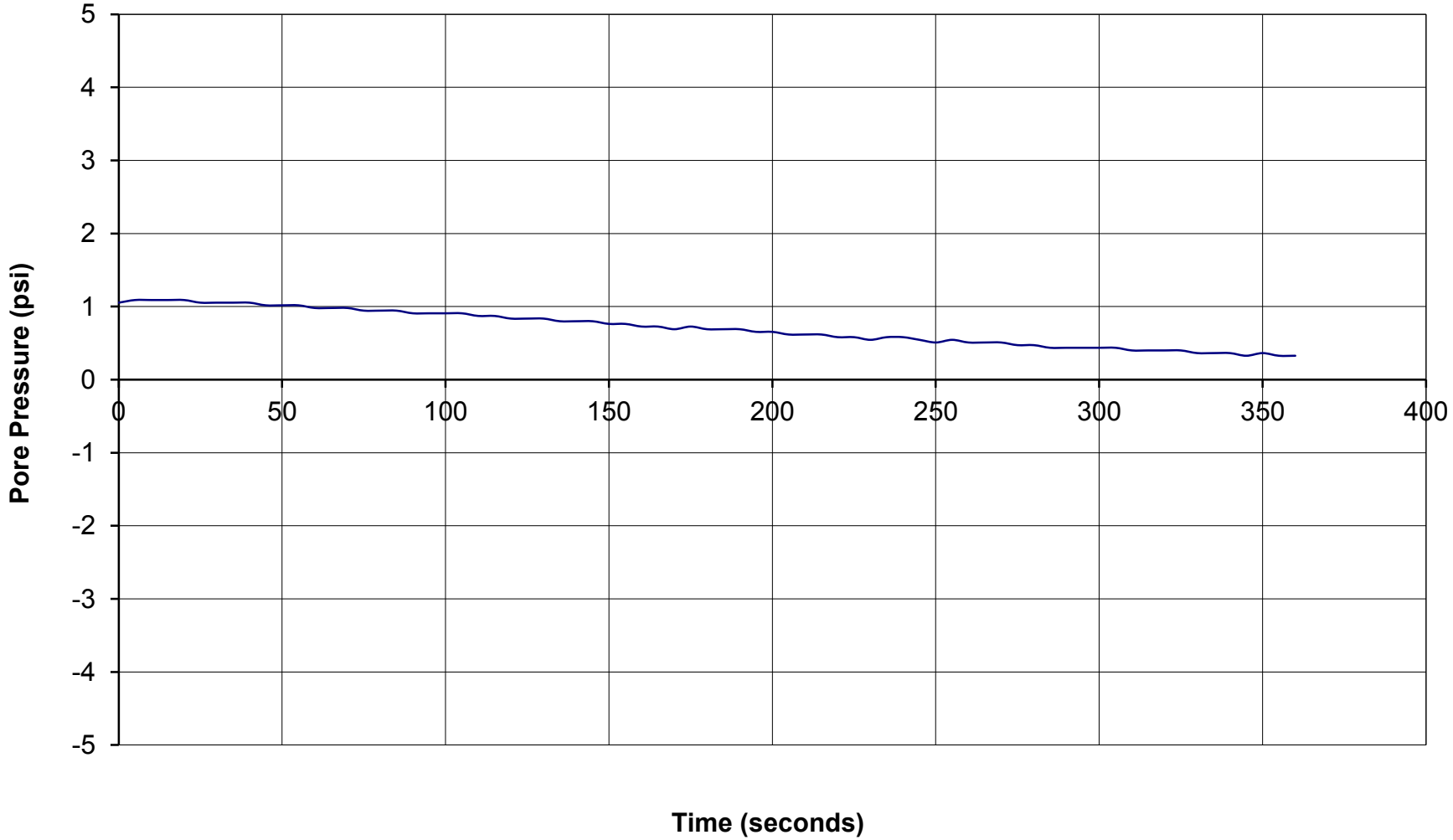
Station: 1007+00
Depth: 65.3
ID: SL0001_039C
Engineer: G.HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

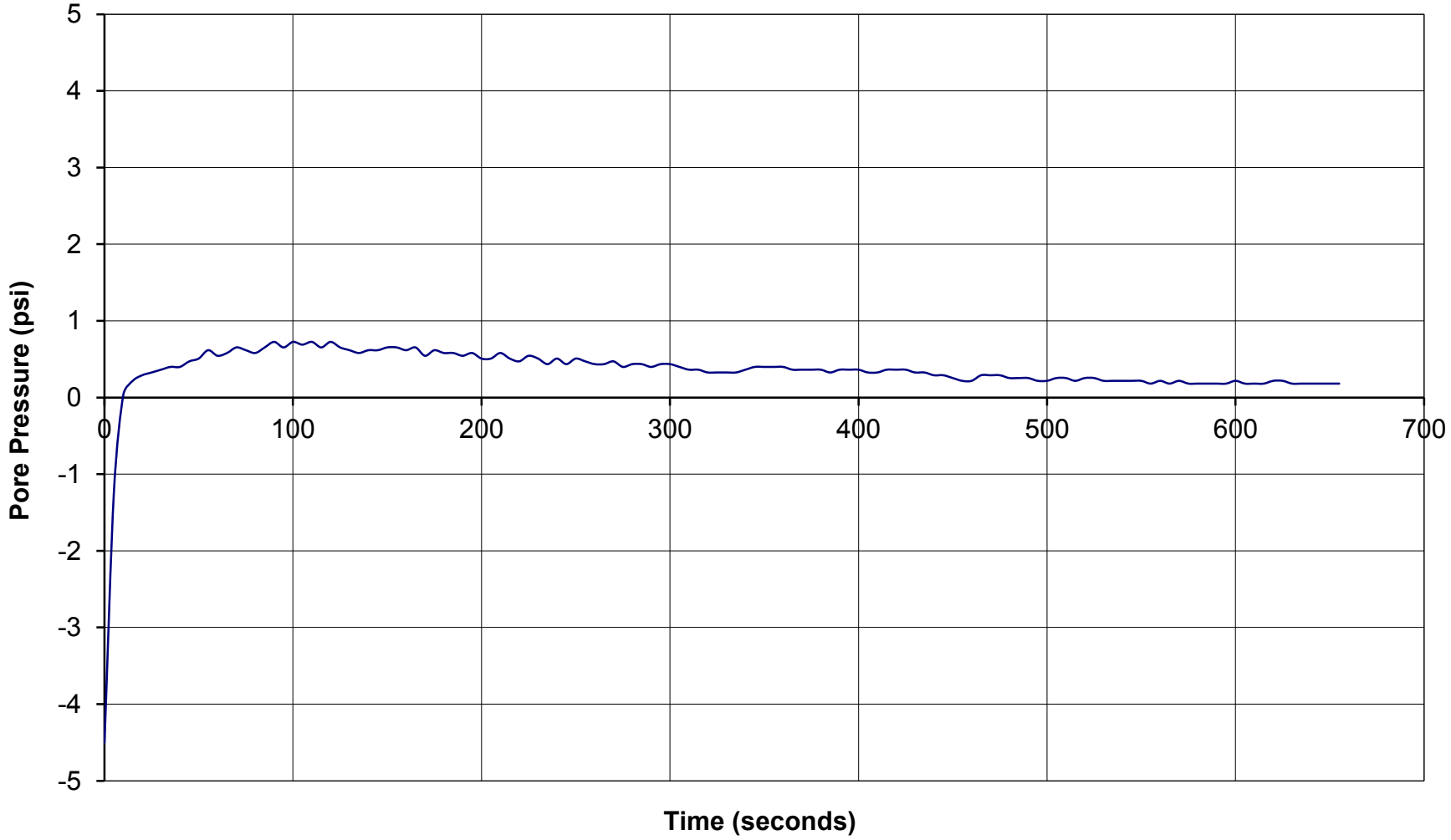
Station: 1994+00
Depth: 19.7
ID: SM0007_007C
Engineer: G.HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

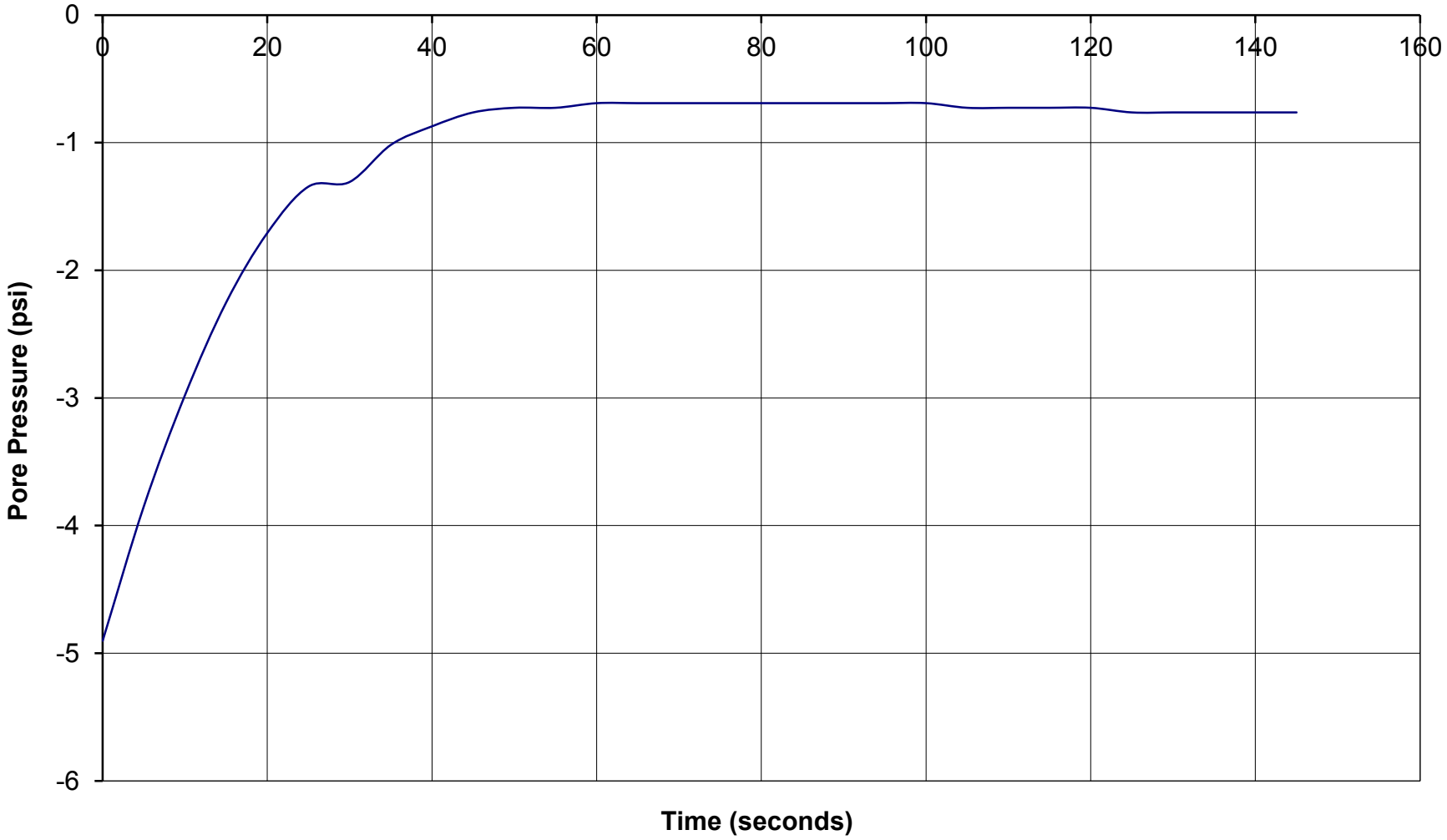
Station: 1999+50
Depth: 24.8
ID: SM0007_008C
Engineer: G.HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

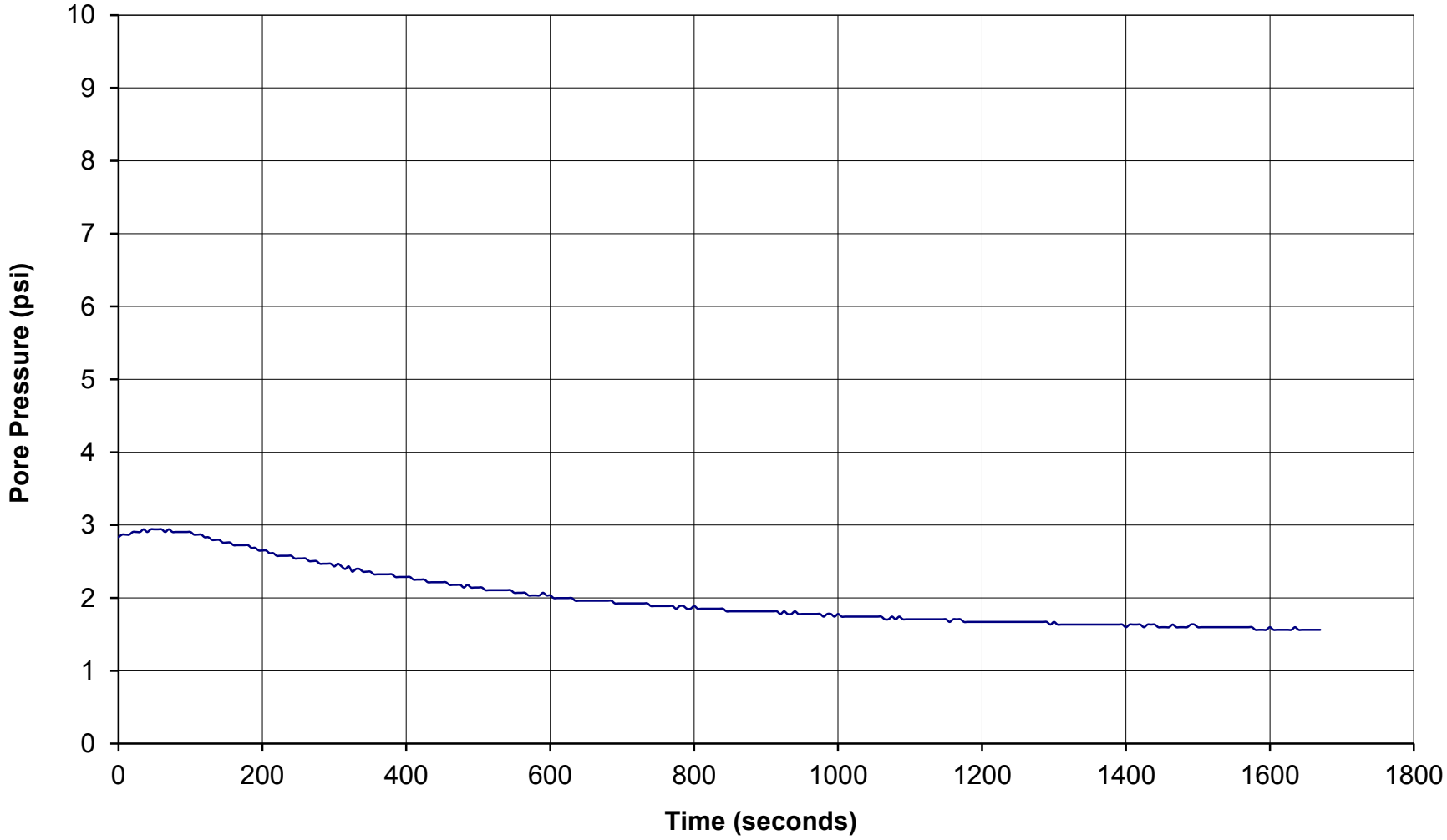
Station: 1999+50
Depth: 21.8
ID: SM0007_008C
Engineer: G.HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

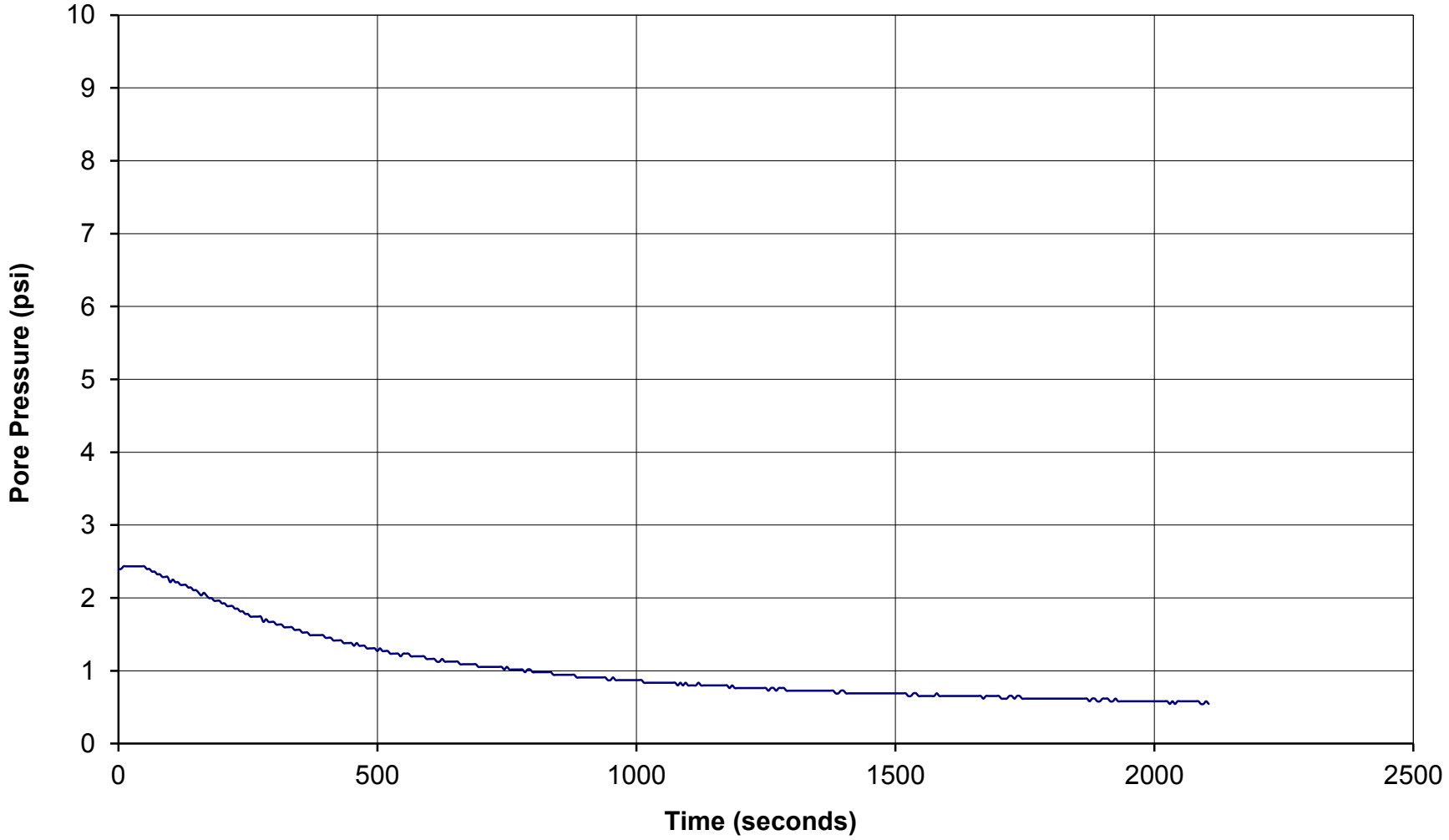
Station: 2020+85
Depth: 24.4
ID: SM0007_009C
Engineer: G.HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

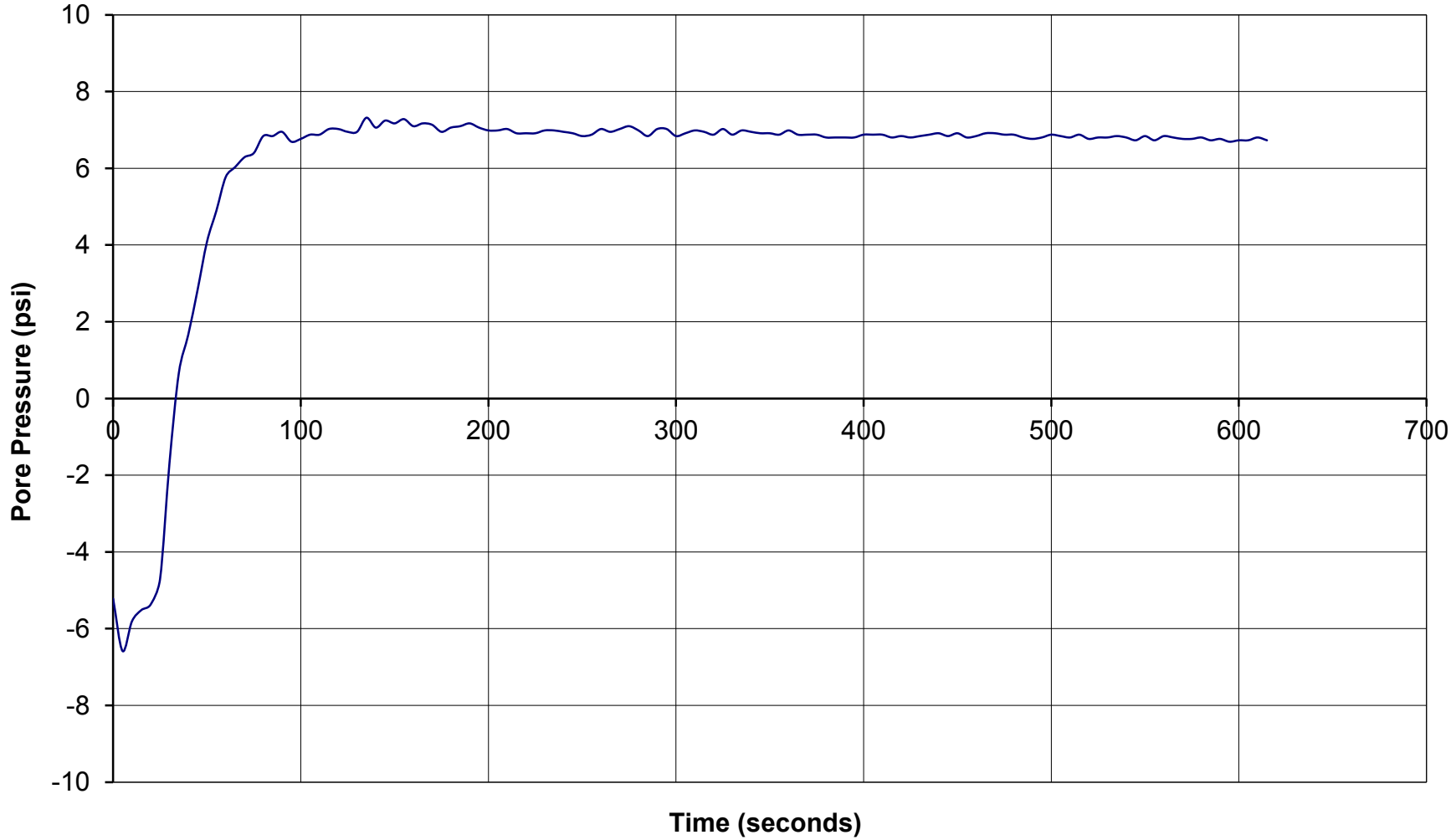
Station: 2051+99
Depth: 22.8
ID: SM0007_010C
Engineer: G.HONG



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Station:	1492+00
Depth:	44.1 ft
ID:	SM0016_005C
Engineer:	GT HONG



APPENDIX J

Task Order 2 and Task Order 4 Laboratory Test Results

BCI Laboratory Schedule
URS Laboratory Schedule 1
URS Laboratory Schedule 2
URS Laboratory Schedule 3
URS Laboratory Schedule 4
URS Laboratory Schedule 5
URS Laboratory Schedule 6
URS Laboratory Schedule 7
URS Laboratory Schedule 8
URS Laboratory Schedule 9

BCI Laboratory Schedule

2491 Boatman Avenue
West Sacramento, CA 95691
www.blackburnconsulting.com

Project Name: Feather River West Levee
BCI Project No: 1967.3
Job No: 17326605.0305233

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Boring	Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Laboratory Pocket Pen. (tsf)
SM0003_001B	1c	1.9-2.5	129.3	108.9	18.8	>4.5
SM0003_001B	3b	6.9-7.5	122.2	94.8	28.8	2.0
SM0003_002B	1c	1.95-2.5	102.3	93.1	9.9	-
SM0003_002B	3c	6.4-7.0	110.1	91.4	20.5	2.0
SM0003_002B	5c	10.9-11.5	118.5	96.7	22.5	3.0
SM0003_003B	1c	1.9-2.5	112.2	91.9	22.0	>4.5
SM0003_003B	5c	11.4-12.0	124.5	101.1	23.1	2.0
SM0003_003B	7b	15.9-16.4	125.2	95.4	31.2	>4.5
SL0001_003B	1b	1.4-1.9	95.0	83.6	13.6	3.5
SL0001_003B	3b	5.9-6.4	101.4	88.4	14.7	2.0
SL0001_003B	3c	6.4-7.0	94.9	87.6	8.4	-
SL0001_003B	7b	15.4-16.0	113.1	90.9	24.4	-
SL0001_003B	17b	37.5-38.0	120.8	93.2	29.6	>4.5
SL0001_004B	1c	1.9-2.5	110.9	104.3	6.3	4.5
SL0001_004B	3b	5.9-6.4	123.0	102.7	19.7	>4.5
SL0001_004B	15a	31.9-32.4	121.9	92.5	31.7	4.0
SL0001_005B	1b	0.9-1.4	90.5	80.2	12.8	2.5
SL0001_005B	3a	5.4-5.9	87.3	74.0	18.0	2.0
SL0001_005B	5a	10.4-10.9	94.0	73.0	28.9	1.0
SL0001_005B	19b	45.15-45.65	121.5	95.5	27.3	4.0
SL0001_006B	1b	0.9-1.4	115.7	100.6	15.0	>4.5
SL0001_006B	3c	6.9-7.5	124.3	99.4	25.0	>4.5
SL0001_007B	1b	0.9-1.4	73.7	59.8	23.2	-
SL0001_007B	3c	5.9-6.5	97.6	72.2	35.3	1.8
SL0001_007B	5c	10.4-11.0	90.3	69.9	29.1	2.3
SL0001_007B	7b	14.4-14.9	108.3	79.6	36.1	3.3
SL0001_007B	11b	23.35-23.91	117.5	90.6	29.7	1.8
SL0001_007B	19b	41.5-42.0	120.8	100.8	19.9	-
SL0001_008B	3b	5.95-6.45	89.6	80.3	11.6	1.5
SL0001_008B	5b	10.35-10.85	101.0	88.0	14.7	1.0
SL0001_008B	7b	14.9-15.4	88.8	82.4	7.8	1.3

2491 Boatman Avenue
West Sacramento, CA 95691
www.blackburnconsulting.com

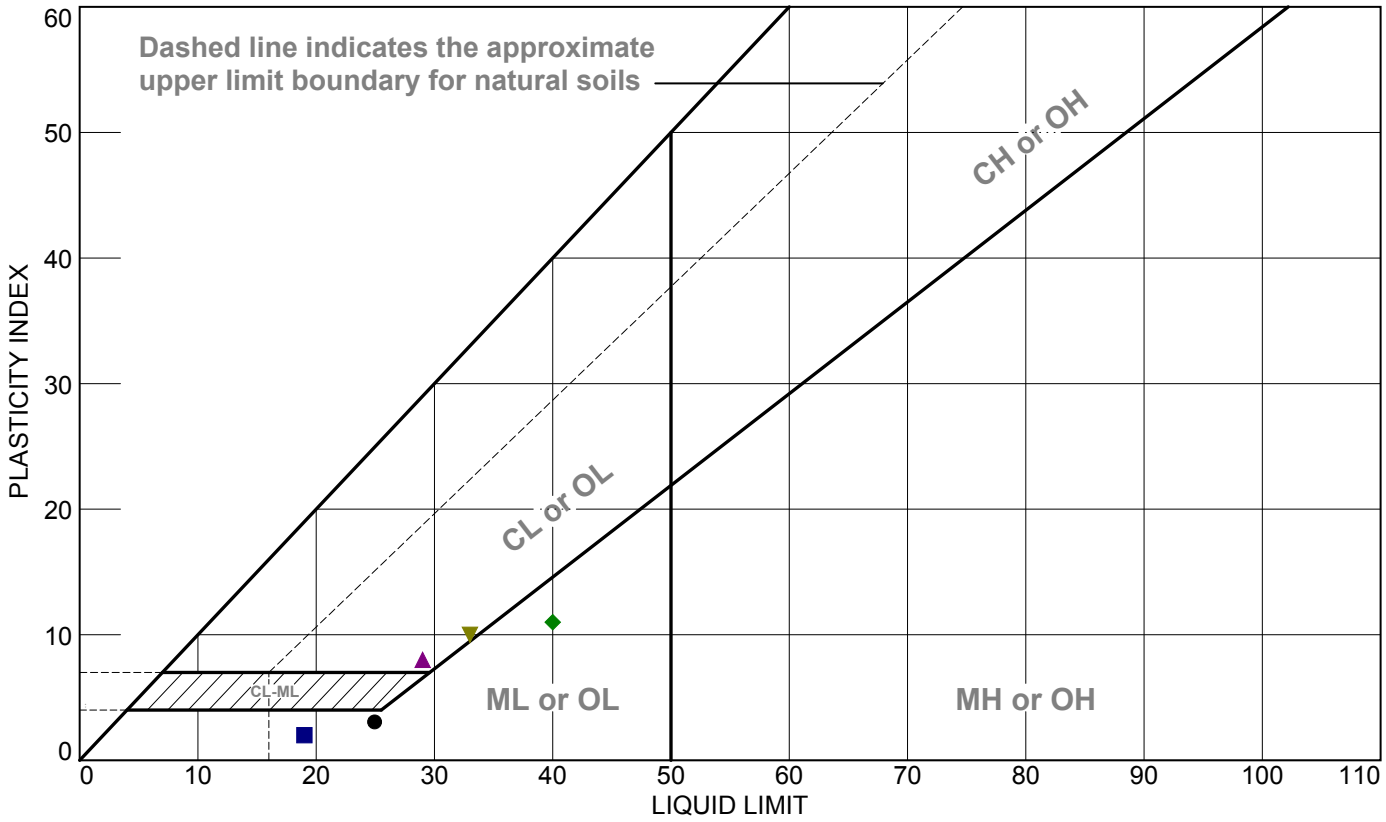
Project Name: Feather River West Levee
BCI Project No: 1967.3
Job No: 17326605.0305233

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Boring	Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Laboratory Pocket Pen. (tsf)
SM0003_015C		0.5-1.5	-	-	15.9	-
SM0003_010C		0.5-1.5	-	-	10.2	-
SM0003_010C		35.5-36.5	-	-	25.8	-
SL0001_042C		13.0-14.0	-	-	36.3	-

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_015C		14.5-15.5'	26.4	22	25	3	ML
■	SM0003_010C		9.0-10'	19.0	17	19	2	SM
▲	SL0001_042C		6.5-7.5'		21	29	8	CL
◆	SL0001_042C		19.0-20.0'		29	40	11	ML
▼	SL0001_042C		20.5-21.0'		23	33	10	CL

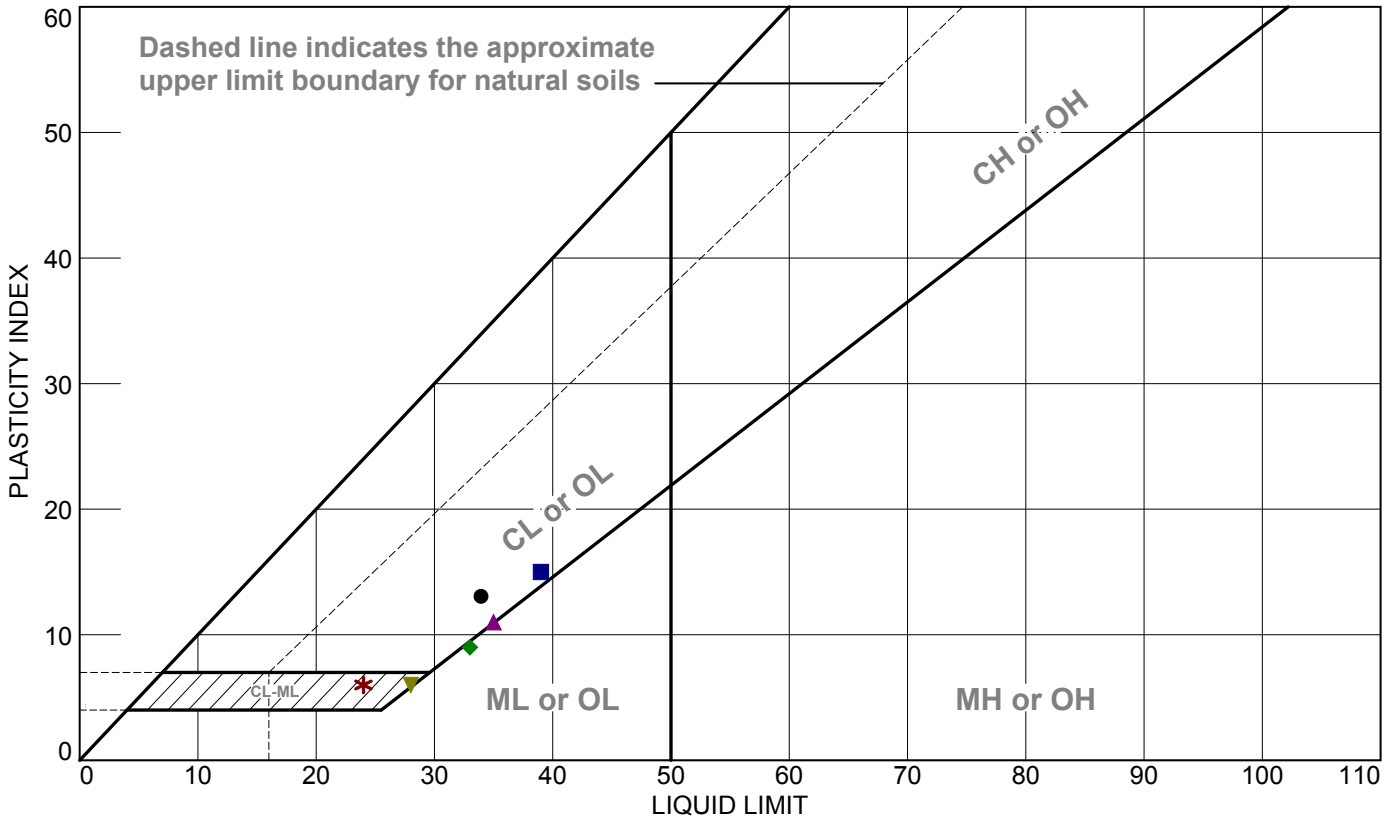
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS3-BCI-1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_001B	1c	1.9-2.5'	18.8	21	34	13	CL
■	SM0003_001B	3b	6.9-7.5'	28.8	24	39	15	CL
▲	SM0003_001B	4	7.5-9.0'	31.7	24	35	11	CL
◆	SM0003_001B	5b	11.4-11.9'	33.1	24	33	9	ML
▼	SM0003_001B	6	12.5-14.0'		22	28	6	CL-ML
✱	SM0003_001B	10	22.5-24.0'	22.5	18	24	6	CL-ML

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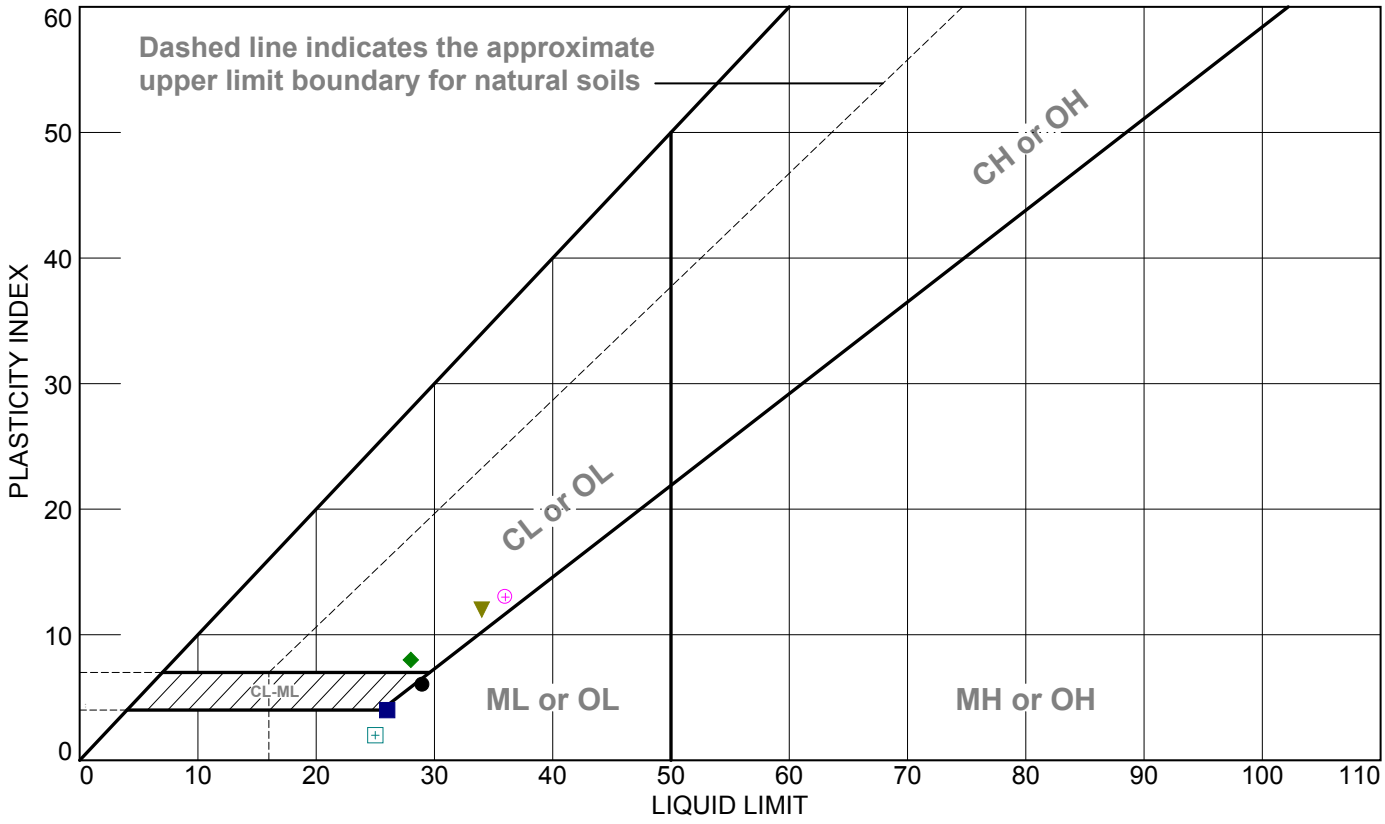
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 7

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_002B	4	7.5-9.0'	22.2	23	29	6	ML
■	SM0003_002B	6	12.0-13.5'	23.4	22	26	4	CL-ML
▲	SM0003_002B	7b	15.0-15.5'	18.0	NP	NV	NP	ML
◆	SM0003_002B	9b	19.35-19.9'	24.7	20	28	8	CL
▼	SM0003_002B	11b	23.9-24.4'	28.6	22	34	12	CL
✱	SM0003_002B	22	48.0-49.5'	24.7	NP	NV	NP	ML
⊕	SM0003_002B	15b	32.8-33.4'	26.7	23	36	13	CL
⊞	SM0003_002B	19b	42.8-43.0'	26.4	23	25	2	ML

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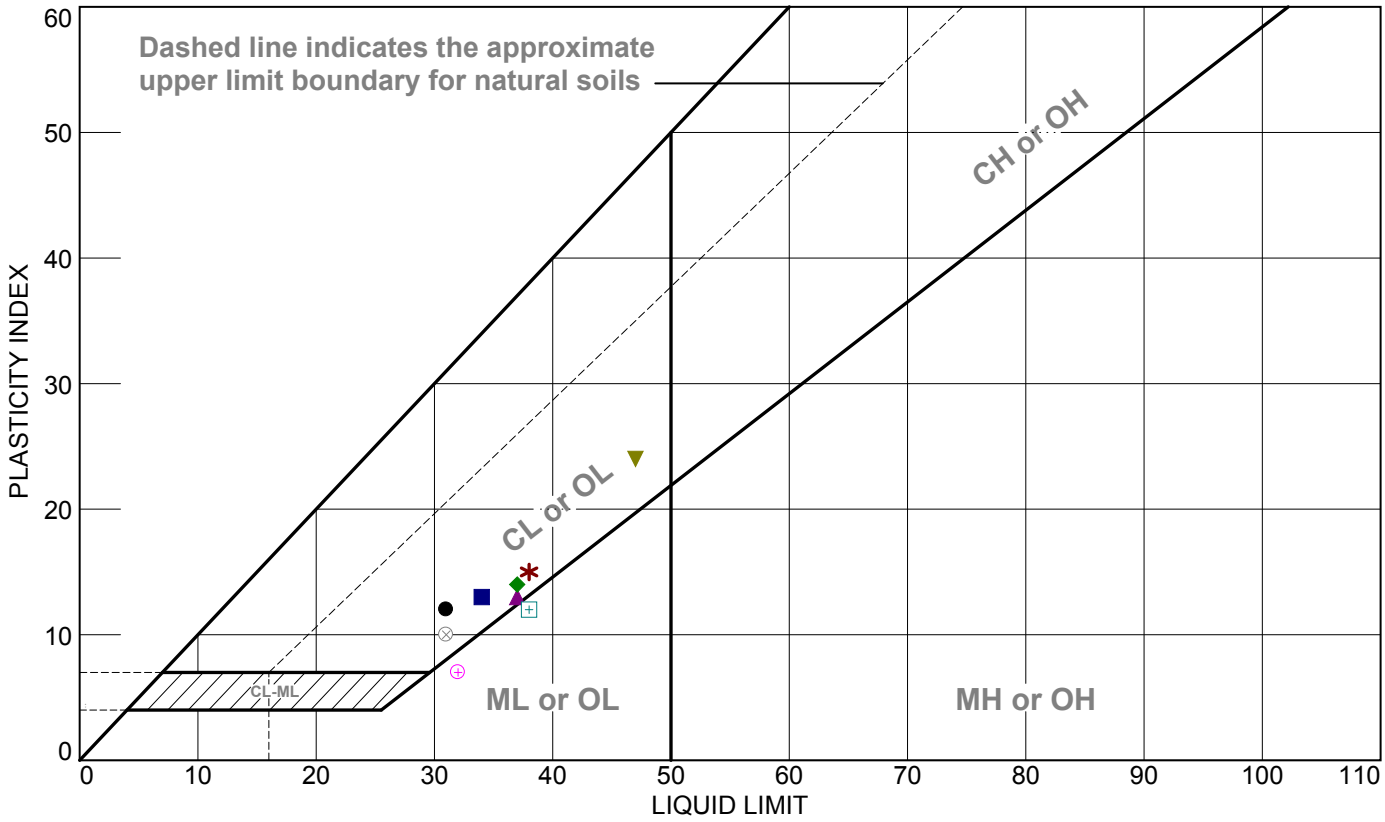
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 8

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

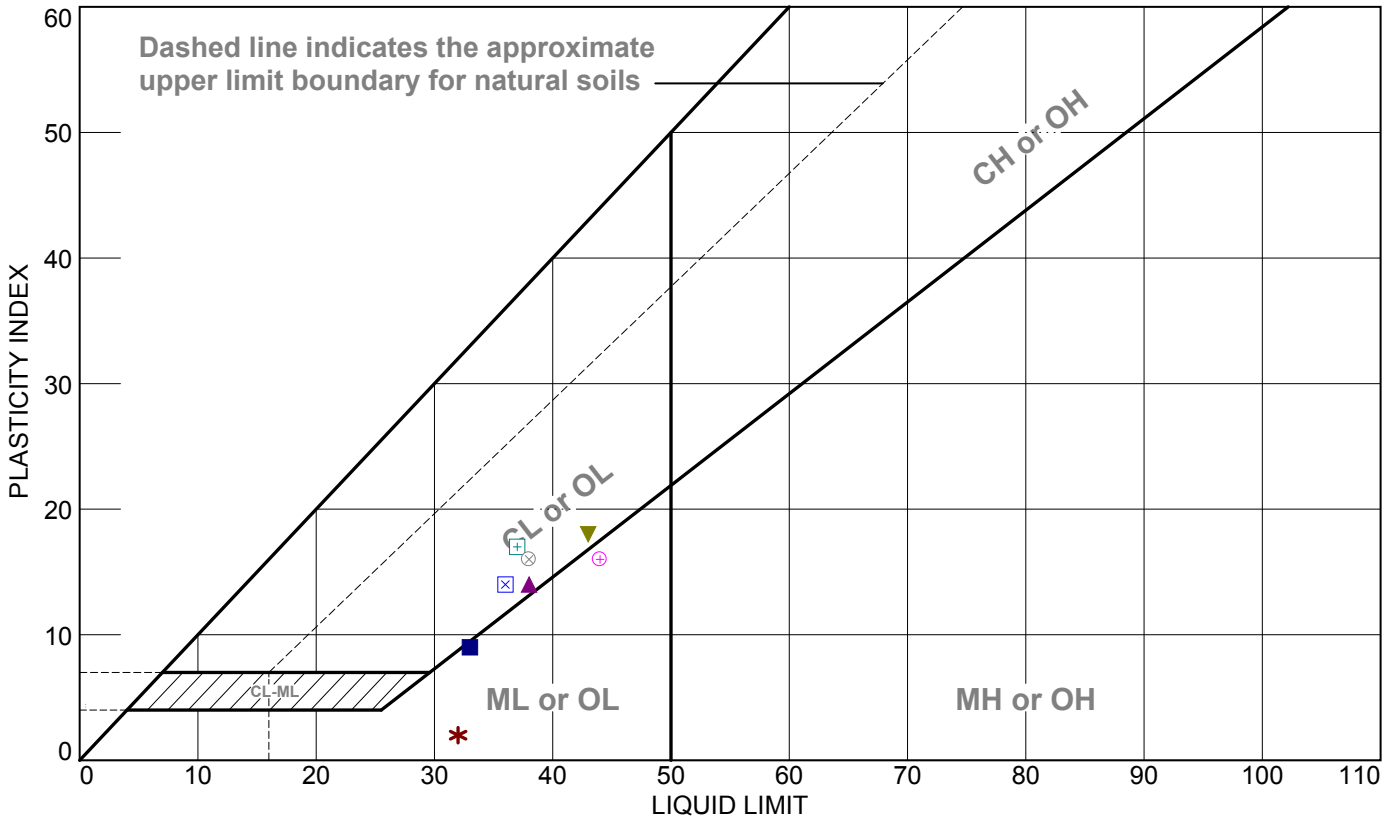
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0003_003B	1a	0.9-1.4'	12.4	19	31	12	CL
■	SM0003_003B	1b	1.4-1.9'	15.9	21	34	13	CL
▲	SM0003_003B	1c	1.9-2.5'	22.0	24	37	13	CL
◆	SM0003_003B	2	2.5-4.0'		23	37	14	CL
▼	SM0003_003B	5c	11.4-12.0'	23.1	23	47	24	CL
✱	SM0003_003B	7b	16.0-16.4'	31.2	23	38	15	CL
⊕	SM0003_003B	9a	20.4-20.9'	35.9	25	32	7	ML
⊞	SM0003_003B	9c	21.4-22.0'	41.3	26	38	12	ML
⊗	SM0003_003B	13b	30.9-31.4'	33.1	21	31	10	CL
⊠	SM0003_003B	21	50.0-51.5'	21.6				SP-SM

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Client: URS
Project: Feather River West Levee
Project No.: 1967.3 **Figure** 9

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_003B	1b	1.4-1.9'	13.6				ML
■	SL0001_003B	7b	15.4-16.0'	24.4	24	33	9	ML
▲	SL0001_003B	9b	19.5-20.0'	24.3	24	38	14	CL
◆	SL0001_003B	13b	28.4-28.9'	19.2	NP	NV	NP	ML
▼	SL0001_003B	14	30.03-31.5'		25	43	18	CL
✱	SL0001_003B	15c	33.4-34.0'	31.4	30	32	2	ML
⊕	SL0001_003B	18	39.0-40.5'		28	44	16	ML
⊞	SL0001_003B	19b	41.9-42.4'	23.9	20	37	17	CL
⊗	SL0001_003B	20	43.5-45.0'		22	38	16	CL
⊠	SL0001_003B	21b	46.4-46.9'	29.8	22	36	14	CL

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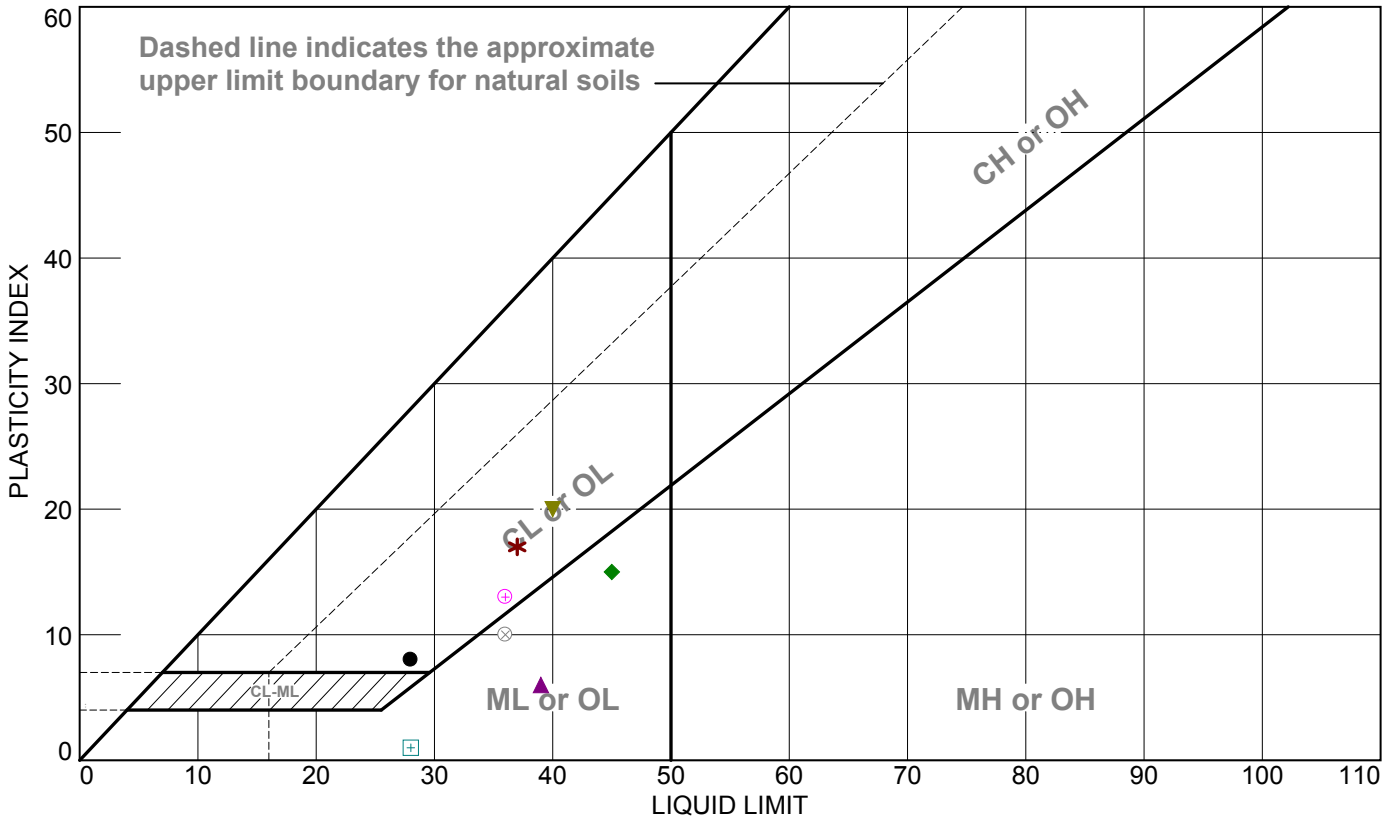
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_004B	1c	1.9-2.5'	6.3	20	28	8	CL
■	SL0001_004B	3b	5.9-6.4	19.7	NP	NV	NP	ML
▲	SL0001_004B	5c	10.4-11.0'	33.7	33	39	6	ML
◆	SL0001_004B	9b	18.4-18.9'	39.3	30	45	15	ML
▼	SL0001_004B	13b	27.4-27.9'	31.9	20	40	20	CL
✱	SL0001_004B	14	28.5-30.0'	31.0	20	37	17	CL
⊕	SL0001_004B	15a	31.9-32.4'		23	36	13	CL
⊞	SL0001_004B	17a	36.9-37.4'	31.8	27	28	1	ML
⊗	SL0001_004B	16	33.5-35.0'	37.1	26	36	10	ML
⊠	SL0001_004B	18	38.5-40.0'	30.4				ML

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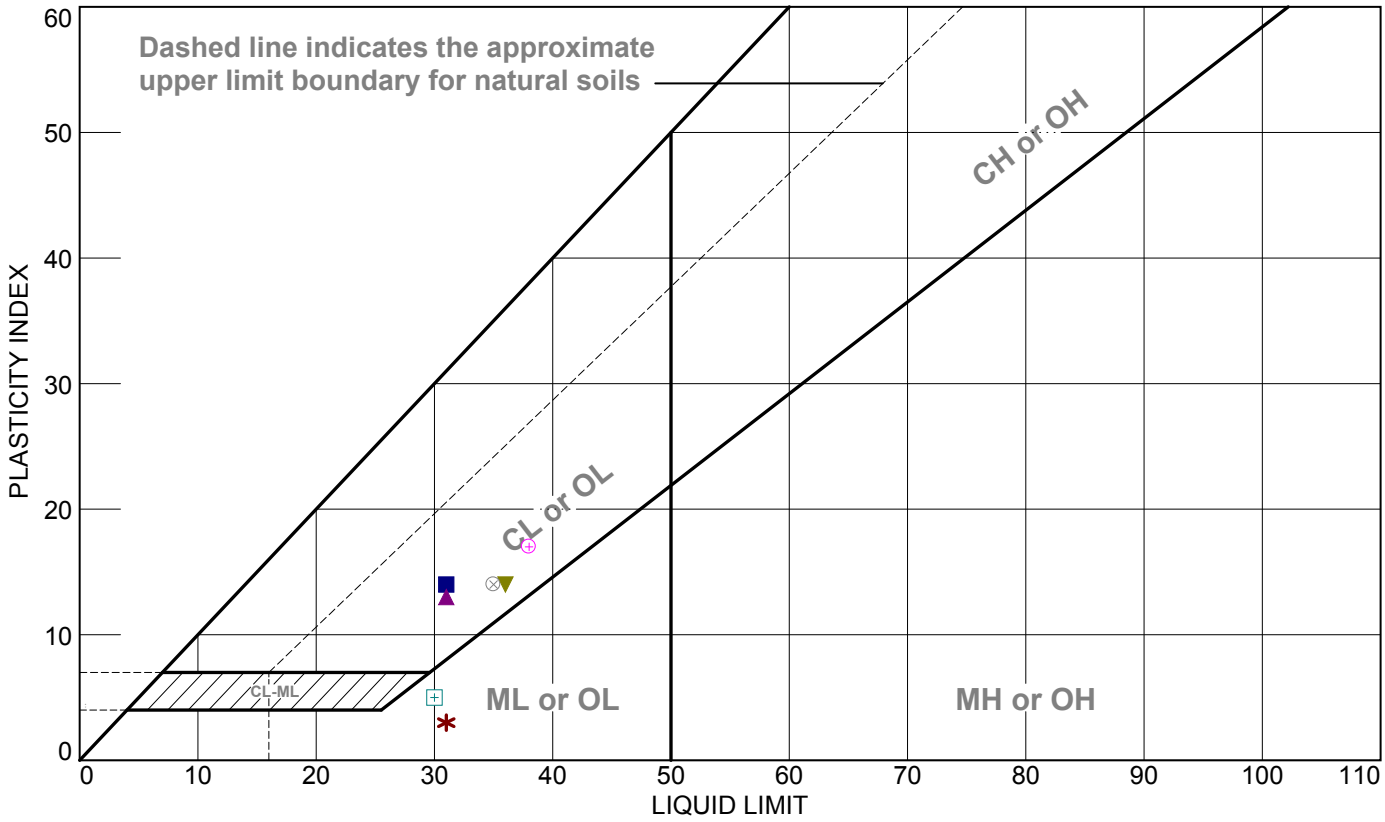
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 2

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_005B	4	7.0-8.5'	18.9				SC
■	SL0001_005B	9a	20.4-20.9'	20.8	17	31	14	CL
▲	SL0001_005B	10	22.0-23.5'	23.0	18	31	13	CL
◆	SL0001_005B	12	27.0-28.5'	22.1	NP	NV	NP	ML
▼	SL0001_005B	14	32.0-33.5		22	36	14	CL
✱	SL0001_005B	18	40.5-42.0'	31.1	28	31	3	ML
⊕	SL0001_005B	19b	45.15-45.65'	27.3	21	38	17	CL
⊞	SL0001_005B	22	51.0-52.5'	32.4	25	30	5	ML
⊗	SL0001_005B	21b	49.9-50.4'	29.8	21	35	14	CL

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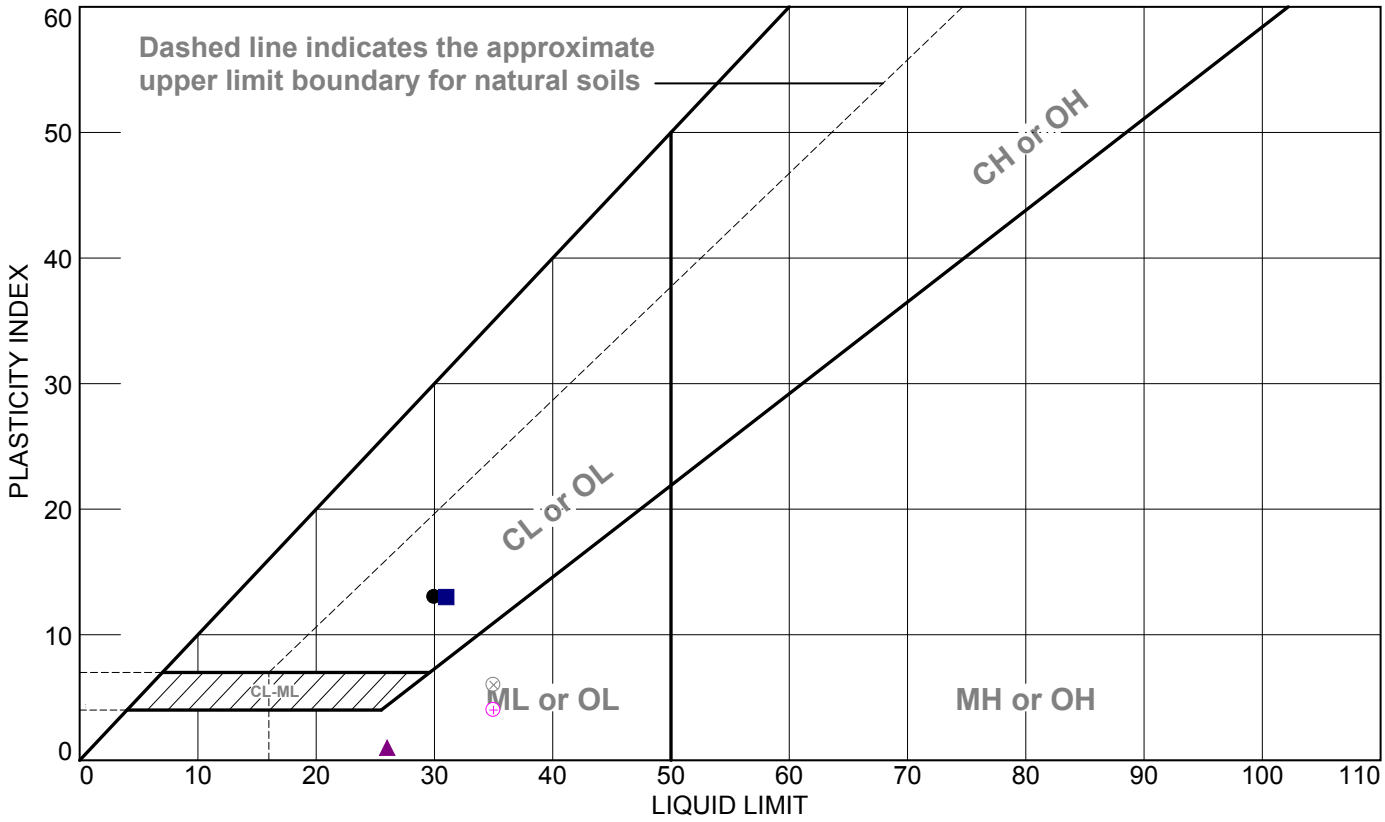
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 3

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_006B	1b	0.9-1.4'	15.0	17	30	13	CL
■	SL0001_006B	3a	5.9-6.4'	20.3	18	31	13	CL
▲	SL0001_006B	3c	6.9-7.5'	25.0	25	26	1	ML
◆	SL0001_006B	4	7.5-9.0'	20.1	NP	NV	NP	ML
▼	SL0001_006B	5b	11.4-11.9'	36.2				ML
✱	SL0001_006B	5c	11.9-12.5'	38.0				ML
⊕	SL0001_006B	6	12.5-14.0'		31	35	4	ML
⊞	SL0001_006B	7c	15.4-16.0'	30.9				CL
⊗	SL0001_006B	8	16.0-17.5'		29	35	6	ML
⊠	SL0001_006B	10	21.0-22.5'	24.0				SP-SM

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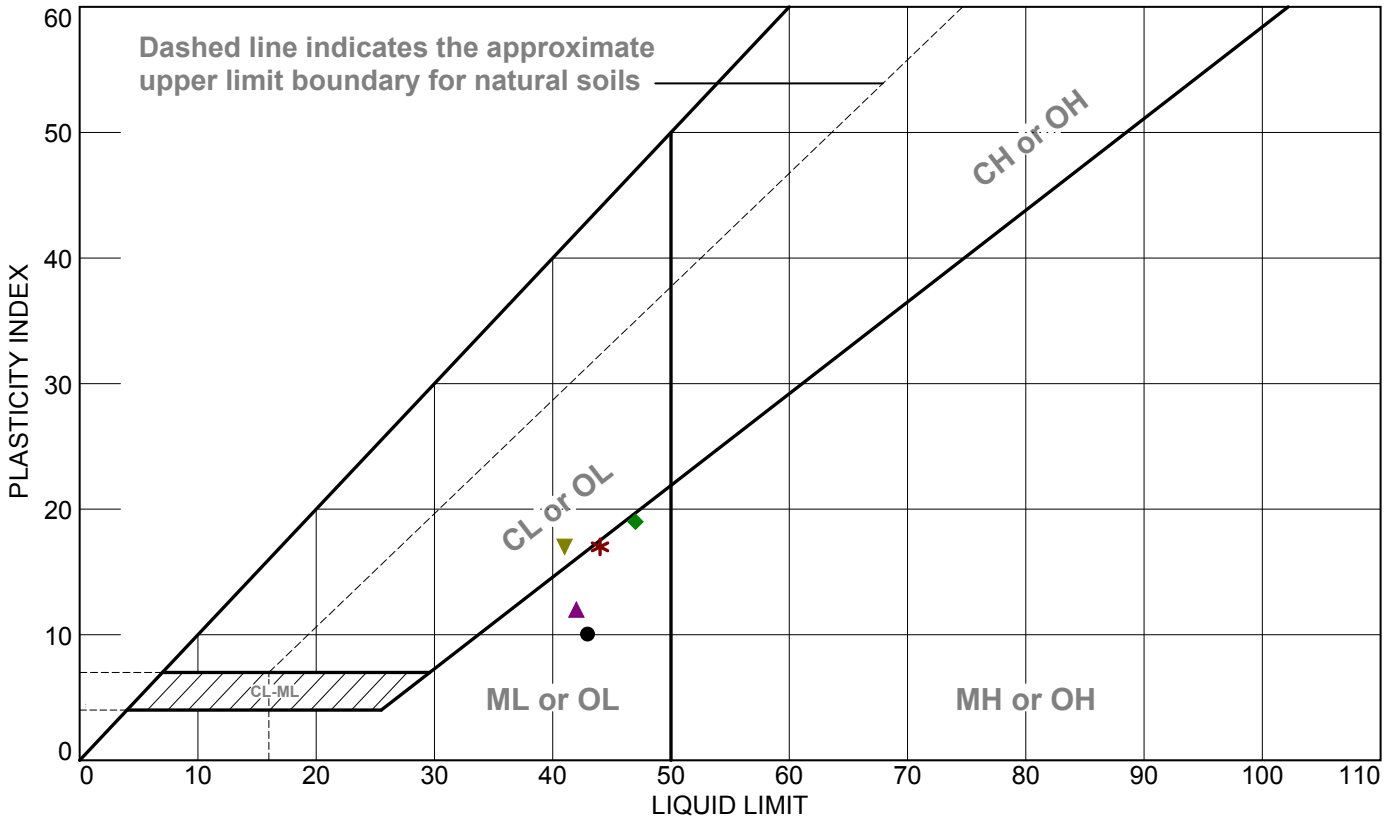
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 4

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_007B	1c	1.55-2.0'	25.1	33	43	10	ML
■	SL0001_007B	2	2.5-4.0'	23.3				CL
▲	SL0001_007B	4	7.0-8.5'		30	42	12	ML
◆	SL0001_007B	7b	13.5-15.5'	36.1	28	47	19	ML
▼	SL0001_007B	11b	23.35-23.9'	29.7	24	41	17	CL
✱	SL0001_007B	13b	27.6-28.2'	26.5	27	44	17	ML
⊕	SL0001_007B	15b	32.4-32.9'	35.2	NP	NV	NP	ML
⊞	SL0001_007B	17b	36.9-37.4'	33.2				SM
⊗	SL0001_007B	19b	41.5-42.0'	19.9				SP
⊠	SL0001_007B	22	47.5-49.0'	26.9				SM

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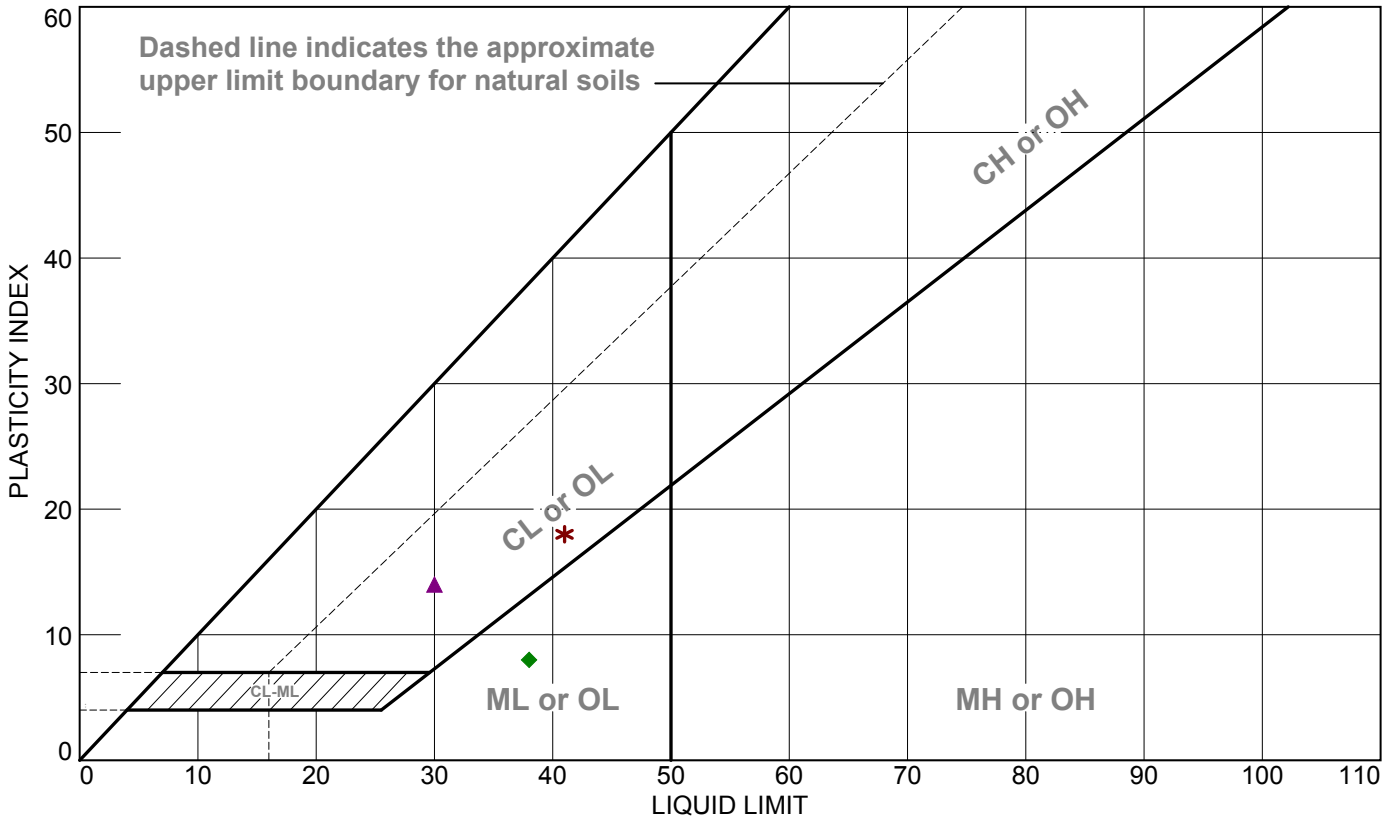
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 5

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_008B	1c	1.9-2.5'	16.8				ML
■	SL0001_008B	9b	19.4-19.9'	20.0				ML
▲	SL0001_008B	9c	19.9-20.4'	18.4	16	30	14	CL
◆	SL0001_008B	13b	28.4-28.9'	34.3	30	38	8	ML
▼	SL0001_008B	15b	32.9-33.4'	32.9				SP
✱	SL0001_008B	17b	37.4-37.9'	31.5	23	41	18	CL
⊕	SL0001_008B	19b		30.8				SP-SM

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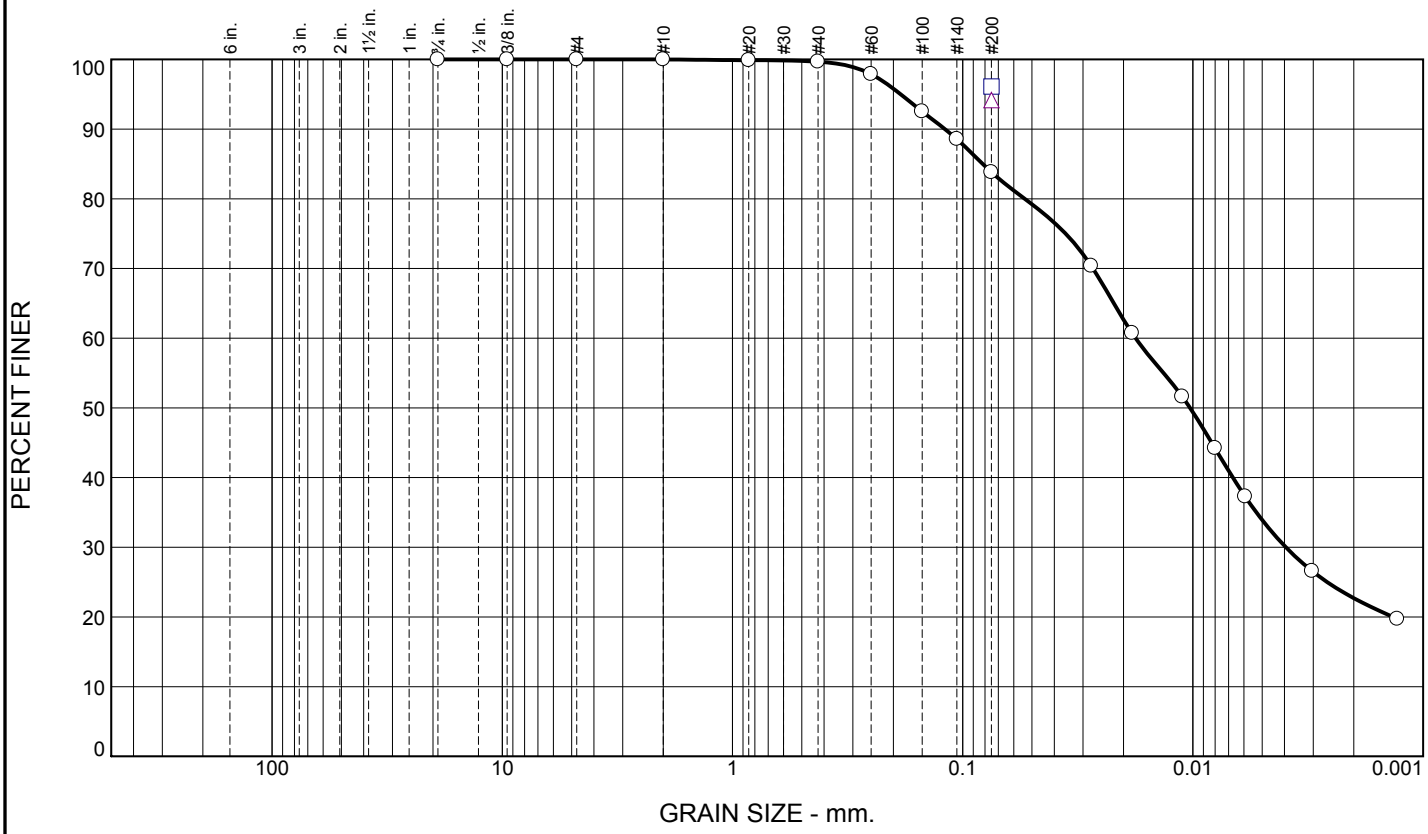
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 6

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	16.2	49.9	33.9	CL	34	21	13
□						CL	39	24	15
△						CL	35	24	11

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	100.0		
GRAIN SIZE			
D_{60}	0.0177		
D_{30}	0.0039		
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.7		
#60	97.9		
#100	92.5		
#140	88.6		
#200	83.8	96.1	94.2

Material Description

○ Lean CLAY with SAND, dark grayish brown

□ Lean CLAY, dark gray

△ Lean CLAY, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_001B Depth: 1.9-2.5' Sample Number: 1c

□ Source of Sample: SM0003_001B Depth: 6.9-7.5' Sample Number: 3b

△ Source of Sample: SM0003_001B Depth: 7.5-9.0' Sample Number: 4

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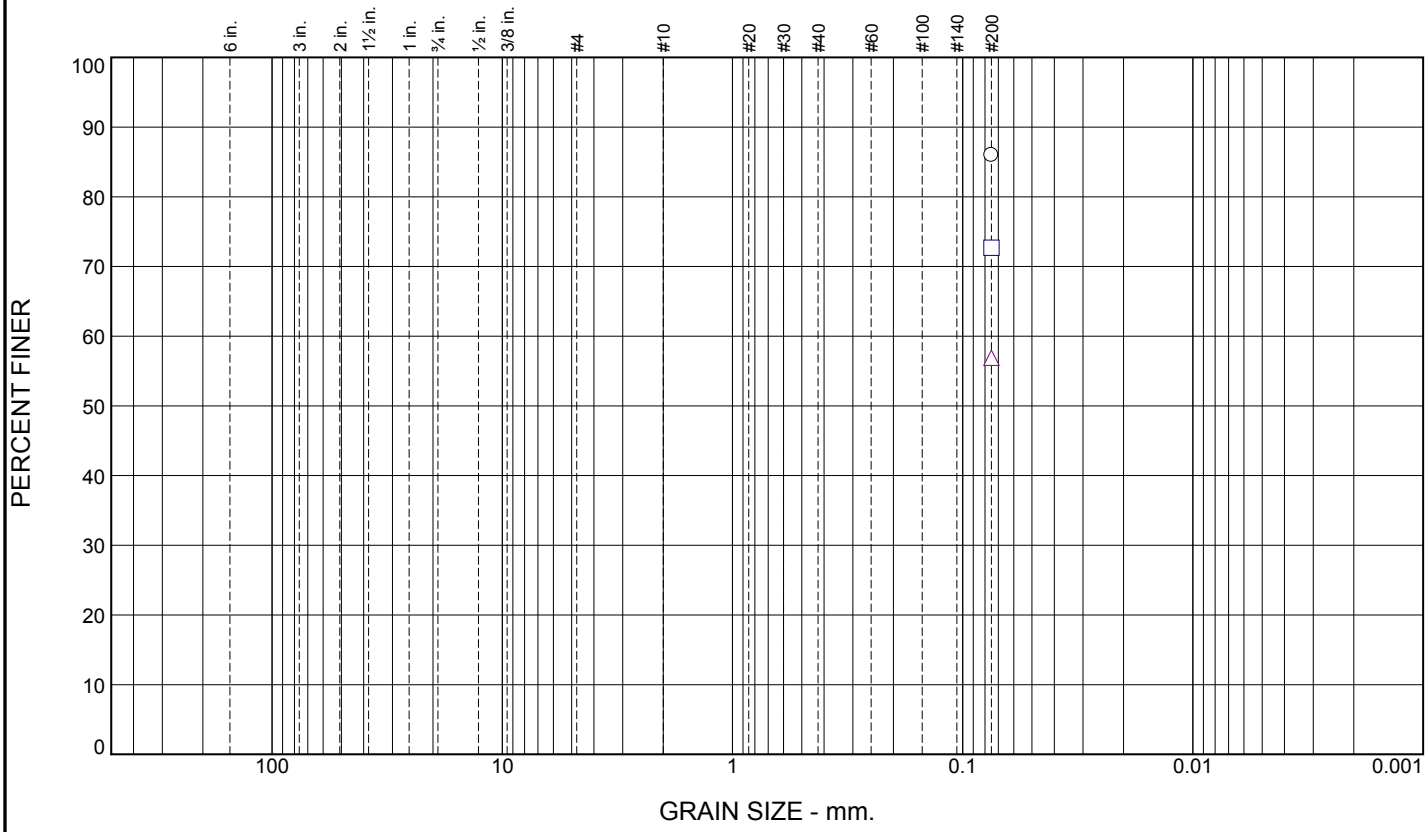
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 22

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	33	24	9
□						CL-ML	28	22	6
△						CL-ML	24	18	6

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	86.0	72.7	56.9

Material Description

○ SILT, very dark grayish brown

□ SILTY CLAY with SAND, dark yellowish brown

△ SANDY SILTY CLAY

REMARKS:

○

□

△

○ Source of Sample: SM0003_001B Depth: 11.4-11.9' Sample Number: 5b

□ Source of Sample: SM0003_001B Depth: 12.5-14.0' Sample Number: 6

△ Source of Sample: SM0003_001B Depth: 22.5-24.0' Sample Number: 10

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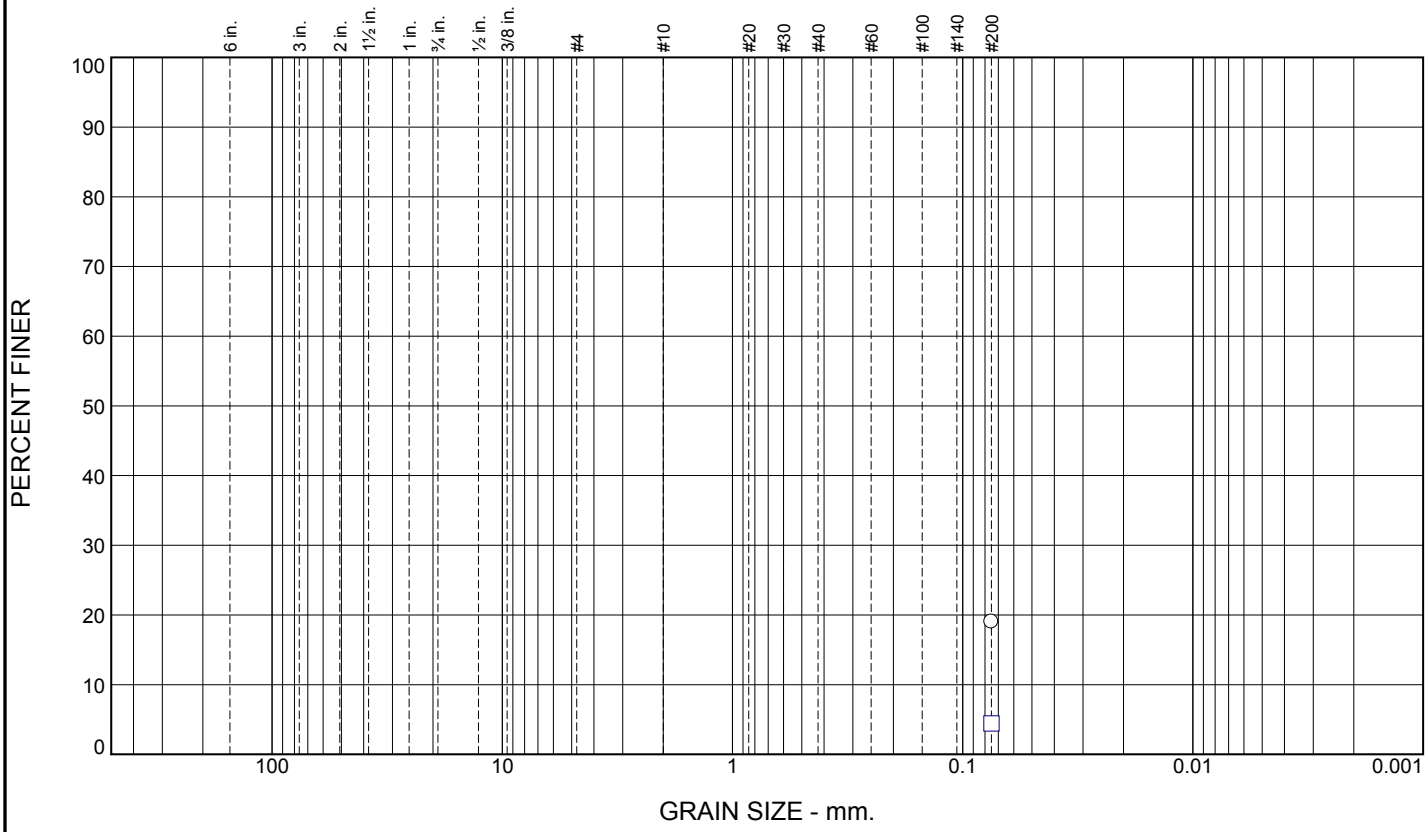
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 23

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SW			

SIEVE inches size	PERCENT FINER ○	□	
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#200	19.0	4.4	

Material Description

○ SILTY SAND, dark olive gray

□ Well-graded SAND with GRAVEL, dark olive gray

REMARKS:

○

□

○ Source of Sample: SM0003_001B Depth: 26.9-27.4' Sample Number: 11c

□ Source of Sample: SM0003_001B Depth: 30.0-31.5' Sample Number: 13

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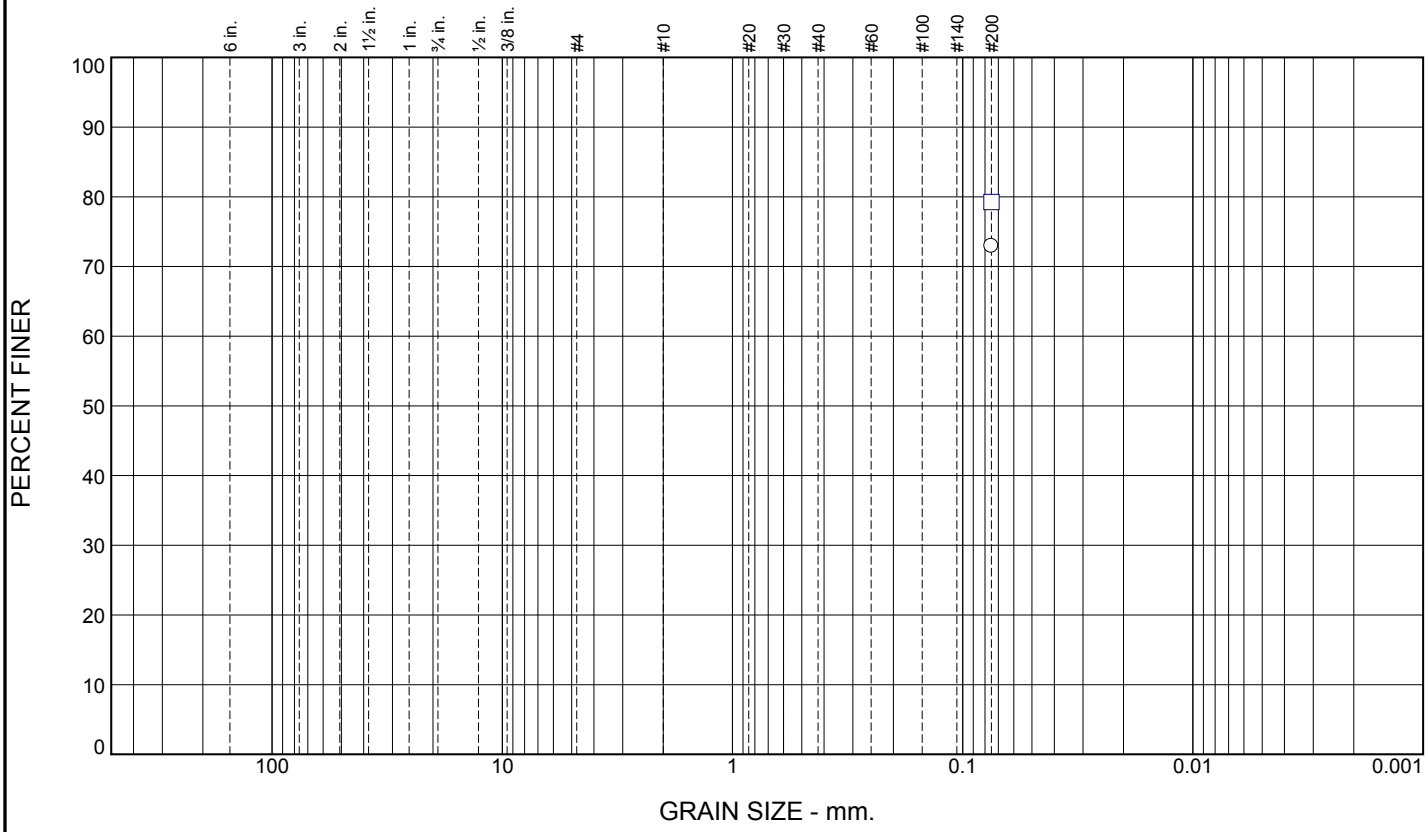
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 24

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						ML	25	22	3

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
GRAIN SIZE		
D_{60}		
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#200	72.9	79.3

Material Description

○ SILT with SAND, yellowish brown

□ SILT with SAND, dark yellowish brown

REMARKS:

○

□

○ Source of Sample: SM0003_015C Depth: 0.5-1.5'

□ Source of Sample: SM0003_015C Depth: 14.5-15.5'

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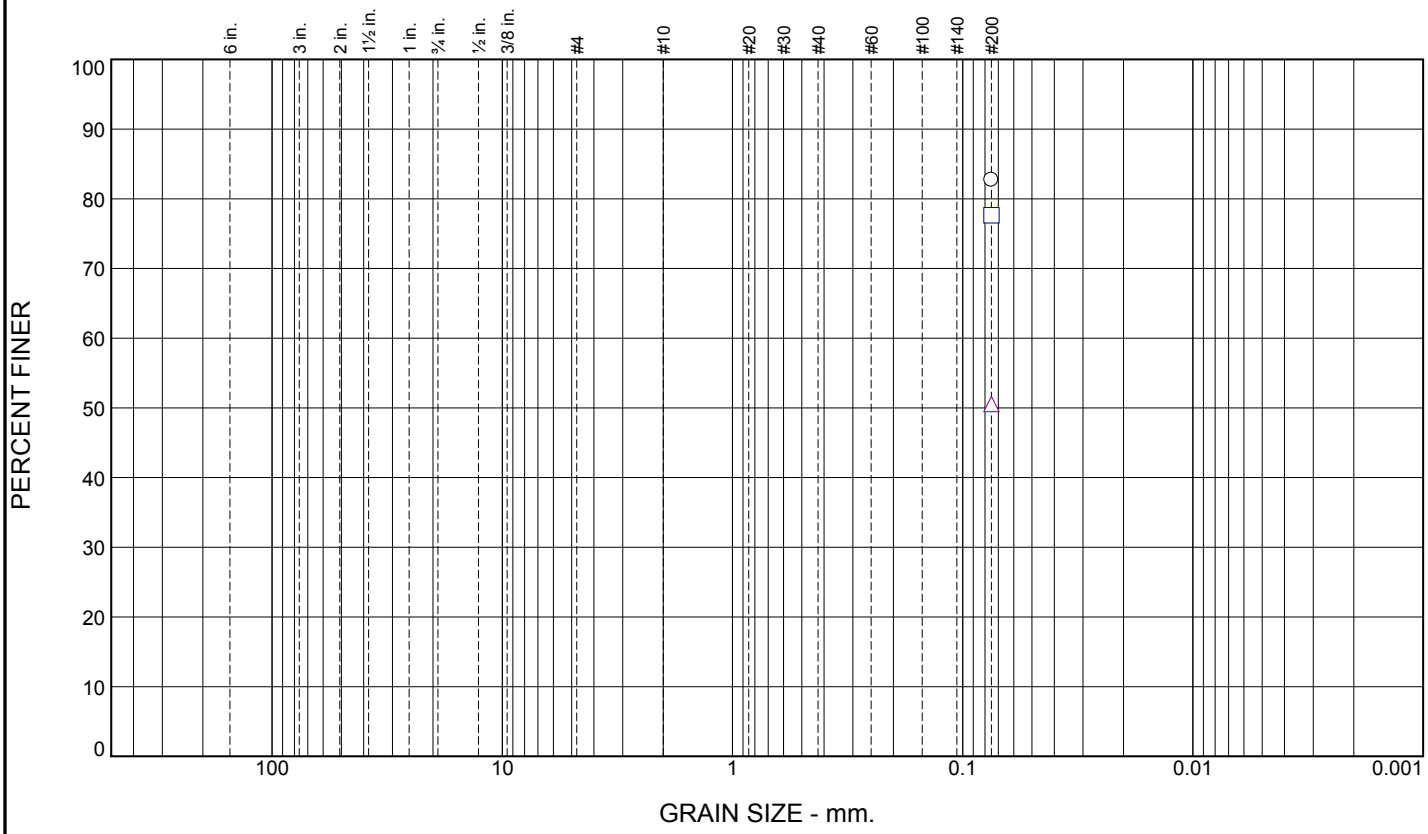
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS3-BCI-1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	29	23	6
□						CL-ML	26	22	4
△						ML	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	82.7	77.6	50.6

Material Description

○ SILT with SAND, dark yellowish brown

□ SILTY CLAY with SAND, dark yellowish brown

△ SANDY SILT, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_002B Depth: 7.5-9.0' Sample Number: 4

□ Source of Sample: SM0003_002B Depth: 12.0-13.5' Sample Number: 6

△ Source of Sample: SM0003_002B Depth: 15.0-15.5' Sample Number: 7b

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W. Sacramento, CA

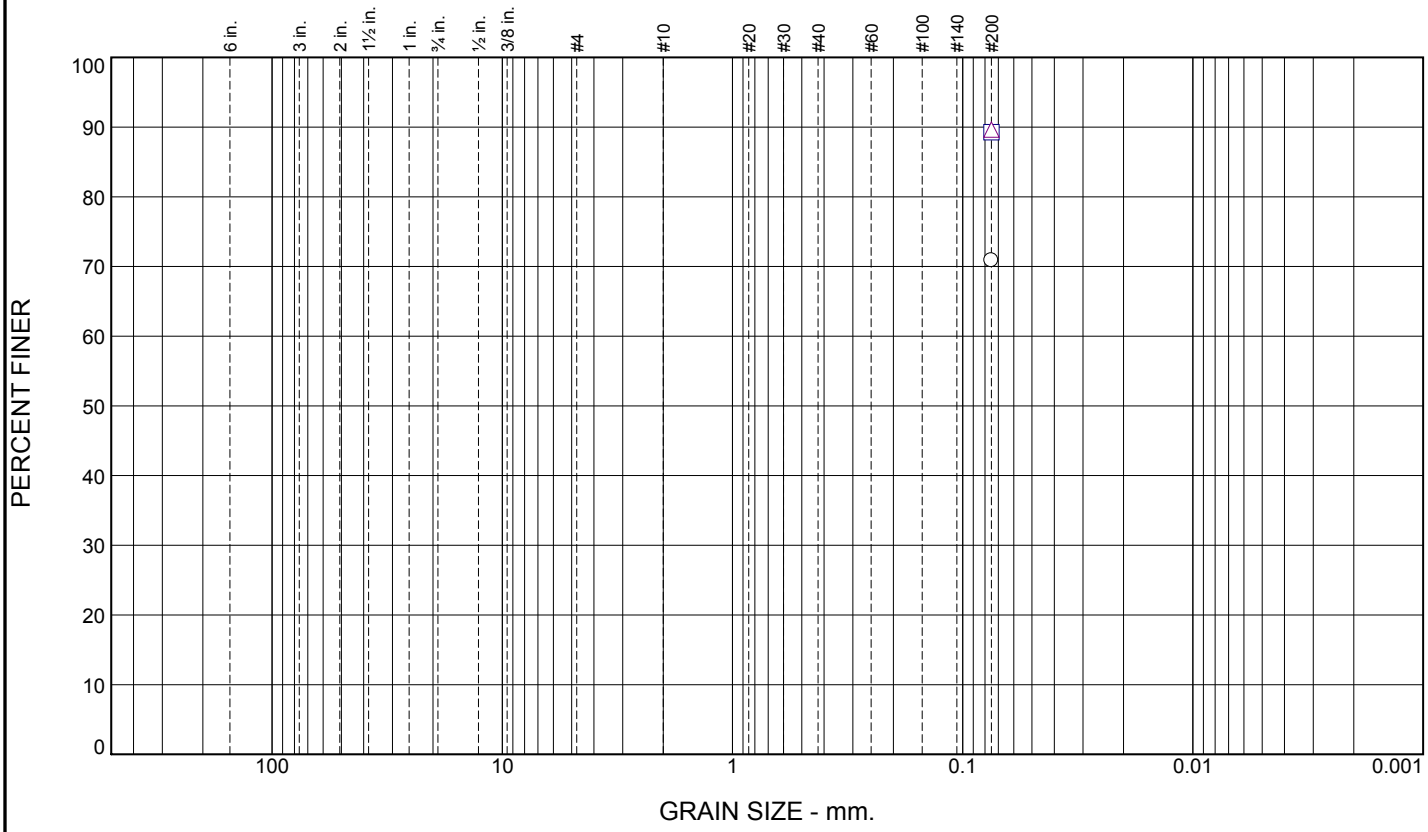
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 25

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	28	20	8
□						CL	34	22	12
△						CL	36	23	13

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	70.9	89.3	89.7

Material Description

○ Lean CLAY with SAND, dark olive brown

□ Lean CLAY, dark yellowish brown

△ Lean CLAY, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_002B Depth: 19.35-19.9' Sample Number: 9b

□ Source of Sample: SM0003_002B Depth: 23.9-24.4' Sample Number: 11b

△ Source of Sample: SM0003_002B Depth: 32.8-33.4' Sample Number: 15b

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W. Sacramento, CA

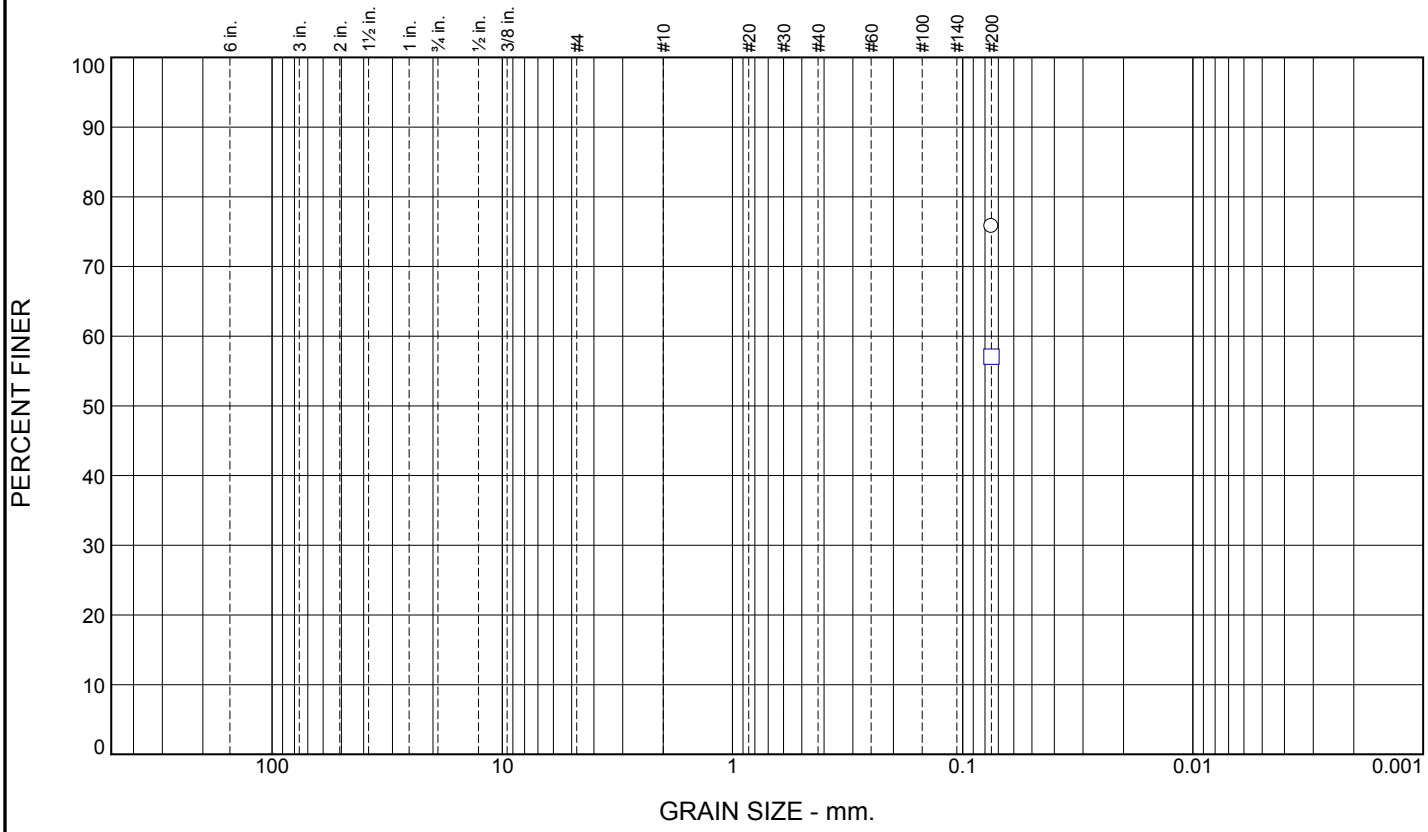
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 26

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	25	23	2
□						ML	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
GRAIN SIZE		
D_{60}		
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#200	75.8	57.1

Material Description

○ SILT with SAND, brown

□ SANDY SILT, dark yellowish brown

REMARKS:

○

□

○ Source of Sample: SM0003_002B Depth: 42.8-33.4' Sample Number: 19b

□ Source of Sample: SM0003_002B Depth: 48.0-49.5' Sample Number: 22

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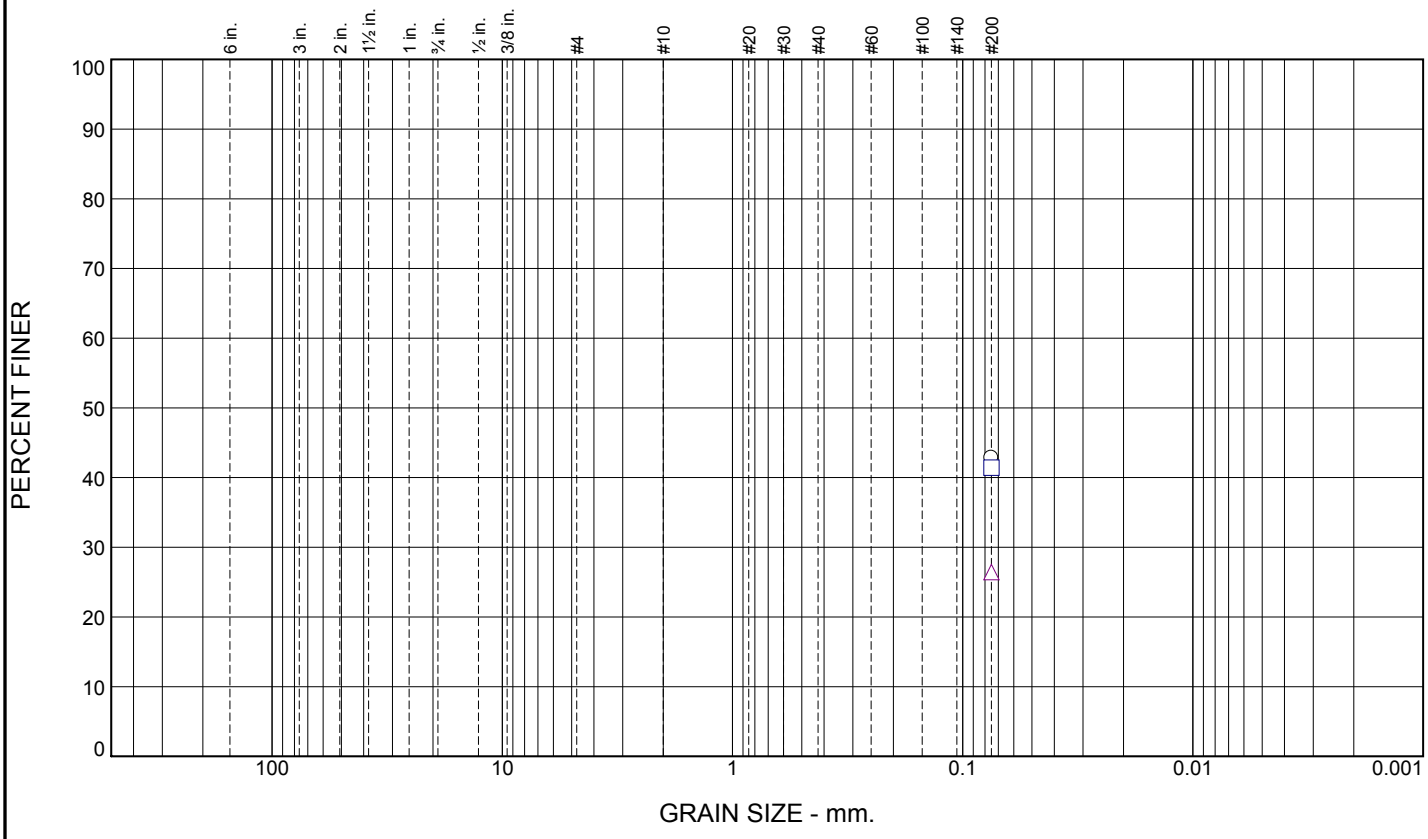
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 27

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SM	19	17	2
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	42.8	41.4	26.4

Material Description

○ SILTY SAND, dark brown

□ SILTY SAND, dark yellowish brown

△ SILTY SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_010C Depth: 0.5-1.5'

□ Source of Sample: SM0003_010C Depth: 9.0-10'

△ Source of Sample: SM0003_010C Depth: 11.0-12.0'

Blackburn Consulting

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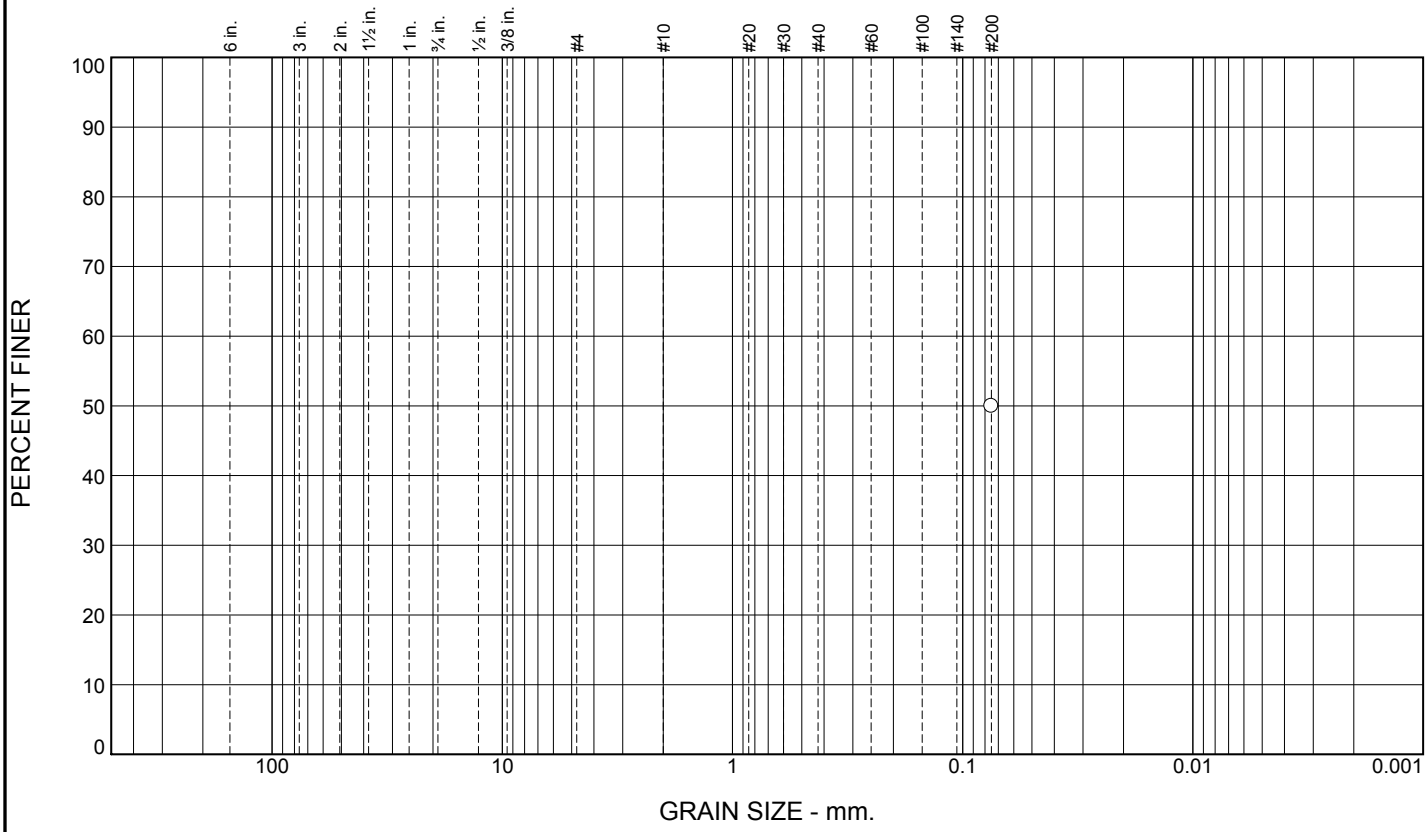
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS3-BCI-2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL			

SIEVE inches size	PERCENT FINER ○		
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	50.0		

Material Description

○ SANDY lean CLAY, olive

REMARKS:

○

○ Source of Sample: SM0003_010C Depth: 35.5-36.5'

Blackburn Consulting

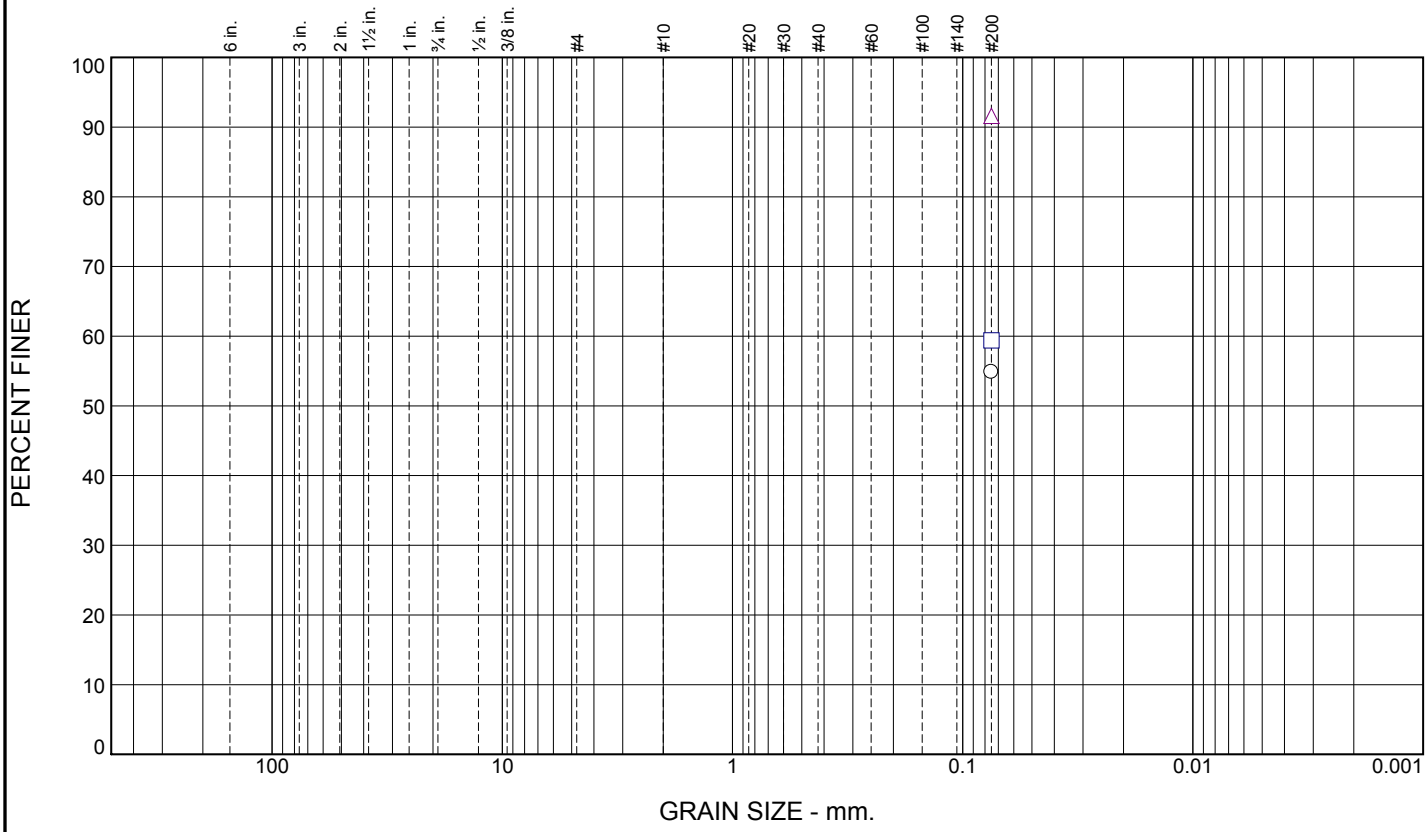
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS3-BCI-3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	31	19	12
□						CL	34	21	13
△						CL	37	24	13

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	54.9	59.4	91.6

Material Description

○ SANDY lean CLAY, olive brown

□ SANDY lean CLAY, dark olive brown

△ Lean CLAY, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_003B Depth: 0.9-1.4' Sample Number: 1a

□ Source of Sample: SM0003_003B Depth: 1.4-1.9' Sample Number: 1b

△ Source of Sample: SM0003_003B Depth: 1.9-2.5' Sample Number: 1c

Blackburn Consulting

W. Sacramento, CA

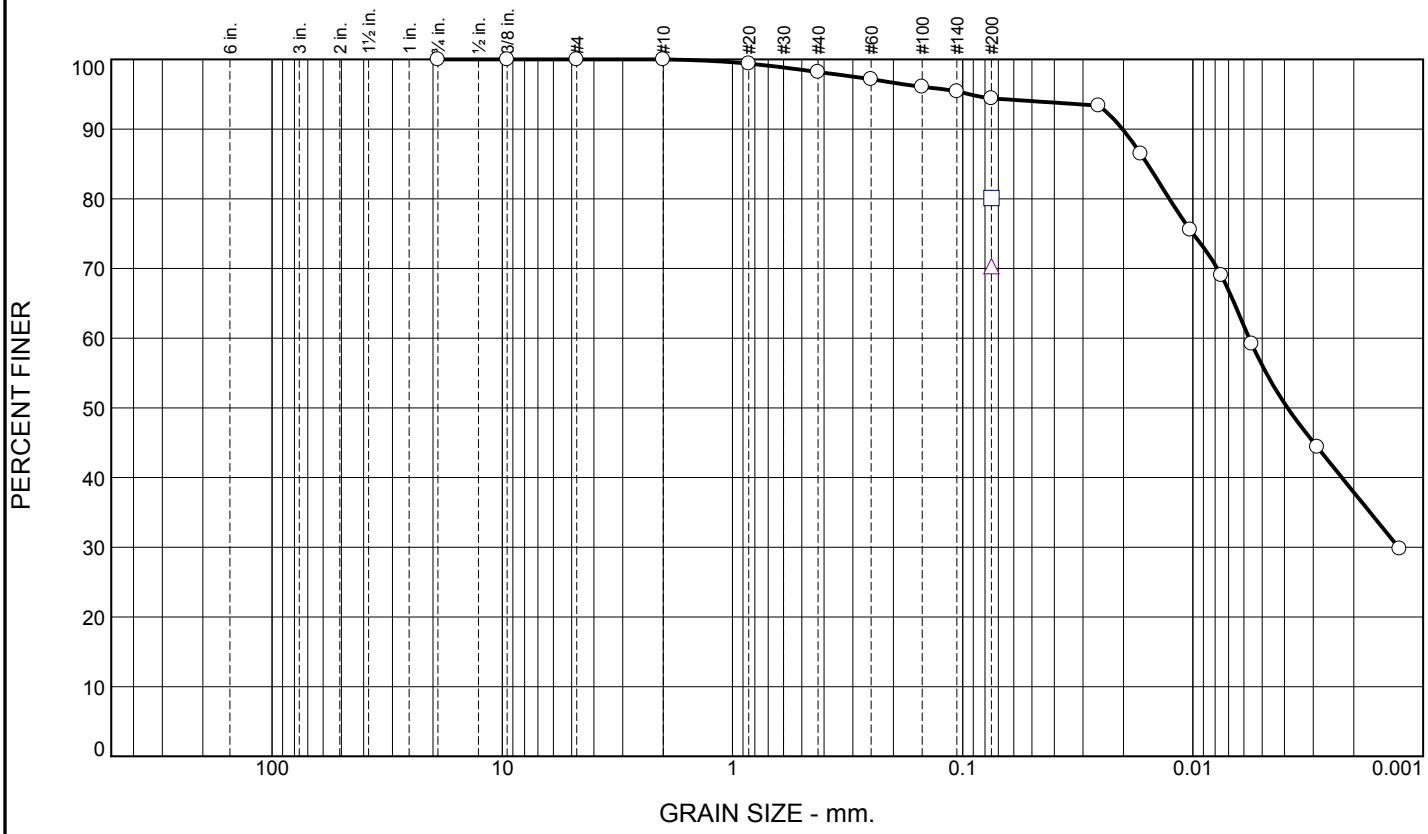
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 28

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	5.6	38.3	56.1	CL	47	23	24
□						CL	38	23	15
△						ML	32	25	7

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	100.0		
GRAIN SIZE			
D_{60}	0.0057		
D_{30}	0.0013		
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		
#10	100.0		
#20	99.4		
#40	98.2		
#60	97.2		
#100	96.1		
#140	95.4		
#200	94.4	80.1	70.3

Material Description

○ Lean CLAY, olive brown

□ Lean CLAY with SAND, light olive brown

△ SILT with SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_003B Depth: 11.4-12.0' Sample Number: 5c

□ Source of Sample: SM0003_003B Depth: 16.0-16.4' Sample Number: 7b

△ Source of Sample: SM0003_003B Depth: 20.4-20.9' Sample Number: 9a

Blackburn Consulting

W. Sacramento, CA

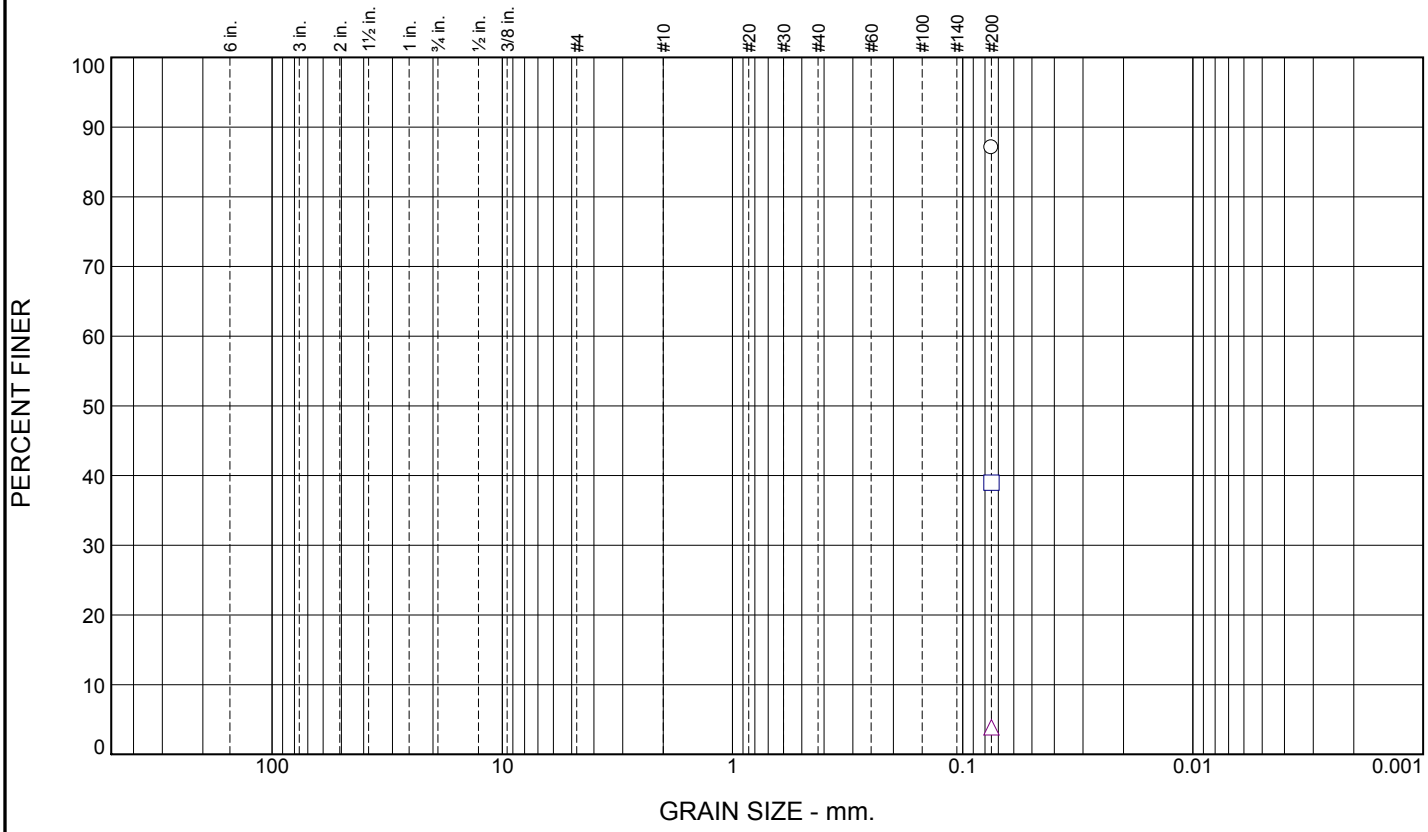
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 29

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	38	26	12
□						SM			
△						SP			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	87.1	39.0	3.9

Material Description

○ SILT, dark yellowish brown

□ SILTY SAND, olive brown

△ Poorly-graded SAND, dark olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0003_003B Depth: 21.4-22.0' Sample Number: 9c

□ Source of Sample: SM0003_003B Depth: 25.9-26.4' Sample Number: 11b

△ Source of Sample: SM0003_003B Depth: 26.4-27.0' Sample Number: 11c

Blackburn Consulting

W. Sacramento, CA

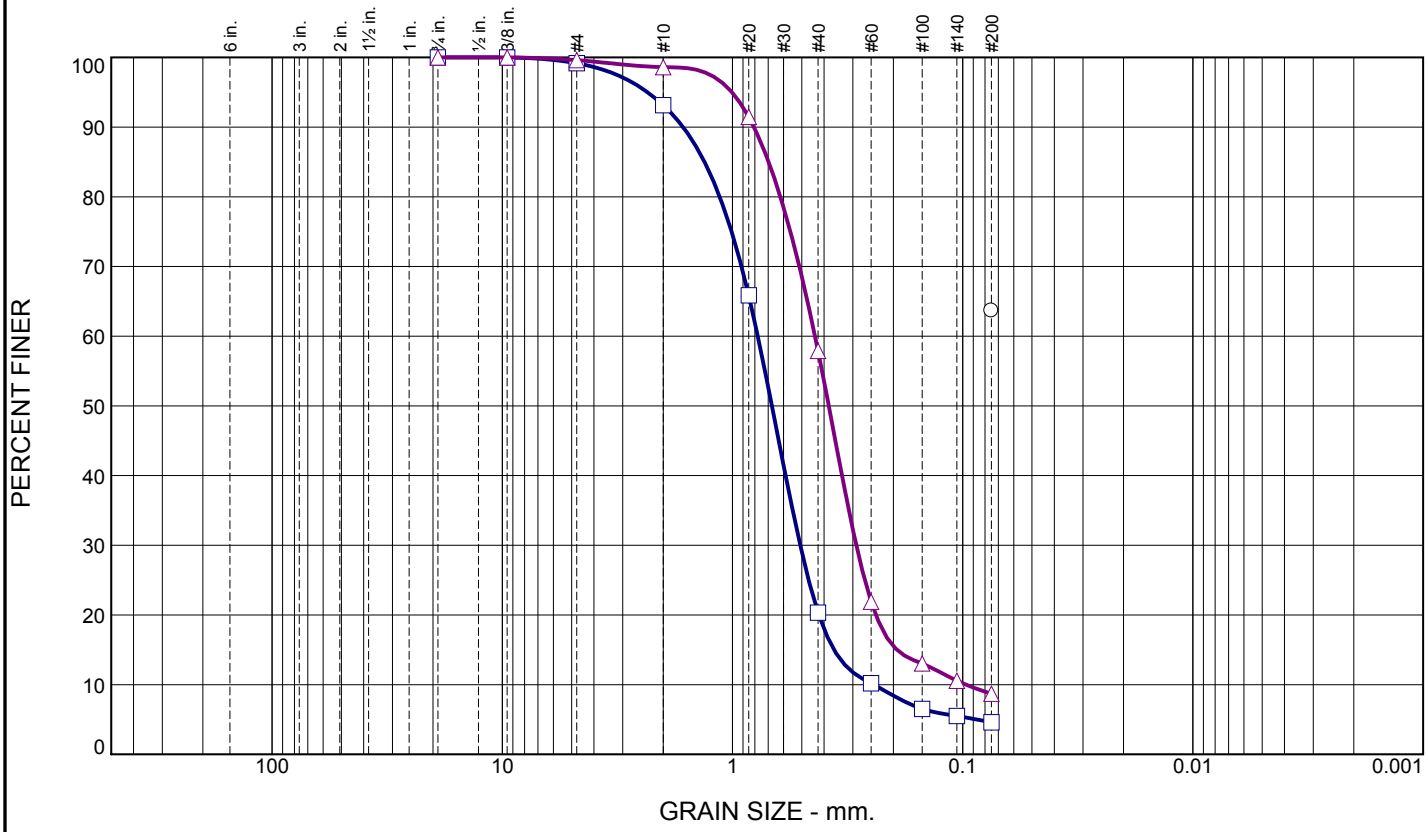
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 30

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	31	21	10
□	0.0	0.8	94.6	4.6		SP			
△	0.0	0.4	90.9	8.7		SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	100.0
3/8"		100.0	100.0
	GRAIN SIZE		
D_{60}		0.7762	0.4381
D_{30}		0.5077	0.2897
D_{10}		0.2435	0.0968
	COEFFICIENTS		
C_c		1.36	1.98
C_u		3.19	4.52

SIEVE number size	PERCENT FINER ○	□	△
#4		99.2	99.6
#10		93.1	98.6
#20		65.9	91.5
#40		20.3	57.9
#60		10.2	21.9
#100		6.5	13.0
#140		5.5	10.6
#200	63.7	4.6	8.7

Material Description

○ SANDY lean CLAY, olive

□ Poorly-graded SAND, yellowish brown

△ Poorly Graded SAND with SILT, dark olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0003_003B Depth: 30.9-31.4' Sample Number: 13b

□ Source of Sample: SM0003_003B Depth: 354.9-36.4' Sample Number: 15b

△ Source of Sample: SM0003_003B Depth: 40.0-41.5' Sample Number: 17

Blackburn Consulting

W. Sacramento, CA

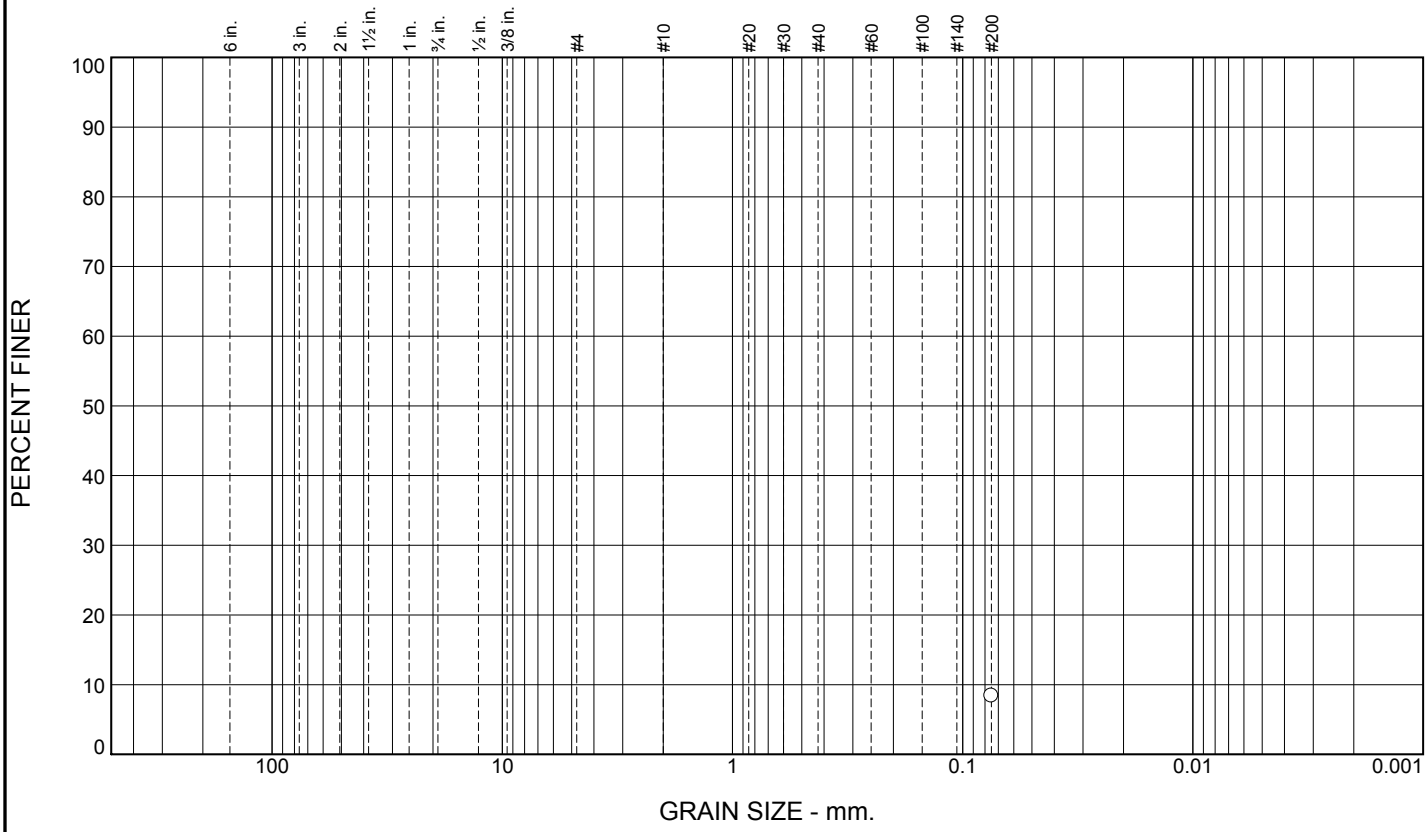
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 31

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP-SM			

SIEVE inches size	PERCENT FINER ○		
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	8.4		

Material Description

○ Poorly-graded SAND with SILT, dark olive gray

REMARKS:

○

○ Source of Sample: SM0003_003B Depth: 50.0-51.5' Sample Number: 21

Blackburn Consulting

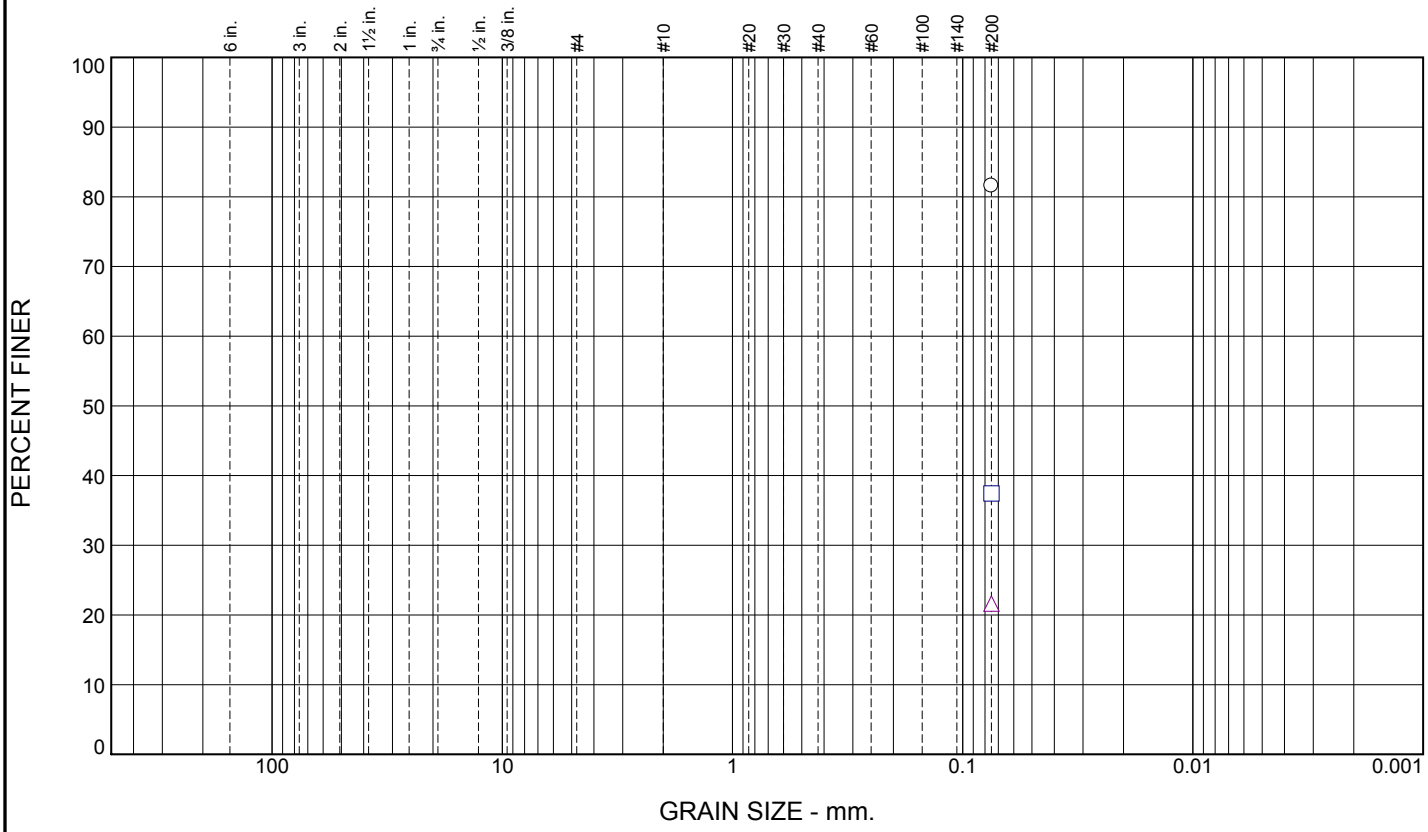
W. Sacramento, CA

Client: URS

Project: Feather River West Levee

Project No.: 1967.3 Figure 32

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						SM			
△						SM			

SIEVE inches size	○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	○	□	△
#200	81.6	37.4	21.6

Material Description

○ SILT with SAND, light olive brown

□ SILTY SAND, light olive brown

△ SILTY SAND, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_003B Depth: 1.4-1.9' Sample Number: 1b

□ Source of Sample: SL0001_003B Depth: 5.9-6.4' Sample Number: 3b

△ Source of Sample: SL0001_003B Depth: 6.4-7.0' Sample Number: 3c

Blackburn Consulting

W. Sacramento, CA

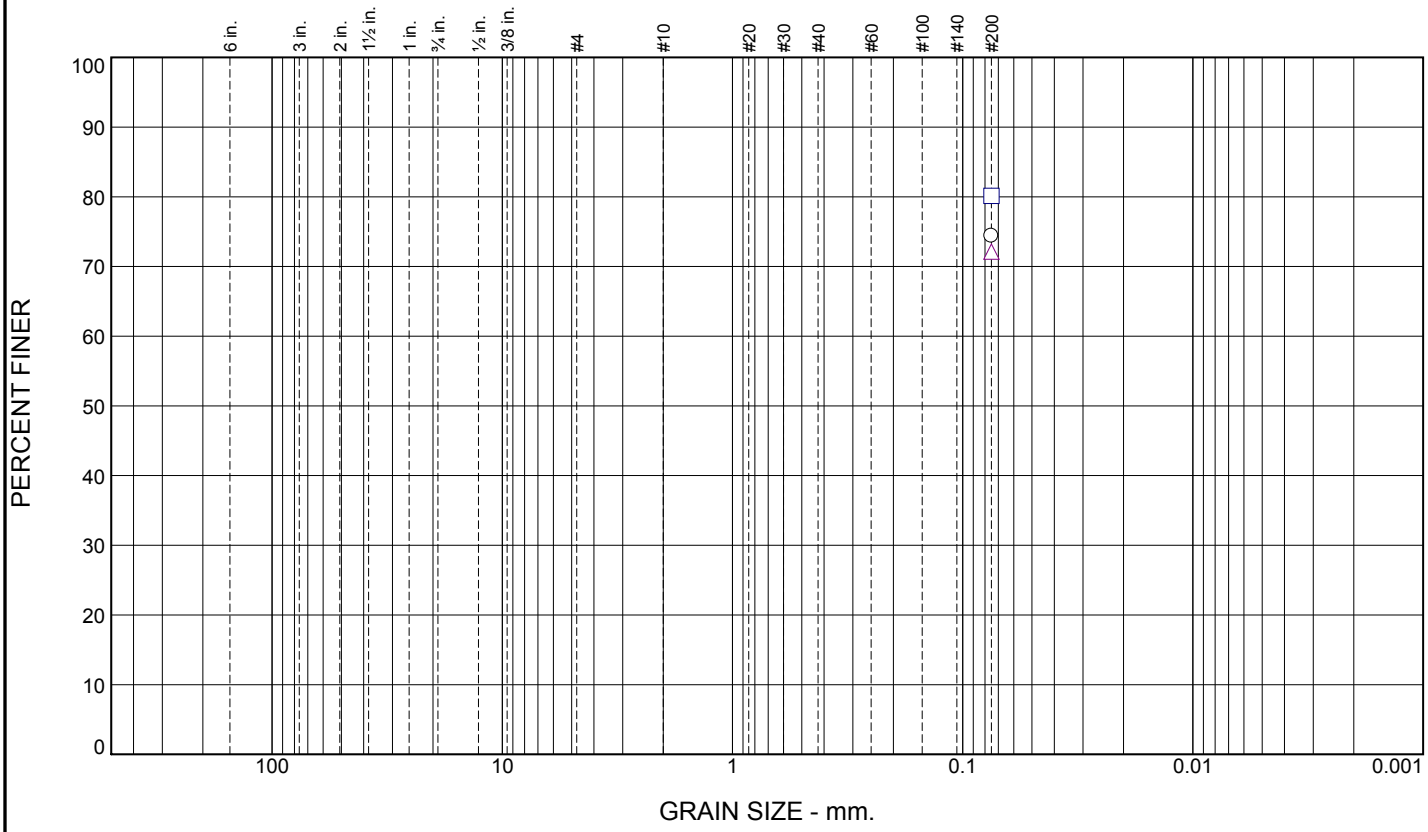
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	33	24	9
□						CL	38	24	14
△						ML	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	74.4	80.1	72.1

Material Description

○ SILT with SAND, brown

□ Lean CLAY with SAND, light olive brown

△ SILT with SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_003B Depth: 15.4-16.0' Sample Number: 7b

□ Source of Sample: SL0001_003B Depth: 19.5-20.0' Sample Number: 9b

△ Source of Sample: SL0001_003B Depth: 28.4-28.9' Sample Number: 13b

Blackburn Consulting

W. Sacramento, CA

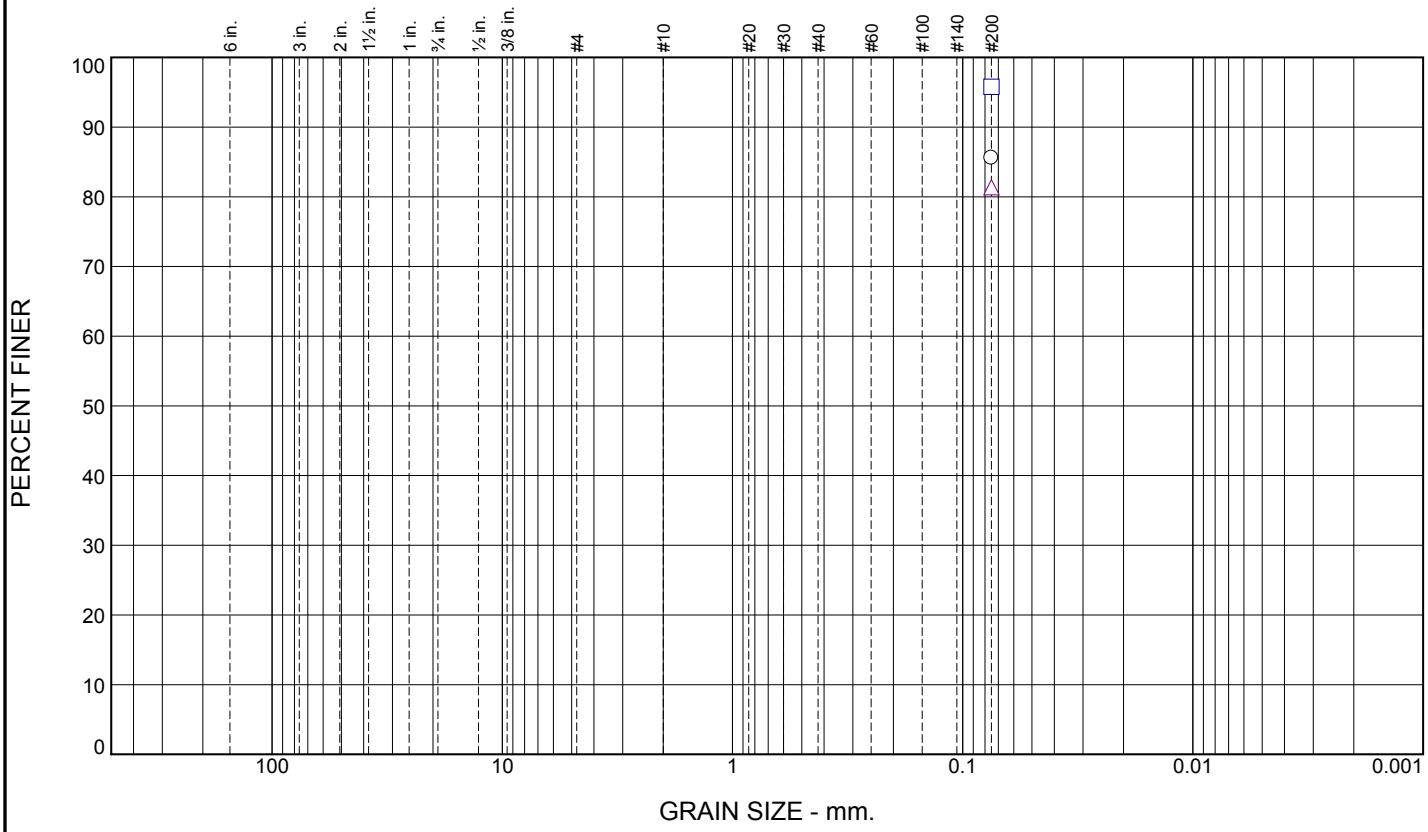
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						ML	32	30	2
△						ML			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	85.6	95.8	81.4

Material Description

○ SILT, olive brown

□ SILT, light olive brown

△ SILT with SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_003B Depth: 28.9-29.5' Sample Number: 13c

□ Source of Sample: SL0001_003B Depth: 33.4-34.0' Sample Number: 15c

△ Source of Sample: SL0001_003B Depth: 37.5-38.0' Sample Number: 17b

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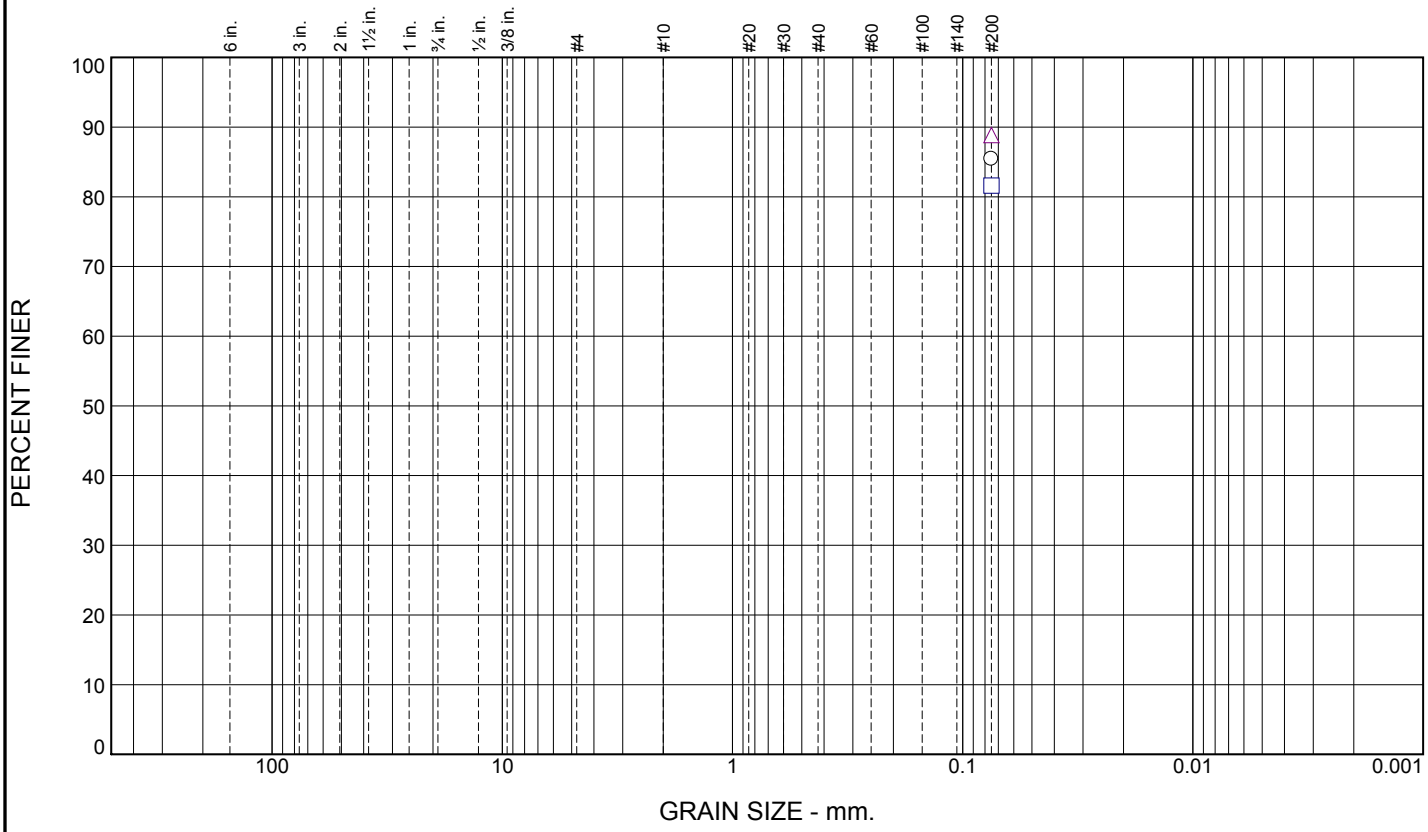
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	37	20	17
□						CL	36	22	14
△						ML			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	85.4	81.6	88.9

Material Description

○ Lean CLAY, brown

□ Lean CLAY with SAND, olive brown

△ SILT, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_003B Depth: 41.9-42.4' Sample Number: 19b

□ Source of Sample: SL0001_003B Depth: 46.4-46.9' Sample Number: 21b

△ Source of Sample: SL0001_003B Depth: 48.0-49.5' Sample Number: 22

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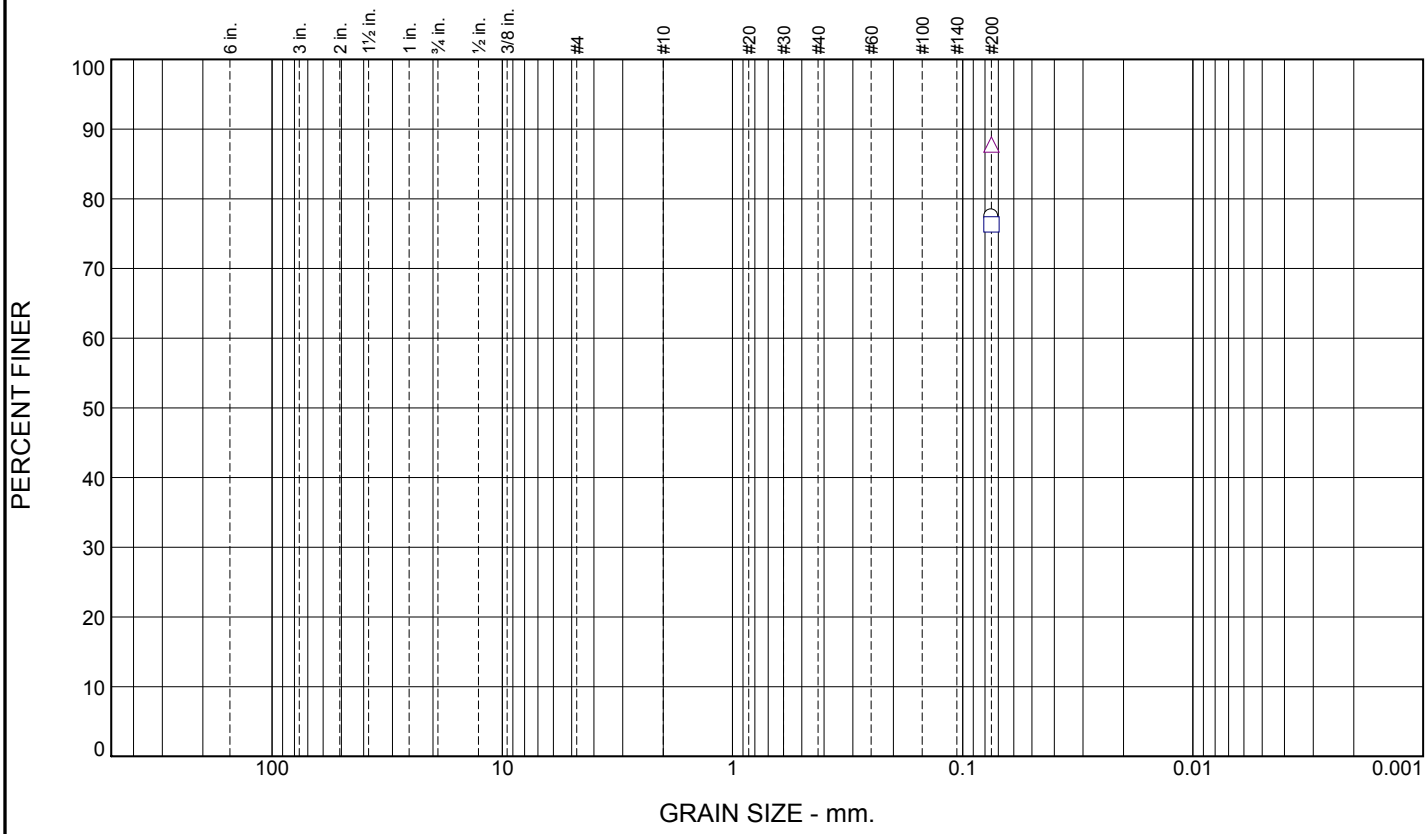
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	28	20	8
□						ML	NV	NP	NP
△						ML	39	33	6

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	77.5	76.3	87.8

Material Description

○ Lean CLAY with SAND, dark yellowish brown

□ SILT with SAND, dark yellowish brown

△ SILT, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_004B Depth: 1.9-2.5' Sample Number: 1c

□ Source of Sample: SL0001_004B Depth: 5.9-6.4 Sample Number: 3b

△ Source of Sample: SL0001_004B Depth: 10.4-11.0' Sample Number: 5c

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W. Sacramento, CA

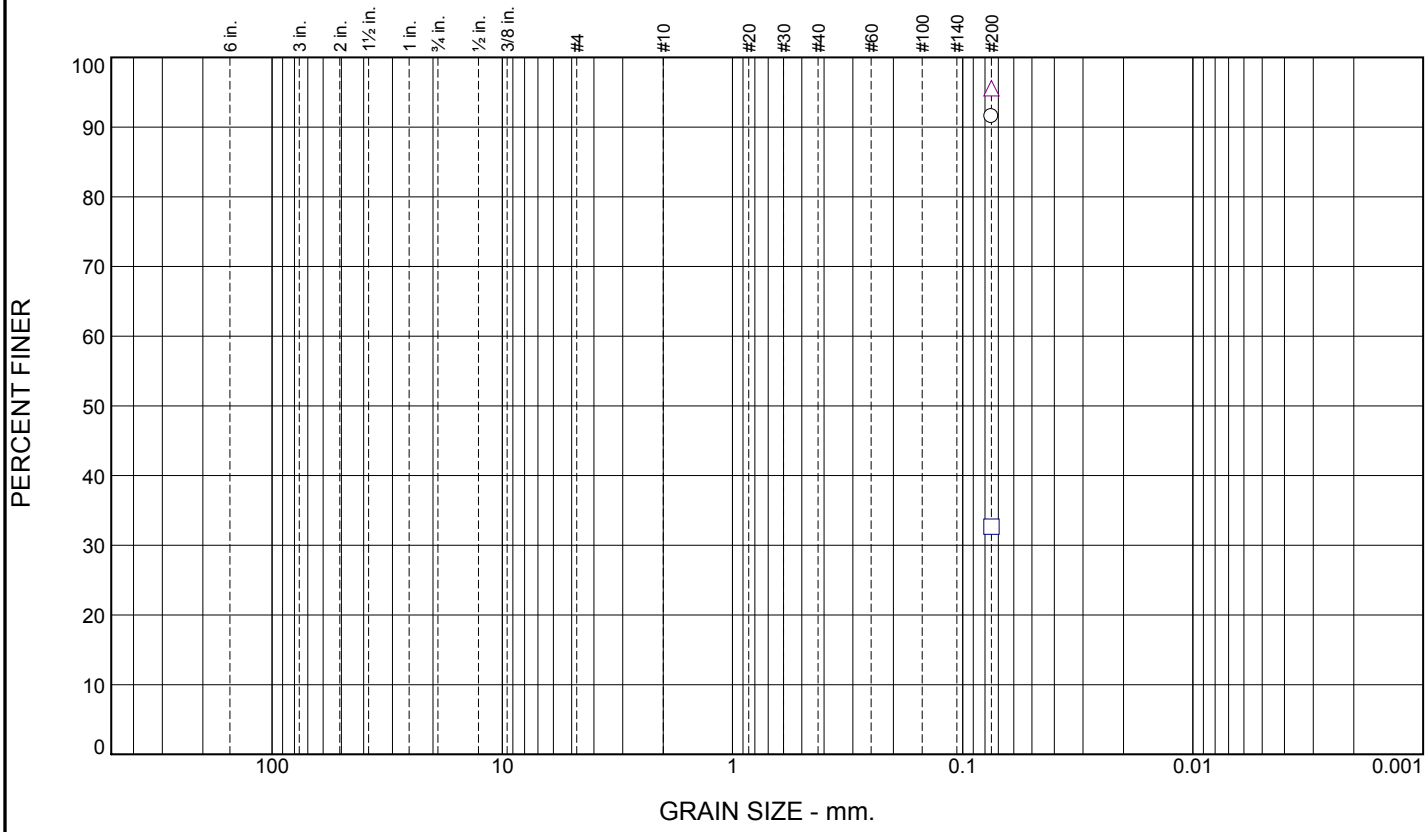
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 5

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						SM			
△						ML	45	30	15

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	91.6	32.7	95.6

Material Description

○ SILT, light olive brown

□ SILTY SAND, dark yellowish brown

△ SILT, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_004B Depth: 11.0-12.5' Sample Number: 6

□ Source of Sample: SL0001_004B Depth: 15.5-17.0' Sample Number: 8

△ Source of Sample: SL0001_004B Depth: 18.4-18.9' Sample Number: 9b

Blackburn Consulting

W. Sacramento, CA

Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 6

GRAIN SIZE DISTRIBUTION TEST DATA

10/24/2011

Client: URS
Project: Feather River West Levee
Project Number: 1967.3
Location: 92+00 CPT
Depth: 0.5-1.5'
Material Description: SILT with SAND, yellowish brown
USCS Classification: ML

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 215.38
Tare Wt. = 169.62
Minus #200 from wash = 72.9%

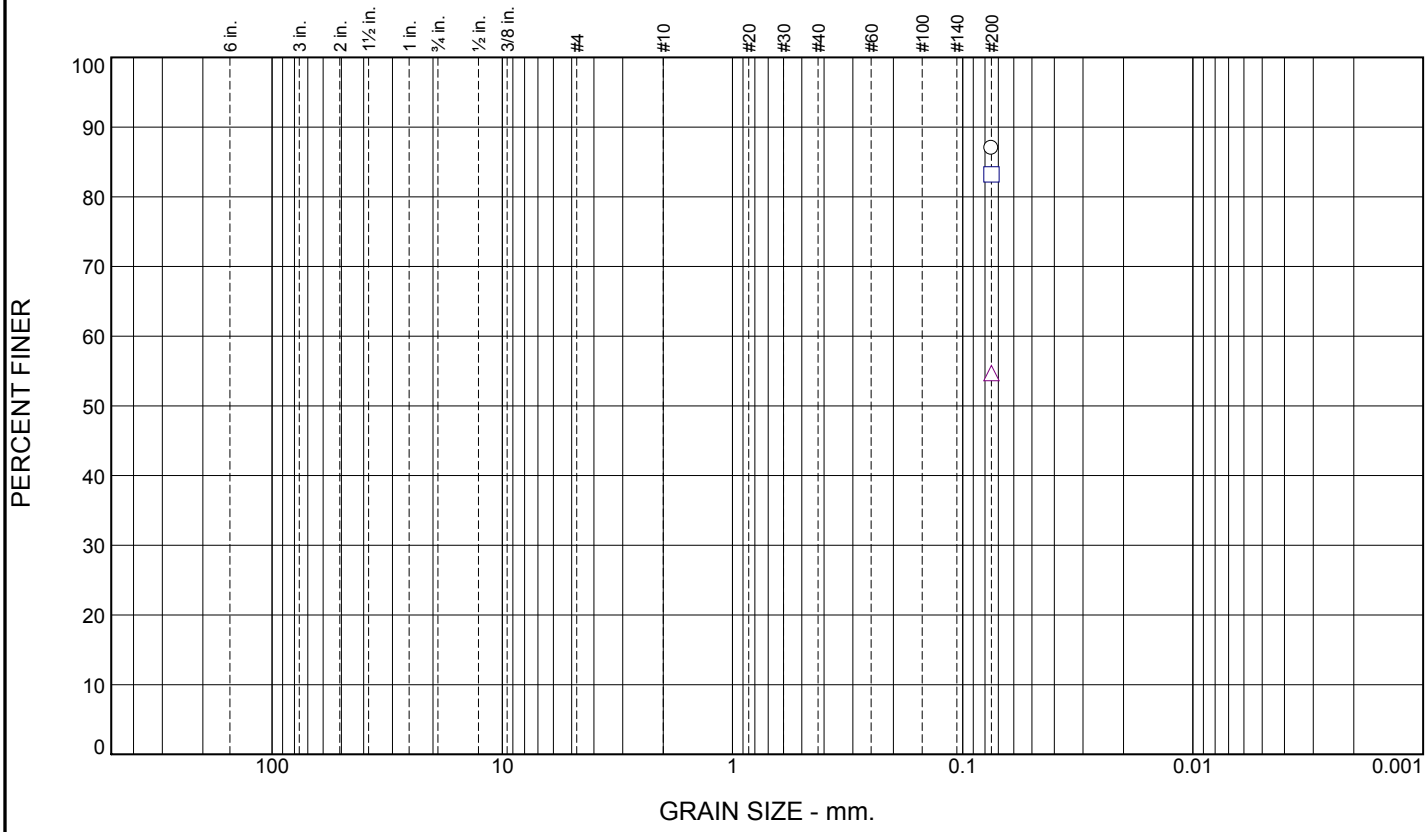
Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
338.78	169.62	169.62			

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
										72.9

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	36	23	13
□						ML	36	26	10
△						ML	28	27	1

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	87.0	83.2	54.7

Material Description

○ Lean CLAY, dark greenish gray

□ SILT with SAND, olive

△ SANDY SILT, dark greenish gray

REMARKS:

○

□

△

○ Source of Sample: SL0001_004B Depth: 31.9-32.4' Sample Number: 15a

□ Source of Sample: SL0001_004B Depth: 33.5-35.0' Sample Number: 16

△ Source of Sample: SL0001_004B Depth: 36.9-37.4' Sample Number: 17a

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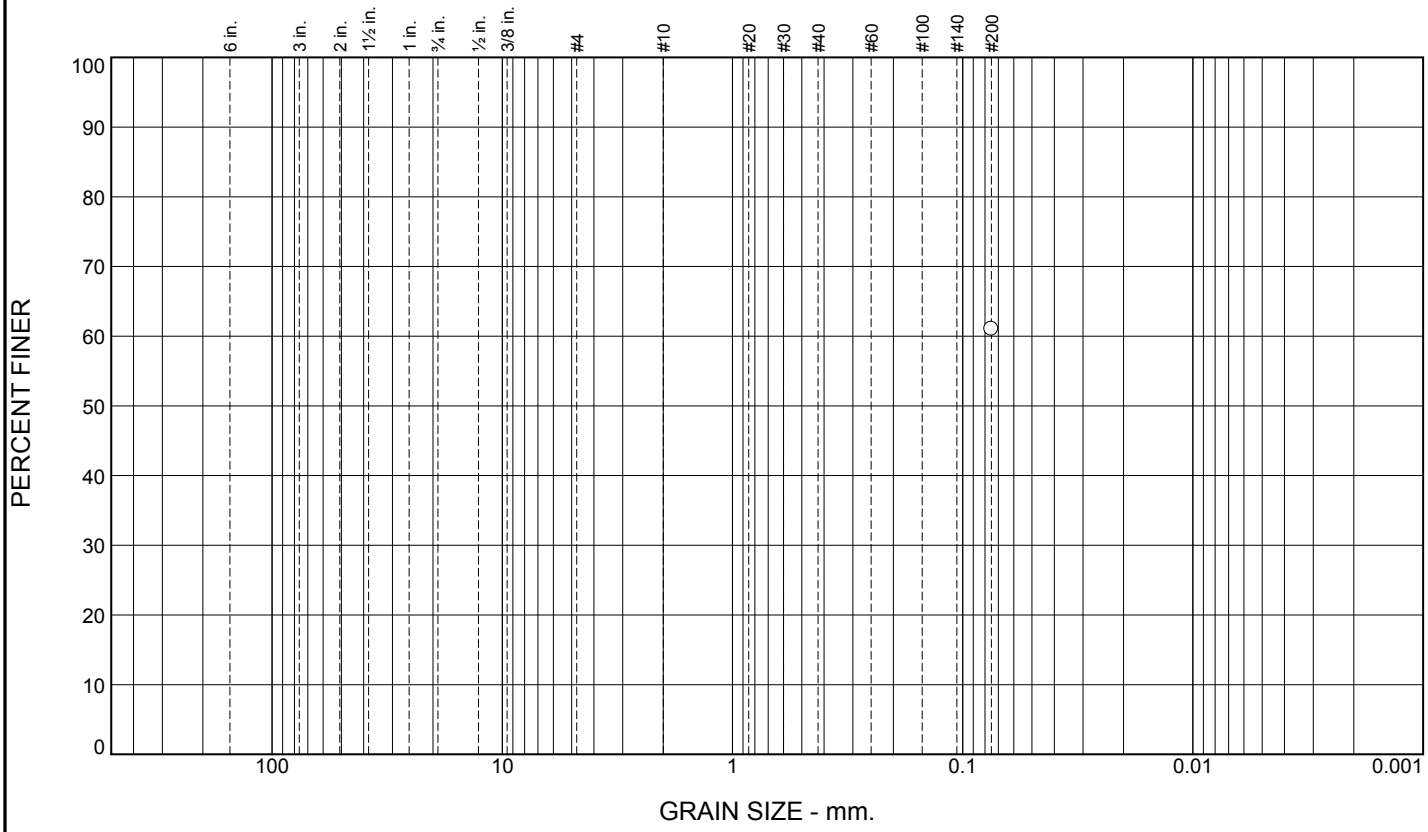
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 8

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			

SIEVE inches size	PERCENT FINER ○		
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	61.1		

Material Description
○ SANDY SILT, olive

REMARKS:
○

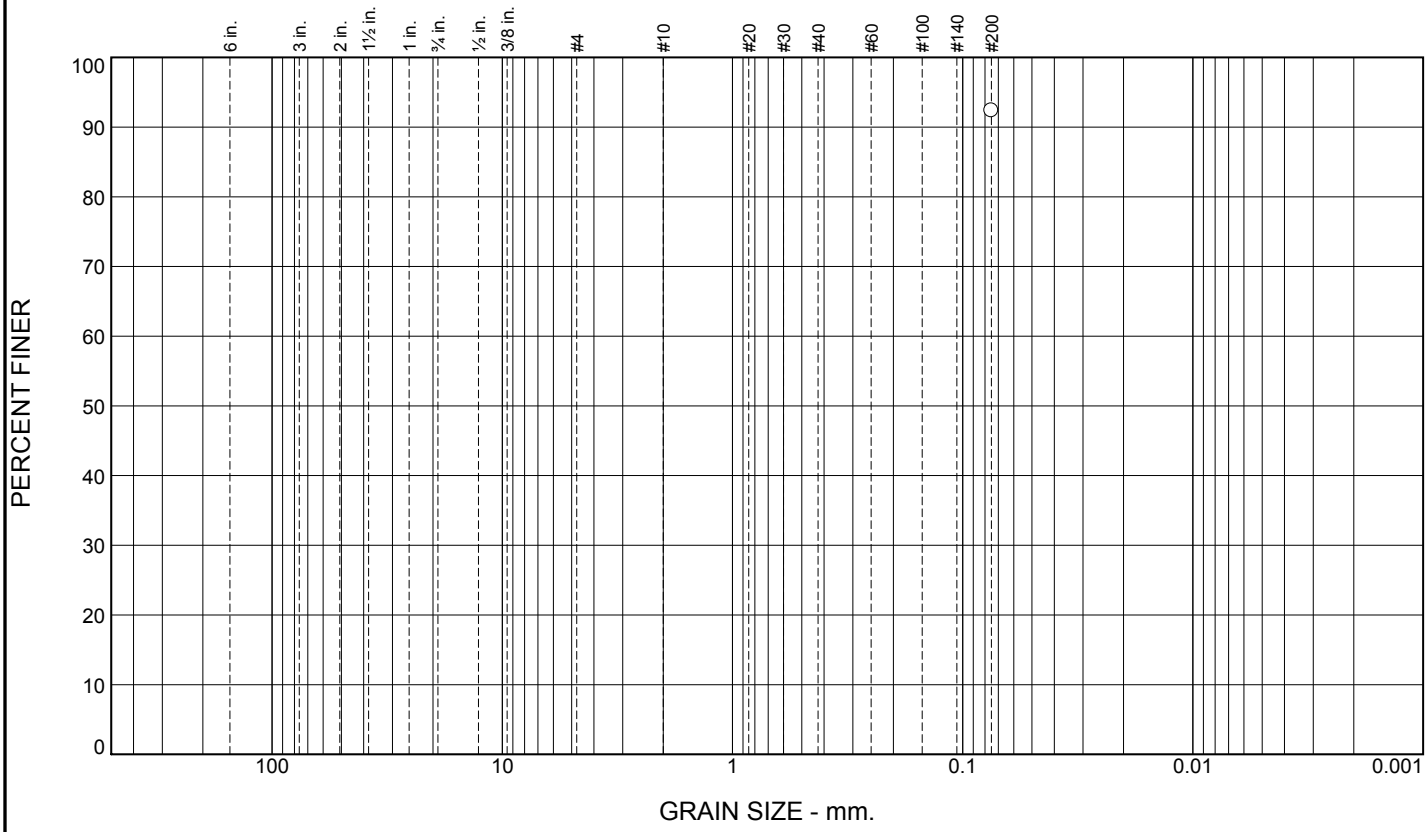
○ Source of Sample: SL0001_004B Depth: 38.5-40.0' Sample Number: 18

Blackburn Consulting

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Client: URS
Project: Feather River West Levee
Project No.: 1967.3 Figure 9

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			

SIEVE inches size	PERCENT FINER ○		
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	92.4		

Material Description
○ SILT, olive brown

REMARKS:
○

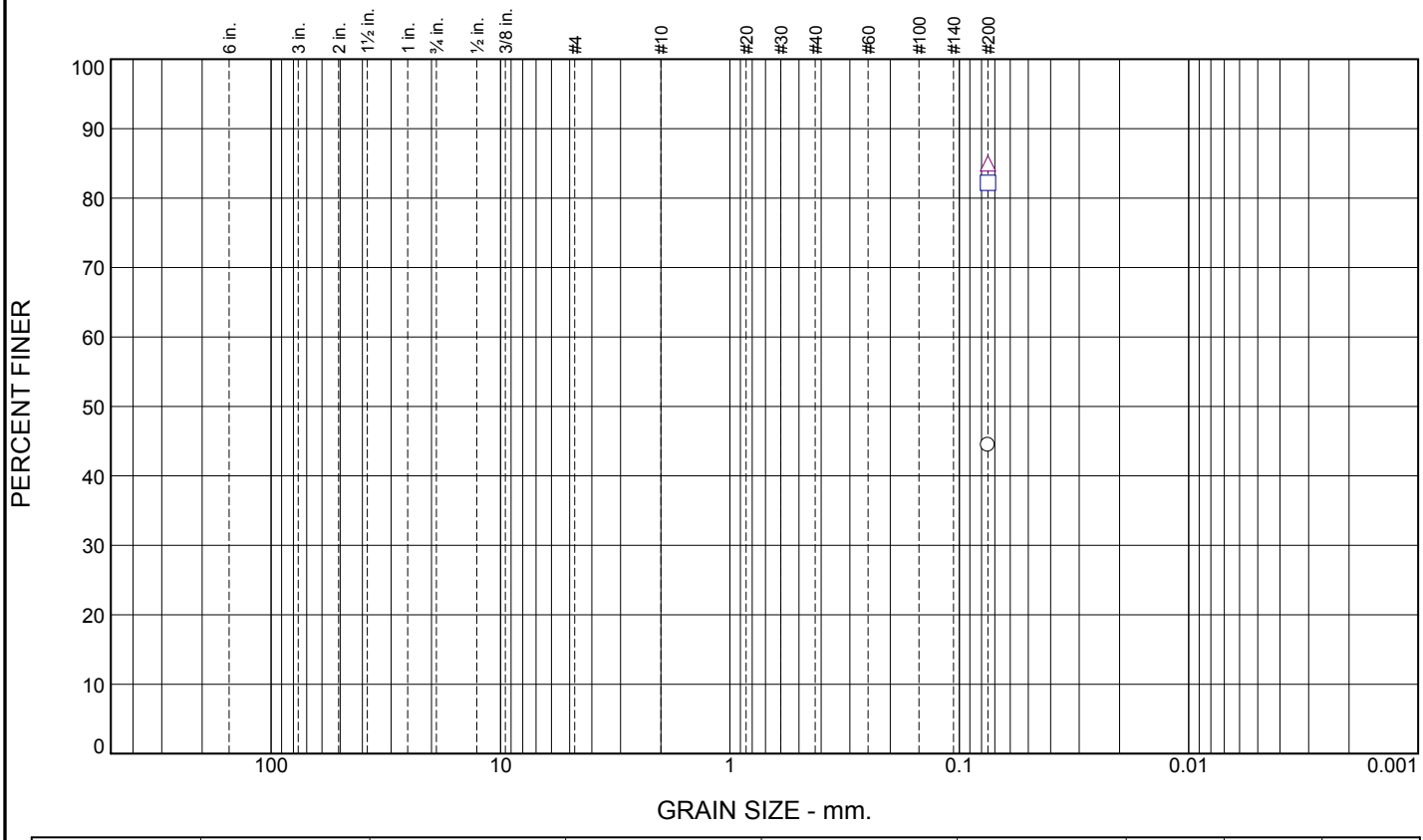
○ Source of Sample: SL0001_042C Depth: 13.0-14.0'

Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee
Project No.: 17326605.0305233 Figure LS3-BCI-4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SC			
□						CL	31	17	14
△						CL	31	18	13

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	44.5	82.2	85.0

Material Description

○ CLAYEY SAND, dark yellowish brown

□ Lean CLAY with SAND, dark yellowish brown

△ Lean CLAY with SAND, dark brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_005B Depth: 7.0-8.5' Sample Number: 4

□ Source of Sample: SL0001_005B Depth: 20.4-20.9' Sample Number: 9a

△ Source of Sample: SL0001_005B Depth: 22.0-23.5' Sample Number: 10

Blackburn Consulting

W. Sacramento, CA

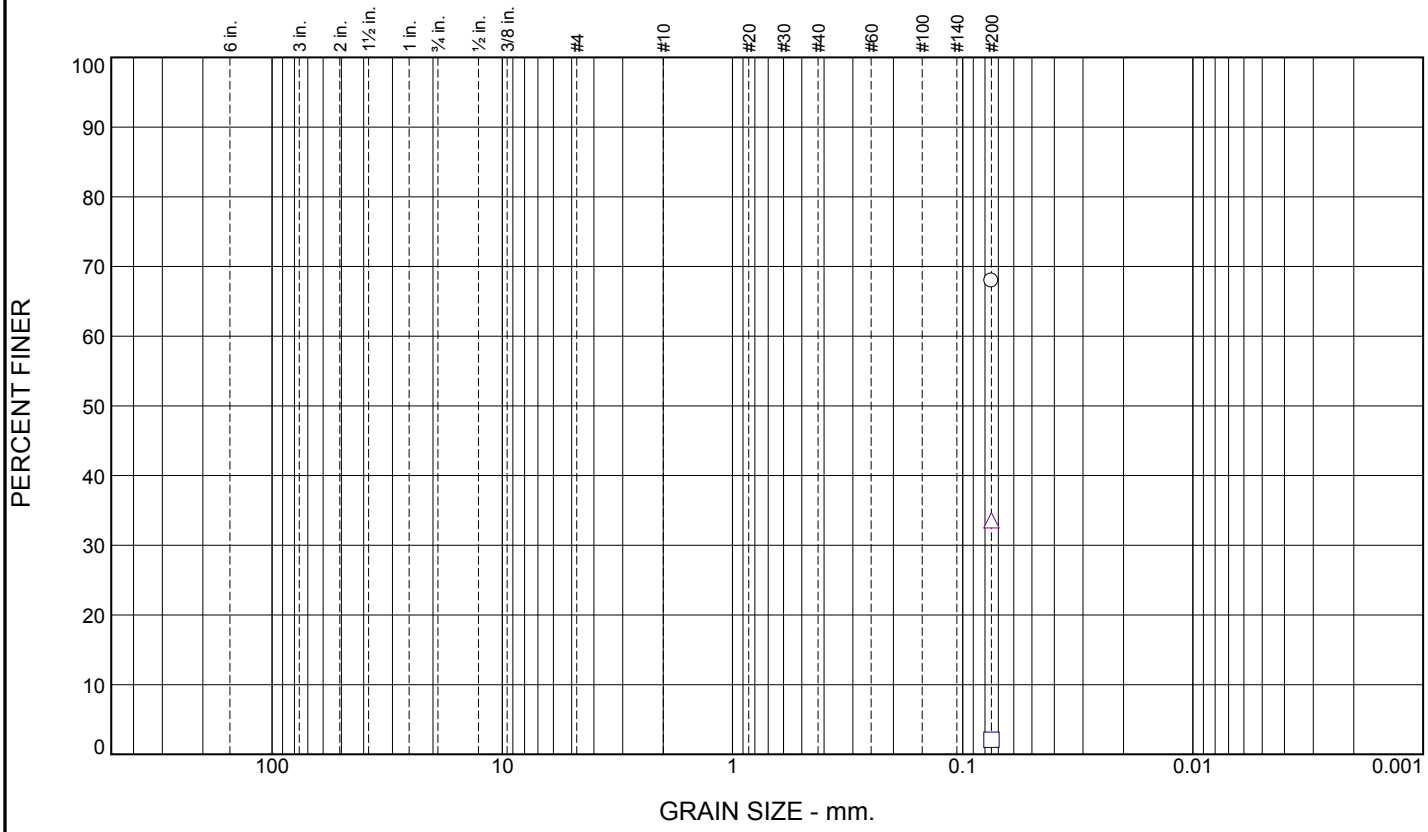
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 10

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	NV	NP	NP
□						SP			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	68.0	2.1	33.6

Material Description

○ SANDY SILT, light olive brown

□ Poorly-graded SAND, dark olive brown

△ SILTY SAND, dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_005B Depth: 27.0-28.5' Sample Number: 12

□ Source of Sample: SL0001_005B Depth: 35.4-35.9' Sample Number: 15a

△ Source of Sample: SL0001_005B Depth: 35.9-36.4' Sample Number: 15b

Blackburn Consulting

W. Sacramento, CA

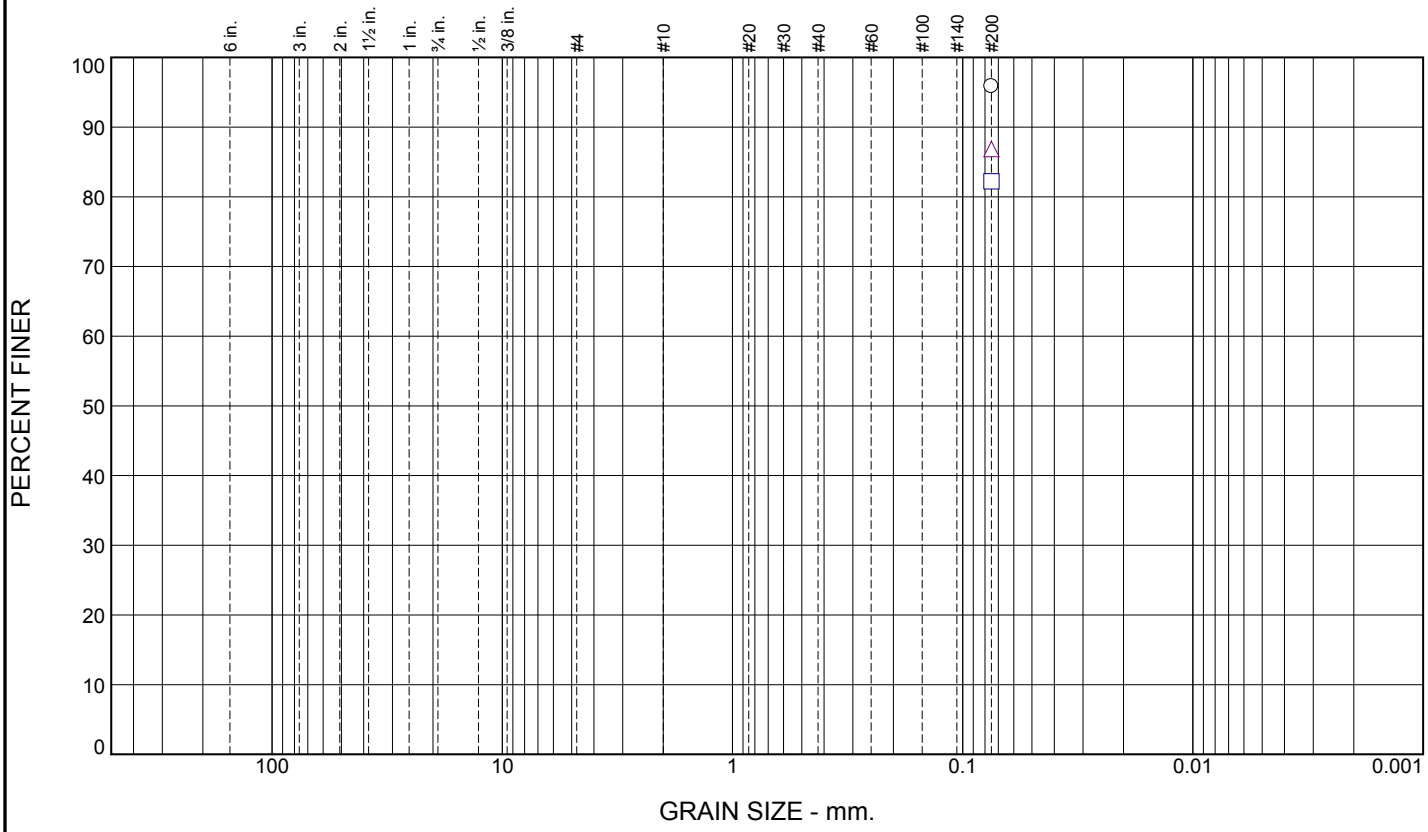
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 11

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	31	28	3
□						CL	38	21	17
△						CL	35	21	14

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	95.9	82.2	86.9

Material Description

○ SILT, light olive brown

□ Lean CLAY, dark yellowish brown

△ Lean CLAY, olive gray

REMARKS:

○

□

△

○ Source of Sample: SL0001_005B Depth: 40.5-42.0' Sample Number: 18

□ Source of Sample: SL0001_005B Depth: 45.15-45.65' Sample Number: 19b

△ Source of Sample: SL0001_005B Depth: 49.9-50.4' Sample Number: 21b

Blackburn Consulting

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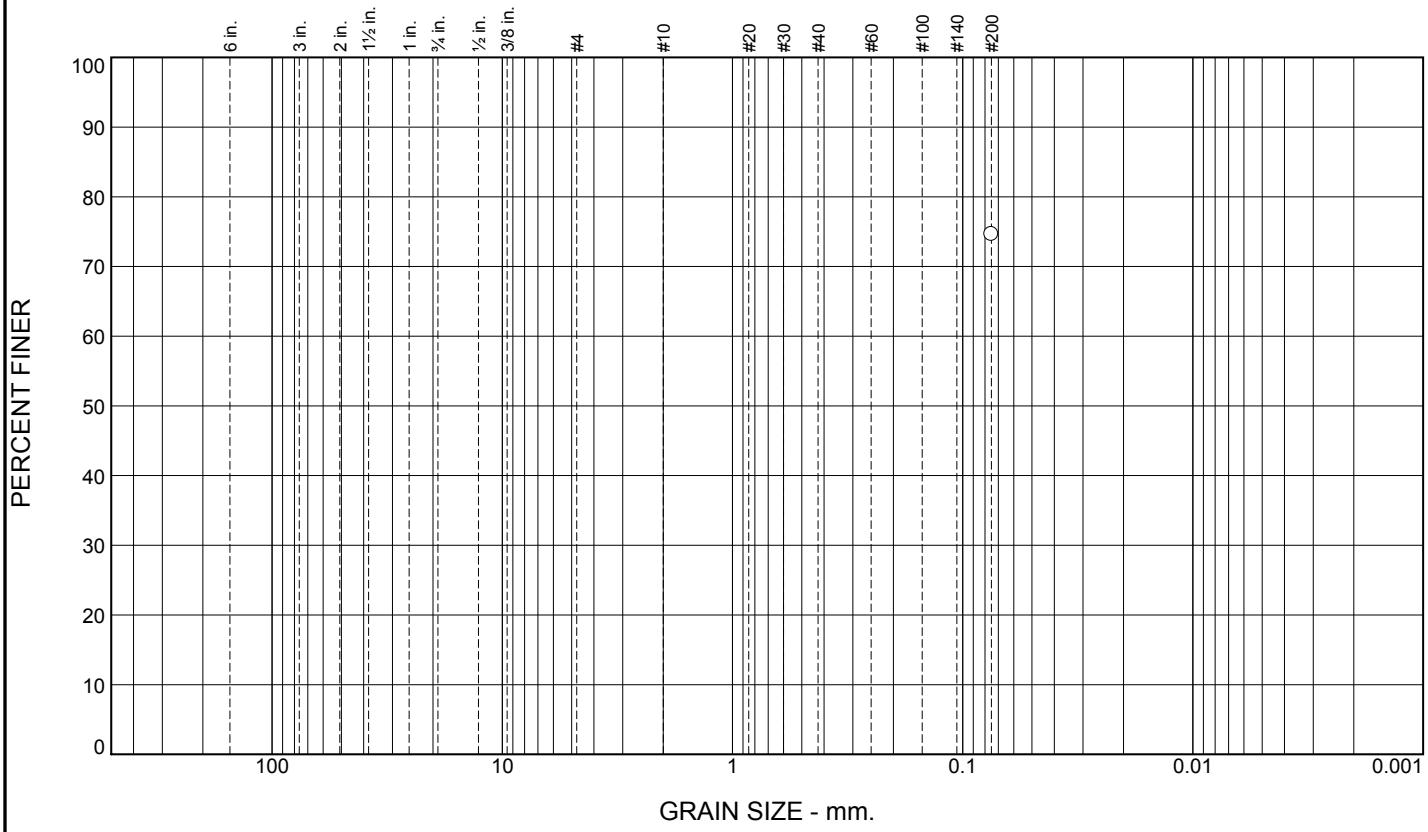
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 12

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	30	25	5

SIEVE inches size	PERCENT FINER ○		
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	74.7		

Material Description

○ SILT with SAND, olive brown

REMARKS:

○

○ Source of Sample: SL0001_005B Depth: 51.0-52.5' Sample Number: 22

Blackburn Consulting

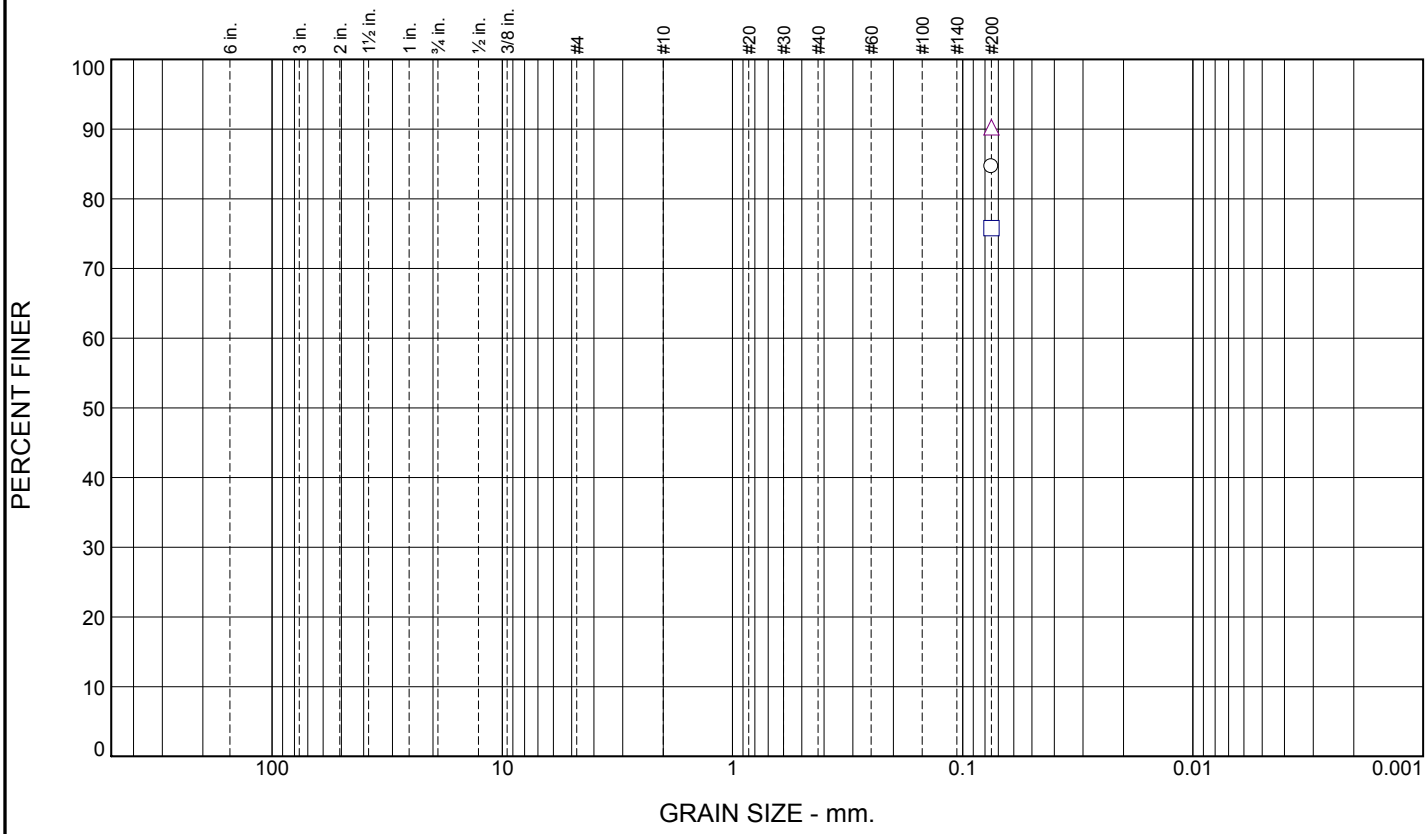
W. Sacramento, CA

Client: URS

Project: Feather River West Levee

Project No.: 1967.3 Figure 13

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	30	17	13
□						ML	26	25	1
△						CL	31	18	13

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	84.6	75.8	90.3

Material Description

○ Lean CLAY with SAND, brown

□ SILT with SAND, yellowish brown

△ Lean CLAY, brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_006B Depth: 0.9-1.4' Sample Number: 1b

□ Source of Sample: SL0001_006B Depth: 6.9-7.5' Sample Number: 3c

△ Source of Sample: SL0001_006B Depth: 5.9-6.4' Sample Number: 3a

Blackburn Consulting

W. Sacramento, CA

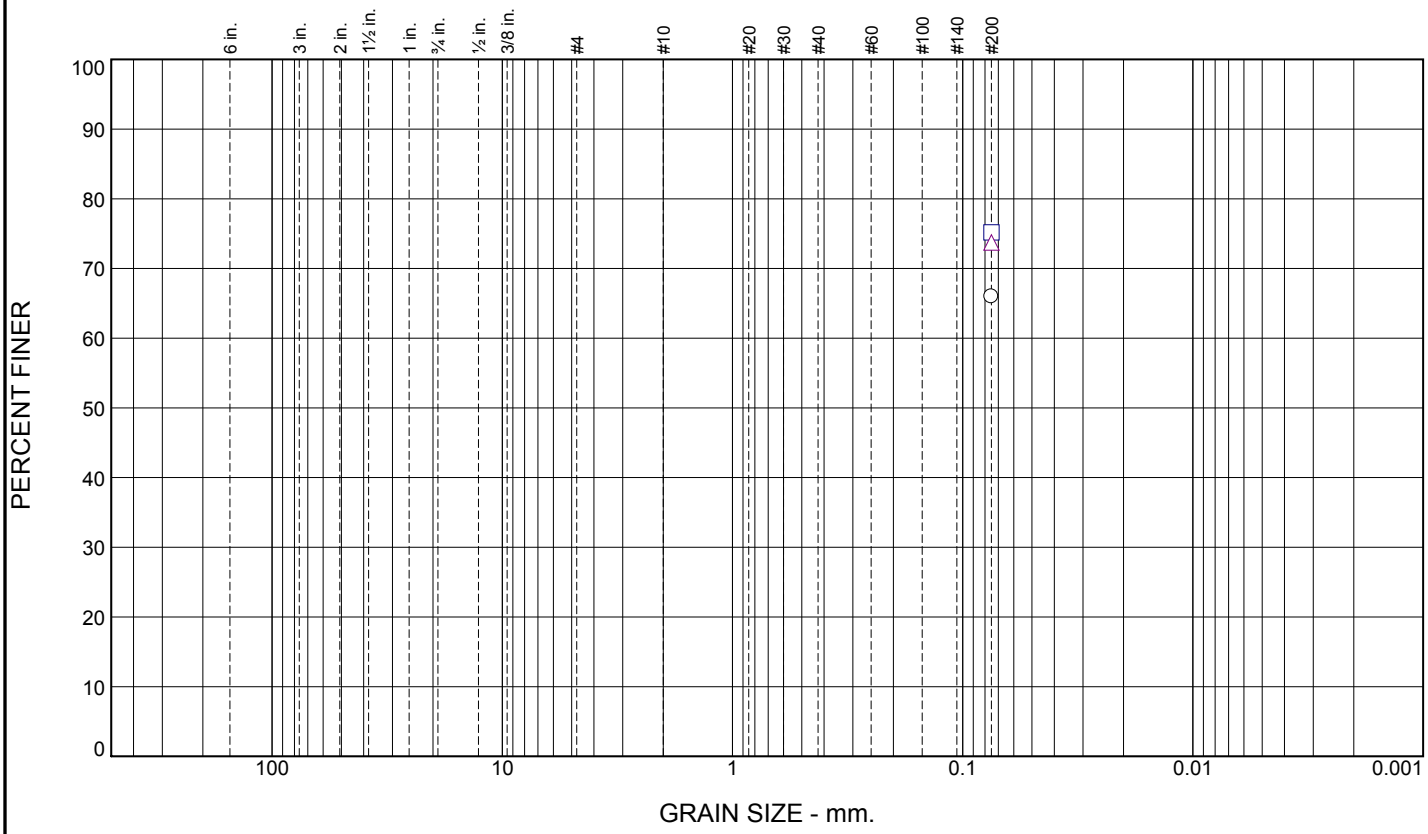
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 14

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	NV	NP	NP
□						ML			
△						ML			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	66.0	75.2	73.7

Material Description

○ SANDY SILT, dark yellowish brown

□ SILT with SAND, olive brown

△ SILT with SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_006B Depth: 7.5-9.0' Sample Number: 4

□ Source of Sample: SL0001_006B Depth: 11.4-11.9' Sample Number: 5b

△ Source of Sample: SL0001_006B Depth: 11.9-12.5' Sample Number: 5c

Blackburn Consulting

W. Sacramento, CA

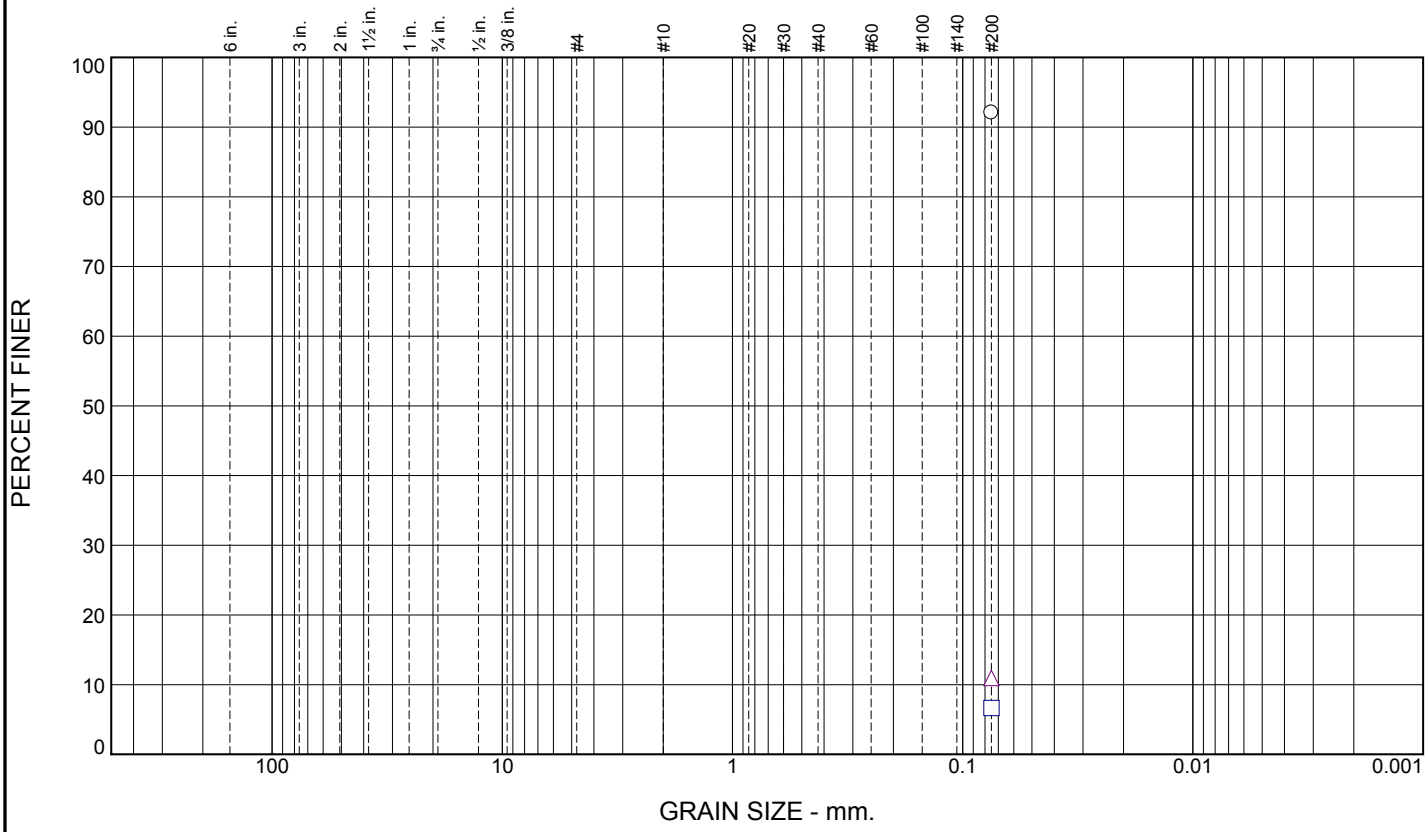
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 15

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL			
□						SP-SM			
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	92.1	6.6	11.0

Material Description

○ Lean CLAY, olive brown

□ Poorly-graded SAND with SILT, light olive brown

△ Poorly-graded SAND with SILT, dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_006B Depth: 15.4-16.0' Sample Number: 7c

□ Source of Sample: SL0001_006B Depth: 21.0-22.5' Sample Number: 10

△ Source of Sample: SL0001_006B Depth: 26.0-27.5' Sample Number: 12

Blackburn Consulting

W. Sacramento, CA

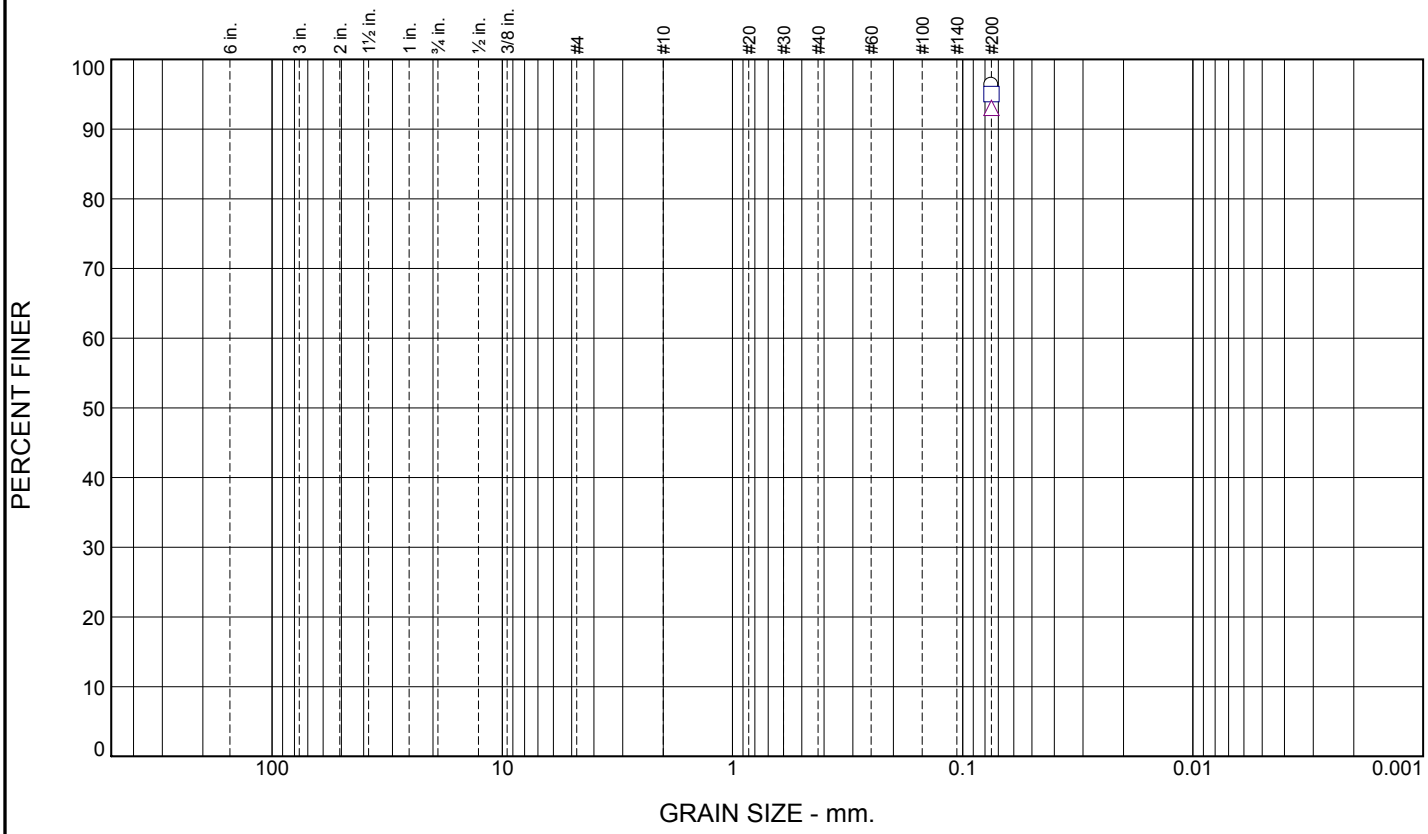
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 16

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	43	33	10
□						CL			
△						ML	47	28	19

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	96.3	95.0	93.0

Material Description

○ SILT, dark yellowish brown

□ Lean CLAY, dark yellowish brown

△ SILT, brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_007B Depth: 1.55-2.0' Sample Number: 1c

□ Source of Sample: SL0001_007B Depth: 2.5-4.0' Sample Number: 2

△ Source of Sample: SL0001_007B Depth: 13.5-15.5' Sample Number: 7b

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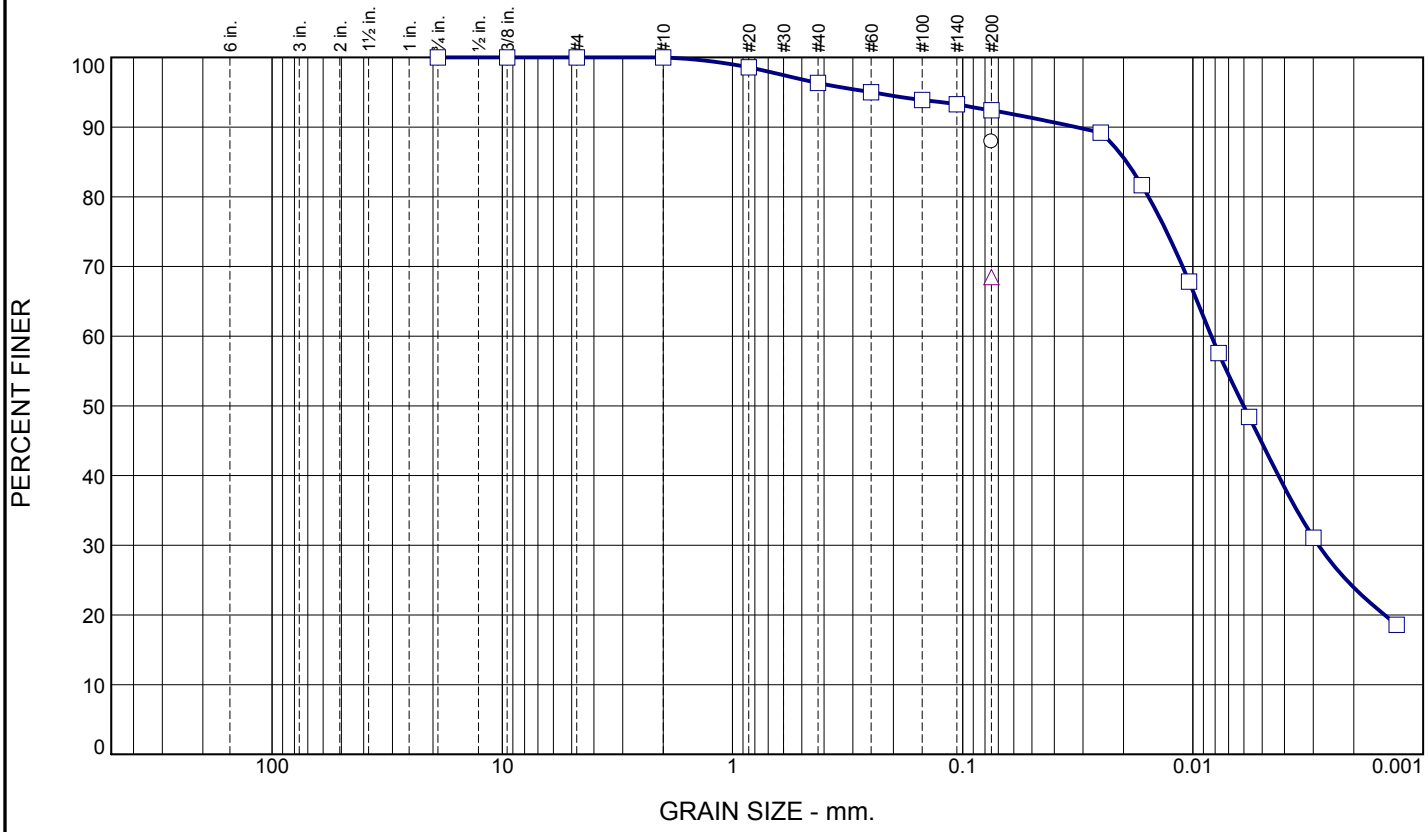
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 17

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	41	24	17
□	0.0	0.0	7.6	47.8	44.6	ML	44	27	17
△						ML	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
3/8"		100.0	
GRAIN SIZE			
D_{60}		0.0083	
D_{30}		0.0028	
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	
#10		100.0	
#20		98.6	
#40		96.3	
#60		95.0	
#100		93.9	
#140		93.3	
#200	87.9	92.4	68.5

Material Description

○ Lean CLAY, brown

□ SILT, yellowish brown

△ SANDY SILT, dark olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_007B Depth: 23.35-23.9' Sample Number: 11b

□ Source of Sample: SL0001_007B Depth: 27.6-28.2' Sample Number: 13b

△ Source of Sample: SL0001_007B Depth: 32.4-32.9' Sample Number: 15b

Blackburn Consulting

W. Sacramento, CA

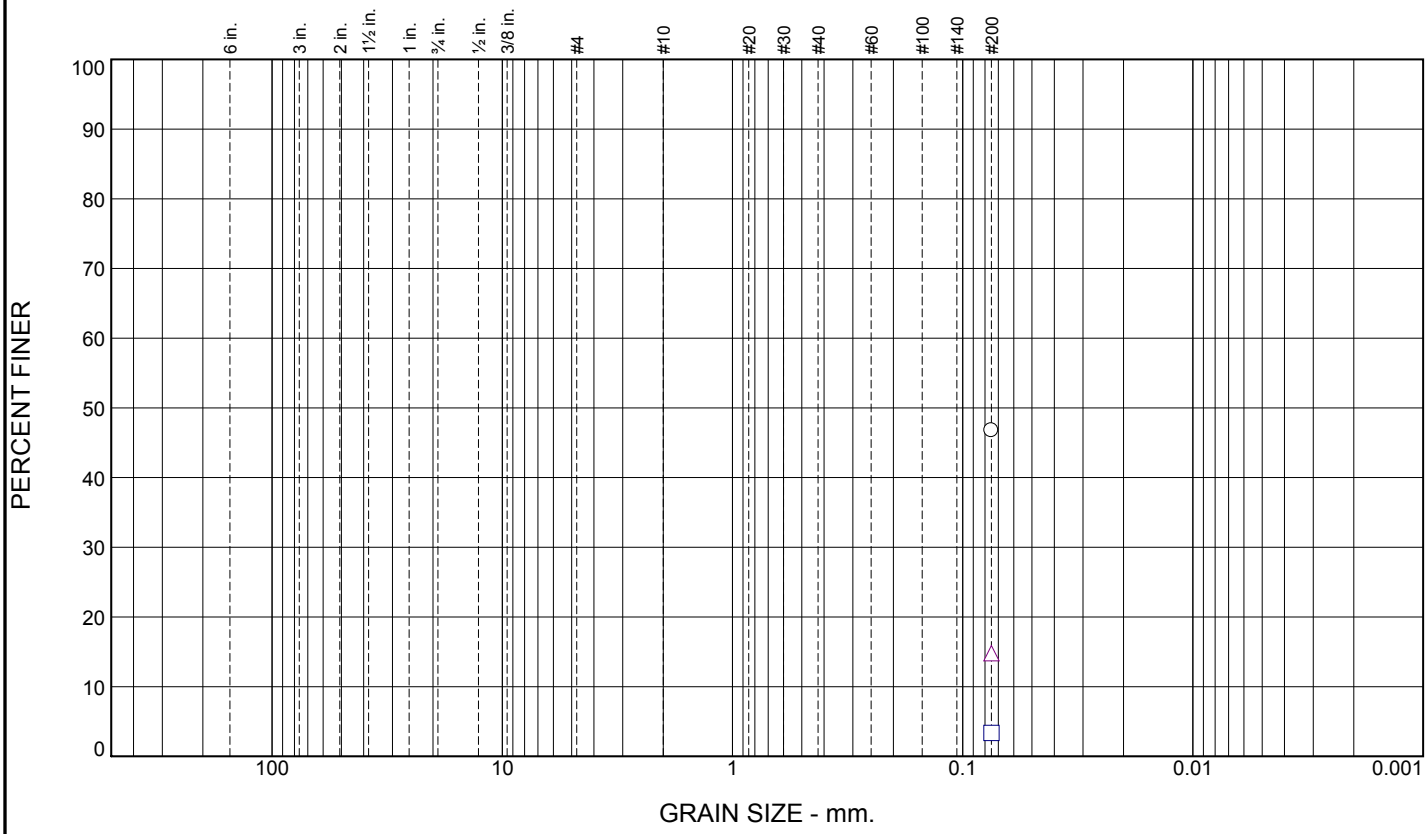
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 18

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SP			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	46.8	3.4	14.8

Material Description

○ SILTY SAND, olive brown

□ Poorly-graded SAND, dark olive brown

△ SILTY SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_007B Depth: 36.9-37.4' Sample Number: 17b

□ Source of Sample: SL0001_007B Depth: 41.5-42.0' Sample Number: 19b

△ Source of Sample: SL0001_007B Depth: 47.5-49.0' Sample Number: 22

Blackburn Consulting

W. Sacramento, CA

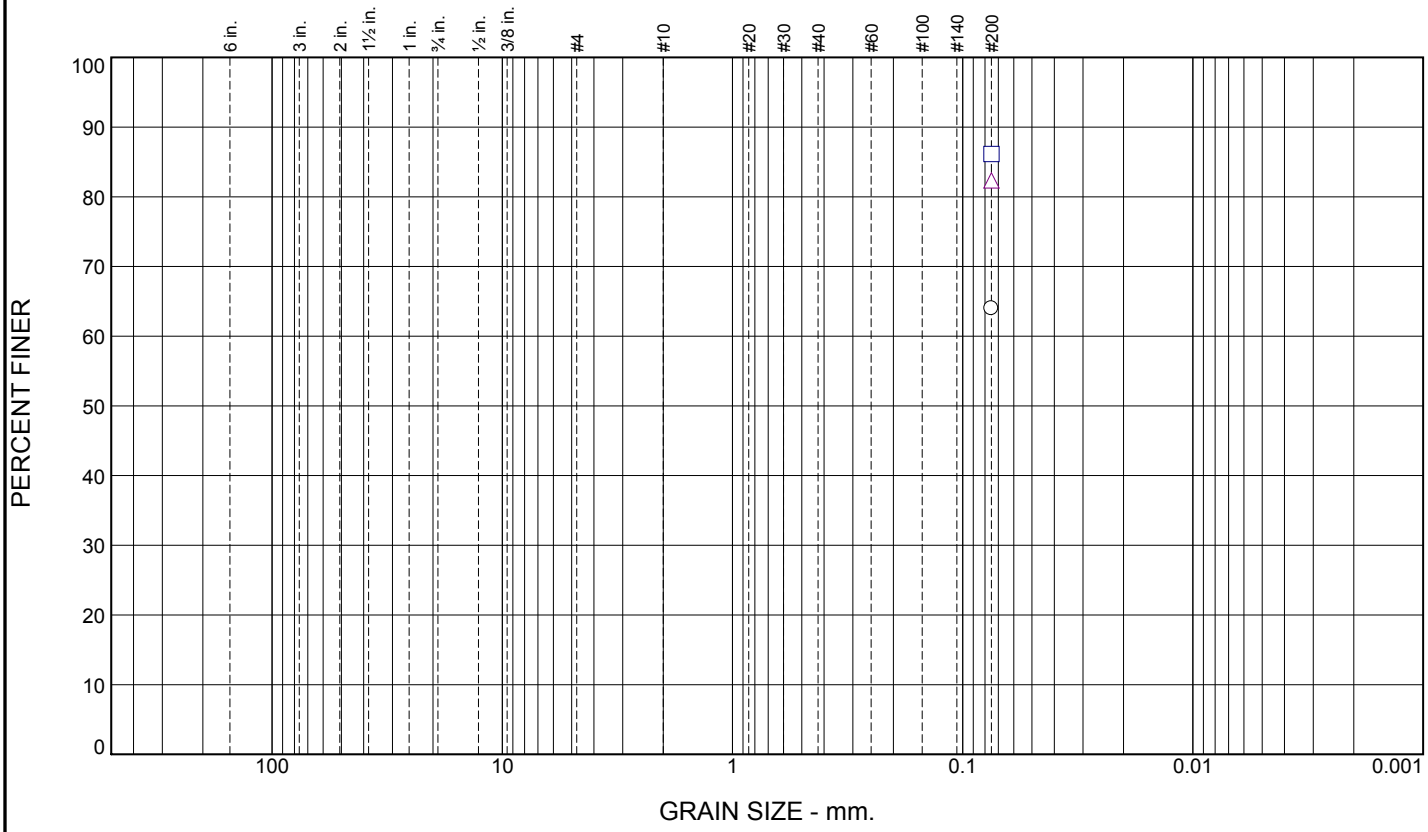
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 19

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						ML			
△						ML	38	30	8

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	64.0	86.1	82.4

Material Description

○ SANDY SILT, olive brown

□ SILT, dark yellowish brown

△ SILT with SAND, brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_008B Depth: 1.9-2.5' Sample Number: 1c

□ Source of Sample: SL0001_008B Depth: 19.4-19.9' Sample Number: 9b

△ Source of Sample: SL0001_008B Depth: 28.4-28.9' Sample Number: 13b

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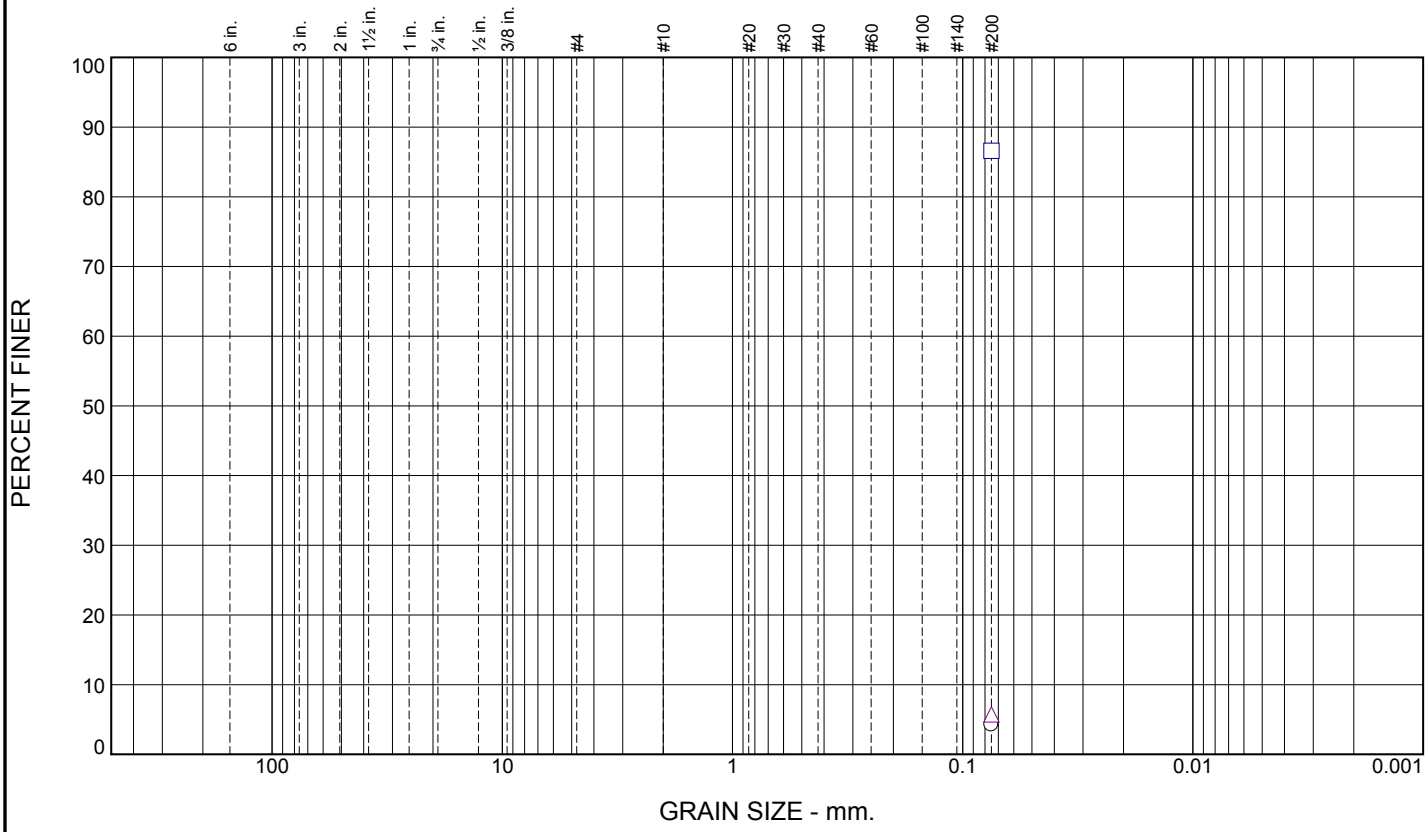
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 20

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP			
□						CL	41	23	18
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	4.2	86.6	5.7

Material Description

○ Poorly-graded SAND, dark olive brown

□ Lean CLAY, olive brown

△ Poorly-graded SAND with silt, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_008B Depth: 32.9-33.4' Sample Number: 15b

□ Source of Sample: SL0001_008B Depth: 37.4-37.9' Sample Number: 17b

△ Source of Sample: SL0001_008B Depth: 42.0-42.5' Sample Number: 19b

Blackburn Consulting

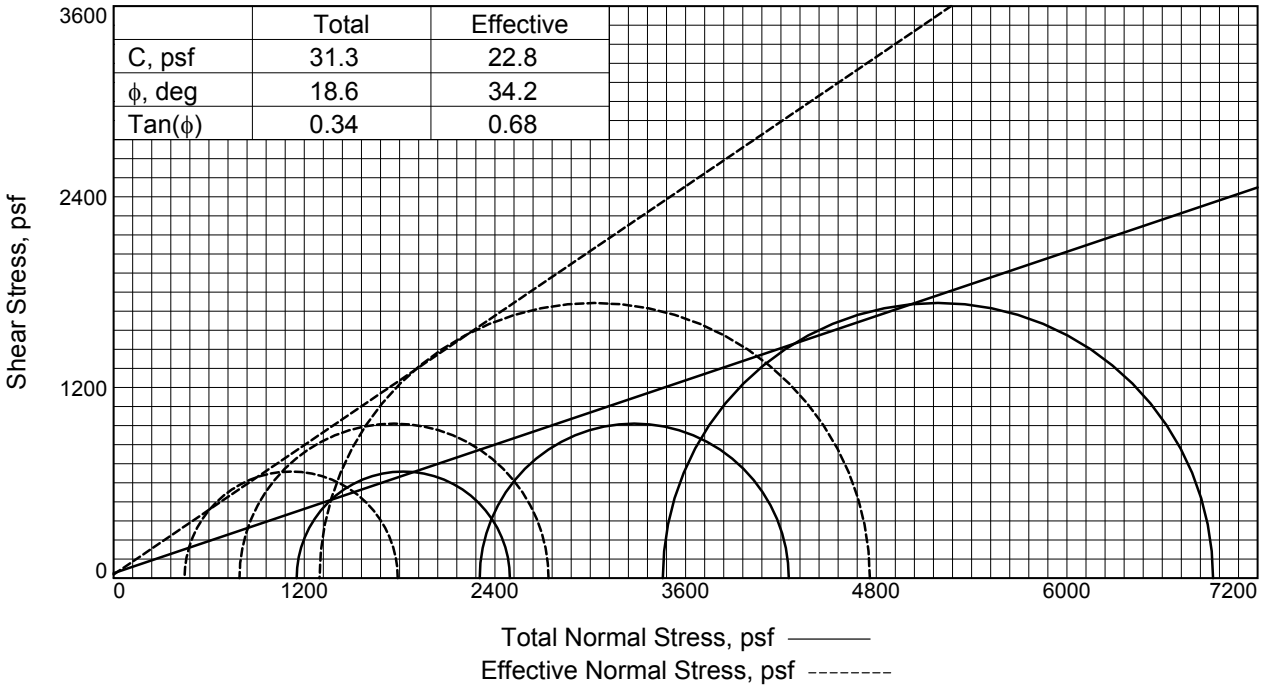
W. Sacramento, CA

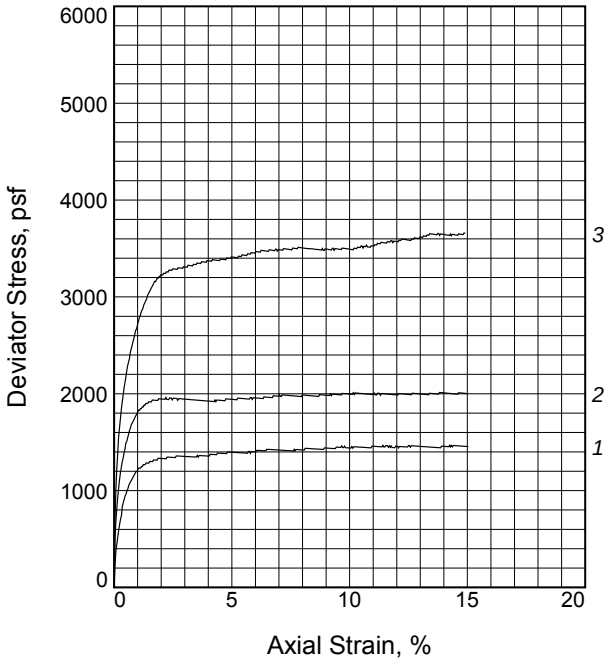
Client: URS

Project: Feather River West Levee

Project No.: 1967.3

Figure 21





Specimen No.		1	2	3
Initial	Water Content, %	28.1	28.4	26.7
	Dry Density, pcf	93.3	96.0	99.4
	Saturation, %	94.2	101.5	103.4
	Void Ratio	0.8066	0.7550	0.6964
	Diameter, in.	2.873	2.815	2.815
	Height, in.	5.924	6.026	6.077
At Test	Water Content, %	28.6	26.4	22.5
	Dry Density, pcf	95.1	98.5	104.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7720	0.7116	0.6062
	Diameter, in.	2.855	2.792	2.764
	Height, in.	5.886	5.976	5.968
Strain rate, in./min.		0.005	0.007	0.007
Eff. Cell Pressure, psf		1152.0	2304.0	3456.0
Fail. Stress, psf		1341.8	1945.2	3463.4
Excess Pore Pr., psf		705.6	1512.0	2160.0
Strain, %		2.6	4.9	6.2
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1788.2	2737.2	4759.4
$\bar{\sigma}_3$ Failure, psf		446.4	792.0	1296.0

Type of Test:
CU with Pore Pressures

Sample Type:

Description: Specimen 1 (7a): Lean CLAY with SAND

Specimen 2 (7b): Lean CLAY with SAND

Assumed Specific Gravity= 2.7

Remarks:

7a: LL=30, PI=8, %fines= 79.1

7b: LL=28, PI=9, %fines= 79.2

7c: LL=29, PI=10, %fines=78.5

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SM0003_001B **Depth:** 15.9-17.5'

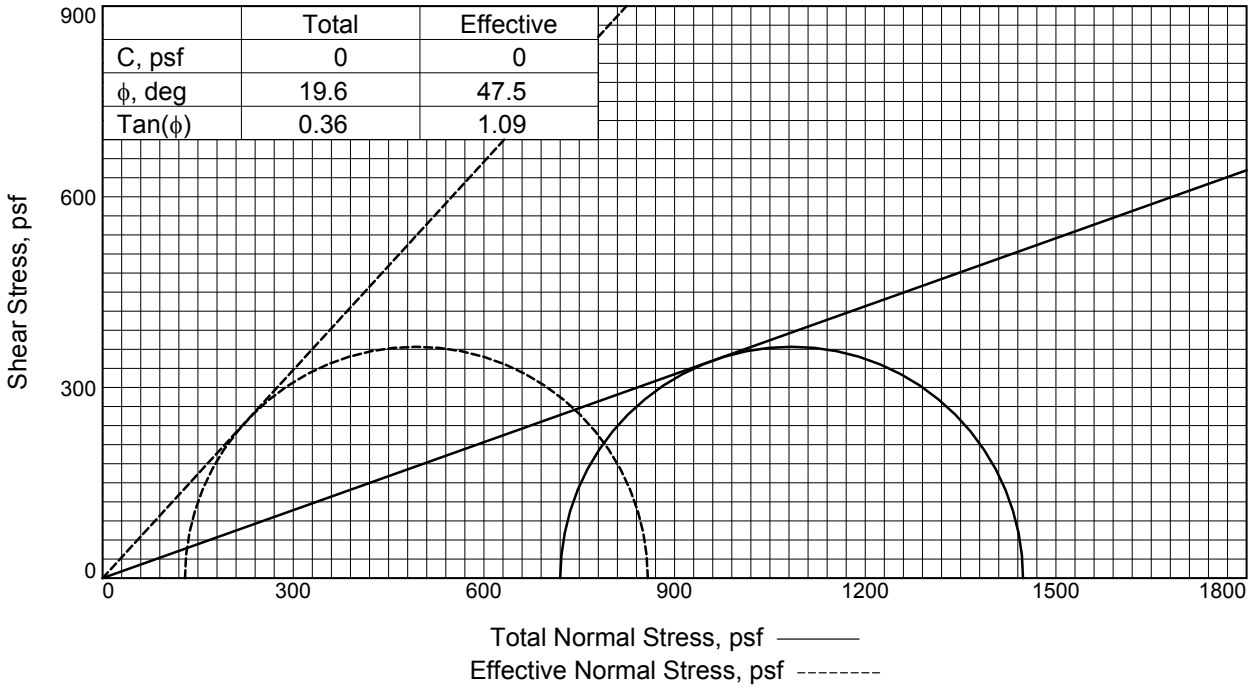
Sample Number: 7

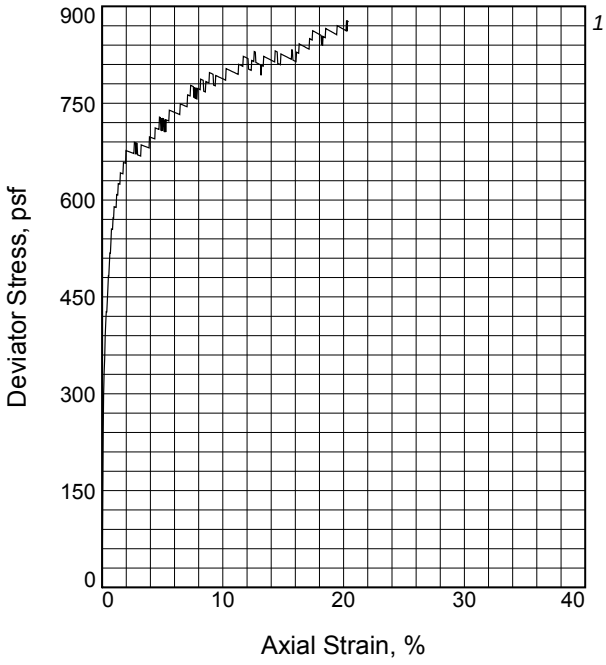
Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

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W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	22.8
	Dry Density, pcf	97.5
	Saturation, %	84.6
	Void Ratio	0.7282
	Diameter, in.	2.810
	Height, in.	5.401
At Test	Water Content, %	27.5
	Dry Density, pcf	96.7
	Saturation, %	100.0
	Void Ratio	0.7437
	Diameter, in.	2.851
	Height, in.	5.294
Strain rate, in./min.		0.002
Eff. Cell Pressure, psf		720.0
Fail. Stress, psf		728.1
Excess Pore Pr., psf		590.4
Strain, %		4.8
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		857.7
$\bar{\sigma}_3$ Failure, psf		129.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 1 (3a): Lean CLAY

Assumed Specific Gravity= 2.7

Remarks:
3a: LL=32, PI=13, % fines=90.8

Figure _____

Client: URS Corporation

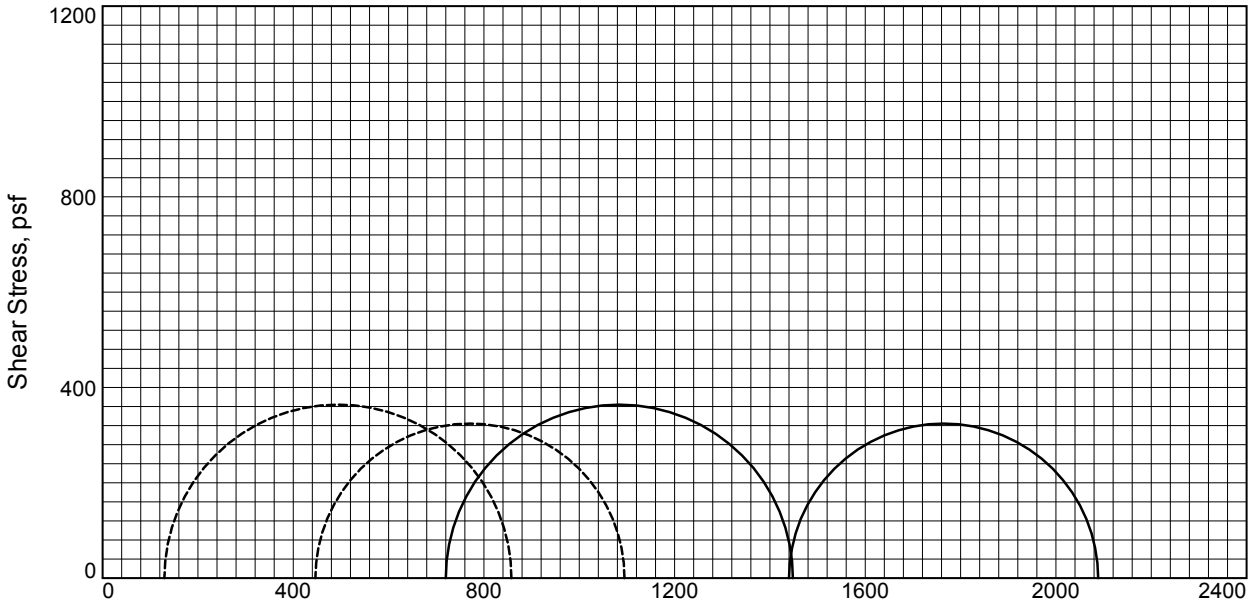
Project: Feather River West Levee

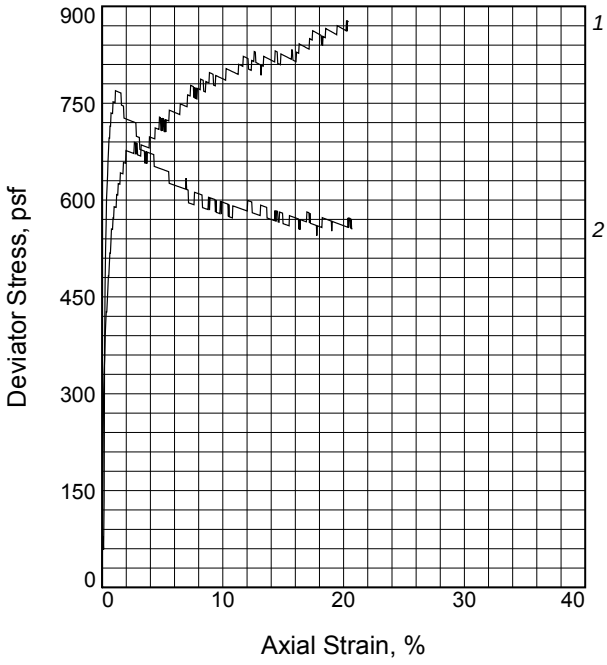
Source of Sample: SM0003_003B **Depth:** 5.5-6.0'

Sample Number: 3a

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2
Initial	Water Content, %	22.8	23.5
	Dry Density, pcf	97.5	88.2
	Saturation, %	84.6	69.8
	Void Ratio	0.7282	0.9107
	Diameter, in.	2.810	2.812
	Height, in.	5.401	5.743
At Test	Water Content, %	27.5	30.4
	Dry Density, pcf	96.7	92.5
	Saturation, %	100.0	100.0
	Void Ratio	0.7437	0.8220
	Diameter, in.	2.851	2.793
	Height, in.	5.294	5.551
Strain rate, in./min.		0.002	0.004
Eff. Cell Pressure, psf		720.0	1440.0
Fail. Stress, psf		728.1	648.5
Excess Pore Pr., psf		590.4	993.6
Strain, %		4.8	4.9
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		857.7	1094.9
$\bar{\sigma}_3$ Failure, psf		129.6	446.4

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 1 (3a): Lean CLAY
Specimen 2 (3b): Lean CLAY

Assumed Specific Gravity= 2.7

Remarks:
3a: LL=32, PI=13, % fines=90.8
3b: LL=32, PI=12, % fines=94.3

Figure _____

Client: URS Corporation

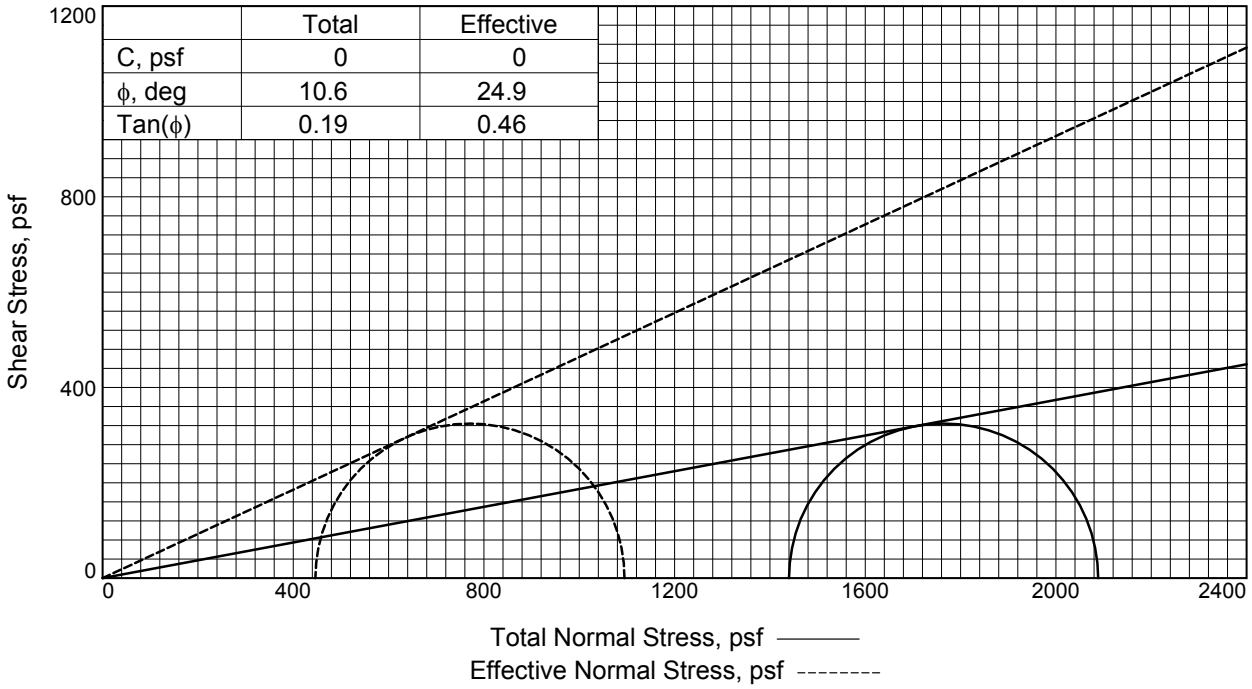
Project: Feather River West Levee

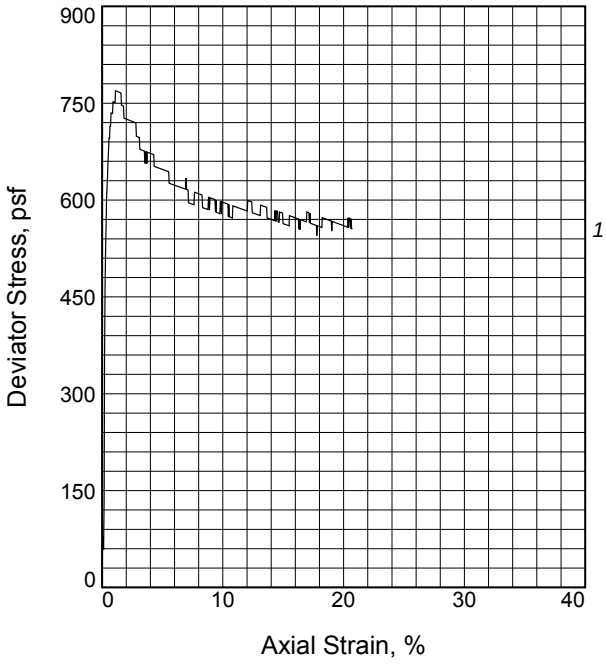
Source of Sample: SM0003_003B **Depth:** 5.5-6.5'

Sample Number: 3

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	23.5
	Dry Density, pcf	88.2
	Saturation, %	69.8
	Void Ratio	0.9107
	Diameter, in.	2.812
	Height, in.	5.743
At Test	Water Content, %	30.4
	Dry Density, pcf	92.5
	Saturation, %	100.0
	Void Ratio	0.8220
	Diameter, in.	2.793
	Height, in.	5.551
Strain rate, in./min.		0.004
Eff. Cell Pressure, psf		1440.0
Fail. Stress, psf		648.5
Excess Pore Pr., psf		993.6
Strain, %		4.9
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		1094.9
$\bar{\sigma}_3$ Failure, psf		446.4

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 2 (3b): Lean CLAY

Assumed Specific Gravity= 2.7

Remarks:
3b: LL=32, PI=12, % fines=94.3

Figure _____

Client: URS Corporation

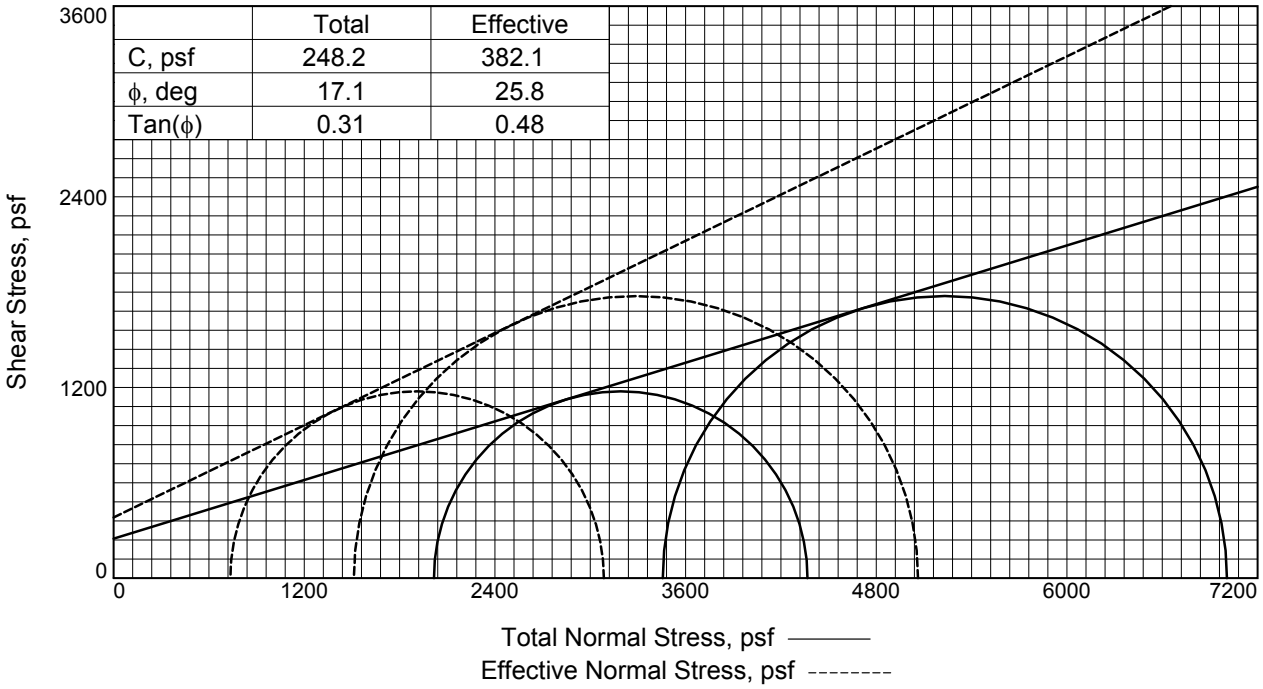
Project: Feather River West Levee

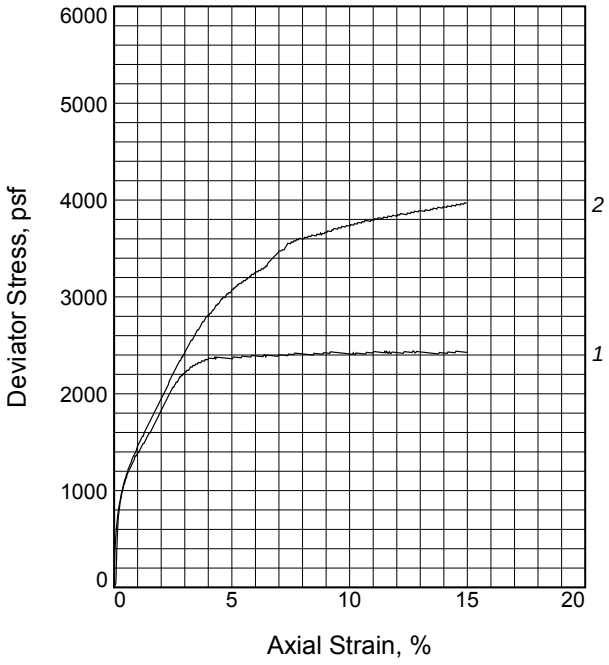
Source of Sample: SM0003_003B **Depth:** 6.0-6.5'

Sample Number: 3b

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2
Initial	Water Content, %	20.7	21.3
	Dry Density, pcf	101.4	106.1
	Saturation, %	84.4	97.5
	Void Ratio	0.6616	0.5890
	Diameter, in.	2.818	2.806
	Height, in.	6.347	6.268
At Test	Water Content, %	22.0	20.4
	Dry Density, pcf	105.8	108.7
	Saturation, %	100.0	100.0
	Void Ratio	0.5929	0.5505
	Diameter, in.	2.805	2.806
	Height, in.	6.140	6.118
Strain rate, in./min.		0.006	0.004
Eff. Cell Pressure, psf		2016.0	3456.0
Fail. Stress, psf		2351.1	3550.5
Excess Pore Pr., psf		1281.6	1944.0
Strain, %		4.0	7.4
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		3085.5	5062.5
$\bar{\sigma}_3$ Failure, psf		734.4	1512.0

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 1 (11a): Lean CLAY with SAND
Specimen 2 (11b): Lean CLAY with SAND

Assumed Specific Gravity= 2.7

Remarks:
11a: LL=27, PI=10, %fines=77.9
11b: LL=29, PI=16, %fines=81.3

Figure _____

Client: URS Corporation

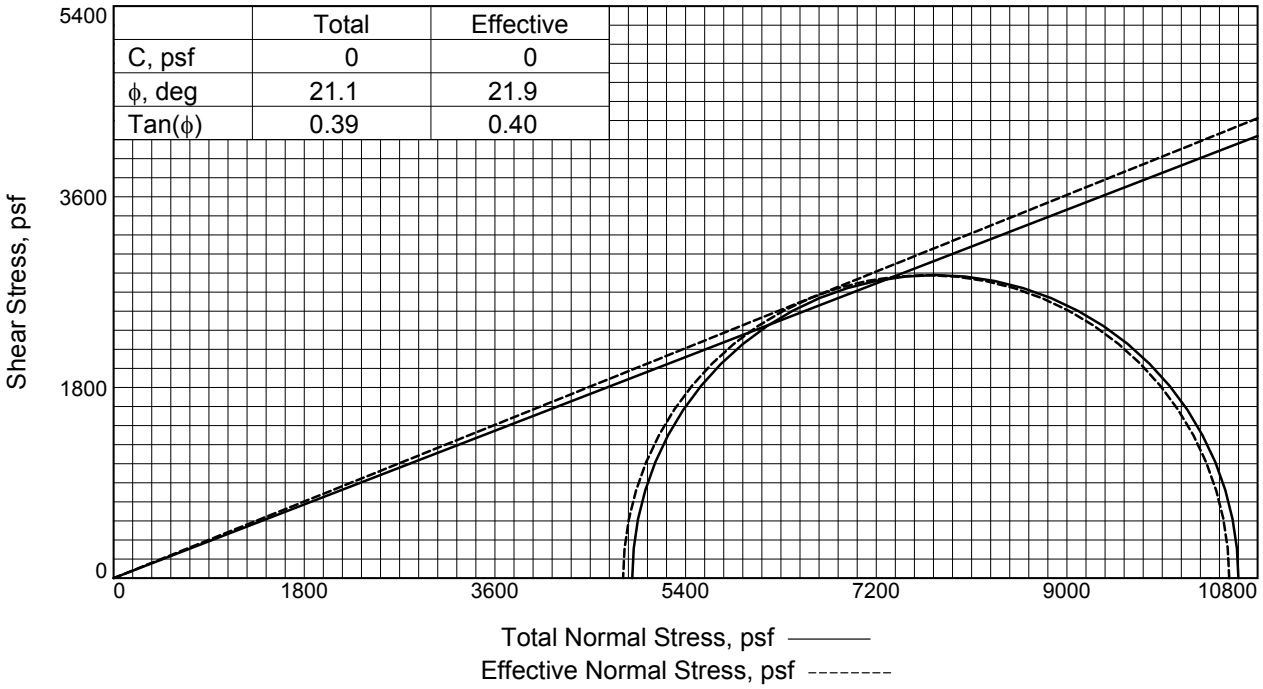
Project: Feather River West Levee

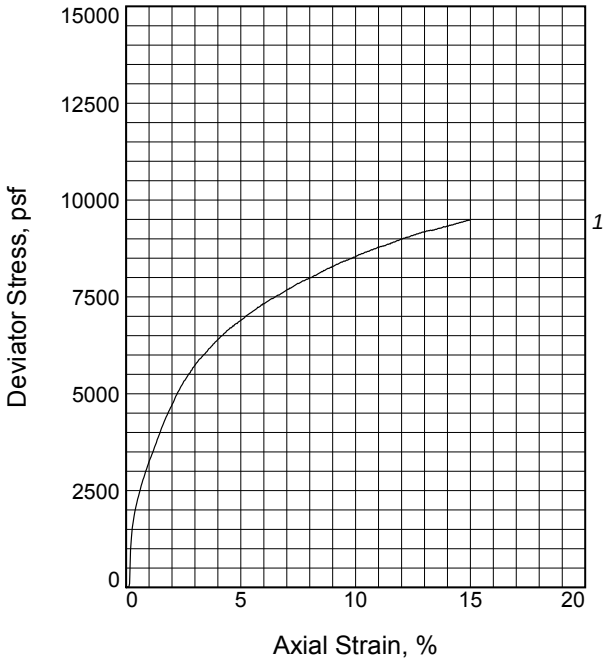
Source of Sample: SL0001_003B **Depth:** 23.4-24.4'

Sample Number: 11

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	20.1
	Dry Density, pcf	105.1
	Saturation, %	89.9
	Void Ratio	0.6035
	Diameter, in.	2.823
	Height, in.	6.097
At Test	Water Content, %	18.4
	Dry Density, pcf	112.6
	Saturation, %	100.0
	Void Ratio	0.4967
	Diameter, in.	2.773
	Height, in.	5.897
Strain rate, in./min.		0.002
Eff. Cell Pressure, psf		4896.0
Fail. Stress, psf		5721.8
Excess Pore Pr., psf		86.4
Strain, %		3.0
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		10531.4
$\bar{\sigma}_3$ Failure, psf		4809.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 1 (11c): Lean CLAY with SAND

Assumed Specific Gravity= 2.7

Remarks:
11c: LL=26, PI=15, %fines=81.7

Figure _____

Client: URS Corporation

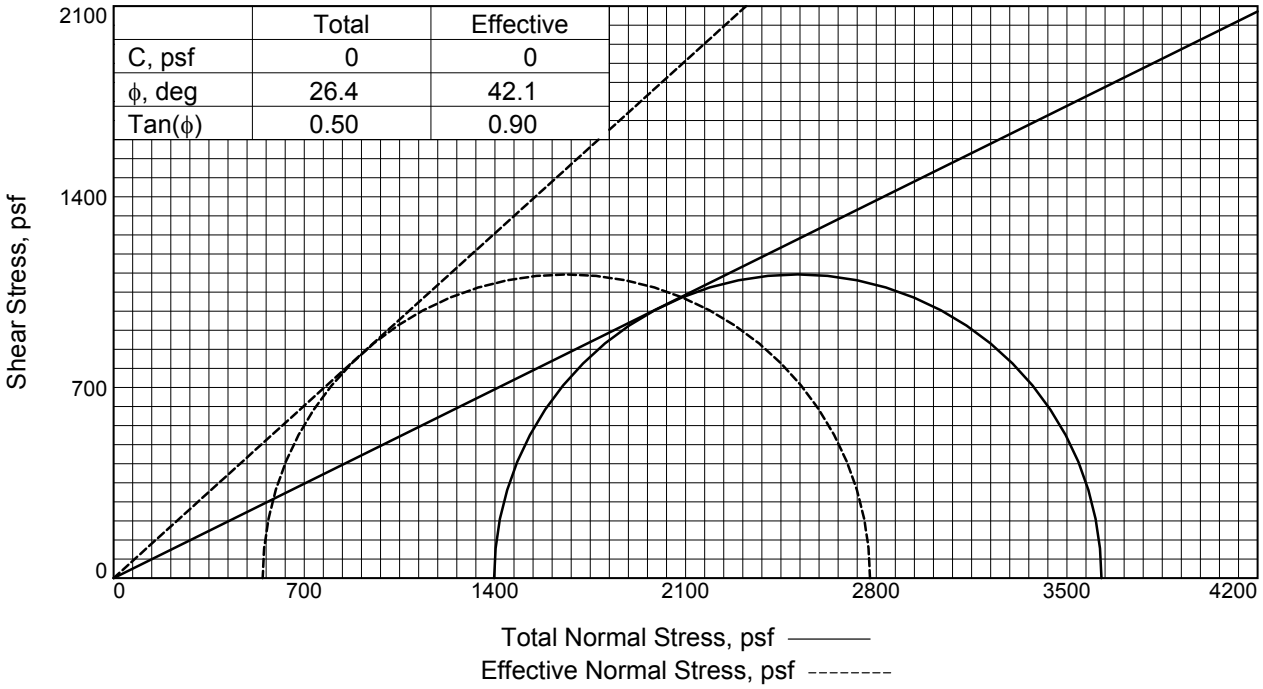
Project: Feather River West Levee

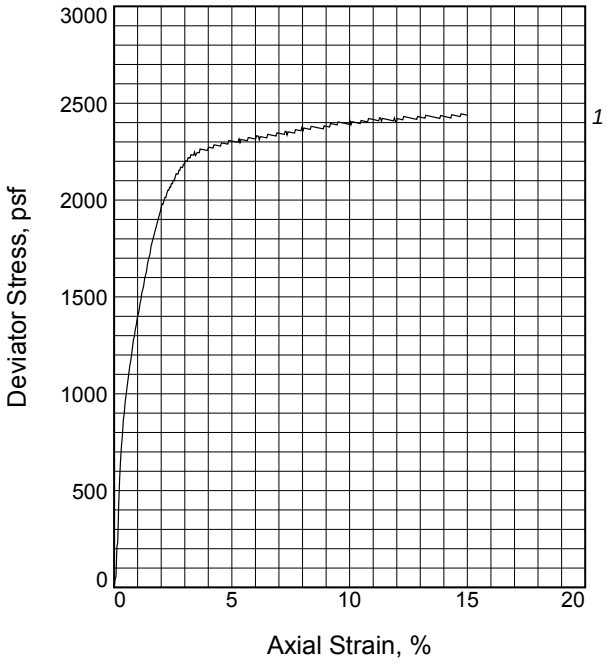
Source of Sample: SL0001_003B **Depth:** 24.4-25.0'

Sample Number: 11c

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	29.2
	Dry Density, pcf	85.4
	Saturation, %	81.0
	Void Ratio	0.9747
	Diameter, in.	2.822
	Height, in.	5.882
At Test	Water Content, %	34.6
	Dry Density, pcf	87.2
	Saturation, %	100.0
	Void Ratio	0.9331
	Diameter, in.	2.808
	Height, in.	5.817
Strain rate, in./min.		0.005
Eff. Cell Pressure, psf		1396.8
Fail. Stress, psf		2229.8
Excess Pore Pr., psf		849.6
Strain, %		3.5
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		2777.0
$\bar{\sigma}_3$ Failure, psf		547.2

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen #1 (7a): SILT with SAND

Assumed Specific Gravity= 2.7

Remarks:
7a: LL=38, PI=11, %fines=75.7

Figure _____

Client: URS Corporation

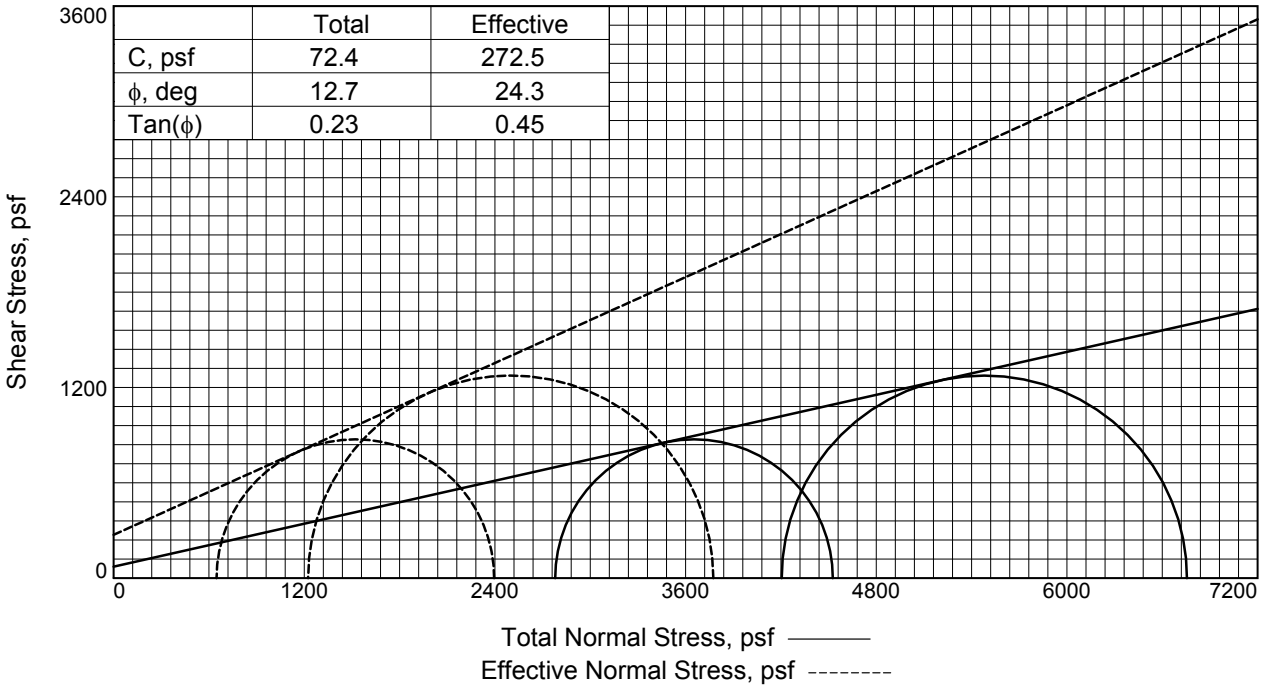
Project: Feather River West Levee

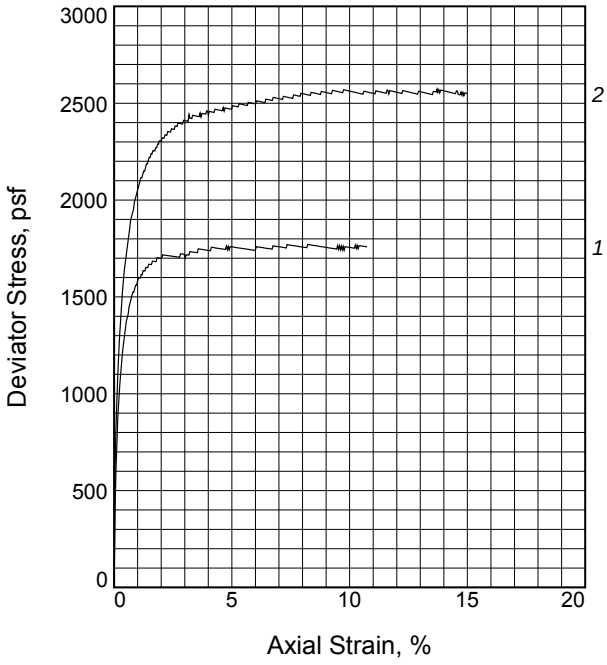
Source of Sample: SL0001_005B **Depth:** 15.4-15.9'

Sample Number: 7a

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2
Initial	Water Content, %	31.0	32.0
	Dry Density, pcf	79.8	80.7
	Saturation, %	75.3	79.4
	Void Ratio	1.1120	1.0881
	Diameter, in.	2.789	2.821
	Height, in.	5.899	5.925
At Test	Water Content, %	39.3	38.7
	Dry Density, pcf	81.8	82.4
	Saturation, %	100.0	100.0
	Void Ratio	1.0603	1.0453
	Diameter, in.	2.776	2.818
	Height, in.	5.808	5.817
Strain rate, in./min.		0.004	0.007
Eff. Cell Pressure, psf		2779.2	4204.8
Fail. Stress, psf		1746.9	2550.2
Excess Pore Pr., psf		2131.2	2980.8
Strain, %		9.5	8.0
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		2394.9	3774.2
$\bar{\sigma}_3$ Failure, psf		648.0	1224.0

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen #1 (7b): SANDY SILT
Specimen #2 (7c): SILT with SAND

Assumed Specific Gravity= 2.7

Remarks:
7b: LL=36, PI=11, %fines=69.9
7c: LL=39, PI=13, %fines=78.5

Figure _____

Client: URS Corporation

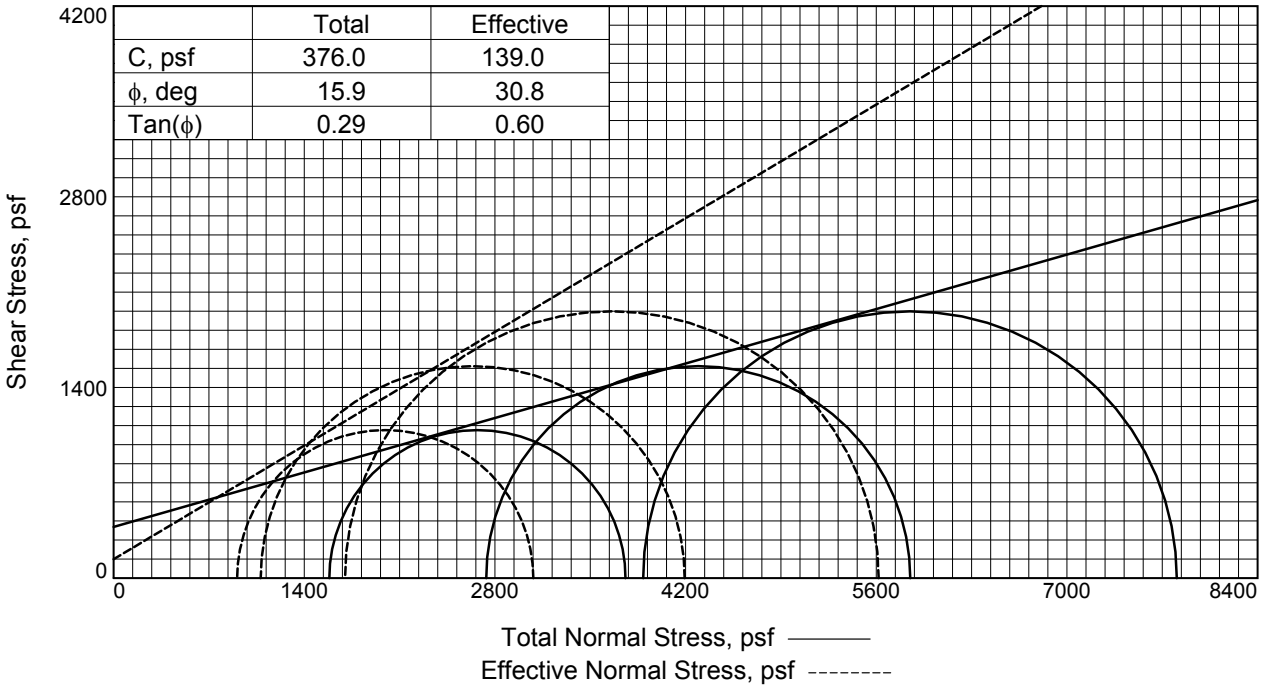
Project: Feather River West Levee

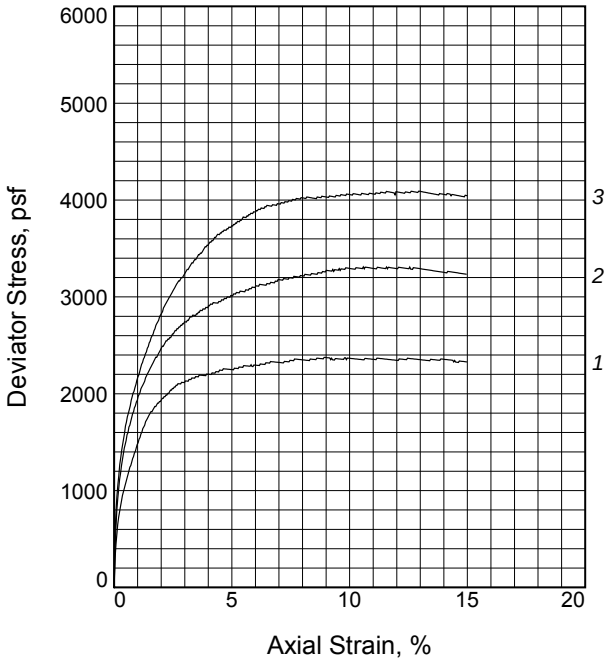
Source of Sample: SL0001_005B **Depth:** 15.9-16.9'

Sample Number: 7

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
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Specimen No.		1	2	3
Initial	Water Content, %	45.7	54.6	41.8
	Dry Density, pcf	74.4	71.0	77.5
	Saturation, %	97.4	107.4	96.1
	Void Ratio	1.2662	1.3729	1.1741
	Diameter, in.	2.825	2.827	2.834
	Height, in.	5.865	5.945	5.765
At Test	Water Content, %	47.8	43.9	40.6
	Dry Density, pcf	73.6	77.1	80.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.2914	1.1852	1.0970
	Diameter, in.	2.853	2.732	2.806
	Height, in.	5.815	5.862	5.671
Strain rate, in./min.		0.003	0.002	0.004
Eff. Cell Pressure, psf		1584.0	2736.0	3888.0
Fail. Stress, psf		2174.4	3113.0	3918.0
Excess Pore Pr., psf		676.8	1656.0	2188.8
Strain, %		3.6	6.1	6.2
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		3081.6	4193.0	5617.2
$\bar{\sigma}_3$ Failure, psf		907.2	1080.0	1699.2

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description: Specimen 1 (9a): Elastic SILT
Specimen 2 (9b): Fat CLAY
Specimen 3 (9c): Elastic SILT

Assumed Specific Gravity= 2.7

Remarks:
9a: LL=53, PI=23, %fines=85.6
9b: LL=57, PI=27, %fines=94.6
9a: LL=52, PI=23, %fines=88.0

Figure _____

Client: URS Corporation

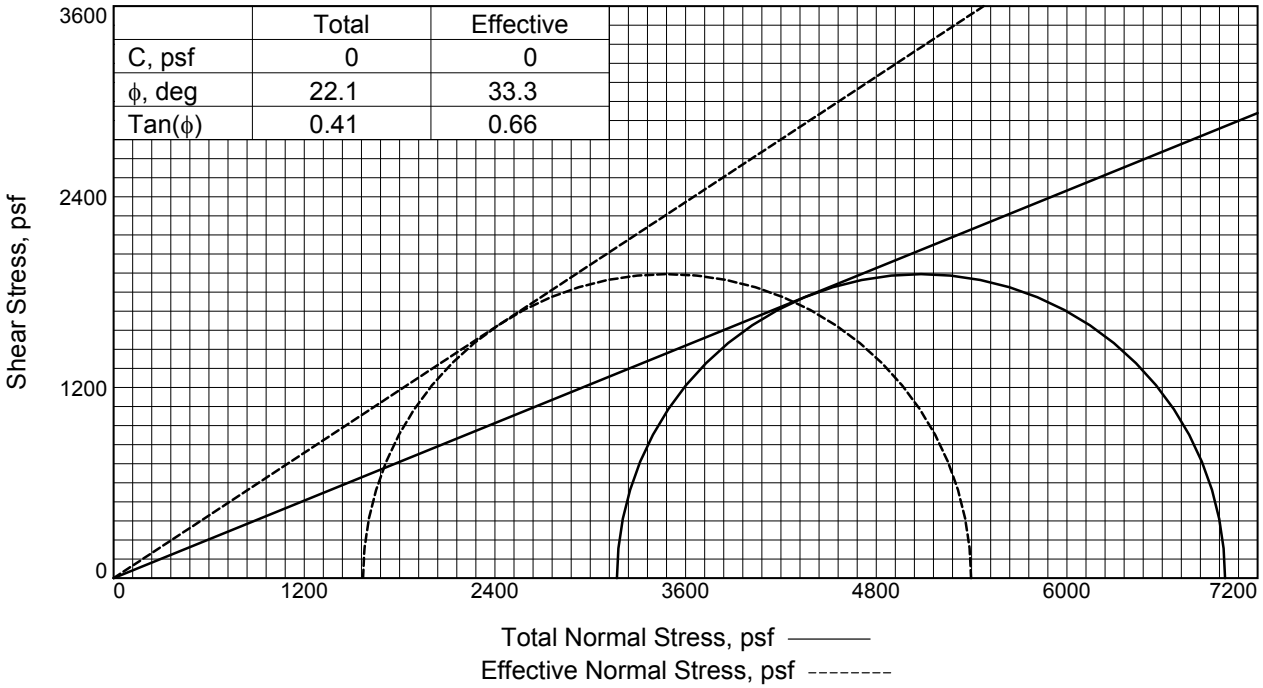
Project: Feather River West Levee

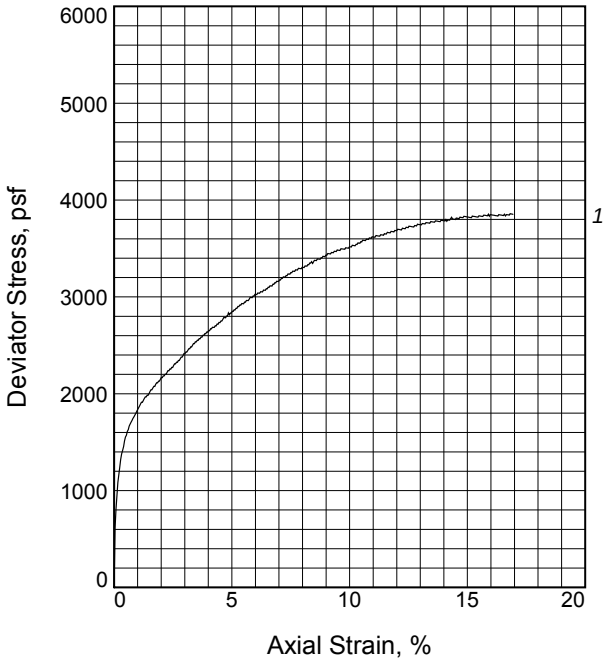
Source of Sample: SL0001_007B **Depth:** 18.3-20.0'

Sample Number: 9

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	25.1
	Dry Density, pcf	80.2
	Saturation, %	61.5
	Void Ratio	1.1024
	Diameter, in.	2.840
	Height, in.	5.876
At Test	Water Content, %	34.8
	Dry Density, pcf	86.9
	Saturation, %	100.0
	Void Ratio	0.9407
	Diameter, in.	2.772
	Height, in.	5.694
Strain rate, in./min.		0.005
Eff. Cell Pressure, psf		3168.0
Fail. Stress, psf		3826.9
Excess Pore Pr., psf		1598.4
Strain, %		15.0
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		5396.5
$\bar{\sigma}_3$ Failure, psf		1569.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 2 (11b): SANDY SILT

Assumed Specific Gravity= 2.7

Remarks:
11b: LL=28, PI=3, % fines=81.5

Figure _____

Client: URS Corporation

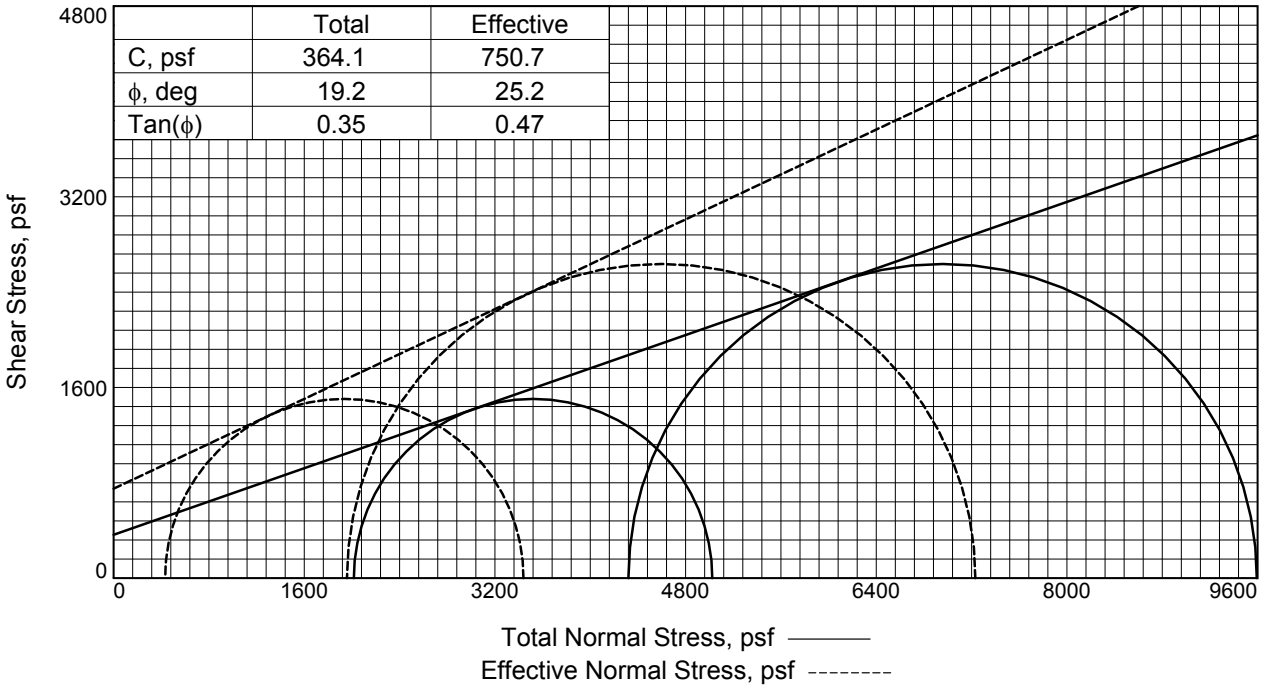
Project: Feather River West Levee

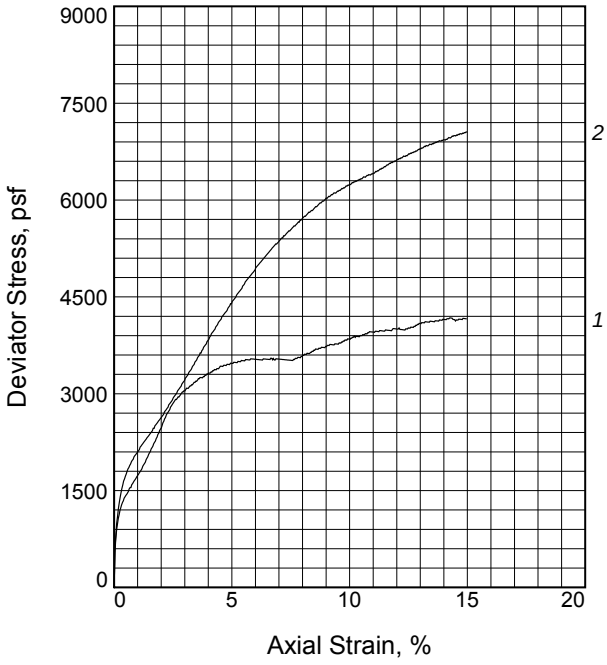
Source of Sample: SL0001_008B **Depth:** 23.9-24.4'

Sample Number: 11

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2
Initial	Water Content, %	22.1	31.6
	Dry Density, pcf	80.9	80.8
	Saturation, %	55.1	78.6
	Void Ratio	1.0839	1.0858
	Diameter, in.	2.816	2.807
	Height, in.	6.514	6.592
At Test	Water Content, %	31.4	35.6
	Dry Density, pcf	91.2	86.0
	Saturation, %	100.0	100.0
	Void Ratio	0.8472	0.9601
	Diameter, in.	2.666	2.795
	Height, in.	6.444	6.249
Strain rate, in./min.		0.005	0.005
Eff. Cell Pressure, psf		2016.0	4320.0
Fail. Stress, psf		3007.6	5273.0
Excess Pore Pr., psf		1584.0	2361.6
Strain, %		2.9	6.8
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		3439.6	7231.4
$\bar{\sigma}_3$ Failure, psf		432.0	1958.4

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description:
Specimen 1 (11a): SANDY SILT
Specimen 2 (11c): SANDY SILT

Assumed Specific Gravity= 2.7

Remarks:
11a: LL=29, PI=4, % fines=81.7
11c: LL=30, PI=NP, % fines=69.2

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SL0001_008B **Depth:** 23.4-25.0'

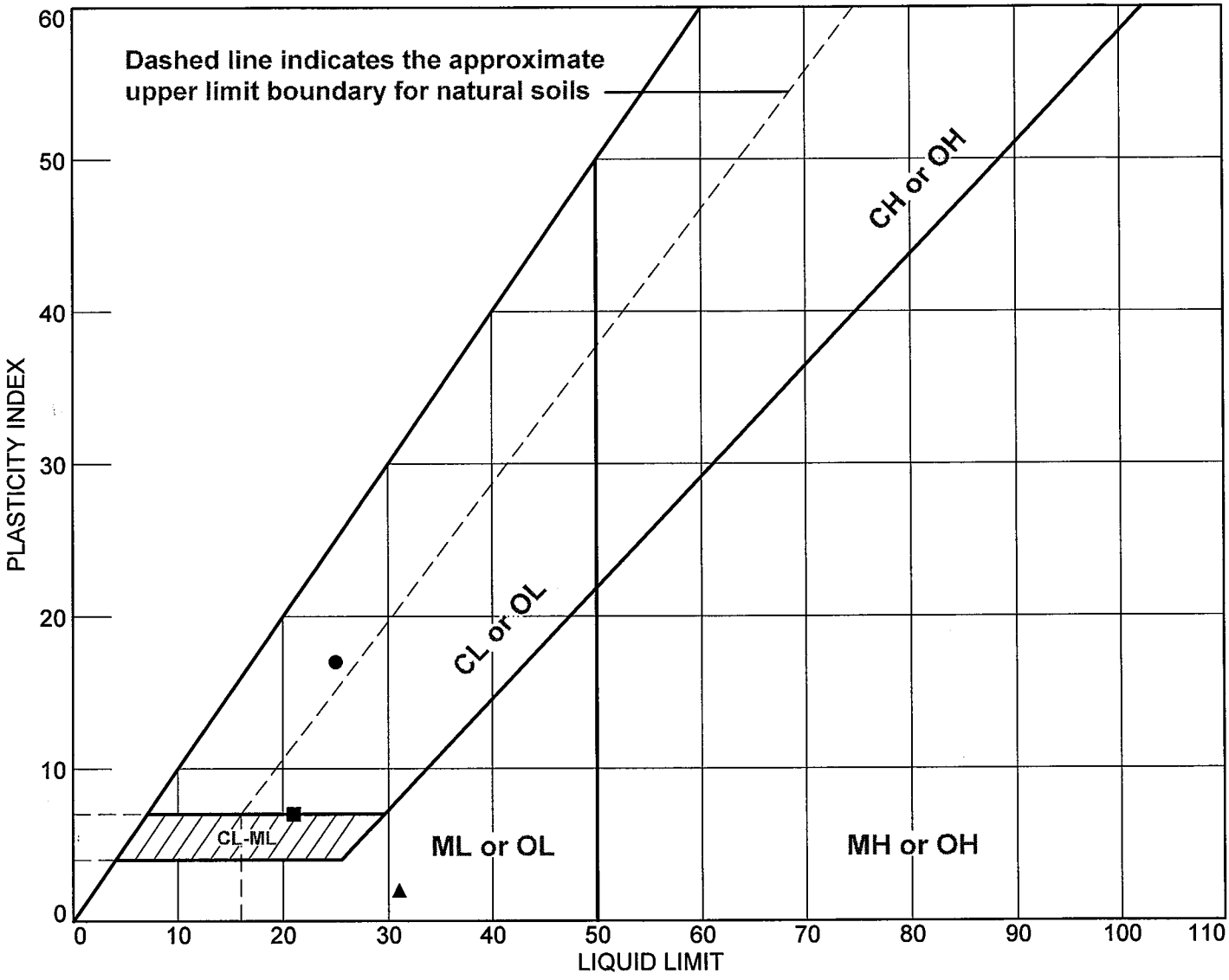
Sample Number: 11

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
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W. Sacramento, CA

Laboratory Schedule 1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	CPT	SM0016_007C CPT	8.5-9.5'		8	25	17	CL
■	CPT	SM0016_007C CPT	30.0-31.0'		14	21	7	CL-ML
▲	CPT	SL0009_006C	35.0-36.0'		29	31	2	ML

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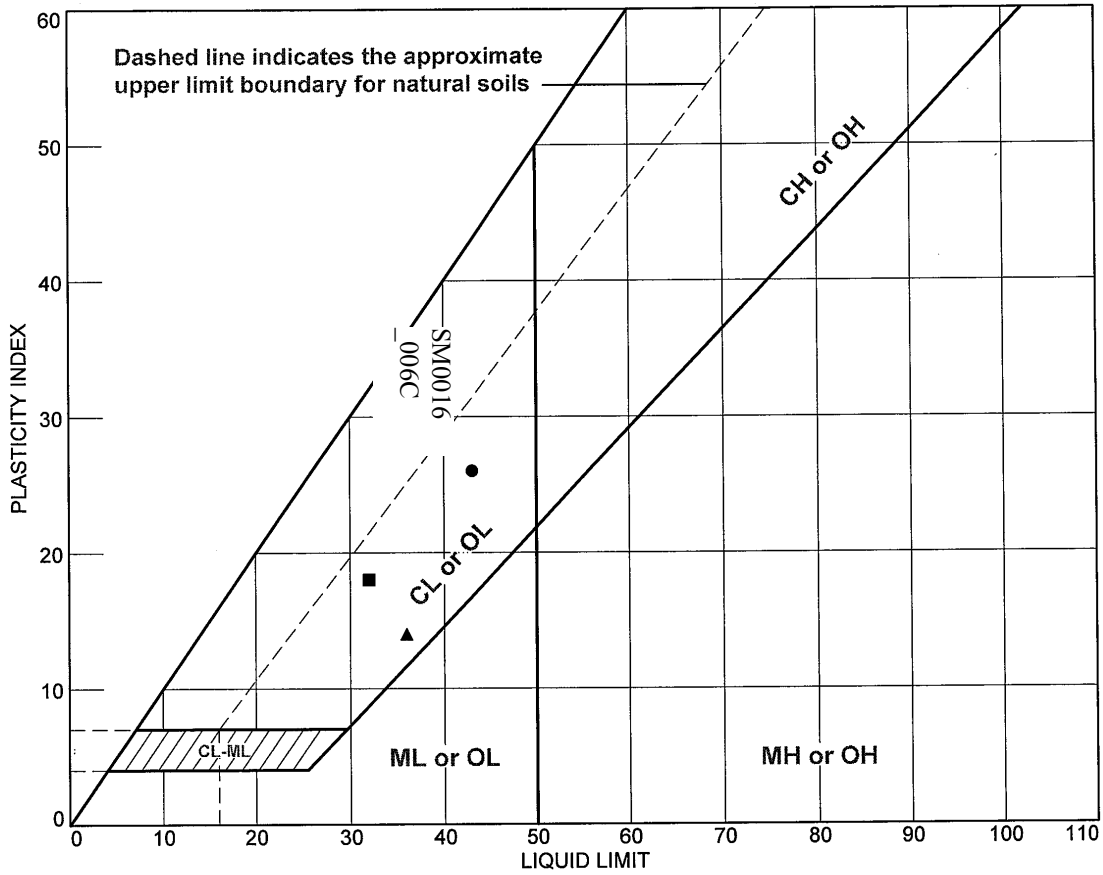
Client: URS

Project: SBFCA - URS (17326605) Cost Code 0305233

Project No.: 1967.2

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	CPT	SM0016_006C CPT	33.0-34.0'		17	43	26	CL
■	CPT	SM0016_005C CPT	30.0-31.0'		14	32	18	CL
▲	CPT	SL0001_031C	27.0-28.0'		22	36	14	CL

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W. Sacramento, CA

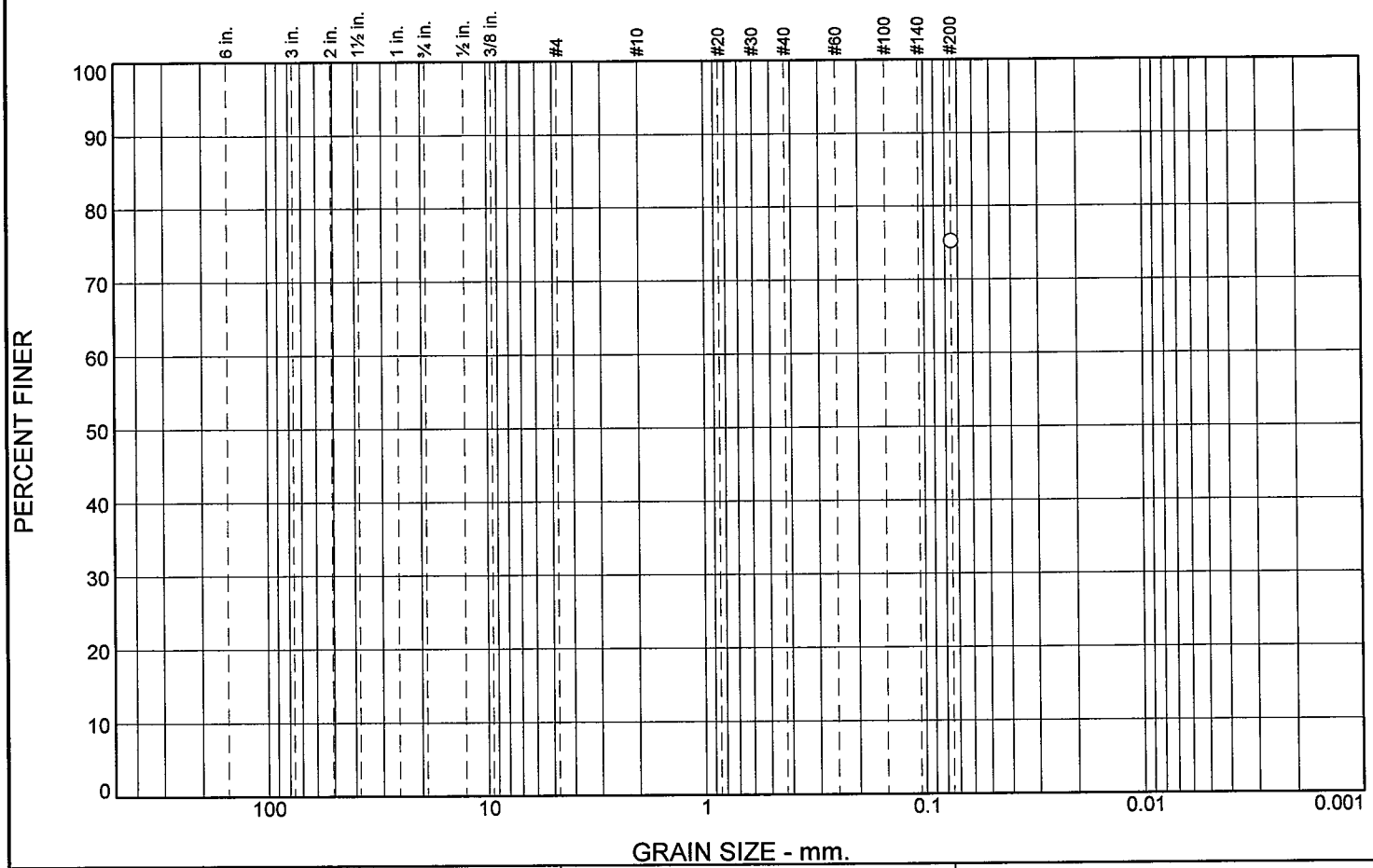
Client: URS

Project: SBFCA - URS (17326605) Cost Code 0305233

Project No.: 1967.2

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						75.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	75.3		

* (no specification provided)

Material Description

Lean CLAY with SAND, olive gray

Atterberg Limits

PL= 22 LL= 36 PI= 14

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Sample Number: SL0001_031C
Source of Sample: CPT **Depth:** 27.0-28.0' **Date:**

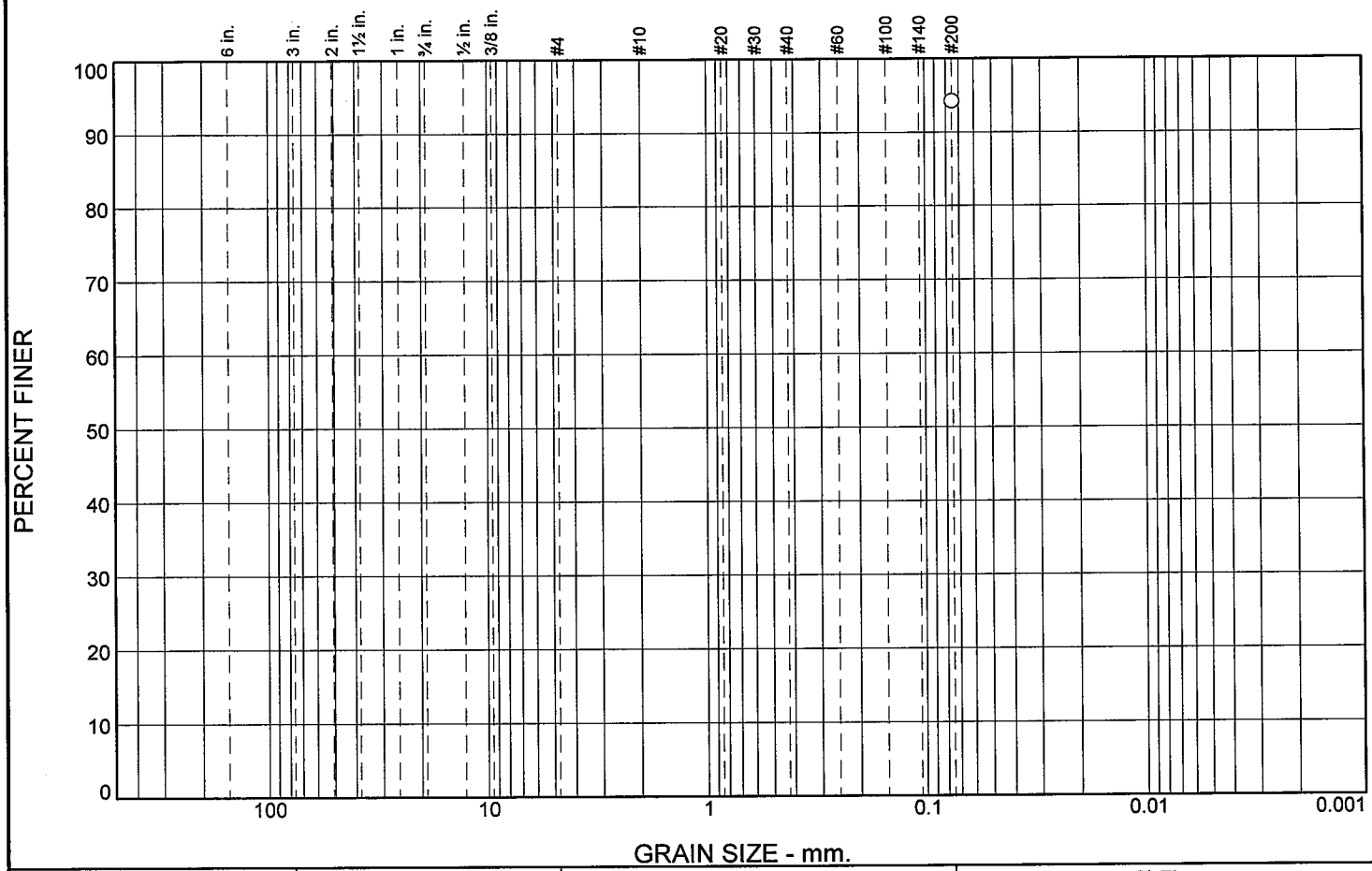
Blackburn Consulting

W. Sacramento, CA

Client: URS
Project: SBFCA - URS (17326605) Cost Code 0305233

Project No: 1967.2 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						94.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	94.2		

* (no specification provided)

Material Description

Lean CLAY, olive brown

Atterberg Limits

PL= 14 LL= 32 PI= 18

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Sample Number: SM0016_005C
Source of Sample: CPT **Depth:** 30.0-31.0' **Date:**

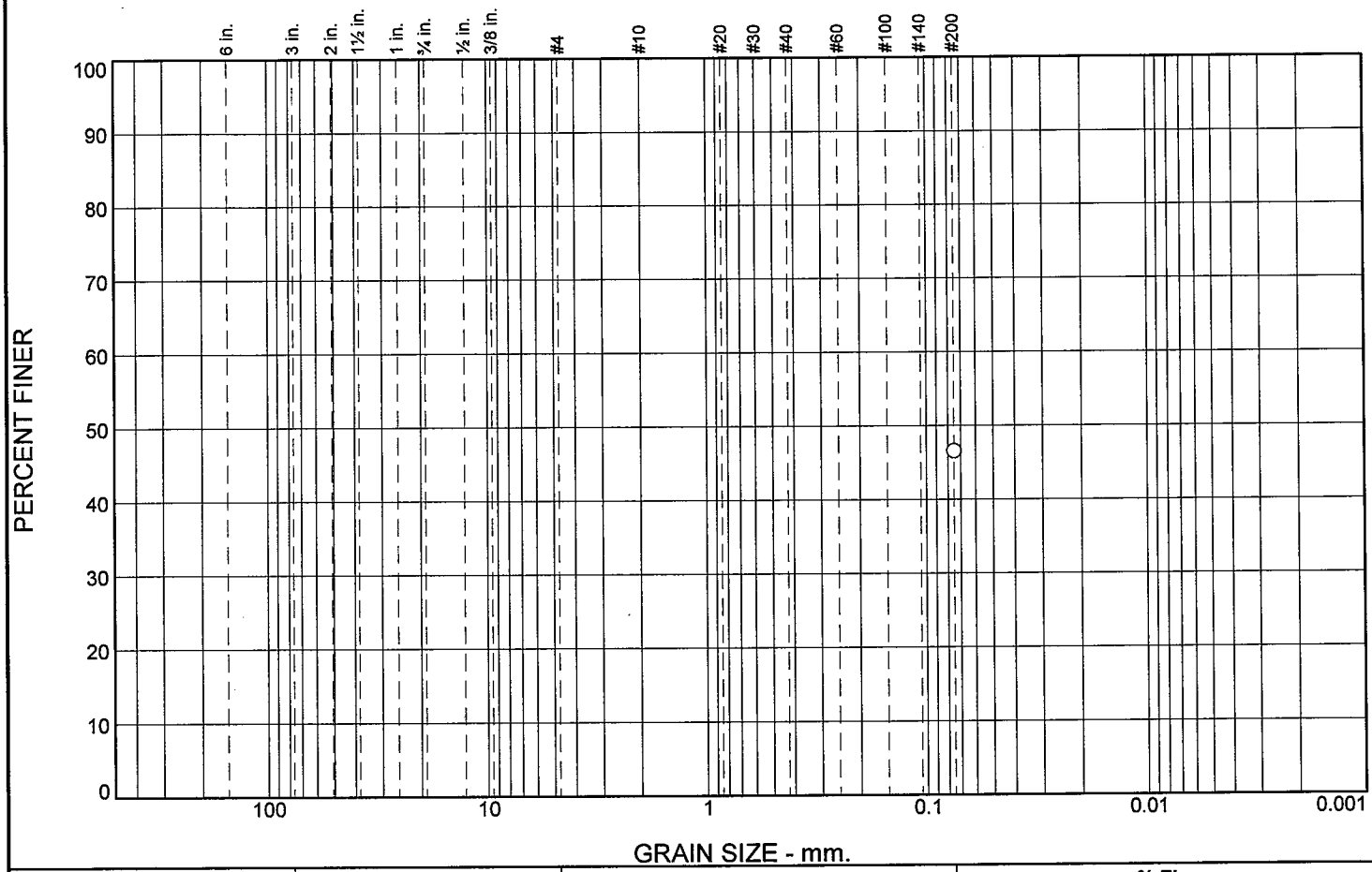
Blackburn Consulting

W. Sacramento, CA

Client: URS
Project: SBFCA - URS (17326605) Cost Code 0305233

Project No: 1967.2 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						46.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	46.6		

* (no specification provided)

Material Description

SILTY SAND, olive brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: SL0009_006C
Source of Sample: CPT **Depth:** 39.0-40.0' **Date:**

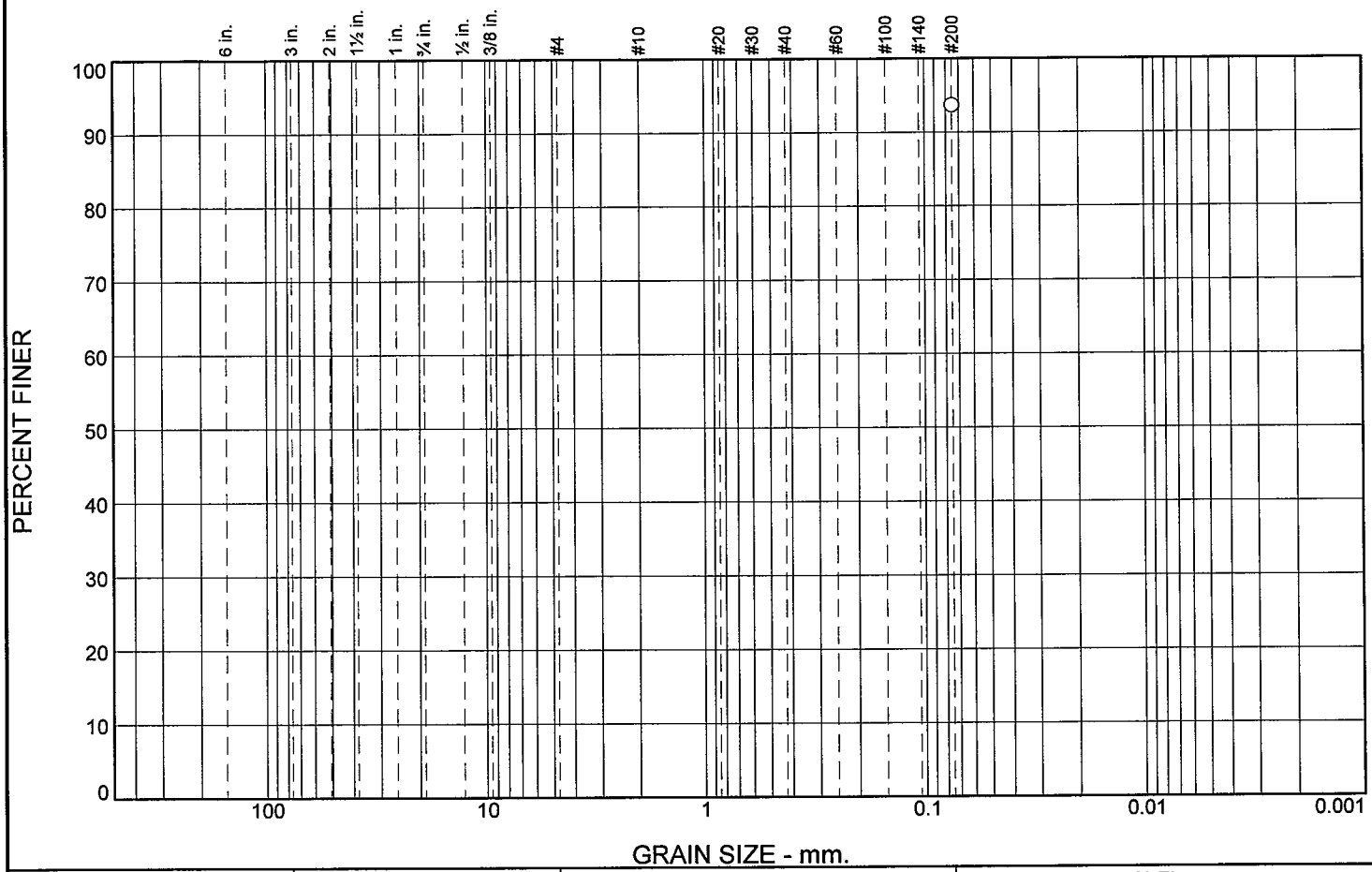
Blackburn Consulting

W. Sacramento, CA

Client: URS
Project: SBFCA - URS (17326605) Cost Code 0305233

Project No: 1967.2 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						93.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	93.7		

* (no specification provided)

Material Description

SILT, yellowish brown

Atterberg Limits

PL= 29 LL= 31 PI= 2

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Sample Number: SL0009_006C
Source of Sample: CPT **Depth:** 35.0-36.0' **Date:**

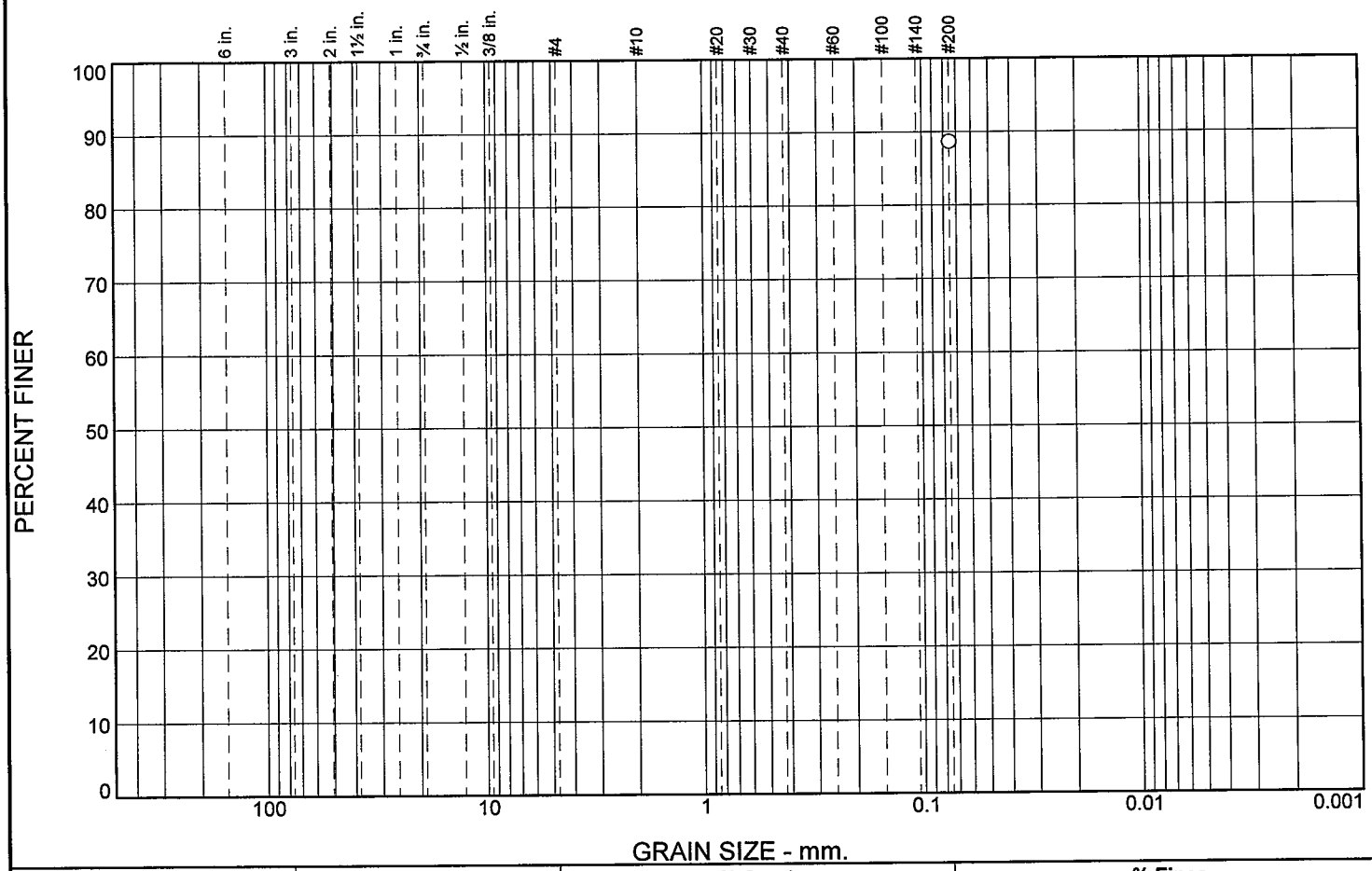
Blackburn Consulting

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Client: URS
Project: SBFCA - URS (17326605) Cost Code 0305233

Project No: 1967.2 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						88.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	88.7		

* (no specification provided)

Material Description

Lean CLAY, dark yellowish brown

Atterberg Limits

PL= 17 LL= 43 PI= 26

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Sample Number: SM0016_006C
Source of Sample: CPT **Depth:** 33.0-34.0' **Date:**

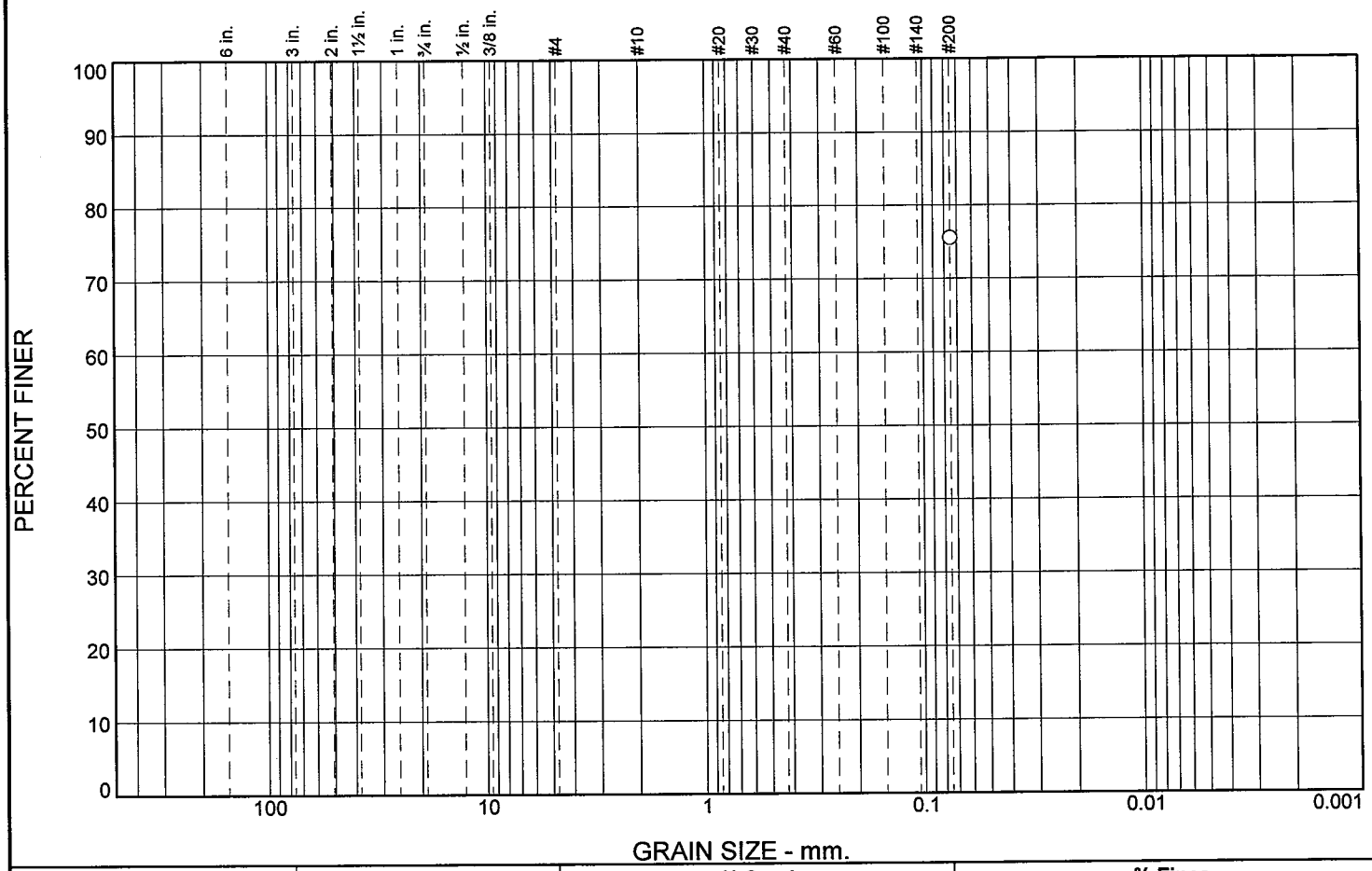
Blackburn Consulting

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Client: URS
Project: SBFCA - URS (17326605) Cost Code 0305233

Project No: 1967.2 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						75.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	75.6		

* (no specification provided)

Material Description

SILTY CLAY with SAND

Atterberg Limits

PL= 14 LL= 21 PI= 7

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO=

Remarks

Sample Number: SM0016_007C
Source of Sample: CPT **Depth:** 30.0-31.0' **Date:**

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Client: URS
Project: SBFCA - URS (17326605) Cost Code 0305233

Project No: 1967.2 **Figure**

Laboratory Schedule 2

2491 Boatman Avenue
West Sacramento, CA 95691
www.blackburnconsulting.com

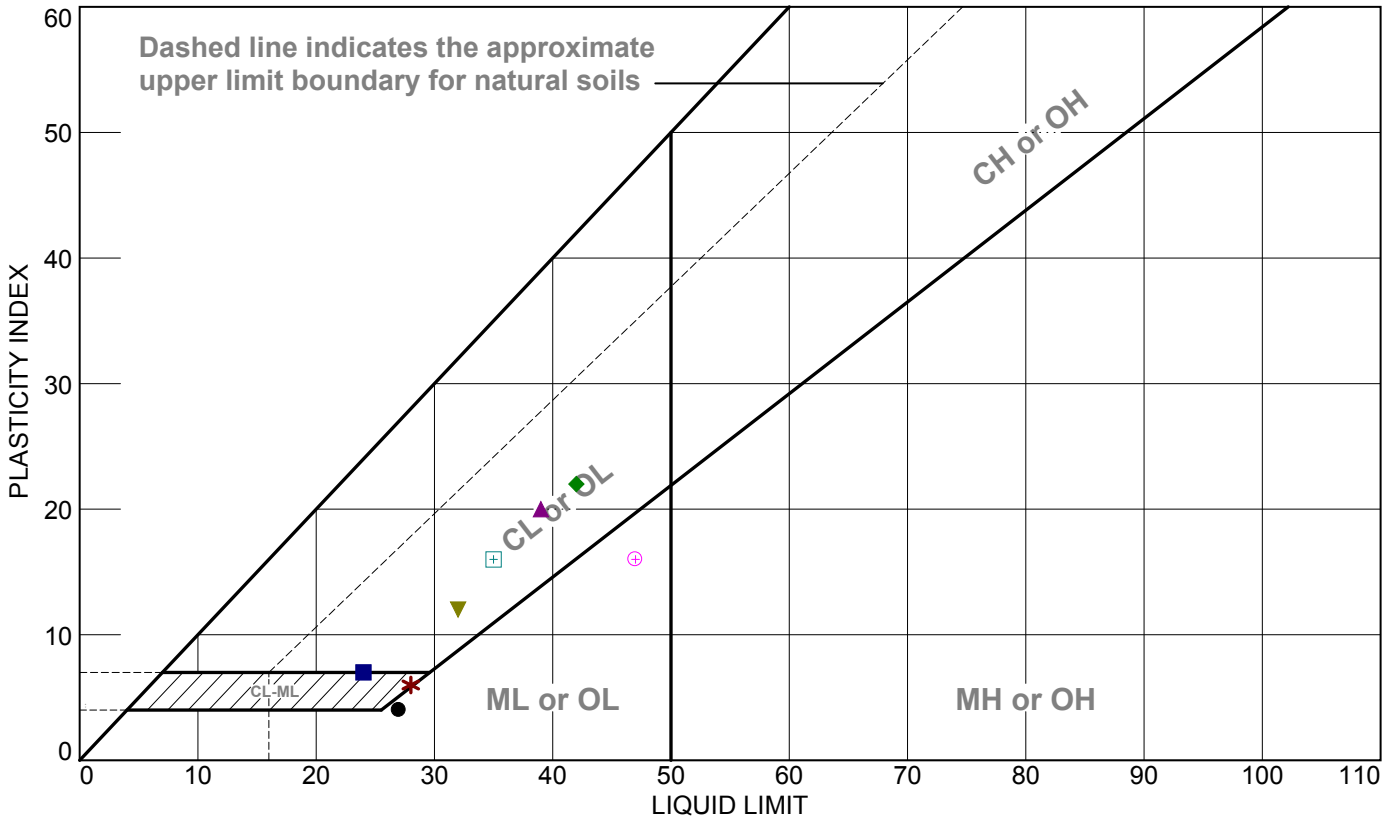
Project Name: Feather River West Levee
BCI Project No: 1967.3
Job No: 17326605.0305233

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Boring	Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Laboratory Pocket Pen. (tsf)
SL0009_004A	2A	5.5-6.0	122.7	105.2	16.7	2.3
SL0009_004A	12	30.0-31.5	-	-	2.4	-
SL0009_004B	3B	8.5-9.0	104.0	83.0	25.3	1.8
SL0009_004B	6B	16.0-16.5	111.2	86.3	28.8	2.0
SL0009_004B	7B	18.5-19.0	125.6	107.4	17.0	3.5
SL0009_004B	8B	21.0-21.5	116.2	99.3	16.9	1.8
SL0009_004B	9B	23.0-23.5	99.7	81.8	21.9	>4.5
SL0009_004B	30	130.0-131.5	123.6	94.7	30.6	>4.5
SM0007_012B	2B	6.0-6.5	122.6	98.2	24.9	0.5
SM0007_013B	4B	11.0-11.5'	126.4	105.2	20.2	2.8
SM0007_013B	6B	16.0-16.5	122.1	97.0	25.8	3.0
SL0001_009B	9	27.5-29.5	128.1	98.1	30.5	1.3
SL0001_011A	2B	6.0-6.5	128.9	107.8	19.5	>4.5
SL0001_011A	7B	18.5-19.0	116.8	85.0	37.4	>4.5
SL0001_011A	12B	31.0-31.5	129.9	106.6	21.9	>4.5
SM0007_014B	2B	6.0-6.5	115.3	83.8	37.6	1.5
SM0007_014B	12B	38.5-39.0	111.5	77.2	44.5	2.5

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0009_004A	#2A	5.5-6.0'	16.7	23	27	4	ML
■	SL0009_004B	#7B	18.5-19.0'	17.0	17	24	7	CL-ML
▲	SM0007_011B	#7	17.5-19.0'	18.8	19	39	20	CL
◆	SM0007_012B	#2B	6.0-6.5'	24.9	20	42	22	CL
▼	SL0001_009B	#9	27.5-29.5'	30.5	20	32	12	CL
✱	SL0001_011A	#2B	6.0-6.5'	19.5	22	28	6	CL-ML
⊕	SL0001_011A	#7B	18.5-19.0	37.4	31	47	16	ML
⊞	SL0001_011A	#12B	31.0-31.5'	21.9	19	35	16	CL

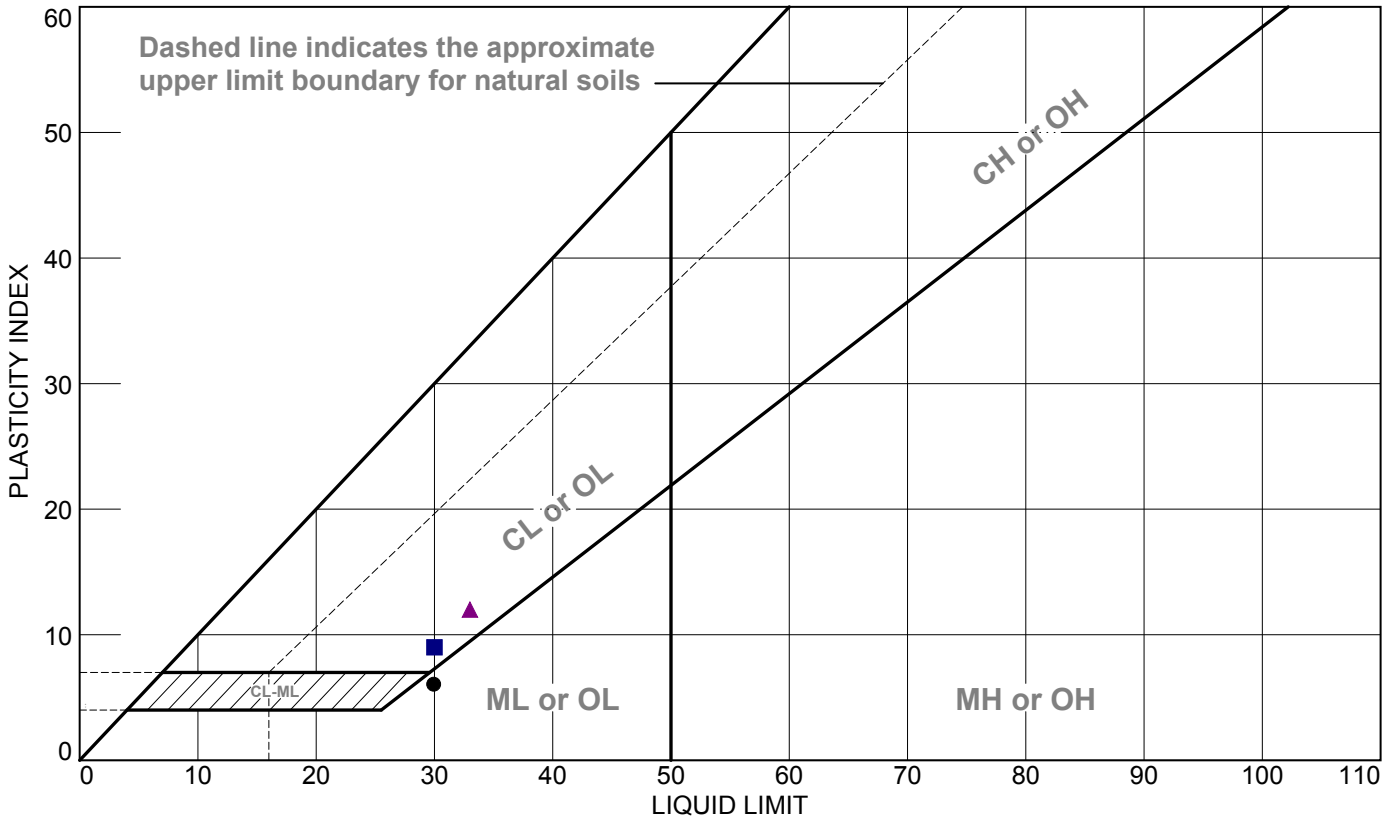
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS2 -1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_013B	#2a	5.4-5.9'		24	30	6	ML
■	SM0007_013B	#2b	5.9-6.4'		21	30	9	CL
▲	SM0007_013B	#2c	6.4-7.0'		21	33	12	CL
◆	SM0007_013B	#7a	17.9-18.4'		NP	NV	NP	SM
▼	SM0007_013B	#7b	18.4-18.9'		NP	NV	NP	ML
✱	SM0007_013B	#7c	18.9-19.5'		NP	NV	NP	ML

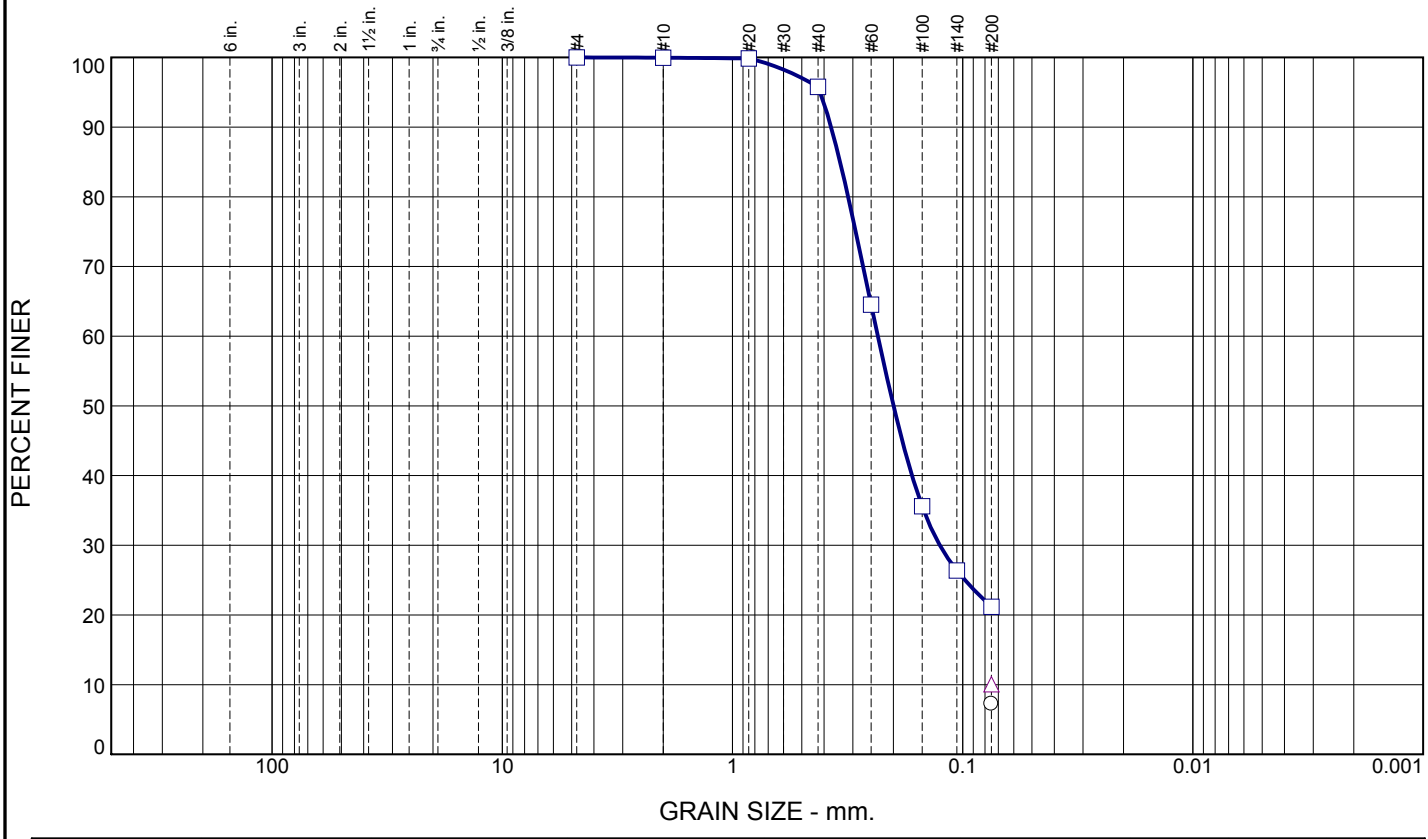
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS2 - 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP			
□	0.0	0.0	78.8	21.2		SM			
△						SP			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}		0.2337	
D_{30}		0.1257	
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	
#10		100.0	
#20		99.9	
#40		95.8	
#60		64.5	
#100		35.6	
#140		26.4	
#200	7.2	21.2	10.1

Material Description

○ Poorly-graded SAND with SILT, olive brown

□ SILTY SAND, olive brown

△ Poorly-graded SAND with SILT, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_009B Depth: 21.0-21.5 Sample Number: #7B

□ Source of Sample: SL0001_009B Depth: 31.0-31.5' Sample Number: #10B

△ Source of Sample: SL0001_009B Depth: 40.0-41.5' Sample Number: #12

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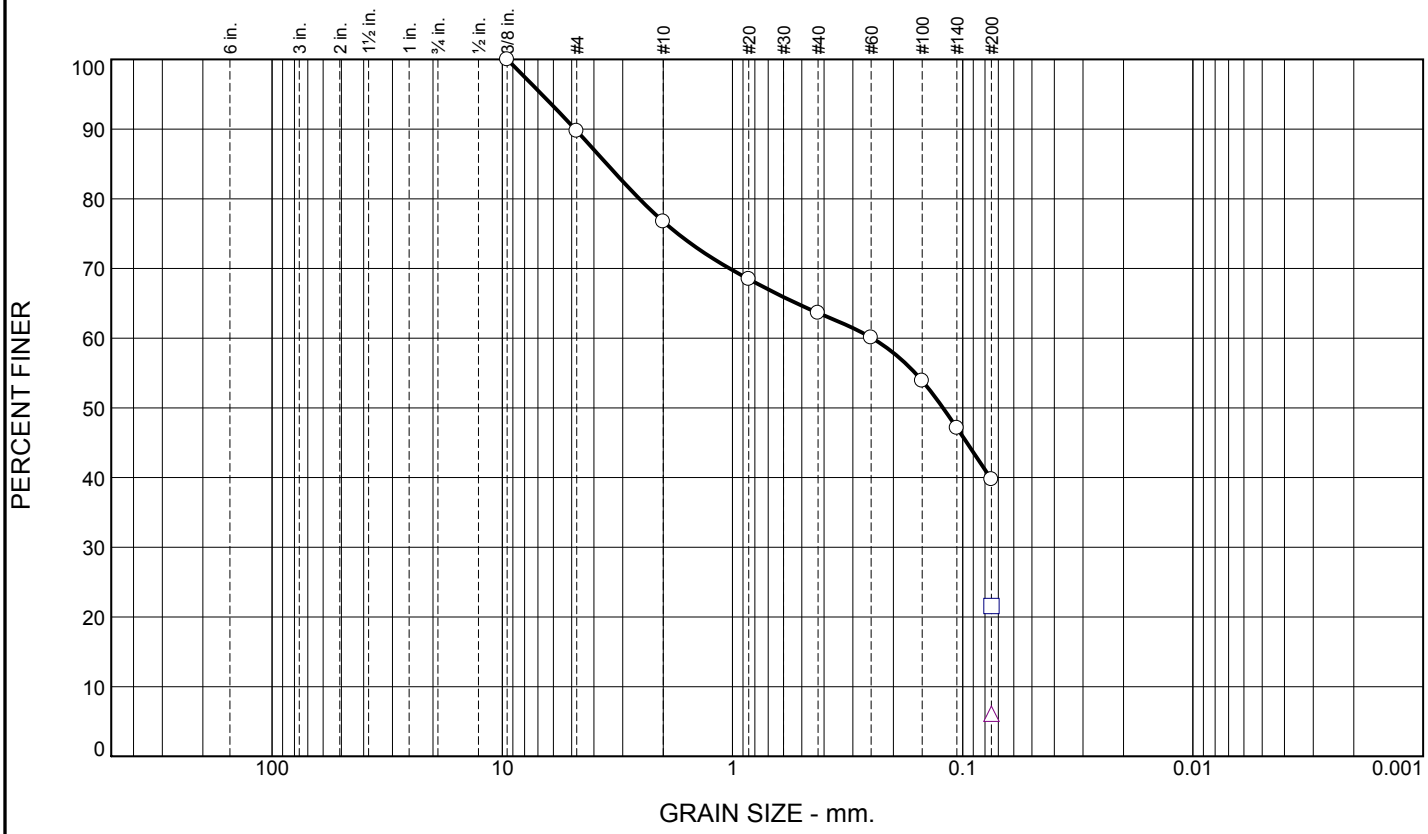
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 7

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	10.3	50.0	39.7		SM			
□						SM			
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/8	100.0		
GRAIN SIZE			
D_{60}	0.2471		
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	89.7		
#10	76.7		
#20	68.5		
#40	63.6		
#60	60.1		
#100	53.9		
#140	47.1		
#200	39.7	21.6	6.1

Material Description

○ SILTY SAND, olive brown, partially cemented

□ SILTY SAND, light olive brown

△ Poorly-graded SAND with SILT, dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_011A Depth: 8.5-9.0' Sample Number: #3B

□ Source of Sample: SL0001_011A Depth: 25.0-26.5' Sample Number: #10

△ Source of Sample: SL0001_011A Depth: 38.5-39.0' Sample Number: #15B

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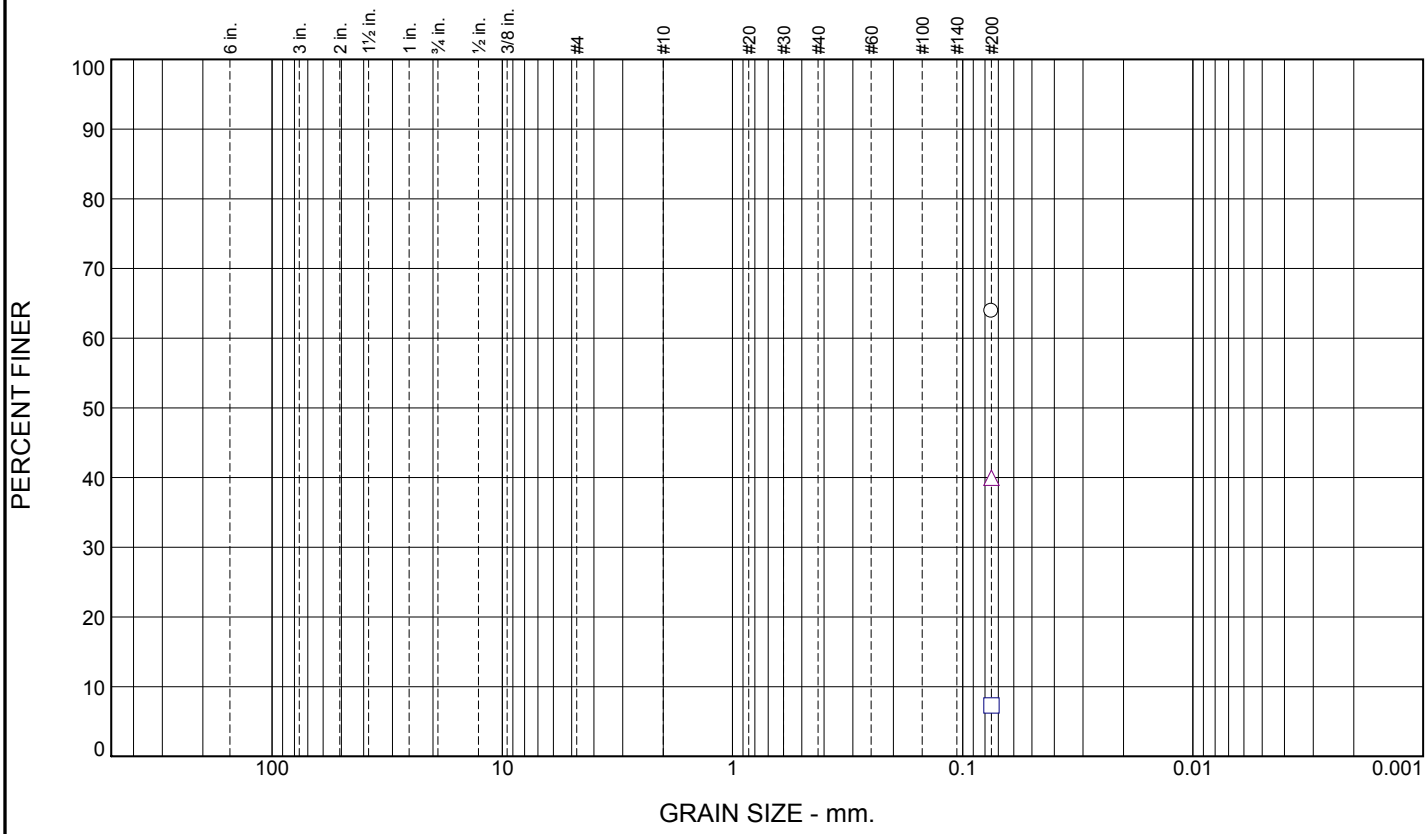
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 8

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	27	23	4
□						SP-SC			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	63.9	7.3	40.0

Material Description

○ SANDY SILT, dark brown

□ Poorly-graded SAND with CLAY, dark grayish brown

△ SILTY SAND with GRAVEL, dark greenish gray

REMARKS:

○

□ Natural Moisture Content=2.4%

△

○ Source of Sample: SL0009_004A Depth: 5.5-6.0' Sample Number: #2A

□ Source of Sample: SL0009_004A Depth: 30.0-31.5' Sample Number: #12

△ Source of Sample: SL0009_004B Depth: 120.0-121.5' Sample Number: #28

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Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	44.3	55.7		ML			
□						CL	39	19	20
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}	0.0815		
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.8		
#60	98.2		
#100	87.0		
#140	73.0		
#200	55.7	69.1	7.2

Material Description

○ SANDY SILT, dark olive brown

□ SANDY lean CLAY, yellowish brown

△ Poorly-graded SAND with SILT, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_011B Depth: 5.0-6.5' Sample Number: #2

□ Source of Sample: SM0007_011B Depth: 17.5-19.0' Sample Number: #7

△ Source of Sample: SM0007_011B Depth: 23.5-24.0' Sample Number: #9B

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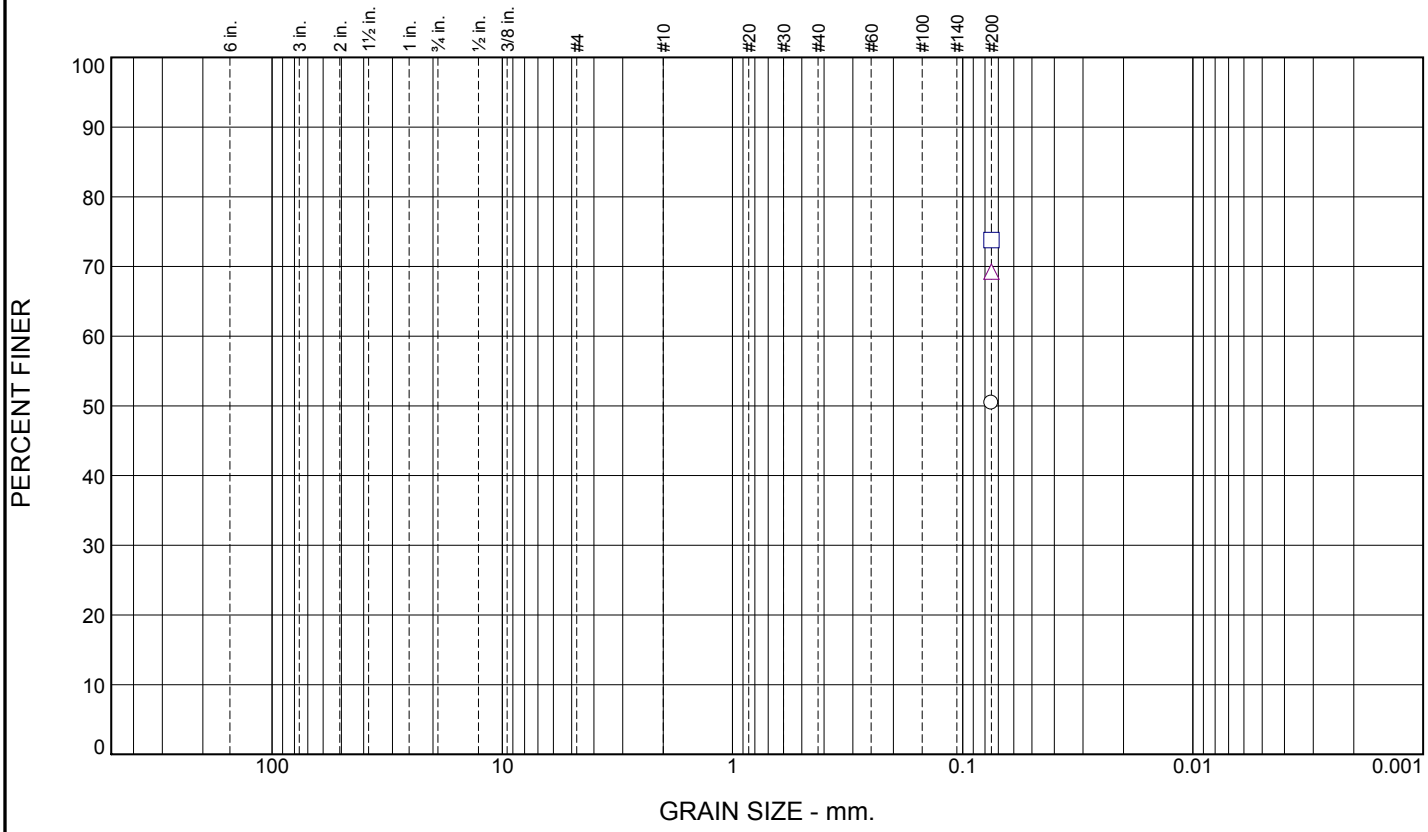
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						ML			
△						ML			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	50.5	73.8	69.3

Material Description

○ SANDY SILT, brown

□ SILT with SAND, olive brown

△ SANDY SILT, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_012B Depth: 18.5-19.0' Sample Number: #7B

□ Source of Sample: SM0007_012B Depth: 20.0-21.5' Sample Number: #8

△ Source of Sample: SM0007_012B Depth: 30.0-31.5' Sample Number: #10

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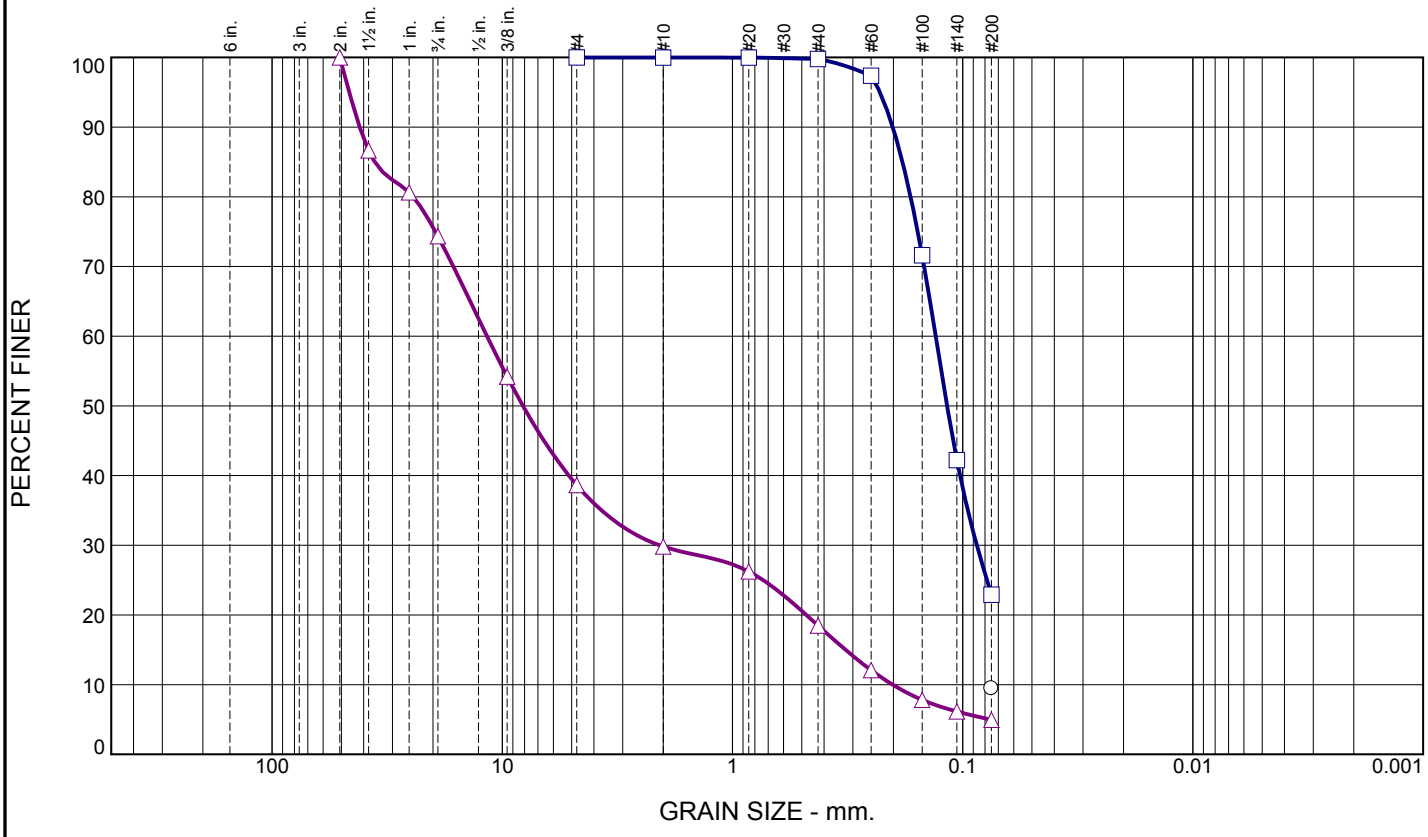
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						GP-GM			
□	0.0	0.0	77.1	22.9		SM			
△	0.0	61.4	33.7	4.9		GW			

SIEVE inches size	PERCENT FINER ○	□	△
2.0			100.0
1.5			86.7
1			80.6
3/4			74.3
3/8			54.2
GRAIN SIZE			
D_{60}		0.1309	11.6530
D_{30}		0.0868	2.0737
D_{10}			0.2014
COEFFICIENTS			
C_c			1.83
C_u			57.86

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	38.6
#10		100.0	29.8
#20		100.0	26.2
#40		99.8	18.5
#60		97.4	12.1
#100		71.6	7.8
#140		42.2	6.2
#200	9.5	22.9	4.9

Material Description

○ Poorly-graded GRAVEL with SILT, olive brown

□ SILTY SAND, dark grayish brown

△ Well-graded GRAVEL with SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_012B Depth: 40.0-41.5' Sample Number: #12

□ Source of Sample: SM0007_013B Depth: 21.0-21.5' Sample Number: #8B

△ Source of Sample: SM0007_013B Depth: 41.0-41.5' Sample Number: #12B

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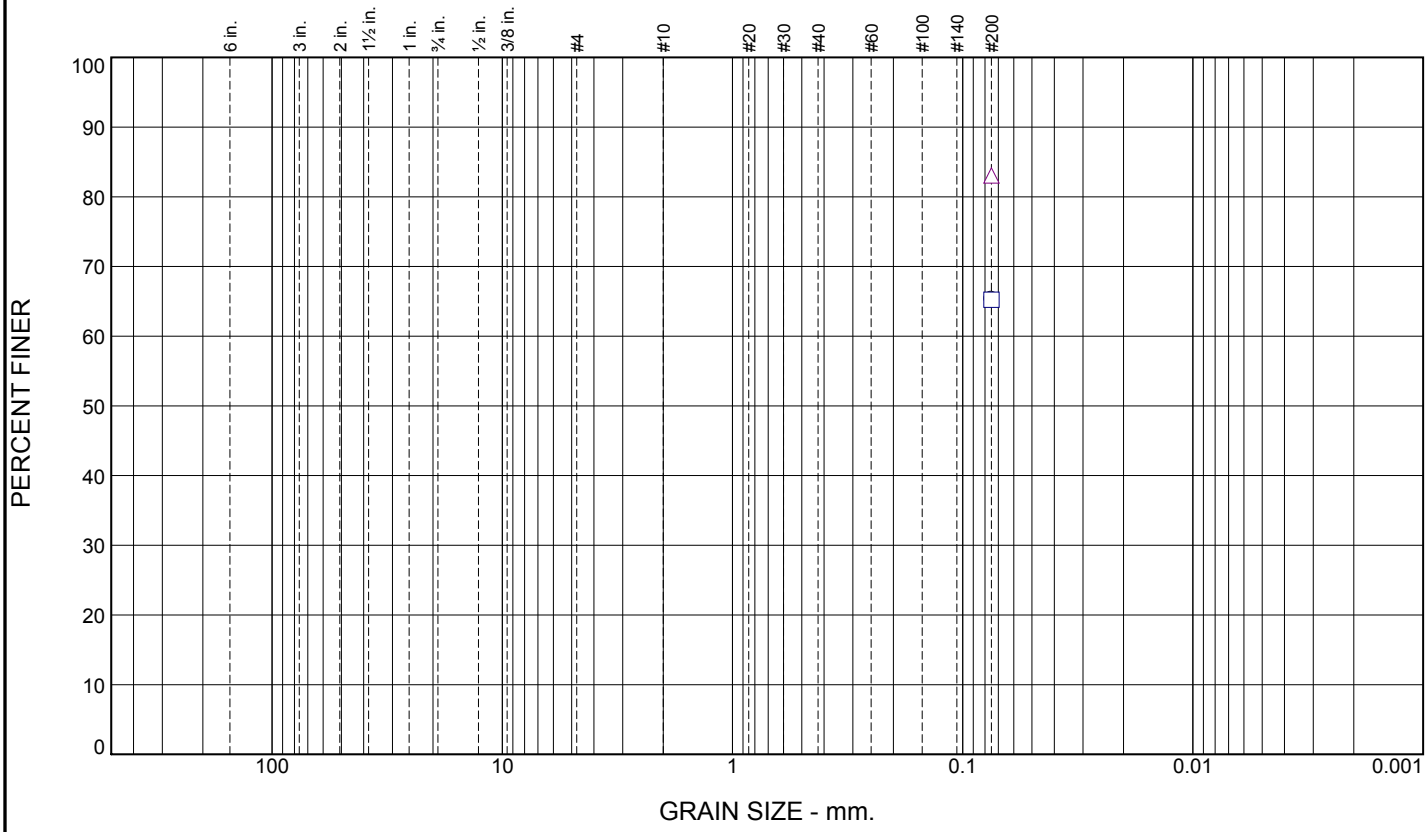
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	30	24	6
□						CL	30	21	9
△						CL	33	21	12

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	65.3	65.2	83.1

Material Description

○ SANDY SILT, dark grayish brown

□ SANDY lean CLAY, brown

△ Lean CLAY with SAND, dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_013B Depth: 5.4-5.9' Sample Number: #2a

□ Source of Sample: SM0007_013B Depth: 5.9-6.4' Sample Number: #2b

△ Source of Sample: SM0007_013B Depth: 6.4-7.0' Sample Number: #2c

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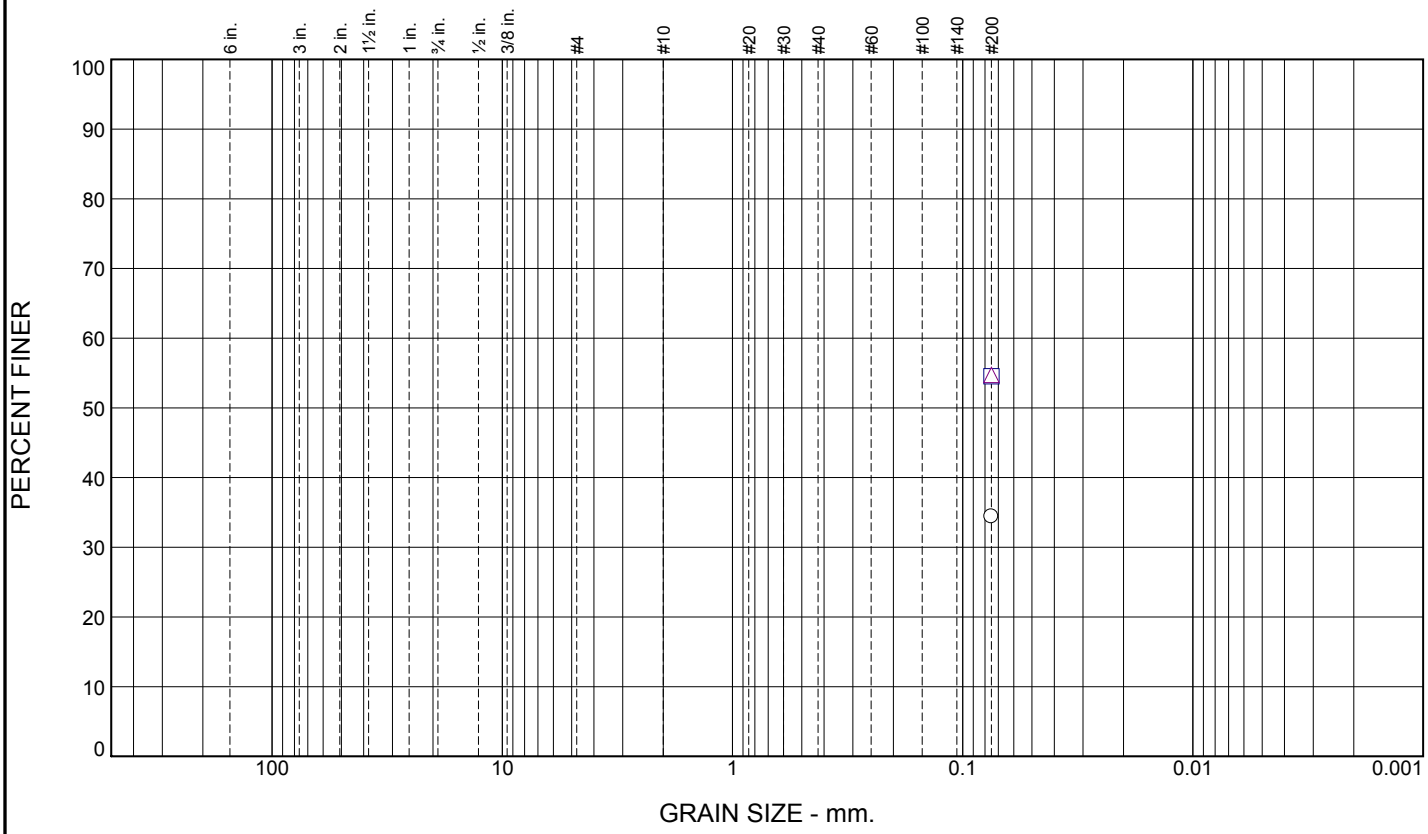
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 5

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	NV	NP	NP
□						ML	NV	NP	NP
△						ML	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	34.4	54.5	54.7

Material Description

○ SILTY SAND, dark yellowish brown

□ SANDY SILT, dark yellowish brown

△ SANDY SILT, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_013B Depth: 17.9-18.4' Sample Number: #7a

□ Source of Sample: SM0007_013B Depth: 18.4-18.9' Sample Number: #7b

△ Source of Sample: SM0007_013B Depth: 18.9-19.5' Sample Number: #7c

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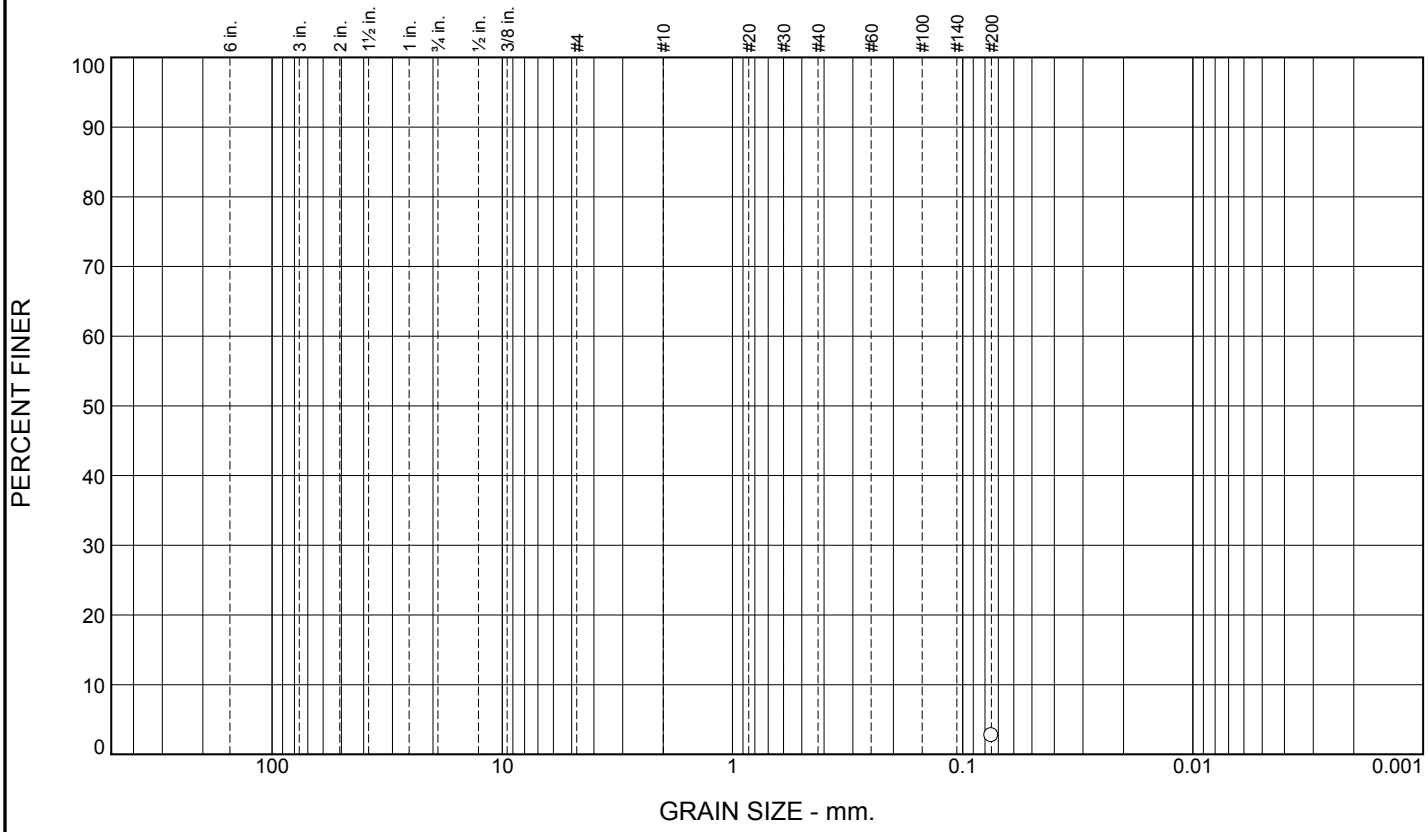
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS2 - 6

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						GP			

SIEVE inches size	PERCENT FINER ○		
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	2.7		

Material Description

○ Poorly-graded GRAVEL, light olive brown

REMARKS:

○

○ Source of Sample: SM0007_014B Depth: 20.0-21.5' Sample Number: #8

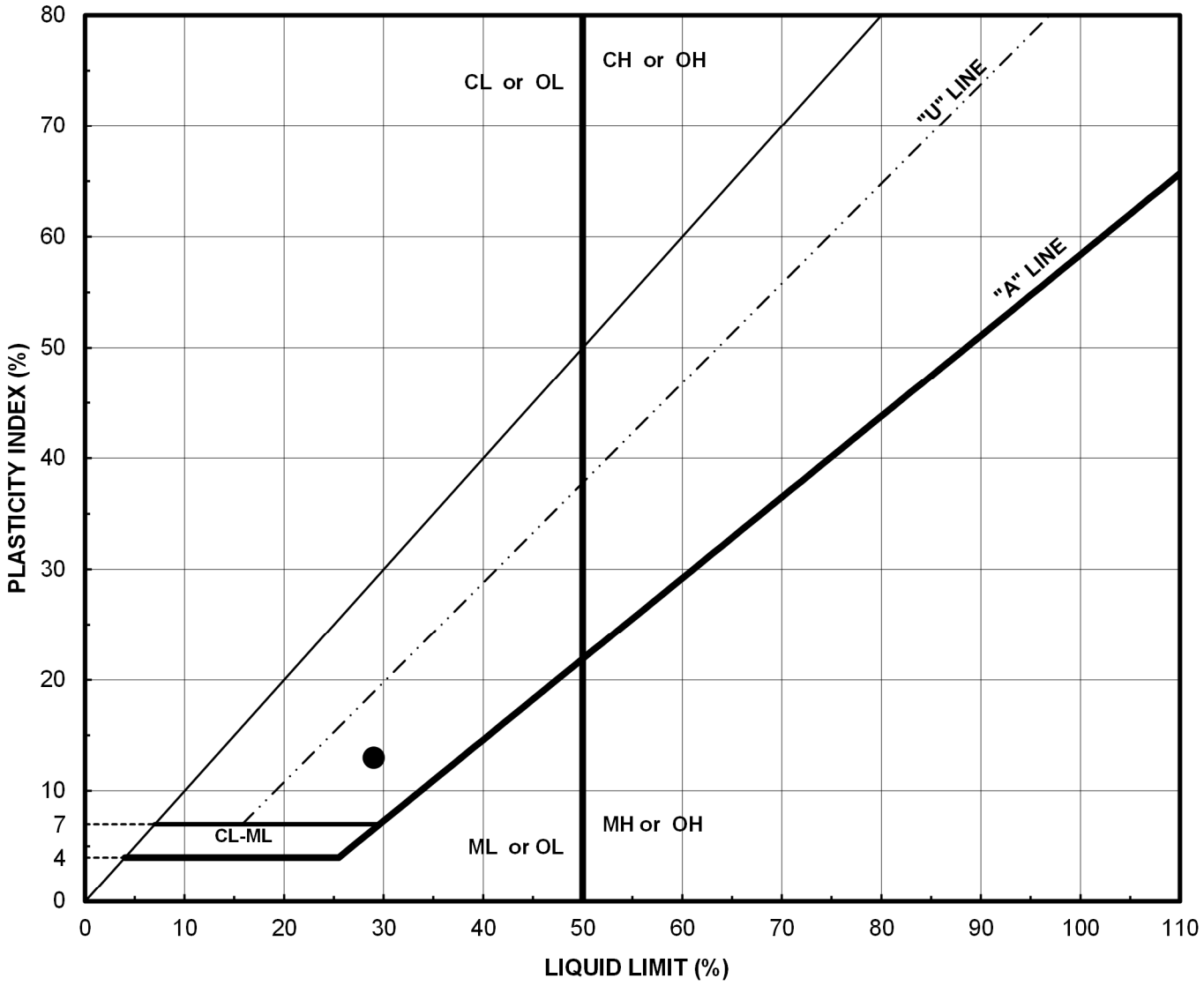
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS2 - 9

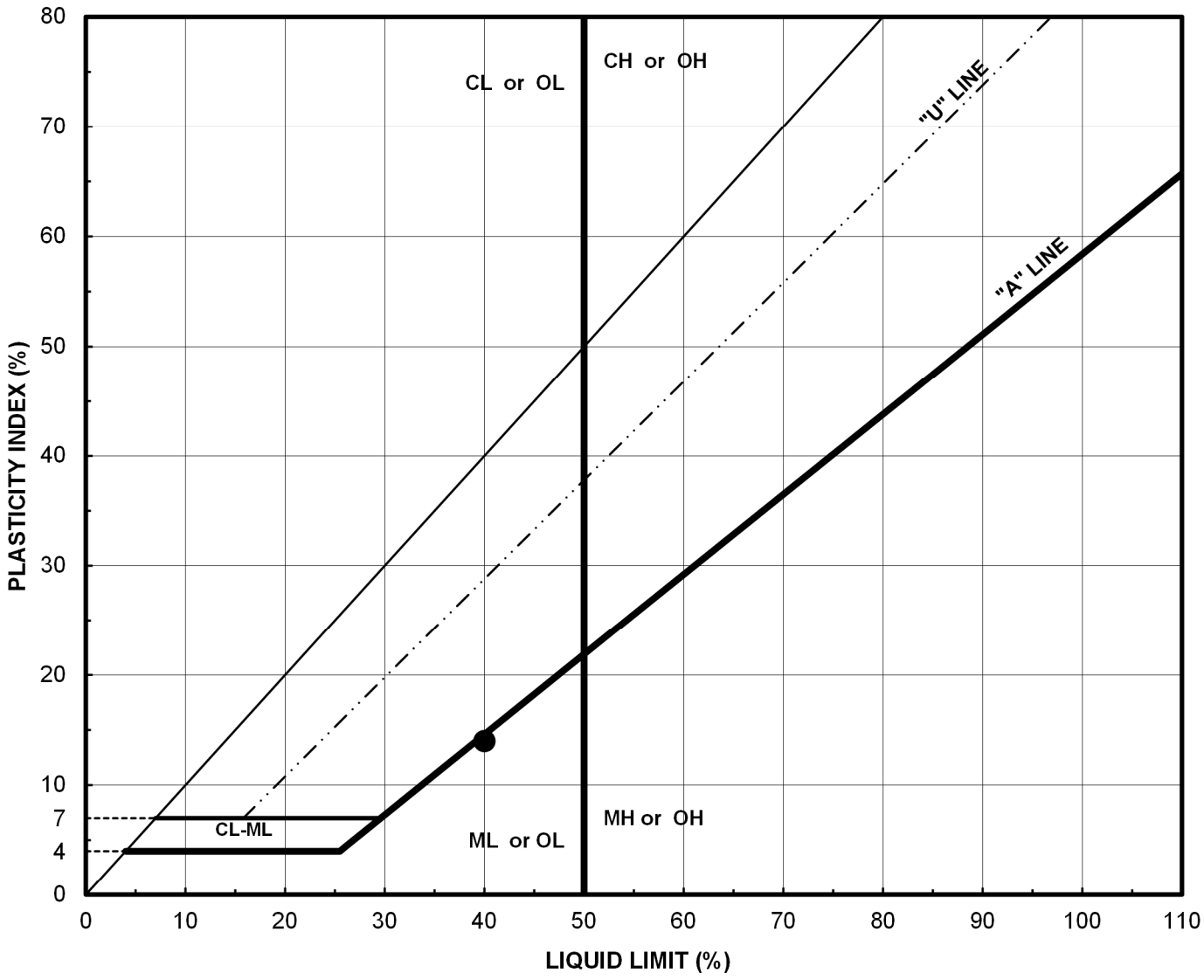


Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
SL0001_009B	1	6.0	17.3	29	13	Brown Clay with sand (CL)

Project Name: **Feather River West Levee (FRWL)** **PLASTICITY CHART**

Project Number: **17326605**

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
SM0007_014B	1	11.5	46.9	40	14	Very dark gray Silt (ML)

Project Name: **Feather River West Levee (FRWL)** **PLASTICITY CHART**

Project Number: **17326605**

URS

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SL0001_009B

Project Name: Feather River West Levee (FRWL) Sample No.: 1

Project Engineer: RN Depth (ft): 6.0

Visual Description: Brown Clay with sand (CL)

SPECIMEN: Tested From:

Bulk Sample			Other ____	
SPT Sample		x	Thin-Walled Tube	x
Calif. Sample			Engr. Test Specimen's WC	c

[ ] **Whole sample used**

[ ] **See Bulk Sample Processing Form**

Selection Method:

Sieves (1) - whole sample used

Sieves (1) - partial sample used & selected by Method(s)

Method

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No [x] Yes [ ]

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

and Soil Soaked for: ~ 6 hrs.

By: [ ] Mortar & Pestle [ ] Hand [ ] Pulverizer [ ] Other

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	**Water Content** As Recieved	
				Container No.	x30
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	750.84
Container Number		x30	x30	Dry, M2 (g)	660.87
Mass of Container and Dry Soil, (g)		660.87	234.28	Cont.,M3 (g)	139.6
Mass of Container, (g)		139.6	139.64	**Water Content (%)**	**17.26**
Dry Soil, Ws (g)		521.27	94.64		

SIEVING RESULTS % error: 0.01

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	4.57		99.1
#60 / 60			
#100 / 40	33.4		93.6
#140 / 30			
#200 / 20	94.33		81.9
Pan	94.65	XXXXXXXX	XXXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES		D60	XXXXX	D85	XXXXX
% GRAVEL		D30	XXXXX	D15	XXXXX
% SAND		D10	XXXXX	D50	XXXXX
% FINES	81.9	Cu =	XXXXX	Cc =	XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

Mica Noted: [x] No [ ] Yes Amount Adjective:

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence. * Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: YS DATE 10/03/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mean

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SM0007_014B

Project Name: Feather River West Levee (FRWL) Sample No.: 1

Project Engineer: RN Depth (ft): 11.5

Visual Description: Very dark gray Silt (ML)

SPECIMEN: Tested From:

Bulk Sample			Other ____		Sieves (1) - whole sample used
SPT Sample		x	Thin-Walled Tube	x	Sieves (1) - partial sample used & selected by Method(s)
Calif. Sample			Engr. Test Specimen's WC	c	Method

Whole sample used

See Bulk Sample Processing Form

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No x Yes

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

and Soil Soaked for: ~ 6 hrs.

By: Mortar & Pestle Hand; Pulverizer Other

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	**Water Content** As Recieved Container No.	x19
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	506.74
Container Number		x19	x19	Dry, M2 (g)	394.24
Mass of Container and Dry Soil, (g)		394.24	184.25	Cont.,M3 (g)	154.26
Mass of Container, (g)		154.26	154.28	**Water Content (%)**	**46.88**
Dry Soil, Ws (g)		239.98	29.97		

SIEVING RESULTS % error: 0.03

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	10.03		95.8
#60 / 60			
#100 / 40	21.29		91.1
#140 / 30			
#200 / 20	29.28		87.8
Pan	29.98	XXXXXXXX	XXXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES ____ D60 XXXXX D85 XXXXX

% GRAVEL ____ D30 XXXXX D15 XXXXX

% SAND ____ D10 XXXXX D50 XXXXX

% FINES 87.8 Cu = XXXXX Cc = XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

Mica Noted: x No Yes Amount Adjective: ____

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

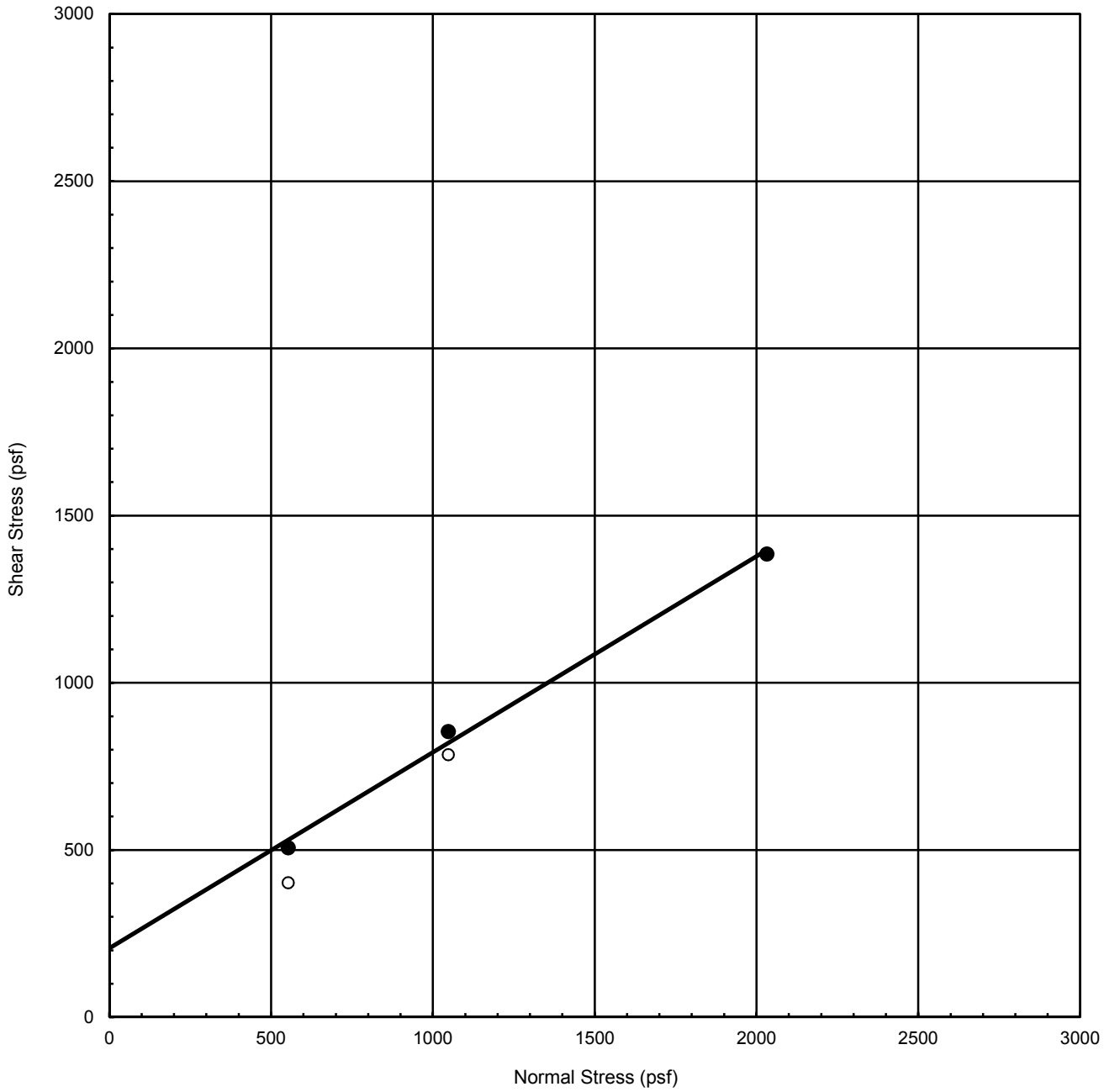
(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence.

* Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: YS DATE 10/03/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mara



Peak Values are : ● ,solid trend line — Ultimate Values are: ❍ ,dashed trend line

Boring No.:	SL0001_009B		Strength Intercept (C) :	205.9	psf	Peak	XXXXX	psf	Ultimate
Sample No.:	1			9.9	kPa		XXXXX	kPa	
Depth (ft | m)	6.0	1.8	Friction Angle (ϕ) :	30	degree		XXXXX	degree	

Description: **Brown Clay with sand (CL)** — Shear rate : 0.0001 (in/min) , 0.0003 (cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (psf)	Normal Stress (kPa)	Peak Stress (psf)	Peak Stress (kPa)	Ultimate Stress (psf)	Ultimate Stress (kPa)
Initial / Set up		17.3	130.9	20.6	111.6	17.5	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	21.3	134.1	21.1	110.5	17.4	553	26	507	24	402	19
	spec. 2	21.6	136.5	21.4	112.2	17.6	1047	50	854	41	785	38
	spec. 3	21.1	135.9	21.4	112.2	17.6	2032	97	1385	66	XXXXX	XXXXX

URS

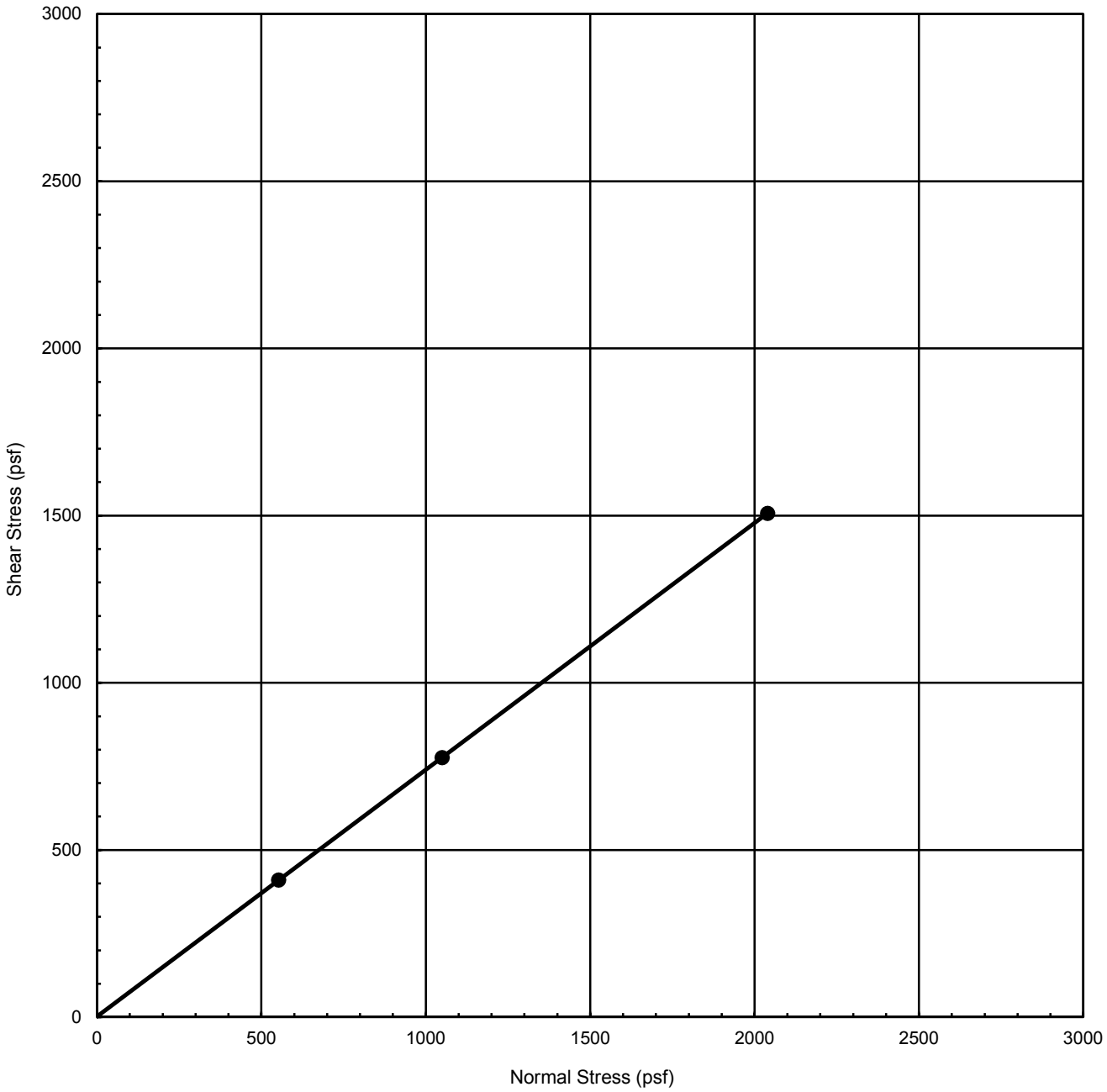
Feather River West Levee (FRWL)

Project Number: 17326605

Test Date: 9/28/2011

DIRECT SHEAR TEST

ASTM D3080



Peak Values are : ● ,solid trend line — Ultimate Values are: ❍ ,dashed trend line

Boring No.:	SM0007_014B		Strength Intercept (C) :	2.0	psf	Peak	XXXXX	psf	Ultimate		
Sample No.:	1			0.1	kPa		XXXXX	kPa			
Depth (ft | m)	11.5	3.5	Friction Angle (ϕ) :	36	degree		XXXXX	degree			
Description:	**Very dark gray Silt (ML)**					Shear rate :	0.0001	(in/min) ,	0.0003	(cm/min)	

SYMBOL		% Water Content	Total Unit Weight		Dry Unit Weight		Normal Stress		Peak Stress		Ultimate Stress	
			(pcf)	(kN/m^3)	(pcf)	(kN/m^3)	(psf)	(kPa)	(psf)	(kPa)	(psf)	(kPa)
Initial / Set up		46.9	109.6	17.2	74.6	11.7	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	45.8	110.4	17.3	75.7	11.9	552	26	410	20	XXXXX	XXXXX
	spec. 2	41.3	116.6	18.3	82.5	13.0	1050	50	776	37	XXXXX	XXXXX
	spec. 3	42.6	116.4	18.3	81.6	12.8	2039	98	1507	72	XXXXX	XXXXX

URS

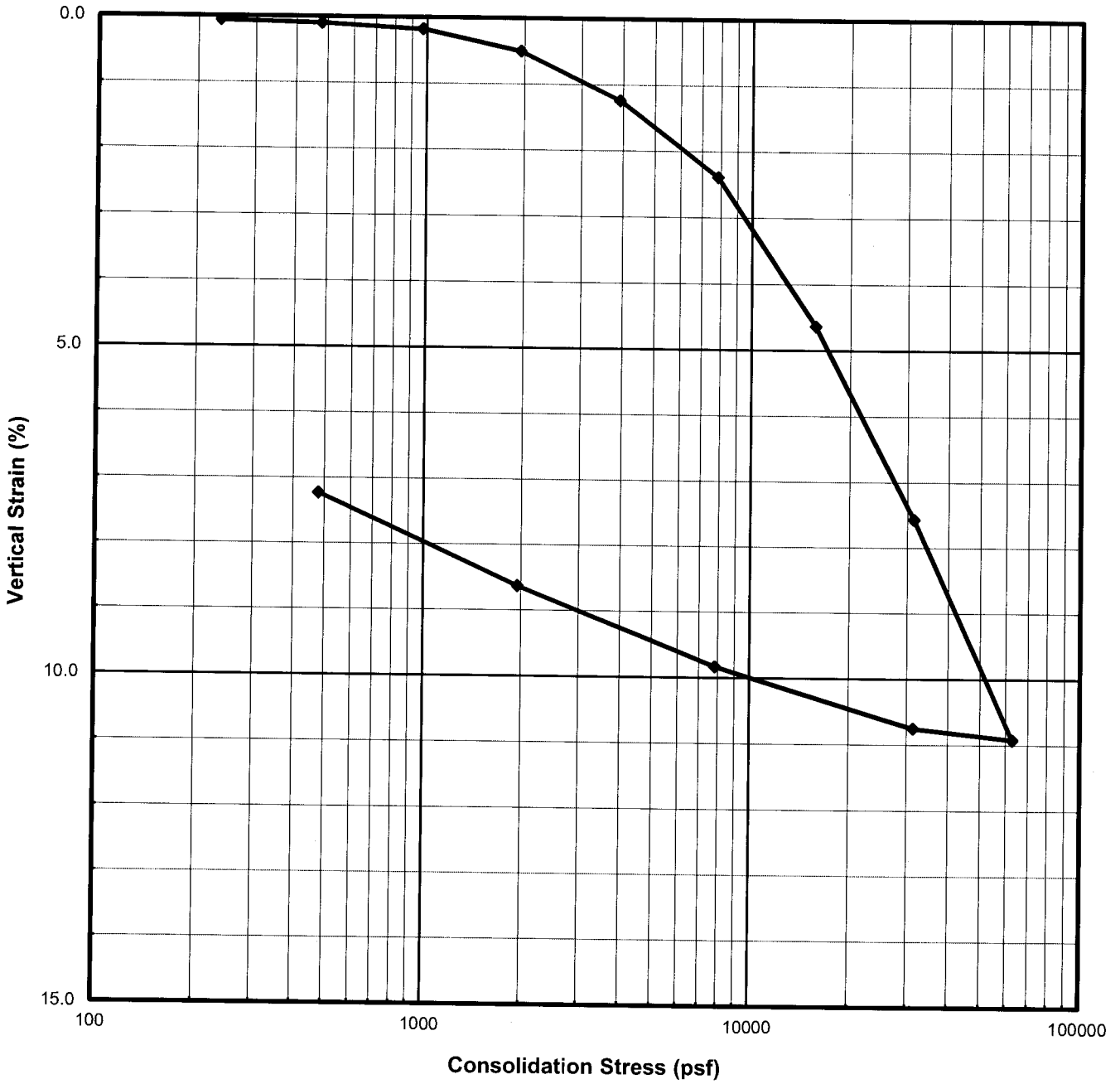
Feather River West Levee (FRWL)

Project Number: 17326605

Test Date: 10/5/2011

DIRECT SHEAR TEST

ASTM D3080



Description:	Brown Clay with sand (CL)								
Boring No.:	SL0001_009B		Liquid Limit	29	%	Specific Gravity	2.75	assumed	
Sample No.:	1		Plasticity Index	13	%	Strain for Saturation	3.66	%	
Depth (ft | m)	5.4	1.65	Fines Content	78.1	%	Water added at	969	psf	

	Water Content (%)	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Saturation (%)	Void Ratio	Height (inches)	Height (cm)	Diameter (inches)	Diameter (cm)
Initial	18.0	129.4	20.33	109.7	17.23	88.0	0.56	1.131	2.87	2.872	7.295
Final	17.2	134.8	21.17	115.0	18.06	96.6	0.49	1.079	2.74		

URS

Feather River West Levee (FRWL)

Project Number: 17326605

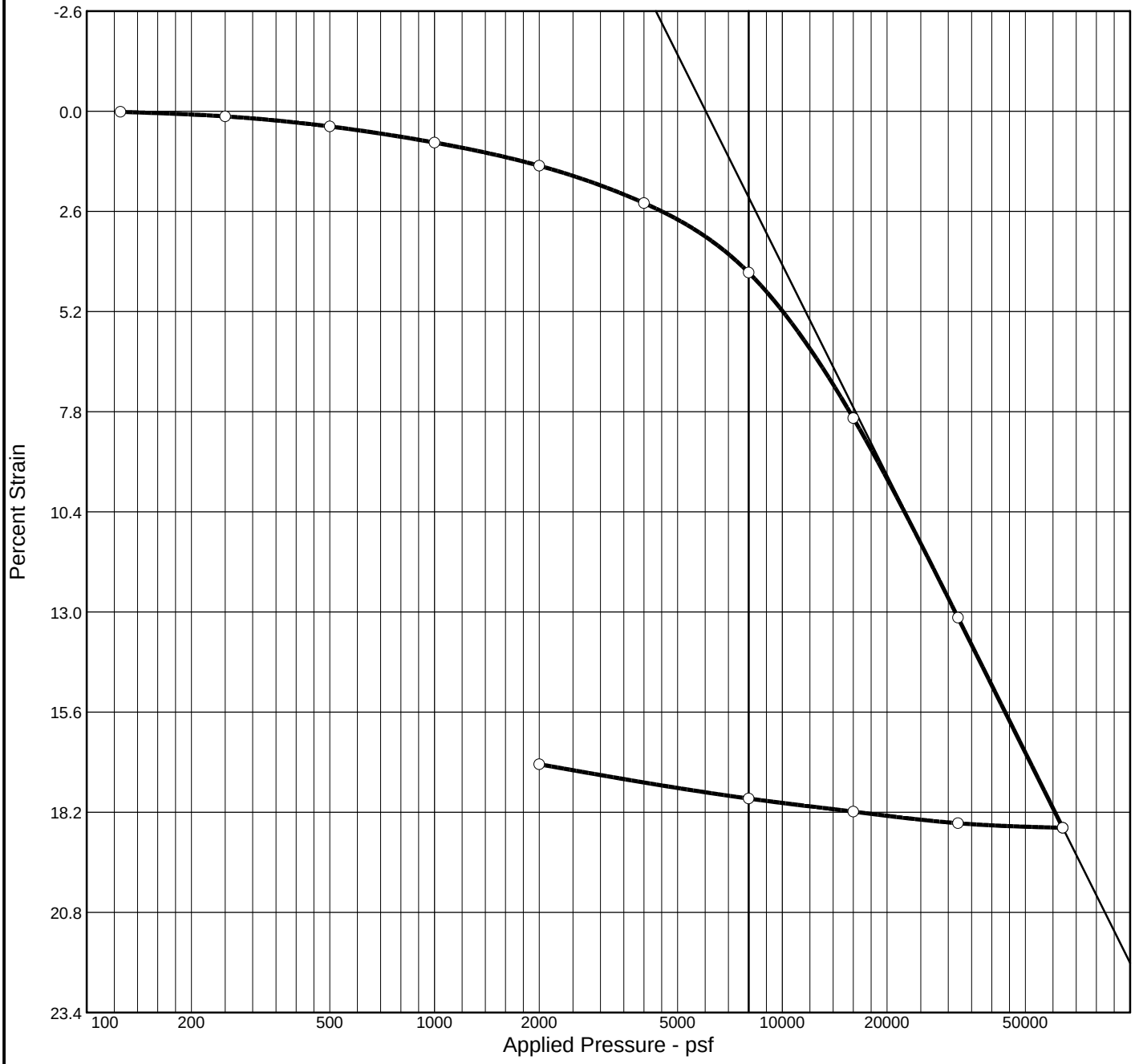
Test Start Date: 10/4/2011

CONSOLIDATION TEST
ASTM D2435

SUBMITTED BY: Thomas L. O'Mara

Con FWRL Sta 636 006

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
79.1 %	33.1 %	79.2			2.70	2124	11137	0.39	0.02			1.128

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY CLAY, dark yellowish brown	CL	

Project No. 17326605.0305233 **Client:** URS Corporation

Project: Feather River West Levee

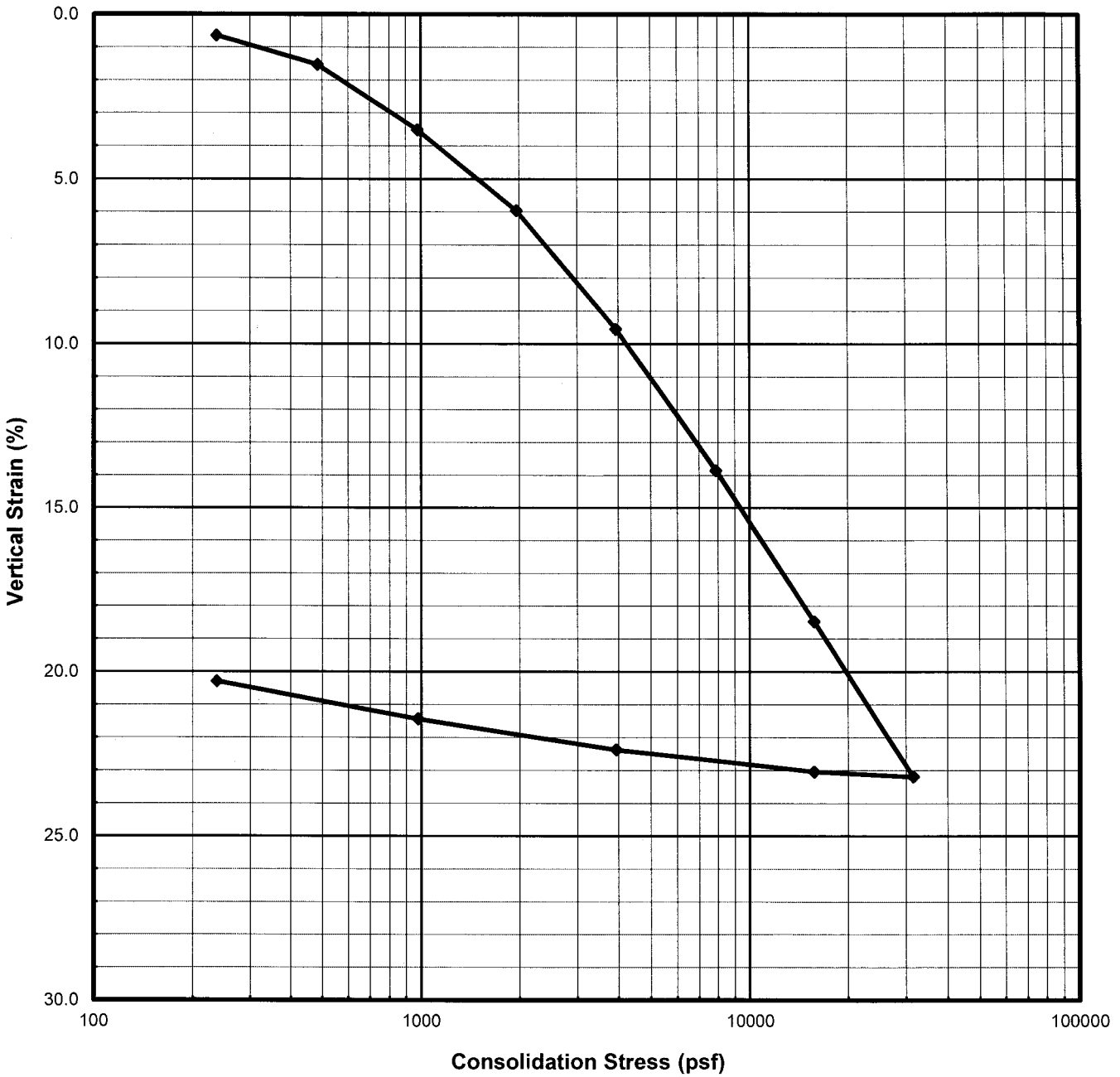
Source: SM0007_013B **Sample No.:** 7a **Elev./Depth:** 17.7-17.8'

Blackburn Consulting

W. Sacramento, CA

Remarks:

Figure



Description:	**Very dark gray Silt (ML)**							
Boring No.:	SM0007_014B		Liquid Limit	40	%	Specific Gravity	2.75	assumed
Sample No.:	1		Plasticity Index	14	%			
Depth (ft | m)	11.5	3.51	Fines Content	87.8	%	Water added at	976	psf

	Water Content (%)	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Saturation (%)	Void Ratio	Height (inches)	Height (cm)	Diameter (inches)	Diameter (cm)
Initial	46.9	112.9	17.74	76.9	12.08	104.9	1.23	1.067	2.71	2.864	7.275
Final	30.5	123.6	19.42	94.7	14.88	103.7	0.81	0.866	2.20		

URS

Feather River West Levee (FRWL)

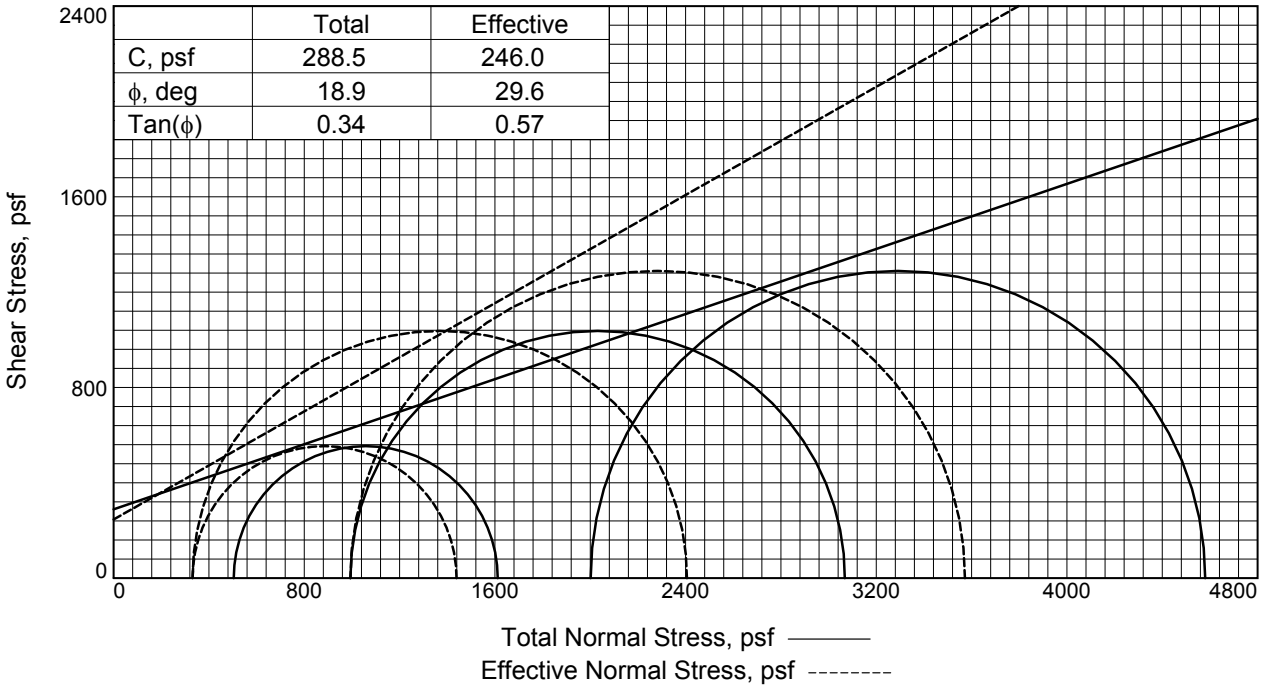
Project Number: 17326605

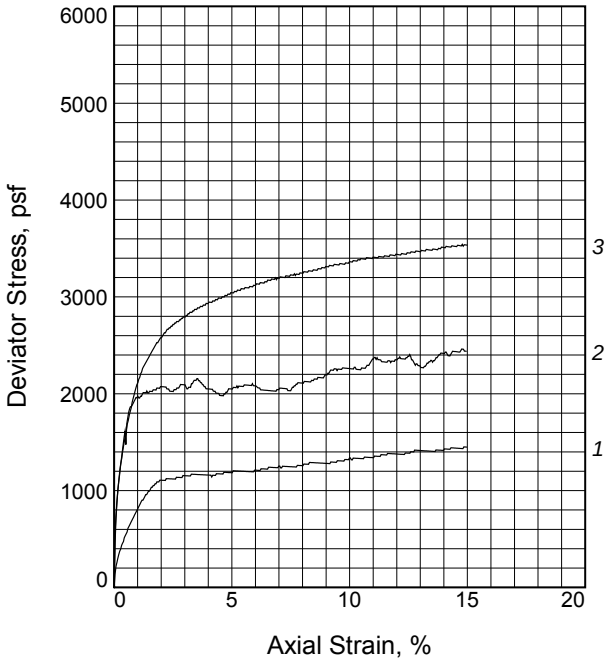
Test Start Date: 10/3/2011

CONSOLIDATION TEST
ASTM D2435

SUBMITTED BY: Thomas J. O'Mara

Con FWRL Sta 1971 012





Specimen No.		1	2	3
Initial	Water Content, %	25.2	24.7	22.4
	Dry Density, pcf	82.7	85.5	96.6
	Saturation, %	65.4	68.5	81.2
	Void Ratio	1.0391	0.9714	0.7454
	Diameter, in.	2.840	2.851	2.852
	Height, in.	5.790	5.930	5.783
At Test	Water Content, %	34.6	31.7	25.6
	Dry Density, pcf	87.1	90.9	99.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9346	0.8550	0.6911
	Diameter, in.	2.767	2.769	2.821
	Height, in.	5.785	5.915	5.725
Strain rate, in./min.		0.004	0.004	0.004
Eff. Cell Pressure, psf		504.0	993.6	2001.6
Fail. Stress, psf		1107.6	2074.5	2578.3
Excess Pore Pr., psf		172.8	662.4	1008.0
Strain, %		2.0	2.0	2.0
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1438.8	2405.7	3571.9
$\bar{\sigma}_3$ Failure, psf		331.2	331.2	993.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0' Shelby Tube

Description: Specimen 1: SANDY SILT
Specimen 2: SANDY Lean CLAY
Specimen 3: Lean CLAY with SAND

Assumed Specific Gravity= 2.7

Remarks: 2a: LL=29, PI=5, %fines=65.3
2b: LL=29, PI=8, %fines=65.2
2c: LL=33, PI=12, %fines=83.1

Figure _____

Client: URS Corporation

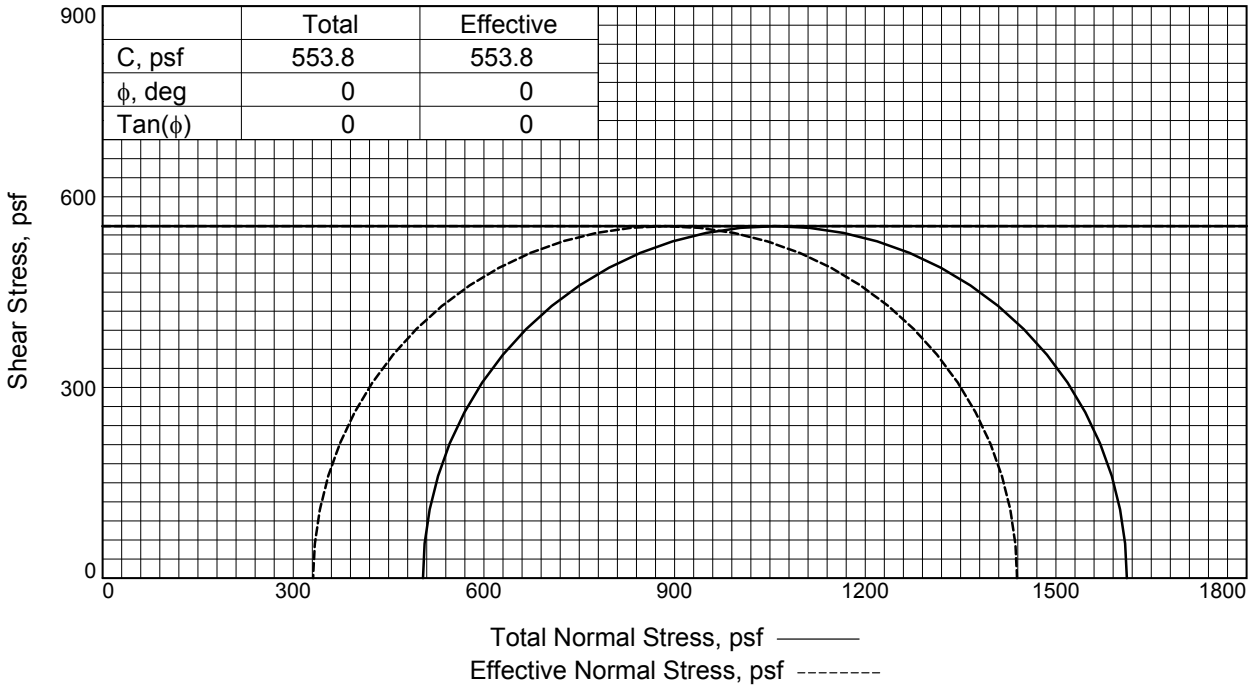
Project: Feather River West Levee

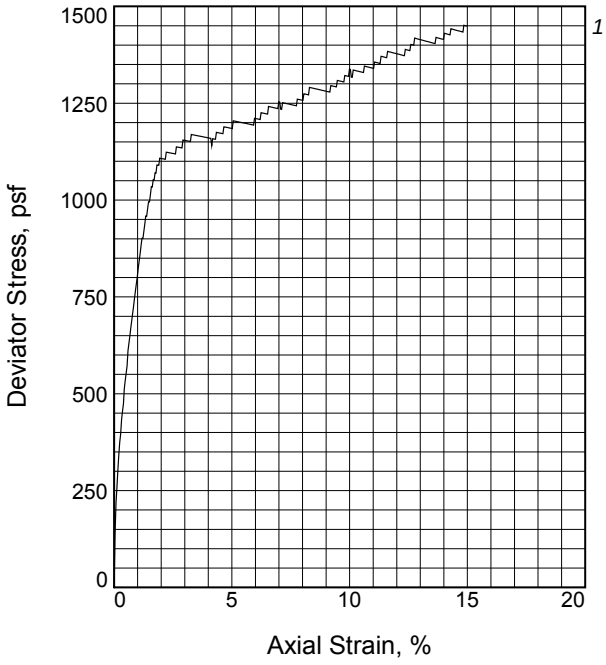
Source of Sample: SM0007_13B **Depth:** 5.4-7.0

Sample Number: #2

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	25.2
	Dry Density, pcf	82.7
	Saturation, %	65.4
	Void Ratio	1.0391
	Diameter, in.	2.840
	Height, in.	5.790
At Test	Water Content, %	34.6
	Dry Density, pcf	87.1
	Saturation, %	100.0
	Void Ratio	0.9346
	Diameter, in.	2.767
	Height, in.	5.785
Strain rate, in./min.		0.004
Eff. Cell Pressure, psf		504.0
Fail. Stress, psf		1107.6
Excess Pore Pr., psf		172.8
Strain, %		2.0
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		1438.8
$\bar{\sigma}_3$ Failure, psf		331.2

Type of Test:
CU with Pore Pressures

Sample Type: 3.0' Shelby Tube

Description: Specimen 1: SANDY SILT

Assumed Specific Gravity= 2.7

Remarks: 2a: LL=29, PI=5, %fines=65.3

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SM0007_13B **Depth:** 5.4-5.9

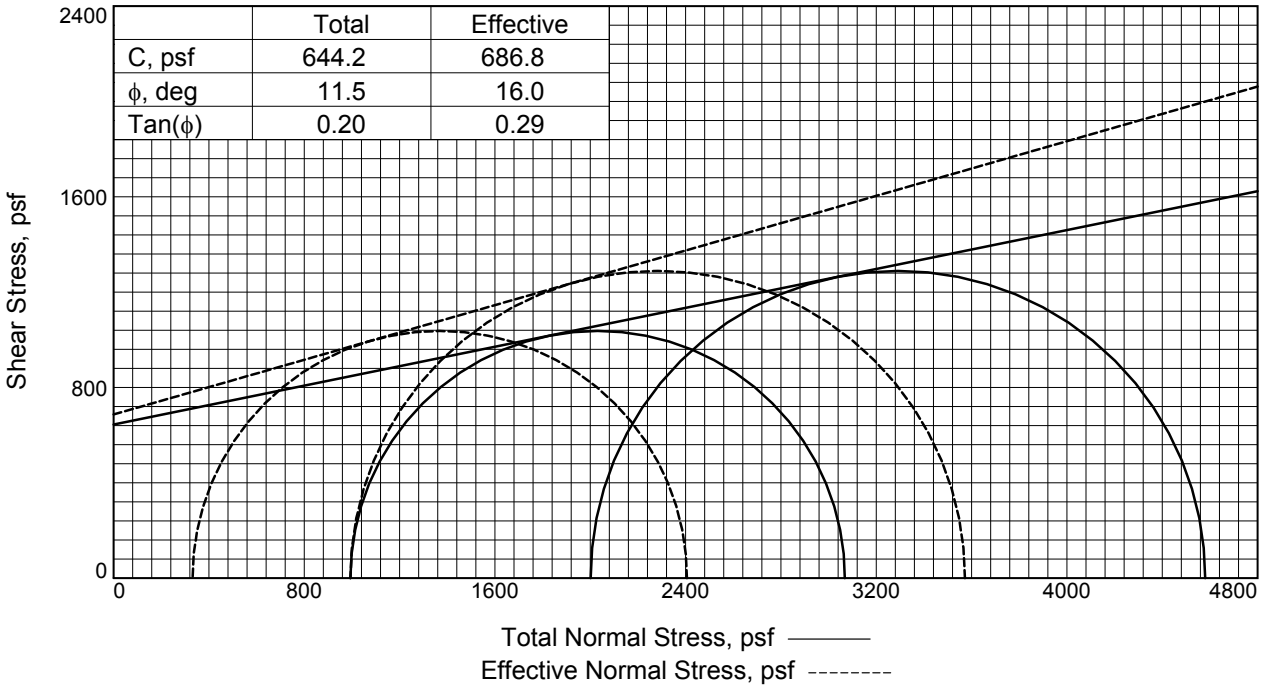
Sample Number: #2

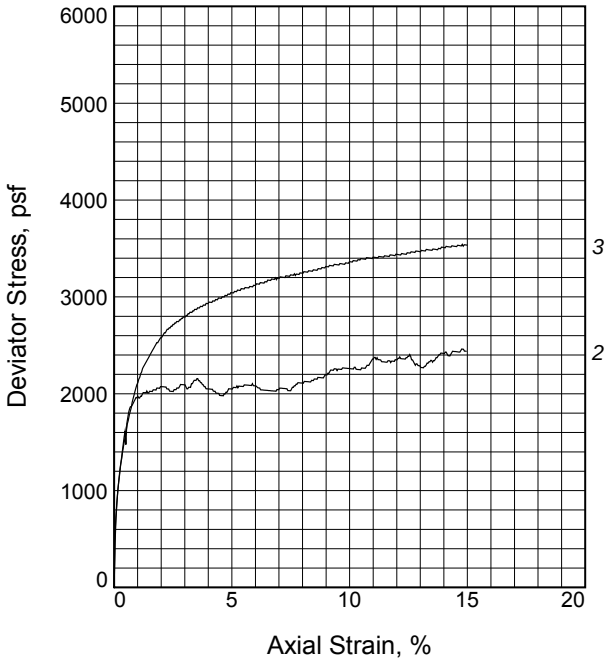
Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

Blackburn Consulting

W. Sacramento, CA





Specimen No.		2	3
Initial	Water Content, %	24.7	22.4
	Dry Density, pcf	85.5	96.6
	Saturation, %	68.5	81.2
	Void Ratio	0.9714	0.7454
	Diameter, in.	2.851	2.852
	Height, in.	5.930	5.783
At Test	Water Content, %	31.7	25.6
	Dry Density, pcf	90.9	99.7
	Saturation, %	100.0	100.0
	Void Ratio	0.8550	0.6911
	Diameter, in.	2.769	2.821
	Height, in.	5.915	5.725
Strain rate, in./min.		0.004	0.004
Eff. Cell Pressure, psf		993.6	2001.6
Fail. Stress, psf		2074.5	2578.3
Excess Pore Pr., psf		662.4	1008.0
Strain, %		2.0	2.0
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		2405.7	3571.9
$\bar{\sigma}_3$ Failure, psf		331.2	993.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0' Shelby Tube

Description: Specimen 2: SANDY Lean CLAY
Specimen 3: Lean CLAY with SAND

Assumed Specific Gravity=

Remarks: 2b: LL=29, PI=8, %fines=65.2
2c: LL=33, PI=12, %fines=83.1

Figure _____

Client: URS Corporation

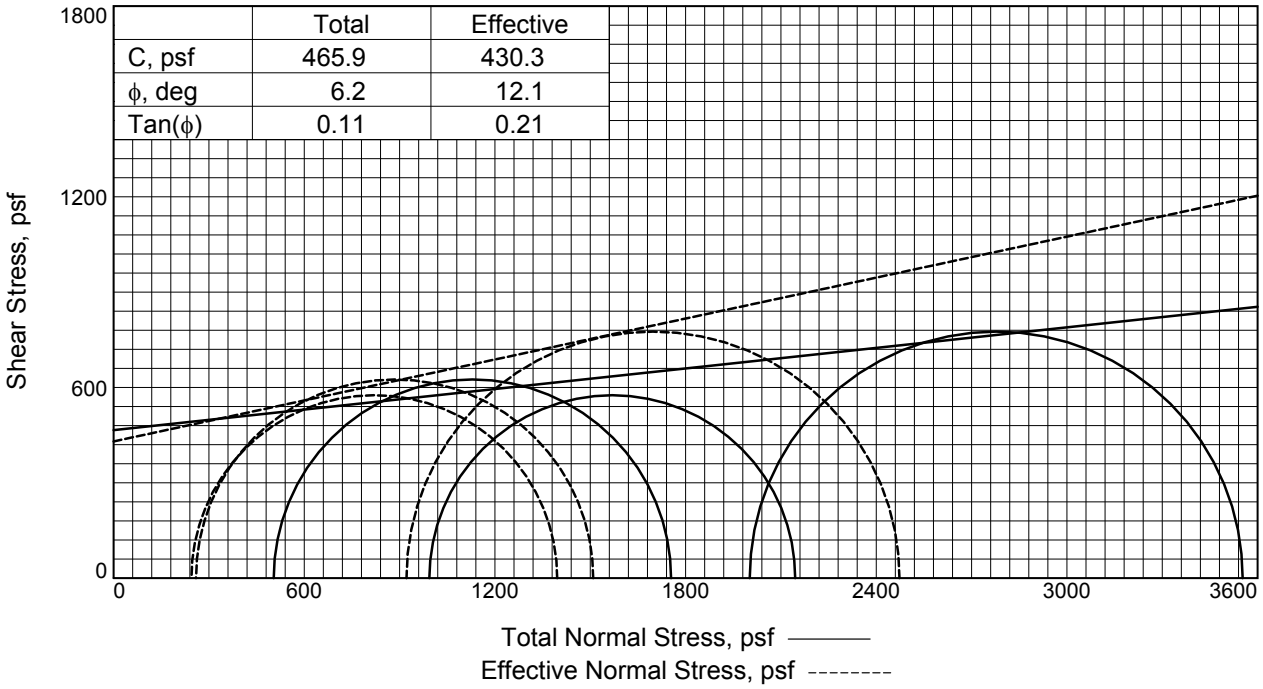
Project: Feather River West Levee

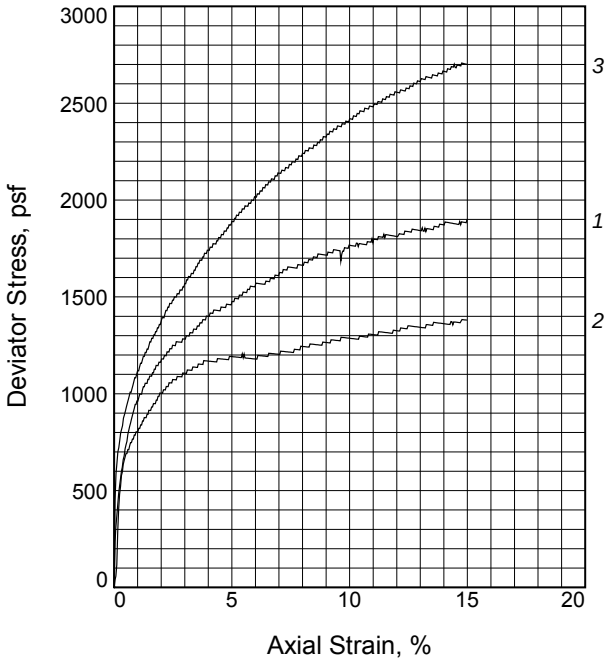
Source of Sample: SM0007_13B **Depth:** 5.9-7.0

Sample Number: #2

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1	2	3
Initial	Water Content, %	18.8	19.8	21.3
	Dry Density, pcf	79.0	79.0	77.4
	Saturation, %	44.7	47.2	48.9
	Void Ratio	1.1348	1.1343	1.1773
	Diameter, in.	2.874	2.872	2.876
	Height, in.	6.018	6.012	5.904
At Test	Water Content, %	36.1	37.3	37.1
	Dry Density, pcf	85.4	83.9	84.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9740	1.0081	1.0015
	Diameter, in.	2.794	2.804	2.790
	Height, in.	5.886	5.934	5.765
Strain rate, in./min.		0.004	0.004	0.004
Eff. Cell Pressure, psf		504.0	993.6	2001.6
Fail. Stress, psf		1250.1	1151.2	1551.4
Excess Pore Pr., psf		244.8	748.8	1080.0
Strain, %		2.5	3.8	3.0
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1509.3	1396.0	2473.0
$\bar{\sigma}_3$ Failure, psf		259.2	244.8	921.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby Tube

Description: Specimen 1: SILTY SAND
Specimen 2: SANDY SILT
Specimen 3: SANDY SILT

Assumed Specific Gravity= 2.7

Remarks: 7a: LL=NV, PI=NP, %fines=34.4
7b: LL=NV, PI=NP, %fines=54.5
7c: LL=NV, PI=NP, %fines=54.7

Figure _____

Client: URS Corporation

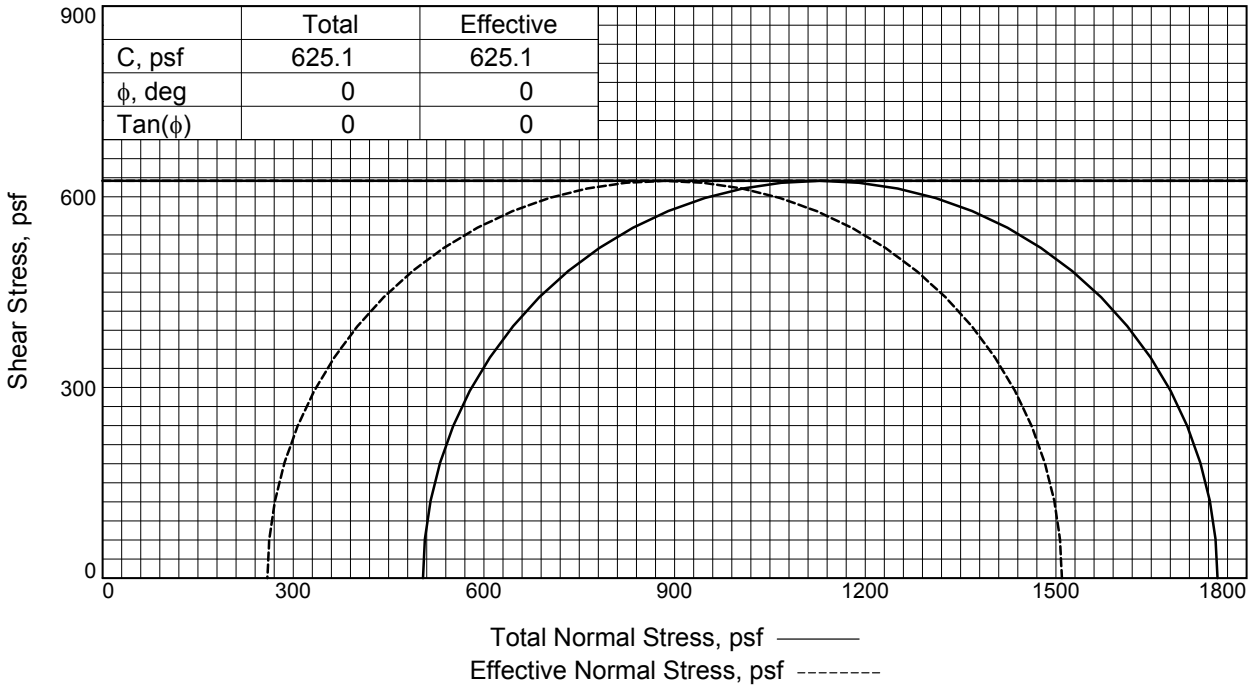
Project: Feather River West Levee

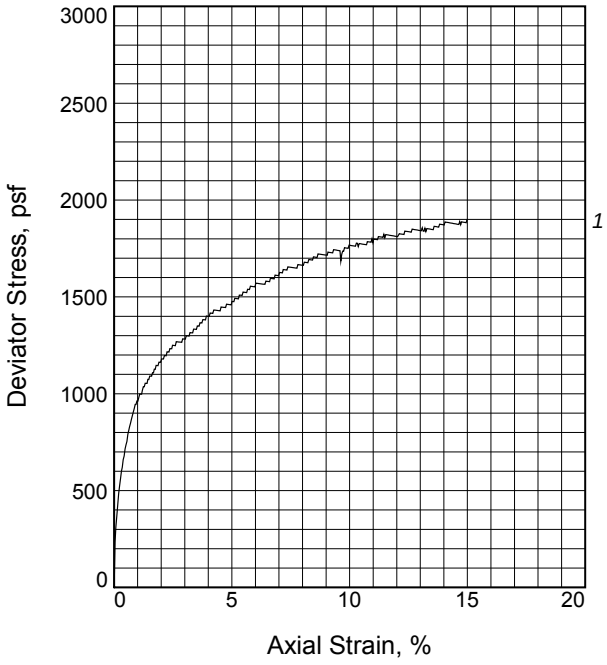
Source of Sample: SM0007_13B **Depth:** 17.9-19.5

Sample Number: #7

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Specimen No.		1
Initial	Water Content, %	18.8
	Dry Density, pcf	79.0
	Saturation, %	44.7
	Void Ratio	1.1348
	Diameter, in.	2.874
	Height, in.	6.018
At Test	Water Content, %	36.1
	Dry Density, pcf	85.4
	Saturation, %	100.0
	Void Ratio	0.9740
	Diameter, in.	2.794
	Height, in.	5.886
Strain rate, in./min.		0.004
Eff. Cell Pressure, psf		504.0
Fail. Stress, psf		1250.1
Excess Pore Pr., psf		244.8
Strain, %		2.5
Ult. Stress, psf		
Excess Pore Pr., psf		
Strain, %		
$\bar{\sigma}_1$ Failure, psf		1509.3
$\bar{\sigma}_3$ Failure, psf		259.2

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby Tube

Description: Specimen 1: SILTY SAND

Assumed Specific Gravity= 2.7

Remarks: 7a: LL=NV, PI=NP, %fines=34.4

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SM0007_13B **Depth:** 17.9-18.4

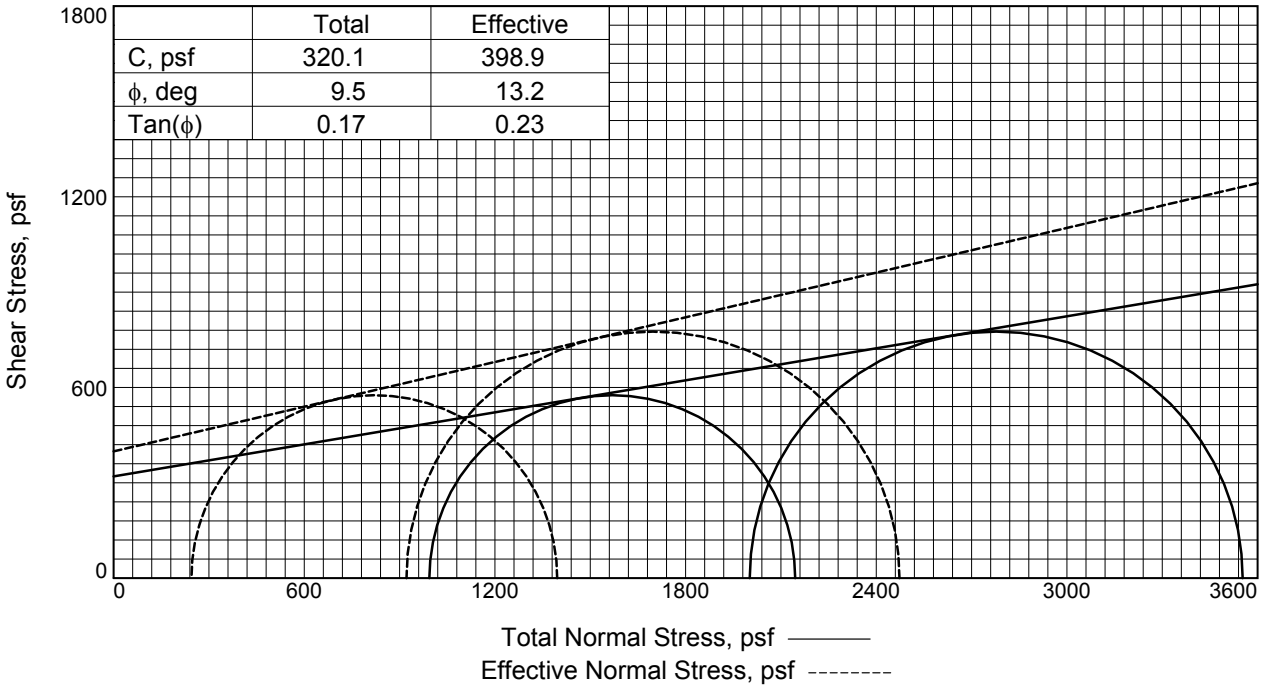
Sample Number: #7

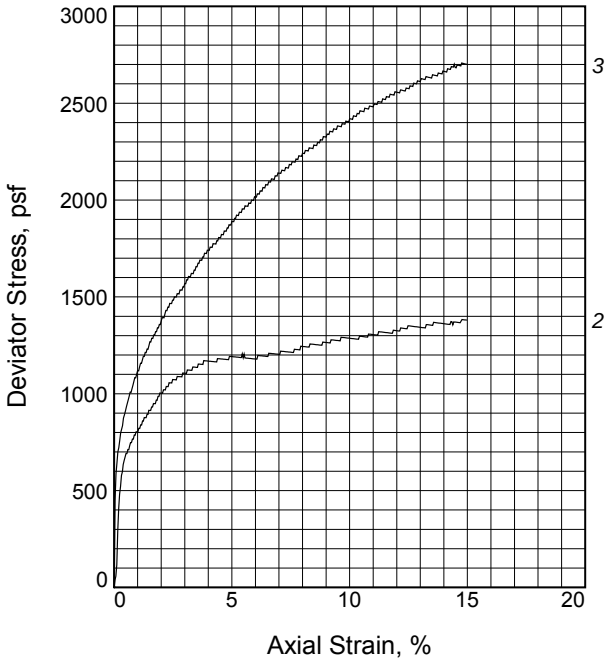
Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

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Specimen No.		2	3
Initial	Water Content, %	19.8	21.3
	Dry Density, pcf	79.0	77.4
	Saturation, %	47.2	48.9
	Void Ratio	1.1343	1.1773
	Diameter, in.	2.872	2.876
	Height, in.	6.012	5.904
At Test	Water Content, %	37.3	37.1
	Dry Density, pcf	83.9	84.2
	Saturation, %	100.0	100.0
	Void Ratio	1.0081	1.0015
	Diameter, in.	2.804	2.790
	Height, in.	5.934	5.765
Strain rate, in./min.		0.004	0.004
Eff. Cell Pressure, psf		993.6	2001.6
Fail. Stress, psf		1151.2	1551.4
Excess Pore Pr., psf		748.8	1080.0
Strain, %		3.8	3.0
Ult. Stress, psf			
Excess Pore Pr., psf			
Strain, %			
$\bar{\sigma}_1$ Failure, psf		1396.0	2473.0
$\bar{\sigma}_3$ Failure, psf		244.8	921.6

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby Tube

Description: Specimen 2: SANDY SILT
Specimen 3: SANDY SILT

Assumed Specific Gravity=

Remarks: 7b: LL=NV, PI=NP, %fines=54.5
7c: LL=NV, PI=NP, %fines=54.7

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SM0007_13B **Depth:** 18.4-19.5

Sample Number: #7

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
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Laboratory Schedule 3

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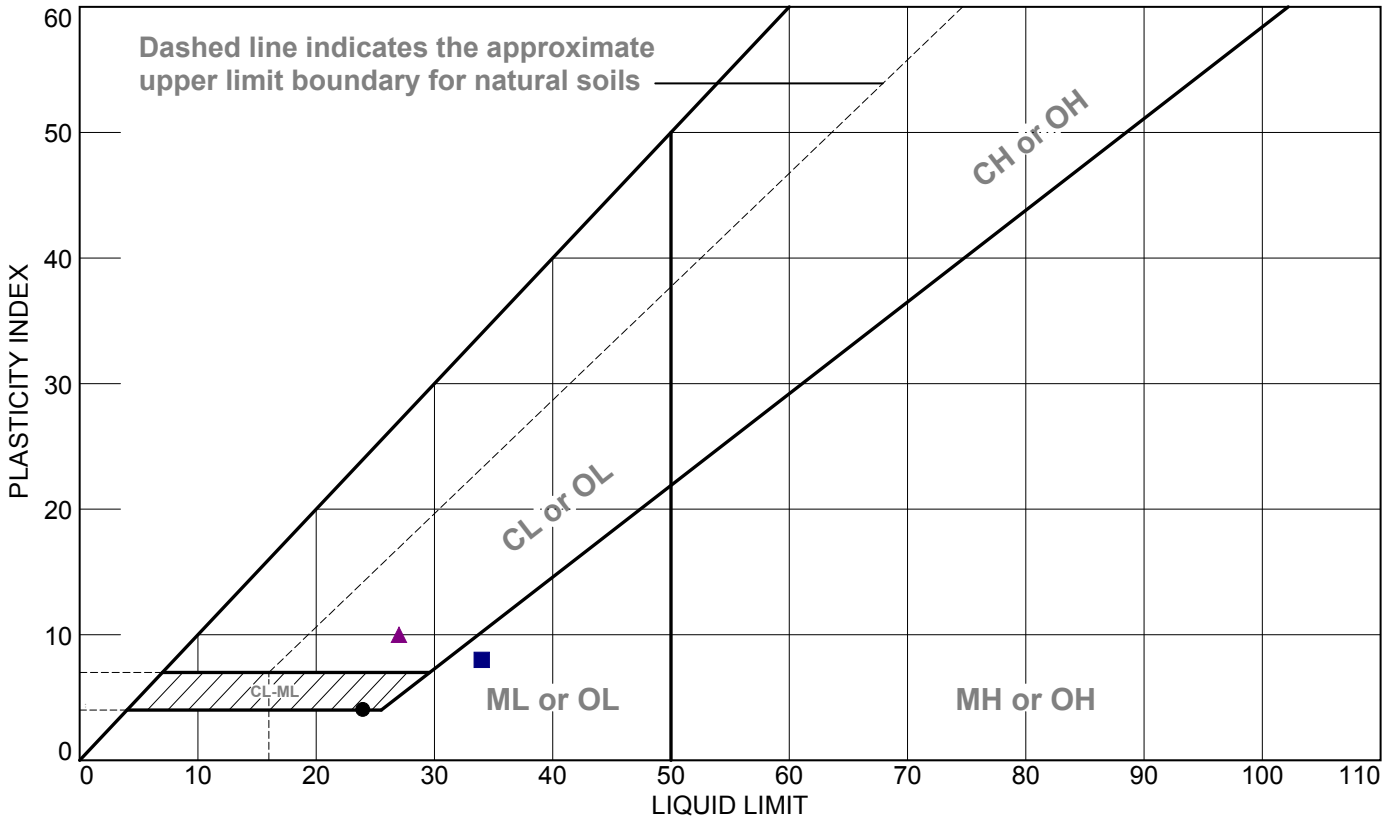
Project Name: Feather River West Levee
BCI Project No: 1967.3
Job No: 17326605.0305233

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Boring	Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Laboratory Pocket Pen. (tsf)
SM0007_010A	2B	6.0-6.5	109.6	95.2	15.1	0.20
SM0007_010A	3	7.4-7.9	115.0	98.5	16.7	1.3
SM0007_015B	10B	38.5-39.0	117.1	86.2	35.8	>4.5
SL0001_024C	4	30.0-30.5	-	-	26.9	-
SL0001_037C	4	30.0-31.0	-	-	34.5	-

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_010A	#2B	6.0-6.5'	15.1	20	24	4	CL-ML
■	SM0016_004C	#2	20.0-24.0'	29.0	26	34	8	ML
▲	SL0001_023C	#1	0.0-2.0'	14.3	17	27	10	CL
◆	SL0001_034C	#3	24.0-25.0'	27.5	22	22	NP	ML

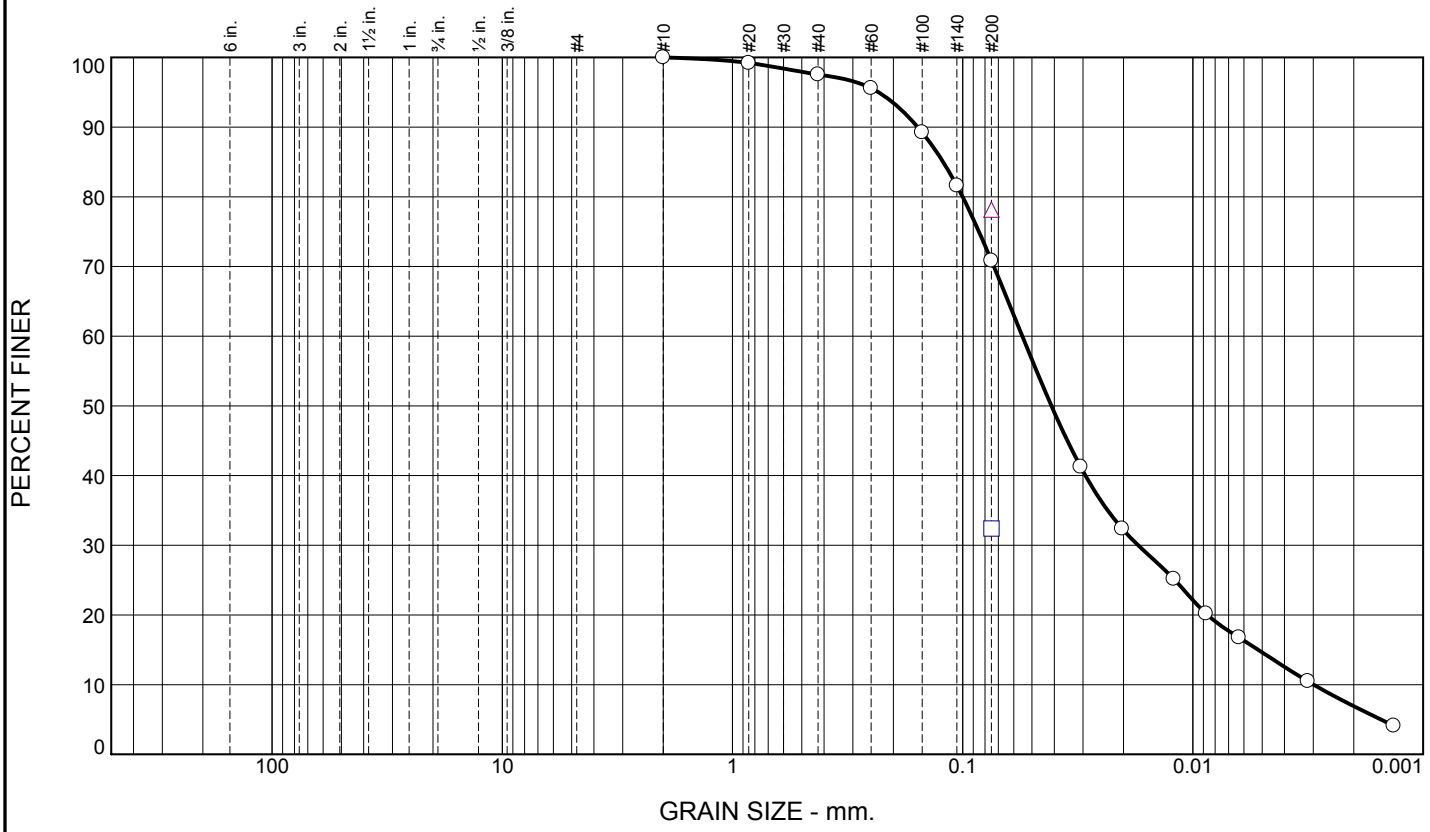
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	29.2	56.2	14.6	ML			
□						GM			
△						CL	27	17	10

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}	0.0551		
D_{30}	0.0173		
D_{10}	0.0030		
	COEFFICIENTS		
C_c	1.82		
C_u	18.42		

SIEVE number size	PERCENT FINER ○	□	△
#10	100.0		
#20	99.2		
#40	97.6		
#60	95.6		
#100	89.2		
#140	81.6		
#200	70.8	32.4	78.2

Material Description

○ SILT with SAND, dark yellowish brown

□ SILTY GRAVEL with SAND, dark brown

△ Lean CLAY with SAND, very dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_010A Depth: 5.5-6.0' Sample Number: #2A

□ Source of Sample: SM0007_015B Depth: 38.0-38.5' Sample Number: #10A

△ Source of Sample: SL0001_023C Depth: 0.0-2.0' Sample Number: #1

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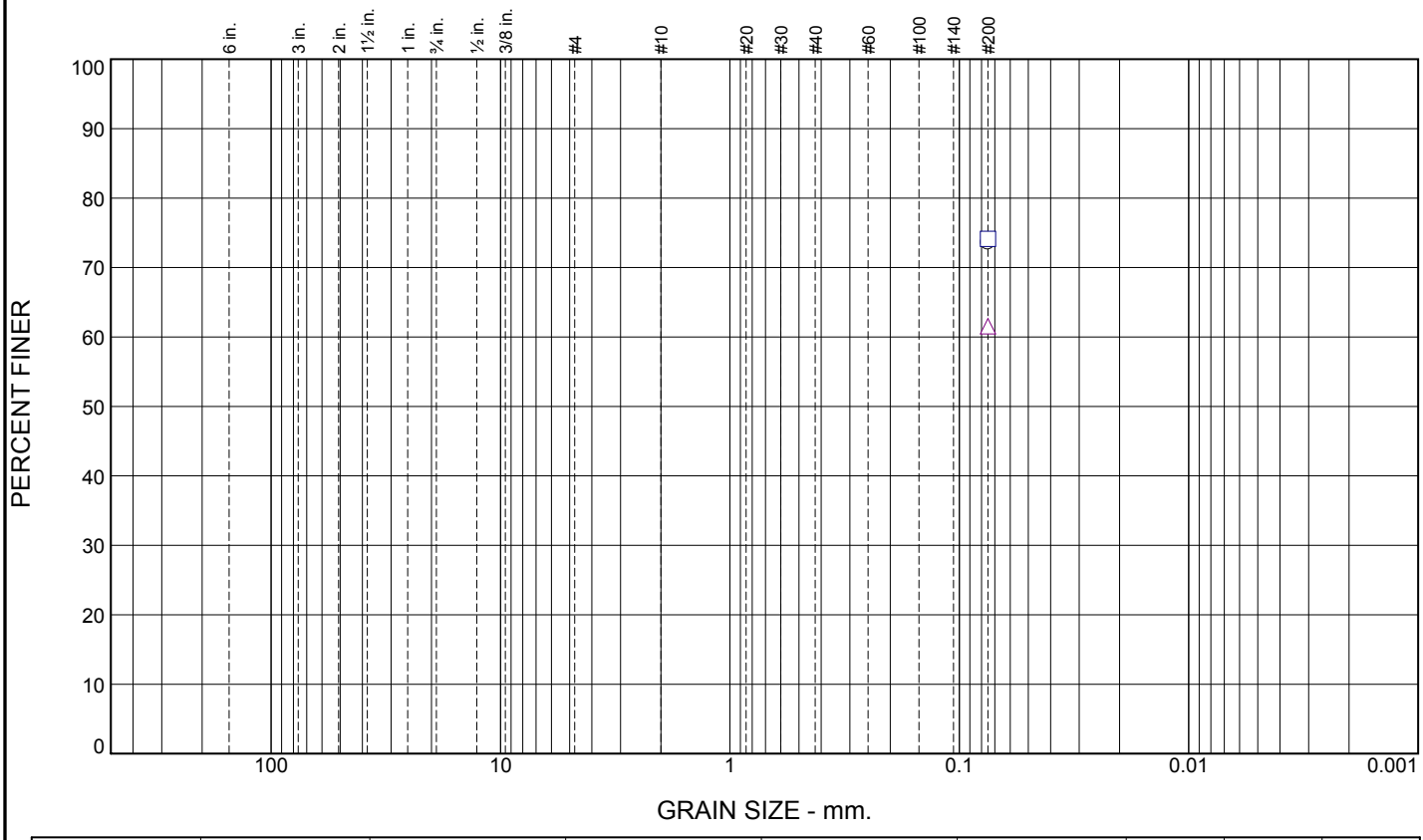
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS3 - 1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL			
□						CL			
△						CL			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	73.6	74.1	61.6

Material Description

○ Lean CLAY with SAND, brown

□ Lean CLAY with SAND, dark brown

△ SANDY Lean CLAY, light olive brown

REMARKS:

○ Natural Water Content=16.4%

□ Natural Water Content=20.2%

△ Natural Water Content=16.5%

○ Source of Sample: SL0001_023C Depth: 4.0-4.5' Sample Number: #2

□ Source of Sample: SL0001_023C Depth: 4.5-5.0' Sample Number: #3

△ Source of Sample: SL0001_023C Depth: 6.5-7.5' Sample Number: #4

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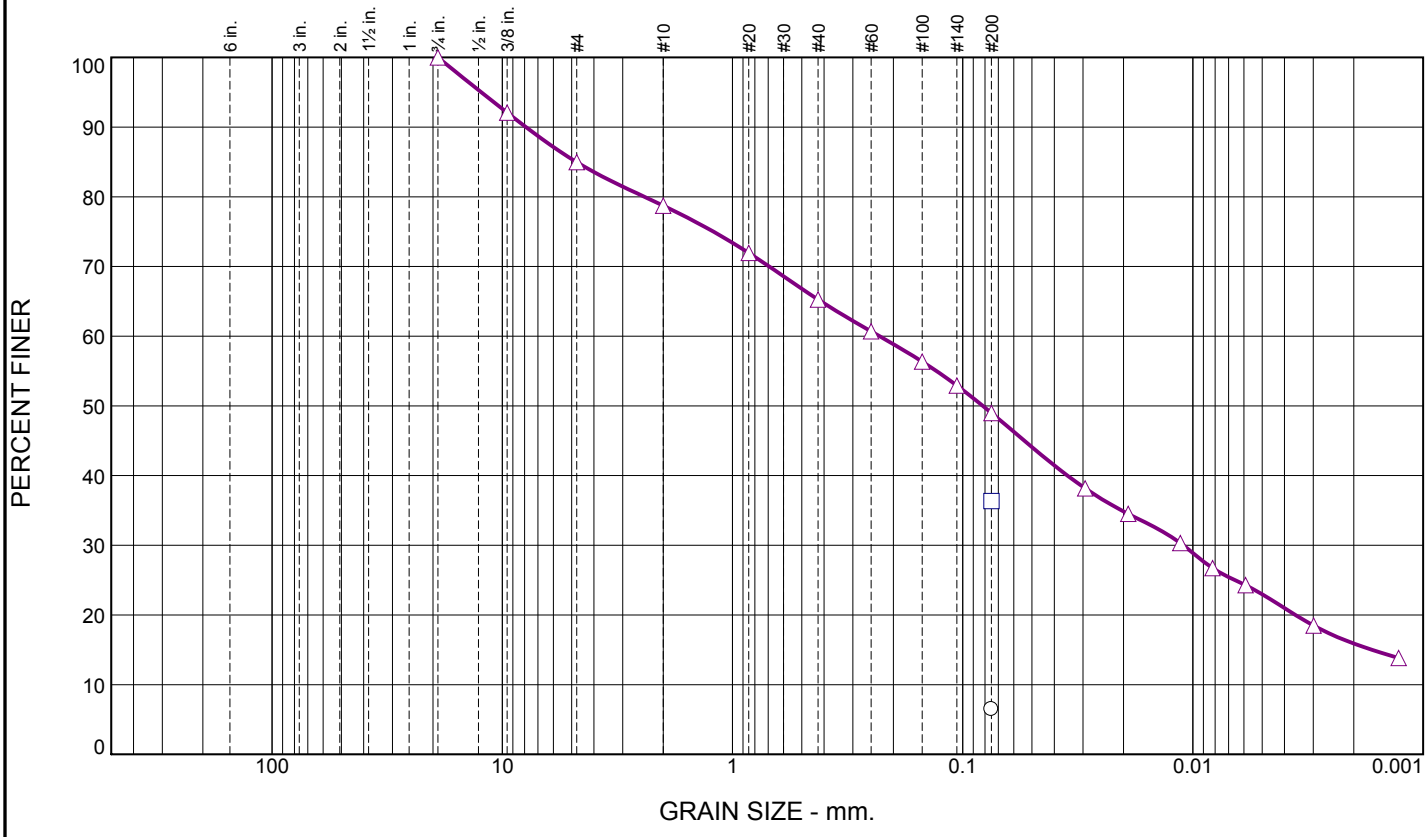
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS3 - 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP-SM			
□						SM			
△	0.0	15.0	36.0	26.0	23.0	SC-SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"			100.0
3/8"			92.1
GRAIN SIZE			
D_{60}			0.2297
D_{30}			0.0110
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4			85.0
#10			78.7
#20			72.0
#40			65.3
#60			60.7
#100			56.4
#140			52.9
#200	6.5	36.3	49.0

Material Description

○ Poorly-Graded SAND with SILT, dark olive brown

□ SILTY SAND, light olive brown

△ SILTY, CLAYEY SAND with GRAVEL, dark brown

REMARKS:

○ Natural Water Content=3.8%

□

△

○ Source of Sample: SL0001_023C Depth: 9.0-10.0' Sample Number: #5

□ Source of Sample: SL0001_035C Depth: 8.0-8.5' Sample Number: #3

△ Source of Sample: SL0009_009C Depth: 2.0-2.5' Sample Number: #1

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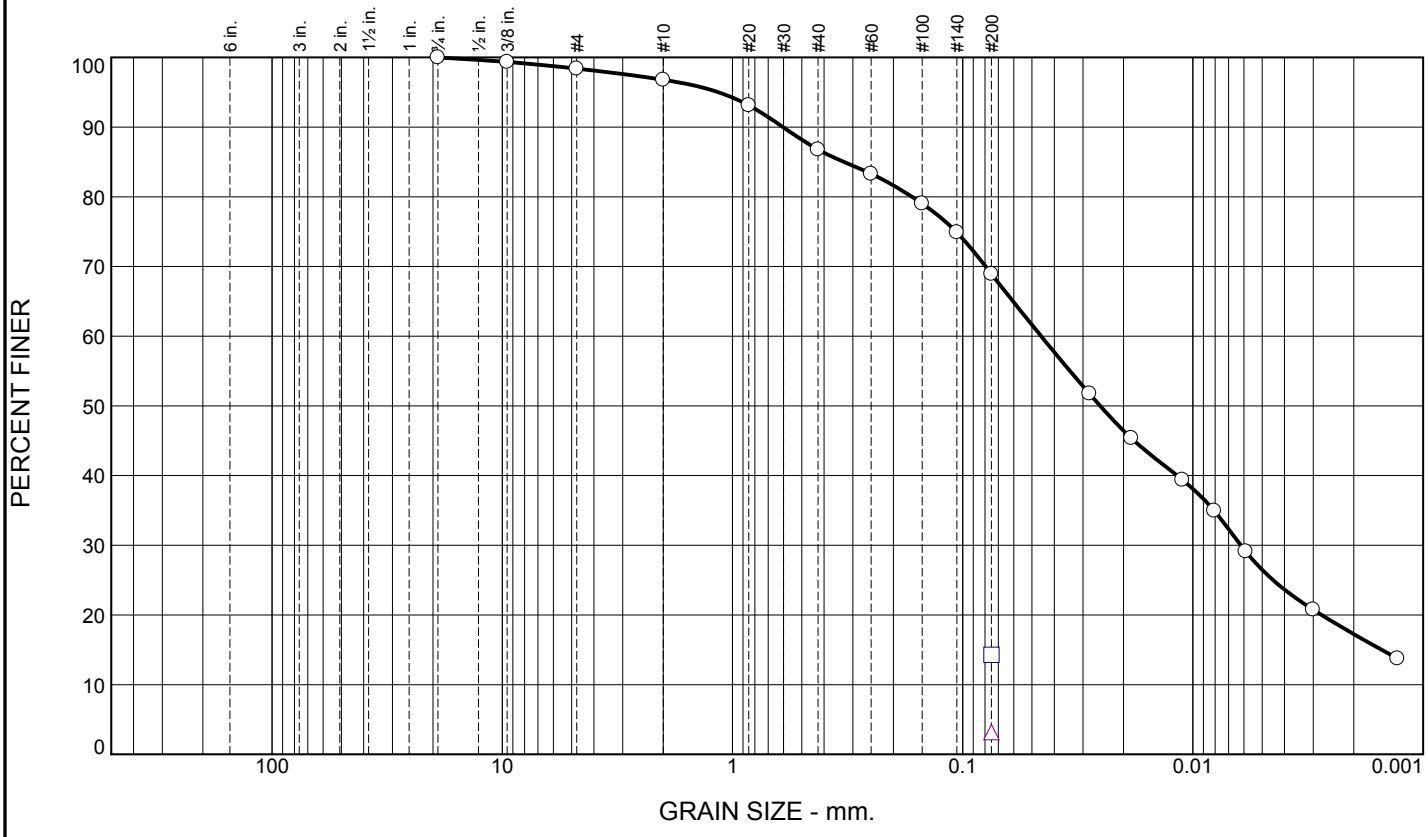
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS3 - 3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	1.6	29.5	42.4	26.5	ML			
□						SM			
△						SP			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	99.4		
GRAIN SIZE			
D_{60}	0.0456		
D_{30}	0.0062		
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	98.4		
#10	96.8		
#20	93.1		
#40	86.8		
#60	83.3		
#100	79.0		
#140	74.9		
#200	68.9	14.3	3.2

Material Description

○ SANDY SILT, dark yellowish brown

□ SILTY SAND, yellowish brown

△ Poorly-graded SAND, light brown

REMARKS:

○

□

△

○ Source of Sample: SL0009_009C Depth: 4.0-4.5' Sample Number: #2

□ Source of Sample: SL0009_009C Depth: 20.0-21.0' Sample Number: #3

△ Source of Sample: SL0001_034C Depth: 4.0-4.5' Sample Number: #2

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Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS3 - 4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	39.6	60.4		ML	22	22	NP

SIEVE inches size	PERCENT FINER ○		
.75	100.0		
.375	100.0		
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.1		
#40	91.5		
#60	84.6		
#100	77.6		
#140	71.8		
#200	60.4		

Material Description
○ SANDY SILT, brown

REMARKS:
○

○ Source of Sample: SL0001_034C Depth: 24.0-25.0' Sample Number: #3

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Client: URS Corporation
Project: Feather River West Levee
Project No.: 17326605.0305233 Figure LS3 - 5

Laboratory Schedule 4

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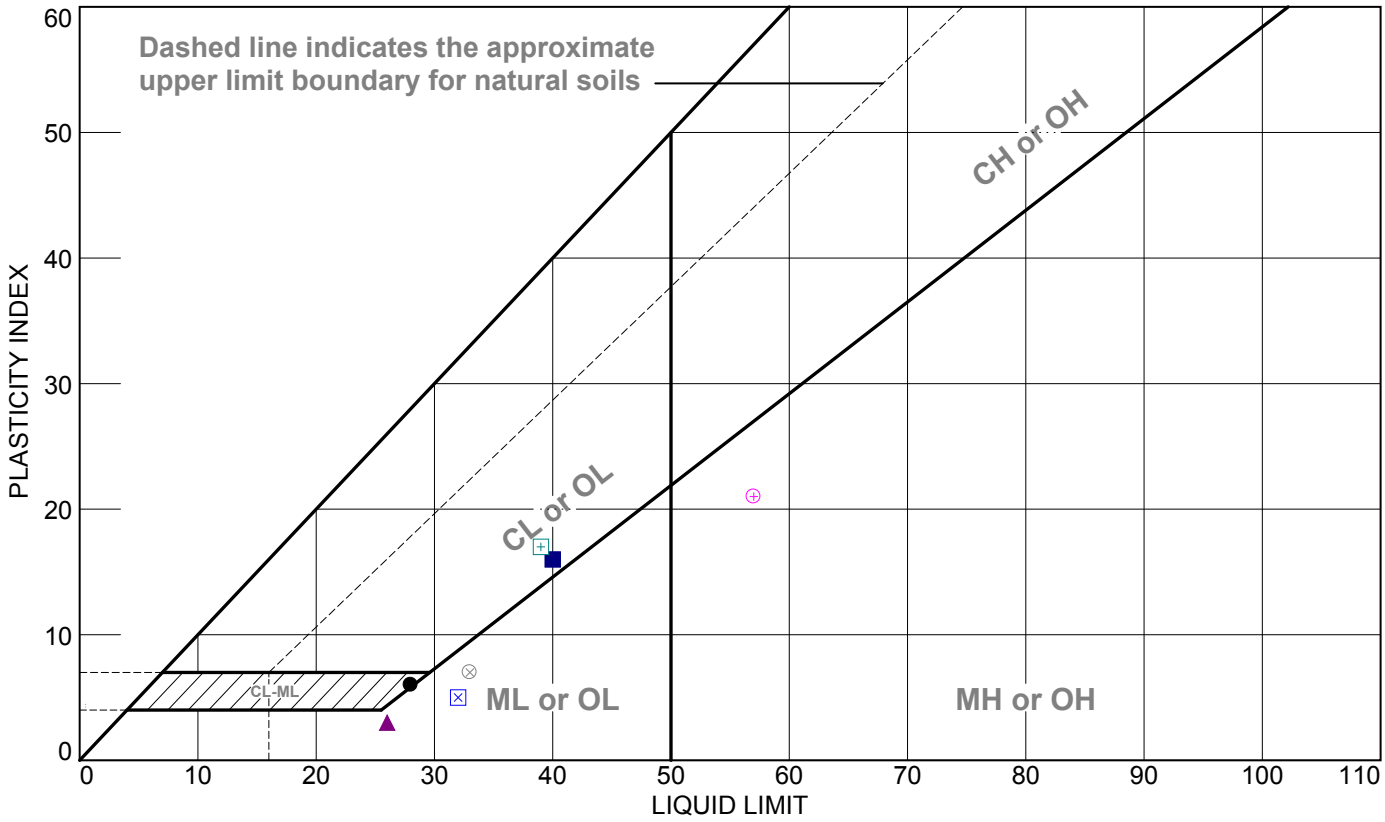
Project Name: Feather River West Levee
BCI Project No: 1967.3
Job No: 17326605.0305233

MOISTURE-DENSITY TESTS

ASTM D 2216 / D 2937

Boring	Sample ID	Depth (ft)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Laboratory Pocket Pen. (tsf)
SM0007_009A	6A	15.5-16.0	-	-	12.8	-
SM0007_009A	16B	58.5-59.0	113.3	81.8	38.5	1.8
SM0007_008A	12	41.0-41.5	124.6	94.2	32.3	1.4
SM0007_001A	3	10.0-11.5	-	-	23.3	-
SM0007_007A	2A	5.5-6.0	120.7	96.6	24.9	>4.5
SM0007_007A	5A	13.0-13.5	119.5	95.1	25.7	>4.5
SM0007_007A	5B	13.5-14.0	115.2	92.8	24.1	>4.5
SL0001_010B	3A	5.5-6.0	130.8	112.5	16.2	>4.5
SL0001_010B	20A	63.0-63.5	123.7	94.3	31.1	-
SM0016_008C	3	19.0-19.5	-	-	28.2	-

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_002S	#2	10.0-11.0'	20.7	22	28	6	CL-ML
■	SM0007_002S	#18	72.0-73.0'	10.6	24	40	16	GW-GC
▲	SM0007_003S	#1	5.0-6.0'	15.9	23	26	3	ML
◆	SM0007_003S	#5	25.0-26.0'	19.9	NP	NV	NP	ML
▼	SM0007_003S	#16	62.0-63.0'	34.7	27	26	NP	ML
✱	SM0007_009A	#4B	10.9-11.4'	12.2	NP	NV	NP	SM
⊕	SM0007_009A	#15B	53.0-54.0'	42.3	36	57	21	MH
⊞	SM0007_008A	#19	72.5-74.0'	18.3	22	39	17	CL
⊗	SM0007_001A	#16	70.0-71.5'	54.7	26	33	7	SM
⊠	SM0007_007A	#2A	5.5-6.0'	24.9	27	32	5	ML

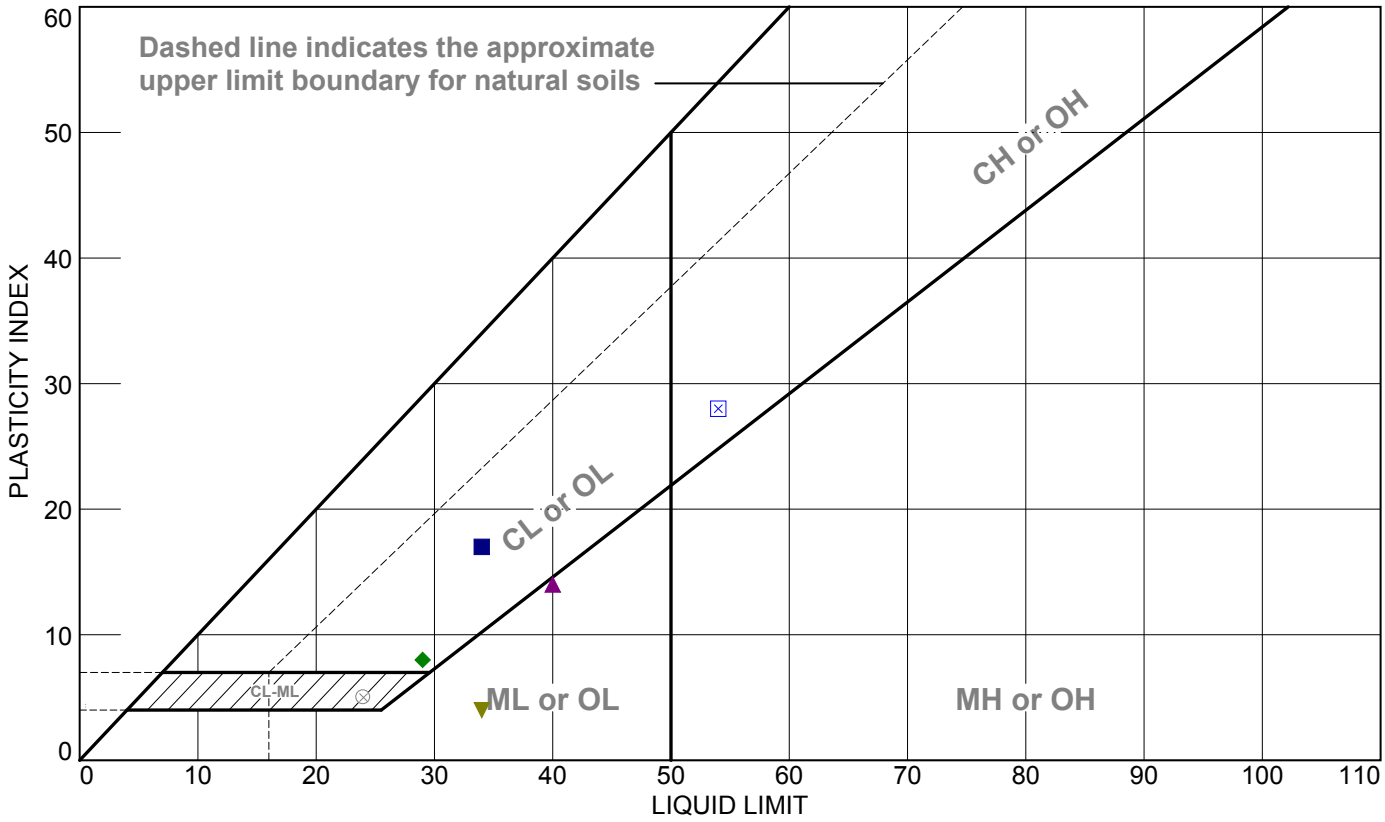
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS4 - 1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_017B	#7	25.0-26.5'	26.1	NP	NV	NP	ML
■	SL0001_010B	#3A	5.5-6.0'	16.2	17	34	17	CL
▲	SL0001_010B	#20A	63.0-63.5'	31.1	26	40	14	ML
◆	SL0001_029C	#3	24.0-25.0'	24.7	21	29	8	CL
▼	SL0009_005C	#2	4.0-4.5'	21.7	30	34	4	SM
✱	SM0007_004S	#4	26.0-27.0'	5.6	NP	NV	NP	SP-SM
⊕	SM0007_004S	#10	48.0-49.0'	16.3	NP	NV	NP	SM
⊞	SM0007_001S	#1	6.0-7.0'	10.6	NP	NV	NP	SM
⊗	SM0007_001S	#4	18.0-19.0'	23.0	19	24	5	CL-ML
⊠	SM0007_001S	#20	70.0-71.0'	24.6	26	54	28	CH

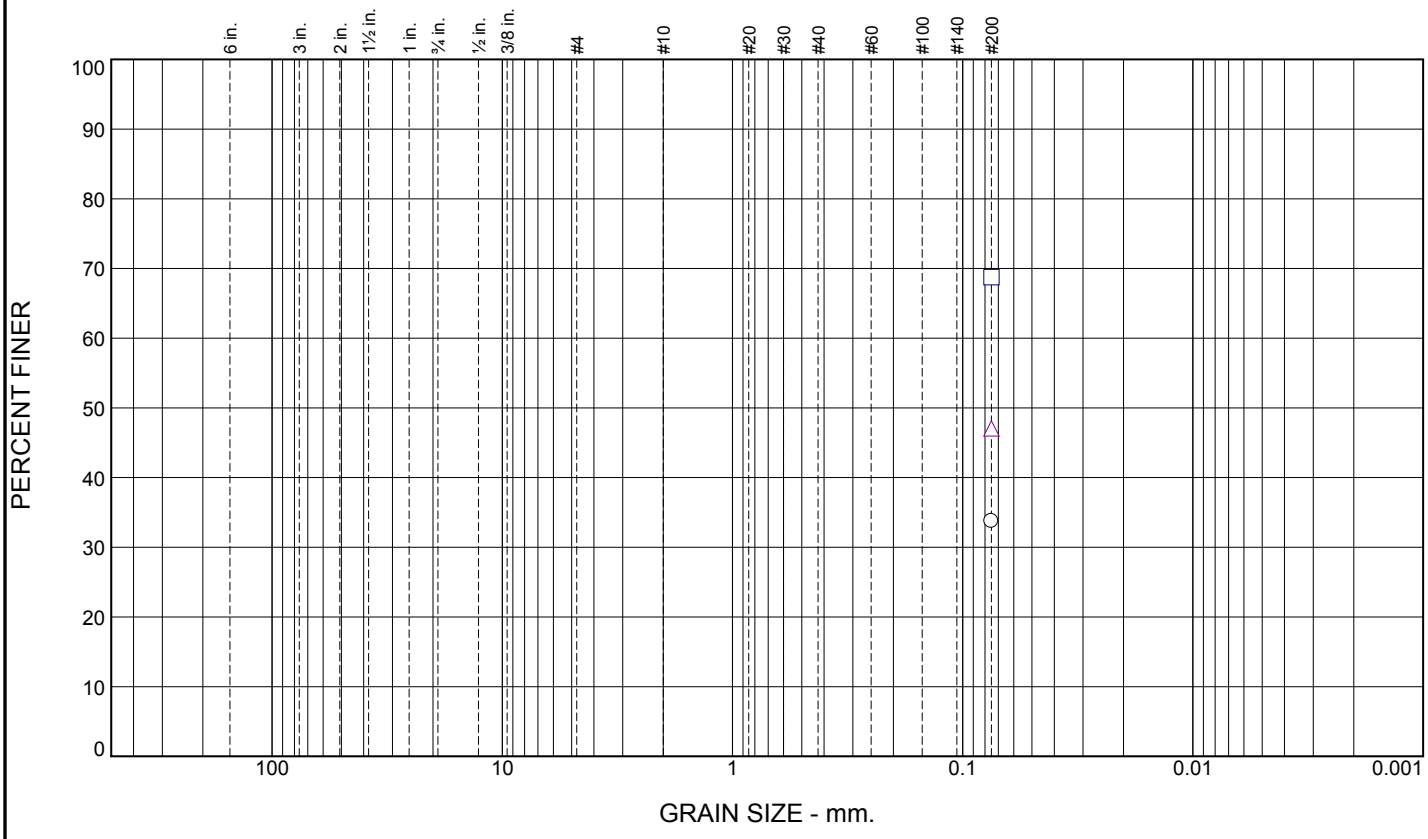
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS4 - 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						CL-ML	28	22	6
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	33.8	68.8	47.1

Material Description

○ SILTY SAND, dark brown

□ SANDY SILTY CLAY, very dark grayish brown

△ SILTY SAND, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_002S Depth: 4.5-5.0' Sample Number: #1

□ Source of Sample: SM0007_002S Depth: 10.0-11.0' Sample Number: #2

△ Source of Sample: SM0007_002S Depth: 17.0-18.0' Sample Number: #3

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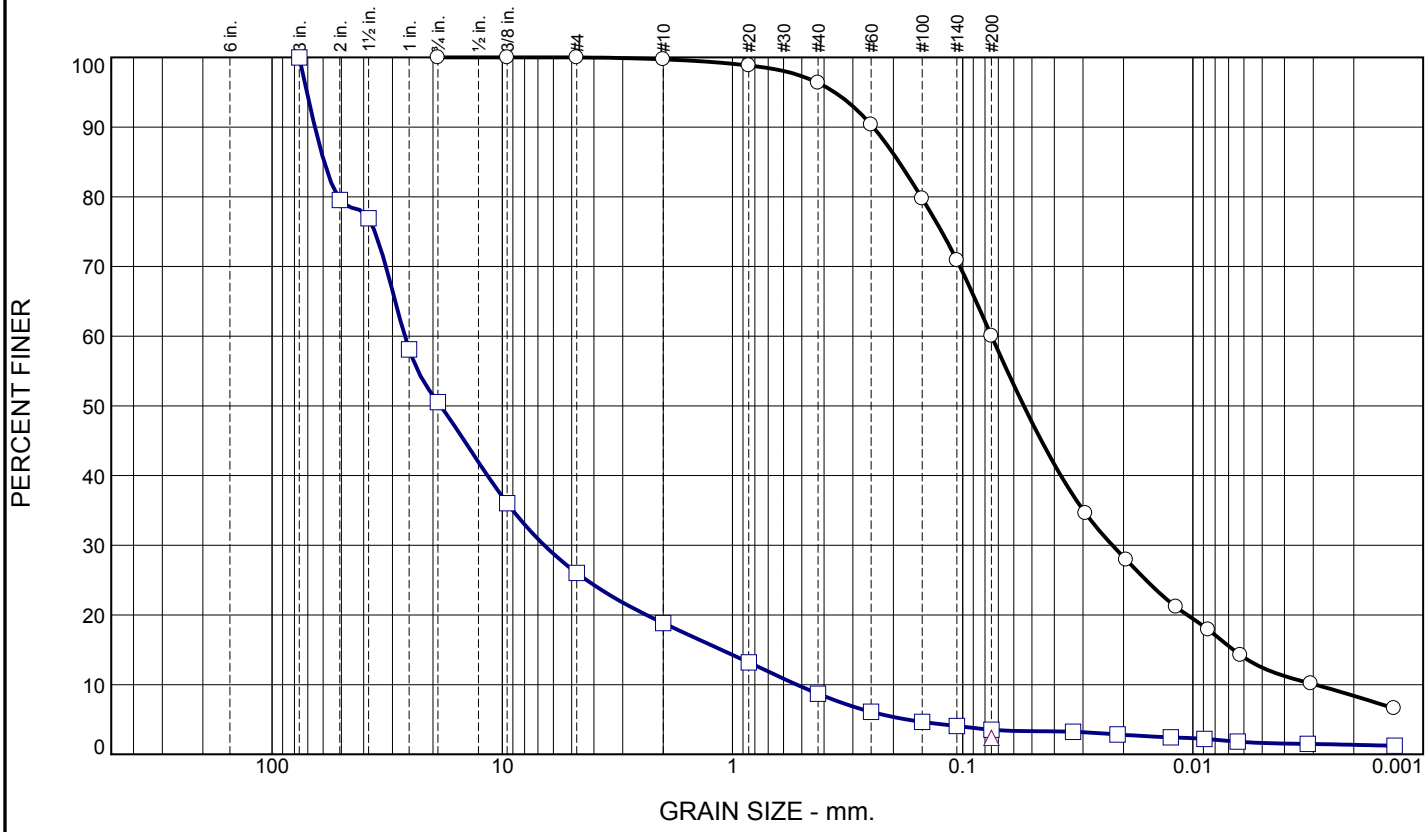
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	40.0	47.6	12.4	ML			
□	0.0	74.0	22.5	1.9	1.6	GP			
△						SP			

SIEVE inches size	PERCENT FINER ○	□	△
3"		100.0	
2"		79.6	
1 1/2"		76.9	
1"		58.1	
3/4"	100.0	50.5	
3/8"	100.0	36.0	
	GRAIN SIZE		
D_{60}	0.0749	26.4992	
D_{30}	0.0224	6.5688	
D_{10}	0.0029	0.5256	
	COEFFICIENTS		
C_c	2.27	3.10	
C_u	25.48	50.42	

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	26.0	
#10	99.7	18.8	
#20	98.8	13.2	
#40	96.4	8.7	
#60	90.4	6.1	
#100	79.8	4.7	
#140	70.9	4.1	
#200	60.0	3.5	2.4

Material Description

○ SANDY SILT, yellowish brown

□ Poorly-graded GRAVEL with SAND, olive gray

△ Poorly-graded SAND with GRAVEL, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_002S Depth: 20.0-21.0' Sample Number: #4

□ Source of Sample: SM0007_002S Depth: 25.0-26.0' Sample Number: #5

△ Source of Sample: SM0007_002S Depth: 34.0-35.0' Sample Number: #7

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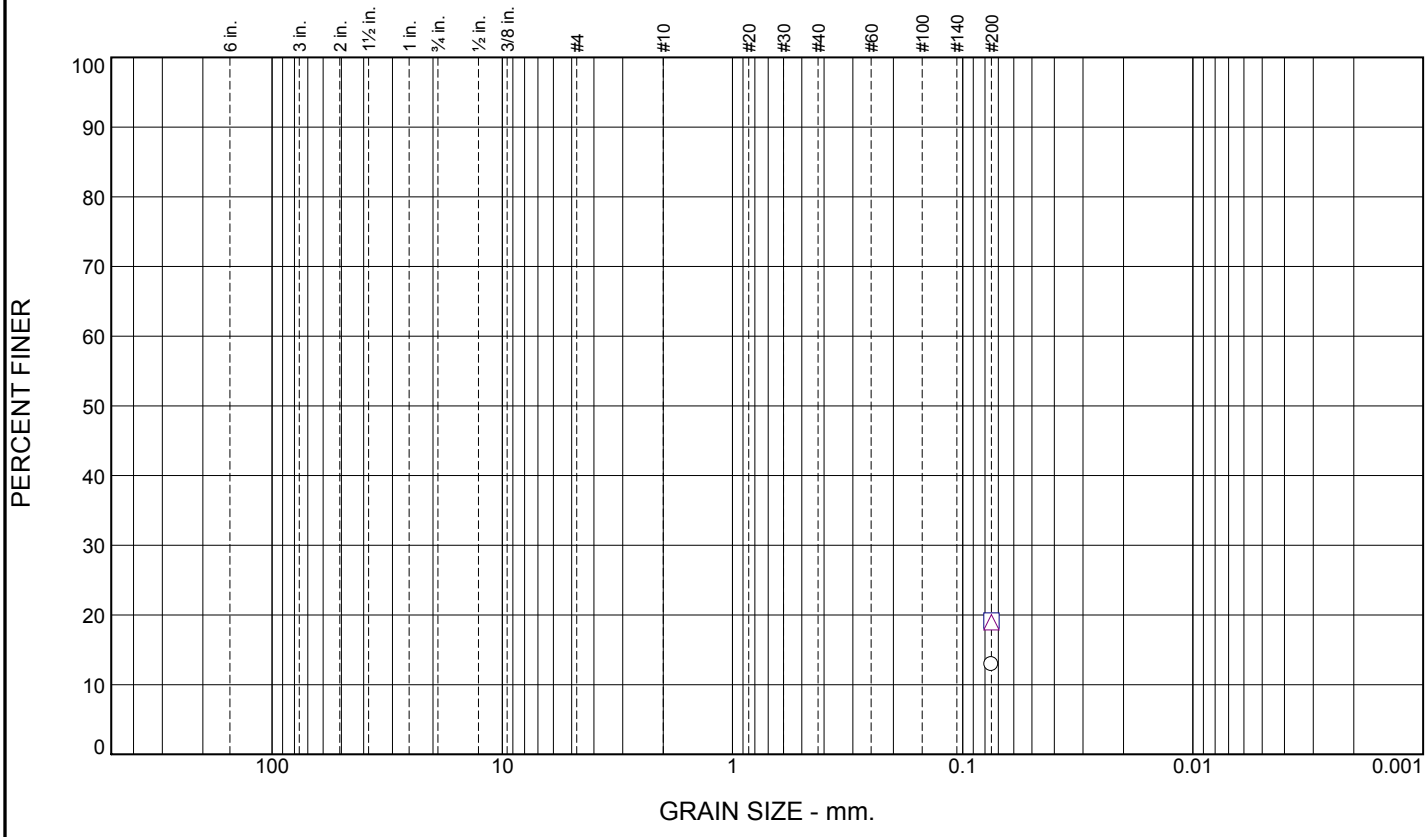
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SM			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	12.9	19.2	19.0

Material Description

○ SILTY SAND with GRAVEL, olive brown

□ SILTY SAND with GRAVEL, olive brown

△ SILTY SAND with GRAVEL, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_002S Depth: 63.0-64.0' Sample Number: #14

□ Source of Sample: SM0007_002S Depth: 65.0-66.0' Sample Number: #15

△ Source of Sample: SM0007_002S Depth: 66.0-67.0' Sample Number: #16

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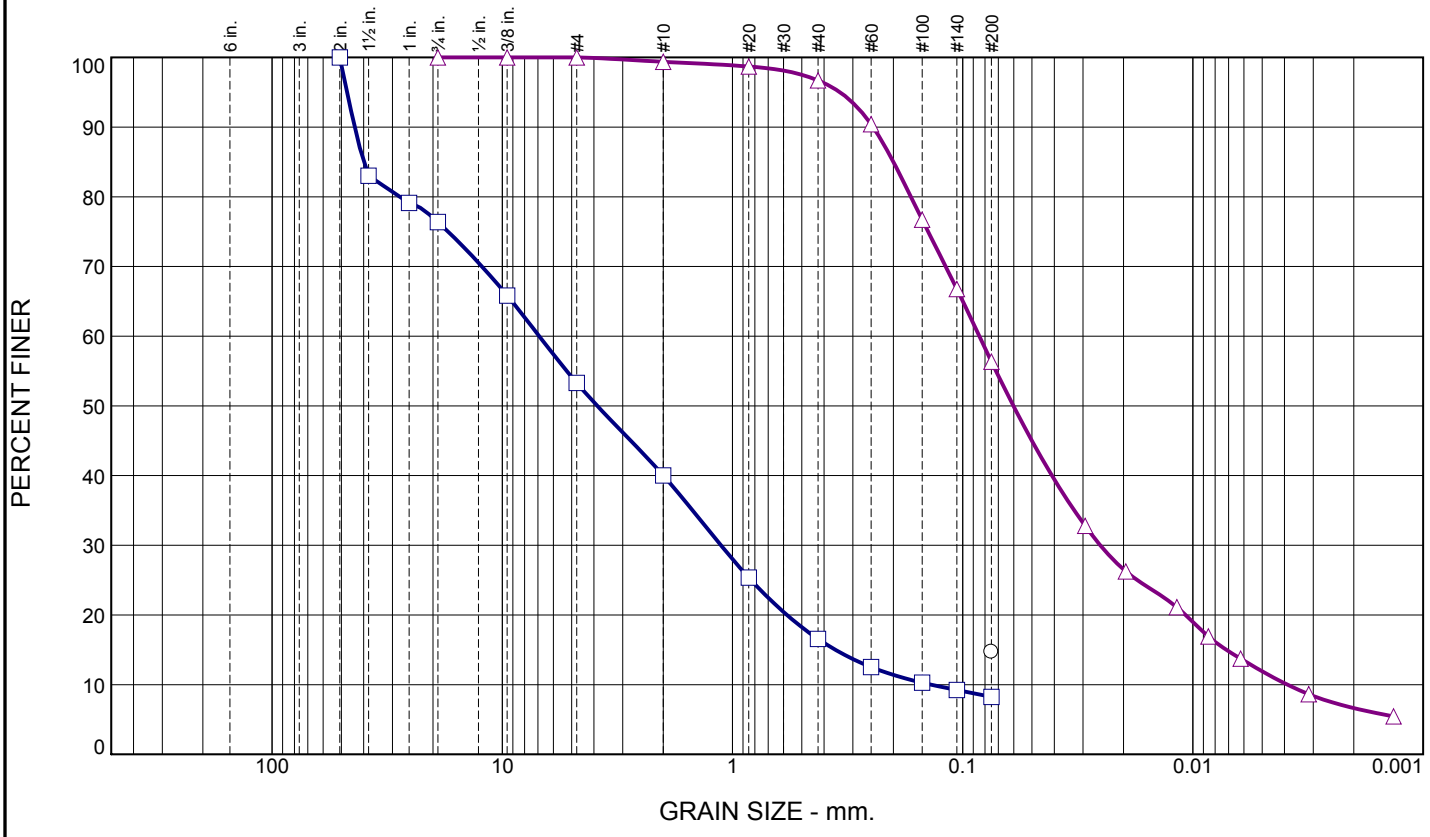
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						GM			
□	0.0	46.7	45.1	8.2		GW-GC	40	24	16
△	0.0	0.0	43.7	44.4	11.9	ML			

SIEVE inches size	PERCENT FINER ○	□	△
2"		100.0	
1 1/2"		83.0	
1"		79.1	
3/4"		76.4	100.0
3/8"		65.8	100.0
GRAIN SIZE			
D_{60}		6.9064	0.0847
D_{30}		1.1220	0.0252
D_{10}		0.1374	0.0039
COEFFICIENTS			
C_c		1.33	1.94
C_u		50.27	21.79

SIEVE number size	PERCENT FINER ○	□	△
#4		53.3	100.0
#10		40.0	99.4
#20		25.4	98.7
#40		16.6	96.7
#60		12.5	90.4
#100		10.3	76.7
#140		9.2	66.8
#200	14.7	8.2	56.3

Material Description

○ SILTY GRAVEL with SAND, olive brown

□ Well-graded GRAVEL with CLAY and SAND, olive brown

△ SANDY SILT, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_002S Depth: 67.0-68.0' Sample Number: #17

□ Source of Sample: SM0007_002S Depth: 72.0-73.0' Sample Number: #18

△ Source of Sample: SM0007_003S Depth: 9.0-10.0' Sample Number: #2

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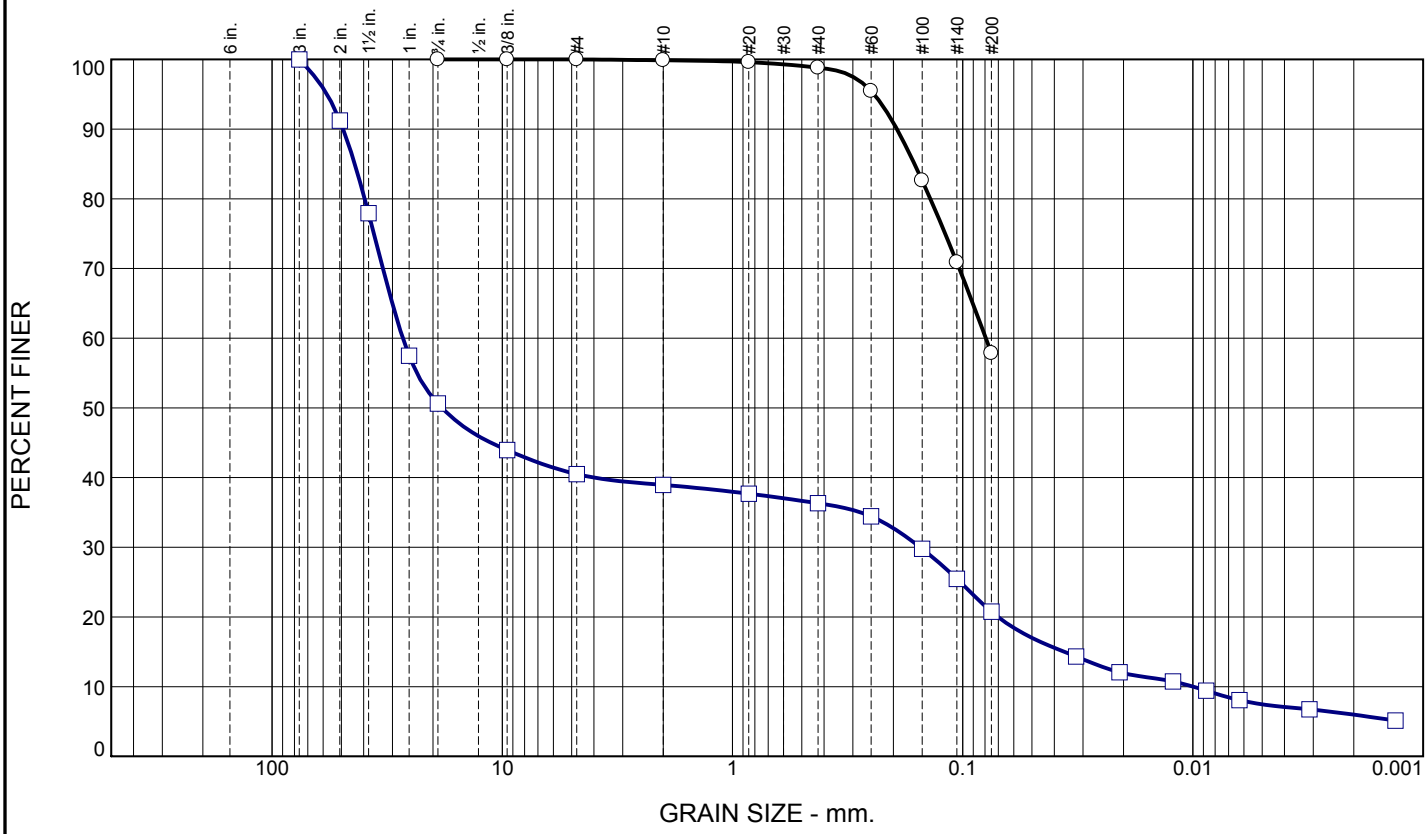
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	42.2	57.8		ML	NV	NP	NP
□	0.0	59.5	19.7	13.3	7.5	GM			

SIEVE inches size	○ PERCENT FINER	□ PERCENT FINER
3"		100.0
2"		91.2
1 1/2"		77.9
1"		57.5
3/4"	100.0	50.6
3/8"	100.0	43.9
GRAIN SIZE		
D_{60}	0.0793	27.0509
D_{30}		0.1529
D_{10}		0.0100
COEFFICIENTS		
C_c		0.09
C_u		2711.51

SIEVE number size	○ PERCENT FINER	□ PERCENT FINER
#4	100.0	40.5
#10	99.9	39.0
#20	99.6	37.7
#40	98.8	36.3
#60	95.5	34.4
#100	82.6	29.8
#140	70.9	25.5
#200	57.8	20.8

Material Description

○ SANDY SILT, yellowish brown

□ SILTY GRAVEL with SAND, dark yellowish brown

REMARKS:

○

□

○ Source of Sample: SM0007_003S Depth: 25.0-26.0' Sample Number: #5

□ Source of Sample: SM0007_003S Depth: 31.0-32.0' Sample Number: #6

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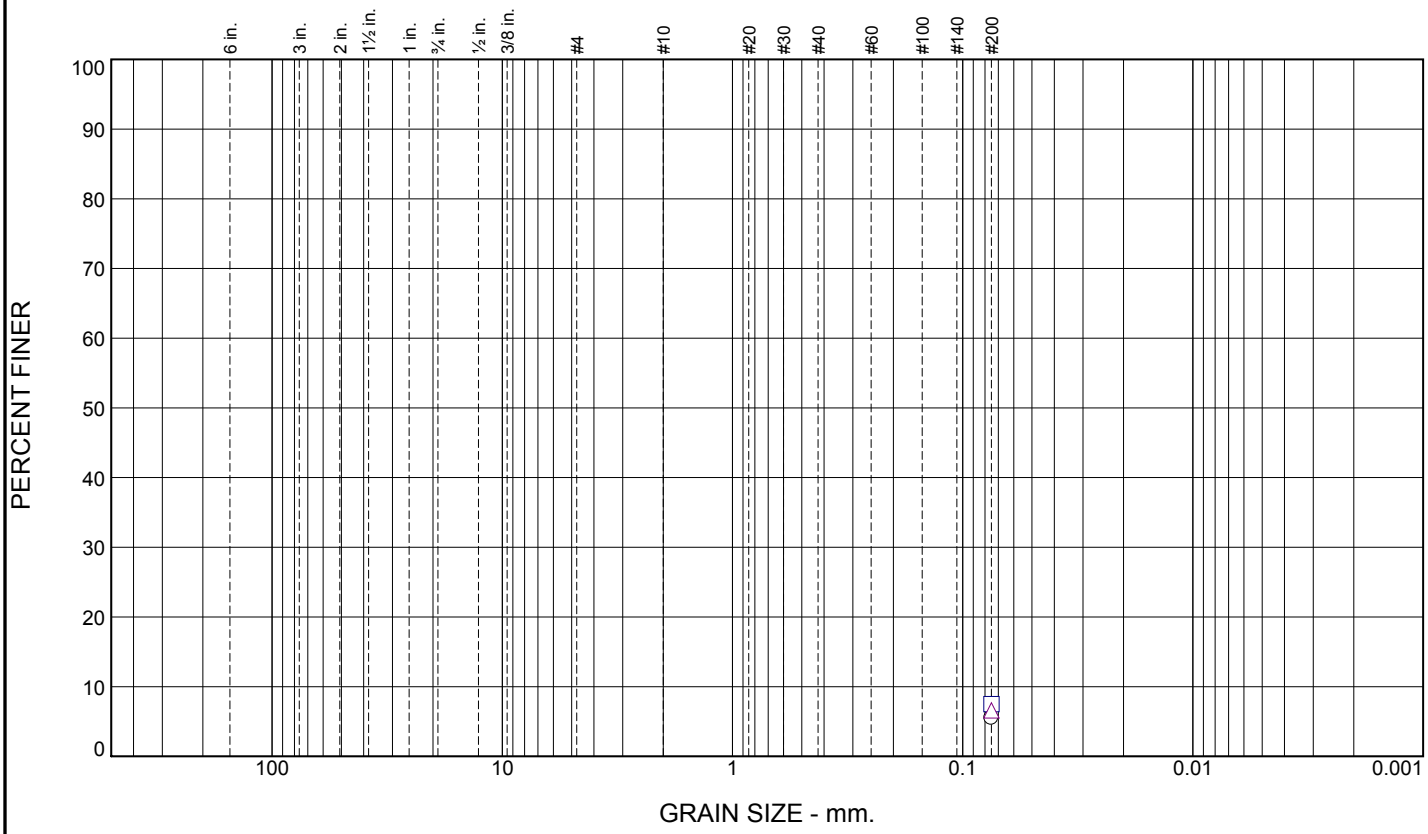
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 5

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP-SM			
□						SP-SM			
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	5.5	7.5	6.6

Material Description

○ Poorly-graded SAND with SILT and GRAVEL, dark olive brown

□ Poorly-graded SAND with SILT, olive brown

△ Poorly-graded SAND with SILT, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_003S Depth: 33.0-34.0' Sample Number: #7

□ Source of Sample: SM0007_003S Depth: 35.0-36.0' Sample Number: #8

△ Source of Sample: SM0007_003S Depth: 40.0-41.0' Sample Number: #9

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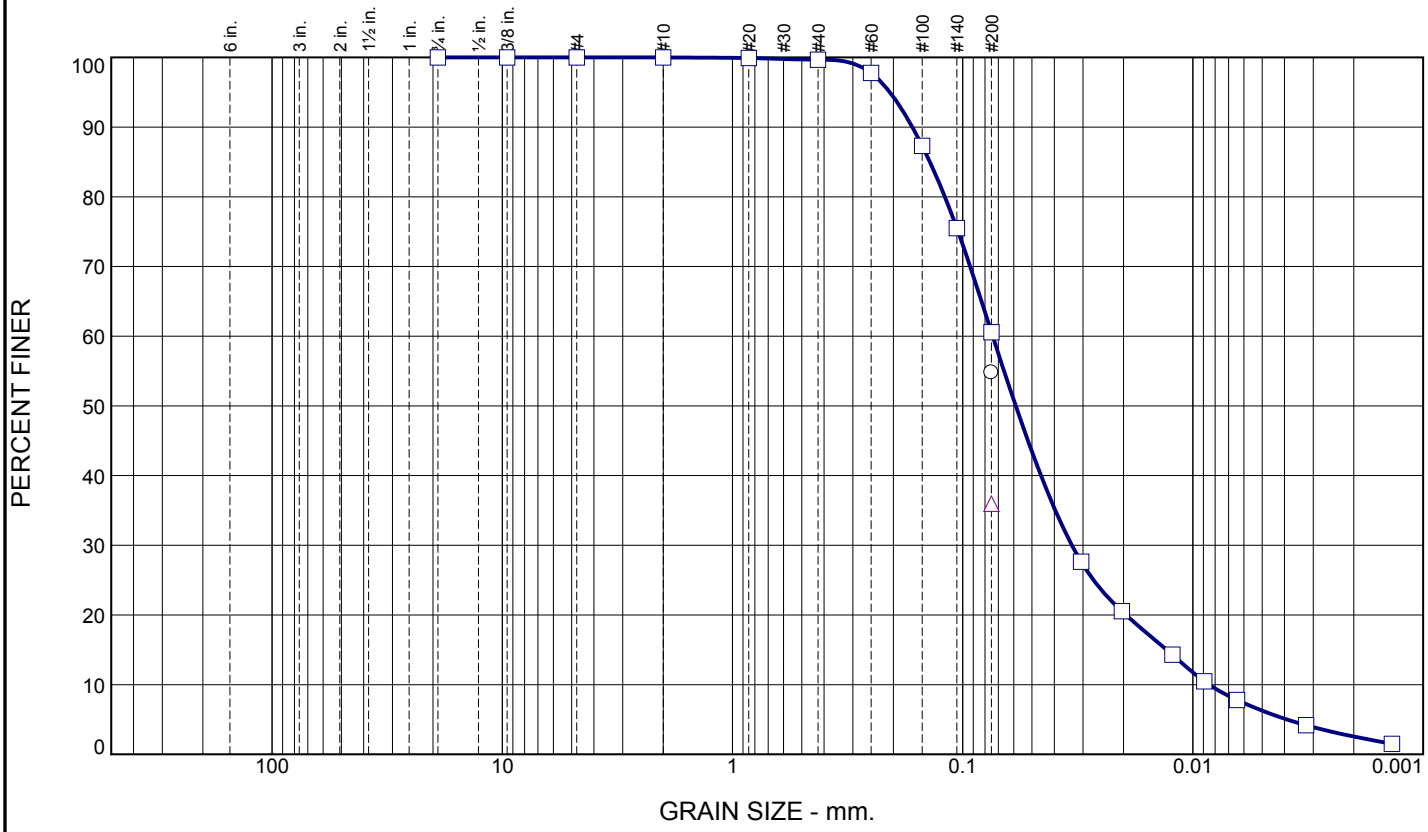
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 6

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	26	27	NP
□	0.0	0.0	39.4	54.3	6.3	ML			
△						SM	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
3/8"		100.0	
GRAIN SIZE			
D_{60}		0.0740	
D_{30}		0.0335	
D_{10}		0.0085	
COEFFICIENTS			
C_c		1.79	
C_u		8.70	

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	
#10		100.0	
#20		99.9	
#40		99.7	
#60		97.8	
#100		87.3	
#140		75.5	
#200	54.8	60.6	36.0

Material Description

○ SANDY SILT, black

□ SANDY SILT, dark yellowish brown

△ SLITY SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_003S Depth: 62.0-63.0' Sample Number: #16

□ Source of Sample: SM0007_009A Depth: 5.5-6.0' Sample Number: #2A

△ Source of Sample: SM0007_009A Depth: 10.9-11.4' Sample Number: #4B

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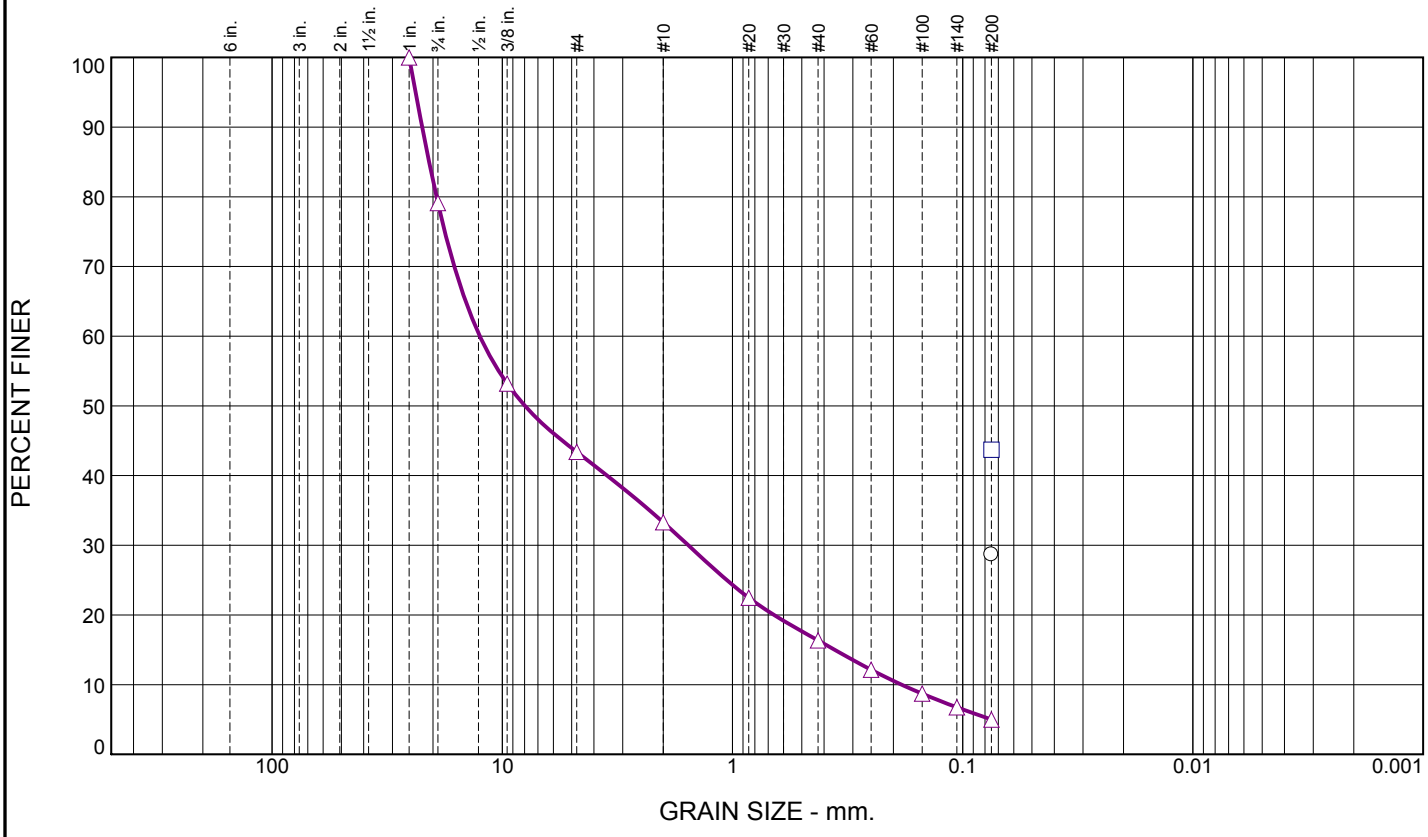
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 7

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SM			
△	0.0	56.6	38.4	5.0		GW-GM			

SIEVE inches size	PERCENT FINER ○	□	△
1"			100.0
3/4"			79.1
3/8"			53.2
GRAIN SIZE			
D_{60}			12.5178
D_{30}			1.5553
D_{10}			0.1841
COEFFICIENTS			
C_c			1.05
C_u			68.01

SIEVE number size	PERCENT FINER ○	□	△
#4			43.4
#10			33.3
#20			22.5
#40			16.4
#60			12.1
#100			8.7
#140			6.8
#200	28.7	43.7	5.0

Material Description

○ SILTY SAND, dark brown

□ SILTY SAND, dark brown

△ Well-graded GRAVEL with SILT and SAND, dark olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_009A Depth: 15.5-16.0' Sample Number: #6A

□ Source of Sample: SM0007_009A Depth: 17.5-19.0' Sample Number: #7

△ Source of Sample: SM0007_009A Depth: 26.5-28.0' Sample Number: #10

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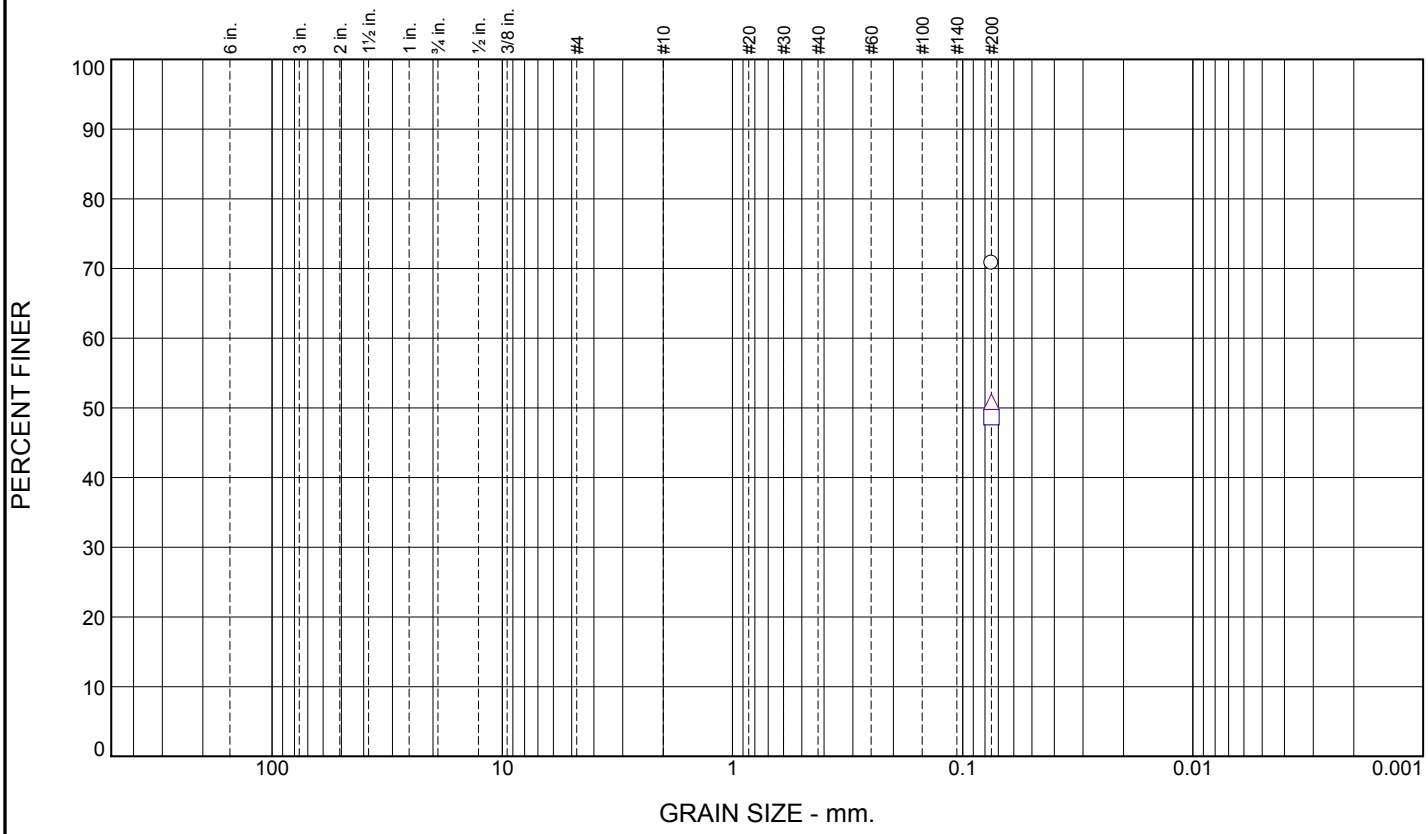
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 8

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						MH	57	36	21
□						SM			
△						ML			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	70.8	48.7	50.9

Material Description

○ Elastic SILT with SAND, yellowish brown

□ SILTY SAND, dark yellowish brown

△ SANDY SILT, very dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_009A Depth: 53.0-54.0' Sample Number: #15B

□ Source of Sample: SM0007_009A Depth: 58.5-59.0' Sample Number: #16B

△ Source of Sample: SM0007_008A Depth: 5.5-6.0' Sample Number: #2A

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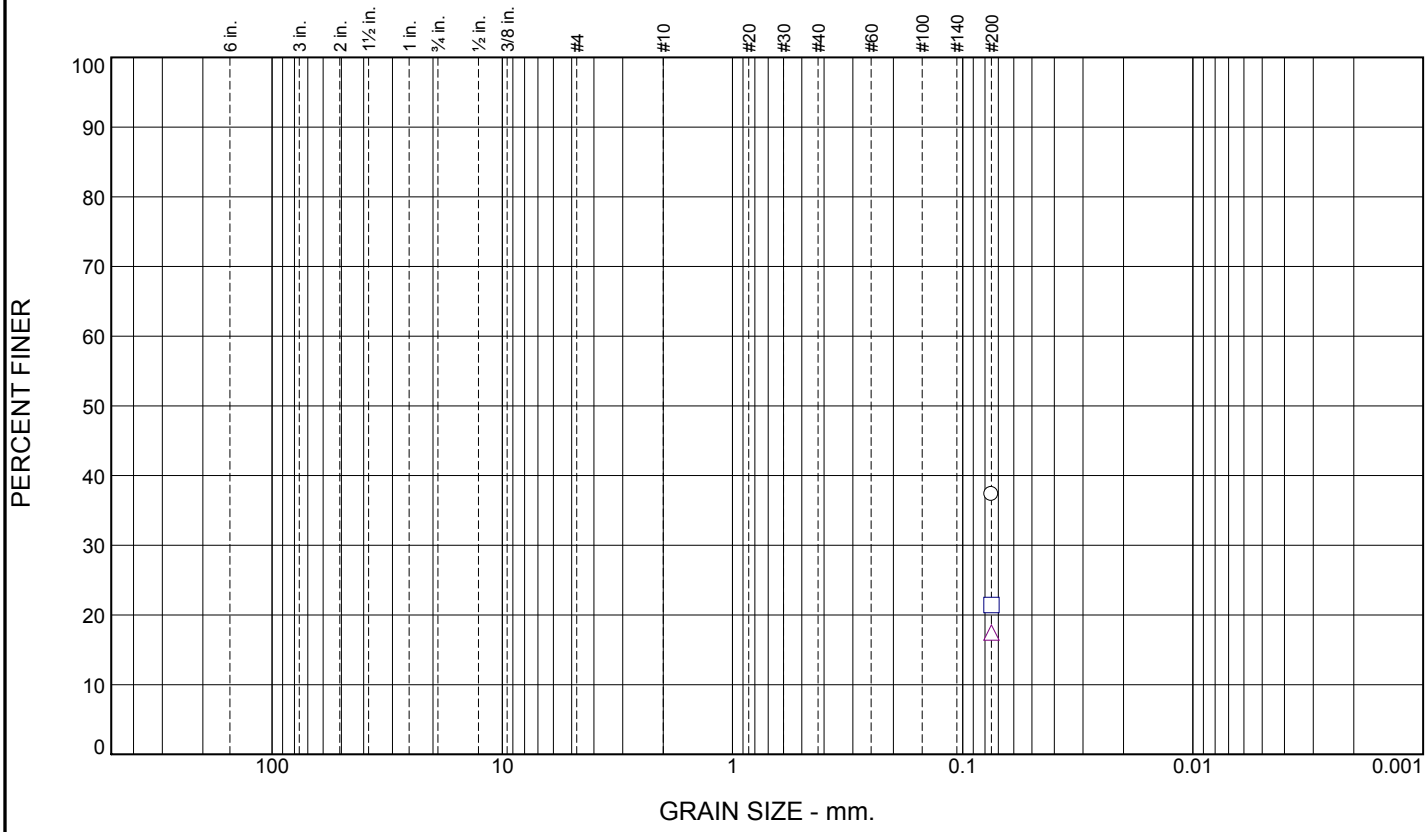
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 9

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SM			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	37.3	21.4	17.5

Material Description

○ SILTY SAND, dark brown

□ SILTY SAND, dark brown

△ SILTY SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_001A Depth: 3.0-3.5' Sample Number: #1

□ Source of Sample: SM0007_001A Depth: 5.5-6.0' Sample Number: #2A

△ Source of Sample: SM0007_001A Depth: 6.0-6.5' Sample Number: #2B

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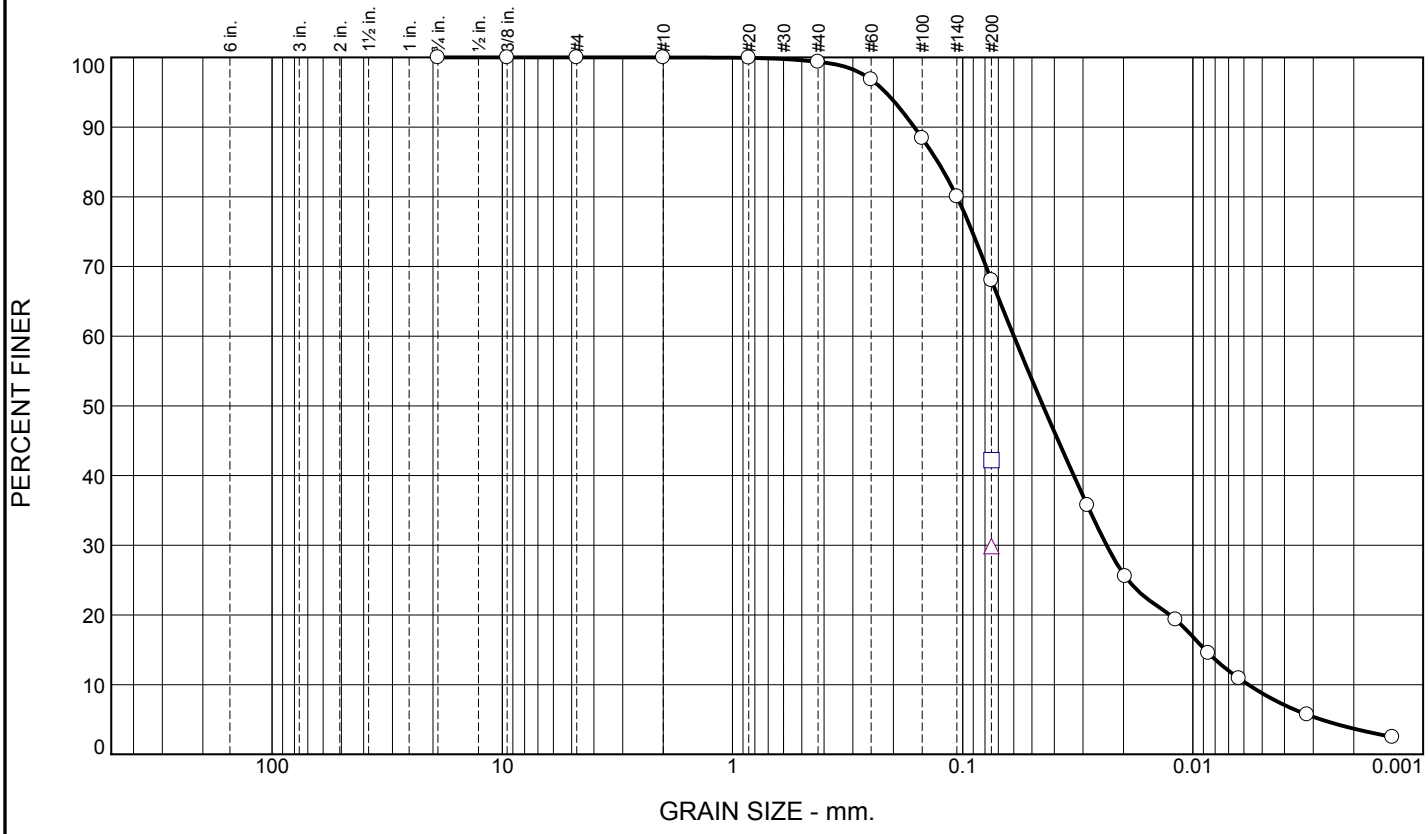
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 10

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	32.0	59.2	8.8	ML			
□						SM			
△						SC			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	100.0		

	GRAIN SIZE		
D_{60}	0.0599		
D_{30}	0.0237		
D_{10}	0.0057		

	COEFFICIENTS		
C_c	1.63		
C_u	10.43		

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.4		
#60	96.8		
#100	88.4		
#140	80.0		
#200	68.0	42.2	29.9

Material Description

○ SANDY SILT, dark brown

□ SILTY SAND, very dark grayish brown

△ CLAYEY SAND, very dark greenish gray

REMARKS:

○ Natural Moisture Content=23.3%

□

△

○ Source of Sample: SM0007_001A Depth: 10.0-11.5' Sample Number: #3

□ Source of Sample: SM0007_001A Depth: 15.0-16.5' Sample Number: #4

△ Source of Sample: SM0007_001A Depth: 65.0-66.5' Sample Number: #15

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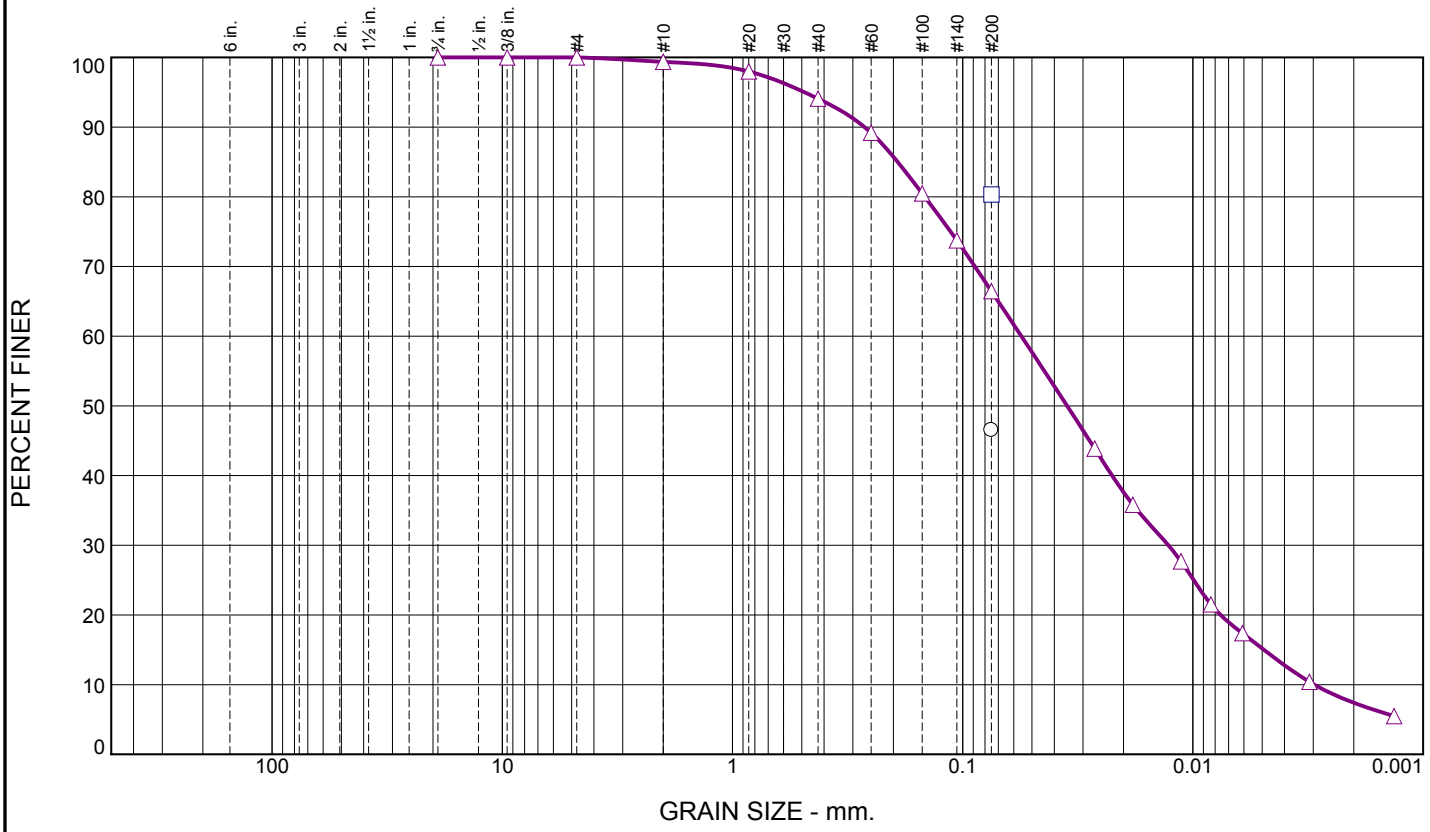
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 11

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	33	26	7
□						ML	32	27	5
△	0.0	0.0	33.5	51.3	15.2	ML			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"			100.0
3/8"			100.0
GRAIN SIZE			
D_{60}			0.0556
D_{30}			0.0128
D_{10}			0.0030
COEFFICIENTS			
C_c			0.99
C_u			18.74

SIEVE number size	PERCENT FINER ○	□	△
#4			100.0
#10			99.4
#20			98.0
#40			94.1
#60			89.2
#100			80.5
#140			73.7
#200	46.5	80.3	66.5

Material Description

○ SILTY SAND, dark greenish gray

□ SILT with SAND, light olive brown

△ SANDY SILT, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_001A Depth: 70.0-71.5' Sample Number: #16

□ Source of Sample: SM0007_007A Depth: 5.5-6.0' Sample Number: #2A

△ Source of Sample: SM0007_007A Depth: 8.0-8.5' Sample Number: #3A

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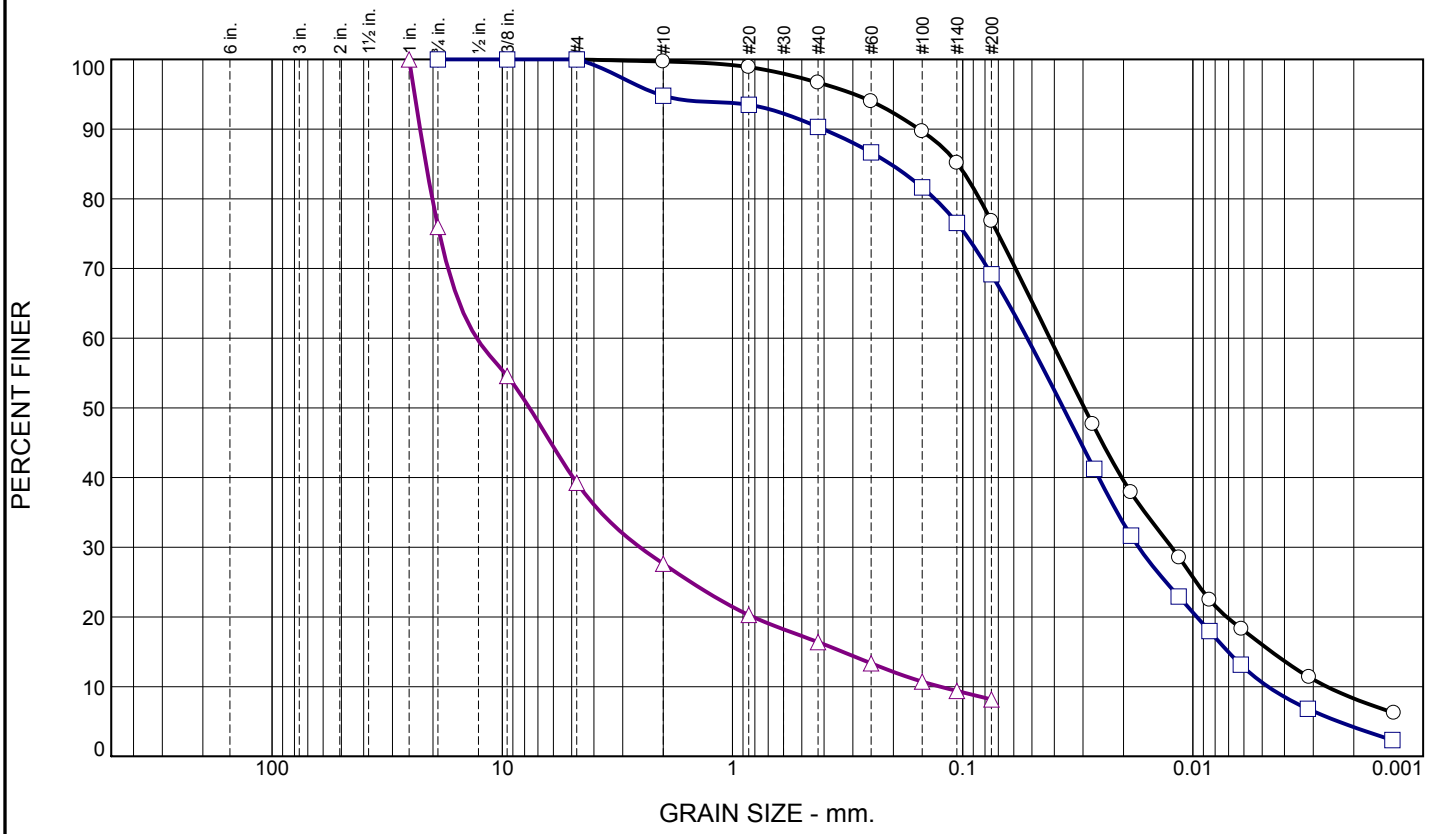
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 12

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	23.2	60.8	16.0	ML			
□	0.0	0.0	30.8	58.6	10.6	ML			
△	0.0	60.7	31.1	8.2		GP-GM			

SIEVE inches size	PERCENT FINER ○	□	△
1"			100.0
3/4"		100.0	76.0
3/8"		100.0	54.6
GRAIN SIZE			
D_{60}	0.0418	0.0524	12.9109
D_{30}	0.0124	0.0172	2.5221
D_{10}	0.0026	0.0047	0.1252
COEFFICIENTS			
C_c	1.40	1.19	3.93
C_u	15.98	11.10	103.10

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	100.0	39.3
#10	99.7	94.8	27.6
#20	98.9	93.5	20.3
#40	96.7	90.3	16.4
#60	94.0	86.7	13.4
#100	89.7	81.6	10.7
#140	85.2	76.6	9.4
#200	76.8	69.2	8.2

Material Description

○ SILT with SAND, dark yellowish brown

□ SANDY SILT, dark yellowish brown

△ Poorly-graded GRAVEL with SILT and SAND, dark olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_007A Depth: 20.0-21.5 Sample Number: #8

□ Source of Sample: SM0007_007A Depth: 22.5-24.0' Sample Number: #9

△ Source of Sample: SM0007_007A Depth: 37.5-39.0' Sample Number: #12

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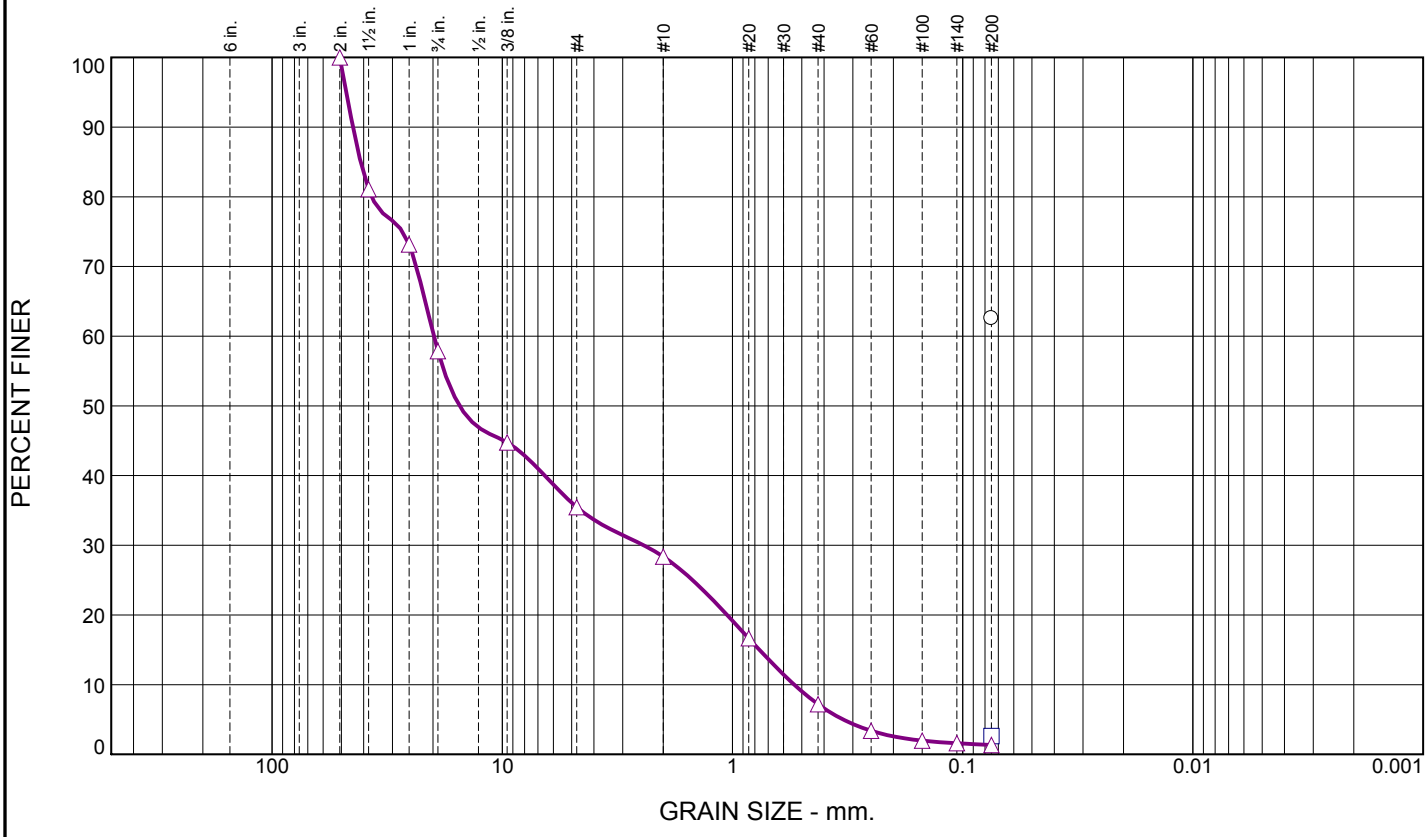
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 13

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						GP			
△	0.0	64.5	34.2	1.3		GP			

SIEVE inches size	PERCENT FINER ○	□	△
2"			100.0
1.5"			81.1
1"			73.2
3/4"			57.9
3/8"			44.8
GRAIN SIZE			
D_{60}			19.8300
D_{30}			2.4315
D_{10}			0.5392
COEFFICIENTS			
C_c			0.55
C_u			36.77

SIEVE number size	PERCENT FINER ○	□	△
#4			35.5
#10			28.4
#20			16.7
#40			7.2
#60			3.4
#100			2.0
#140			1.6
#200	62.6	2.6	1.3

Material Description

○ SANDY SILT, dark yellowish brown

□ Poorly-graded GRAVEL, yellowish brown

△ Poorly-graded GRAVEL with SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_010A Depth: 3.0-3.5' Sample Number: #1

□ Source of Sample: SM0007_010A Depth: 11.0-11.5' Sample Number: #4

△ Source of Sample: SM0007_010A Depth: 27.0-27.5' Sample Number: #7

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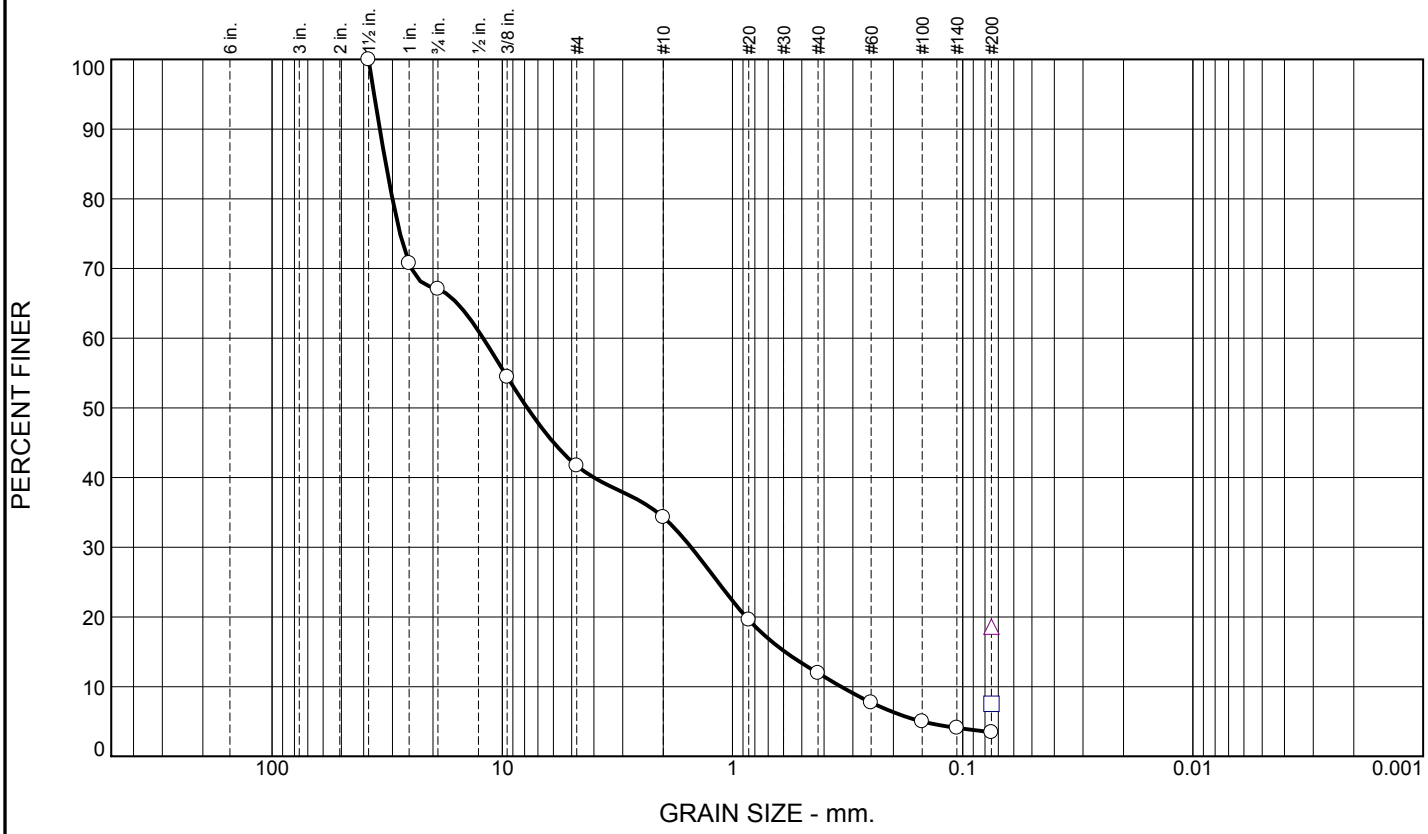
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 14

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	58.3	38.2	3.5		GP			
□						GP-GM			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0		
1"	70.8		
3/4"	67.1		
3/8"	54.4		
	GRAIN SIZE		
D_{60}	12.1055		
D_{30}	1.5129		
D_{10}	0.3374		
	COEFFICIENTS		
C_c	0.56		
C_u	35.88		

SIEVE number size	PERCENT FINER ○	□	△
#4	41.7		
#10	34.3		
#20	19.6		
#40	11.9		
#60	7.7		
#100	5.0		
#140	4.1		
#200	3.5	7.5	18.6

Material Description

○ Poorly-graded GRAVEL with SAND, olive brown

□ Poorly-graded GRAVEL with SILT, very dark yellowish brown

△ SILTY SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_010A Depth: 35.5-36.5' Sample Number: #9A

□ Source of Sample: SM0007_017B Depth: 5.0-5.5' Sample Number: #1

△ Source of Sample: SM0007_017B Depth: 13.5-14.0' Sample Number: #2

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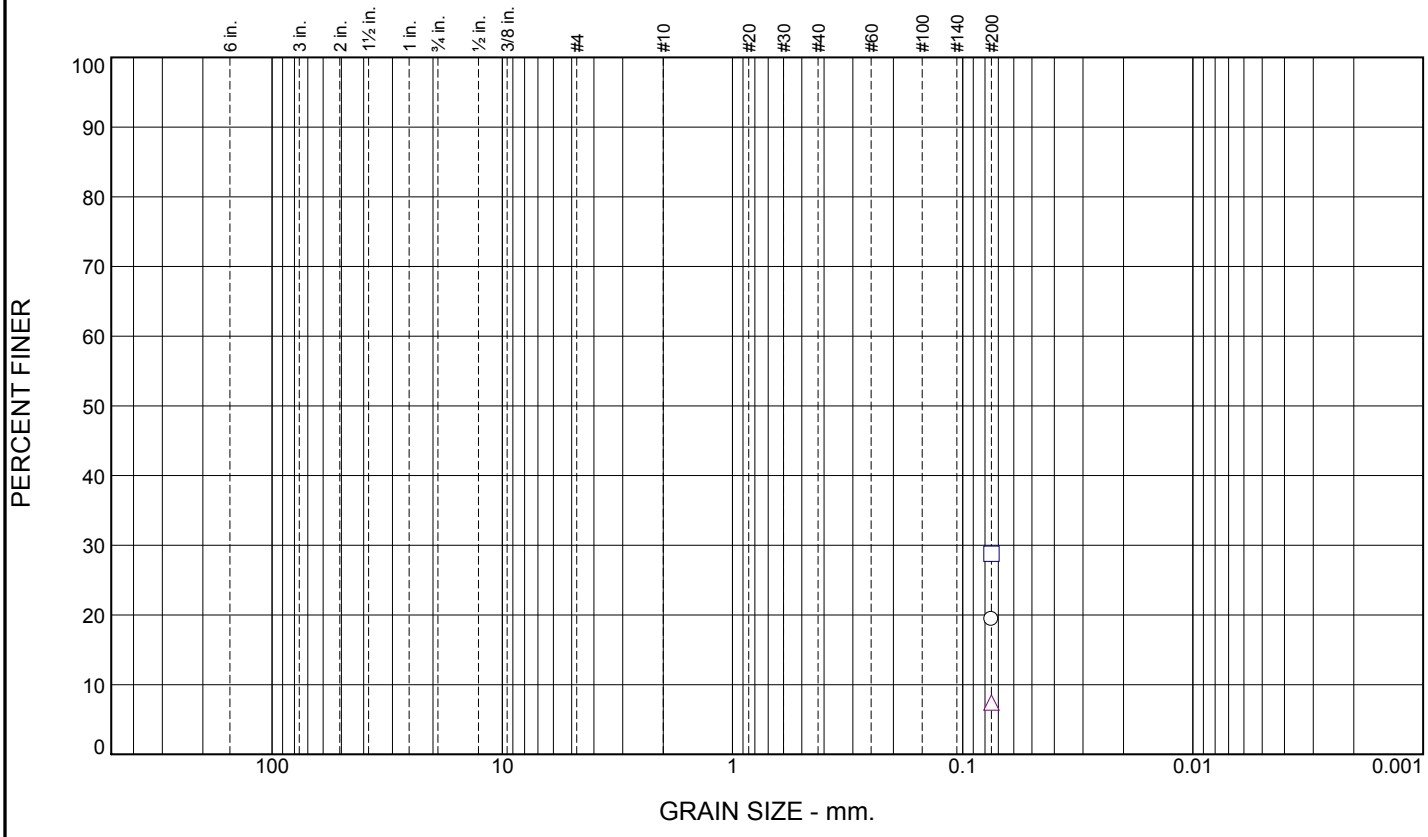
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 15

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SM			
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	19.4	28.8	7.4

Material Description

○ SILTY SAND, dark yellowish brown

□ SILTY SAND, olive brown

△ Poorly-graded SAND with SILT, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_017B Depth: 20.0-21.5' Sample Number: #5

□ Source of Sample: SL0001_010B Depth: 15.5-16.0' Sample Number: #7A

△ Source of Sample: SL0001_010B Depth: 32.5-34.0' Sample Number: #14

Blackburn Consulting

W. Sacramento, CA

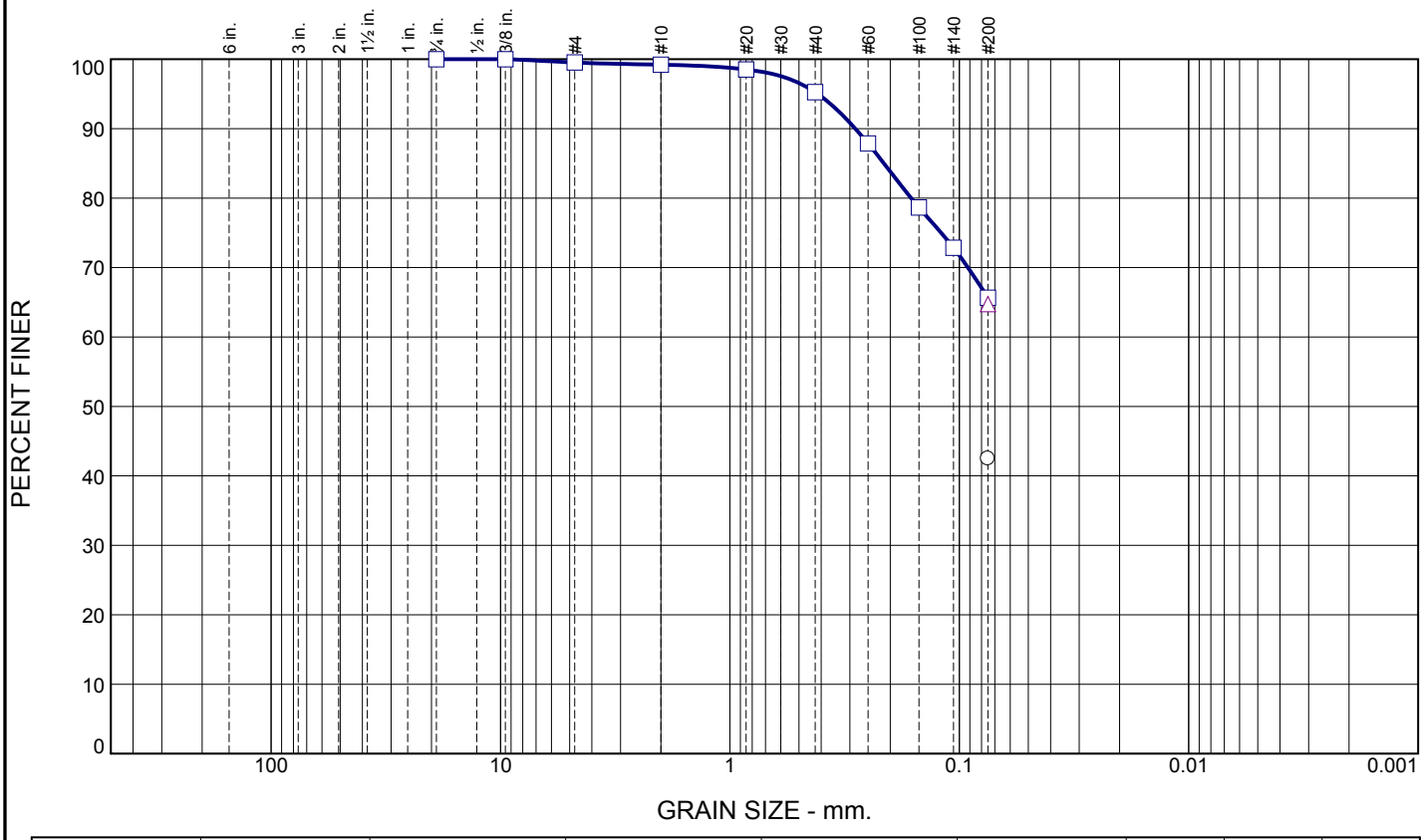
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 16

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□	0.0	0.5	33.9	65.6		ML			
△						CL	29	21	8

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
3/8"		100.0	
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		99.5	
#10		99.2	
#20		98.5	
#40		95.3	
#60		87.9	
#100		78.7	
#140		72.9	
#200	42.5	65.6	64.7

Material Description

○ SILTY SAND, dark yellowish brown

□ SANDY SILT, dark yellowish brown

△ SANDY lean CLAY, very dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0016_008C Depth: 19.0-19.5' Sample Number: #3

□ Source of Sample: SL0001_029C Depth: 4.0-4.5' Sample Number: #2

△ Source of Sample: SL0001_029C Depth: 24.0-25.0' Sample Number: #3

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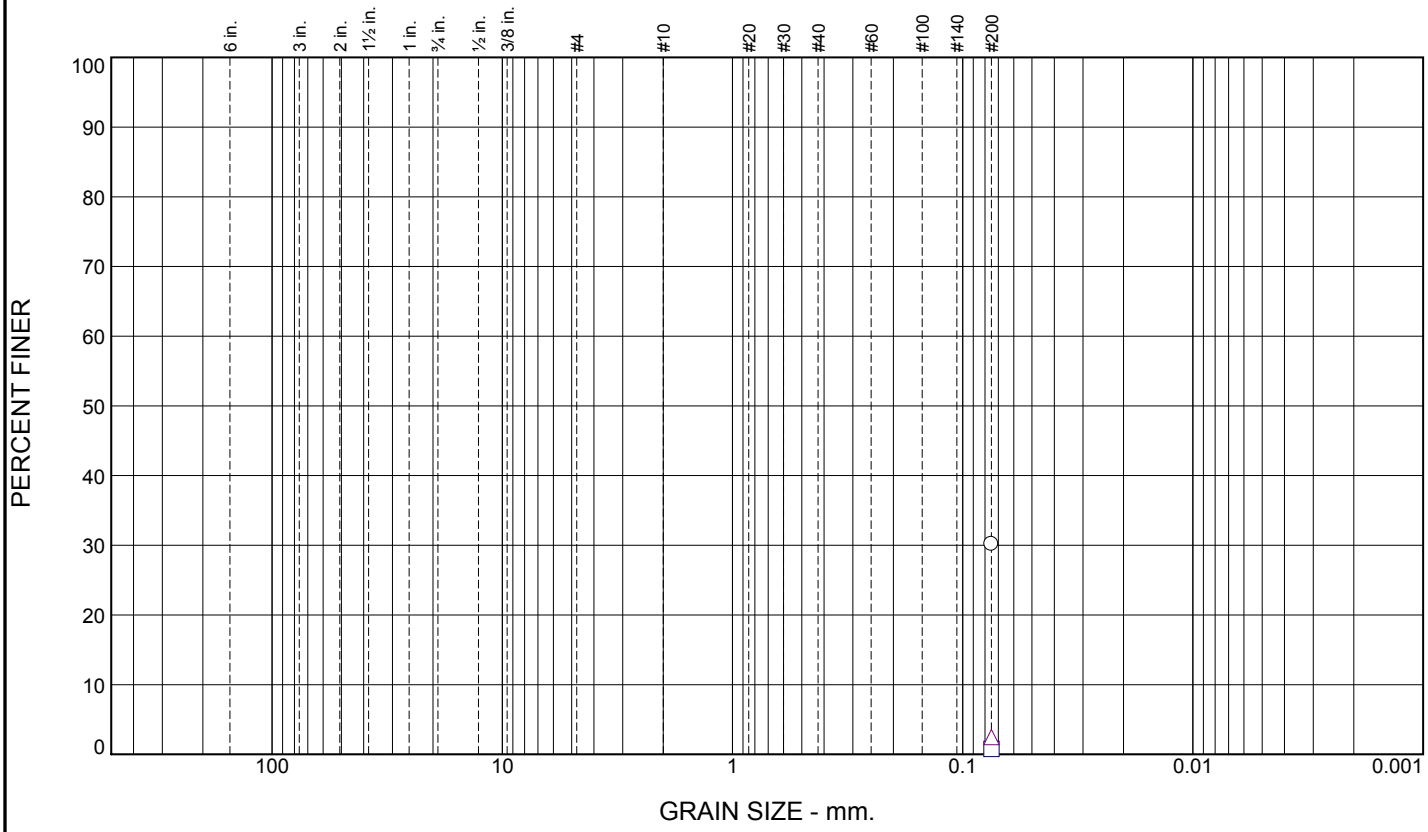
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 17

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	34	30	4
□						GP			
△						GP			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	30.2	0.8	2.5

Material Description

○ SILTY SAND, light olive brown

□ Poorly-graded GRAVEL, dark olive brown

△ Poorly-graded GRAVEL, olive gray

REMARKS:

○

□

△

○ Source of Sample: SL0009_005C Depth: 4.0-4.5' Sample Number: #2

□ Source of Sample: SM0007_004S Depth: 5.0-6.0' Sample Number: #1

△ Source of Sample: SM0007_004S Depth: 21.0-22.0' Sample Number: #3

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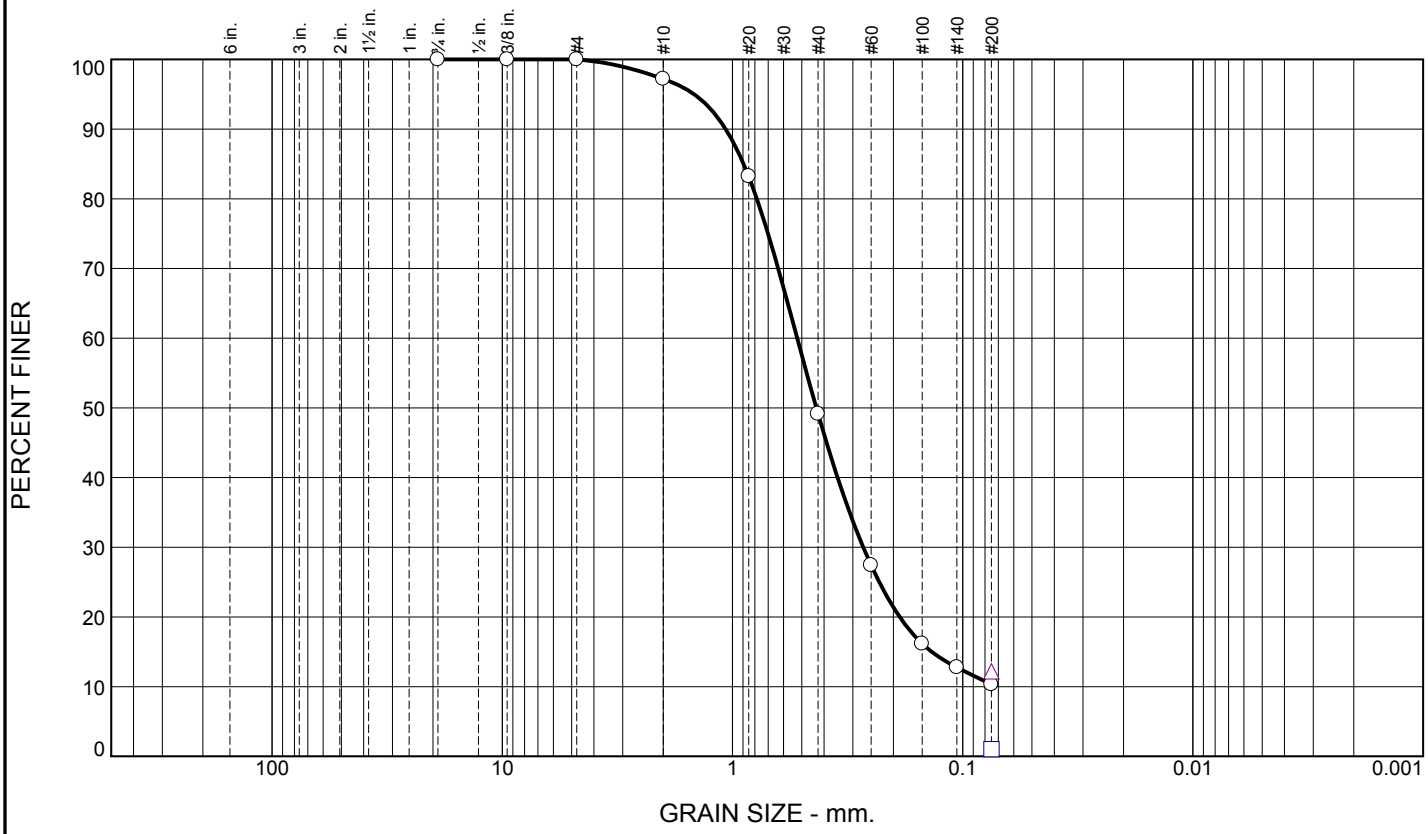
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 18

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	89.7	10.3		SP-SM	NV	NP	NP
□						SP			
△						SM	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	100.0		
	GRAIN SIZE		
D_{60}	0.5234		
D_{30}	0.2704		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		
#10	97.2		
#20	83.2		
#40	49.1		
#60	27.4		
#100	16.2		
#140	12.8		
#200	10.3	1.0	12.2

Material Description

○ Poorly-graded SAND with SILT, yellowish brown

□ Poorly-graded SAND, olive brown

△ SILTY SAND, dark olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_004S Depth: 26.0-27.0' Sample Number: #4

□ Source of Sample: SM0007_004S Depth: 28.0-29.0' Sample Number: #5

△ Source of Sample: SM0007_004S Depth: 48.0-49.0' Sample Number: #10

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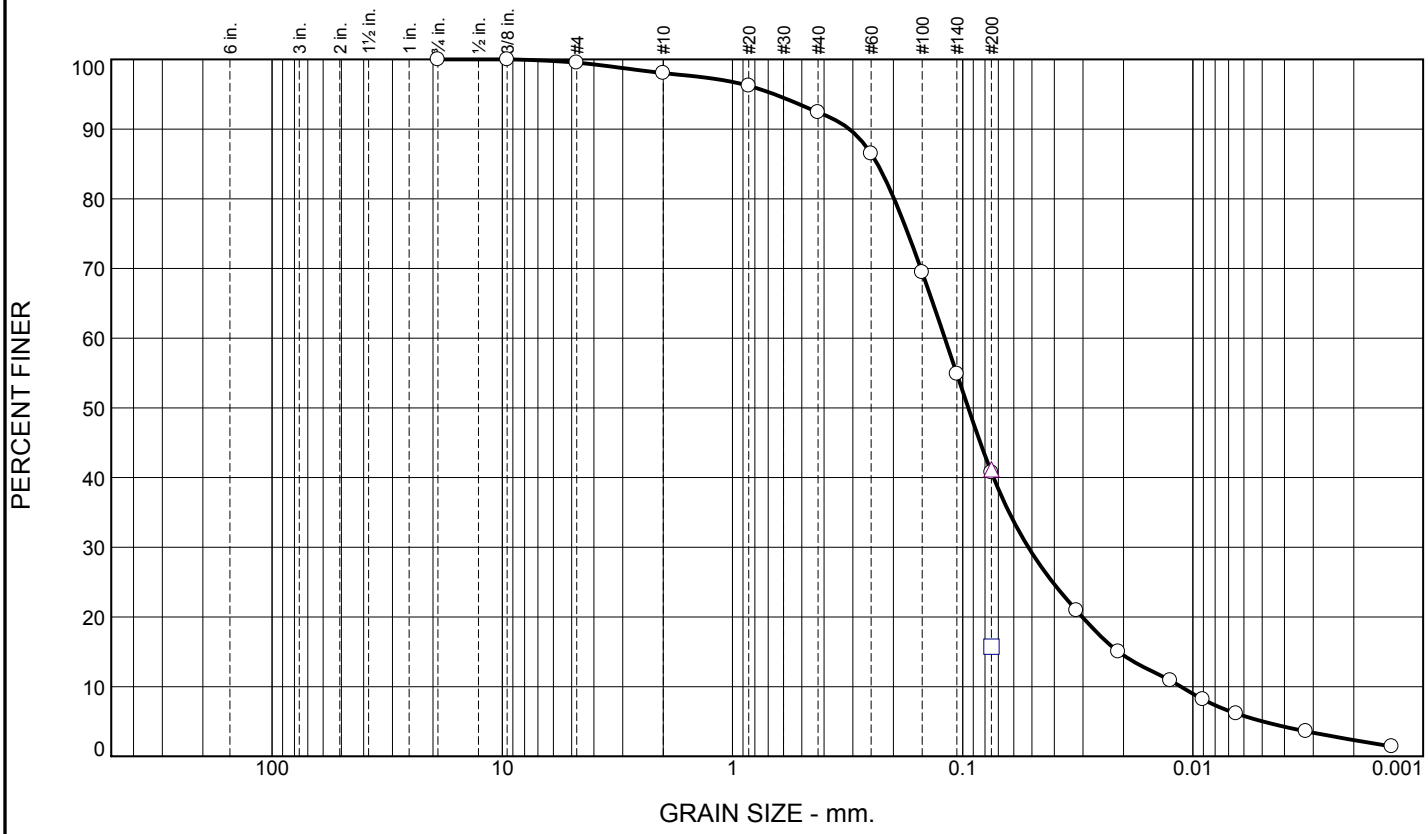
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 19

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.5	58.8	35.7	5.0	SM			
□						GM			
△						SM	NV	NP	NP

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	100.0		
GRAIN SIZE			
D_{60}	0.1195		
D_{30}	0.0519		
D_{10}	0.0113		
COEFFICIENTS			
C_c	2.00		
C_u	10.62		

SIEVE number size	PERCENT FINER ○	□	△
#4	99.5		
#10	98.0		
#20	96.2		
#40	92.4		
#60	86.5		
#100	69.5		
#140	54.9		
#200	40.7	15.7	41.2

Material Description

○ SILTY SAND, olive brown

□ SILTY GRAVEL with SAND, olive brown

△ SILTY SAND, very dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_004S Depth: 54.0-55.0' Sample Number: #11

□ Source of Sample: SM0007_005S Depth: 41.0-42.0' Sample Number: #7

△ Source of Sample: SM0007_001S Depth: 6.0-7.0' Sample Number: #1

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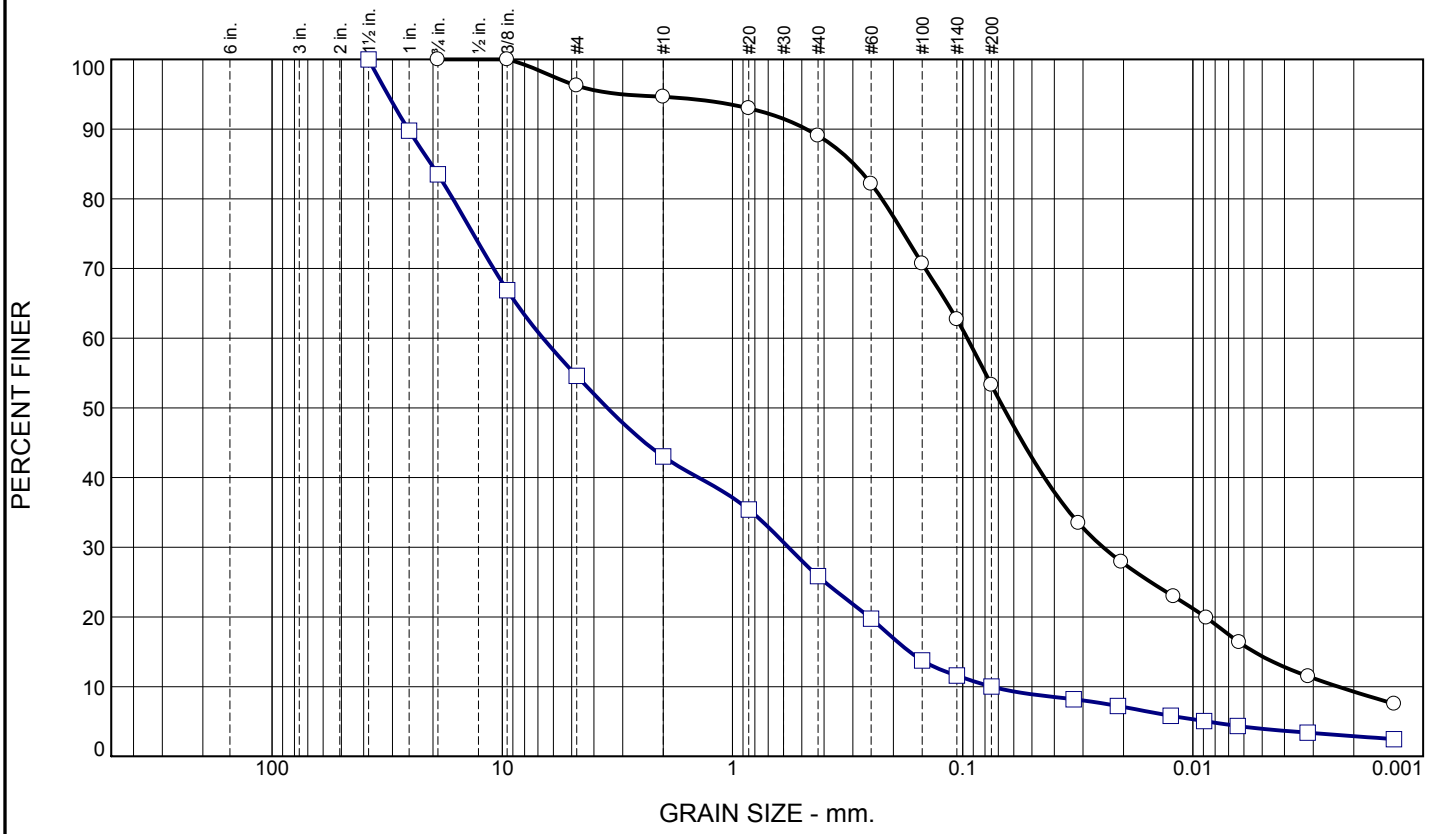
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 20

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	3.8	42.9	39.0	14.3	ML			
□	0.0	45.4	44.6	6.0	4.0	GP-GM			

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
1 1/2"		100.0
1"		89.8
3/4"	100.0	83.5
3/8"	100.0	66.9
	GRAIN SIZE	
D_{60}	0.0955	6.6530
D_{30}	0.0245	0.5714
D_{10}	0.0023	0.0748
	COEFFICIENTS	
C_c	2.70	0.66
C_u	40.85	89.00

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	96.2	54.6
#10	94.6	43.0
#20	93.0	35.4
#40	89.1	25.9
#60	82.2	19.8
#100	70.7	13.8
#140	62.7	11.6
#200	53.3	10.0

Material Description

○ SANDY SILT, dark yellowish brown

□ Poorly-graded GRAVEL with SILT and SAND, olive brown

REMARKS:

○

□

○ Source of Sample: SM0007_001S Depth: 10.0-11.0' Sample Number: #2

□ Source of Sample: SM0007_001S Depth: 22.0-23.0' Sample Number: #5

Blackburn Consulting

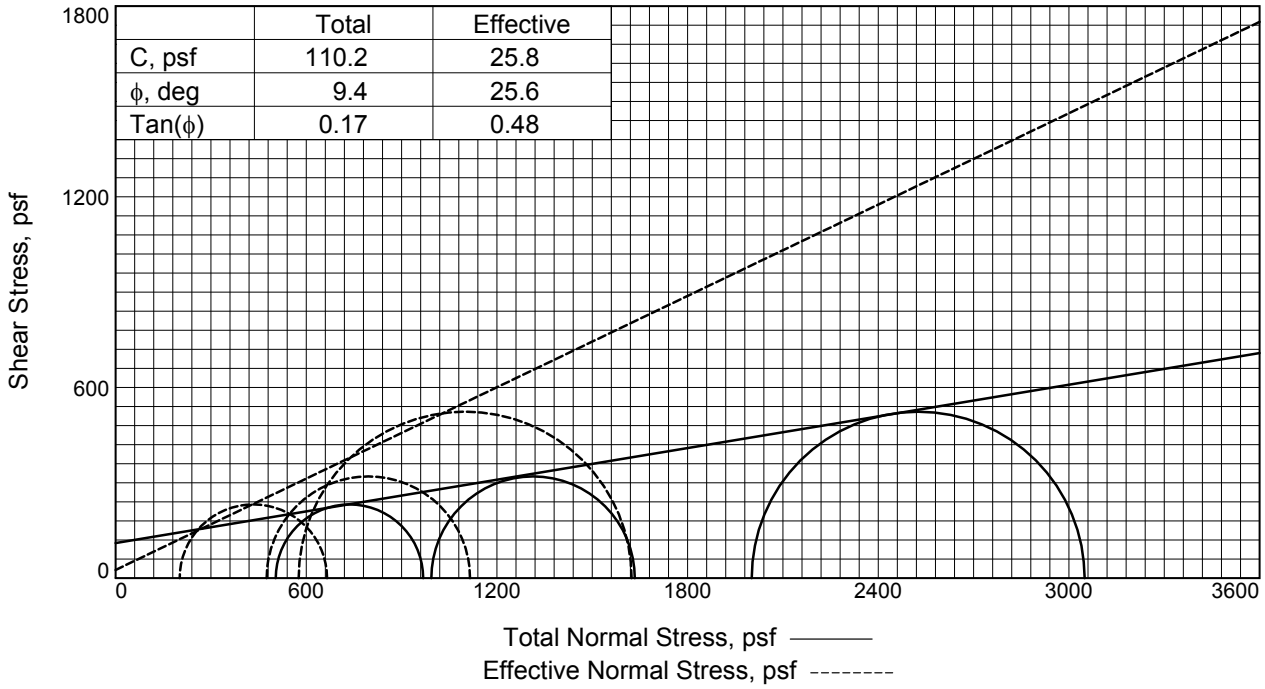
W. Sacramento, CA

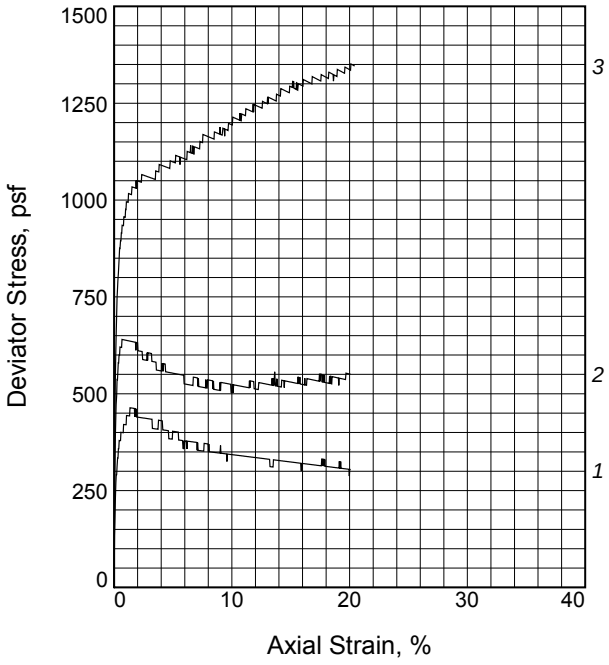
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS4 - 21





Specimen No.		1	2	3
Initial	Water Content, %	11.9	12.2	11.7
	Dry Density, pcf	76.7	75.5	81.1
	Saturation, %	26.9	26.6	29.2
	Void Ratio	1.1972	1.2339	1.0794
	Diameter, in.	2.877	2.880	2.867
	Height, in.	6.385	6.620	6.518
At Test	Water Content, %	28.2	31.2	28.0
	Dry Density, pcf	95.6	91.5	95.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7622	0.8424	0.7573
	Diameter, in.	2.605	2.656	2.662
	Height, in.	6.247	6.419	6.387
Strain rate, in./min.		0.004	0.004	0.004
Eff. Cell Pressure, psf		504.0	993.6	2001.6
Fail. Stress, psf		463.8	640.2	1047.6
Excess Pore Pr., psf		302.4	518.4	1425.6
Strain, %		1.4	0.7	2.2
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		665.4	1115.4	1623.6
$\bar{\sigma}_3$ Failure, psf		201.6	475.2	576.0

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby tube

Description: Specimen #1: SILTY SAND
Specimen #2: SILTY SAND
Specimen #3: SILTY SAND

Assumed Specific Gravity= 2.7

Remarks: 4b (Specimen #2): LL=NV, PI=NP, %fines=

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SM0007_09A **Depth:** 10.4-12.0

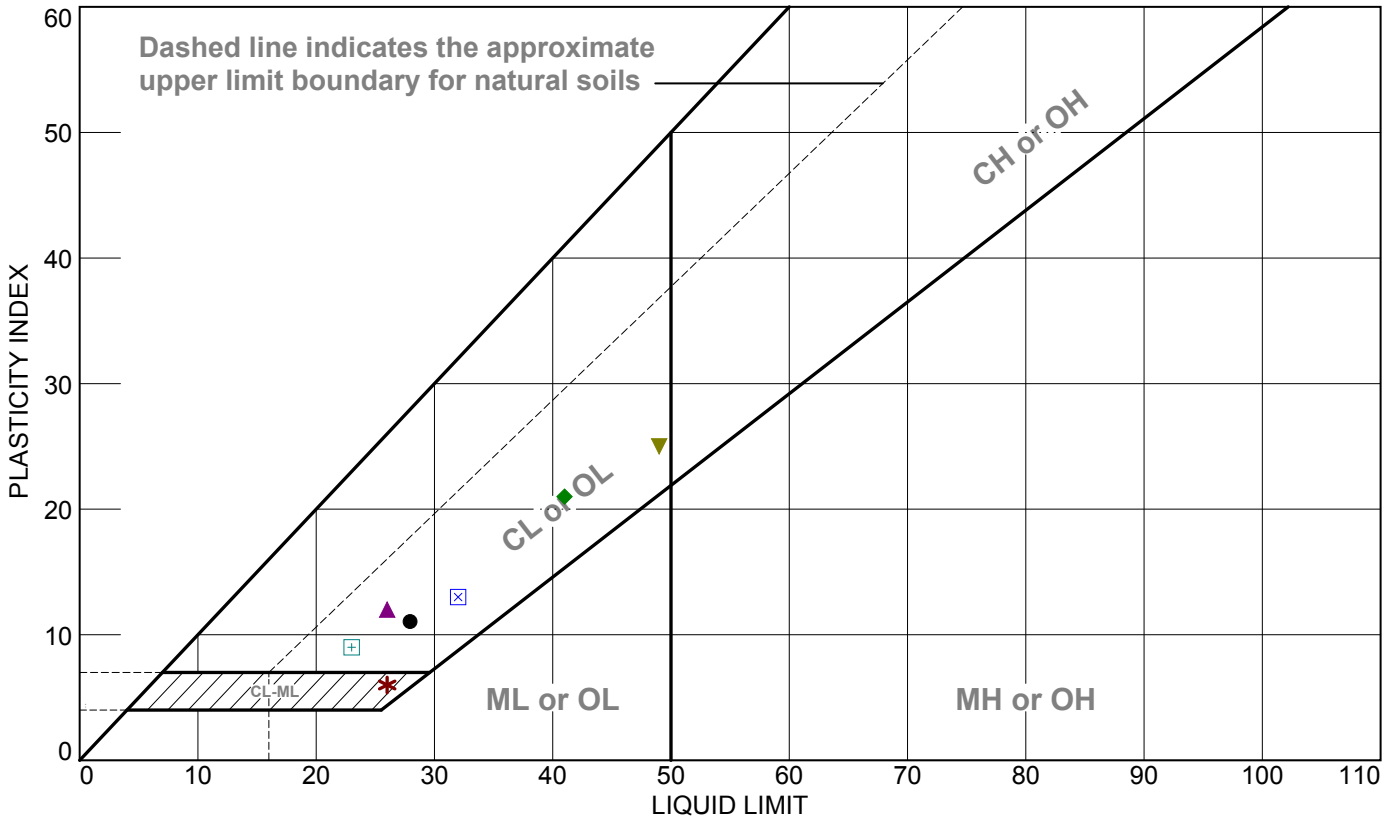
Sample Number: #4

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA

Laboratory Schedule 5

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_011B	1	3.0-4.0'	12.0	17	28	11	CL
■	SL0001_011B	4	11.0-12.0'	21.3	NP	NV	NP	ML
▲	SL0001_012B	1	3.0-3.5'	7.6	14	26	12	CL
◆	SL0001_012B	2	7.0-7.5'	13.7	20	41	21	CL
▼	SL0001_012B	11	35.0-36.5'	42.4	24	49	25	CL
✱	SL0001_040C	CPT	8.0-9.0'	-	20	26	6	CL-ML
⊕	SL0001_040C	CPT	12.0-13.0'	-	27	26	NP	ML
⊞	SM0007_006S	19	72.0-73.0'	5.7	14	23	9	CL
⊗	SM0007_007S	14	44.0-45.0'	6.9	15	14	NP	GM
☒	SM0007_007S	22	71.0-72.0'	23.7	19	32	13	SC

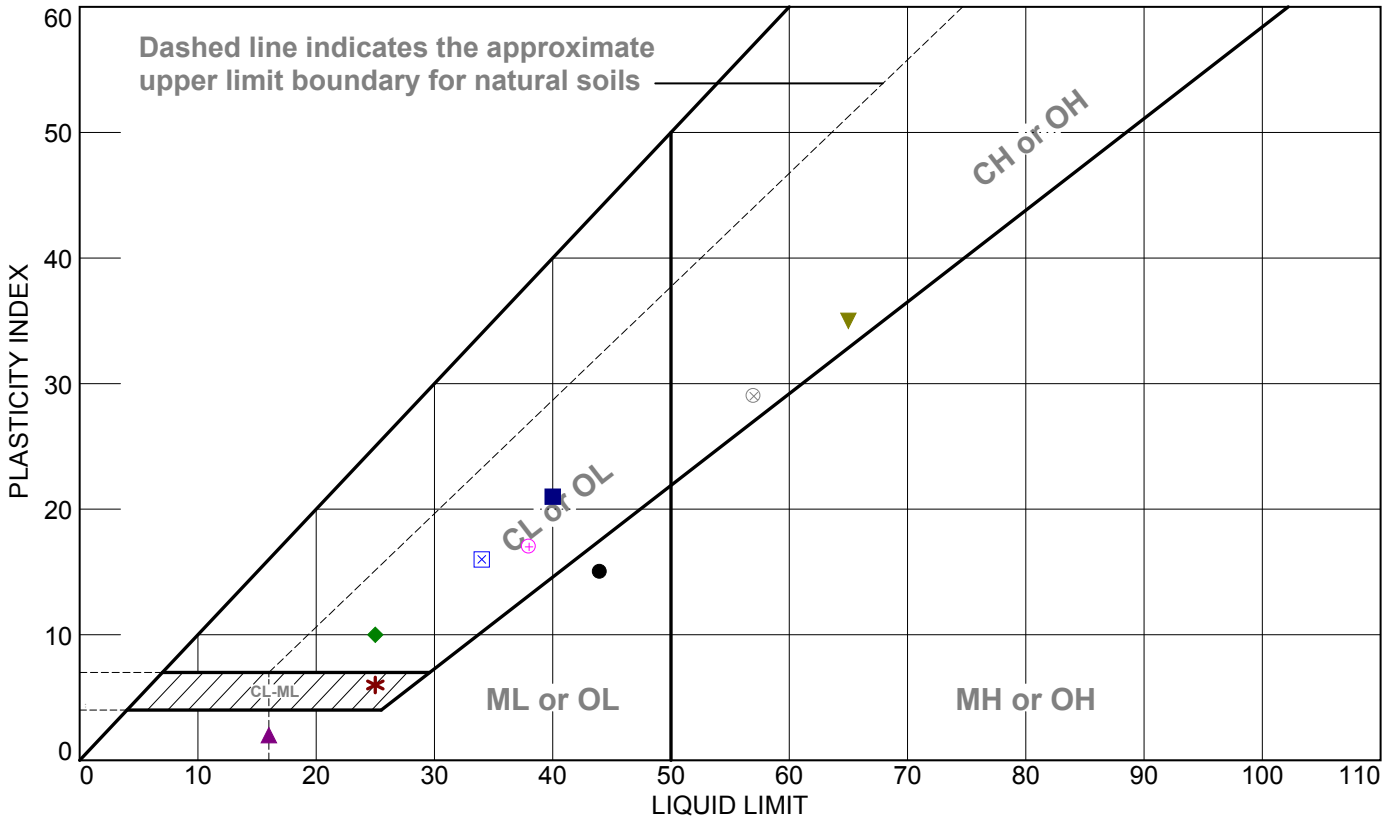
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS5-1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_031S	12	54.0-55.0'	34.5	29	44	15	ML
■	SM0007_008S	21	77.0-78.0'	20.0	19	40	21	CL
▲	SM0007_009S	6	27.0-28.0'	2.5	14	16	2	GM
◆	SM0007_009S	15	69.0-70.0'	20.6	15	25	10	CL
▼	SM0007_010S	15	59.0-60.0'	45.4	30	65	35	CH
✱	SM0007_025S	19	71.0-72.0'	74.7	19	25	6	SC-SM
⊕	SM0007_012S	11	48.0-49.0'	28.7	21	38	17	CL
⊞	SM0007_012S	13	56.0-57.0'	24.7	NP	NV	NP	SM
⊗	SM0007_013S	11	44.0-45.0'	40.1	28	57	29	CH
⊠	SM0007_013S	14	56.0-57.0'	19.8	18	34	16	CL

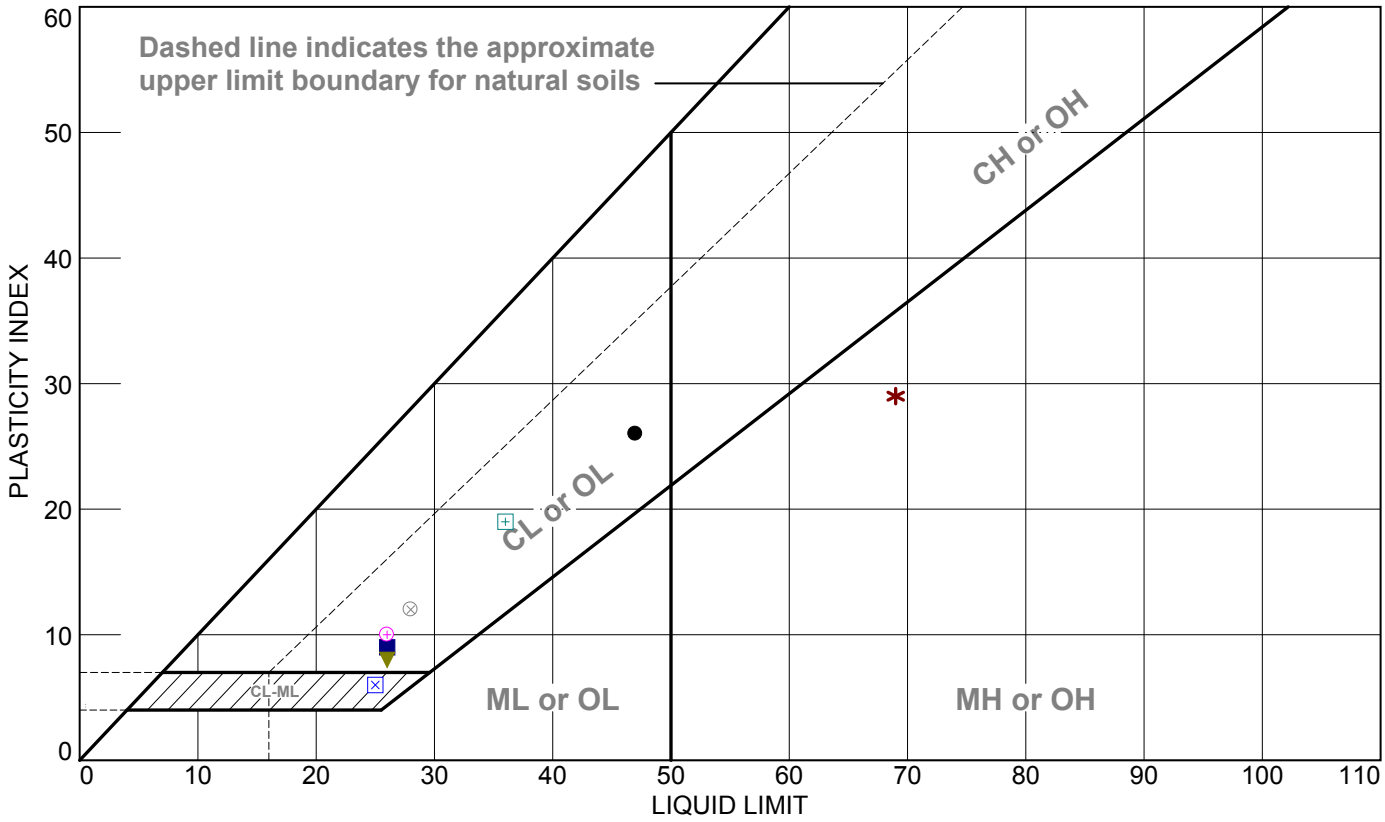
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS5-2

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_014S	6	33.0-34.0'	35.3	21	47	26	CL
■	SM0007_014S	11	57.0-58.0'	3.7	17	26	9	GC
▲	SM0007_015S	10	60.0-61.0'	22.4	20	19	NP	SM
◆	SM0007_016S	5	46.0-47.0'	30.4	26	26	NP	ML
▼	SM0007_018S	6	37.0-38.0'	6.6	18	26	8	CL
✱	SM0007_018S	10	58.0-59.0'	43.5	40	69	29	SM
⊕	SM0007_020S	1	6.0-7.0'	14.6	16	26	10	CL
⊞	SM0007_020S	2	13.0-14.0'	21.4	17	36	19	CL
⊗	SM0007_020S	3	19.0-20.0'	19.5	16	28	12	CL
⊠	SM0007_020S	6	34.0-35.0'	20.1	19	25	6	CL-ML

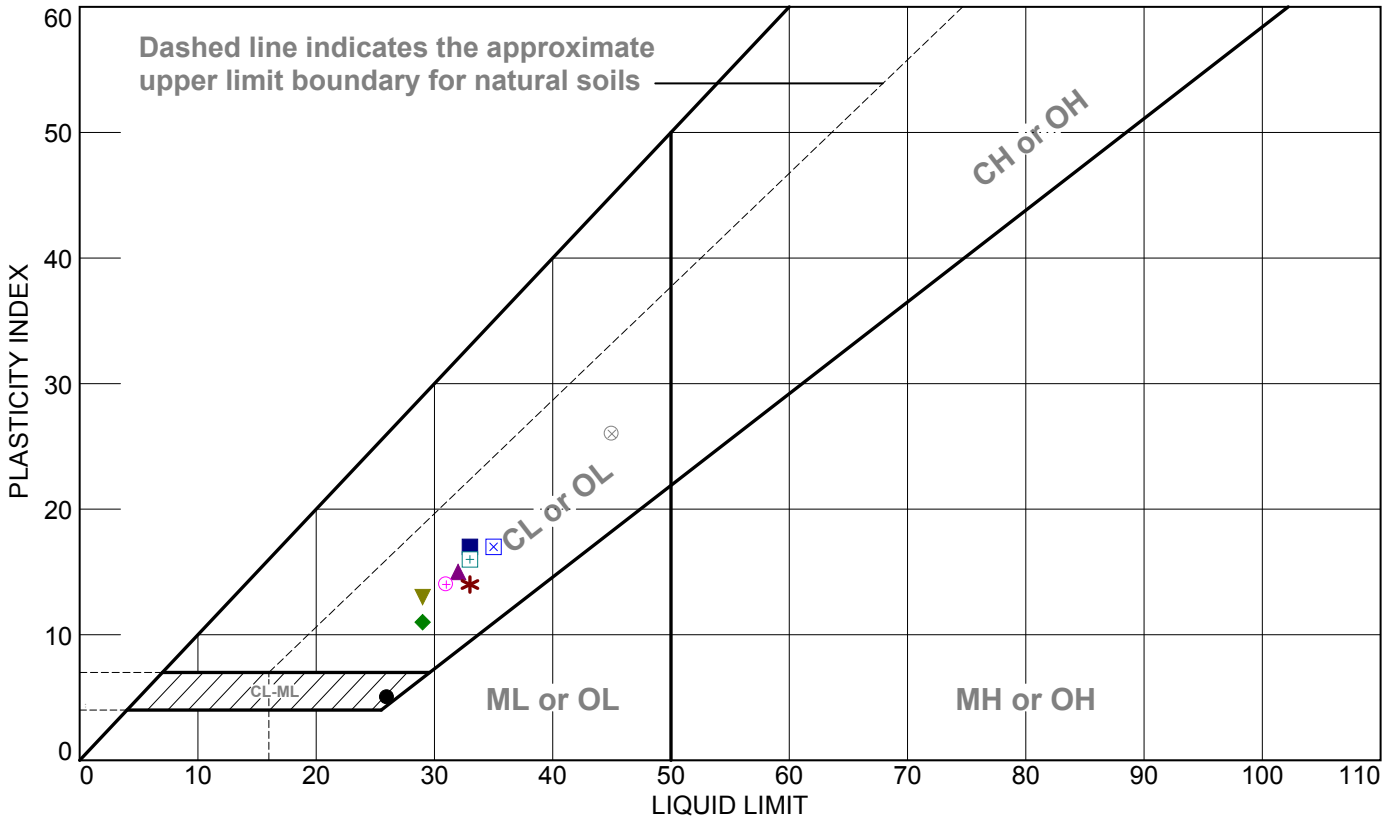
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS5-3

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_020S	9	60.0-61.0'	30.6	21	26	5	CL-ML
■	SM0007_022S	1	6.0-7.0'	12.0	16	33	17	CL
▲	SM0007_022S	3	17.0-18.0'	23.2	17	32	15	CL
◆	SM0007_022S	4	23.0-24.0'	12.6	18	29	11	CL
▼	SM0007_007H	2	7.0-8.0'	19.1	16	29	13	CL
✱	SM0007_023S	1	5.0-6.0'	22.9	19	33	14	CL
⊕	SM0007_023S	4	16.0-17.0'	22.3	17	31	14	CL
⊞	SM0007_023S	6	27.0-28.0'	21.3	17	33	16	CL
⊗	SM0007_023S	13	62.0-63.0'	7.6	19	45	26	GC
⊠	SM0007_023S	16	77.0-78.0'	7.5	18	35	17	GC

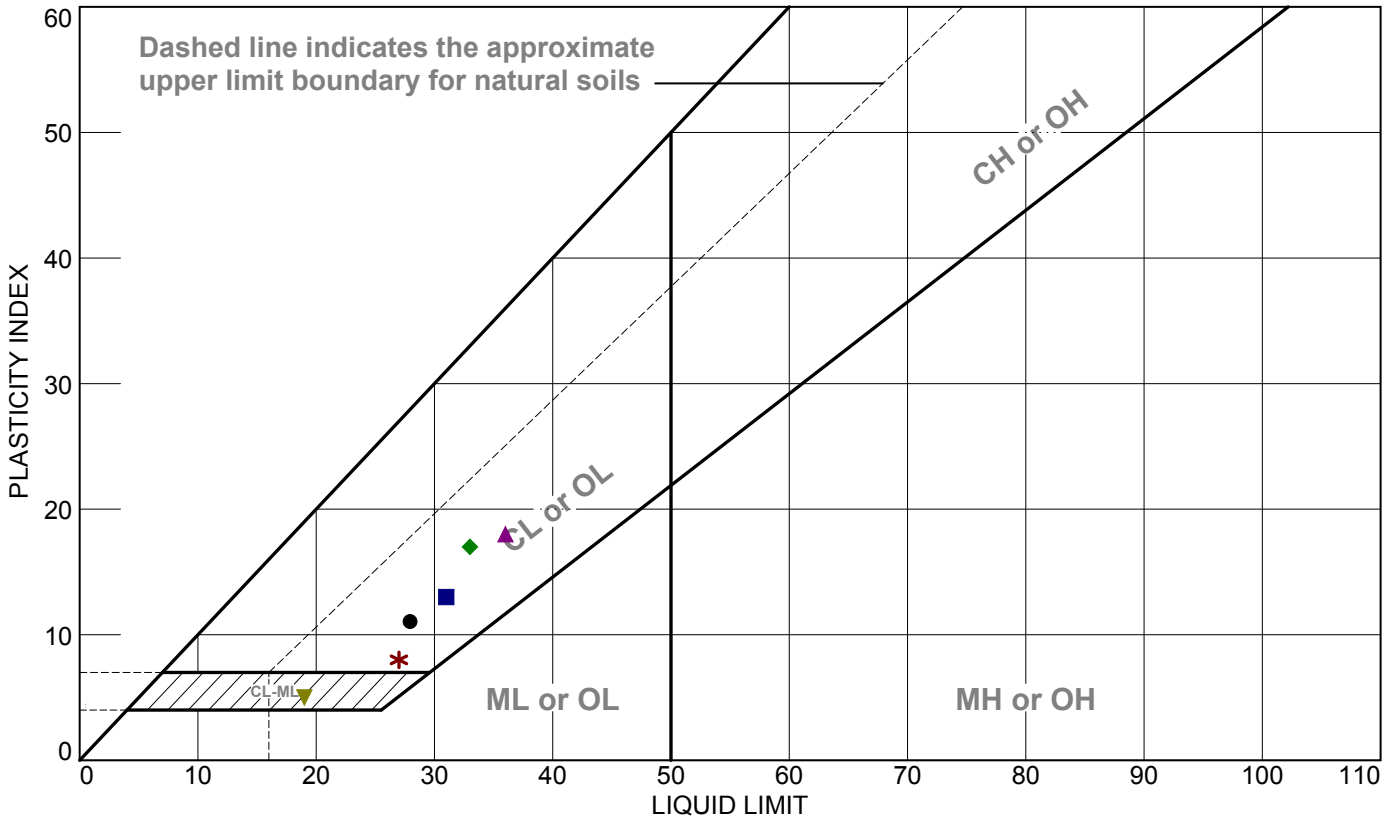
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS5-4

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_017A	1	3.0-4.0'	10.3	17	28	11	CL
■	SM0007_017A	2	8.0-9.0'	23.1	18	31	13	CL
▲	SM0007_024S	3	10.0-11.0'	25.5	18	36	18	CL
◆	SM0007_024S	5	19.0-20.0'	16.7	16	33	17	CL
▼	SM0007_024S	10	41.0-42.0'	7.3	14	19	5	GC-GM
✱	SM0007_024S	20	76.0-77.0'	7.6	19	27	8	CL

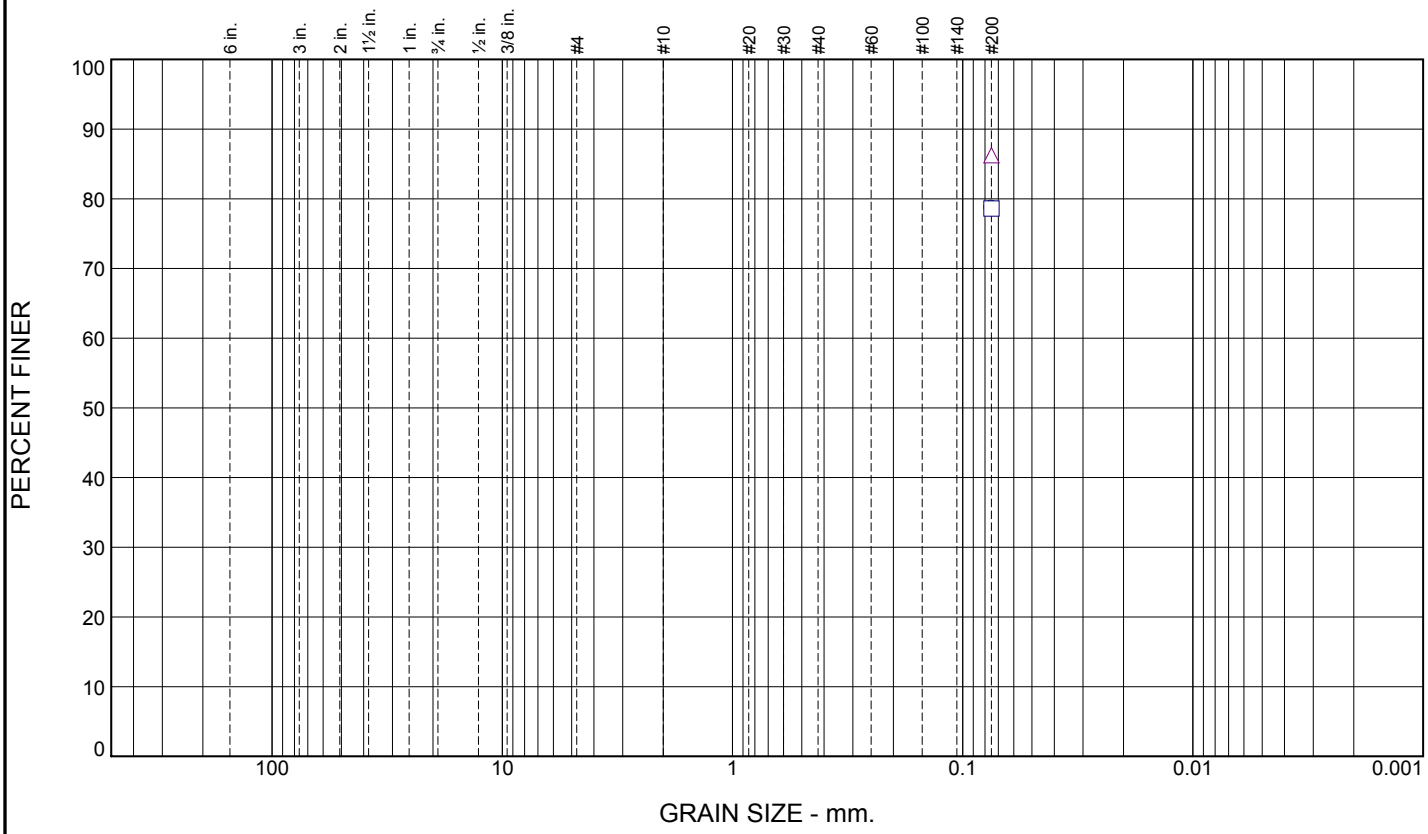
Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS5-5

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	28	17	11
□						ML	NV	NP	NP
△						CL			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	78.7	78.6	86.3

Material Description

○ Lean CLAY with SAND, dark yellowish brown

□ SILT with SAND, dark yellowish brown

△ Lean CLAY, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_011B Depth: 3.0-4.0' Sample Number: 1

□ Source of Sample: SL0001_011B Depth: 11.0-12.0' Sample Number: 4

△ Source of Sample: SL0001_011B Depth: 20.0-21.5' Sample Number: 6

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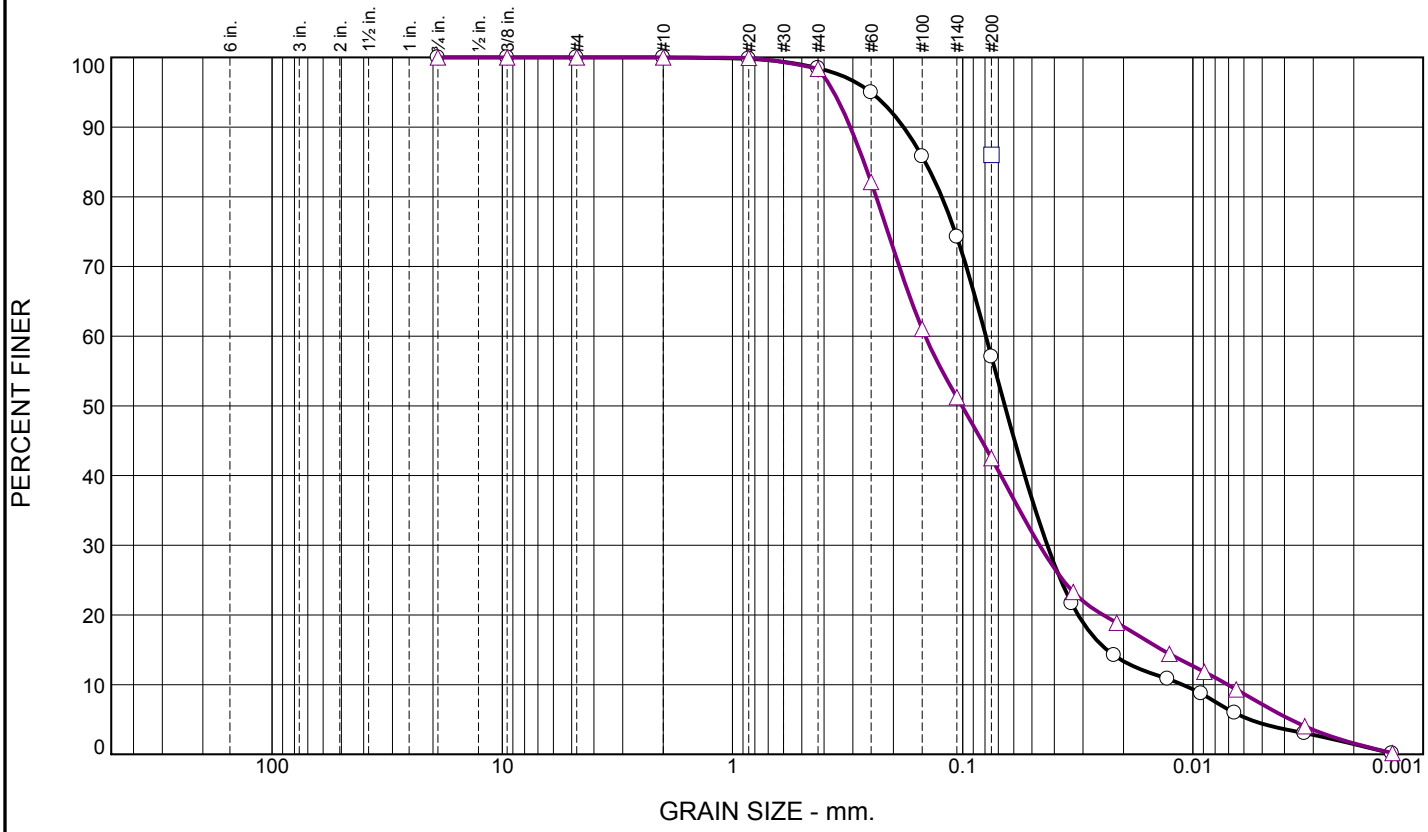
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	42.9	52.7	4.4	ML			
□						CL	41	20	21
△	0.0	0.0	57.5	35.3	7.2	SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		100.0
3/8"	100.0		100.0
GRAIN SIZE			
D_{60}	0.0793		0.1454
D_{30}	0.0429		0.0464
D_{10}	0.0111		0.0070
COEFFICIENTS			
C_c	2.09		2.10
C_u	7.15		20.63

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		100.0
#10	100.0		100.0
#20	99.8		99.9
#40	98.5		98.4
#60	95.0		82.1
#100	85.8		61.0
#140	74.3		51.3
#200	57.1	86.0	42.5

Material Description

○ SANDY SILT, greenish gray

□ Lean CLAY, dark yellowish brown

△ SILTY SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_011B Depth: 35.0-36.5' Sample Number: 9

□ Source of Sample: SL0001_012B Depth: 7.0-7.5 Sample Number: 2

△ Source of Sample: SL0001_012B Depth: 22.0-23.5' Sample Number: 8

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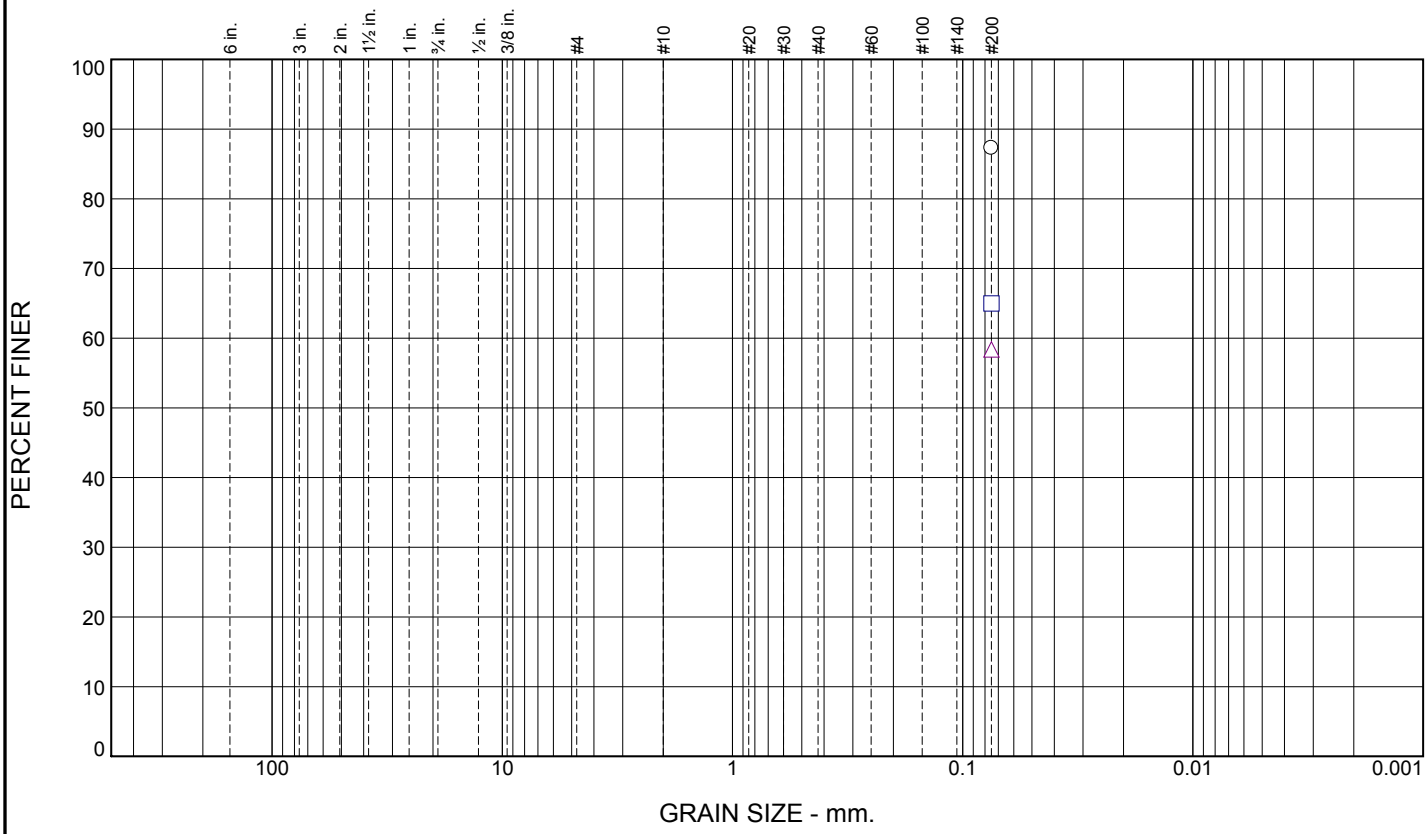
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	49	24	25
□						CL-ML	26	20	6
△						ML	26	27	NP

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	87.3	65.0	58.4

Material Description

○ Lean CLAY, dark greenish gray

□ SANDY SILTY CLAY, dark brown

△ SANDY SILT, dark brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_012B Depth: 35.0-36.5' Sample Number: 11

□ Source of Sample: SL0001_040C Depth: 8.0-9.0' Sample Number: CPT

△ Source of Sample: SL0001_040C Depth: 12.0-13.0' Sample Number: CPT

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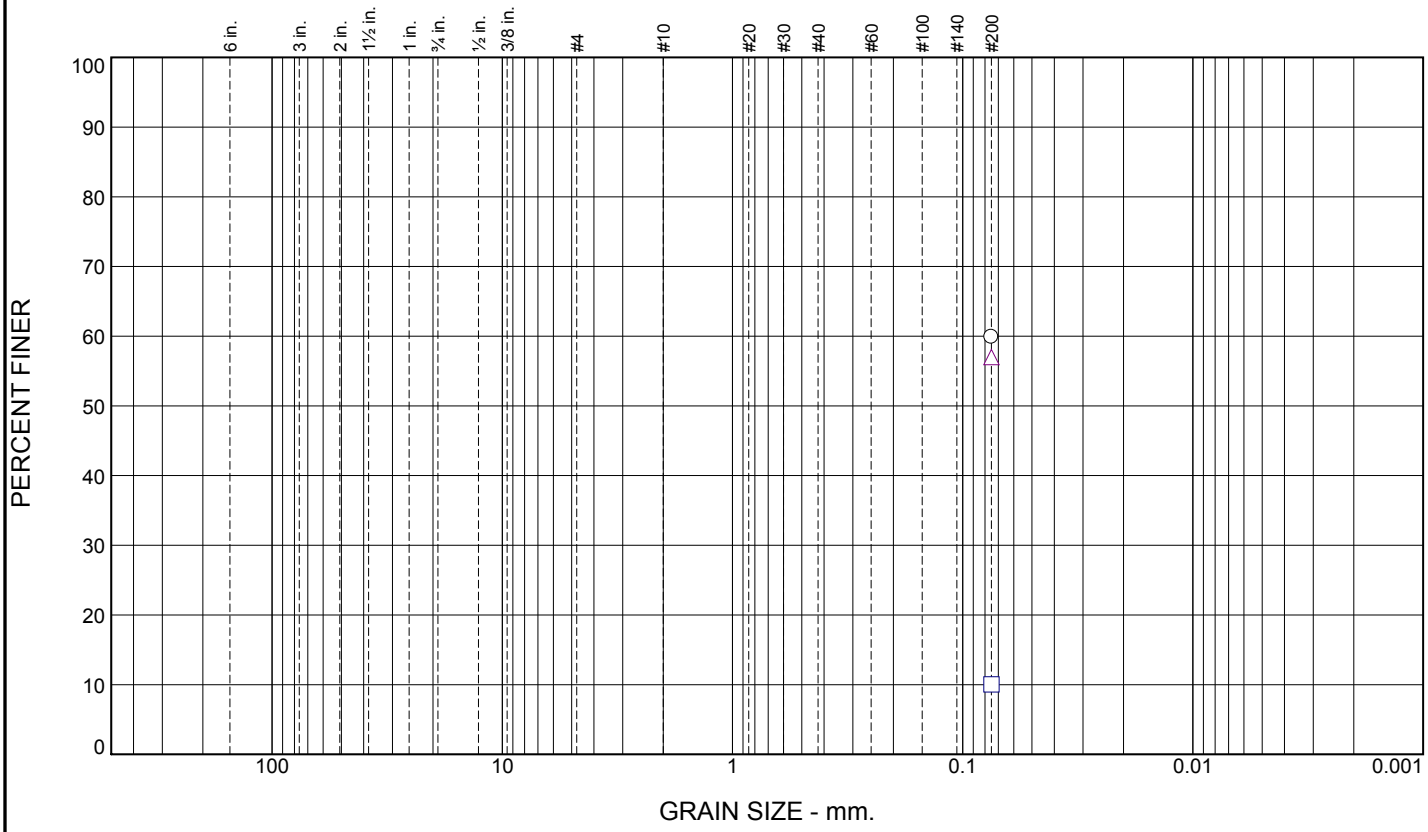
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						SP-SM			
△						ML			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	59.9	10.0	57.0

Material Description

○ SANDY SILT, dark brown

□ Poorly-graded SAND with SILT, dark olive brown

△ SANDY SILT, very dark brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_007C Depth: 5.0-5.5' Sample Number: CPT

□ Source of Sample: SL0001_007C Depth: 14.0-15.0' Sample Number: CPT

△ Source of Sample: SL0001_008C Depth: 15.0-16.0' Sample Number: CPT

Blackburn Consulting

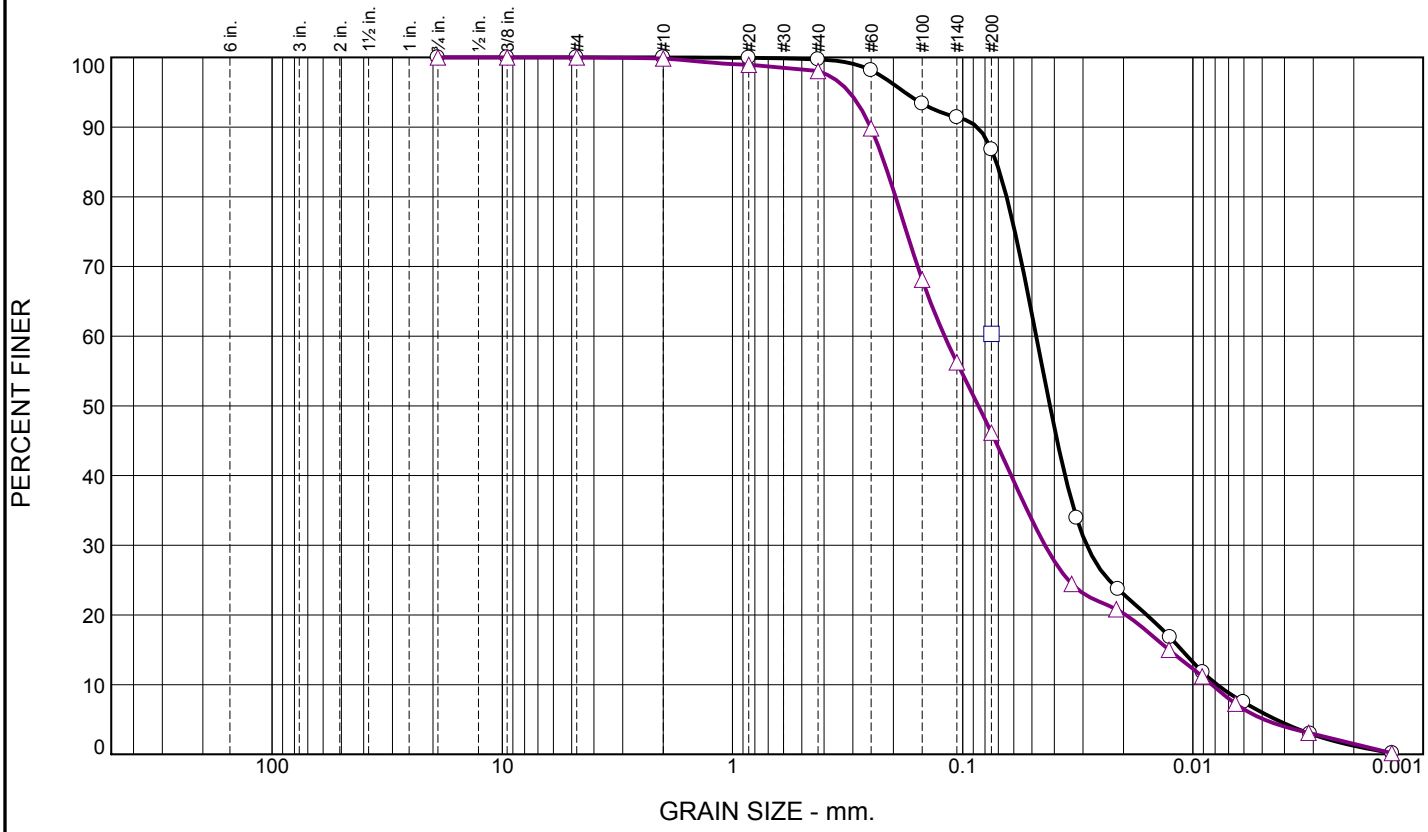
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	13.2	80.8	6.0	ML			
□						ML			
△	0.0	0.0	53.8	41.1	5.1	SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		100.0
3/8"	100.0		100.0
	GRAIN SIZE		
D_{60}	0.0479		0.1198
D_{30}	0.0289		0.0439
D_{10}	0.0078		0.0083
	COEFFICIENTS		
C_c	2.23		1.95
C_u	6.11		14.49

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		100.0
#10	100.0		99.8
#20	99.9		98.9
#40	99.7		98.1
#60	98.2		89.8
#100	93.4		68.1
#140	91.4		56.2
#200	86.8	60.3	46.2

Material Description

○ SILT, brown

□ SANDY SILT, very dark brown

△ SILTY SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_006S Depth: 4.0-5.0' Sample Number: 1

□ Source of Sample: SM0007_006S Depth: 10.0-11.0' Sample Number: 3

△ Source of Sample: SM0007_006S Depth: 12.0-13.0' Sample Number: 4

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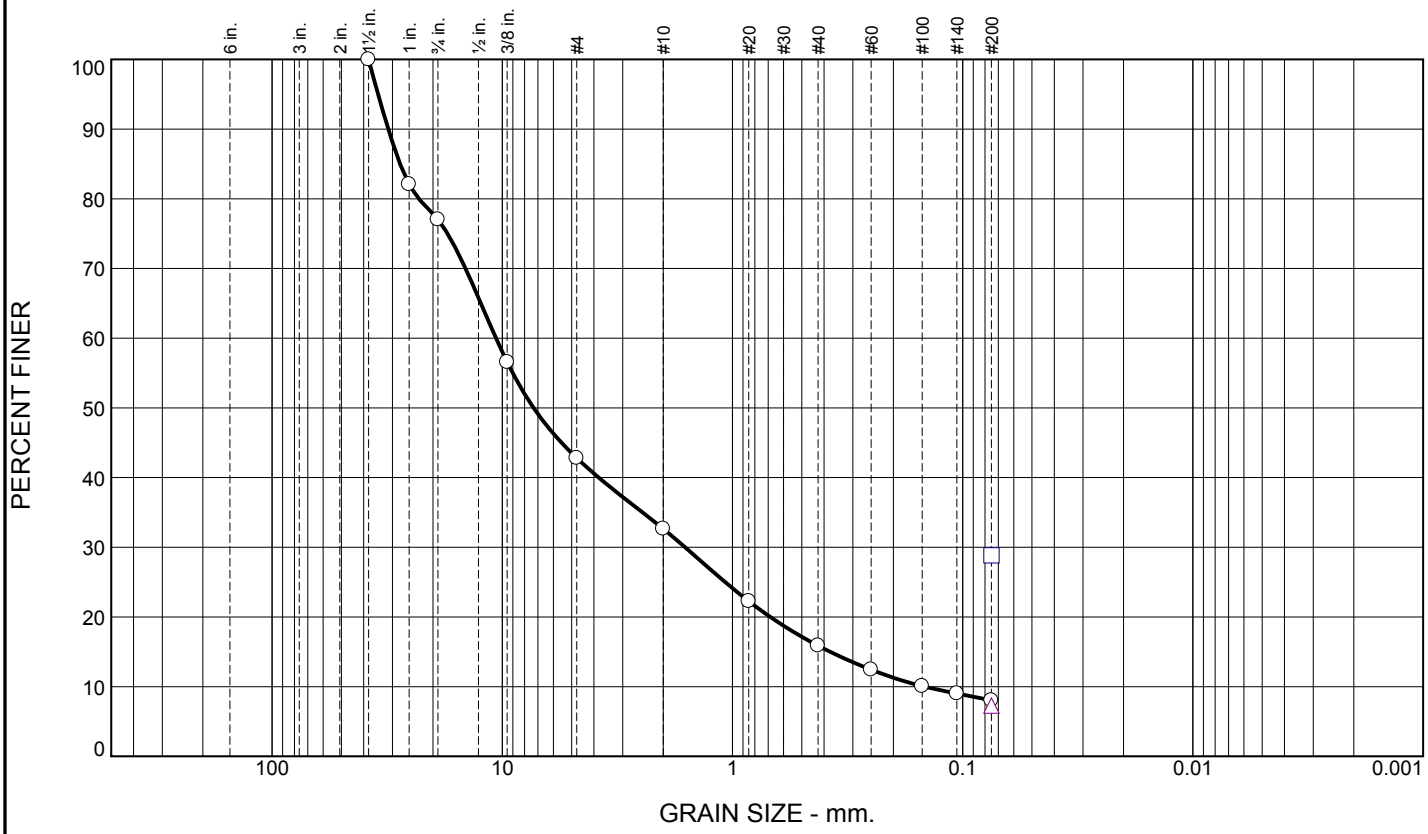
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-5

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	57.2	34.8	8.0		GP-GC			
□						GC			
△						GP-GC			

SIEVE inches size	PERCENT FINER ○	□	△
1 1/2"	100.0		
1"	82.1		
3/4"	77.0		
3/8"	56.6		
	GRAIN SIZE		
D_{60}	10.6495		
D_{30}	1.6072		
D_{10}	0.1468		
	COEFFICIENTS		
C_c	1.65		
C_u	72.56		

SIEVE number size	PERCENT FINER ○	□	△
#4	42.8		
#10	32.7		
#20	22.3		
#40	15.9		
#60	12.4		
#100	10.1		
#140	9.0		
#200	8.0	28.8	7.3

Material Description

○ Poorly-graded GRAVEL with CLAY and SAND, olive

□ CLAYEY GRAVEL with SAND, olive

△ Poorly-graded GRAVEL with CLAY, olive

REMARKS:

○

□

△

○ Source of Sample: SM0007_006S Depth: 23.0-24.0' Sample Number: 7

□ Source of Sample: SM0007_006S Depth: 63.0-64.0' Sample Number: 16

△ Source of Sample: SM0007_006S Depth: 67.0-68.0' Sample Number: 17

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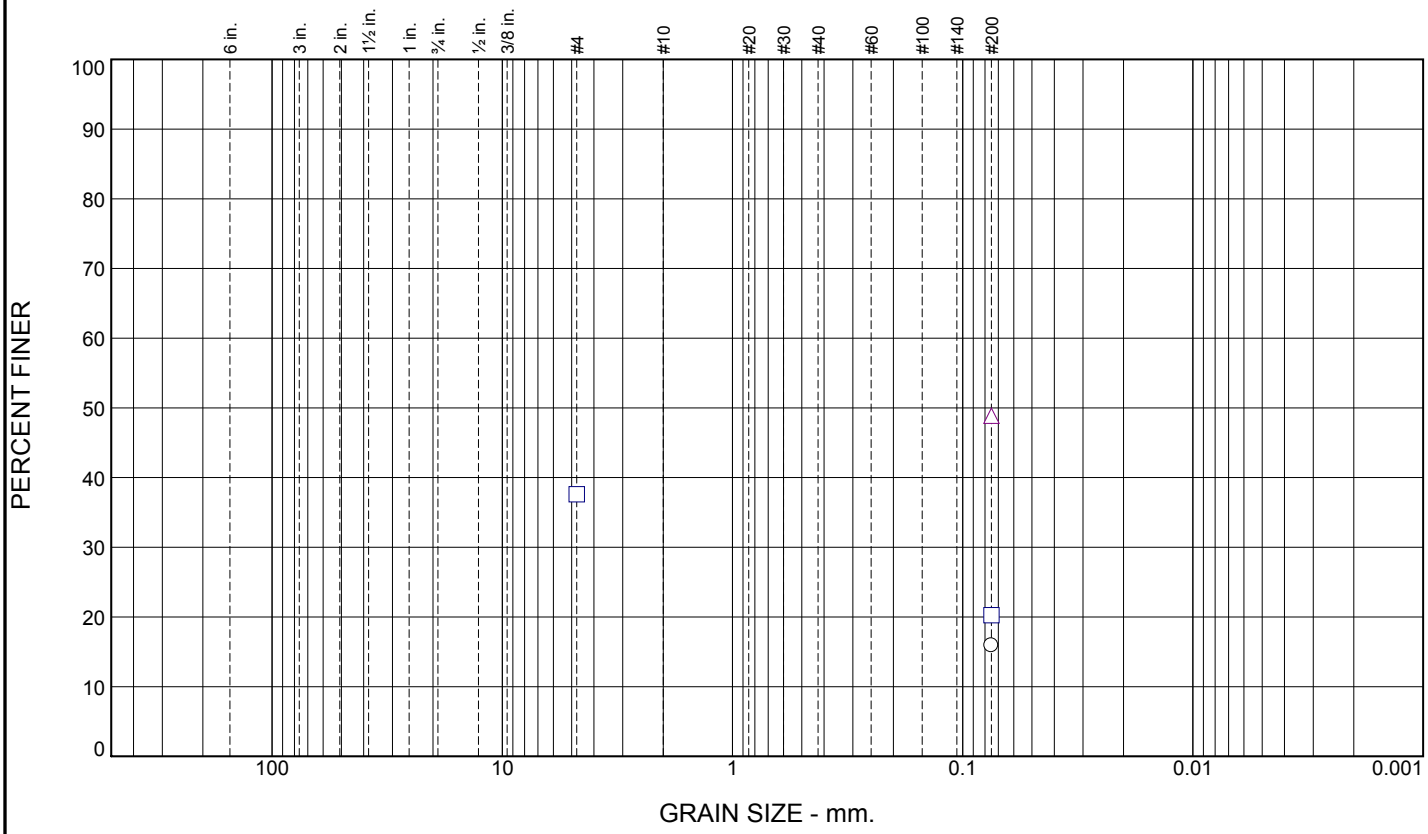
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-6

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						GC			
□			17.3	20.3		GM	14	15	NP
△						SC	32	19	13

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}		0.7703	
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		37.6	
#200	15.9	20.3	48.9

Material Description

○CLAYEY GRAVEL with SAND, olive

□SILTY GRAVEL with SAND, olive

△CLAYEY SAND, greenish gray

REMARKS:

○

□

△cemented particles retained above #200 sieve

○Source of Sample: SM0007_006S Depth: 69.0-70.0' Sample Number: 18

□Source of Sample: SM0007_007S Depth: 44.0-45.0' Sample Number: 14

△Source of Sample: SM0007_007S Depth: 71.0-72.0' Sample Number: 22

Blackburn Consulting

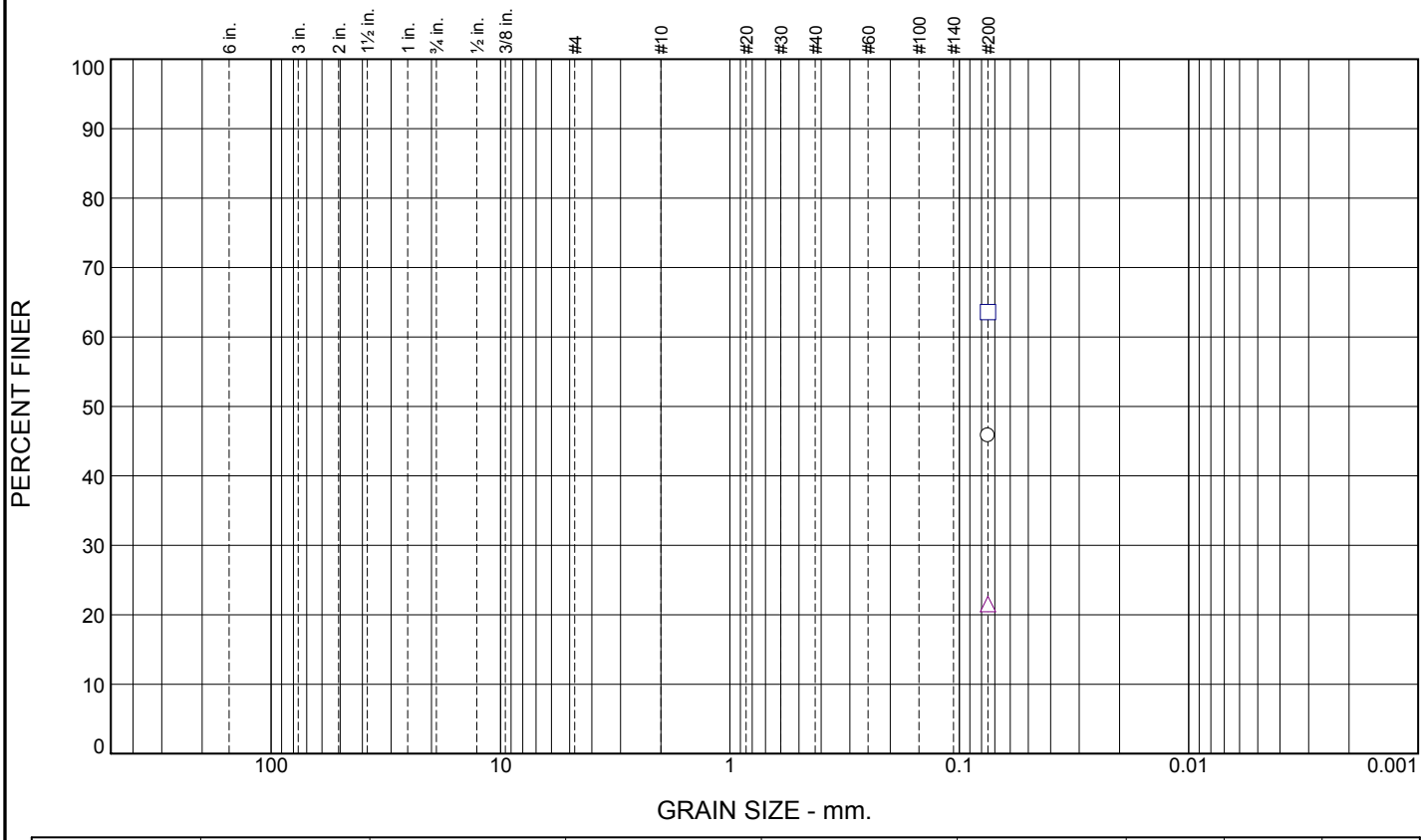
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-7

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						ML			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	45.8	63.6	21.5

Material Description

○ SILTY SAND, brown

□ SANDY SILT, dark grayish brown

△ SILTY SAND, dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_031S Depth: 3.0-4.0' Sample Number: 1

□ Source of Sample: SM0007_031S Depth: 14.0-15.0' Sample Number: 3

△ Source of Sample: SM0007_031S Depth: 17.0-18.0' Sample Number: 4

Blackburn Consulting

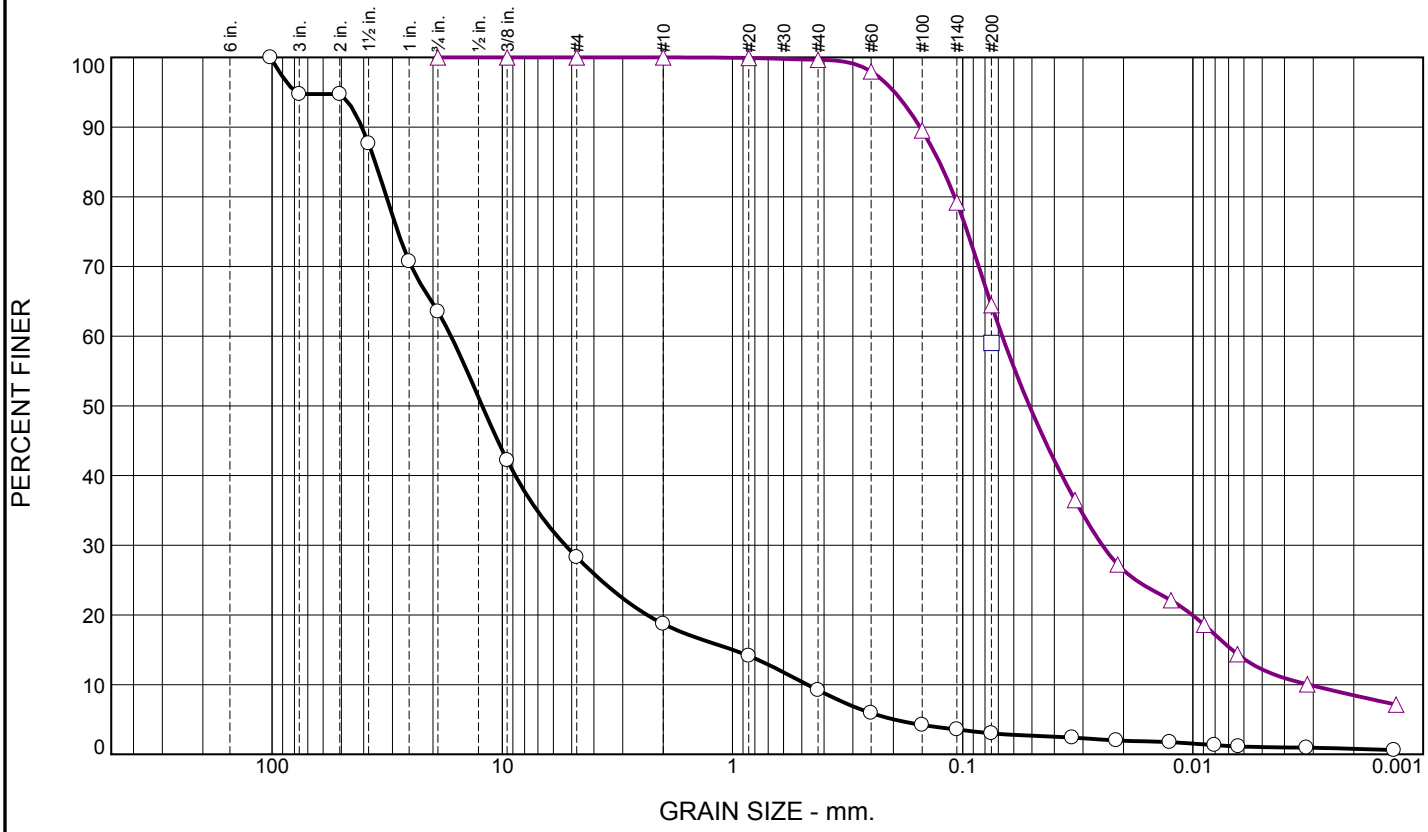
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-8

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	5.3	66.4	25.3	2.0	1.0	GP			
□						ML	44	29	15
△	0.0	0.0	35.5	52.3	12.2	ML			

SIEVE inches size	PERCENT FINER ○	□	△
4"	100.0		
3"	94.7		
2"	94.7		
1 1/2"	87.7		
1"	70.7		
3/4"	63.5		100.0
3/8"	42.2		100.0
	GRAIN SIZE		
D_{60}	16.7042		0.0673
D_{30}	5.3197		0.0247
D_{10}	0.4731		0.0031
	COEFFICIENTS		
C_c	3.58		2.89
C_u	35.31		21.44

SIEVE number size	PERCENT FINER ○	□	△
#4	28.3		100.0
#10	18.7		100.0
#20	14.1		99.9
#40	9.2		99.7
#60	5.9		98.0
#100	4.2		89.5
#140	3.6		79.2
#200	3.0	59.0	64.5

Material Description

○ Poorly-graded GRAVEL with SAND, olive brown

□ SANDY SILT, light olive brown

△ SANDY SILT, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_031S Depth: 27.0-28.0' Sample Number: 6

□ Source of Sample: SM0007_031S Depth: 54.0-55.0' Sample Number: 12

△ Source of Sample: SM0007_008S Depth: 4.0-5.0' Sample Number: 1

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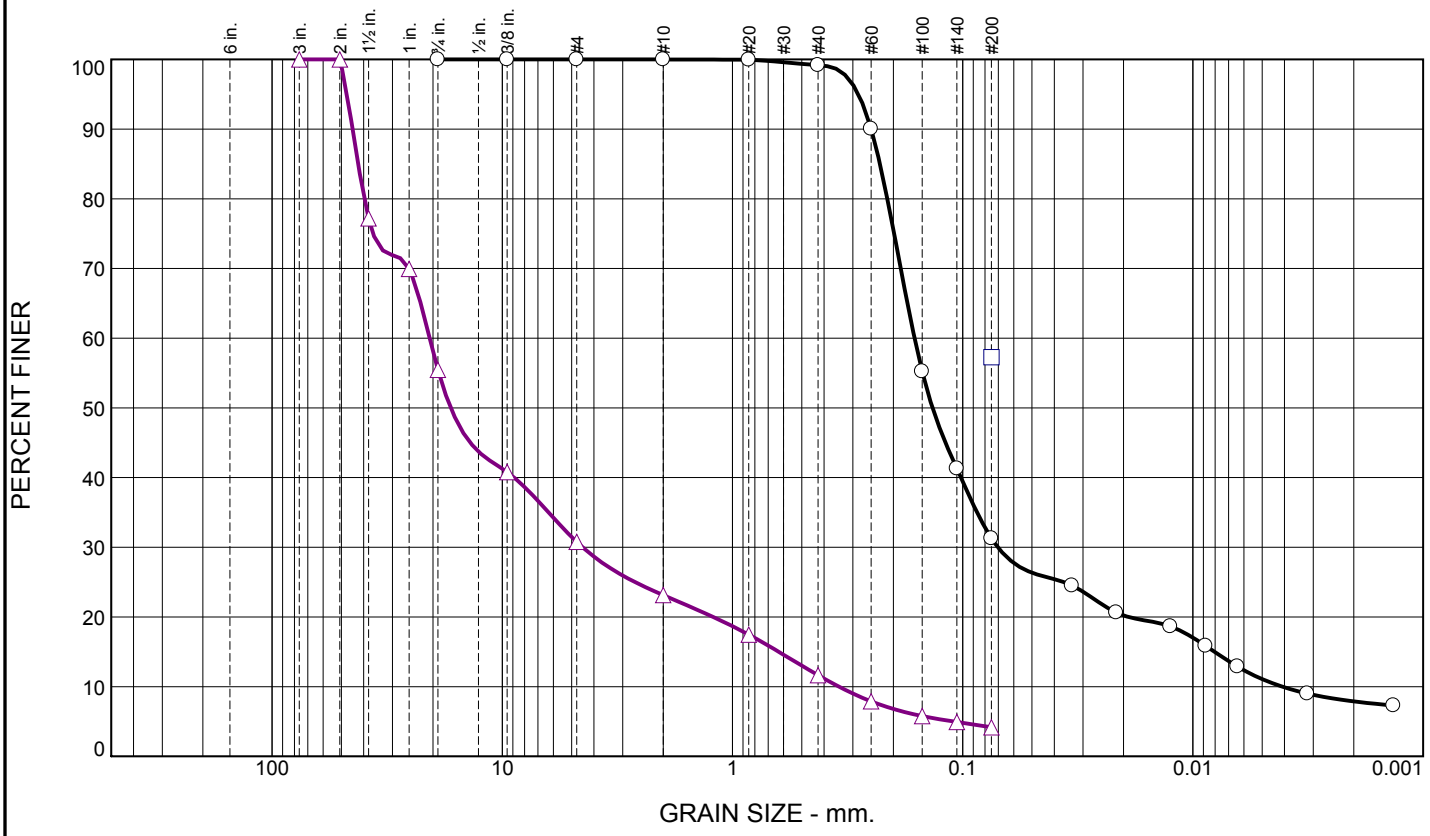
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-9

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	68.7	20.2	11.1	SM			
□						ML			
△	0.0	69.2	26.6	4.2		GW			

SIEVE inches size	PERCENT FINER ○	□	△
3"			100.0
2"			100.0
1 1/2"			77.2
1"			69.9
3/4"	100.0		55.5
3/8"	100.0		40.8
GRAIN SIZE			
D_{60}	0.1618		20.6827
D_{30}	0.0704		4.4787
D_{10}	0.0041		0.3444
COEFFICIENTS			
C_c	7.49		2.82
C_u	39.58		60.05

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		30.8
#10	100.0		23.1
#20	100.0		17.5
#40	99.2		11.6
#60	90.1		7.9
#100	55.2		5.8
#140	41.3		4.9
#200	31.3	57.3	4.2

Material Description

○ SILTY SAND, yellowish brown

□ SANDY SILT, dark grayish brown

△ Well-graded GRAVEL with SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_008S Depth: 11.0-12.0' Sample Number: 3

□ Source of Sample: SM0007_008S Depth: 15.0-16.0' Sample Number: 4

△ Source of Sample: SM0007_008S Depth: 18.0-19.0' Sample Number: 5

Blackburn Consulting

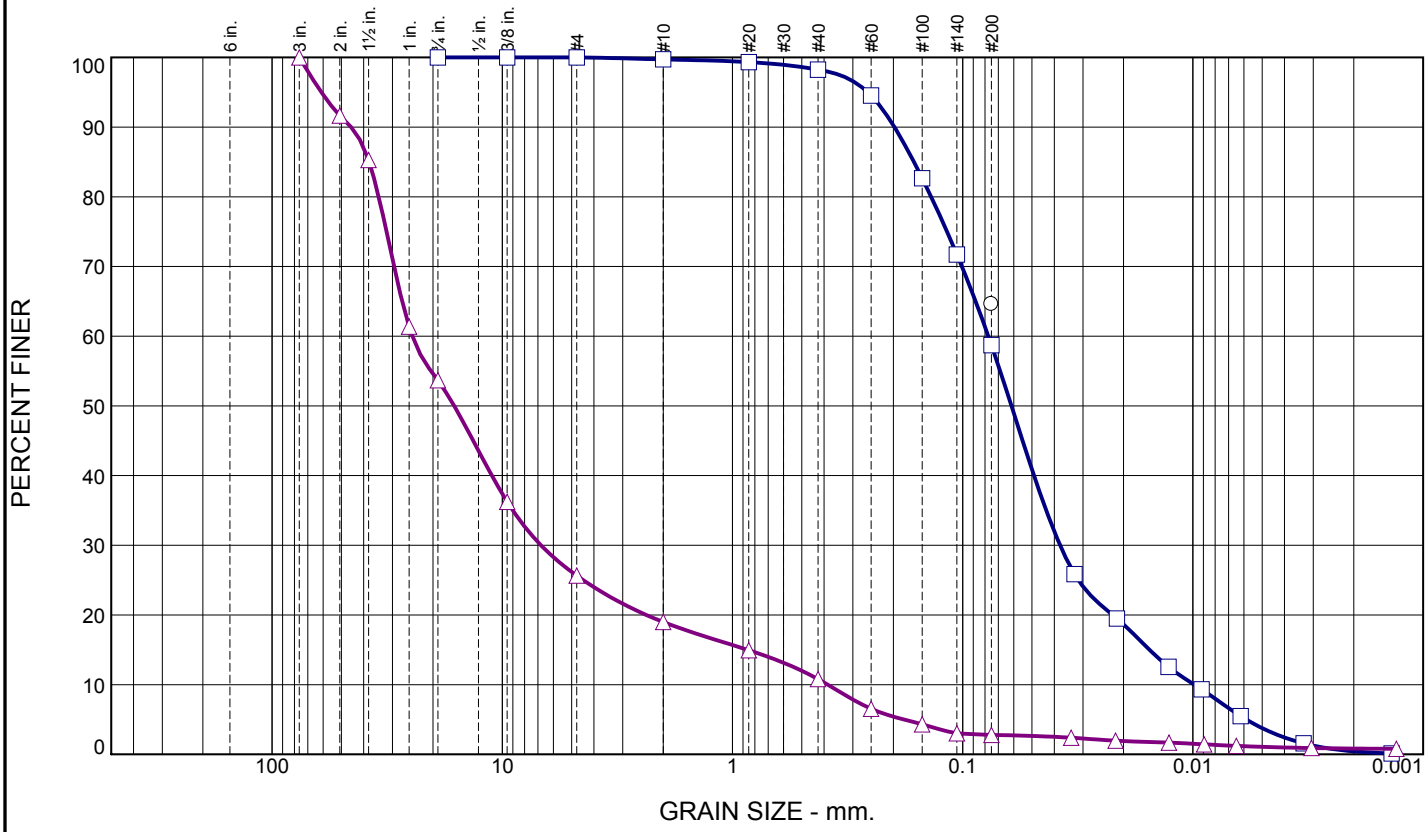
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-10

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	40	19	21
□	0.0	0.0	41.3	54.9	3.8	ML			
△	0.0	74.3	22.9	1.7	1.1	GP			

SIEVE inches size	PERCENT FINER ○	□	△
3"			100.0
2"			91.7
1 1/2"			85.3
1"			61.4
3/4"		100.0	53.7
3/8"		100.0	36.2
GRAIN SIZE			
D_{60}		0.0774	24.5918
D_{30}		0.0378	6.7910
D_{10}		0.0098	0.3855
COEFFICIENTS			
C_c		1.87	4.86
C_u		7.85	63.79

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	25.7
#10		99.7	19.0
#20		99.3	14.9
#40		98.2	10.8
#60		94.5	6.5
#100		82.7	4.3
#140		71.7	3.0
#200	64.6	58.7	2.8

Material Description

○ SANDY lean CLAY, dark yellowish brown

□ SANDY SILT, dark brown

△ Poorly-graded GRAVEL with SAND, dark olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_008S Depth: 77.0-78.0' Sample Number: 21

□ Source of Sample: SM0007_009S Depth: 4.0-5.0' Sample Number: 1

△ Source of Sample: SM0007_009S Depth: 12.0-13.0' Sample Number: 3

Blackburn Consulting

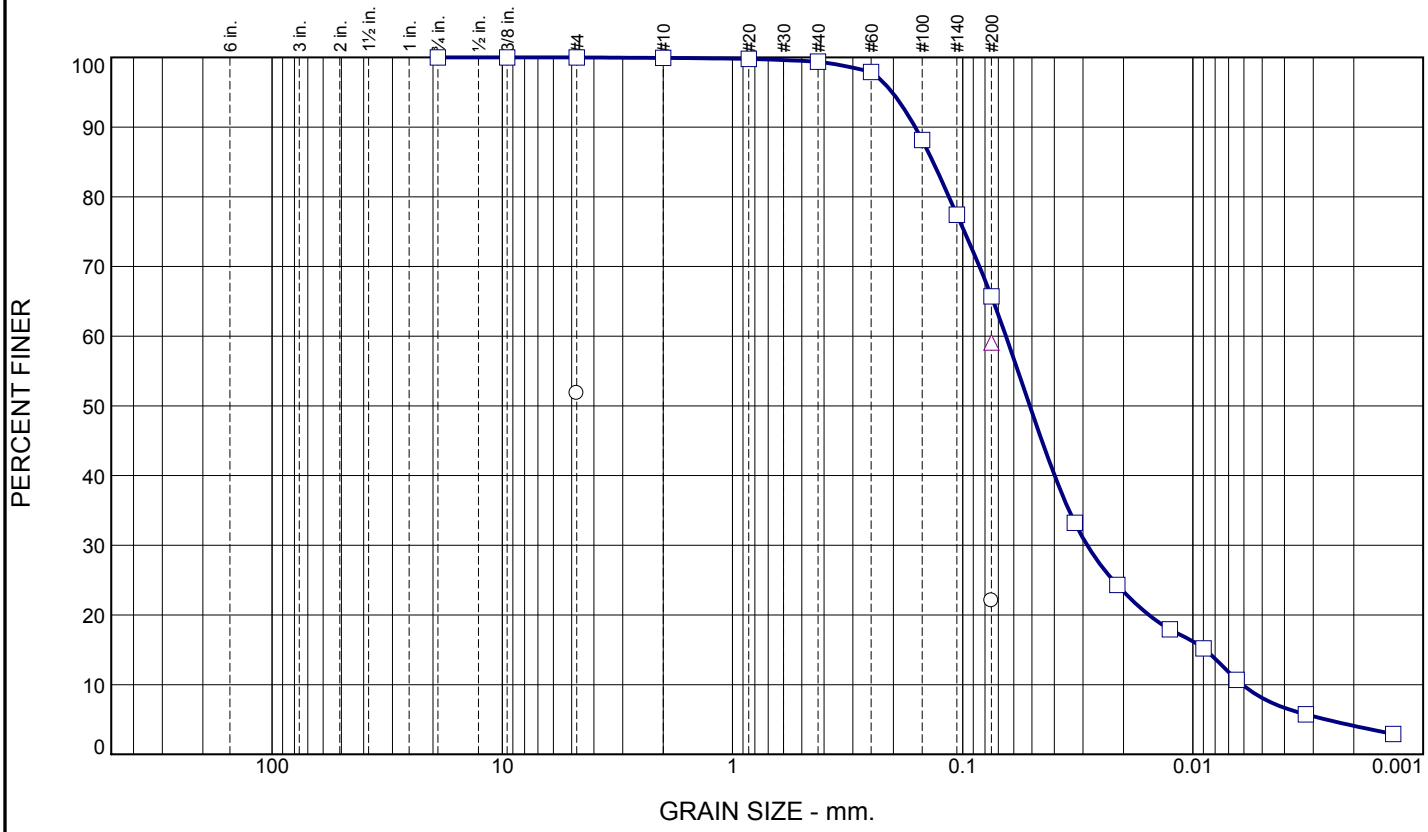
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-11

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○			29.7	22.1		GM	16	14	2
□	0.0	0.0	34.3	57.6	8.1	ML			
△						CH	65	30	35

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
3/8"		100.0	
GRAIN SIZE			
D_{60}		0.0649	
D_{30}	0.2263	0.0288	
D_{10}		0.0061	
COEFFICIENTS			
C_c		2.09	
C_u		10.63	

SIEVE number size	PERCENT FINER ○	□	△
#4	51.8	100.0	
#10		99.9	
#20		99.8	
#40		99.4	
#60		97.9	
#100		88.2	
#140		77.4	
#200	22.1	65.7	59.1

Material Description

○ SILTY GRAVEL with SAND, olive gray

□ SANDY SILT, brown

△ SANDY fat CLAY, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_009S Depth: 27.0-28.0' Sample Number: 6

□ Source of Sample: SM0007_010S Depth: 4.0-5.0' Sample Number: 1

△ Source of Sample: SM0007_010S Depth: 59.0-60.0' Sample Number: 15

Blackburn Consulting

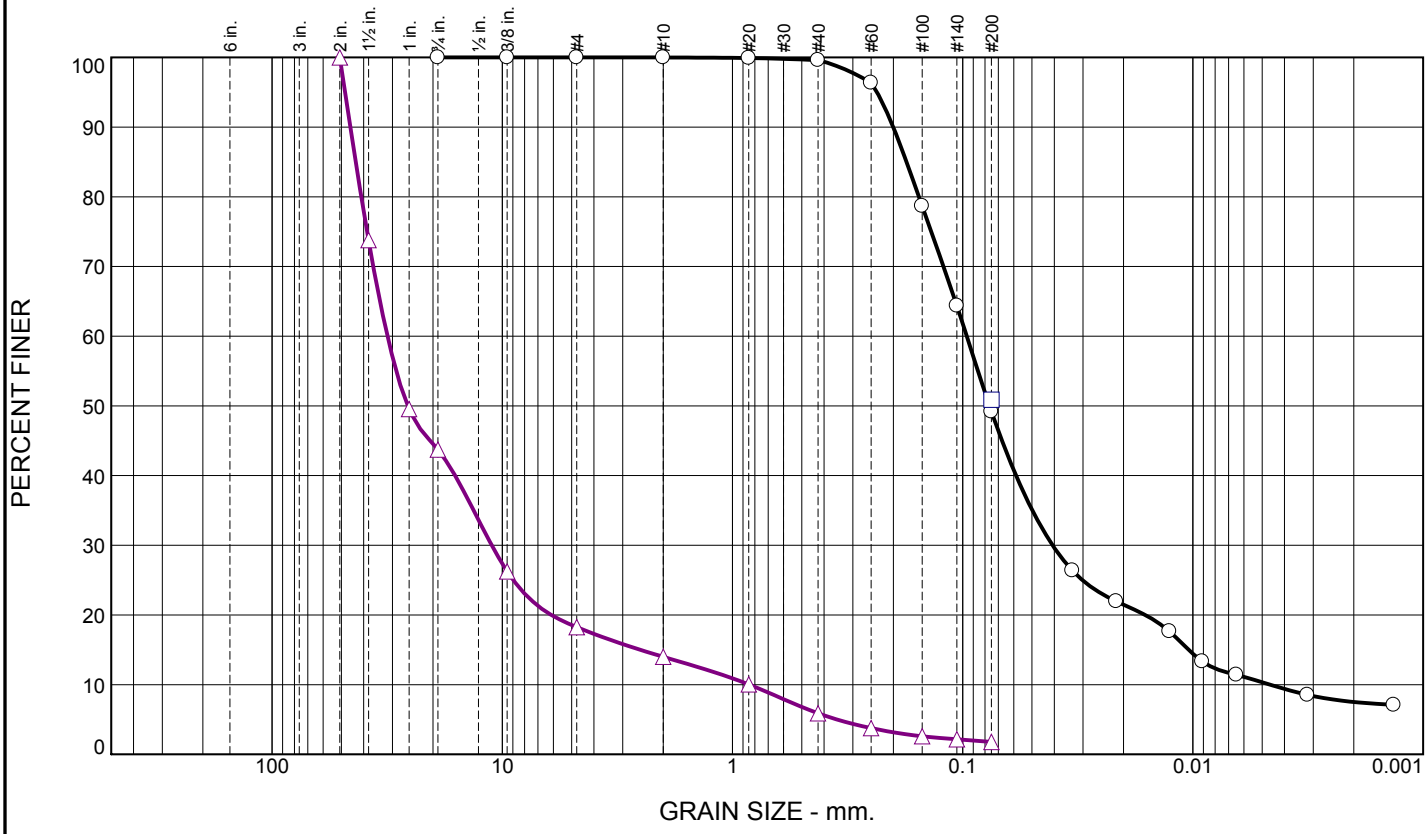
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-12

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	50.8	38.8	10.4	SM			
□						ML			
△	0.0	81.7	16.5	1.8		GP			

SIEVE inches size	PERCENT FINER ○	□	△
2"			100.0
1 1/2"			73.8
1"			49.5
3/4"	100.0		43.7
3/8"	100.0		26.2
	GRAIN SIZE		
D_{60}	0.0960		31.5471
D_{30}	0.0407		11.1147
D_{10}	0.0046		0.8447
	COEFFICIENTS		
C_c	3.74		4.64
C_u	20.82		37.35

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0		18.3
#10	100.0		14.0
#20	99.9		10.0
#40	99.6		5.9
#60	96.4		3.8
#100	78.7		2.6
#140	64.4		2.2
#200	49.2	50.9	1.8

Material Description

○ SILTY SAND, dark brown

□ SANDY SILT, dark yellowish brown

△ Poorly-graded GRAVEL with SAND, dark olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_025S Depth: 3.0-3.5' Sample Number: 1

□ Source of Sample: SM0007_025S Depth: 9.0-10.0' Sample Number: 2

△ Source of Sample: SM0007_025S Depth: 17.0-18.0' Sample Number: 4

Blackburn Consulting

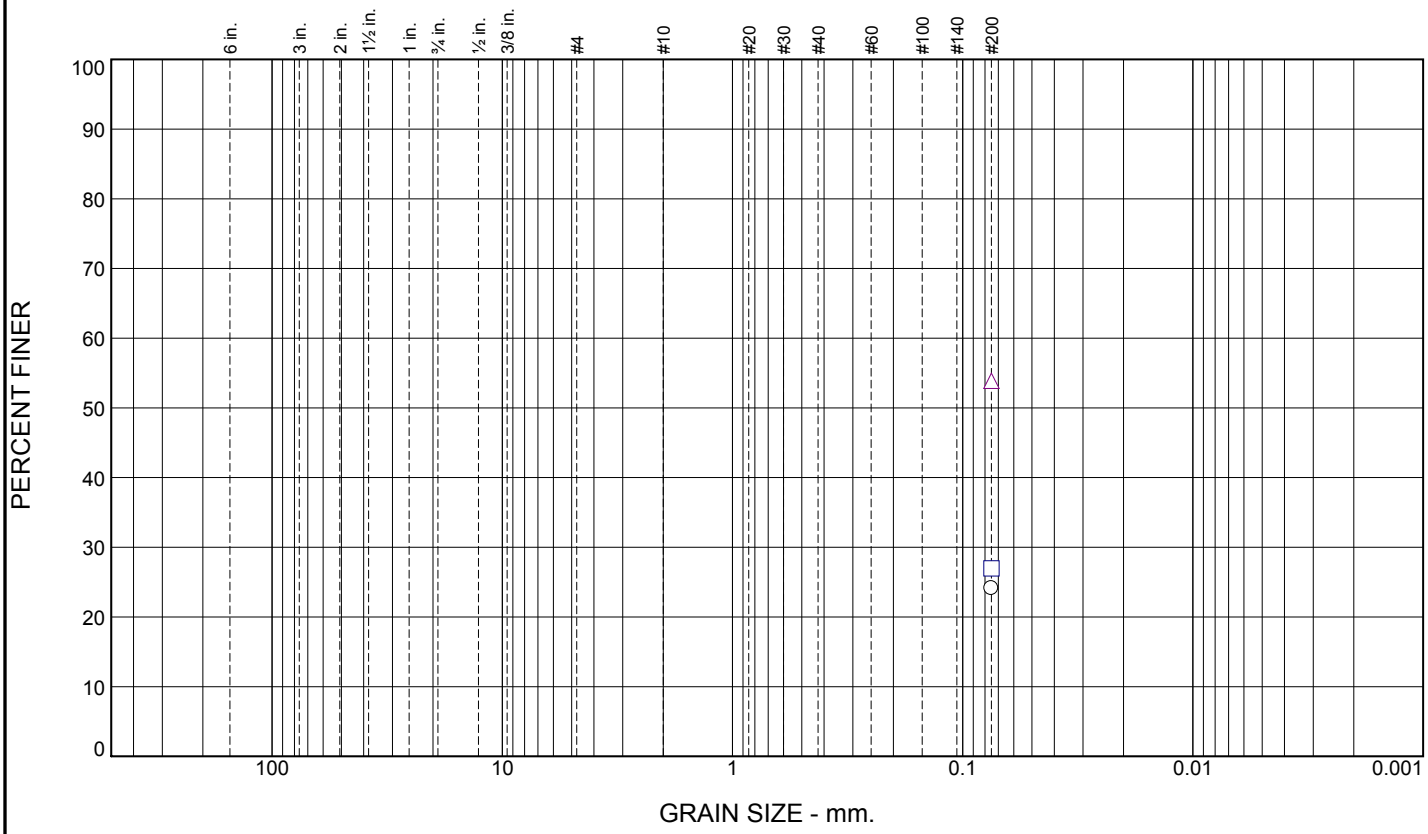
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-13

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SC-SM	25	19	6
□						GM			
△						CL	38	21	17

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	24.1	27.0	53.9

Material Description

○ SILTY, CLAYEY SAND, light olive brown

□ SILTY GRAVEL with SAND, brown

△ SANDY lean CLAY, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_025S Depth: 71.0-72.0' Sample Number: 19

□ Source of Sample: SM0007_025S Depth: 76.0-77.0' Sample Number: 21

△ Source of Sample: SM0007_012S Depth: 48.0-49.0' Sample Number: 11

Blackburn Consulting

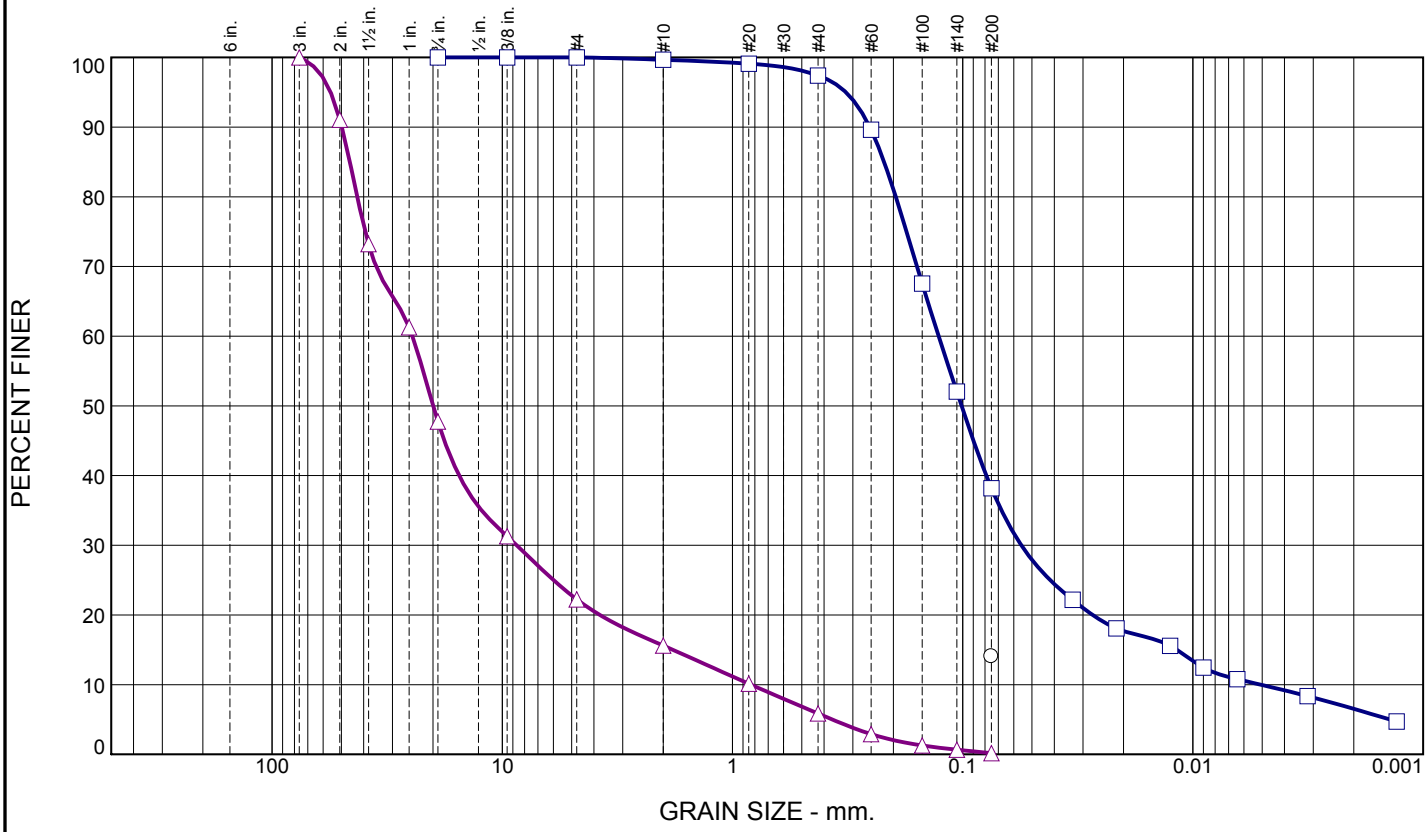
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-14

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	NV	NP	NP
□	0.0	0.0	61.8	28.3	9.9	SM			
△	0.0	77.8	22.0	0.2		GP			

SIEVE inches size	PERCENT FINER ○	□	△
3"			100.0
2"			91.1
1 1/2"			73.2
1"			61.3
3/4"		100.0	47.7
3/8"		100.0	31.3
GRAIN SIZE			
D_{60}		0.1271	24.5699
D_{30}		0.0556	8.6604
D_{10}		0.0051	0.8317
COEFFICIENTS			
C_c		4.79	3.67
C_u		25.02	29.54

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	22.2
#10		99.7	15.6
#20		99.1	10.1
#40		97.4	5.9
#60		89.6	2.9
#100		67.5	1.3
#140		52.1	0.7
#200	14.1	38.2	0.2

Material Description

○ SILTY SAND, olive brown

□ SILTY SAND, dark brown

△ Poorly-graded GRAVEL with SAND, dark olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_012S Depth: 56.0-57.0' Sample Number: 13

□ Source of Sample: SM0007_013S Depth: 4.0-5.0' Sample Number: 1

△ Source of Sample: SM0007_013S Depth: 17.0-18.0' Sample Number: 4

Blackburn Consulting

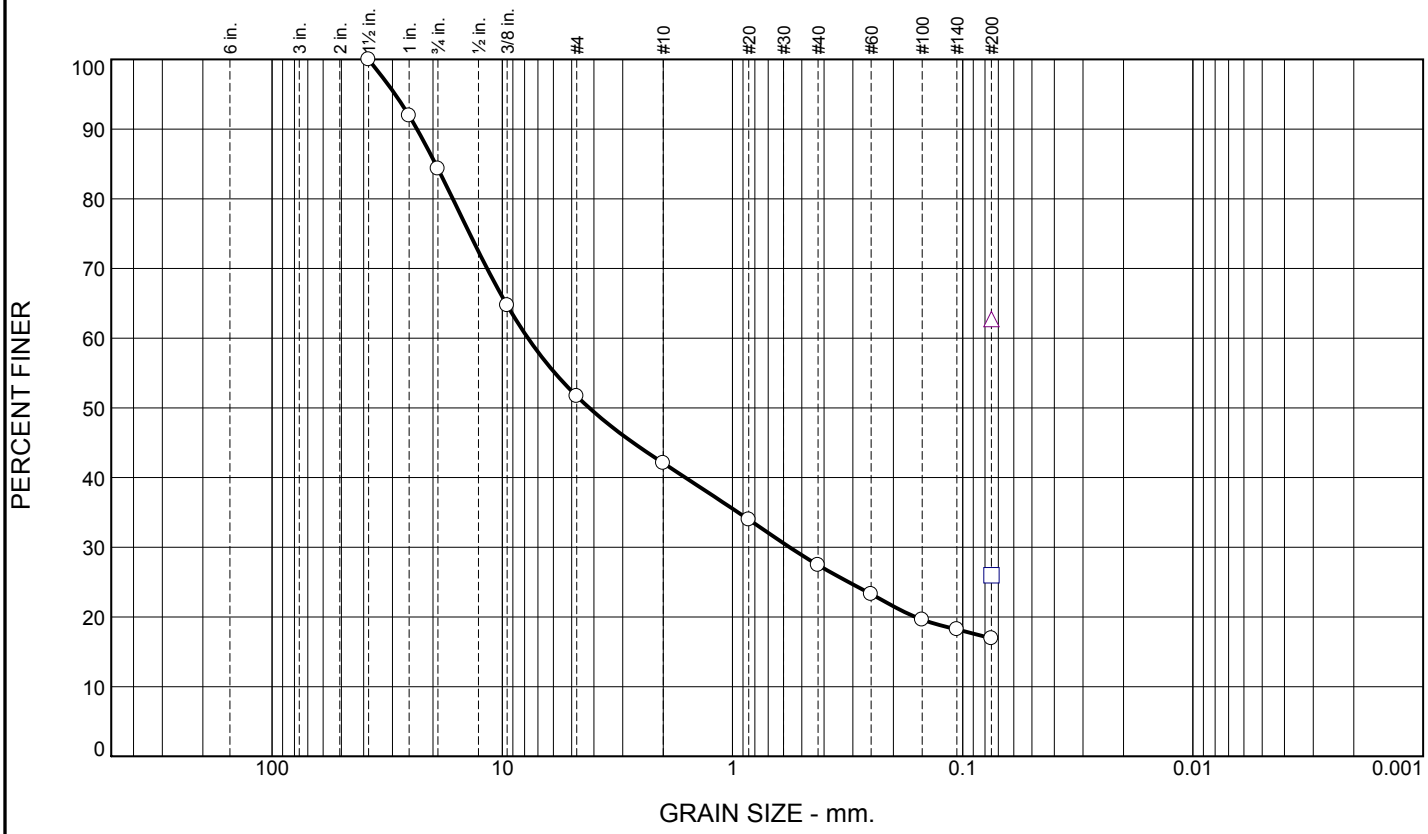
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-15

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	48.3	34.8	16.9		GM			
□						GM			
△						CL			

SIEVE inches size	PERCENT FINER ○	□	△
1 1/2"	100.0		
1"	91.9		
3/4"	84.3		
3/8"	64.7		
GRAIN SIZE			
D_{60}	7.7312		
D_{30}	0.5644		
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	51.7		
#10	42.1		
#20	34.0		
#40	27.4		
#60	23.3		
#100	19.6		
#140	18.2		
#200	16.9	26.0	62.7

Material Description

○ SILTY GRAVEL with SAND, very dark grayish brown

□ SILTY GRAVEL with SAND, dark brown

△ SANDY lean CLAY, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_013S Depth: 42.0-43.0' Sample Number: 10

□ Source of Sample: SM0007_014S Depth: 5.0-6.0' Sample Number: 1

△ Source of Sample: SM0007_014S Depth: 36.0-37.0' Sample Number: 7

Blackburn Consulting

W. Sacramento, CA

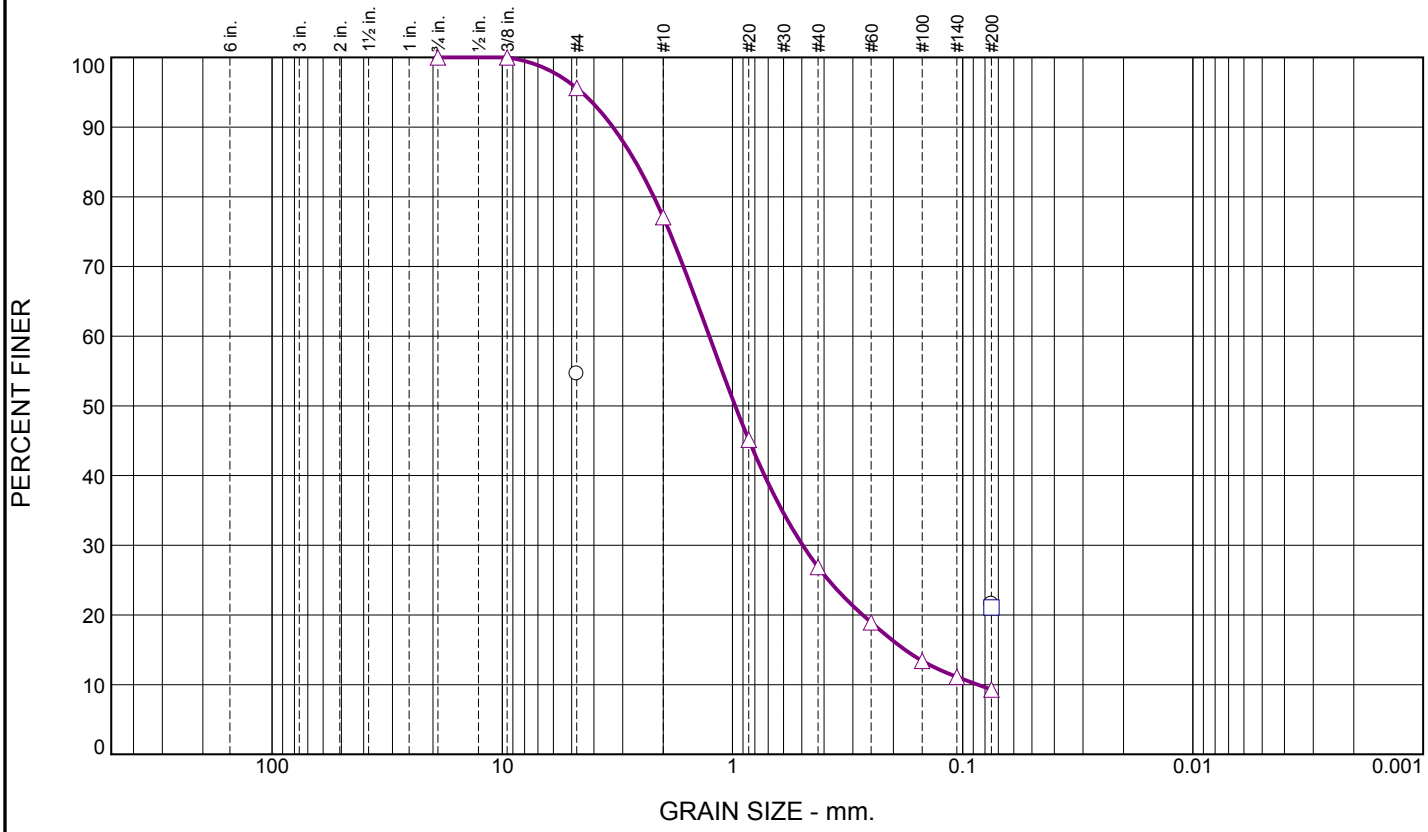
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-16

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○			33.0	21.6		GC	26	17	9
□						SM			
△	0.0	4.4	86.3	9.3		SW-SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"			100.0
3/8"			100.0
GRAIN SIZE			
D_{60}			1.2608
D_{30}	0.2155		0.4954
D_{10}			0.0860
COEFFICIENTS			
C_c			2.26
C_u			14.66

SIEVE number size	PERCENT FINER ○	□	△
#4	54.6		95.6
#10			77.1
#20			45.2
#40			26.9
#60			18.9
#100			13.4
#140			11.1
#200	21.6	21.1	9.3

Material Description

○ CLAYEY GRAVEL with SAND, olive gray

□ SILTY SAND, dark grayish brown

△ Well-graded SAND with SILT, dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_014S Depth: 57.0-58.0' Sample Number: 11

□ Source of Sample: SM0007_015S Depth: 29.0-30.0' Sample Number: 3

△ Source of Sample: SM0007_015S Depth: 34.0-35.0' Sample Number: 4

Blackburn Consulting

W. Sacramento, CA

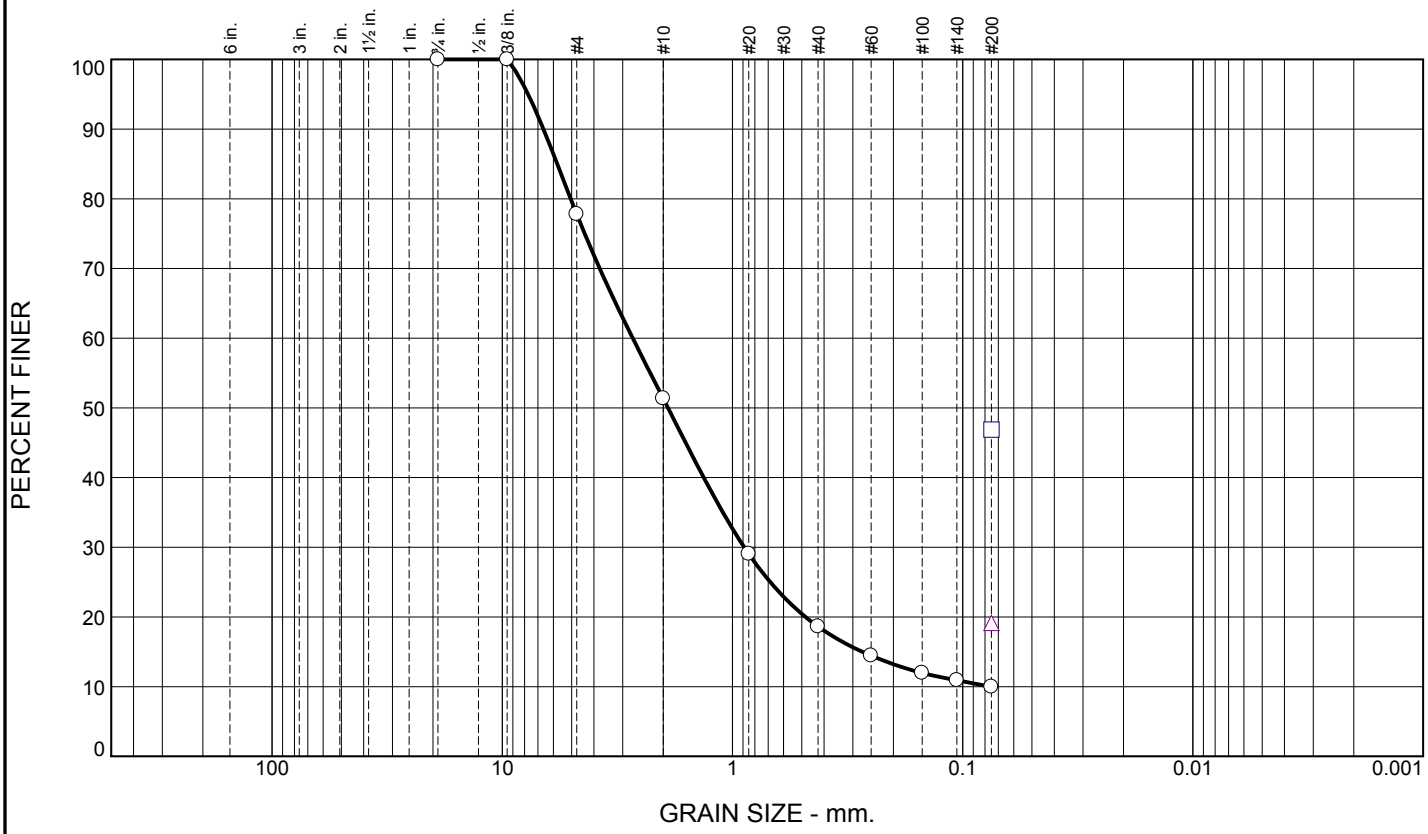
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-17

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	22.2	67.8	10.0		SP-SC			
□						SM	19	20	NP
△						GM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
3/8"	100.0		

	GRAIN SIZE		
D_{60}	2.7120		
D_{30}	0.8886		
D_{10}	0.0755		

	COEFFICIENTS		
C_c	3.86		
C_u	35.93		

SIEVE number size	PERCENT FINER ○	□	△
#4	77.8		
#10	51.4		
#20	29.1		
#40	18.6		
#60	14.5		
#100	12.0		
#140	10.9		
#200	10.0	46.9	19.1

Material Description

○ Poorly-graded SAND with CLAY and GRAVEL, olive brown

□ SILTY SAND, olive brown

△ SILTY GRAVEL with SAND, very dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_015S Depth: 39.0-40.0' Sample Number: 5

□ Source of Sample: SM0007_015S Depth: 60.0-61.0' Sample Number: 10

△ Source of Sample: SM0007_015S Depth: 63.0-64.0' Sample Number: 11

Blackburn Consulting

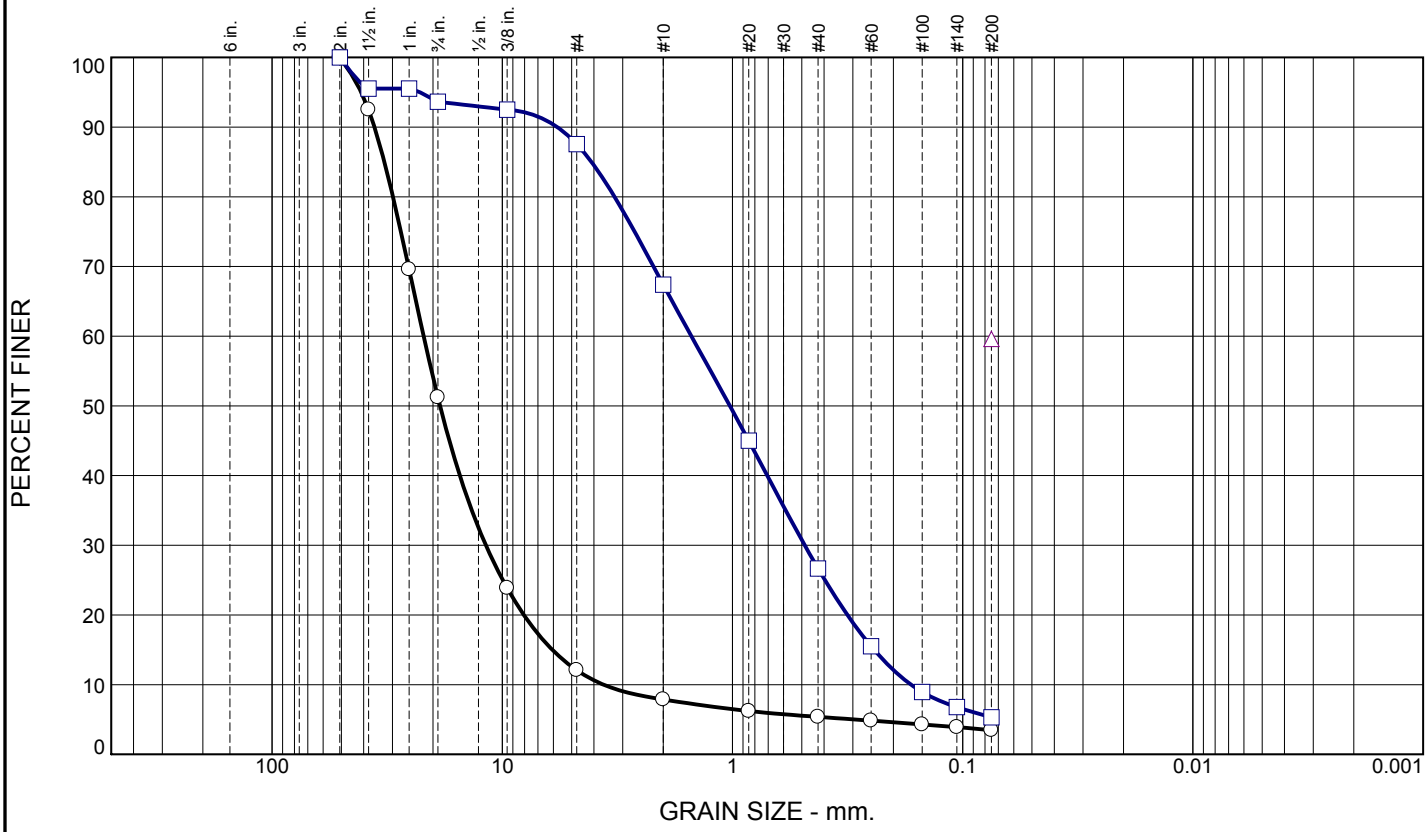
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-18

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	87.9	8.6	3.5		GW			
□	0.0	12.4	82.3	5.3		SP-SM			
△						ML	26	26	NP

SIEVE inches size	PERCENT FINER ○	□	△
2"	100.0	100.0	
1 1/2"	92.5	95.5	
1"	69.6	95.5	
3/4"	51.2	93.6	
3/8"	23.9	92.5	
	GRAIN SIZE		
D_{60}	21.9606	1.5082	
D_{30}	11.7862	0.4855	
D_{10}	3.6337	0.1676	
	COEFFICIENTS		
C_c	1.74	0.93	
C_u	6.04	9.00	

SIEVE number size	PERCENT FINER ○	□	△
#4	12.1	87.6	
#10	7.9	67.4	
#20	6.2	45.0	
#40	5.4	26.7	
#60	4.8	15.5	
#100	4.3	9.0	
#140	3.9	6.8	
#200	3.5	5.3	59.6

Material Description

○ Well-graded GRAVEL, very dark grayish brown

□ Poorly-graded SAND with SILT, dark olive brown

△ SANDY SILT, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_016S Depth: 6.0-7.0' Sample Number: 1

□ Source of Sample: SM0007_016S Depth: 37.0-38.0' Sample Number: 2

△ Source of Sample: SM0007_016S Depth: 46.0-47.0' Sample Number: 5

Blackburn Consulting

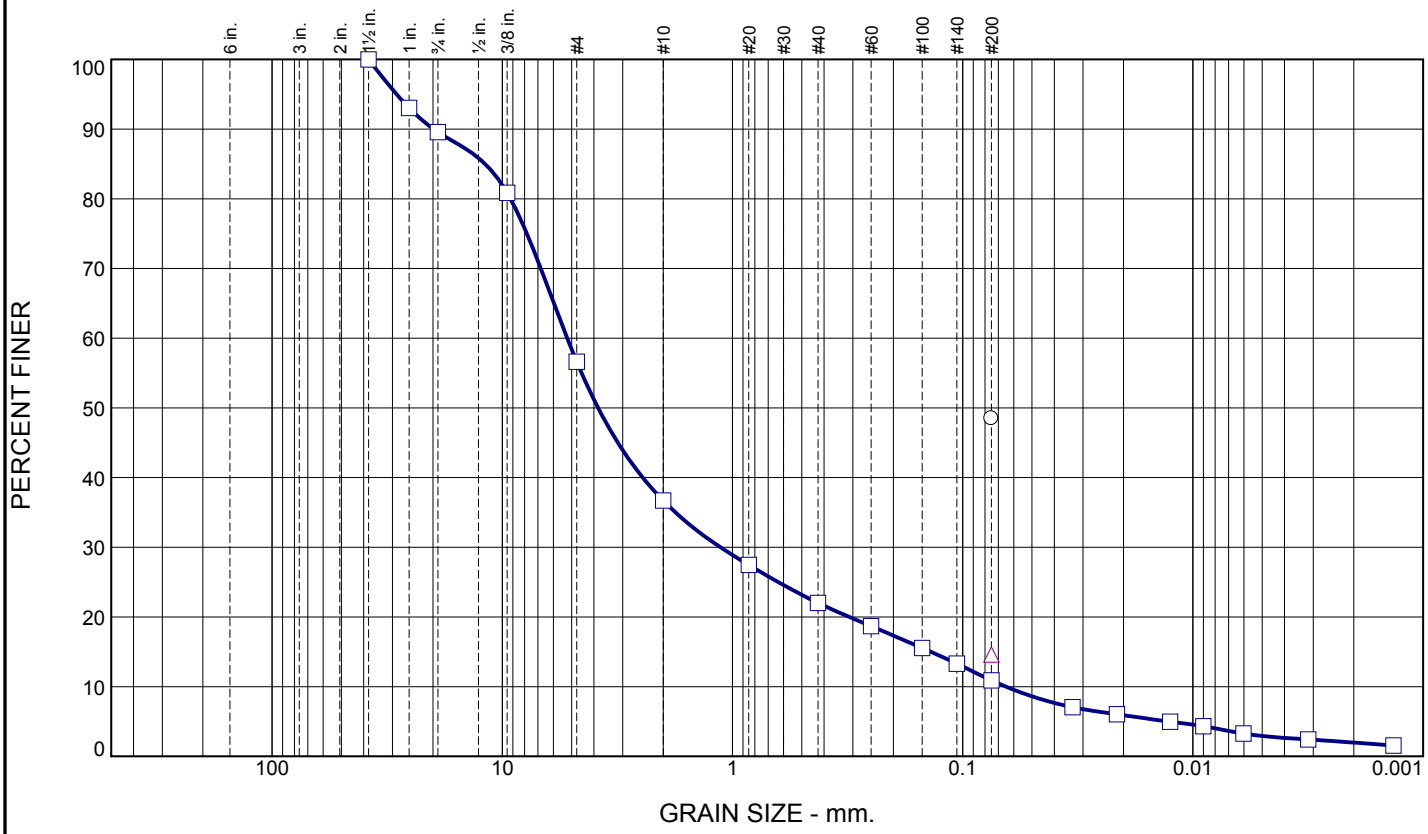
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-19

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□	0.0	43.4	45.7	8.0	2.9	SP-SM			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
1 1/2"		100.0	
1"		93.0	
3/4"		89.6	
3/8"		80.9	
GRAIN SIZE			
D_{60}		5.2225	
D_{30}		1.1276	
D_{10}		0.0649	
COEFFICIENTS			
C_c		3.75	
C_u		80.42	

SIEVE number size	PERCENT FINER ○	□	△
#4		56.6	
#10		36.7	
#20		27.5	
#40		22.0	
#60		18.7	
#100		15.5	
#140		13.3	
#200	48.5	10.9	14.6

Material Description

○ SILTY SAND, dark brown

□ Poorly-graded SAND with SILT and GRAVEL, dark grayish brown

△ SILTY SAND, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_016S Depth: 57.0-58.0' Sample Number: 7

□ Source of Sample: SM0007_017S Depth: 30.0-31.0' Sample Number: 3

△ Source of Sample: SM0007_018S Depth: 22.0-23.0' Sample Number: 2

Blackburn Consulting

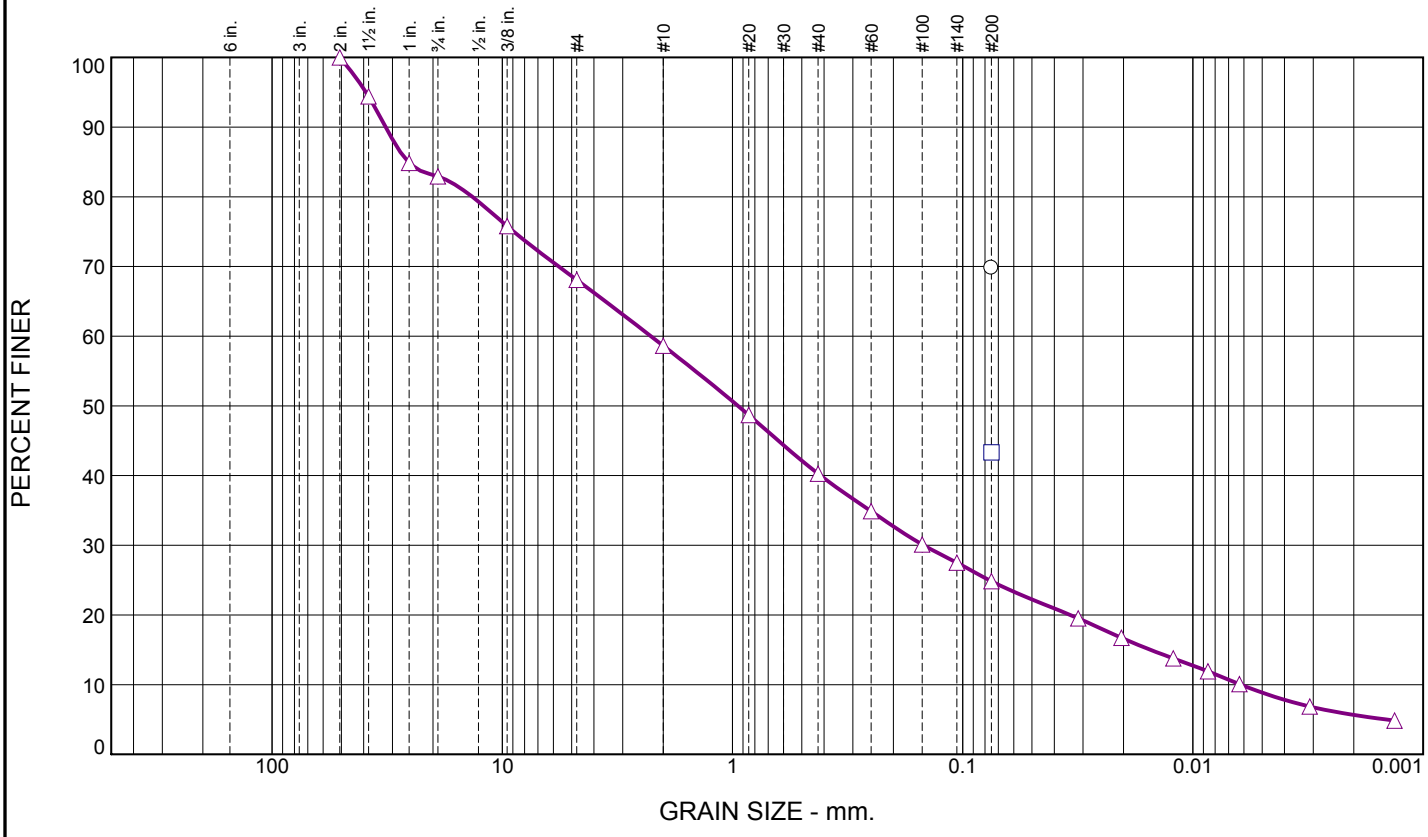
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-20

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						SM	69	40	29
△	0.0	31.9	43.3	15.9	8.9	SM			

SIEVE inches size	PERCENT FINER ○	□	△
2"			100.0
1 1/2"			94.4
1"			84.9
3/4"			82.9
3/8"			75.8
GRAIN SIZE			
D_{60}			2.2614
D_{30}			0.1479
D_{10}			0.0062
COEFFICIENTS			
C_c			1.56
C_u			365.09

SIEVE number size	PERCENT FINER ○	□	△
#4			68.1
#10			58.6
#20			48.7
#40			40.3
#60			34.9
#100			30.1
#140			27.5
#200	69.8	43.3	24.8

Material Description

○ SANDY SILT, brown

□ SILTY SAND, light reddish brown

△ SILTY SAND with GRAVEL, olive brown

REMARKS:

○

□ cemented particles reatained above #200 sieve fines classified as Elastic SILT (MH)

△

○ Source of Sample: SM0007_018S Depth: 33.0-34.0' Sample Number: 5

□ Source of Sample: SM0007_018S Depth: 58.0-59.0' Sample Number: 10

△ Source of Sample: SM0007_019S Depth: 14.0-15.0' Sample Number: 2

Blackburn Consulting

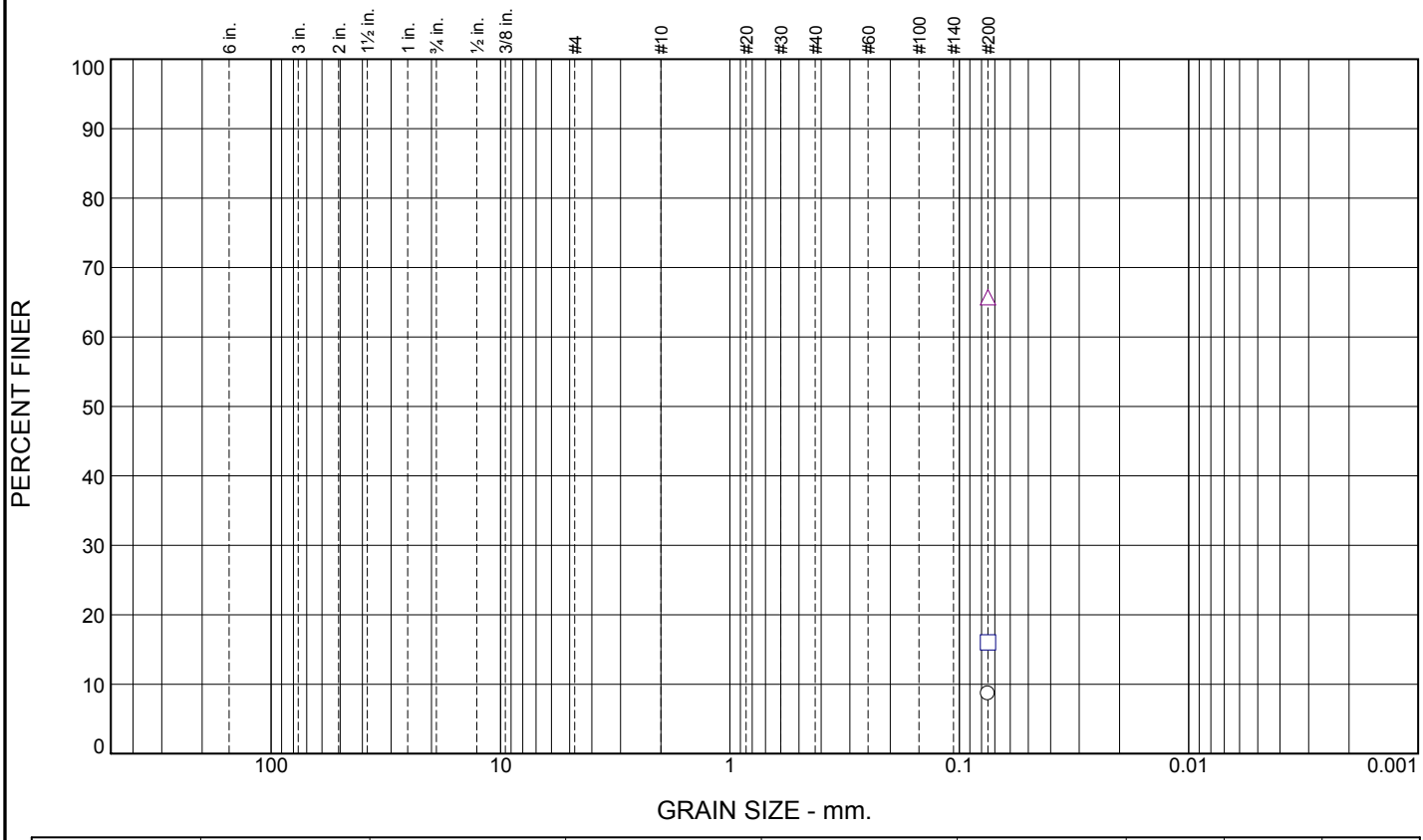
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-21

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP-SC			
□						SM			
△						CL	26	16	10

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	8.7	16.0	65.7

Material Description

○ Poorly-graded SAND with CLAY and GRAVEL, dark olive brown

□ SILTY SAND, olive brown

△ SANDY lean CLAY, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_019S Depth: 19.0-20.0' Sample Number: 3

□ Source of Sample: SM0007_019S Depth: 29.0-30.0' Sample Number: 5

△ Source of Sample: SM0007_020S Depth: 6.0-7.0' Sample Number: 1

Blackburn Consulting

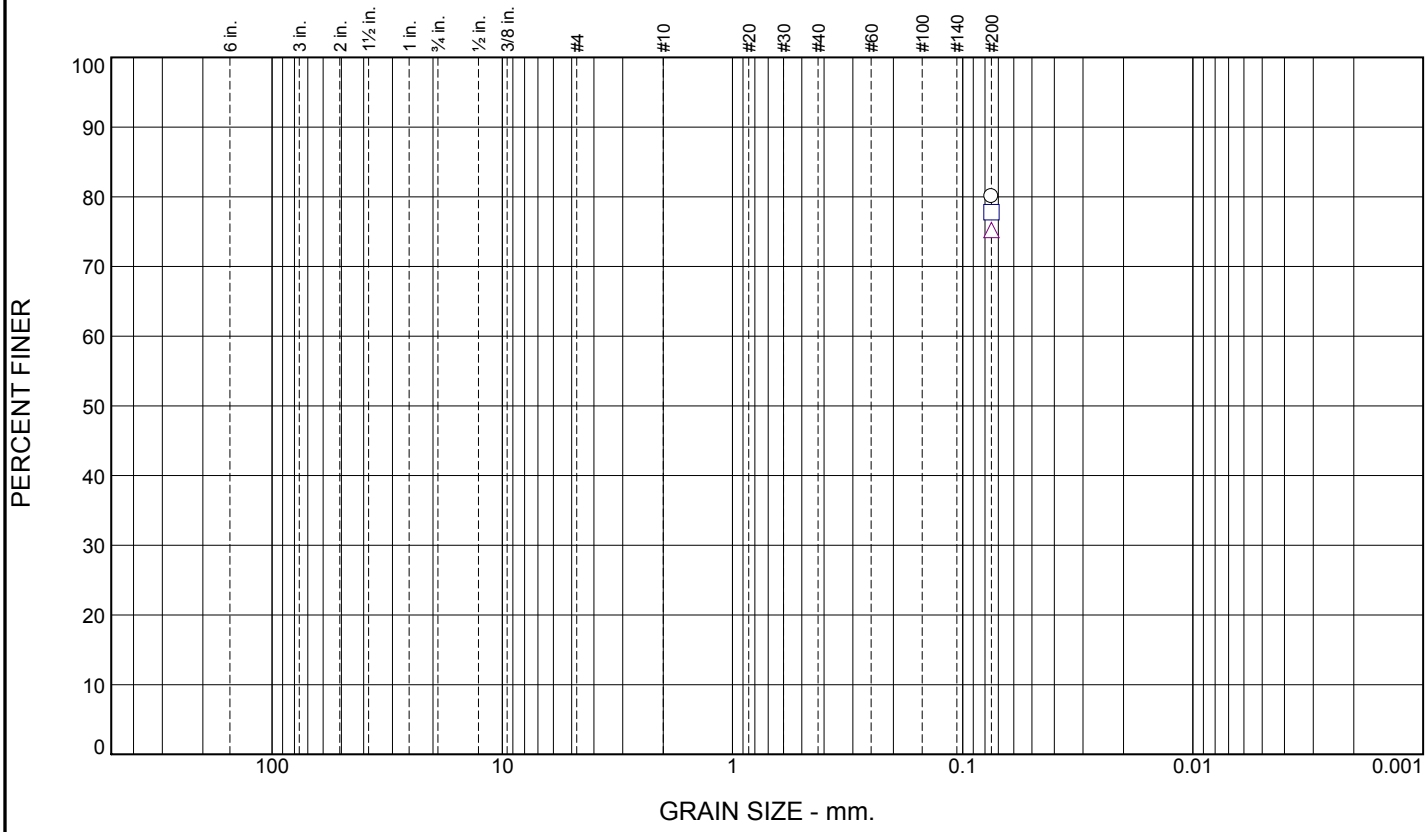
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-22

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	36	17	19
□						CL	28	16	12
△						CL-ML	25	19	6

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	80.1	77.8	75.2

Material Description

○ Lean CLAY with SAND, dark yellowish brown

□ Lean CLAY with SAND, dark reddish brown

△ SILTY CLAY with SAND, very dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_020S Depth: 13.0-14.0' Sample Number: 2

□ Source of Sample: SM0007_020S Depth: 19.0-20.0' Sample Number: 3

△ Source of Sample: SM0007_020S Depth: 34.0-35.0' Sample Number: 6

Blackburn Consulting

W. Sacramento, CA

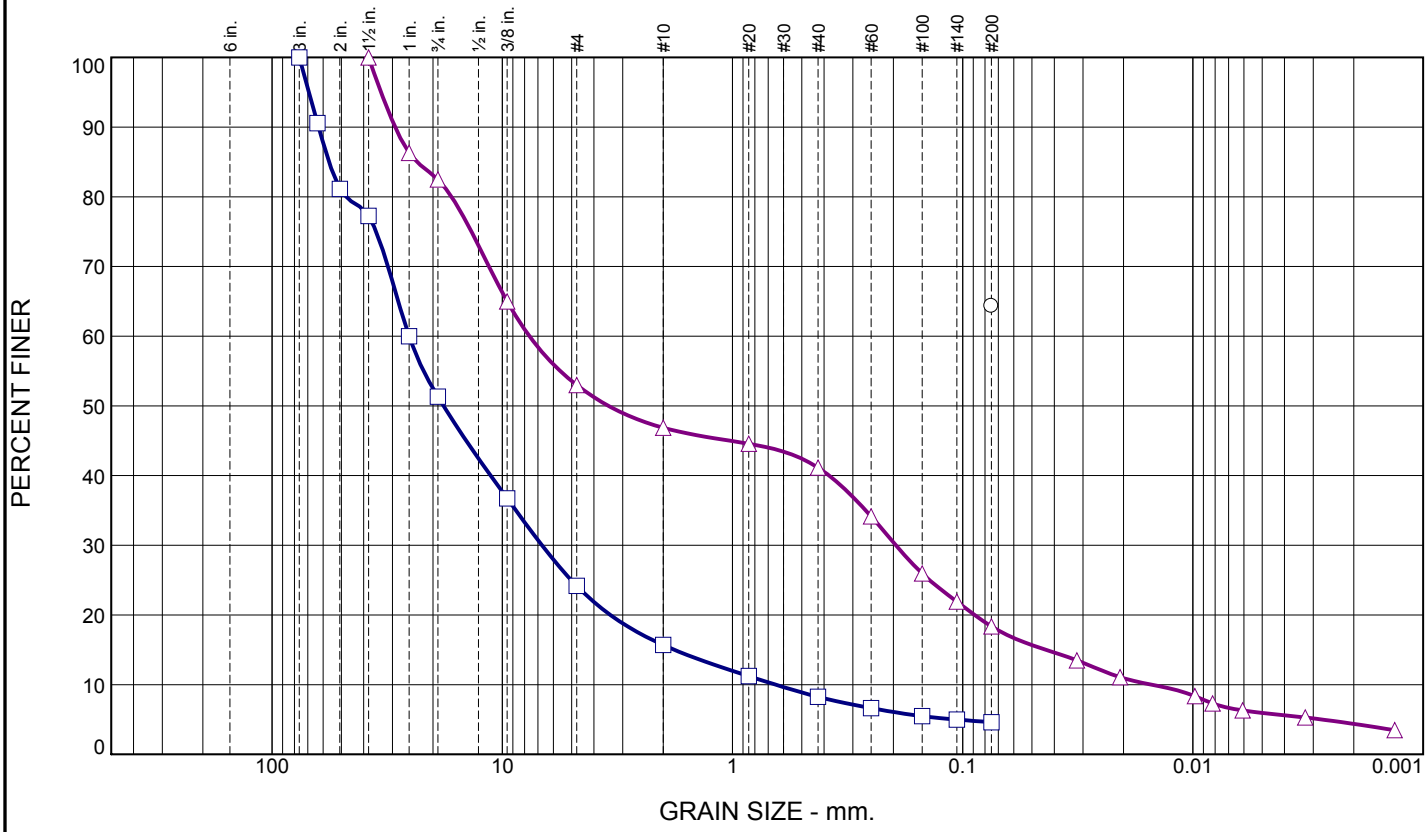
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-23

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL-ML	26	21	5
□	0.0	75.8	19.6	4.6		GW			
△	0.0	47.0	34.6	12.4	6.0	GM			

SIEVE inches size	PERCENT FINER ○	□	△
3"		100.0	
2 1/2"		90.6	
2"		81.1	
1 1/2"		77.3	100.0
1"		60.0	86.3
3/4"		51.3	82.5
3/8"		36.7	65.0
GRAIN SIZE			
D_{60}		25.4008	7.6202
D_{30}		6.7223	0.1950
D_{10}		0.6492	0.0151
COEFFICIENTS			
C_c		2.74	0.33
C_u		39.12	503.42

SIEVE number size	PERCENT FINER ○	□	△
#4		24.2	53.0
#10		15.7	46.9
#20		11.2	44.6
#40		8.3	41.1
#60		6.6	34.1
#100		5.5	26.0
#140		5.0	21.9
#200	64.3	4.6	18.4

Material Description

○ SANDY SILTY CLAY, dark yellowish brown

□ Well-graded GRAVEL with SAND, dark olive gray

△ SILTY GRAVEL with SAND, brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_020S Depth: 60.0-61.0' Sample Number: 9

□ Source of Sample: SM0007_021S Depth: 8.0-9.0' Sample Number: 2

△ Source of Sample: SM0007_021S Depth: 25.0-26.0' Sample Number: 4

Blackburn Consulting

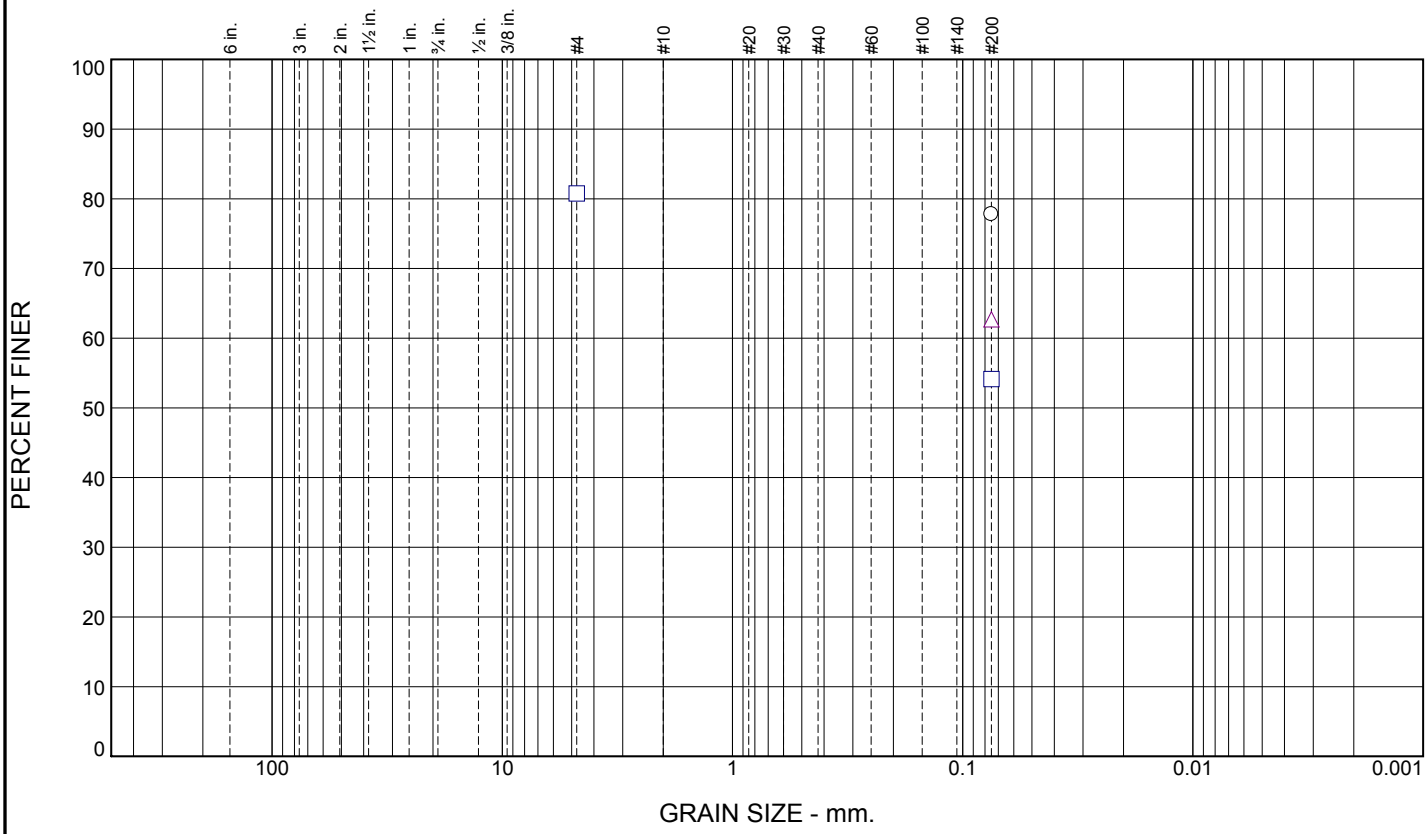
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-24

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	33	16	17
□			26.7	54.1		CL	32	17	15
△						CL	29	18	11

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}		0.1869	
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		80.8	
#200	77.8	54.1	62.7

Material Description

○ Lean CLAY with SAND, dark yellowish brown

□ SANDY CLAY with GRAVEL, dark brown

△ SANDY lean CLAY, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_022S Depth: 6.0-7.0' Sample Number: 1

□ Source of Sample: SM0007_022S Depth: 17.0-18.0' Sample Number: 3

△ Source of Sample: SM0007_022S Depth: 23.0-24.0' Sample Number: 4

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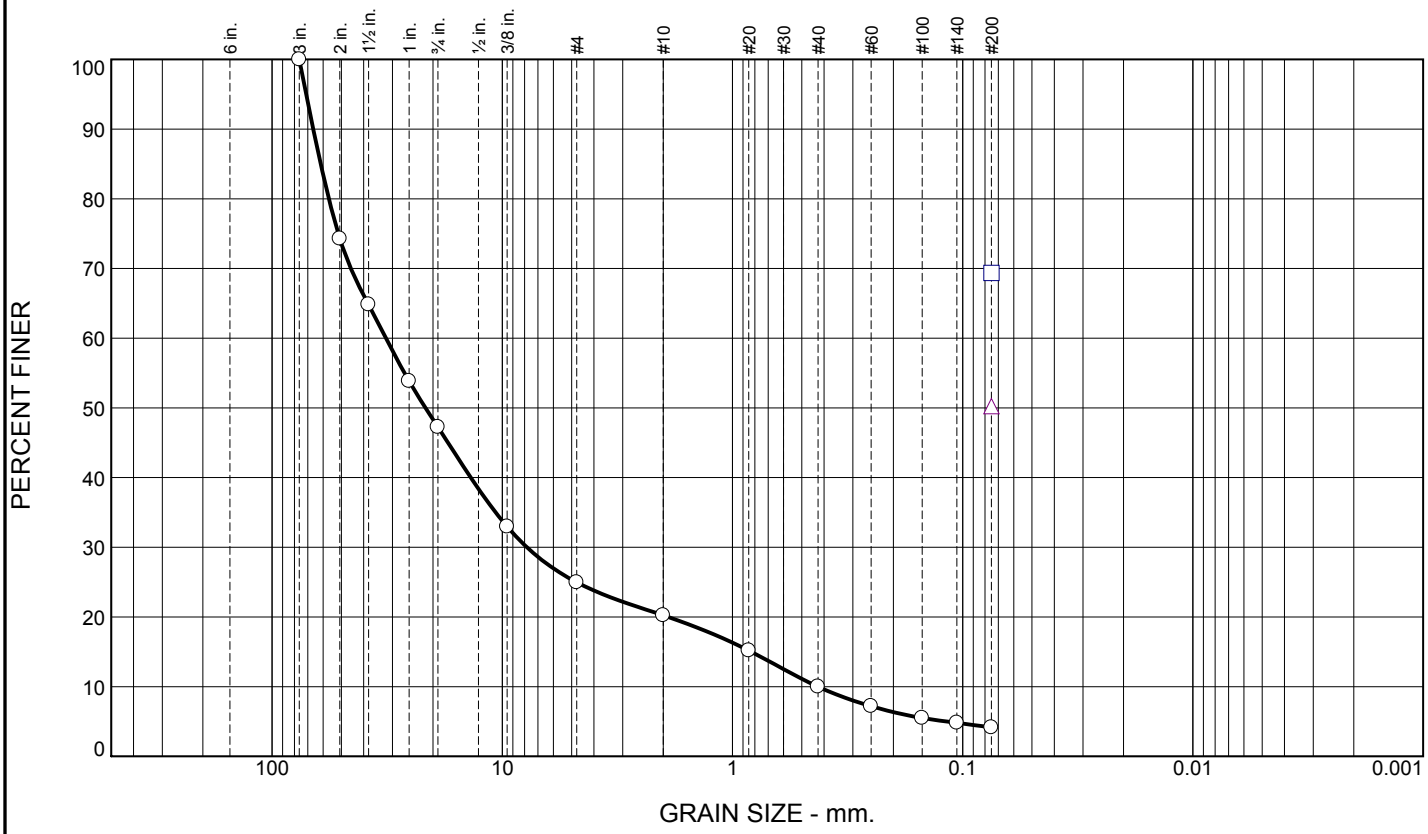
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-25

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	75.0	20.8	4.2		GP			
□						CL	29	16	13
△						CL	33	19	14

SIEVE inches size	PERCENT FINER ○	□	△
3"	100.0		
2"	74.3		
1 1/2"	64.8		
1"	53.8		
3/4"	47.3		
3/8"	33.0		
	GRAIN SIZE		
D_{60}	32.0127		
D_{30}	7.8133		
D_{10}	0.4256		
	COEFFICIENTS		
C_c	4.48		
C_u	75.23		

SIEVE number size	PERCENT FINER ○	□	△
#4	25.0		
#10	20.2		
#20	15.2		
#40	10.0		
#60	7.2		
#100	5.5		
#140	4.8		
#200	4.2	69.4	50.3

Material Description

○ Poorly-graded GRAVEL with SAND, olive gray

□ SANDY lean CLAY, brown

△ SANDY lean CLAY, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_022S Depth: 37.0-38.0' Sample Number: 6

□ Source of Sample: SM0007_007H Depth: 7.0-8.0' Sample Number: 2

△ Source of Sample: SM0007_023S Depth: 5.0-6.0' Sample Number: 1

Blackburn Consulting

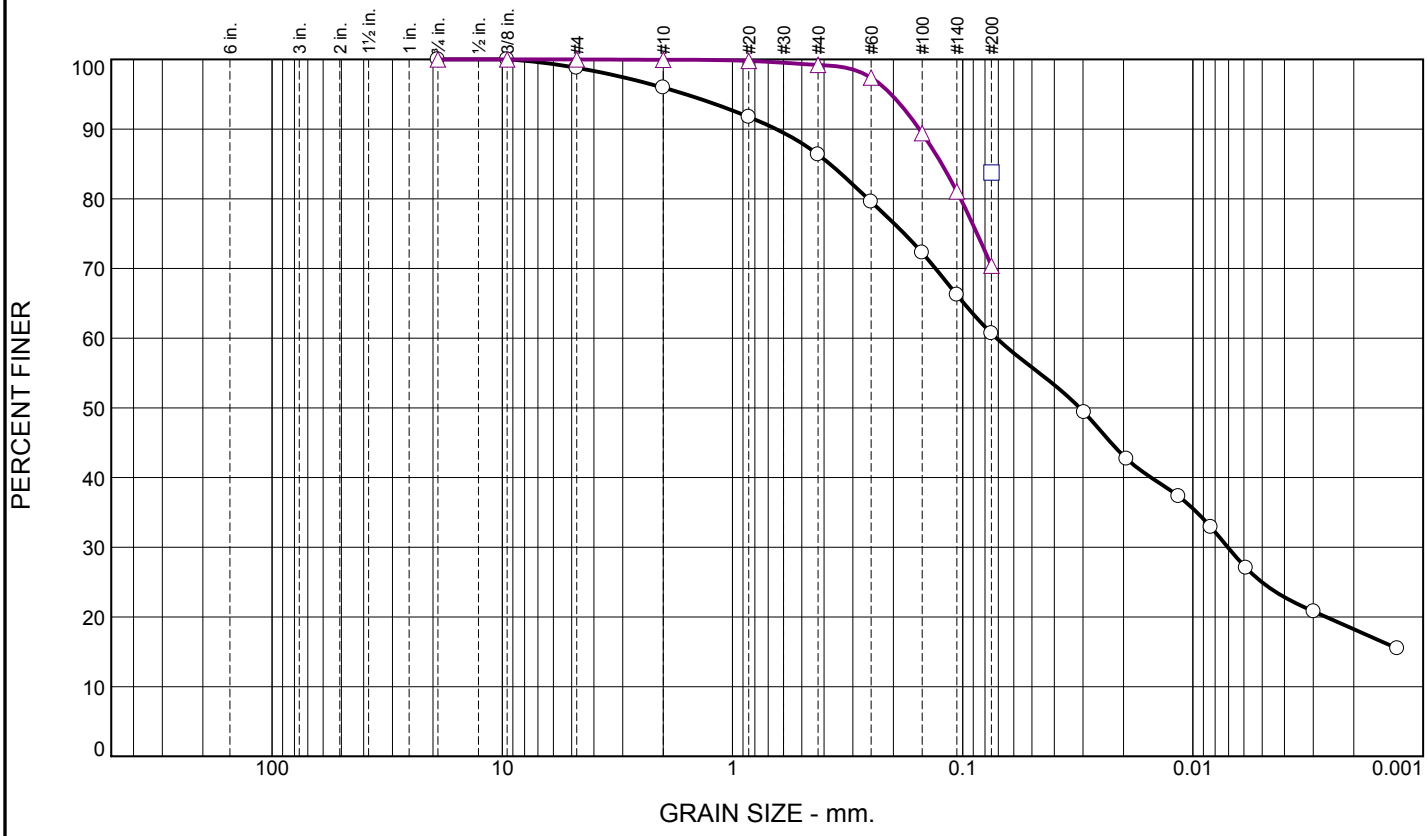
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-26

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	1.2	38.1	35.7	25.0	ML			
□						CL			
△	0.0	0.0	29.6	70.4		CL	33	17	16

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		100.0
3/8"	100.0		100.0
GRAIN SIZE			
D_{60}	0.0712		
D_{30}	0.0070		
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	98.8		100.0
#10	96.0		99.9
#20	91.8		99.8
#40	86.4		99.2
#60	79.6		97.4
#100	72.3		89.4
#140	66.2		81.1
#200	60.7	83.8	70.4

Material Description

○ SANDY SILT, dark yellowish brown

□ Lean CLAY with SAND, dark brown

△ Lean CLAY with SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_023S Depth: 10.0-11.0' Sample Number: 2

□ Source of Sample: SM0007_023S Depth: 22.0-23.0' Sample Number: 5

△ Source of Sample: SM0007_023S Depth: 27.0-28.0' Sample Number: 6

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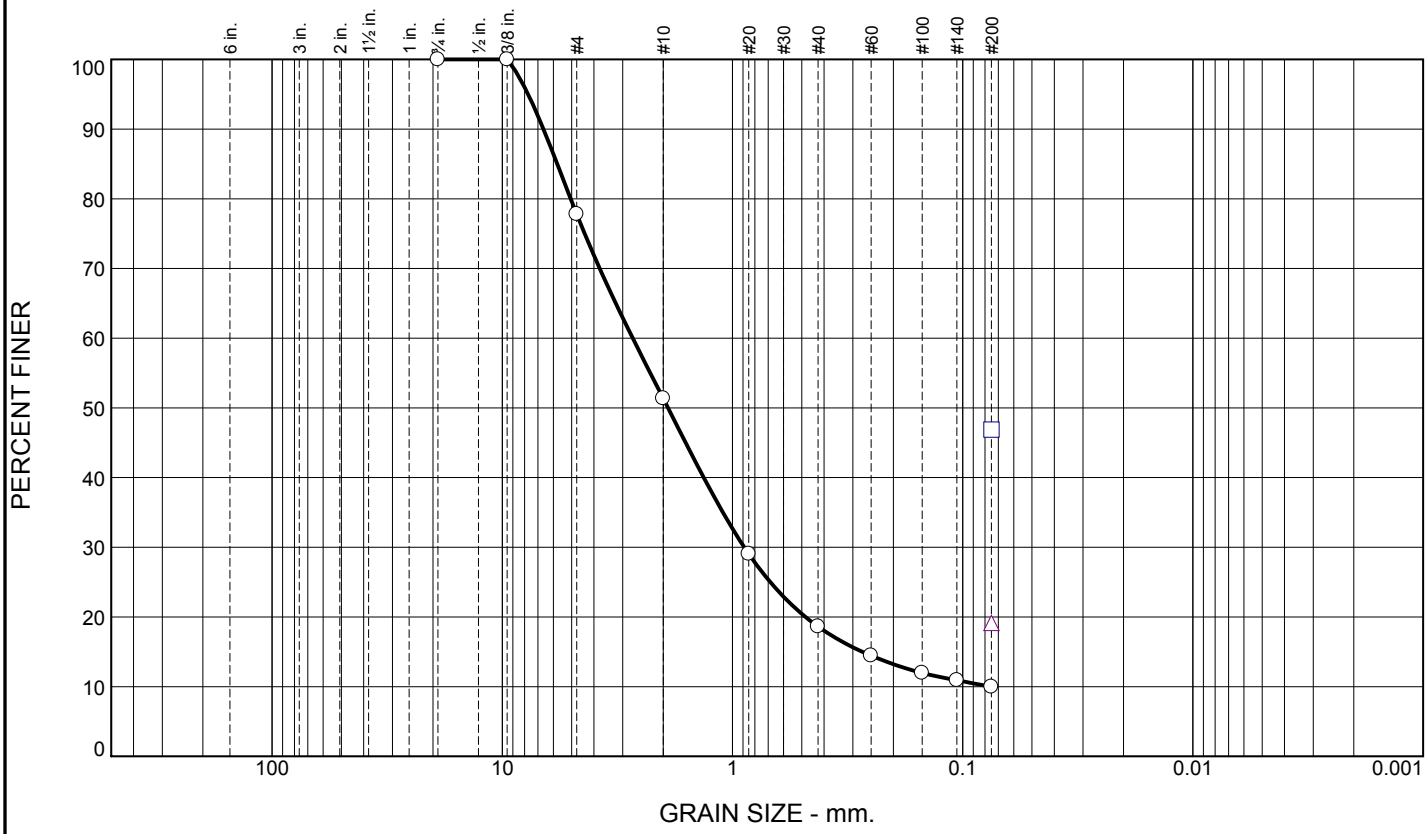
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Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-27

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	22.2	67.8	10.0		SP-SC			
□						SM	19	20	NP
△						GM			

SIEVE inches size	○	□	△
3/4"	100.0		
3/8"	100.0		

GRAIN SIZE	○	□	△
D_{60}	2.7120		
D_{30}	0.8886		
D_{10}	0.0755		

COEFFICIENTS	○	□	△
C_c	3.86		
C_u	35.93		

SIEVE number size	○	□	△
#4	77.8		
#10	51.4		
#20	29.1		
#40	18.6		
#60	14.5		
#100	12.0		
#140	10.9		
#200	10.0	46.9	19.1

Material Description

○ Poorly-graded SAND with CLAY and GRAVEL, olive brown

□ SILTY SAND, olive brown

△ SILTY GRAVEL with SAND, very dark grayish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_015S Depth: 39.0-40.0' Sample Number: 5

□ Source of Sample: SM0007_015S Depth: 60.0-61.0' Sample Number: 10

△ Source of Sample: SM0007_015S Depth: 63.0-64.0' Sample Number: 11

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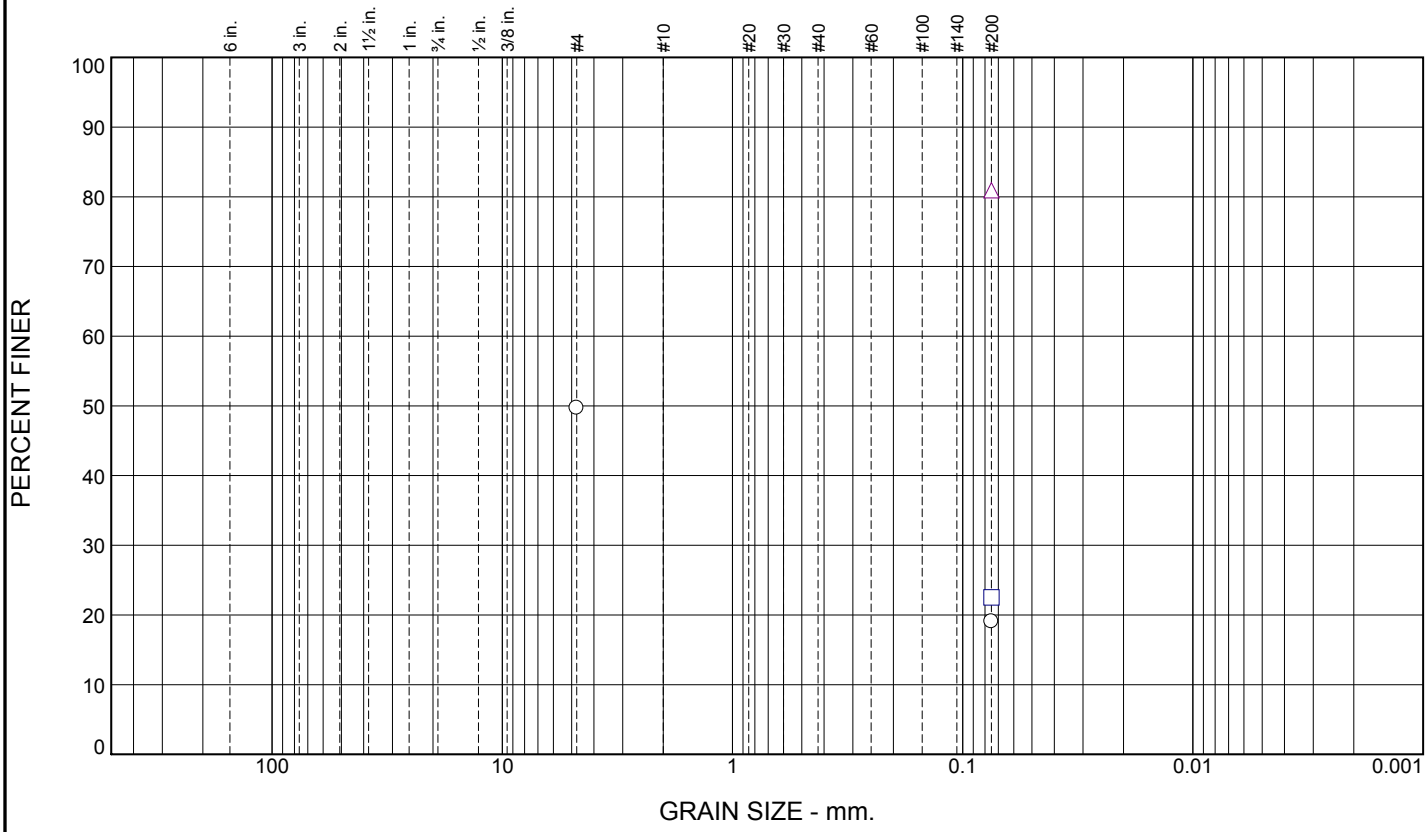
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-18

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○			30.6	19.1		GC	35	18	17
□						GC			
△						CL	28	17	11

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}	0.3296		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	49.7		
#200	19.1	22.5	80.9

Material Description

○ CLAYEY GRAVEL with SAND, dark olive brown

□ CLAYEY GRAVEL with SAND, olive brown

△ Lean CLAY with SAND, brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_023S Depth: 77.0-78.0' Sample Number: 16

□ Source of Sample: SM0007_023S Depth: 82.0-83.0' Sample Number: 17

△ Source of Sample: SM0007_017A Depth: 3.0-4.0' Sample Number: 1

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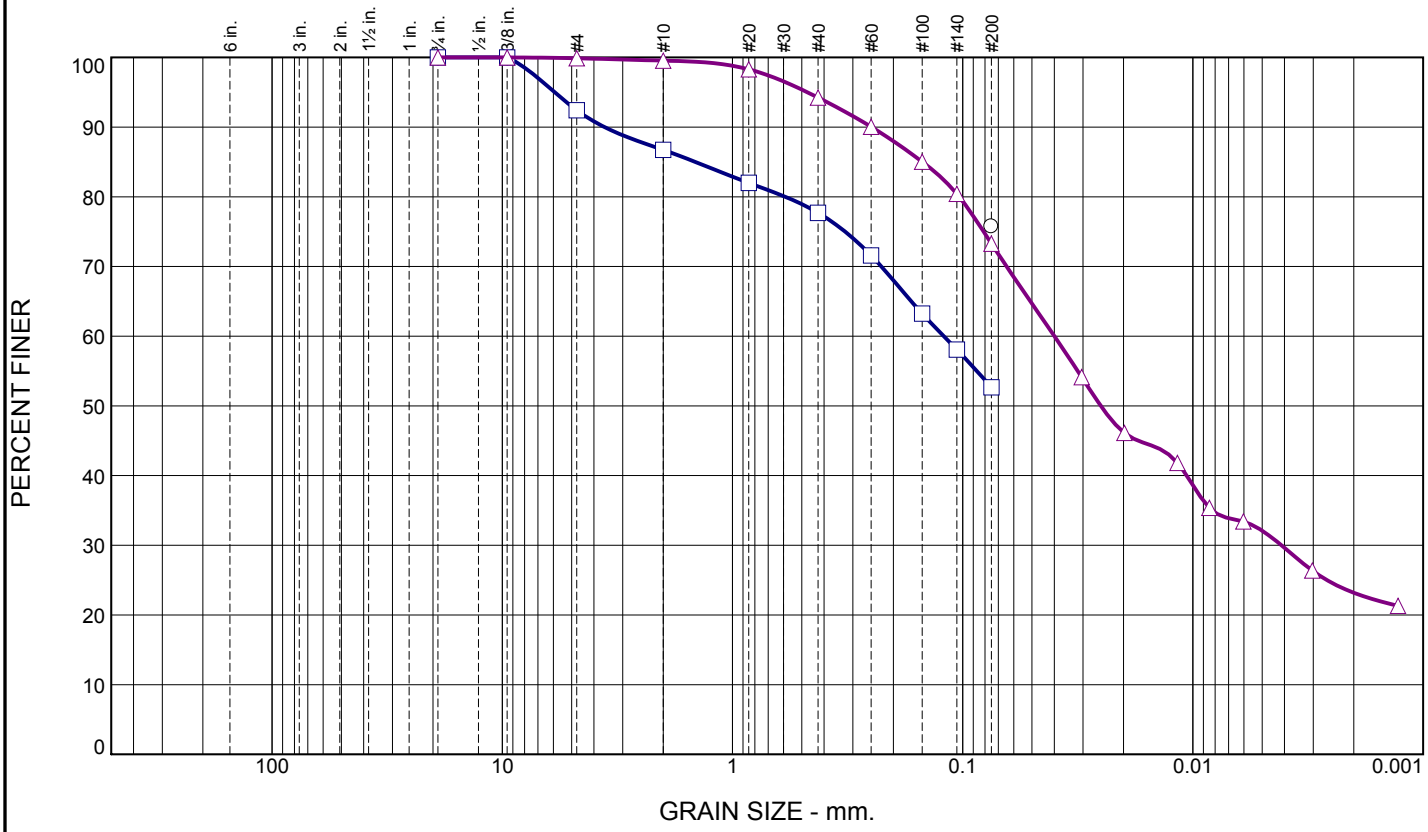
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-29

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	31	18	13
□	0.0	7.6	39.7	52.7		CL	36	18	18
△	0.0	0.1	26.6	41.2	32.1	CL			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	100.0
3/8"		100.0	100.0
GRAIN SIZE			
D_{60}		0.1208	0.0400
D_{30}			0.0041
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		92.4	99.9
#10		86.7	99.5
#20		82.0	98.3
#40		77.7	94.2
#60		71.6	90.1
#100		63.2	85.0
#140		58.1	80.4
#200	75.7	52.7	73.3

Material Description

○ Lean CLAY with SAND, brown

□ SANDY lean CLAY, dark yellowish brown

△ Lean CLAY with SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_017A Depth: 8.0-9.0' Sample Number: 2

□ Source of Sample: SM0007_024S Depth: 10.0-11.0' Sample Number: 3

△ Source of Sample: SM0007_024S Depth: 24.0-25.0' Sample Number: 6

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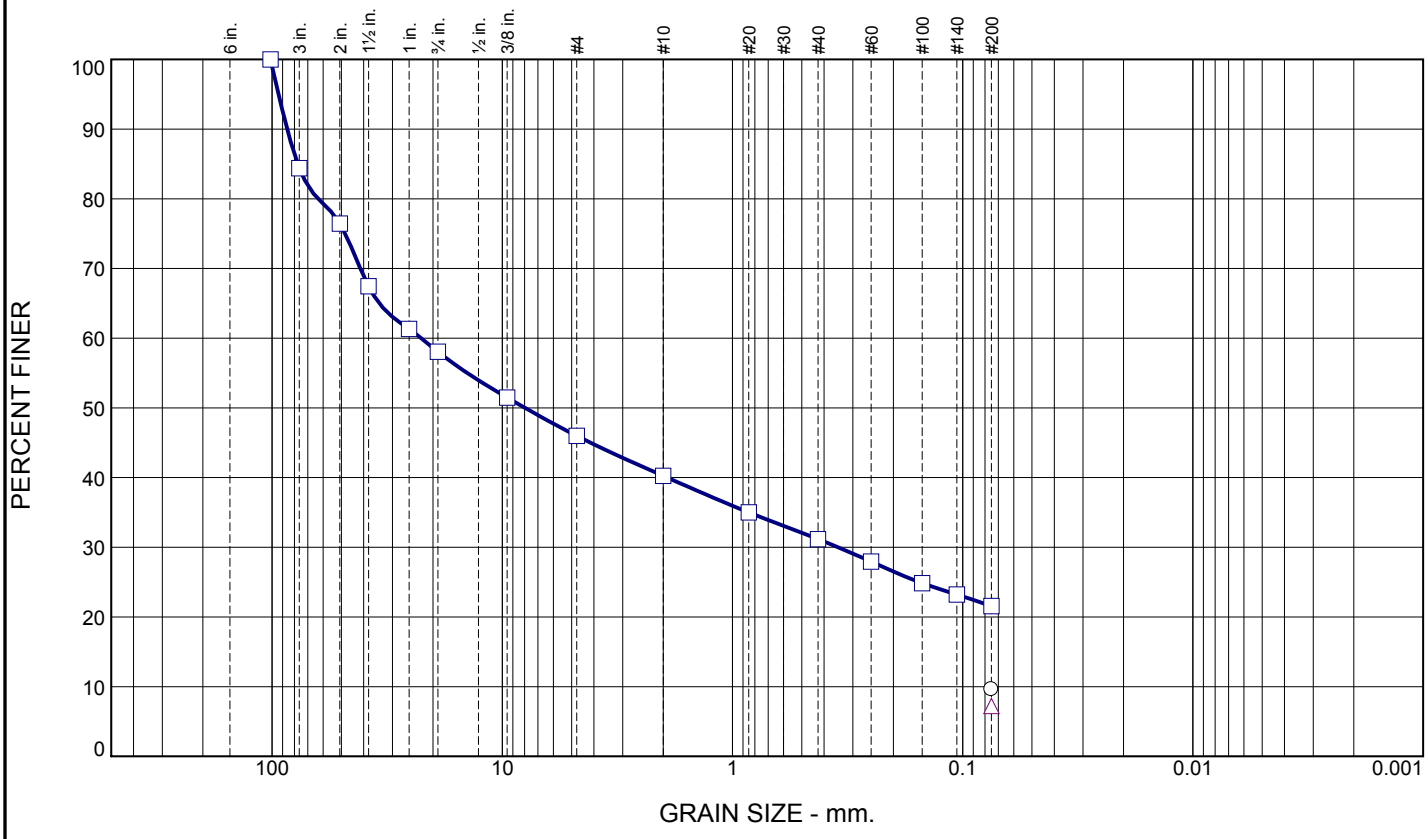
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS5-30

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SP-SM			
□	15.6	38.4	24.4	21.6		GC-GM	19	14	5
△						GP-GM			

SIEVE inches size	○ PERCENT FINER	□ PERCENT FINER	△ PERCENT FINER
4"		100.0	
3"		84.4	
2"		76.5	
1 1/2"		67.5	
1"		61.3	
3/4"		58.1	
3/8"		51.5	
GRAIN SIZE			
D_{60}		22.5086	
D_{30}		0.3482	
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	○ PERCENT FINER	□ PERCENT FINER	△ PERCENT FINER
#4		46.0	
#10		40.3	
#20		35.0	
#40		31.2	
#60		28.0	
#100		24.9	
#140		23.2	
#200	9.6	21.6	7.2

Material Description

○ Poorly-graded SAND with SILT and GRAVEL, dark olive brown

□ SILTY CLAYEY GRAVEL with SAND, olive

△ Poorly-graded GRAVEL with SILT and SAND, dark brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_024S Depth: 27.0-28.0' Sample Number: 7

□ Source of Sample: SM0007_024S Depth: 41.0-42.0' Sample Number: 10

△ Source of Sample: SM0007_024S Depth: 46.0-47.0' Sample Number: 11

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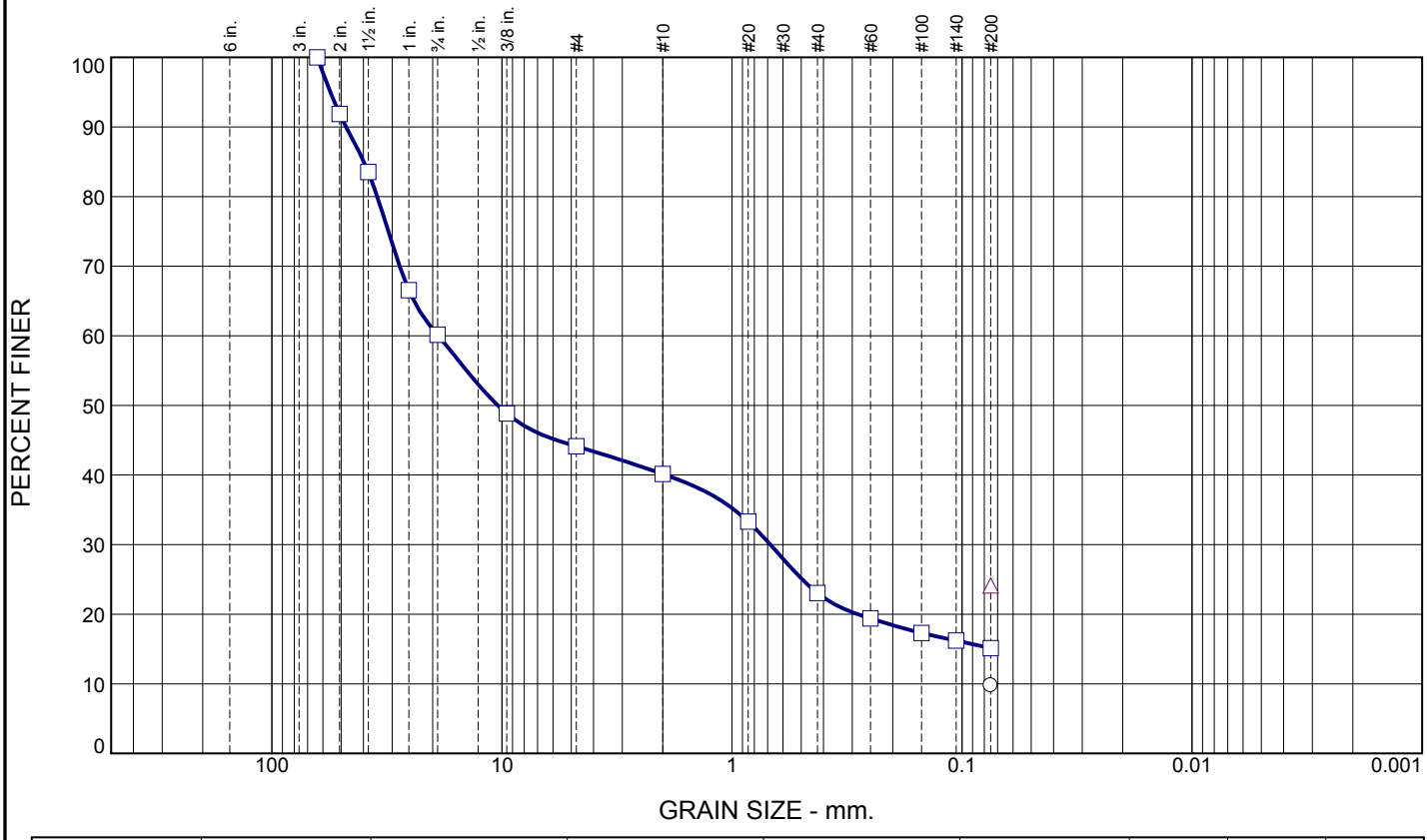
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-31

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						GP-GM			
□	0.0	55.9	29.0	15.1		GM			
△						GM			

SIEVE inches size	○	□	△
2 1/2"		100.0	
2"		91.9	
1 1/2"		83.5	
1"		66.6	
3/4"		60.2	
3/8"		48.8	
GRAIN SIZE			
D_{60}		18.8782	
D_{30}		0.6810	
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	○	□	△
#4		44.1	
#10		40.1	
#20		33.3	
#40		23.0	
#60		19.4	
#100		17.3	
#140		16.2	
#200	9.8	15.1	24.1

Material Description

○ Poorly-graded GRAVEL with SILT and SAND, olive brown

□ SILTY GRAVEL with SAND, dark olive gray

△ SILTY GRAVEL with SAND, dark olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_024S Depth: 66.0-67.0' Sample Number: 18

□ Source of Sample: SM0007_024S Depth: 71.0-72.0' Sample Number: 19

△ Source of Sample: SM0007_024S Depth: 81.0-82.0' Sample Number: 21

Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS5-32

Laboratory Schedule 6

Specimen ID	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
SL0001_012A_818+00_3_24.0-26.0		32	21	11			20.3	
SL0009_005A_1146+ 00_Bulk1_0.0-5.0		26	20	6		74.1	15.2	
SL0009_005A_1146+00_2_20.0-22.0		27	16	11		80.8	16.5	
SL0009_006A_1244+00_1_12.0-14.0		31	24	7			20.4	
SL0009_006A_1244+00_2_15.0-17.0		38	29	9			23.7	

GEOCON
Geocon Consultants, Inc
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: 916-852-9118
Fax: 916-852-9132

Summary of Laboratory Results

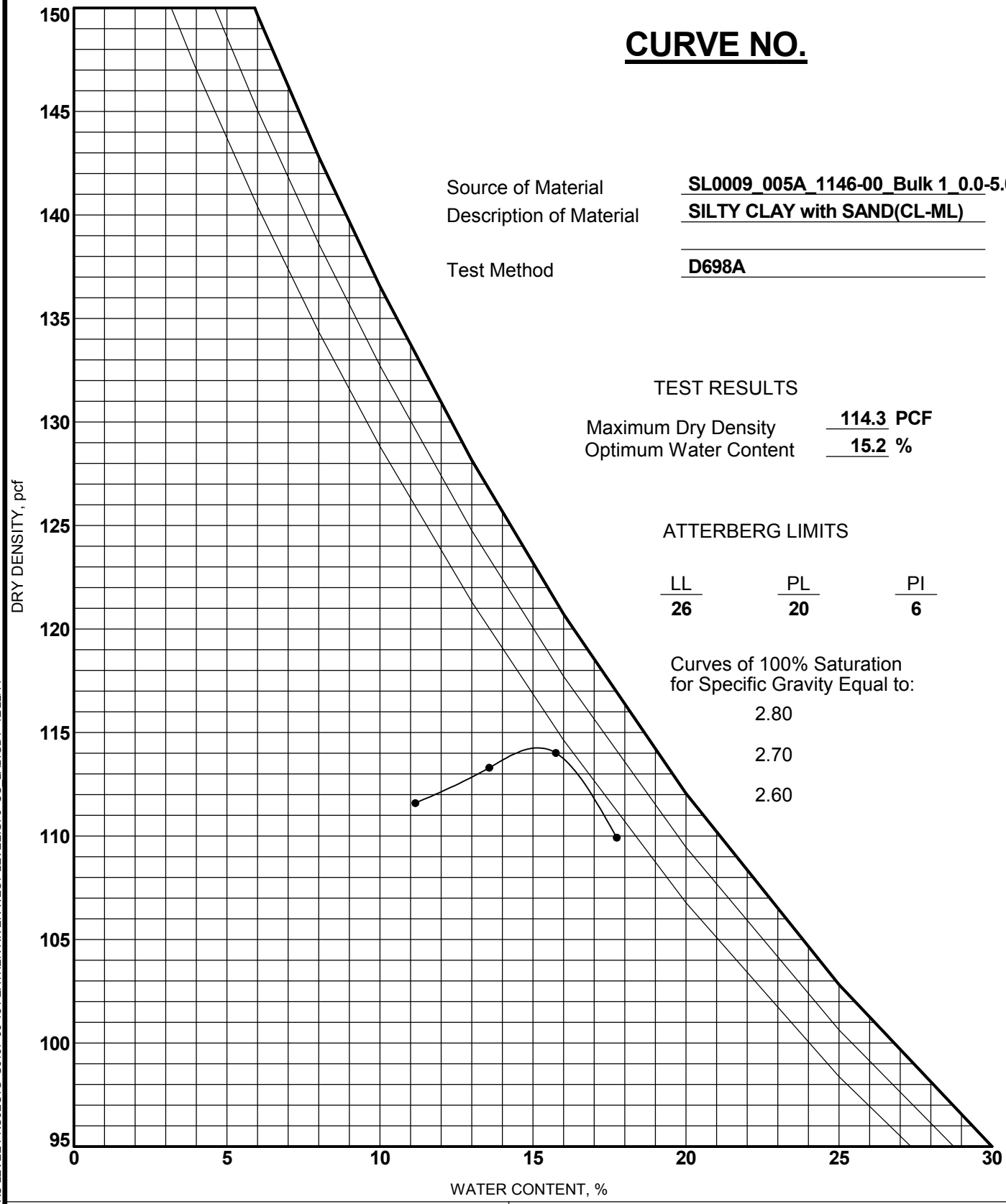
Project: Feather River

Location: West Levee

Number: S9197-06-15

US_LB_SUMMARY URS LAB_S9197-06-15 FEATHER RIVER WEST LEVEE.GPJ US_LAB.GDT 12/22/11

CURVE NO.



Source of Material: **SL0009_005A_1146-00_Bulk 1_0.0-5.0**

Description of Material: **SILTY CLAY with SAND(CL-ML)**

Test Method: **D698A**

TEST RESULTS

Maximum Dry Density	**114.3**	**PCF**
Optimum Water Content	**15.2**	**%**

ATTERBERG LIMITS

LL	PL	PI
26	**20**	**6**

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

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Rancho Cordova, CA 95742
Telephone: 916-852-9118
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MOISTURE-DENSITY RELATIONSHIP

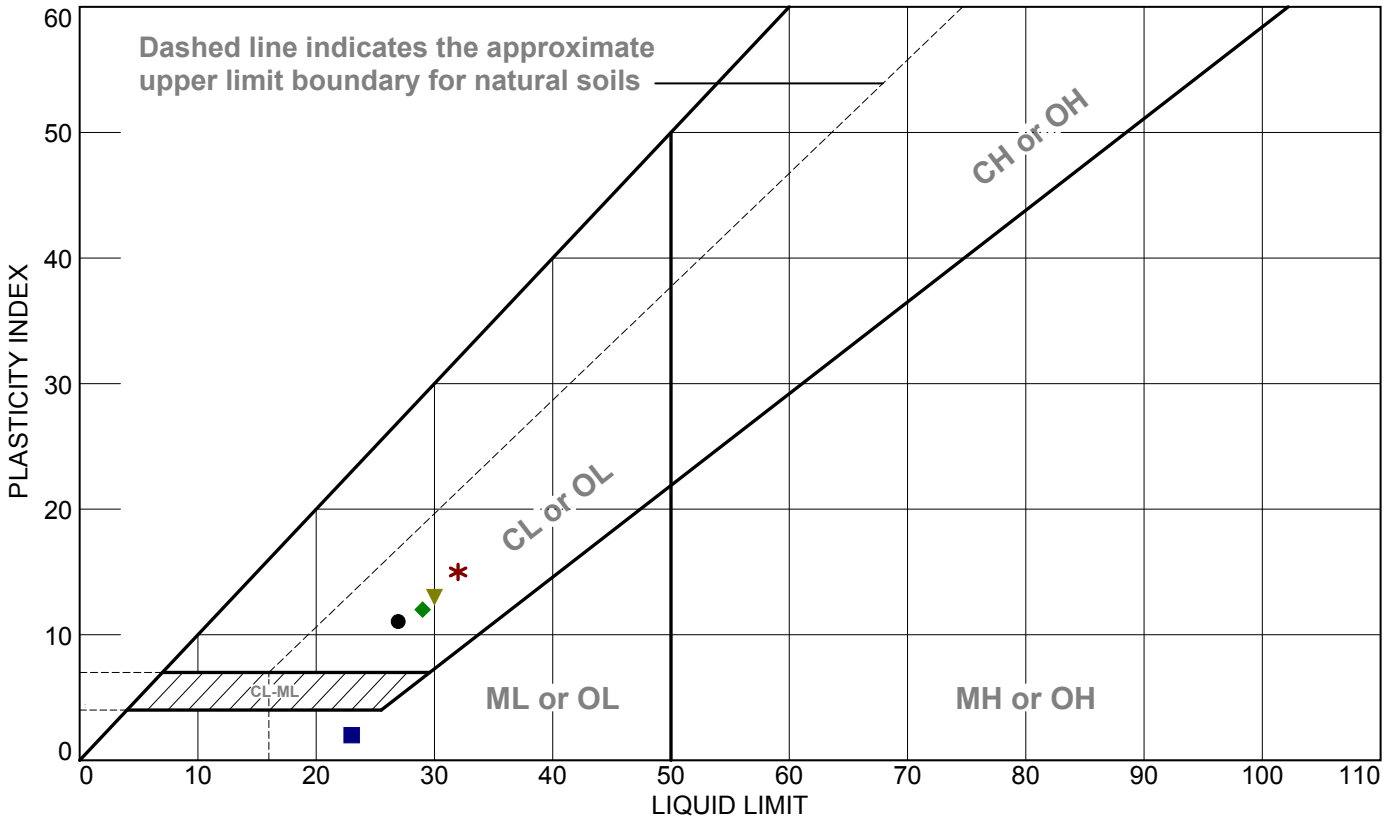
Project: Feather River

Location: West Levee

Number: S9197-06-15

US COMPACTION FOR URS LEVEE PROJECTS S9197-06-15 FEATHER RIVER WEST LEVEE.GPJ US_LAB.GDT 12/22/11

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_012A	2	19.0-21.0'	21.2	16	27	11	CL
■	SM0007_015A	2	5.0-10.0'	15.2	21	23	2	ML
▲	SM0007_015A	7	23.0-25.0'	15.4				SM
◆	SM0007_016A	3	10.0-11.5'	18.8	17	29	12	CL
▼	SM0007_016A	6	18.5-20.5'	18.7	17	30	13	CL
✱	SM0007_017A	6	20.0-22.0'	17.3	17	32	15	CL

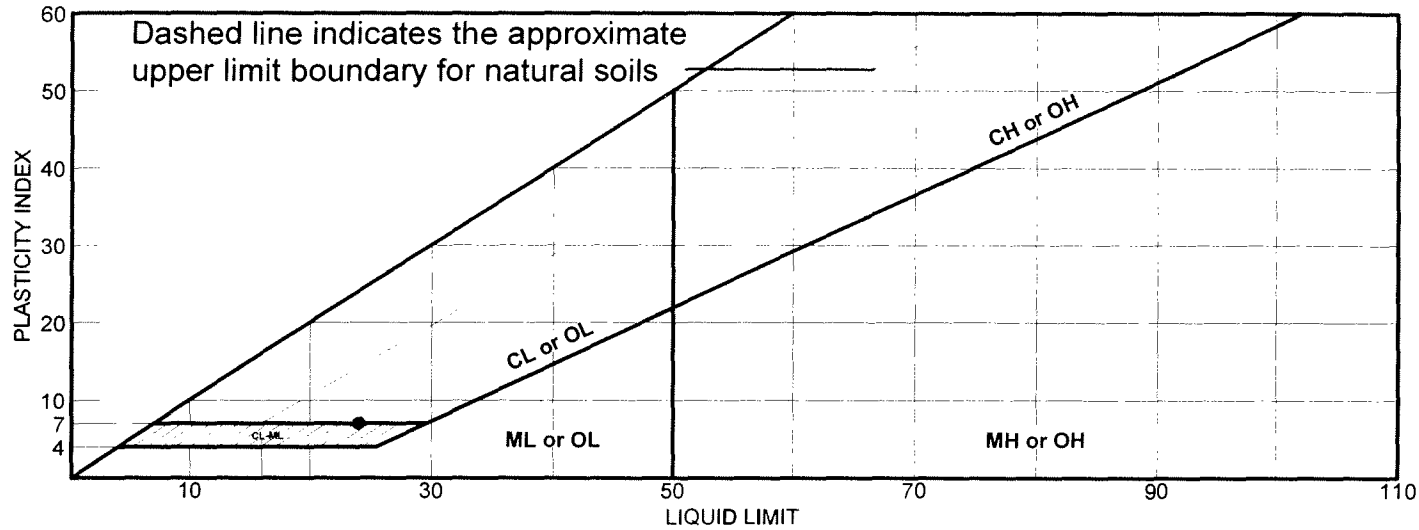
Blackburn Consulting

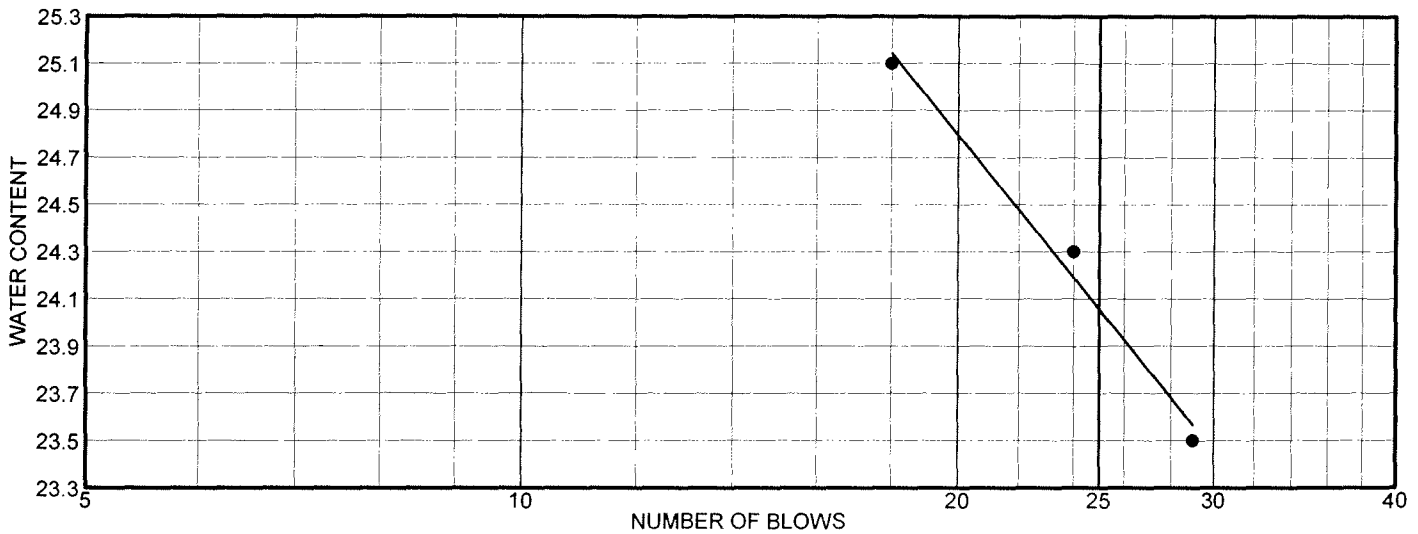
W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish brown silty clayey sand	24	17	7		48.2	SC-SM

Project No. 17326605.03052 **Client:** URS

Project: Feather River West Levee

● **Source:** SL0001_012A **Sample No.:** 818+00 **Elev./Depth:** 6-12

Remarks:

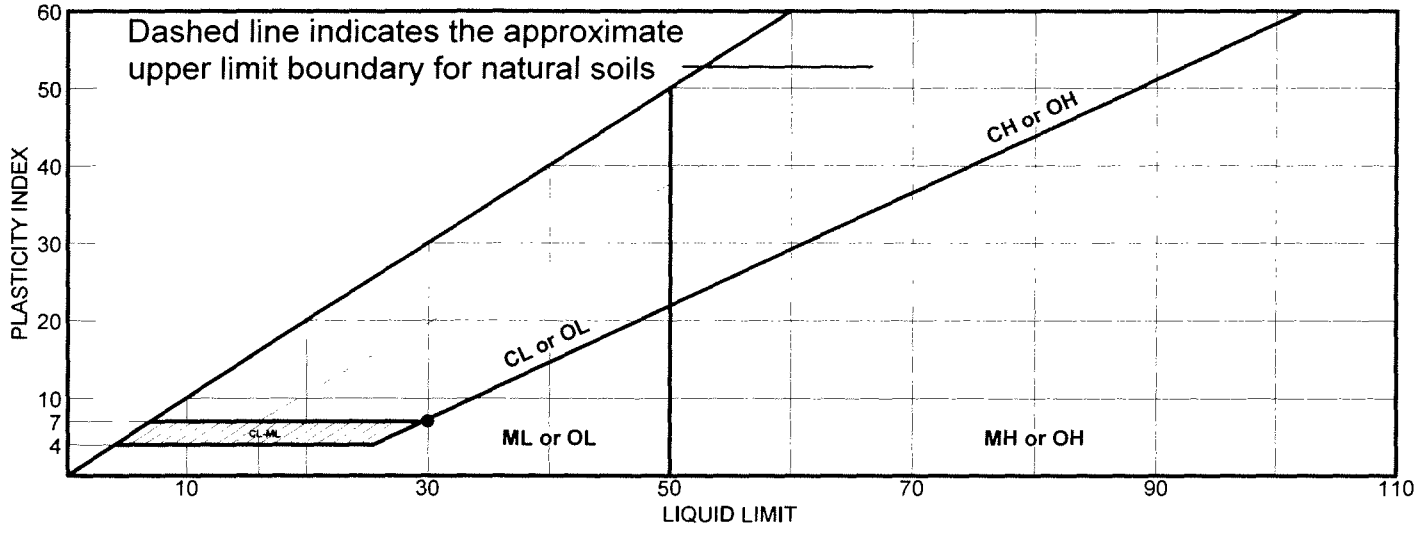
● Bulk #2

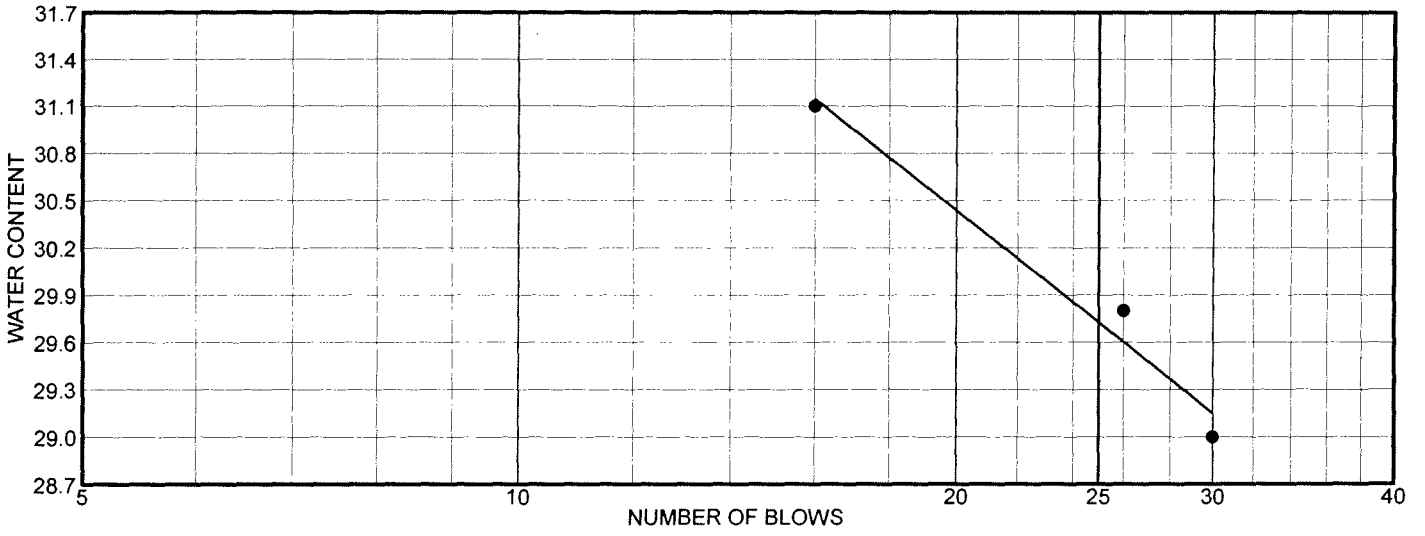
LIQUID AND PLASTIC LIMITS TEST REPORT

SIGNET TESTING LABS, INC.

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish brown sandy silty clay	30	23	7		66.1	CL-ML

Project No. 17326605.03052 **Client:** URS

Project: Feather River West Levee

● **Source:** SM0007_012A **Sample No.:** 1891+60 **Elev./Depth:** 5-10

Remarks:

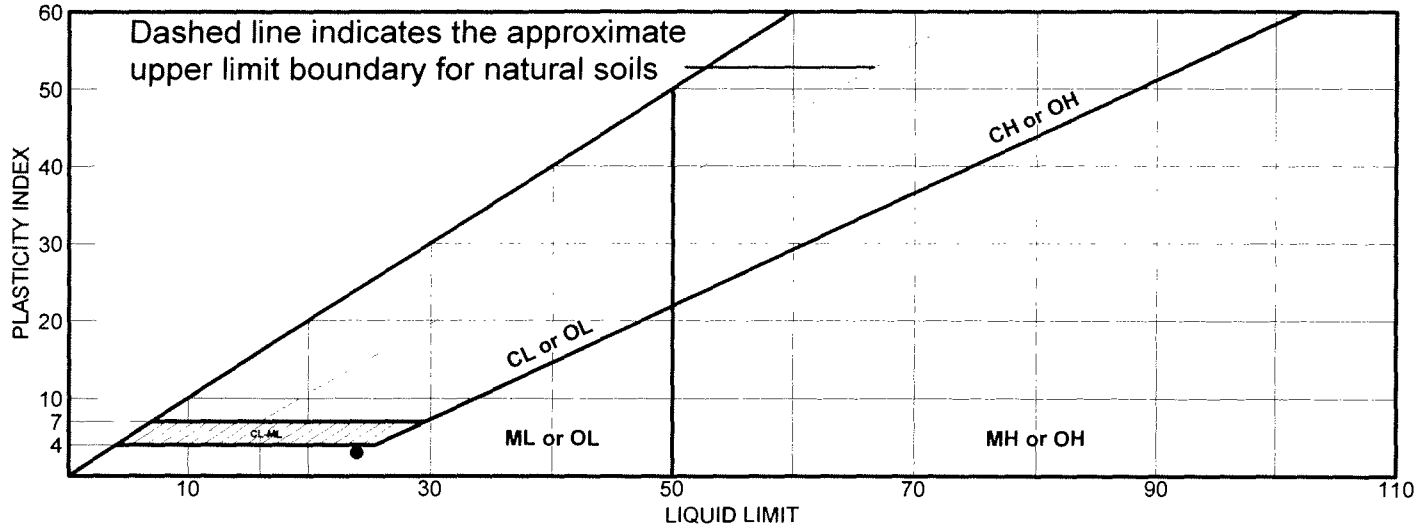
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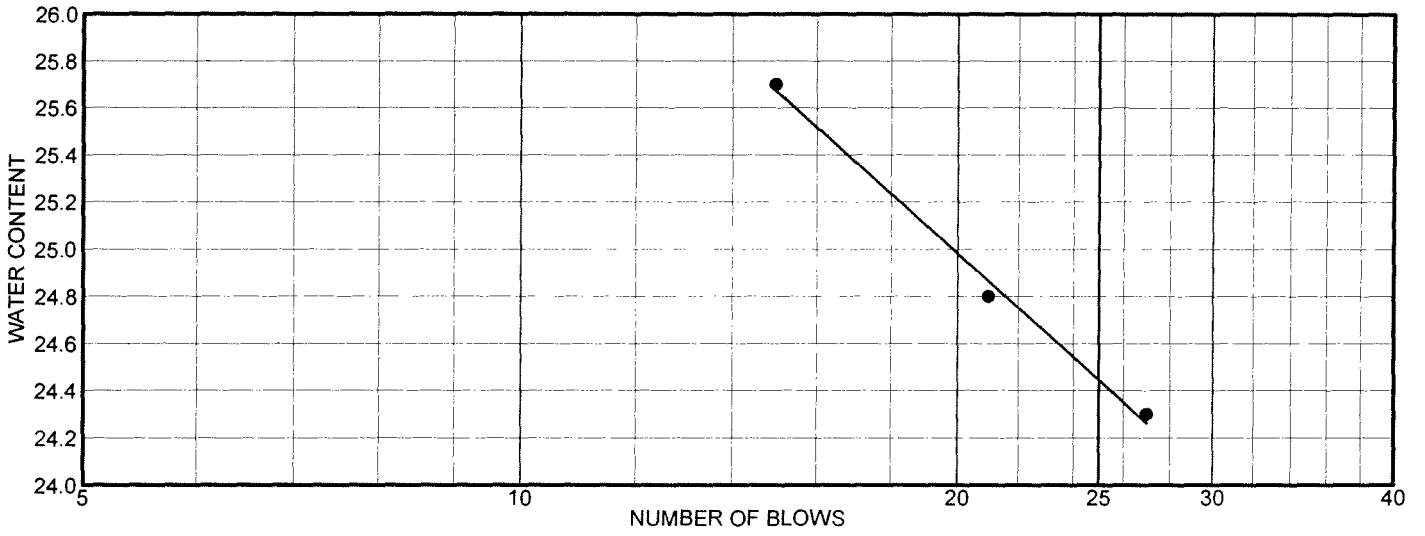
LIQUID AND PLASTIC LIMITS TEST REPORT

SIGNET TESTING LABS, INC.

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish brown silty sand	24	21	3		46.4	SM

Project No. 17326605.03052 **Client:** URS

Project: Feather River West Levee

● **Source:** **Sample No.:** 1892+00 **Elev./Depth:** 5-10

Remarks:

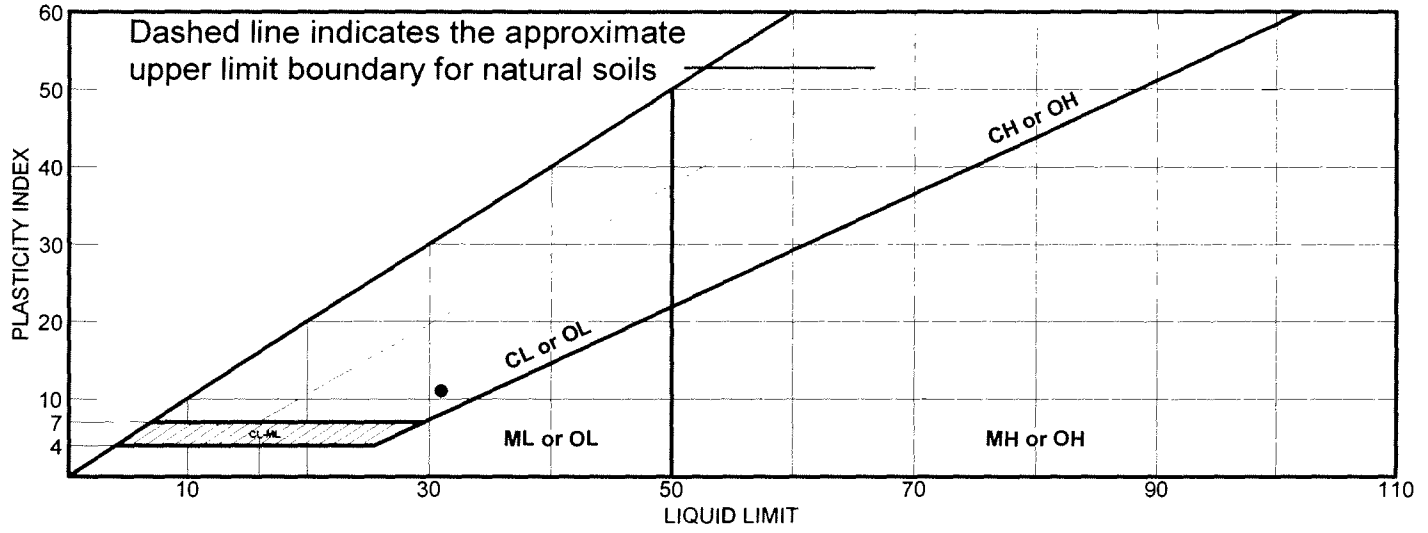
● Bulk #2

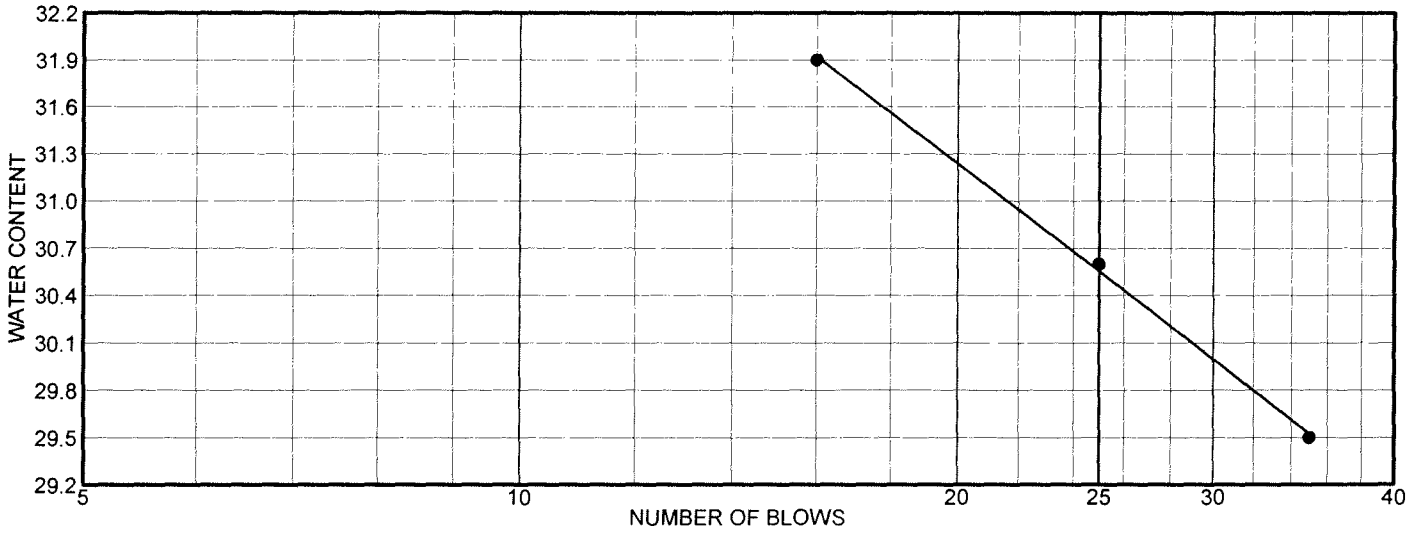
LIQUID AND PLASTIC LIMITS TEST REPORT

SIGNET TESTING LABS, INC.

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish brown sandy lean clay	31	20	11			CL

Project No. 17326605.03052C **Client:** URS

Project: Feather River West Levee

● **Source:** SM0007_013A **Sample No.:** 1912+00 **Elev./Depth:** 1-5

Remarks:

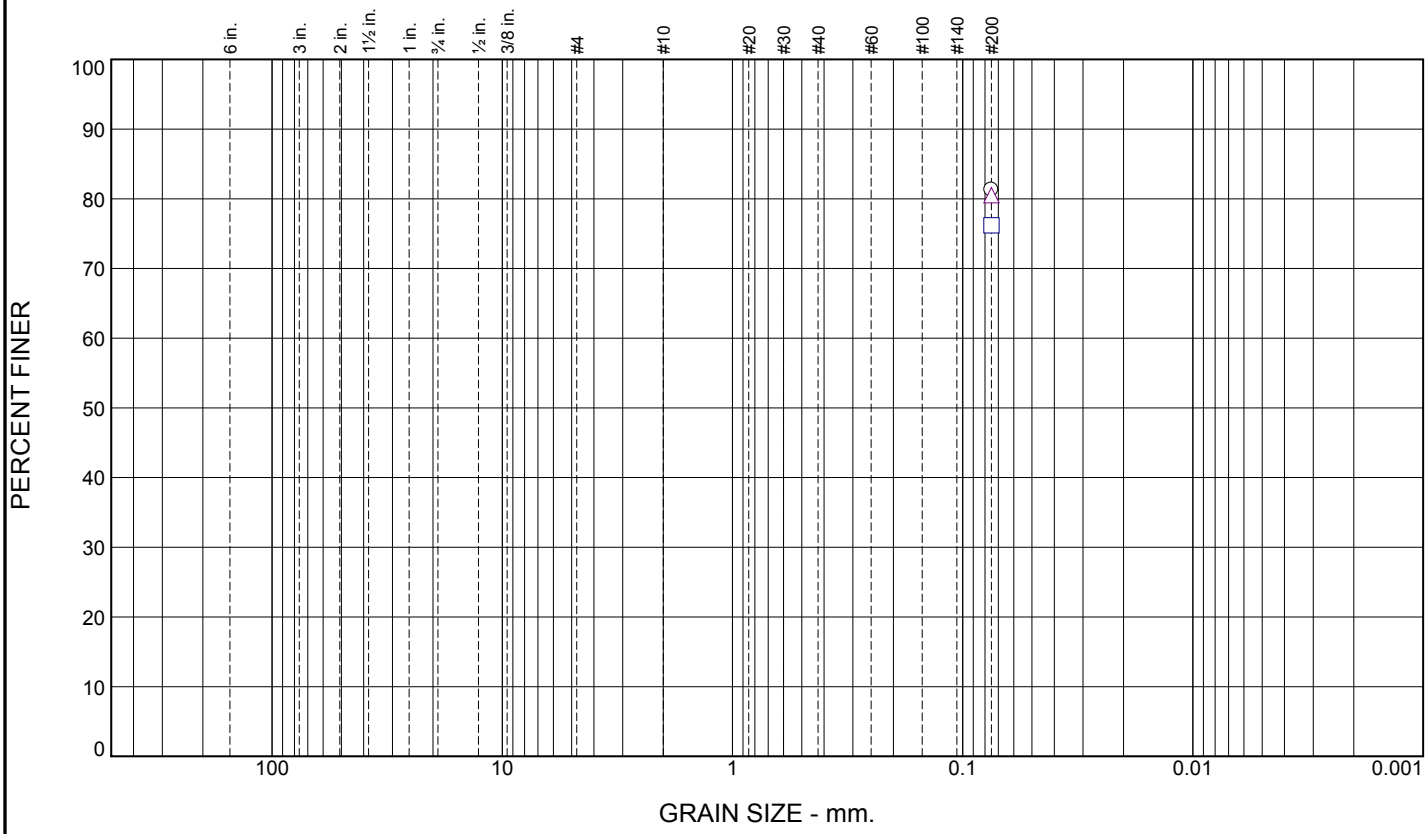
● Bulk #1

LIQUID AND PLASTIC LIMITS TEST REPORT

SIGNET TESTING LABS, INC.

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	27	16	11
□						CL			
△						CL			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	81.3	76.2	80.5

Material Description

○ Lean CLAY with SAND, brown

□ Lean CLAY with SAND, dark yellowish brown

△ Lean CLAY with SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_012A Depth: 19.0-21.0' Sample Number: 2

□ Source of Sample: SM0007_015B Depth: 41.0-41.5' Sample Number: 11

△ Source of Sample: SM0007_015B Depth: 46.0-46.5' Sample Number: 12

Blackburn Consulting

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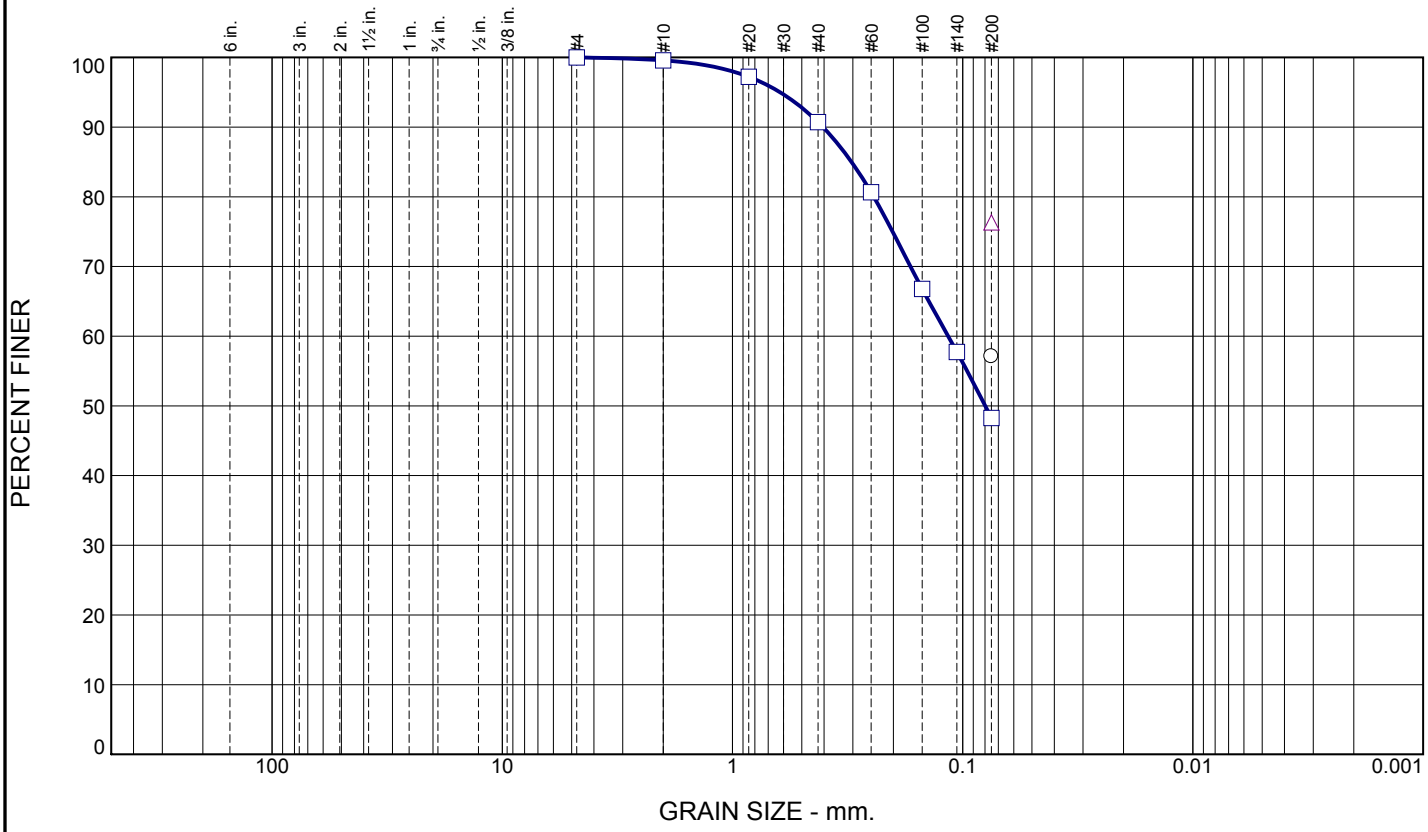
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	23	21	2
□	0.0	0.0	51.7	48.3		SM			
△						CL	29	17	12

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}		0.1156	
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	
#10		99.6	
#20		97.2	
#40		90.7	
#60		80.7	
#100		66.8	
#140		57.7	
#200	57.1	48.3	76.3

Material Description

○ SANDY SILT, very dark grayish brown

□ SILTY SAND, brown

△ Lean CLAY with SAND, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_015A Depth: 5.0-10.0' Sample Number: 2

□ Source of Sample: SM0007_015A Depth: 23.0-25.0' Sample Number: 7

△ Source of Sample: SM0007_016A Depth: 10.0-11.5' Sample Number: 3

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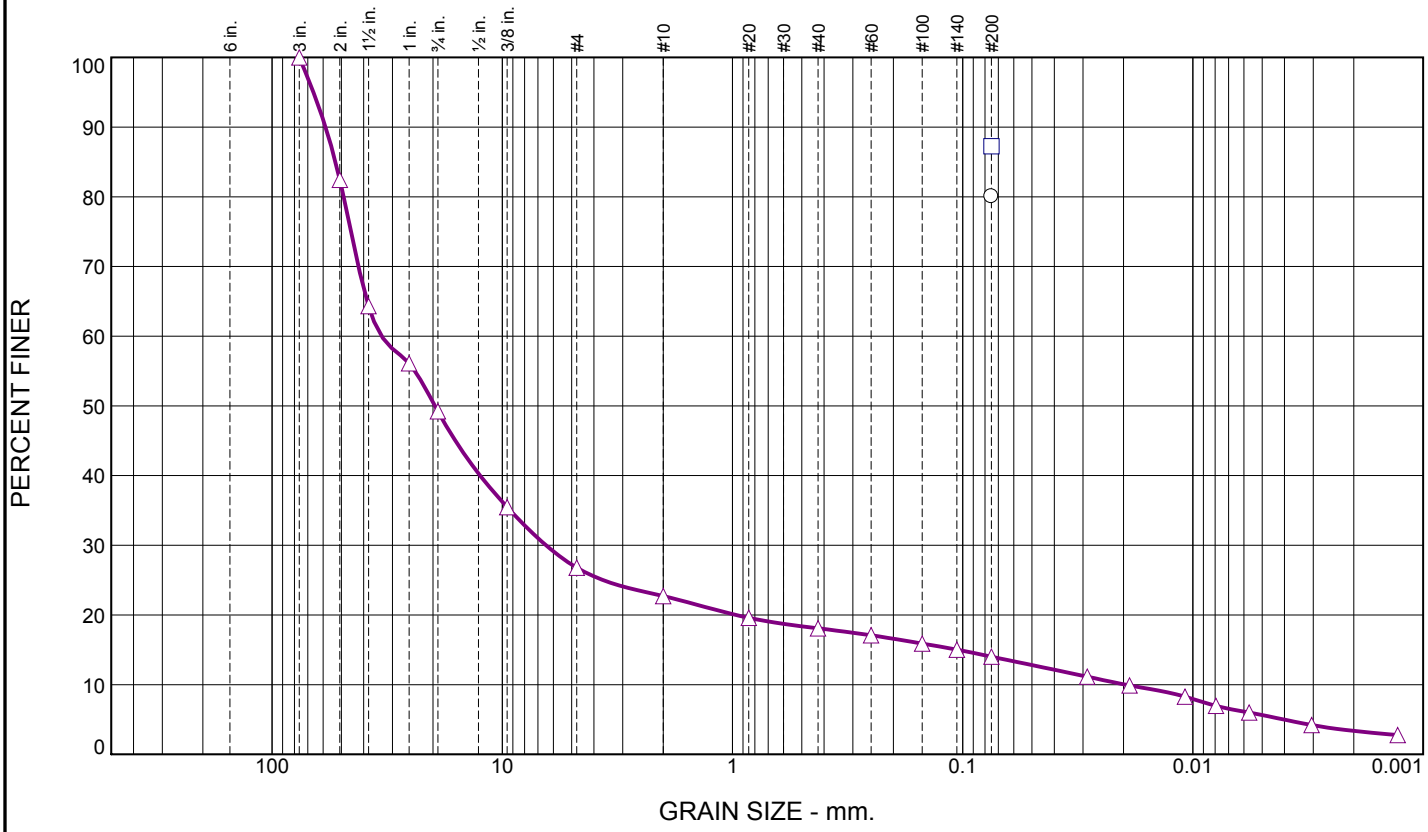
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	30	17	13
□						CL	32	17	15
△	0.0	73.2	12.8	8.4	5.6	GC			

SIEVE inches size	PERCENT FINER ○	□	△
3"			100.0
2"			82.4
1 1/2"			64.3
1"			56.1
3/4"			49.2
3/8"			35.5
GRAIN SIZE			
D_{60}			33.4527
D_{30}			6.4590
D_{10}			0.0196
COEFFICIENTS			
C_c			63.63
C_u			1706.73

SIEVE number size	PERCENT FINER ○	□	△
#4			26.8
#10			22.7
#20			19.6
#40			18.1
#60			17.1
#100			15.9
#140			15.0
#200	80.1	87.3	14.0

Material Description

○ Lean CLAY with SAND, dark yellowish brown

□ Lean CLAY, dark yellowish brown

△ CLAYEY GRAVEL, brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_016A Depth: 18.5-20.5' Sample Number: 6

□ Source of Sample: SM0007_017A Depth: 20.0-22.0' Sample Number: 6

△ Source of Sample: SM0007_021S Depth: 11.0-12.0' Sample Number: 3

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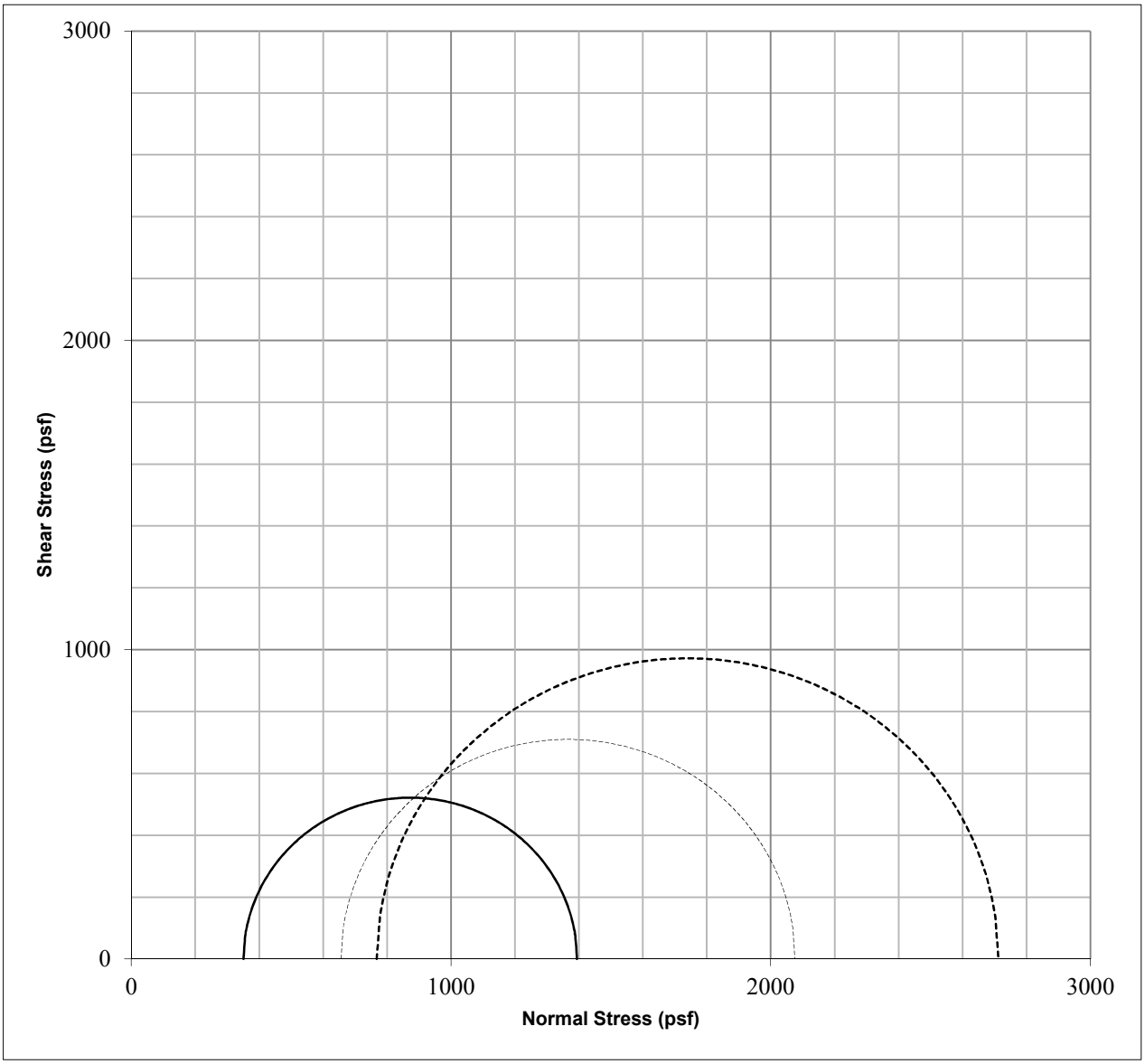
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure



EFFECTIVE STRESS MOHR CIRCLES

Failure Criteria Maximum Effective σ1 / σ3 ratio

Line Type	Minor Principal Stress at failure (psf) σ_3	Maximum Deviator Stress at failure (psf)	Axial Strain at Failure (%)	Initial Height (in.)	Initial Diam. (in.)	Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Initial Void Ratio	Initial Satura-tion (%)	Specific Gravity (assumed)	Rate of Strain (%/min)	Liquid Limit	Plastic Limit	Height to Diameter Ratio
solid	500	740	14.05	5.00	2.42	12.52	127.3	113.1	0.490	69.0	2.70	0.02	24	17	2.1
dash	1000	716	13.50	5.00	2.42	12.31	127.3	113.4	0.487	68.3	2.70	0.02			2.1
dot	1500	1092	7.71	5.00	2.42	12.23	127.3	113.4	0.486	67.9	2.70	0.02			2.1

Client: **URS**	Boring #: **SL0001_012A**	Sample #:	**818+00 Bulk 2**
Project: **Feather River West River**	Depth (ft): **6-12**		
Project #: **17326605.0305233**	Soil: **Yellowish brown clayey sand**		

ASTM D-4767	**TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED**	**TXCU**

SIGNET TESTING LABS **PLATE NUMBER_____**

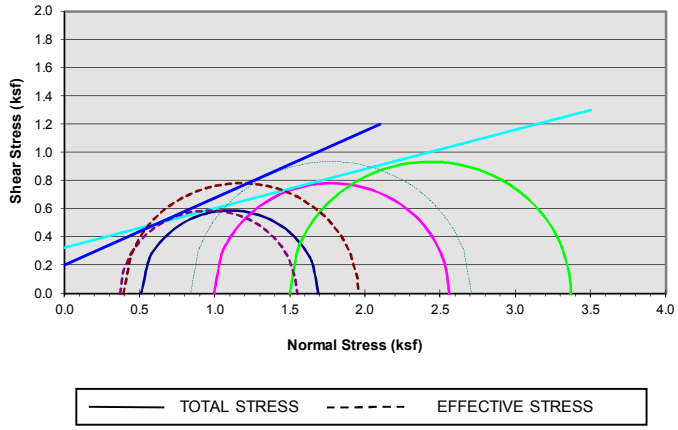
TRIAXIAL SHEAR STRENGTH - CU TEST

ASTM D4767

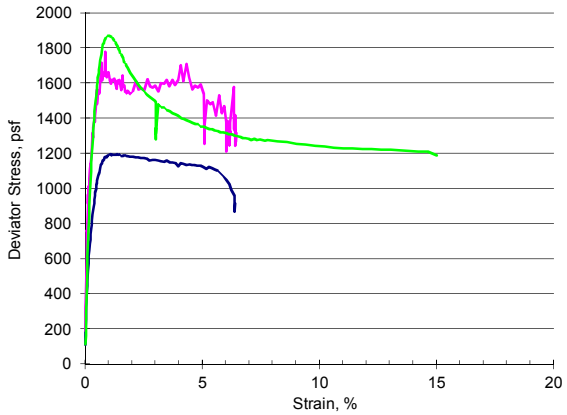
Project Name: Feather River West Levee
Project Number: S9197-06-15
Sample Number: SL0001_012A 818+00_3_24.0-26.0

		SAMPLE ID:	1	2	3
INITIAL CONDITIONS AT START OF TEST		HEIGHT (in.)	4.95	4.92	4.91
		DIAMETER (in.)	2.42	2.39	2.38
		MOISTURE CONTENT (%)	21.1	19.2	20.4
		SATURATION (%)	81.4	80.8	84.4
		DRY DENSITY (pcf)	100.2	103.7	103.1
AFTER SATURATION		DRY DENSITY (pcf)	100.2	103.7	103.1
AFTER CONSOLIDATION		DRY DENSITY (pcf)	100.7	104.6	103.9
SHEAR TEST CONDITIONS		DRY DENSITY (pcf)	100.7	104.6	104.0
		MOISTURE CONTENT (%)	25.1	23.3	23.1
		SATURATION (%)	98.0	100.0	97.6
		STRAIN RATE (%/min)	0.0323	0.0413	0.0325
		CELL PRESSURE (psf)	10600	12440	12920
		INITIAL BACK PRESSURE (psf)	10090	11440	11430
		INITIAL EFF CONFINING PRESS (psf)	510	990	1500
		TOTAL MAJOR PRIN STR AT FAIL (psf)	1690	2560	3370
		EFF MAJOR PRIN STR AT FAIL (psf)	1550	1950	2710
		PORE PRESSURE AT FAIL (psf)	140	600	660
		EFF MINOR PRIN STR AT FAIL (psf)	370	390	840

MOHR'S CIRCLES



STRESS-STRAIN

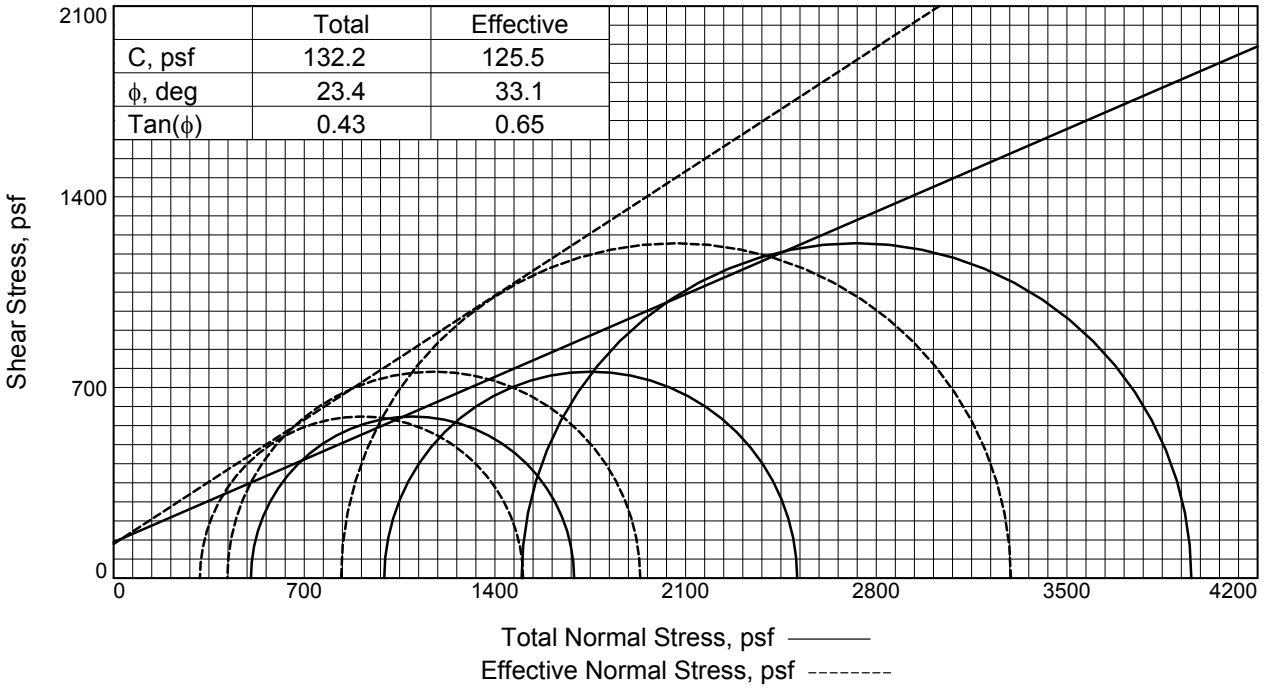


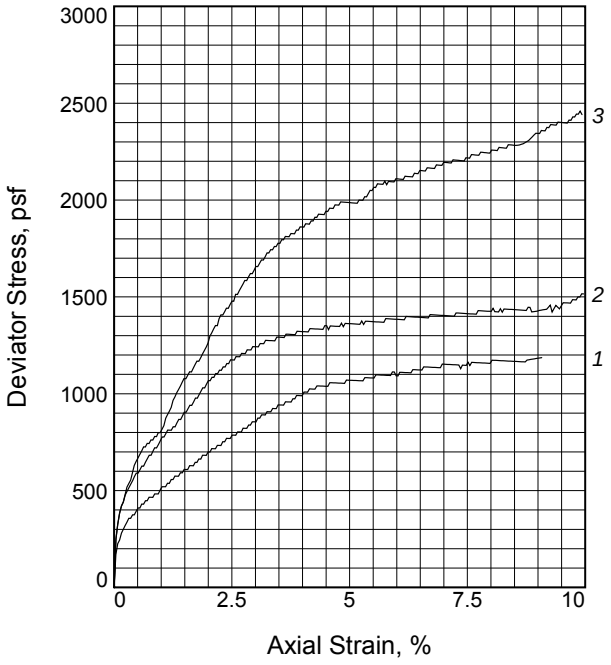
Strength Parameters: At maximum principal stress ratio

	TOTAL	EFFECTIVE:
ϕ, degrees	15.6	25.5
c, psf	325	200

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Sample No.		1	2	3
Initial	Water Content, %	23.4	21.2	18.3
	Dry Density, pcf	97.2	98.0	104.4
	Saturation, %	86.2	79.7	80.2
	Void Ratio	0.7341	0.7197	0.6143
	Diameter, in.	2.880	2.880	2.880
	Height, in.	5.958	5.947	5.919
At Test	Water Content, %	24.9	23.2	19.2
	Dry Density, pcf	100.7	103.6	110.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6734	0.6276	0.5196
	Diameter, in.	2.845	2.818	2.812
	Height, in.	5.893	5.878	5.844
Strain rate, in./min.		0.002	0.002	0.002
Eff. Cell Pressure, psf		504.0	993.6	1497.6
Fail. Stress, psf		1186.6	1515.8	2458.9
Excess Pore Pr., psf		187.2	576.0	662.4
Strain, %		9.1	9.9	9.9
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1503.4	1933.4	3294.1
$\bar{\sigma}_3$ Failure, psf		316.8	417.6	835.2

Type of Test:
CU with Pore Pressures

Sample Type: 3.0" Shelby Tube

Description: Lean CLAY with SAND, brown

Assumed Specific Gravity= 2.7

Remarks:

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SL0001_012A

Sample Number: 2

Proj. No.: 17326605.0305233 **Date Sampled:**

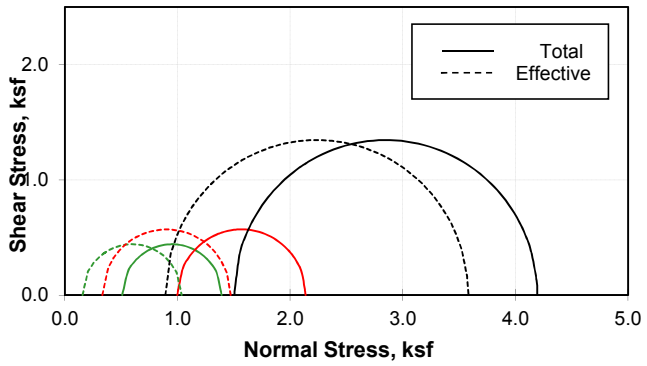
TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA

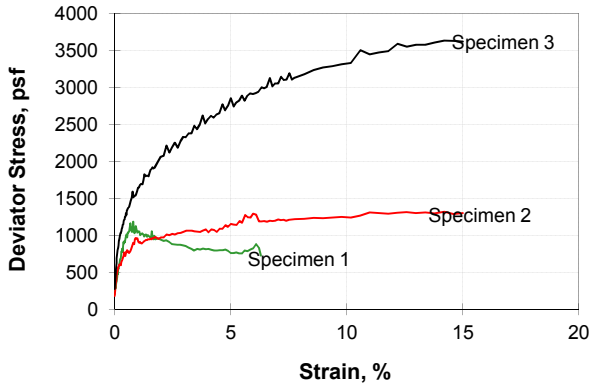
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION - ICU TEST ASTM D4767

Project Name	Feather River West Levee
Geocon Project Number	S9197-06-15
Boring Number	SL0009_005A
Sample Number	1146+00_2_20.0-22.0
Sample Description	Sandy Silty CLAY

Phase	Measurement	Specimen 1	Specimen 2	Specimen 3
INITIAL	Height (in.) =	4.94	4.91	4.90
	Diameter (in.) =	2.42	2.40	2.41
	Moisture Content (%) =	18.5	20.2	19.2
	Saturation (%) =	68.8	82.7	81.8
	Dry Density (pcf) =	95.4	100.8	104.4
AFTER SATURATION	Dry Density (pcf) =	95.4	100.8	104.4
AFTER CONSOLIDATION	Dry Density (pcf) =	95.6	101.5	106.3
SHEAR TEST	Dry Density (pcf) =	95.6	101.6	106.4
	Moisture Content (%) =	25.7	23.9	22.1
	Saturation (%) =	95.7	99.6	99.3
	Strain rate (%/min) =	0.0325	0.0329	0.0330
	Initial Consolidation Pressure (psf) =	500	1000	1500
	Pre-shear Cell Pressure (psf) =	12060	12550	11630
	Pre-shear Initial Back Pressure (psf) =	11550	11550	10130
	Pre-shear Effective Confining Pressure (psf) =	510	1000	1500
	Total Major Principal Stress at Failure (psf) =	1390	2140	4190
	Effective Major Principal Stress at Failure (psf) =	1040	1470	3580
	Pore Pressure at Failure (psf) =	350	670	610
	Effective Minor Principial Stress at Failure (psf) =	160	330	890

Note: Assumed Gs = 2.6





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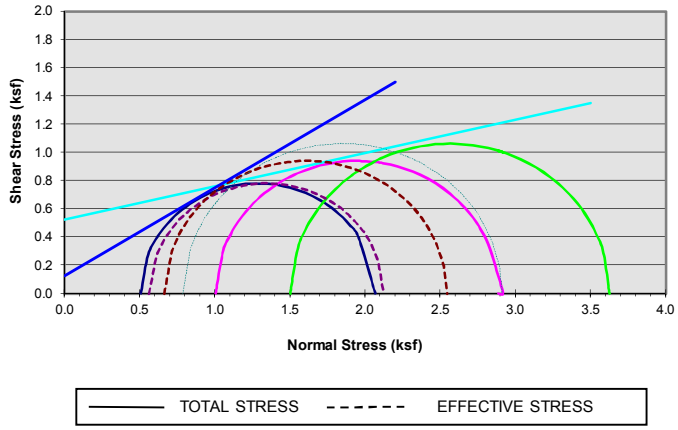
TRIAXIAL SHEAR STRENGTH - CU TEST

ASTM D4767

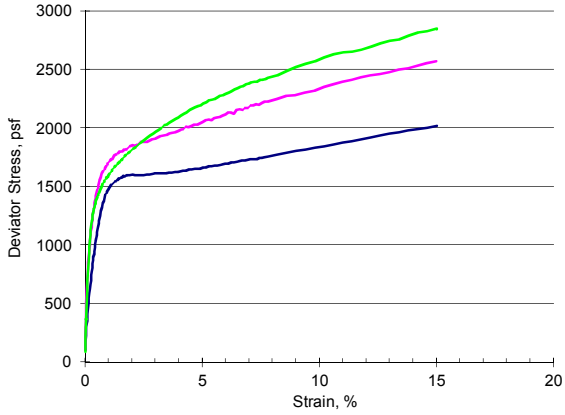
Project Name: Feather River West Levee
Project Number: S9197-06-15
Sample Number: SL0009_005A 1146+00_Bulk #1_0.0-5.0

		SAMPLE ID:	1	2	3
INITIAL CONDITIONS AT START OF TEST		HEIGHT (in.)	5.00	5.00	5.00
		DIAMETER (in.)	2.42	2.42	2.42
		MOISTURE CONTENT (%)	14.9	15.0	14.9
		SATURATION (%)	71.0	71.2	70.8
		DRY DENSITY (pcf)	108.7	108.7	108.7
AFTER SATURATION		DRY DENSITY (pcf)	108.7	108.7	108.7
AFTER CONSOLIDATION		DRY DENSITY (pcf)	108.9	109.2	109.8
SHEAR TEST CONDITIONS		DRY DENSITY (pcf)	108.9	109.2	109.9
		MOISTURE CONTENT (%)	20.9	20.7	20.3
		SATURATION (%)	99.8	99.7	99.5
		STRAIN RATE (%/min)	0.0333	0.0330	0.0331
		CELL PRESSURE (psf)	13380	13860	14390
		INITIAL BACK PRESSURE (psf)	12870	12860	12880
		INITIAL EFF CONFINING PRESS (psf)	510	1010	1500
		TOTAL MAJOR PRIN STR AT FAIL (psf)	2070	2890	3630
		EFF MAJOR PRIN STR AT FAIL (psf)	2120	2540	2910
		PORE PRESSURE AT FAIL (psf)	-60	340	710
		EFF MINOR PRIN STR AT FAIL (psf)	560	660	790

MOHR'S CIRCLES



STRESS-STRAIN



Strength Parameters: At maximum principal stress ratio

	TOTAL	EFFECTIVE:
ϕ, degrees	13.3	32.0
c, psf	525	125

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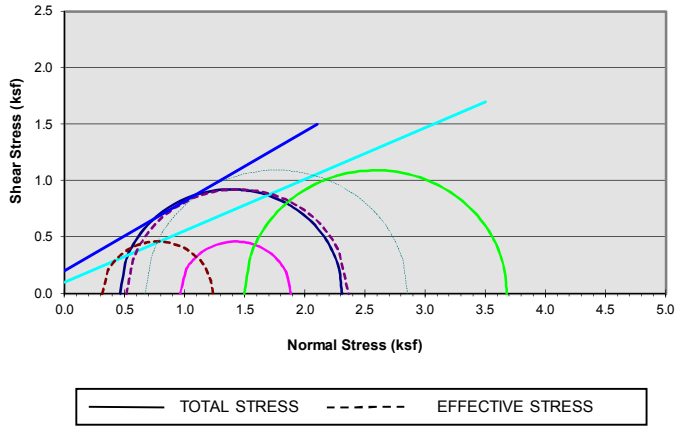
TRIAXIAL SHEAR STRENGTH - CU TEST

ASTM D4767

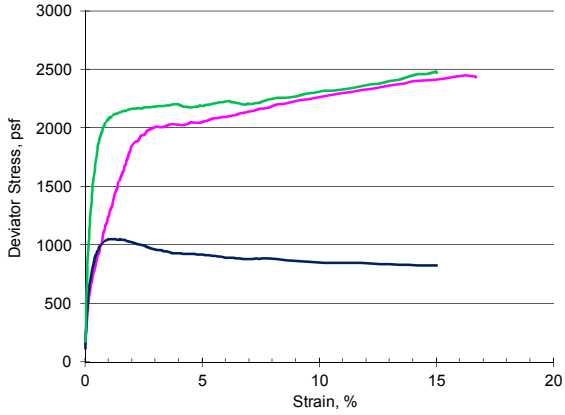
Project Name: Feather River West Levee
Project Number: S9197-06-15
Sample Number: SL0009_006A 1244+00_2_15.0-17.0

		SAMPLE ID:	1	2	3
INITIAL CONDITIONS AT START OF TEST		HEIGHT (in.)	4.94	4.92	4.92
		DIAMETER (in.)	2.40	2.40	2.41
		MOISTURE CONTENT (%)	27.0	19.3	26.2
		SATURATION (%)	78.1	60.5	75.2
		DRY DENSITY (pcf)	88.8	89.9	87.6
AFTER SATURATION		DRY DENSITY (pcf)	88.8	89.9	87.6
AFTER CONSOLIDATION		DRY DENSITY (pcf)	89.0	90.7	88.4
SHEAR TEST CONDITIONS		DRY DENSITY (pcf)	89.0	90.7	88.4
		MOISTURE CONTENT (%)	34.3	30.3	32.6
		SATURATION (%)	99.9	96.8	95.2
		STRAIN RATE (%/min)	0.0371	0.0335	0.0331
		CELL PRESSURE (psf)	12000	13860	14380
		INITIAL BACK PRESSURE (psf)	11540	12900	12890
		INITIAL EFF CONFINING PRESS (psf)	460	960	1500
		TOTAL MAJOR PRIN STR AT FAIL (psf)	2310	1880	3680
		EFF MAJOR PRIN STR AT FAIL (psf)	2360	1230	2850
		PORE PRESSURE AT FAIL (psf)	-60	650	820
		EFF MINOR PRIN STR AT FAIL (psf)	520	310	670

MOHR'S CIRCLES



STRESS-STRAIN

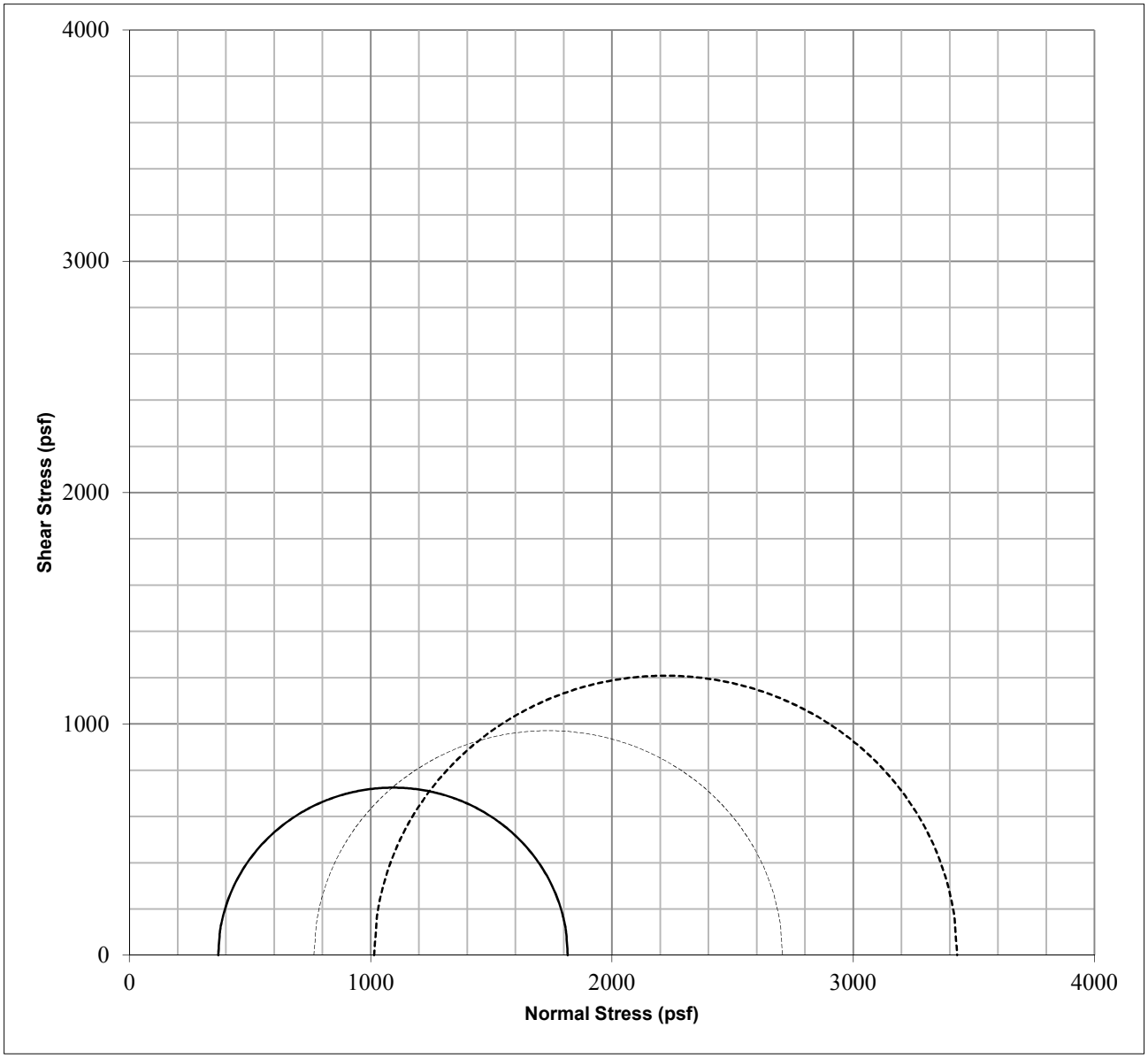


Strength Parameters: At maximum principal stress ratio

	TOTAL	EFFECTIVE:
ϕ, degrees	24.6	31.8
c, psf	100	200

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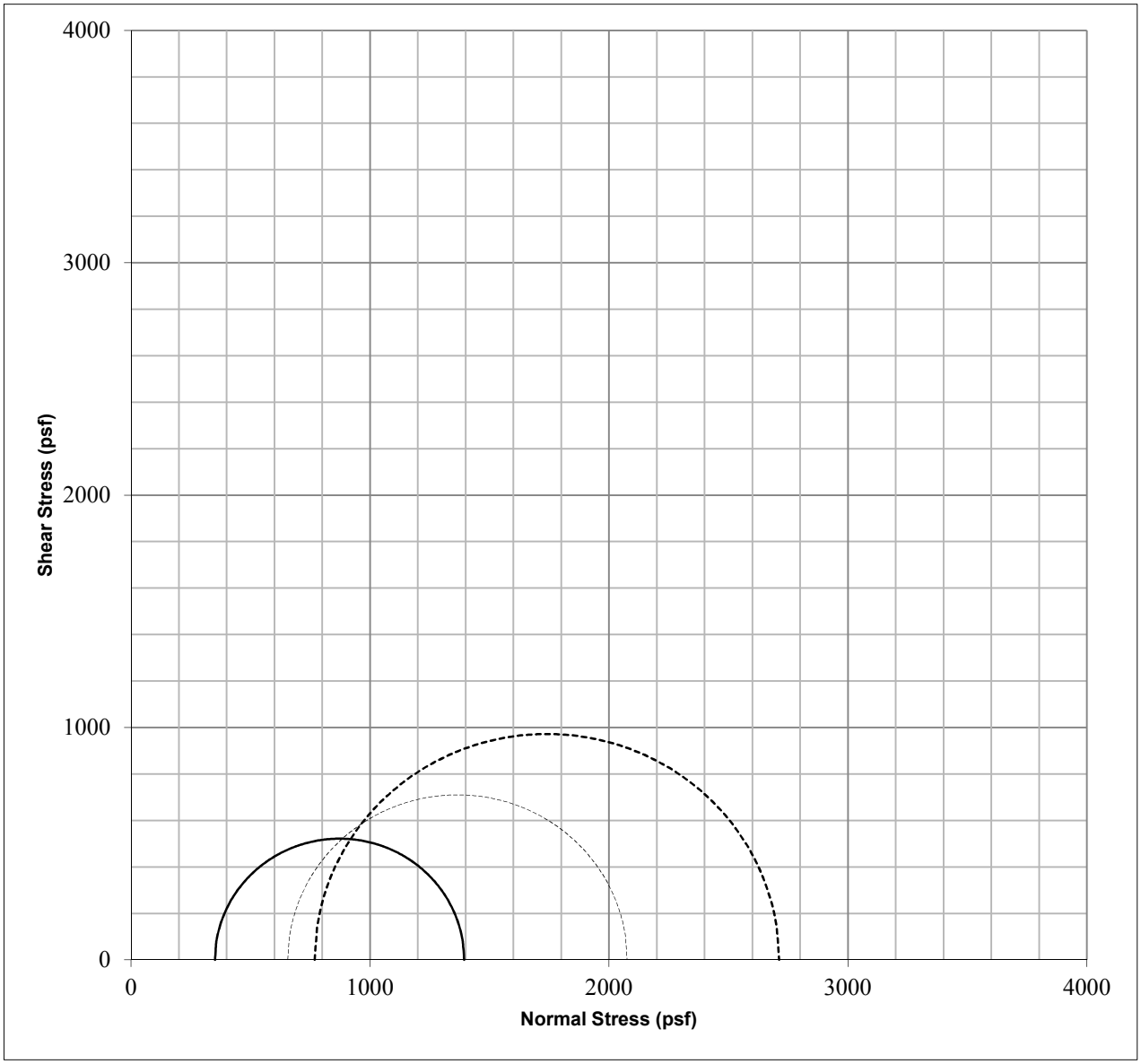
EFFECTIVE STRESS MOHR CIRCLES

Failure Criteria Maximum Effective σ1 / σ3 ratio

Line Type	Minor Principal Stress at failure (psf) σ_3	Maximum Deviator Stress at failure (psf)	Axial Strain at Failure (%)	Initial Height (in.)	Initial Diam. (in.)	Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Initial Void Ratio	Initial Satura-tion (%)	Specific Gravity (assumed)	Rate of Strain (%/min)	Liquid Limit	Plastic Limit	Height to Diameter Ratio
solid	500	1448	1.41	5.01	2.42	16.24	124.3	106.9	0.576	76.1	2.70	0.02	30	23	2.1
dash	1000	1942	1.98	5.01	2.42	16.44	124.3	106.7	0.579	76.7	2.70	0.02			2.1
dot	1500	2417	2.38	5.01	2.42	16.36	124.3	106.8	0.578	76.4	2.70	0.02			2.1

Client: **URS**	Boring #: **SM0007_012A**	Sample #:	**1891+60 Bulk 2**
Project: **Feather River West Levee**	Depth (ft): **5-10**		
Project #: **17326605.0305233**	Soil: **Yellowish brown sandy lean clay**		

ASTM D-4767	**TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED**	**TXCU**



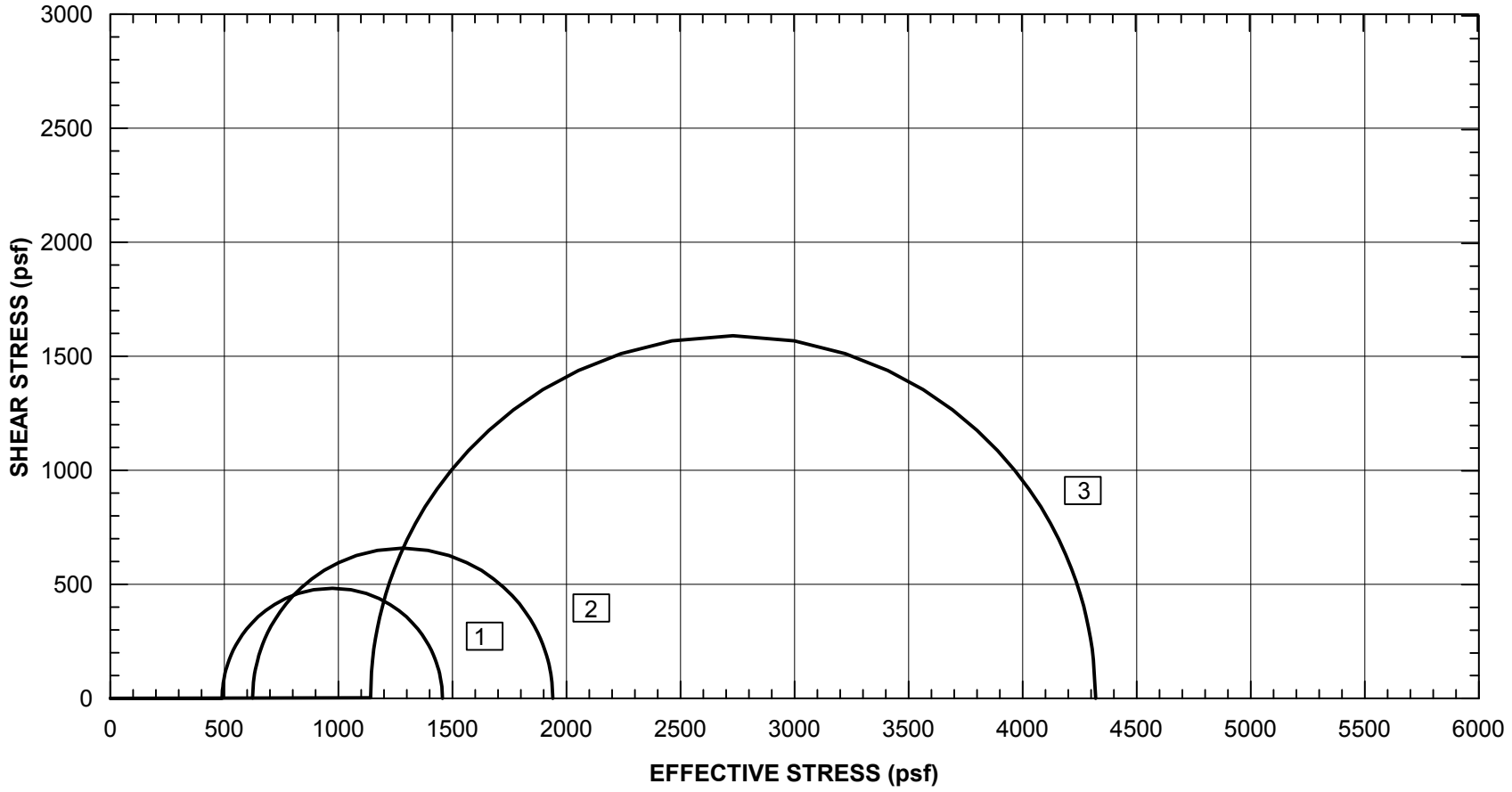
EFFECTIVE STRESS MOHR CIRCLES

Failure Criteria Maximum Effective σ1 / σ3 ratio

Line Type	Minor Principal Stress at failure (psf) σ_3	Maximum Deviator Stress at failure (psf)	Axial Strain at Failure (%)	Initial Height (in.)	Initial Diam. (in.)	Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Initial Void Ratio	Initial Satura-tion (%)	Specific Gravity (assumed)	Rate of Strain (%/min)	Liquid Limit	Plastic Limit	Height to Diameter Ratio
solid	500	1043	1.40	5.01	2.42	14.35	127.4	111.5	0.512	75.6	2.70	0.02	24	21	2.1
dash	1000	1420	3.88	5.00	2.42	14.51	127.7	111.5	0.511	76.6	2.70	0.02			2.1
dot	1500	1944	7.14	5.01	2.42	14.76	127.5	111.1	0.517	77.1	2.70	0.02			2.1

Client: **URS**	Boring #: **SM0007_020A**	Sample #:	**1892+00 Bulk 2**
Project: **Feather River West Levee**	Depth (ft): **5-10**		
Project #: **17326605.0305233**	Soil: **Yellowish brown silty sand**		

ASTM D-4767	**TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED**	**TXCU**



Legend

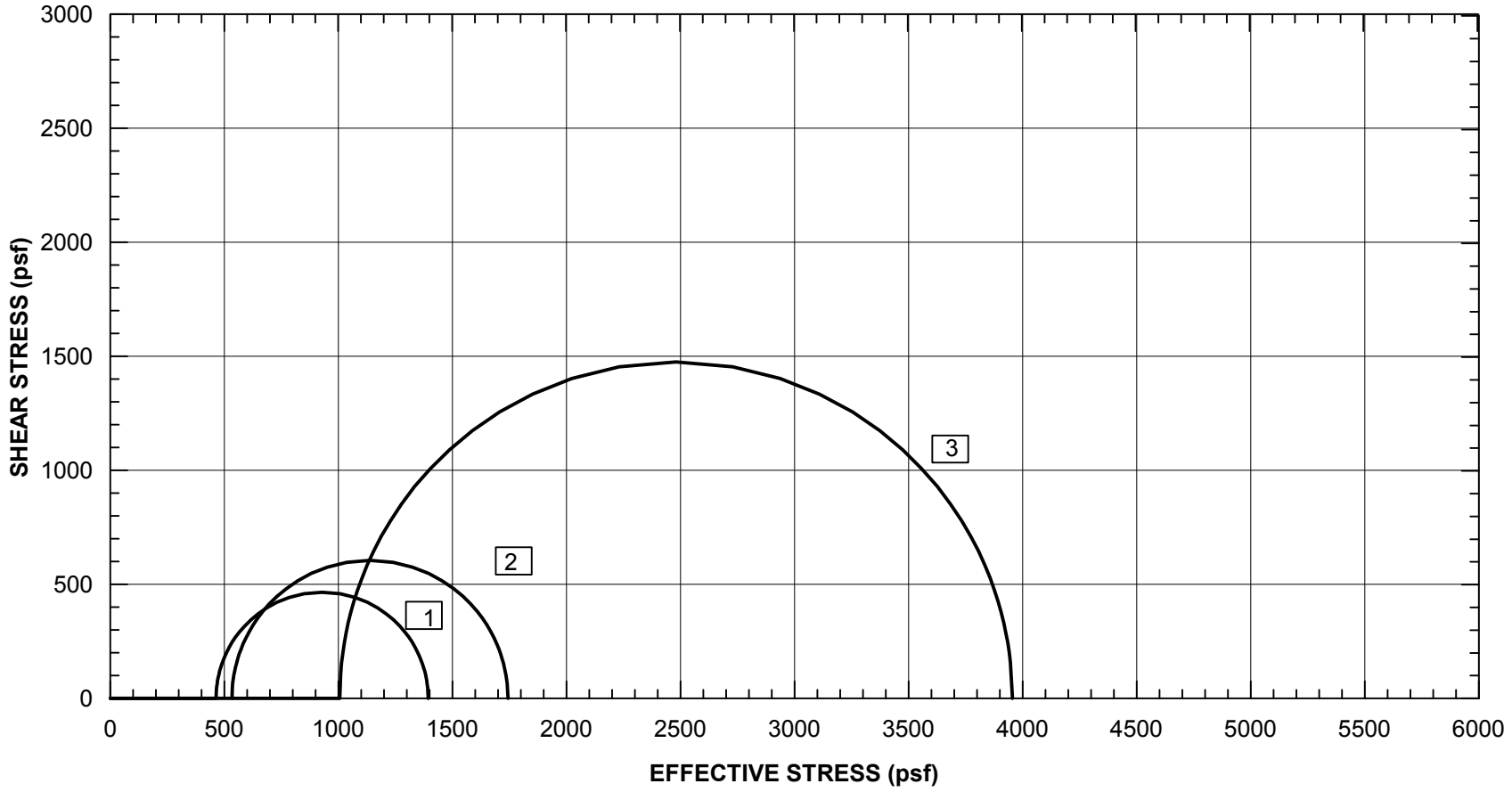
1. SM0007_020A, s4 at 19.5 ft., Effective Confining Stress = 720 psf
2. SM0007_020A, s4 at 20.0 ft., Effective Confining Stress = 1440 psf
3. SM0007_020A, s4 at 20.5 ft., Effective Confining Stress = 2160 psf

MOHR CIRCLES AT PEAK DEVIATOR STRESS FOR ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS

Project No.: 17326605	Date: November 2011	Project Name: Feather River West Levee	Fig.:

mcd

URS



SM0007_020A,

Legend

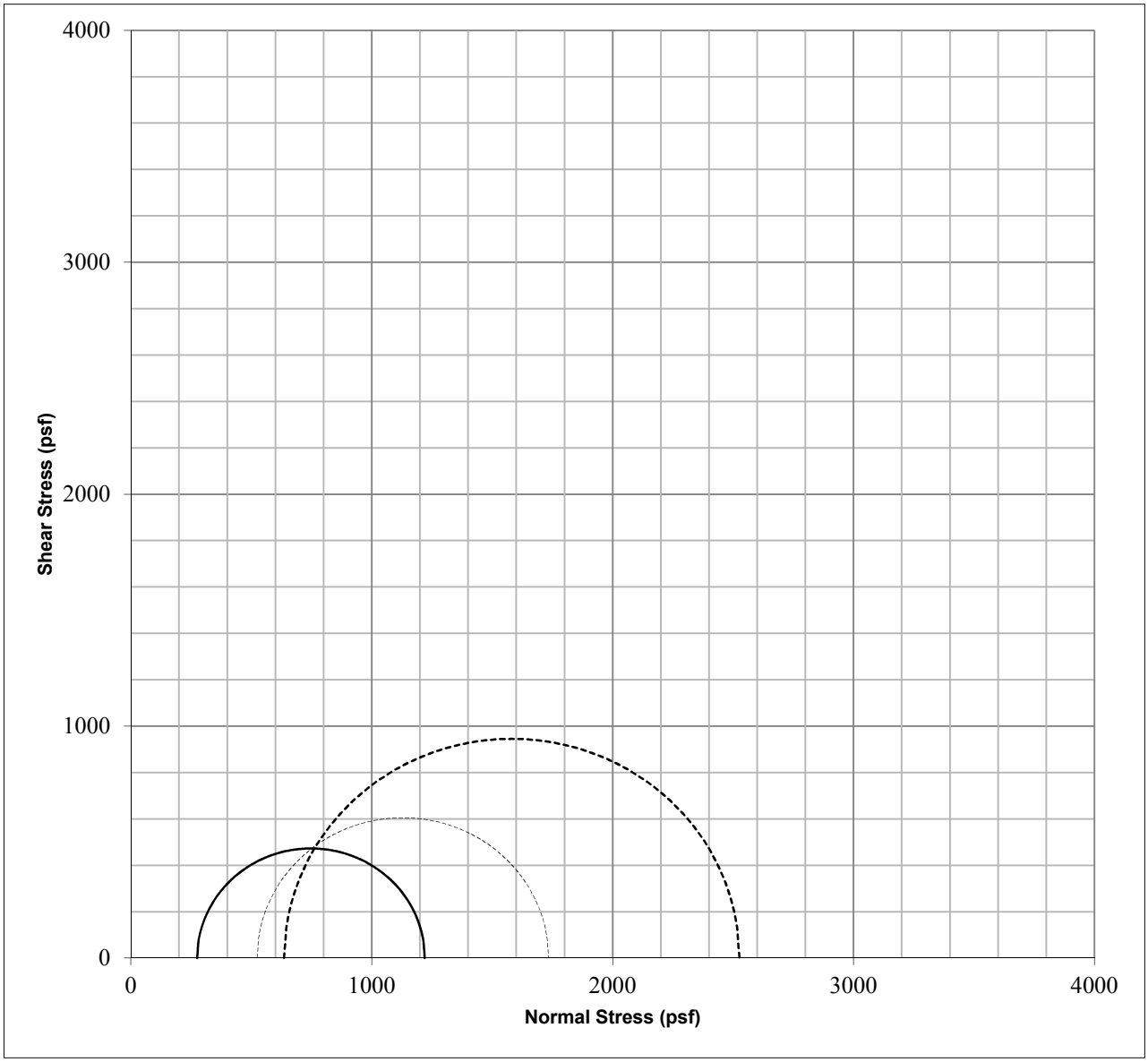
1.) SM0007_020A, s4 at 19.5 ft., Effective Confining Stress = 720 psf
2.) SM0007_020A, s4 at 20.0 ft., Effective Confining Stress = 1440 psf
3.) SM0007_020A, s4 at 20.5 ft., Effective Confining Stress = 2160 psf

MOHR CIRCLES AT AT MAXIMUM OBLIQUITY FOR ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS

Project No.: 17326605	Date: November 2011	Project Name: Feather River West Levee	Fig.:

mco_FRWL

URS



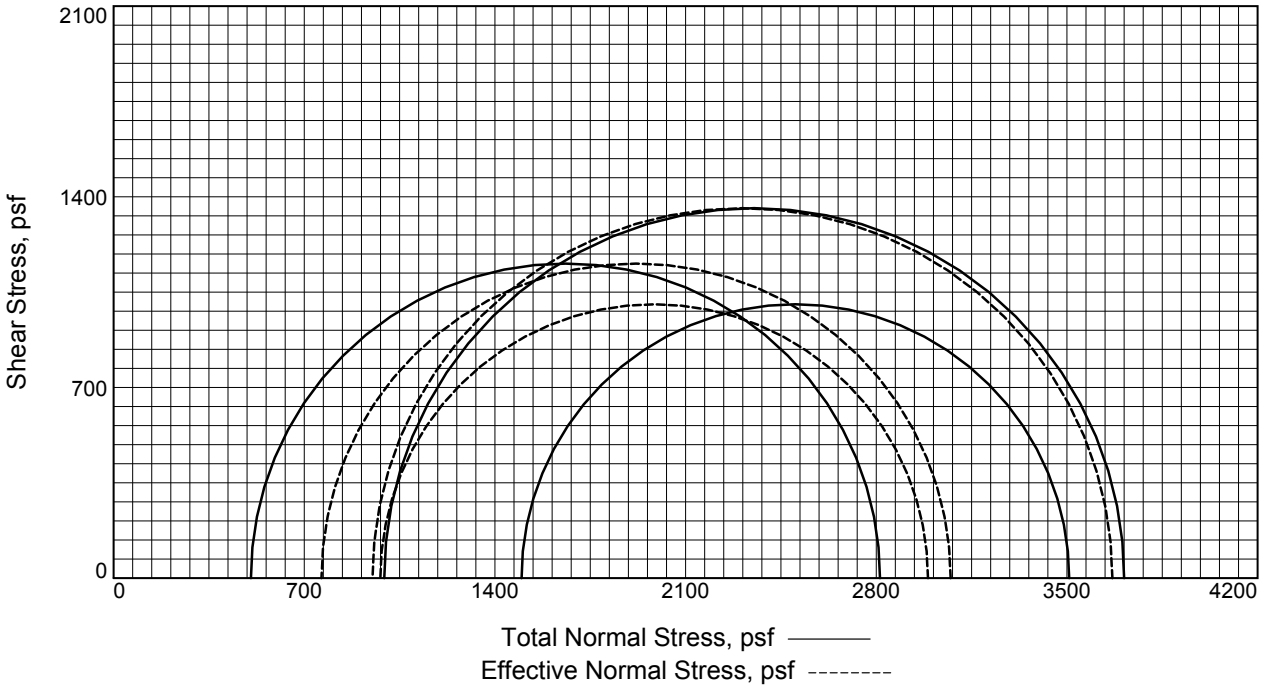
EFFECTIVE STRESS MOHR CIRCLES

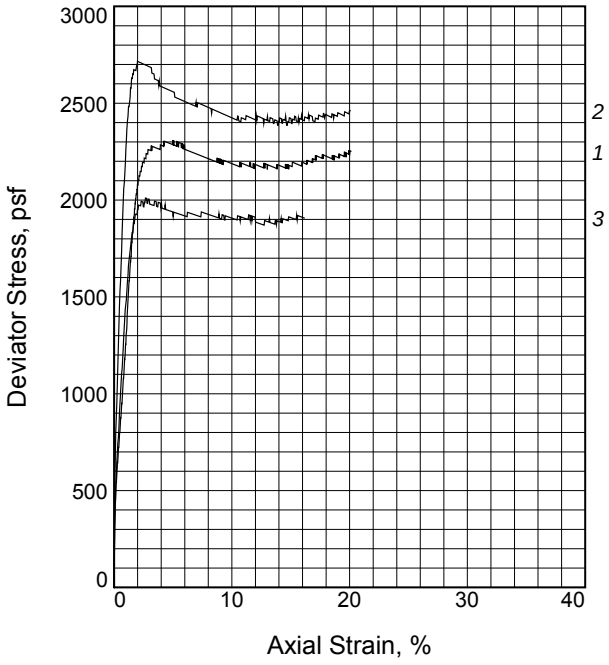
Failure Criteria Maximum Effective σ1 / σ3 ratio

Line Type	Minor Principal Stress at failure (psf) σ_3	Maximum Deviator Stress at failure (psf)	Axial Strain at Failure (%)	Initial Height (in.)	Initial Diam. (in.)	Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Initial Void Ratio	Initial Satura-tion (%)	Specific Gravity (assumed)	Rate of Strain (%/min)	Liquid Limit	Plastic Limit	Height to Diameter Ratio
solid	500	945	0.92	5.00	2.42	15.79	123.6	106.8	0.578	73.7	2.70	0.02	31	20	2.1
dash	1000	1210	1.09	5.00	2.42	15.88	123.6	106.7	0.580	74.0	2.70	0.02			2.1
dot	1500	1890	2.36	5.00	2.42	15.70	123.7	106.9	0.577	73.5	2.70	0.02			2.1

Client: **URS**	Boring #: **SM0007_013A**	Sample #:	**1912+00 Bulk 1**
Project: **Feather River West Levee**	Depth (ft): **1-5**		
Project #: **17326605.0305233**	Soil: **Yellowish brown sandy lean clay**		

ASTM D-4767	**TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED**	**TXCU**





Sample No.		1	2	3
Initial	Water Content, %	15.3	15.2	15.6
	Dry Density, pcf	102.9	103.9	102.1
	Saturation, %	64.9	66.0	64.7
	Void Ratio	0.6381	0.6216	0.6507
	Diameter, in.	2.401	2.415	2.401
	Height, in.	5.151	5.075	5.145
At Test	Water Content, %	24.3	23.6	24.8
	Dry Density, pcf	101.8	103.0	101.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6562	0.6370	0.6691
	Diameter, in.	2.422	2.432	2.424
	Height, in.	5.117	5.052	5.104
Strain rate, in./min.		0.001	0.001	0.001
Eff. Cell Pressure, psf		504.0	993.6	1497.6
Fail. Stress, psf		2309.7	2716.2	2010.5
Excess Pore Pr., psf		-259.2	43.2	518.4
Strain, %		5.0	2.0	2.7
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		3072.9	3666.6	2989.7
$\bar{\sigma}_3$ Failure, psf		763.2	950.4	979.2

Type of Test:
CU with Pore Pressures

Sample Type: 2.4" Cal Mod

Description: SANDY SILT, very dark grayish brown

LL= 23 **PL=** 21 **PI=** 2

Assumed Specific Gravity= 2.70

Remarks:

Figure _____

Client: URS Corporation

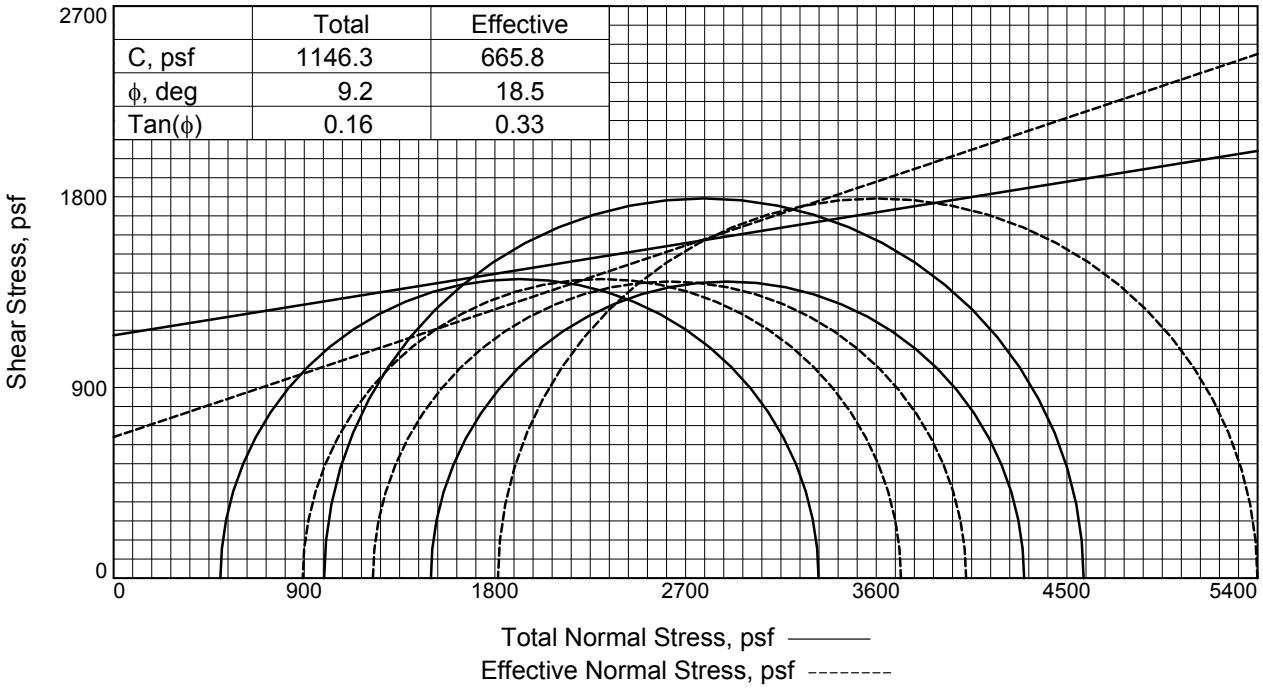
Project: Feather River West Levee

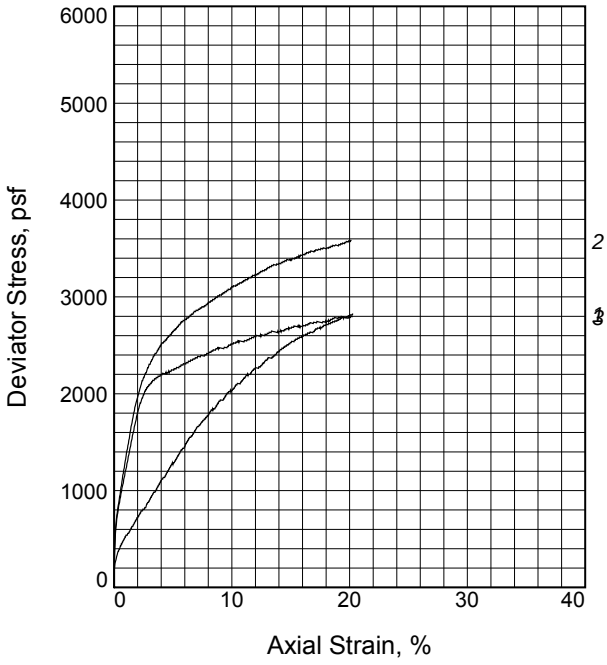
Source of Sample: SM0007_015A **Depth:** 5.0-10.0'

Sample Number: 2

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Sample No.		1	2	3
Initial	Water Content, %	19.2	18.7	19.4
	Dry Density, pcf	107.3	109.6	105.2
	Saturation, %	90.8	94.0	87.2
	Void Ratio	0.5704	0.5375	0.6020
	Diameter, in.	2.880	2.880	2.880
	Height, in.	5.932	5.936	5.936
At Test	Water Content, %	18.6	18.8	20.2
	Dry Density, pcf	112.2	111.8	109.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5028	0.5073	0.5442
	Diameter, in.	2.838	2.861	2.845
	Height, in.	5.846	5.897	5.864
Strain rate, in./min.		0.002	0.003	0.003
Eff. Cell Pressure, psf		504.0	993.6	1497.6
Fail. Stress, psf		2823.5	3584.7	2799.9
Excess Pore Pr., psf		-388.8	-820.8	273.6
Strain, %		20.2	20.1	20.1
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		3716.3	5399.1	4023.9
$\bar{\sigma}_3$ Failure, psf		892.8	1814.4	1224.0

Type of Test:
CU with Pore Pressures

Sample Type:

Description: Lean CLAY with SAND, dark yellowish brown

LL= 30 **PL=** 17 **PI=** 13

Assumed Specific Gravity= 2.70

Remarks:

Figure _____

Client: URS Corporation

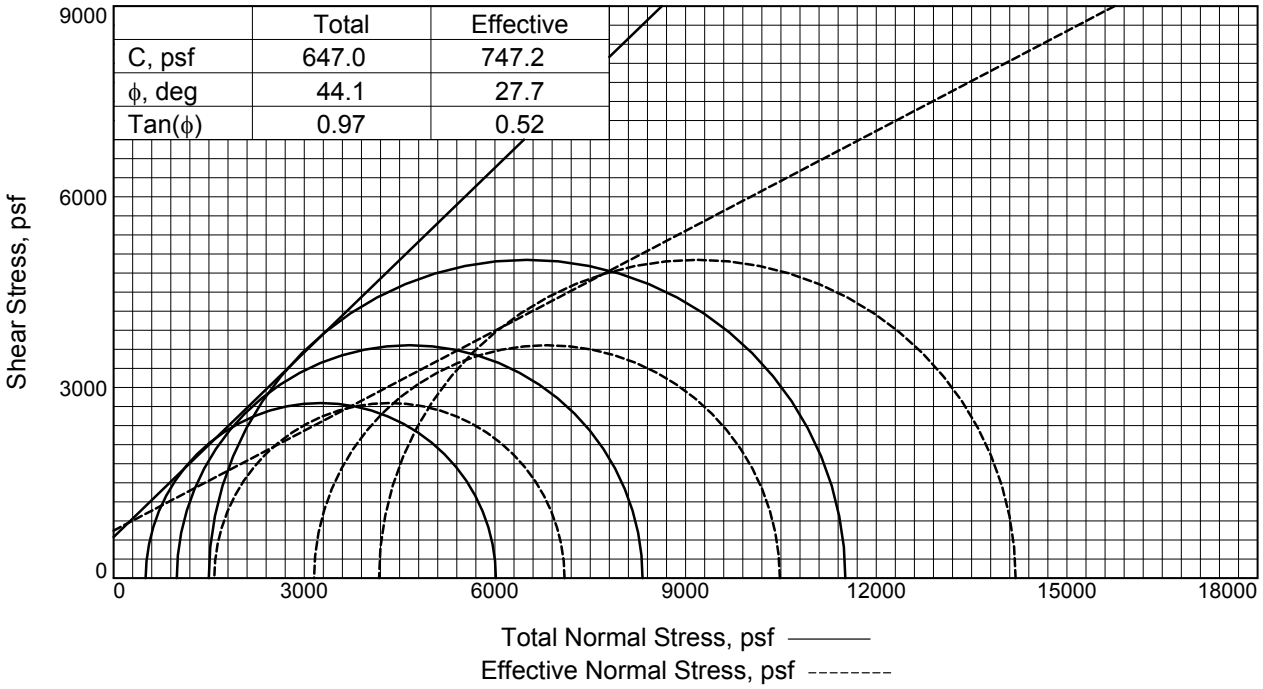
Project: Feather River West Levee

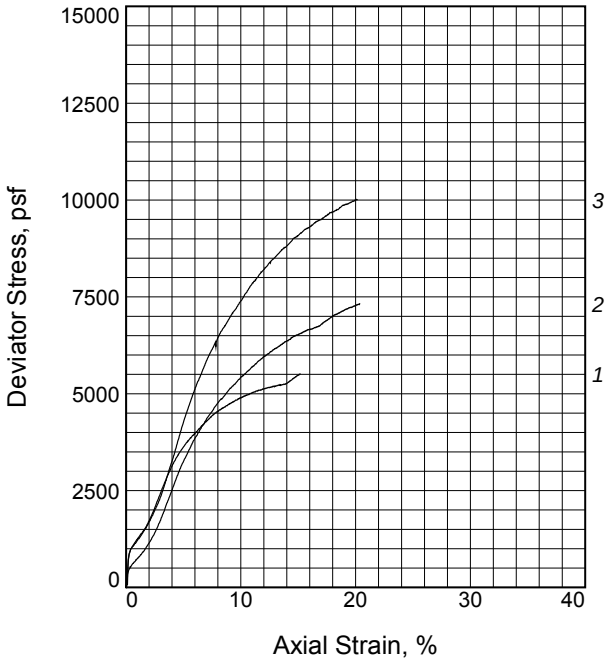
Source of Sample: SM0007_016A **Depth:** 18.5-20.5'

Sample Number: 6

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Sample No.		1	2	3
Initial	Water Content, %	18.1	17.3	15.6
	Dry Density, pcf	110.7	109.3	111.9
	Saturation, %	93.9	86.4	83.0
	Void Ratio	0.5220	0.5423	0.5062
	Diameter, in.	2.880	2.880	2.880
	Height, in.	5.943	5.955	5.950
At Test	Water Content, %	17.2	17.1	17.5
	Dry Density, pcf	115.1	115.4	114.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4641	0.4610	0.4722
	Diameter, in.	2.843	2.828	2.858
	Height, in.	5.867	5.849	5.905
Strain rate, in./min.		0.002	0.002	0.002
Eff. Cell Pressure, psf		504.0	993.6	1497.6
Fail. Stress, psf		5510.7	7328.8	10015.9
Excess Pore Pr., psf		-1080.0	-2160.0	-2678.4
Strain, %		15.2	20.4	20.1
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		7094.7	10482.4	14191.9
$\bar{\sigma}_3$ Failure, psf		1584.0	3153.6	4176.0

Type of Test:
CU with Pore Pressures

Sample Type:

Description: Lean CLAY, dark yellowish brown

LL= 32 **PL=** 17 **PI=** 15

Assumed Specific Gravity= 2.70

Remarks:

Figure _____

Client: URS Corporation

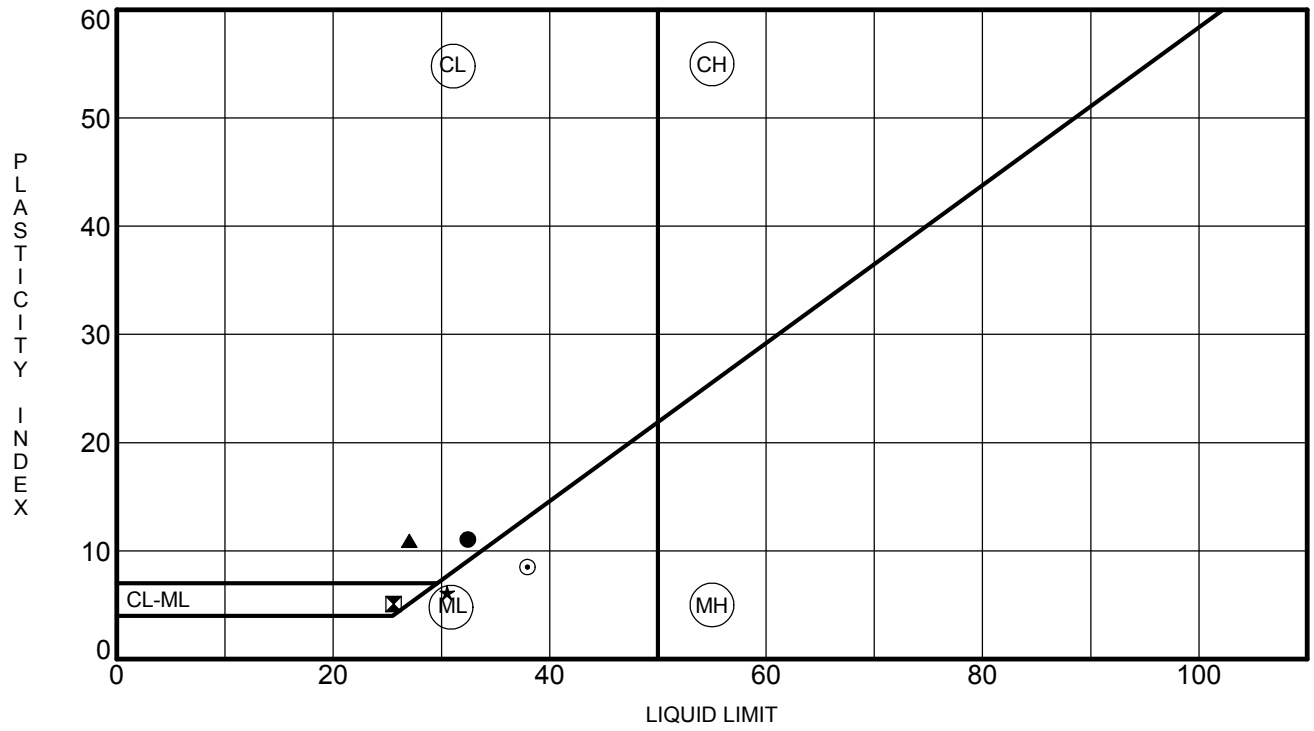
Project: Feather River West Levee

Source of Sample: SM0007_017A **Depth:** 20.0-22.0'

Sample Number: 6

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA



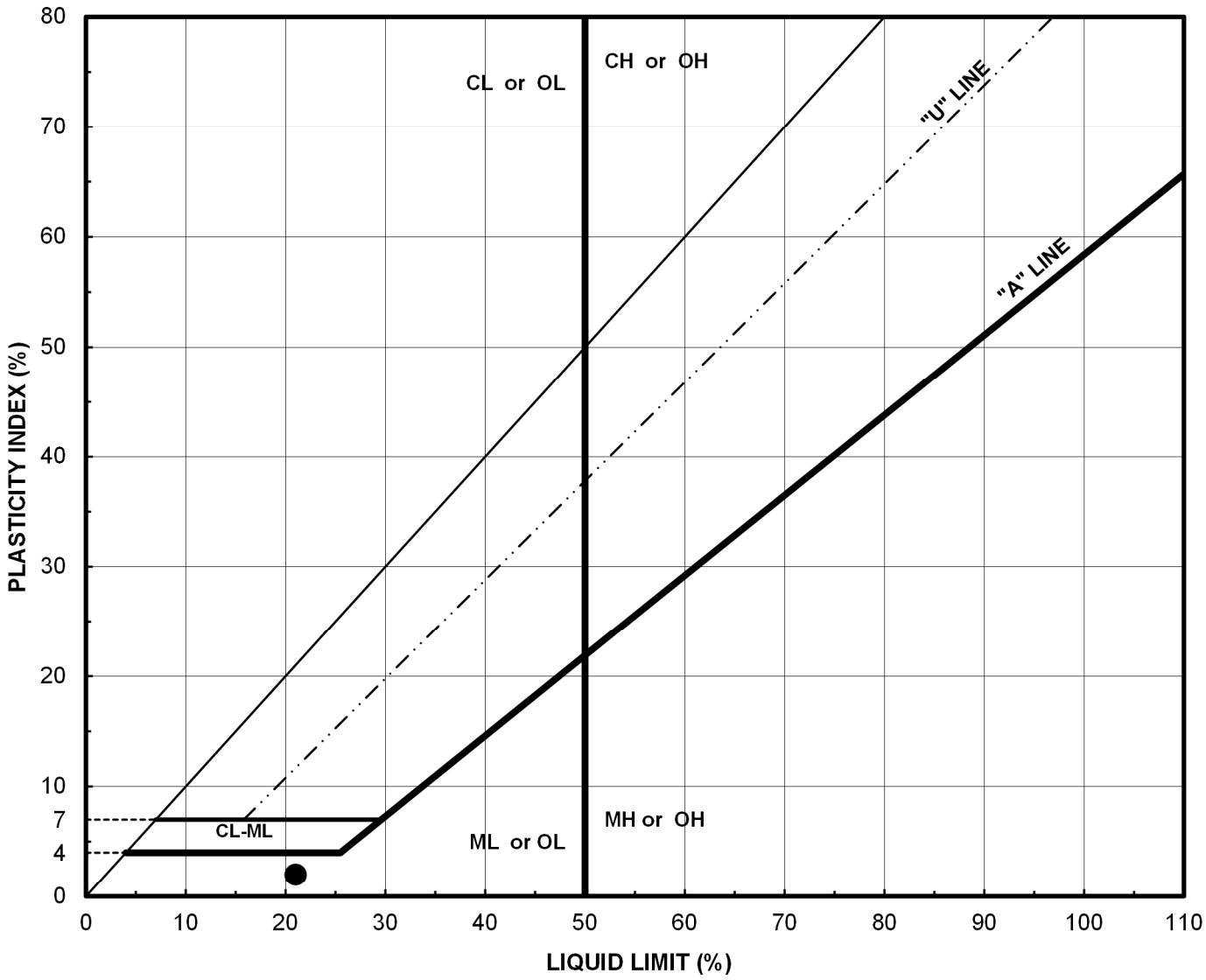
	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description
●	SL0001_012A_818+00_3_24.0-26.0	32	21	11		
⊠	SL0009_005A_1146+ 00_Bulk1_0.0-5.0	26	20	6	74.1	SILTY CLAY with SAND(CL-ML)
▲	SL0009_005A_1146+00_2_20.0-22.0	27	16	11	80.8	LEAN CLAY with SAND(CL)
★	SL0009_006A_1244+00_1_12.0-14.0	31	24	7		
⊙	SL0009_006A_1244+00_2_15.0-17.0	38	29	9		

GEOCON
Geocon Consultants, Inc
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: 916-852-9118
Fax: 916-852-9132

ATTERBERG LIMITS

Project: Feather River
Location: West Levee
Number: S9197-06-15

PI FOR DWR-URS S9197-06-15 FEATHER RIVER WEST LEVEE.GPJ US_LAB.GDT 12/22/11

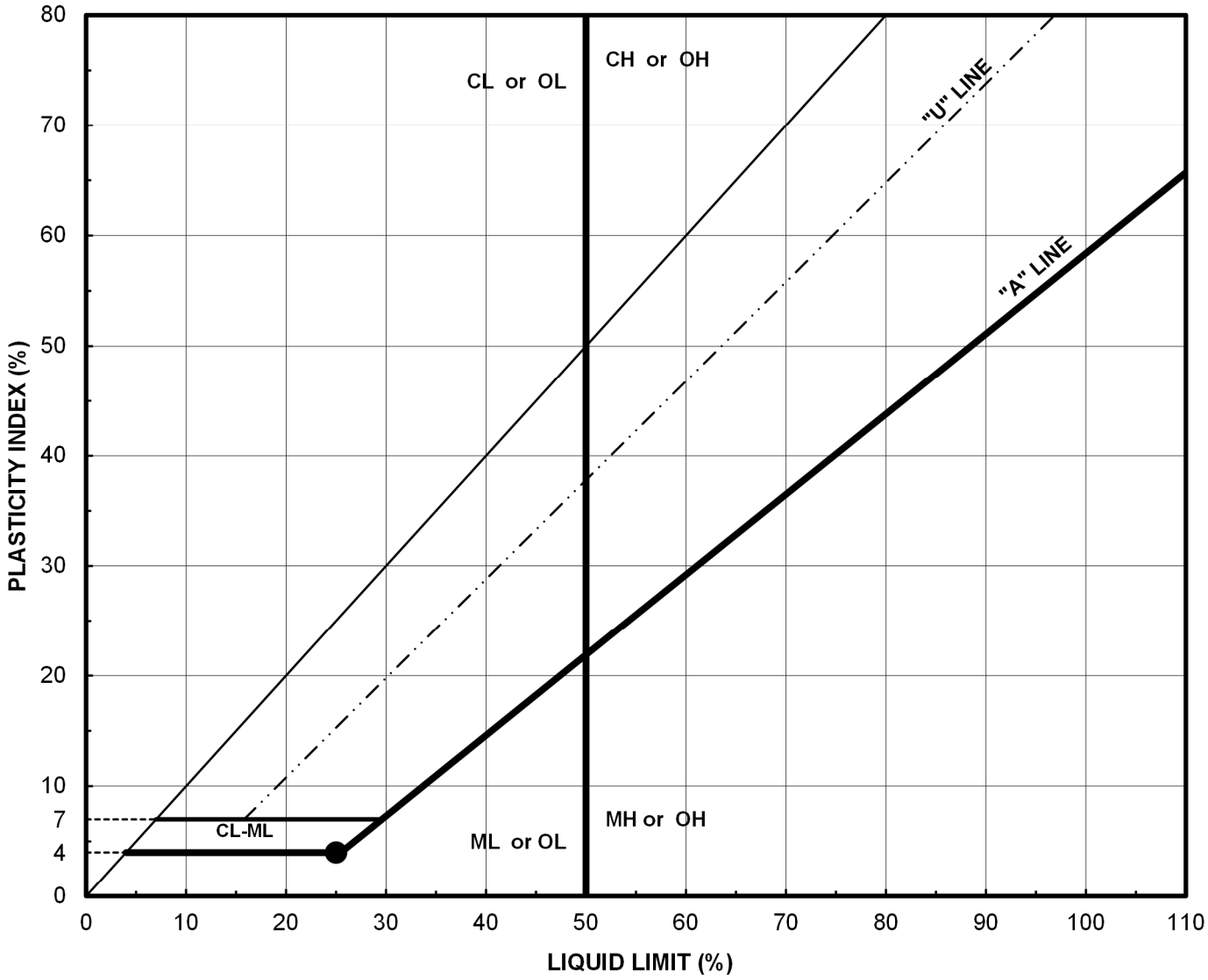


Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
SM0007_012A	3	15.5	12.3	21	2	Dark grayish brown silty Sand (SM)

Project Name: **Feather River West Levee** **PLASTICITY CHART**

Project Number: **17326605**

URS

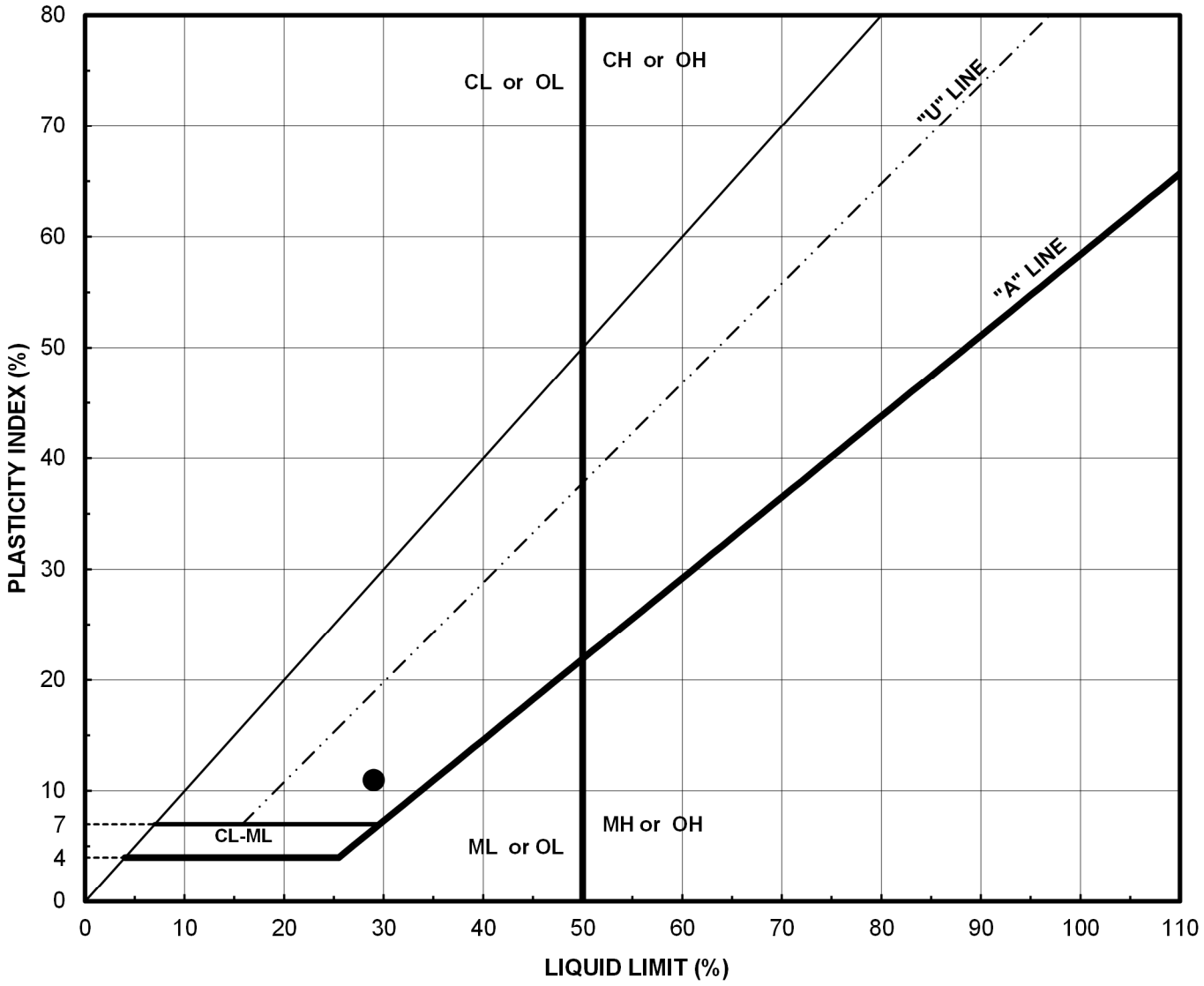


Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
SM0007_012A	4	20.5	24.1	25	4	Brown sandy, silty Clay (CL-ML)

Project Name: **Feather River West Levee** **PLASTICITY CHART**

Project Number: **17326605**

URS

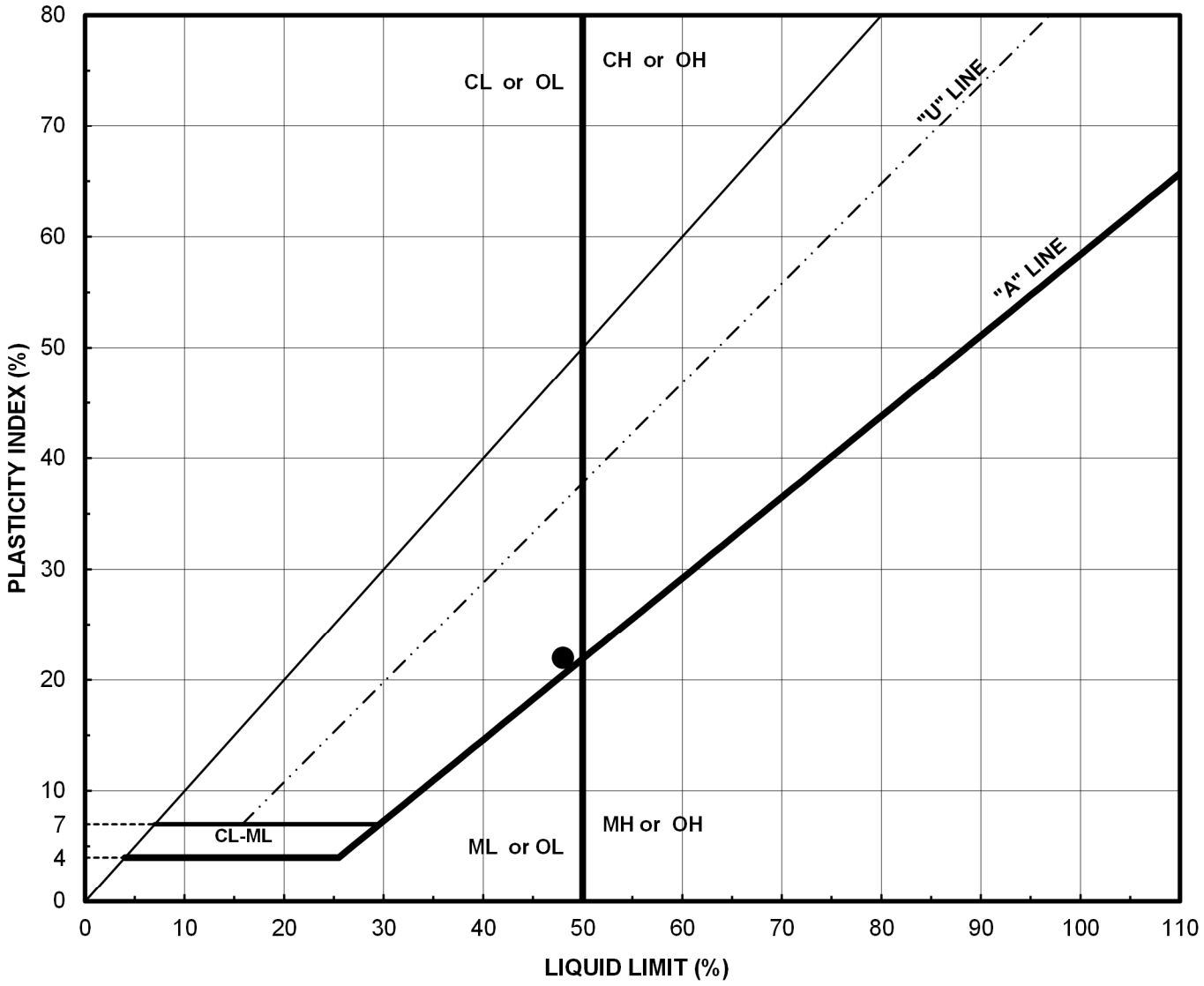


Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
SM0007_020A	4	19.5	21.2	29	11	Dark brown Clay with sand (CL)

Project Name: **Feather River West Levee** **PLASTICITY CHART**

Project Number: **17326605**

URS



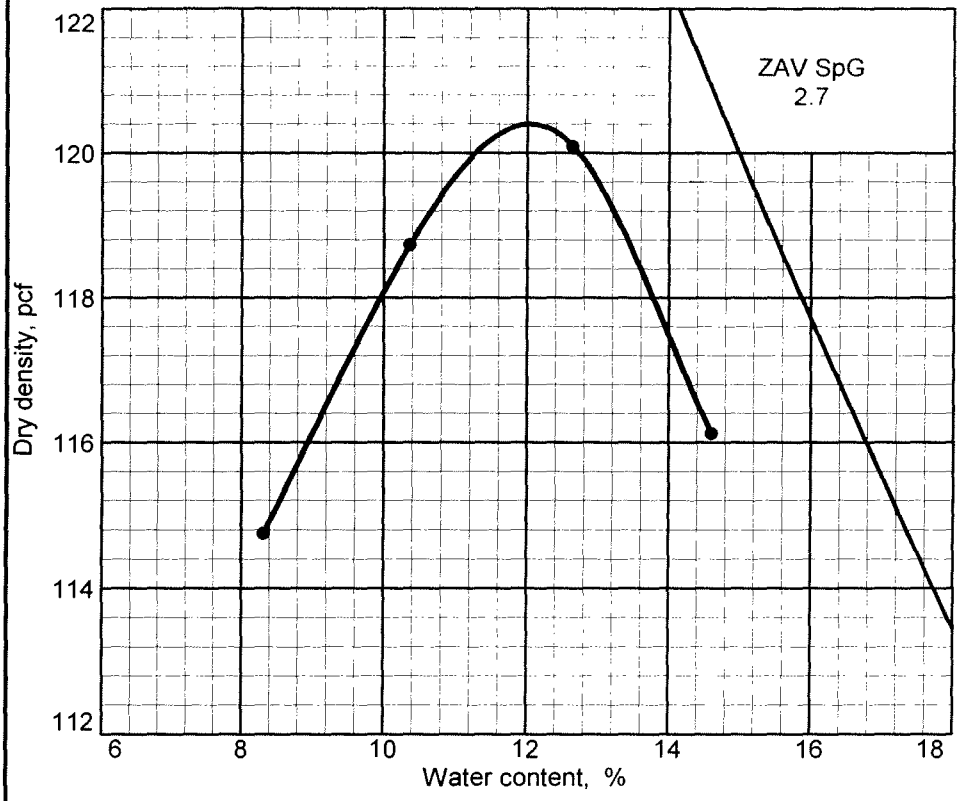
Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
SM0007_013A	4	13.7	35.5	48	22	Very pale to yellowish brown Clay (CL)

Project Name: **Feather River West Levee** **PLASTICITY CHART**

Project Number: **17326605**

URS

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 698-91 Procedure B Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: three
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM		**Sp.G.**	
LL	24	**PI**	7
%>3/8 in.		**%<#200**	48.2
USCS	SC-SM	**AASHTO**	

TESTING DATA

	1	2	3	4	5	6
WM + WS	3998.0	4062.0	4029.0	3896.0		
WM	2017.0	2017.0	2017.0	2017.0		
WW + T #1	802.90	735.20	747.80	738.60		
WD + T #1	727.50	652.70	652.50	681.90		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	10.4	12.6	14.6	8.3		
DRY DENSITY	118.7	120.1	116.1	114.7		

TEST RESULTS

Maximum dry density = 120 pcf

Optimum moisture = 12 %

Material Description

Yellowish brown silty clayey sand

Project No. 17326605.030501 **Client:** URS
Project: Feather River West Levee

● **Source:** SL0001_012A **Sample No.:** 818+00 **Elev./Depth:** 6-12

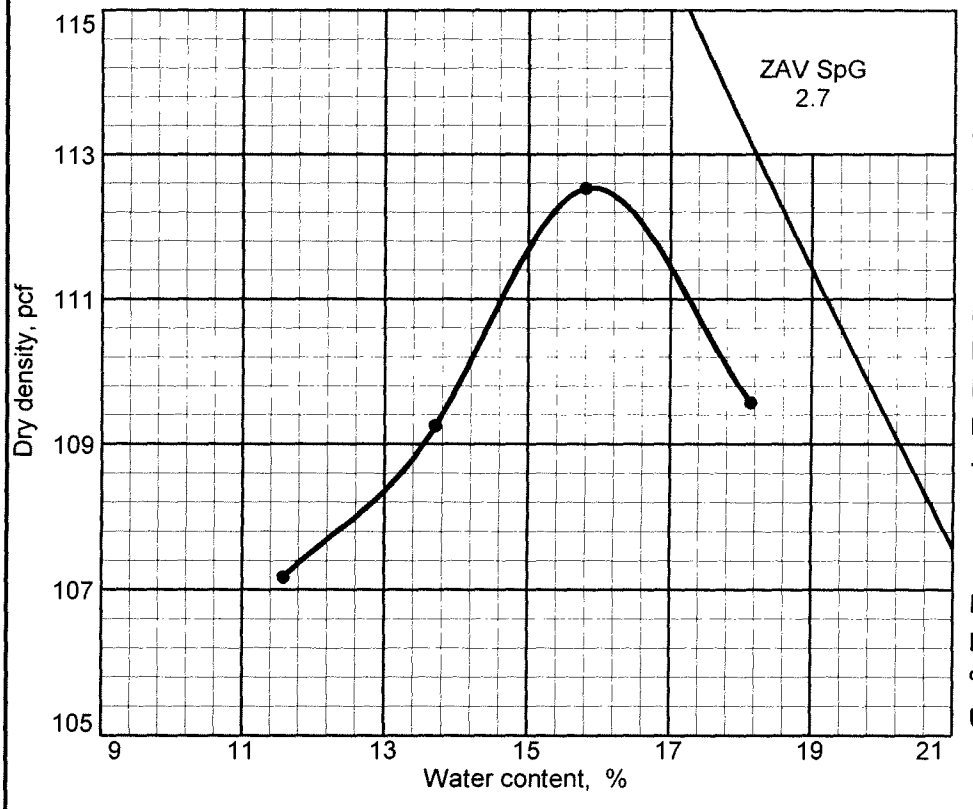
Remarks:
Bulk #2

COMPACTION TEST REPORT

SIGNET TESTING LABS, INC.

Figure

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 698-91 Procedure B Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: three
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM _____ **Sp.G.** _____
LL 30 **PI** 7
%>3/8 in. _____ **%<#200** 66.1
USCS CL-ML **AASHTO** _____

TESTING DATA

	1	2	3	4	5	6
WM + WS	3895.0	3987.0	3974.0	3825.0		
WM	2017.0	2017.0	2017.0	2017.0		
WW + T #1	608.90	541.60	535.20	618.10		
WD + T #1	535.50	467.70	453.00	553.90		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	13.7	15.8	18.1	11.6		
DRY DENSITY	109.2	112.5	109.6	107.2		

TEST RESULTS

Maximum dry density = 113 pcf

Optimum moisture = 16 %

Material Description

Yellowish brown sandy silty clay

Project No. 17326605.0305 **Client:** URS
Project: Feather River West Levee

● **Source:** SM0007_012A **Sample No.:** 1891+60 **Elev./Depth:** 5-10

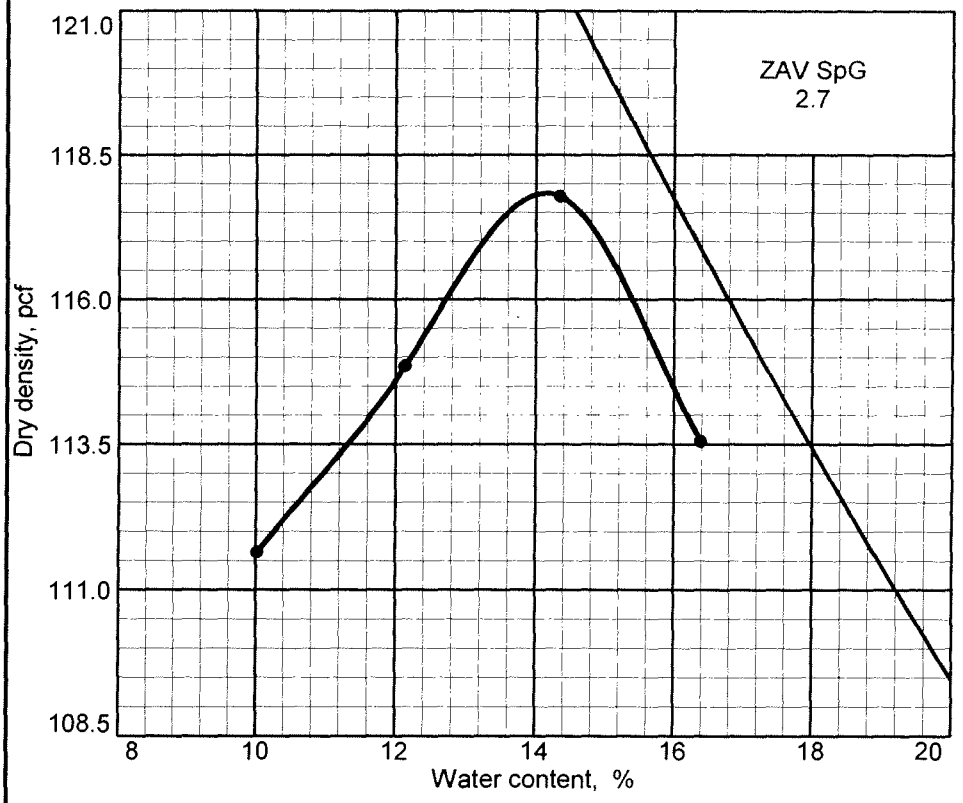
Remarks:
Bulk #2

COMPACTION TEST REPORT

SIGNET TESTING LABS, INC.

Figure

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 698-91 Procedure B Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: three
Blows per Layer: 25
Mold Size: .03333 cu.ft.

Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM		**Sp.G.**	
LL	24	**PI**	3
%>3/8 in.		**%<#200**	46.4
USCS	SM	**AASHTO**	

TESTING DATA

	1	2	3	4	5	6
WM + WS	3874.0	3964.0	4053.0	4015.0		
WM	2017.0	2017.0	2017.0	2017.0		
WW + T #1	631.30	649.60	656.80	781.80		
WD + T #1	573.80	579.30	574.40	671.70		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	10.0	12.1	14.3	16.4		
DRY DENSITY	111.6	114.8	117.8	113.5		

TEST RESULTS

Maximum dry density = 118 pcf

Optimum moisture = 14 %

Material Description

Yellowish brown silty sand

Project No. 17326605.0305 **Client:** URS
Project: Feather River West Levee

● **Source:** **Sample No.:** 1892+00 **Elev./Depth:** 5-10

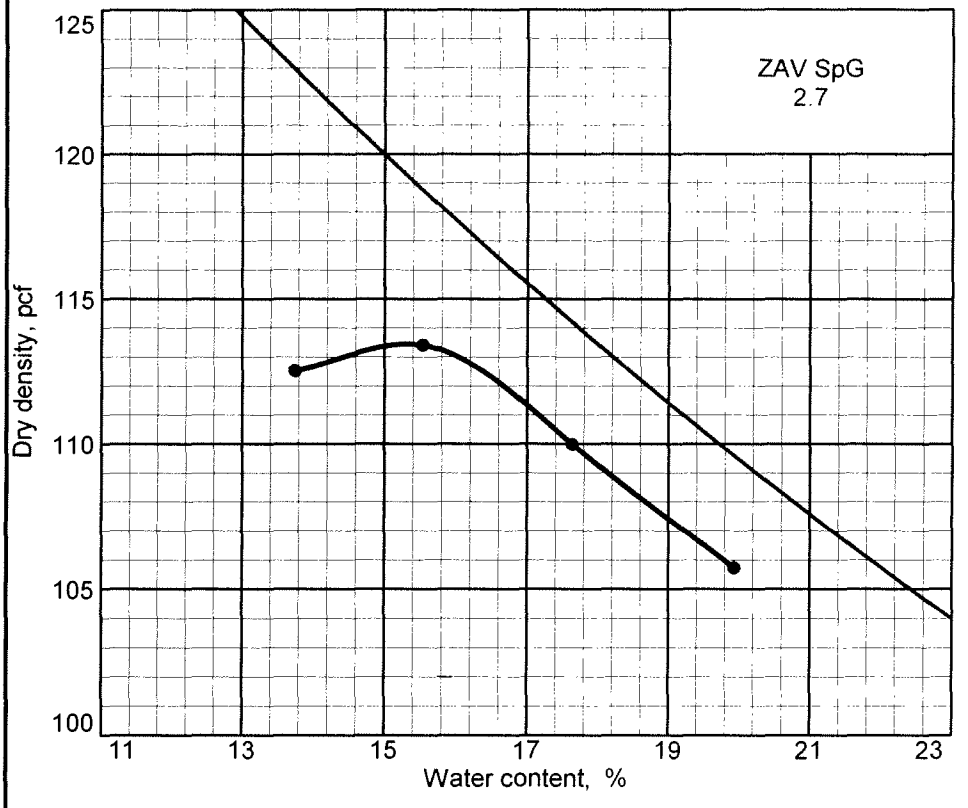
Remarks:
Bulk #2

COMPACTION TEST REPORT

SIGNET TESTING LABS, INC.

Figure

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 698-91 Procedure B Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: three
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM _____ **Sp.G.** _____
LL 31 **PI** 11
%>3/8 in. _____ **%<#200** _____
USCS CL **AASHTO** _____

TESTING DATA

	1	2	3	4	5	6
WM + WS	3952.0	3998.0	3973.0	3934.0		
WM	2017.0	2017.0	2017.0	2017.0		
WW + T #1	612.30	515.20	584.90	747.80		
WD + T #1	538.30	445.90	497.20	623.50		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	13.7	15.5	17.6	19.9		
DRY DENSITY	112.5	113.4	110.0	105.7		

TEST RESULTS

Maximum dry density = 113 pcf

Optimum moisture = 15 %

Material Description

Yellowish brown sandy lean clay

Project No. 17326605.0305 **Client:** URS
Project: Feather River West Levee

● **Source:** SM0007_013A **Sample No.:** 1912+00 **Elev./Depth:** 1-5

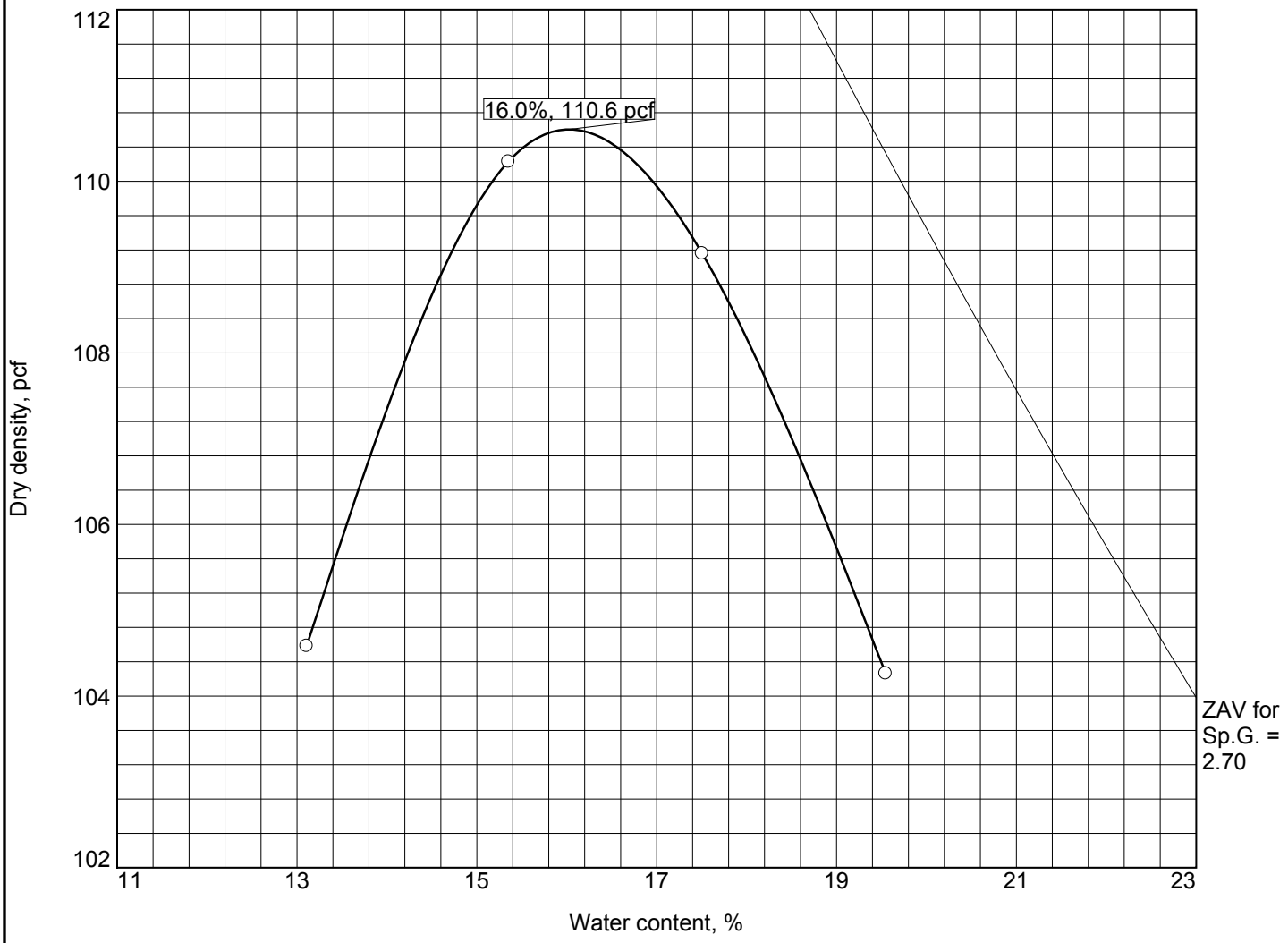
Remarks:
Bulk #1

COMPACTION TEST REPORT

SIGNET TESTING LABS, INC.

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
5.0-10.0'	ML		15.2	2.7	23	2	0.0	57.1

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.6 pcf Optimum moisture = 16.0 %	SANDY SILT, very dark grayish brown

Project No. 17326605.0305233 **Client:** URS Corporation
Project: Feather River West Levee

○ **Sample Source:** SM0007_015A **Depth:** 5.0-10.0' **Sample No.:** 2

Blackburn Consulting

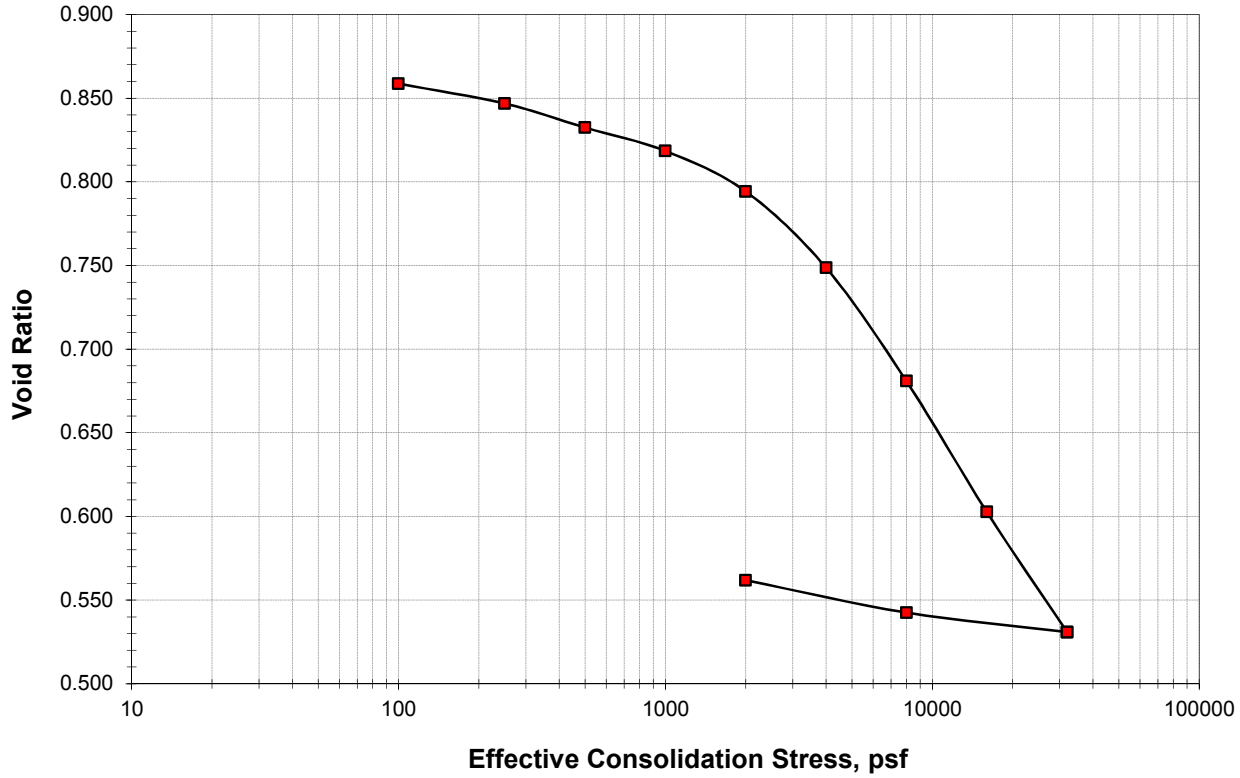
W. Sacramento, CA

Remarks:

Figure

CONSOLIDATION TEST - ASTM D2435

Project Name	Urban Levee Geotechnical Evaluation Program - Davis
Geocon Project Number	S9197-06-15
Boring Number	SL0001-012A
Sample Number	818+00_3_24.0-26.0
Sample Description	



Axial Load, psf	Void Ratio	Axial Strain, %
initial	0.858	0.00
100	0.859	-0.01
250	0.847	0.63
500	0.832	1.40
1000	0.818	2.15
2000	0.794	3.46
4000	0.749	5.91
8000	0.681	9.55
16000	0.603	13.76
32000	0.531	17.63
8000	0.543	17.00
2000	0.562	15.96

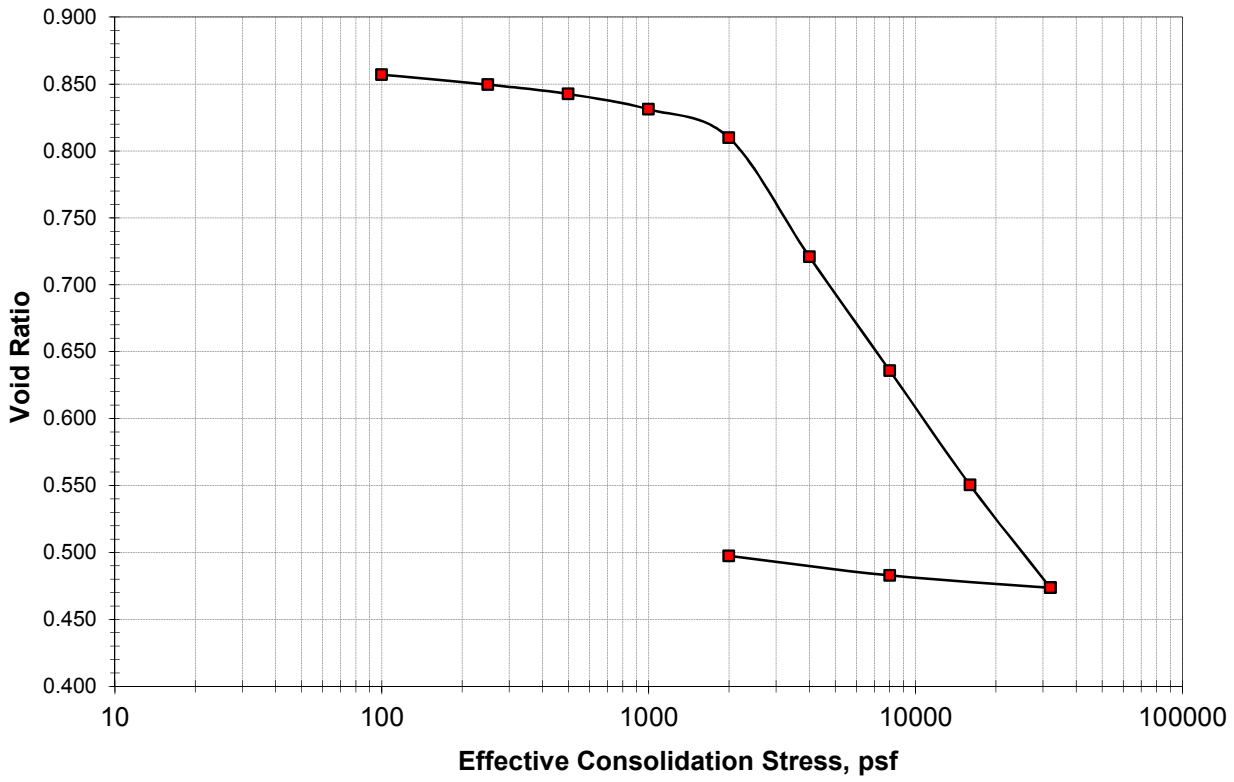
Measurement	Initial	Final
Height (in.)	0.750	0.630
Moisture Content (%)	20.3	19.9
Dry Density (pcf)	94.7	112.7
Saturation (%)	67	100

Note:
Gs = 2.82 (assumed)

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3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
tel. 916.852-9118 fax. 916.852.9132

CONSOLIDATION TEST - ASTM D2435

Project Name	Feather River West Levee
Geocon Project Number	S9197-06-15
Boring Number	SL0009_005A
Sample Number	1146+00_2_20.0_22.0
Sample Description	



Axial Load, psf	Void Ratio	Axial Strain, %
initial	0.857	0.00
100	0.857	0.00
250	0.850	0.40
500	0.842	0.78
1000	0.831	1.39
2000	0.810	2.54
4000	0.721	7.33
8000	0.636	11.90
16000	0.550	16.51
32000	0.474	20.64
8000	0.483	20.15
2000	0.497	19.36

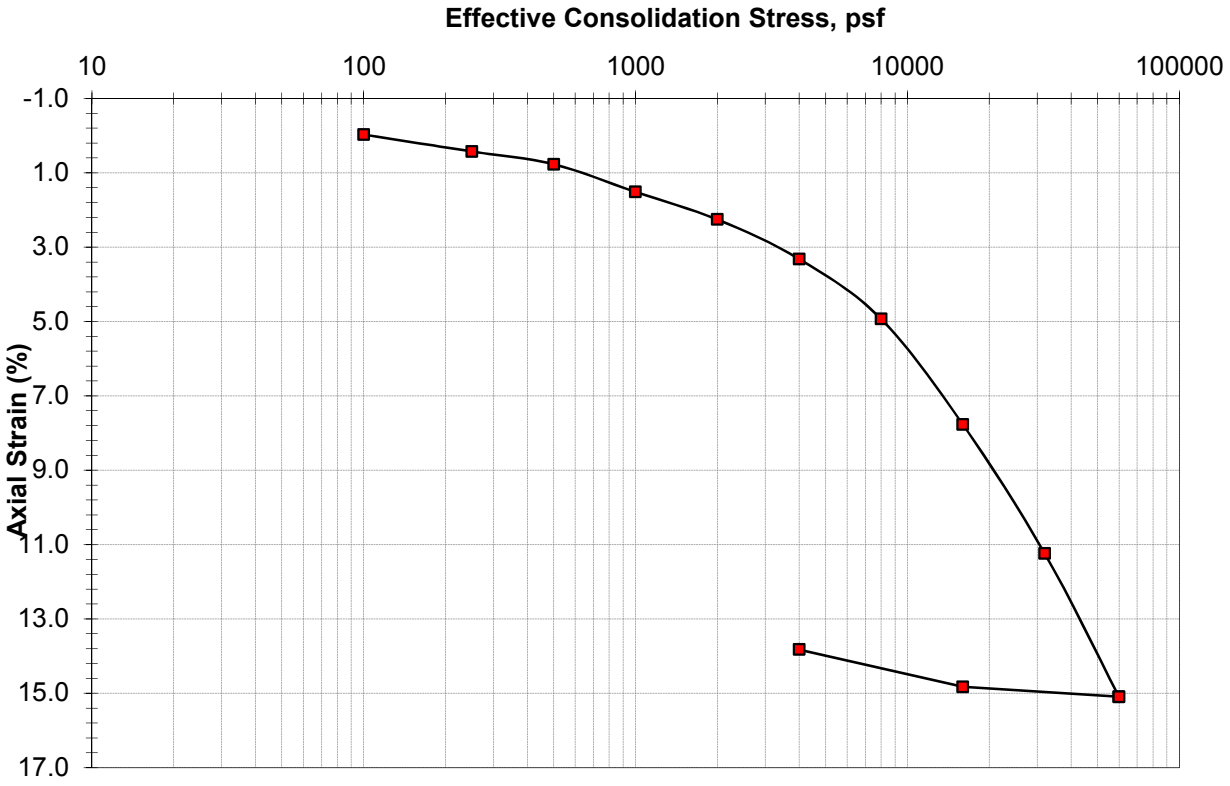
Measurement	Initial	Final
Height (in.)	0.750	0.599
Moisture Content (%)	16.5	17.3
Dry Density (pcf)	92.5	115.8
Saturation (%)	53	99

Note:
Gs = 2.75 (assumed)

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CONSOLIDATION TEST - ASTM D2435

Project Name	Feather River West Levee
Geocon Project Number	S9197-06-15
Boring Number	SL0009_006A
Sample Number	1244+00_1_12.0-14.0
Sample Description	

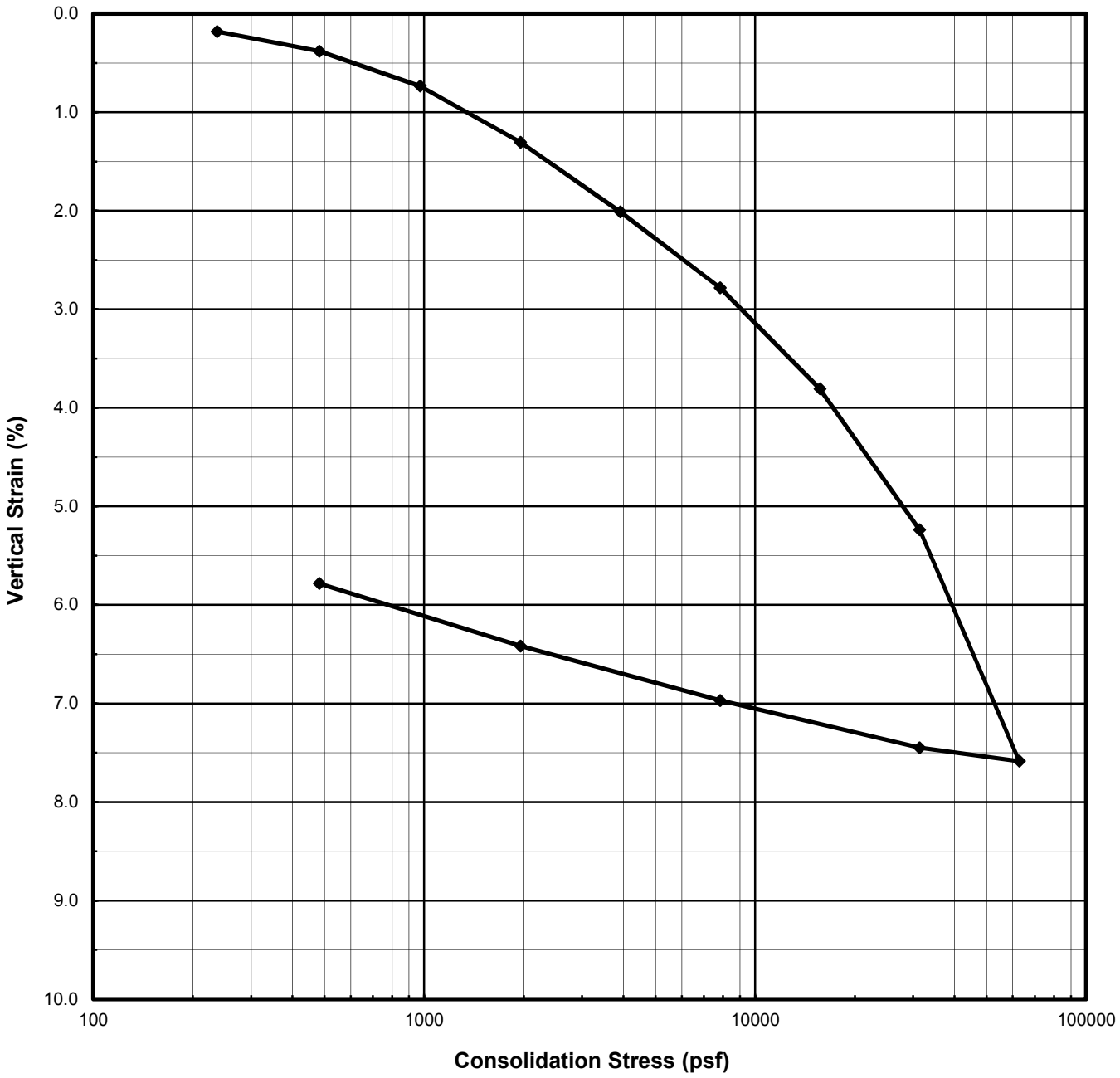


Axial Load, psf	Void Ratio	Axial Strain, %
initial	1.007	0.00
100	1.008	-0.03
250	0.999	0.43
500	0.992	0.77
1000	0.977	1.51
2000	0.962	2.26
4000	0.941	3.32
8000	0.908	4.93
16000	0.851	7.77
32000	0.782	11.24
60000	0.704	15.09
16000	0.710	14.83
4000	0.730	13.83

Measurement	Initial	Final
Height (in.)	0.750	0.630
Moisture Content (%)	22.4	23.8
Dry Density (pcf)	89.3	106.2
Saturation (%)	64	100

Note:
Gs = 2.87 (assumed)

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Description:	**Dark grayish brown silty Sand (SM)**								
Boring No.:	SM0007_012A		Liquid Limit	21	%	Specific Gravity	2.75	assumed	
Sample No.:	3		Plasticity Index	2	%				
Depth (ft | m)	15.8	4.82	Fines Content	45.2	%	Water added at	114	psf	

	Water Content (%)	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Saturation (%)	Void Ratio	Height (inches)	Height (cm)	Diameter (inches)	Diameter (cm)
Initial	13.5	124.4	19.55	109.7	17.23	65.9	0.56	1.103	2.80	2.870	7.290
Final	16.6	132.9	20.87	114.0	17.90	90.5	0.50	1.062	2.70		

URS

Feather River West Levee

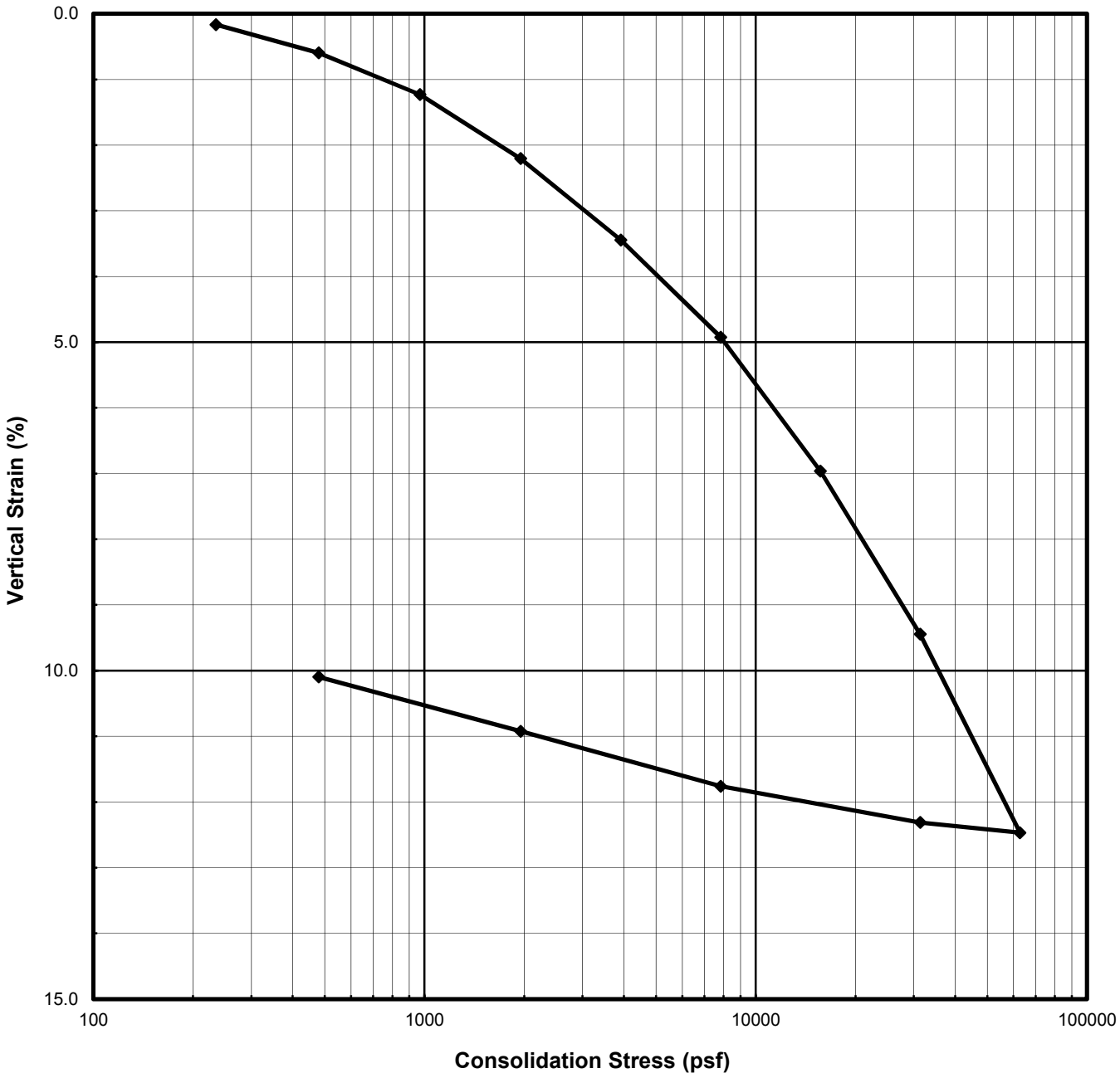
Project Number: 17326605

Test Start Date: 10/26/2011

CONSOLIDATION TEST
ASTM D2435

SUBMITTED BY: Thomas J. O'Mara

Con FRWL SM0007_012A.xls



Description:	**Dark yellowish brown Clay with sand (CL)**								
Boring No.:	SM0007_020A		Liquid Limit	29	%	Specific Gravity	2.75	assumed	
Sample No.:	4		Plasticity Index	11	%				
Depth (ft | m)	21.0	6.40	Fines Content	81.7	%	Water added at	112	psf	

	Water Content (%)	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Saturation (%)	Void Ratio	Height (inches)	Height (cm)	Diameter (inches)	Diameter (cm)
Initial	19.5	127.5	20.02	106.6	16.75	88.5	0.61	1.088	2.76	2.871	7.292
Final	17.5	137.3	21.56	116.8	18.35	103.2	0.47	0.994	2.52		

URS

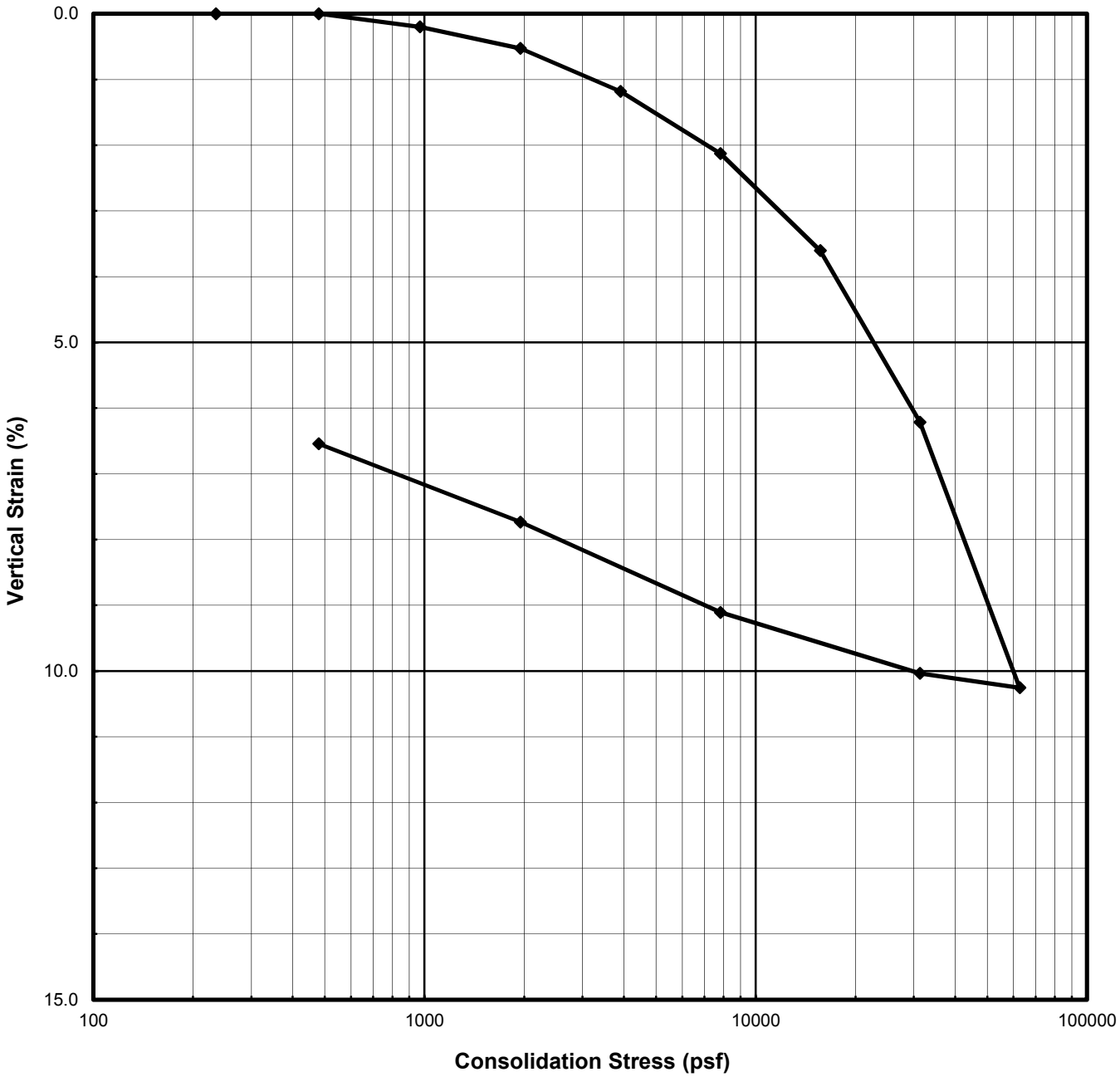
Feather River West Levee

Project Number: 17326605
Test Start Date: 10/26/2011

CONSOLIDATION TEST
ASTM D2435

SUBMITTED BY: Thomas J. O'Mean

Con FRWL SM0007_020A.xls



Description:	**Very pale to yellowish brown Clay (CL)**							
Boring No.:	SM0007_013A		Liquid Limit	48	%	Specific Gravity	2.75	assumed
Sample No.:	4		Plasticity Index	22	%			
Depth (ft | m)	14.5	4.42	Fines Content	95.7	%	Water added at	112	psf

	Water Content (%)	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Saturation (%)	Void Ratio	Height (inches)	Height (cm)	Diameter (inches)	Diameter (cm)
Initial	29.4	118.2	18.56	91.3	14.34	92.3	0.88	1.099	2.79	2.872	7.295
Final	28.3	123.1	19.34	96.0	15.08	99.1	0.79	1.045	2.66		

URS

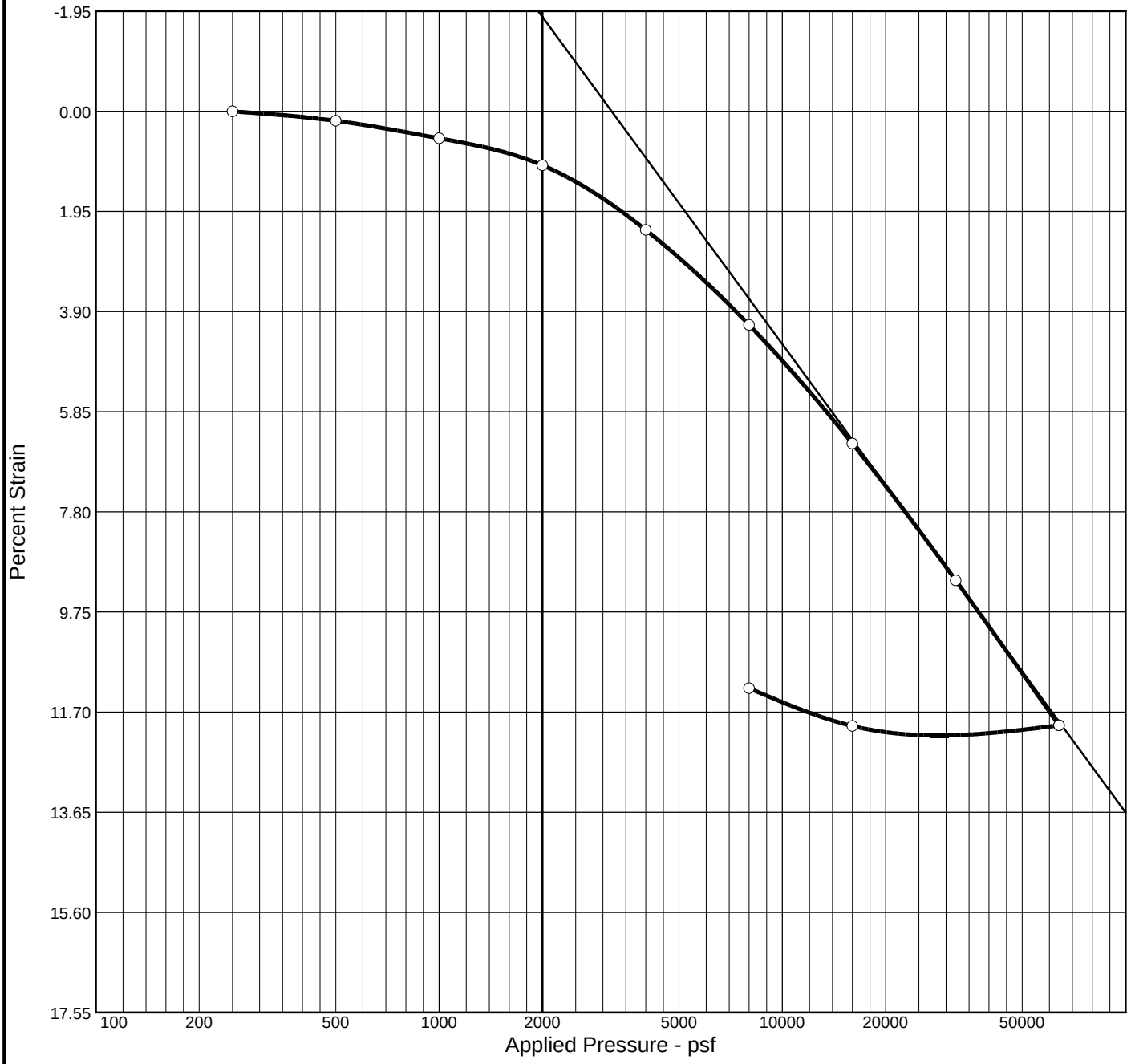
Feather River West Levee

Project Number: 17326605
Test Start Date: 10/26/2011

CONSOLIDATION TEST
ASTM D2435

SUBMITTED BY: Thomas J. O'Mean

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
92.4 %	18.8 %	108.7	29	12	2.70	1326	4739	0.14	0.02			0.551

MATERIAL DESCRIPTION	USCS	AASHTO
Lean CLAY with SAND, yellowish red, stiff	CL	

Project No. 17326605.0305233 **Client:** URS Corporation

Project: Feather River West Levee

Source: SM0007_016A **Sample No.:** #3 **Elev./Depth:** 11.03-11.10'

Blackburn Consulting

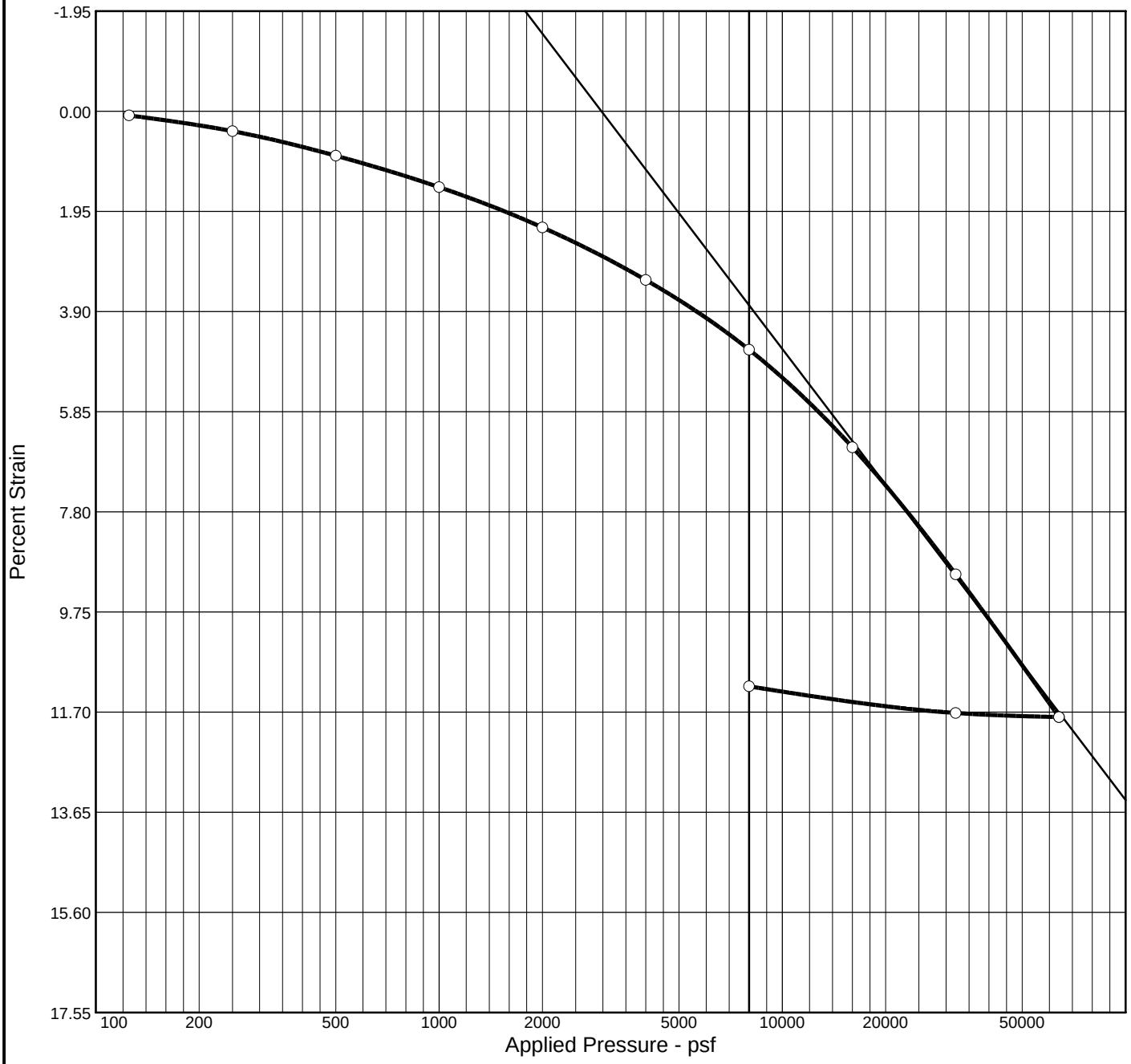
W. Sacramento, CA

Remarks:

76.3 % Fines

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
136.5 %	42.9 %	91.2	32	15	2.70	2418	11067	0.16	0.01			0.848

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY CLAY, dark yellowish brown	CL-ML	

Project No. 17326605.0305233 **Client:** URS Corporation

Project: Feather River West Levee

Source: SM0007_017A **Sample No.:** #6 **Elev./Depth:** 20.13-20.20

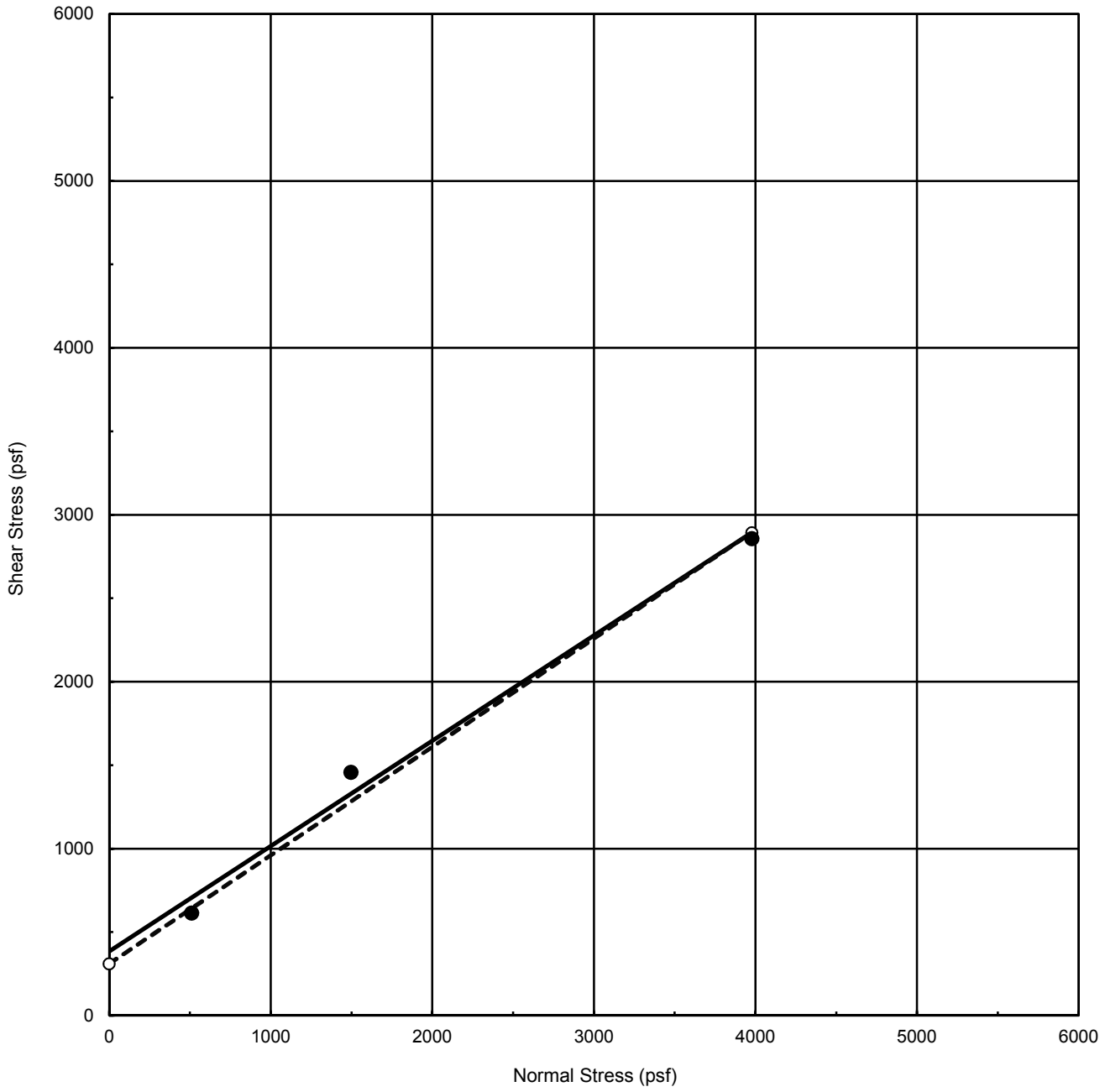
Blackburn Consulting

W. Sacramento, CA

Remarks:

87.3% Fines

Figure



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	SM0007_013A		Strength Intercept (C) :	385.2	psf	Peak	310.2	psf	Ultimate		
Sample No.:	4			18.4	kPa		14.9	kPa			
Depth (ft | m)	14.0	4.3	Friction Angle (ϕ) :	32	degree		33	degree			
Description:	**Very pale to yellowish brown Clay (CL)**					Shear rate :	0.0001	(in/min) ,	0.0003	(cm/min)	

SYMBOL		% Water Content	Total Unit Weight		Dry Unit Weight		Normal Stress		Peak Stress		Ultimate Stress	
			(pcf)	(kN/m^3)	(pcf)	(kN/m^3)	(psf)	(kPa)	(psf)	(kPa)	(psf)	(kPa)
Initial / Set up		35.5	113.4	17.8	83.7	13.2	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	41.9	118.6	18.6	83.6	13.1	510	24	615	29	551	26
	spec. 2	39.8	120.2	18.9	86.0	13.5	1496	72	1457	70	1408	67
	spec. 3	42.1	120.2	18.9	84.6	13.3	3977	190	2857	137	2857	137

URS

Feather River West Levee

Project Number: 17326605

Test Date: 11/5/2011

DIRECT SHEAR TEST

ASTM D 3080

ds_shear plot FRWL SM0007_013A.xlsx

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SM0007_012A

Project Name: Feather River West Levee Sample No.: 3

Project Engineer: RN Depth (ft): 15.5

Visual Description: Dark grayish brown silty Sand (SM)

SPECIMEN: Tested From:

Bulk Sample			Other ____	
SPT Sample		x	Thin-Walled Tube	x
Calif. Sample			Engr. Test Specimen's WC	c

[ ] **Whole sample used**

[ ] **See Bulk Sample Processing Form**

Selection Method:

Sieves (1) - whole sample used

Sieves (1) - partial sample used & selected by Method(s)

Method

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No [x] Yes [ ]

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

By: [ ] Mortar & Pestle [ ] Hand [ ] Pulverizer [ ] Other

and Soil Soaked for: ~ 6 hrs.

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	**Water Content** As Recieved	
				Container No.	m5
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	600.31
Container Number		m5	m5	Dry, M2 (g)	544.75
Mass of Container and Dry Soil, (g)		544.75	340.31	Cont.,M3 (g)	91.29
Mass of Container, (g)		91.29	91.35	**Water Content (%)**	**12.25**
Dry Soil, Ws (g)		453.46	248.96		

SIEVING RESULTS % error: 0.00

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	123.95		72.7
#60 / 60			
#100 / 40	227.22		49.9
#140 / 30			
#200 / 20	248.58		45.2
Pan	248.95	XXXXXXXX	XXXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES		D60	XXXXX	D85	XXXXX
% GRAVEL		D30	XXXXX	D15	XXXXX
% SAND		D10	XXXXX	D50	XXXXX
% FINES	45.2	Cu =	XXXXX	Cc =	XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

Mica Noted: [x] No [ ] Yes Amount Adjective:

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence.

* Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: TJO DATE 10/26/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mara

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SM0007_012A

Project Name: Feather River West Levee Sample No.: 4

Project Engineer: RN Depth (ft): 20.5

Visual Description: Brown sandy, silty Clay (CL-ML)

SPECIMEN: Tested From:

Bulk Sample			Other ____	
SPT Sample		x	Thin-Walled Tube	x
Calif. Sample			Engr. Test Specimen's WC	c

[ ] **Whole sample used**

[ ] **See Bulk Sample Processing Form**

Selection Method:

Sieves (1) - whole sample used

Sieves (1) - partial sample used & selected by Method(s)

Method

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No [x] Yes [ ]

By: [ ] Mortar & Pestle [ ] Hand [ ] Pulverizer [ ] Other

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

and Soil Soaked for: ~ 6 hrs.

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	**Water Content** As Recieved Container No.	m60
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	483.57
Container Number		m60	m60	Dry, M2 (g)	407.43
Mass of Container and Dry Soil, (g)		407.43	193.24	Cont.,M3 (g)	91.43
Mass of Container, (g)		91.43	91.46	**Water Content (%)**	**24.09**
Dry Soil, Ws (g)		316	101.78		

SIEVING RESULTS % error: 0.00

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	33.53		89.4
#60 / 60			
#100 / 40	81.18		74.3
#140 / 30			
#200 / 20	101.34		67.9
Pan	101.78	XXXXXXXX	XXXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES ____ D60 XXXXX D85 XXXXX

% GRAVEL ____ D30 XXXXX D15 XXXXX

% SAND ____ D10 XXXXX D50 XXXXX

% FINES 67.9 Cu = XXXXX Cc = XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

Mica Noted: [x] No [ ] Yes Amount Adjective: ____

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence.

* Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: TJO DATE 10/26/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mara

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SM0007_020A

Project Name: Feather River West Levee Sample No.: 4

Project Engineer: RN Depth (ft): 19.5

Visual Description: Dark brown Clay with sand (CL)

SPECIMEN: Tested From:

Bulk Sample			Other ____	
SPT Sample		x	Thin-Walled Tube	x
Calif. Sample			Engr. Test Specimen's WC	c

Whole sample used

See Bulk Sample Processing Form

Selection Method:

Sieves (1) - whole sample used

Sieves (1) - partial sample used & selected by Method(s)

Method

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No x Yes

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

and Soil Soaked for: ~ 6 hrs.

By: Mortar & Pestle Hand; Pulverizer Other

Water Content

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	As Recieved	
				Container No.	m13
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	303.74
Container Number		m13	m13	Dry, M2 (g)	266.25
Mass of Container and Dry Soil, (g)		266.25	122.38	Cont.,M3 (g)	89.82
Mass of Container, (g)		89.82	89.85	**Water Content (%)**	**21.25**
Dry Soil, Ws (g)		176.43	32.53		

SIEVING RESULTS % error: 0.03

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	3.14		98.2
#60 / 60			
#100 / 40	18.53		89.5
#140 / 30			
#200 / 20	32.27		81.7
Pan	32.52	XXXXXXXX	XXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES ____ D60 XXXXX D85 XXXXX

% GRAVEL ____ D30 XXXXX D15 XXXXX

% SAND ____ D10 XXXXX D50 XXXXX

% FINES 81.7 Cu = XXXXX Cc = XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

Mica Noted: x No ____ Yes Amount Adjective: ____

(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence. * Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: TJO DATE 10/26/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mara

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SM0007_013A

Project Name: Feather River West Levee Sample No.: 4

Project Engineer: RN Depth (ft): 13.7

Visual Description: Vey pale to yellowish brown Clay (CL)

SPECIMEN: Tested From:

Bulk Sample			Other ____	
SPT Sample		x	Thin-Walled Tube	x
Calif. Sample			Engr. Test Specimen's WC	c

[ ] **Whole sample used**

[ ] **See Bulk Sample Processing Form**

Selection Method:

Sieves (1) - whole sample used

Sieves (1) - partial sample used & selected by Method(s)

Method

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No [x] Yes [ ]

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

and Soil Soaked for: ~ 6 hrs.

By: [ ] Mortar & Pestle [ ] Hand [ ] Pulverizer [ ] Other

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	**Water Content** As Recieved	
				Container No.	m7
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	445.49
Container Number		m7	m7	Dry, M2 (g)	352.73
Mass of Container and Dry Soil, (g)		352.73	102.4	Cont.,M3 (g)	91.12
Mass of Container, (g)		91.12	91.13	**Water Content (%)**	**35.46**
Dry Soil, Ws (g)		261.61	11.27		

SIEVING RESULTS % error: 0.18

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	6.65		97.5
#60 / 60			
#100 / 40	9.75		96.3
#140 / 30			
#200 / 20	11.28		95.7
Pan	11.29	XXXXXXXX	XXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES ____ D60 XXXXX D85 XXXXX

% GRAVEL ____ D30 XXXXX D15 XXXXX

% SAND ____ D10 XXXXX D50 XXXXX

% FINES 95.7 Cu = XXXXX Cc = XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

Mica Noted: [x] No [ ] Yes Amount Adjective: ____

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence.

* Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: TJO DATE 10/26/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mara

GRADATION OF SOILS by Sieving using Soil Sieve Sizes & with Water Content

ASTM D1140 and D2216

Project Number: 17326605 Task Number: 0305233 Boring No.: SM0007_020A

Project Name: Feather River West Levee Sample No.: 4

Project Engineer: RN Depth (ft): 19.5

Visual Description: Dark brown Clay with sand (CL)

SPECIMEN: Tested From:

Bulk Sample			Other ____	
SPT Sample		x	Thin-Walled Tube	x
Calif. Sample			Engr. Test Specimen's WC	c

[ ] **Whole sample used**

[ ] **See Bulk Sample Processing Form**

Selection Method:

Sieves (1) - whole sample used

Sieves (1) - partial sample used & selected by Method(s)

Method

(a): Splitter; (use for dry soils or that which will segregate)

(b): Quartering; (use for dry soils or that which will segregate)

(c) : Representative scoop after mixing, or slice of intact sample. (use for moist soils or that which will not segregate)

Preparation: Sample/Specimen:

As-Received	x
Air Dried	
Oven-Dried	

Test Method (D1140)

Method A	
Method B	x

Oven-Dried Soil Broken Up Before:

Selecting partial sample: No [x] Yes [ ]

By: [ ] Mortar & Pestle [ ] Hand [ ] Pulverizer [ ] Other

Washing:

	No	Yes
Whole Specimen Washed on No. 200 sieve ?		x
Retained Fraction: 1st Split Washed ?		
Fine Fraction Washed on No. 200 sieve ?		

and Soil Soaked for: ~ 6 hrs.

MASS OF TEST SPECIMEN (g)	Total Test Specimen with Coarse Fraction	Partial or Whole Test Specimen	Soil Retained (after washing)	**Water Content** As Recieved	
				Container No.	m13
Min. sieve size in sieving sequence (3)	#N/A	# 200	+200	Wet, M1 (g)	303.74
Container Number		m13	m13	Dry, M2 (g)	266.25
Mass of Container and Dry Soil, (g)		266.25	122.38	Cont.,M3 (g)	89.82
Mass of Container, (g)		89.82	89.85	**Water Content (%)**	**21.25**
Dry Soil, Ws (g)		176.43	32.53		

SIEVING RESULTS % error: 0.03

See (1)	Sieve No.	Cum. Mass Retained (g)	Total Specimen % Finer N'
	3 "		
	2 "		
	1 1/2"		
	1 "		
	3/4 "		
	1/2 "		
	3/8 "		
	4		
	Pan		XXXXXXXX

Req. Mass of Test Spec. for 1% (kg)
3"= 70
1 1/2"=10
3/4"= 1.1
3/8"= 0.25
#4 = 0.1
#10 = 0.1

Sieve No. / (2)	Cum. Mass Retained (g)	Partial Test Specimen	Total Specimen % Finer N'
3 "			
2 "			
1 1/2"			
1 "			
3/4 "			
1/2 "			
3/8 "			
#4 / 325			
#10 / 180			
#20 / 115			
#40 / 75	3.14		98.2
#60 / 60			
#100 / 40	18.53		89.5
#140 / 30			
#200 / 20	32.27		81.7
Pan	32.52	XXXXXXXX	XXXXXXXXX

SUMMARY: Shape & Filter Parameters

% COBBLES

% GRAVEL

% SAND

% FINES 81.7

D60 XXXXX D85 XXXXX

D30 XXXXX D15 XXXXX

D10 XXXXX D50 XXXXX

Cu = XXXXX Cc = XXXXX

Cu = D60 / D10 Cc = D30^2 / (D60 * D10)

Mica Noted: [x] No [ ] Yes Amount Adjective:

(1) X in box denotes sieve on which split was made

(2) Proposed allowable amount of soil retained on 8" dia. Sieve.

(3) Sieve size given, denotes min. sieve size used in the appropriate sieving sequence.

* Denotes sieve added to better define gradation curve

The above values D## denotes particle size (mm) at the corresponding percent passing.

SET-UP BY: TJO DATE 10/26/11 CALCULATED BY: TJO CHECKED BY: TJO

SUBMITTED BY: Thomas J O'Mara

Laboratory Schedule 7

Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/3/2011

Boring/Sample Number: SL0001_005B #13B **Depth:** 30.9-31.4'
Material Description: Poorly-graded SAND with SILT (SP-SM), dark yellowish brown
%fines=7

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			**Final Data:**		
Sample Length =	13.4	cm	Sample Length =	13.2	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.08	cm
Area =	42.0	cm^2	Area =	39.4	cm^2
Volume =	564.2	cm^3	Volume =	521.0	cm^3
Wet Weight=	877.6	g	Wet Weight=	1029.7	g
Moisture =	9.8	%	Moisture =	27.3	%
Dry Density =	1.42	g/cm^3	Dry Density =	1.55	g/cm^3
Dry Density =	88.4	pcf	Dry Density =	96.9	pcf
Saturation =	29.3	%	Saturation =	99.9	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

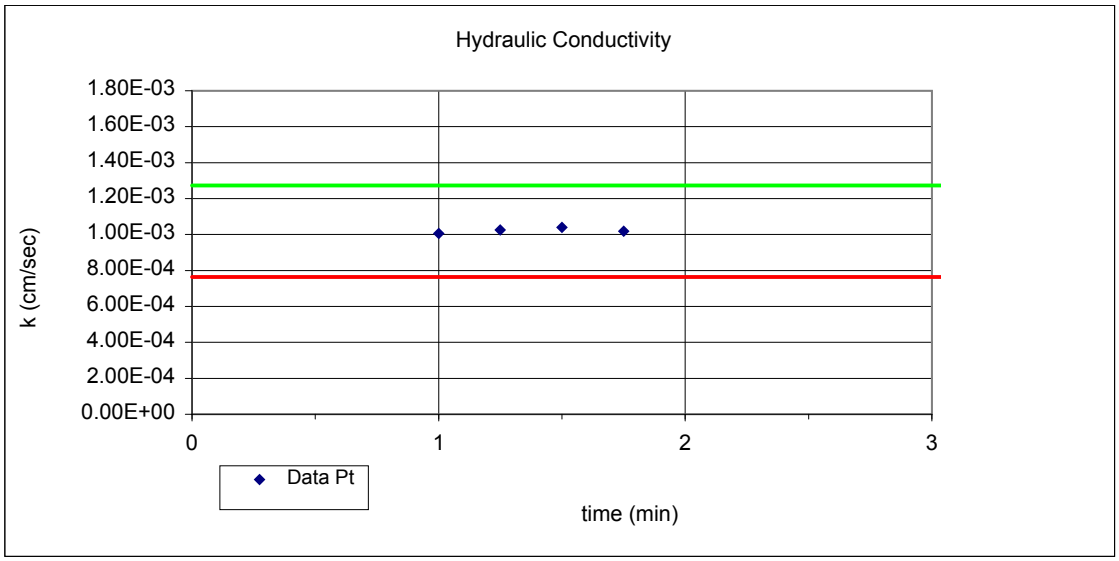
Testing Parameters:

Pressures:

Cell Pressure	P_C=	68	psi
Bottom Pressure	P_b=	55	psi
Top Pressure	P_T=	55	psi
Consolidation	=	13	psi
Confining Pressure	=	1872	psf

Permeant: Deaired Water
Temp= 23.3 °C
Burette Area= 0.2 cm^2
Initial Hydraulic Gradient= 1.86
Final Hydrualic Gradient= 1.86

Results: **Average k (cm/sec)= 1.02E-03 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/8/2011

Boring/Sample Number: SL0001_005B #15C **Depth:** 36.4-37.0'
Material Description: SILTY SAND (SM), light yellowish brown
%fines=31.6

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			Final Data:		
Sample Length =	13.9	cm	Sample Length =	13.7	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.26	cm
Area =	42.0	cm^2	Area =	41.4	cm^2
Volume =	583.0	cm^3	Volume =	569.2	cm^3
Wet Weight=	1021.8	g	Wet Weight=	1070.9	g
Moisture =	26.9	%	Moisture =	34.3	%
Dry Density =	1.38	g/cm^3	Dry Density =	1.40	g/cm^3
Dry Density =	86.2	pcf	Dry Density =	87.5	pcf
Saturation =	76.1	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

Testing Parameters:

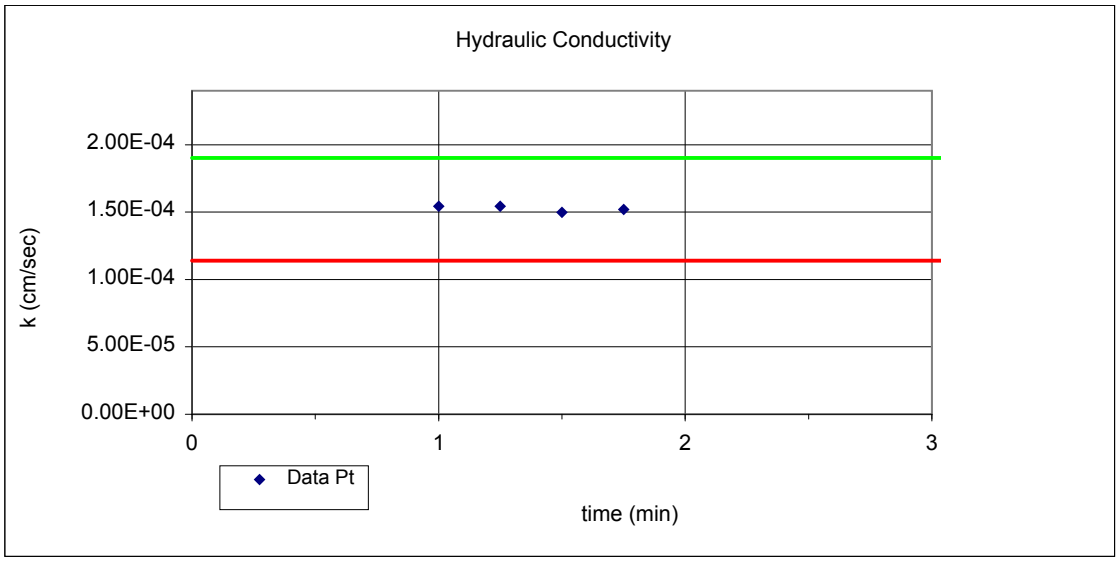
Pressures:

Cell Pressure	P_C=	60.3	psi
Bottom Pressure	P_b=	45	psi
Top Pressure	P_T=	45	psi
Consolidation	=	15.3	psi
Confining Pressure	=	2203.2	psf

Permeant: Deaired Water

Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.81	
Final Hydrualic Gradient=	1.80	

Results: **Average k (cm/sec)= 1.53E-04 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/5/2011

Boring/Sample Number: SL0001_007B #17C **Depth:** 37.4-38.0'
Material Description: Poorly-graded SAND (SP), light olive brown
%fines=3.7

Sample Data:
Type of Sample = 3.0 SHELBY

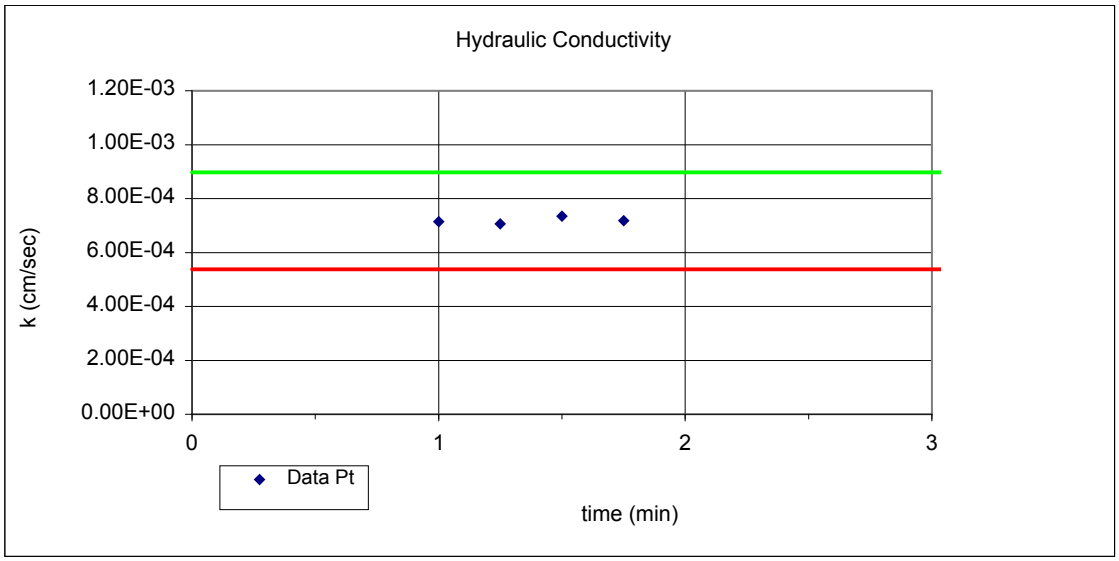
Initial Data:			Final Data:		
Sample Length =	13.5	cm	Sample Length =	13.4	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.16	cm
Area =	42.0	cm^2	Area =	40.3	cm^2
Volume =	567.3	cm^3	Volume =	539.1	cm^3
Wet Weight=	1052.6	g	Wet Weight=	1075.4	g
Moisture =	21.9	%	Moisture =	26.2	%
Dry Density =	1.52	g/cm^3	Dry Density =	1.58	g/cm^3
Dry Density =	95.0	pcf	Dry Density =	98.7	pcf
Saturation =	76.5	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

Testing Parameters:

Pressures:			
Cell Pressure	P_C=	80.67	psi
Bottom Pressure	P_b=	65	psi
Top Pressure	P_T=	65	psi
Consolidation	=	15.67	psi
Confining Pressure	=	2256.48	psf

Permeant: Deaired Water		
Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.86	
Final Hydrualic Gradient=	1.85	

Results: **Average k (cm/sec)= 7.18E-04 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/6/2011

Boring/Sample Number: SL0001_007B #19C **Depth:** 42.0-42.5'
Material Description: Poorly-graded SAND with SILT (SP-SM), yellowish brown
%fines=5.8

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			Final Data:		
Sample Length =	14.6	cm	Sample Length =	14.4	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.16	cm
Area =	42.0	cm^2	Area =	40.3	cm^2
Volume =	612.3	cm^3	Volume =	581.2	cm^3
Wet Weight=	1103.7	g	Wet Weight=	1179.3	g
Moisture =	20.6	%	Moisture =	24.1	%
Dry Density =	1.50	g/cm^3	Dry Density =	1.63	g/cm^3
Dry Density =	93.3	pcf	Dry Density =	102.1	pcf
Saturation =	68.9	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

Testing Parameters:

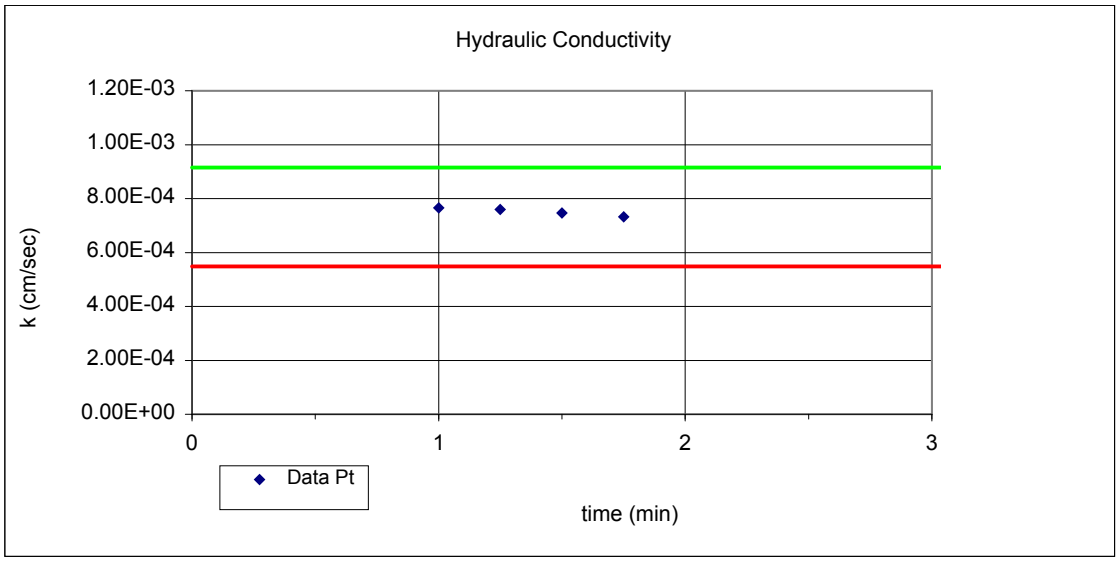
Pressures:

Cell Pressure	P_C=	72.6	psi
Bottom Pressure	P_b=	55	psi
Top Pressure	P_T=	55	psi
Consolidation	=	17.6	psi
Confining Pressure	=	2534.4	psf

Permeant: Deaired Water

Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.72	
Final Hydrualic Gradient=	1.71	

Results: **Average k (cm/sec)= 7.51E-04 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/5/2011

Boring/Sample Number: SM0003_001B #11B **Depth:** 26.4-27.0'
Material Description: SILTY SAND (SM), yellowish brown
%fines=15.3

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			Final Data:		
Sample Length =	13.3	cm	Sample Length =	13.2	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.04	cm
Area =	42.0	cm^2	Area =	38.9	cm^2
Volume =	556.9	cm^3	Volume =	514.0	cm^3
Wet Weight=	1060.4	g	Wet Weight=	1046.0	g
Moisture =	25.5	%	Moisture =	23.8	%
Dry Density =	1.52	g/cm^3	Dry Density =	1.64	g/cm^3
Dry Density =	94.7	pcf	Dry Density =	102.6	pcf
Saturation =	88.5	%	Saturation =	100.1	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

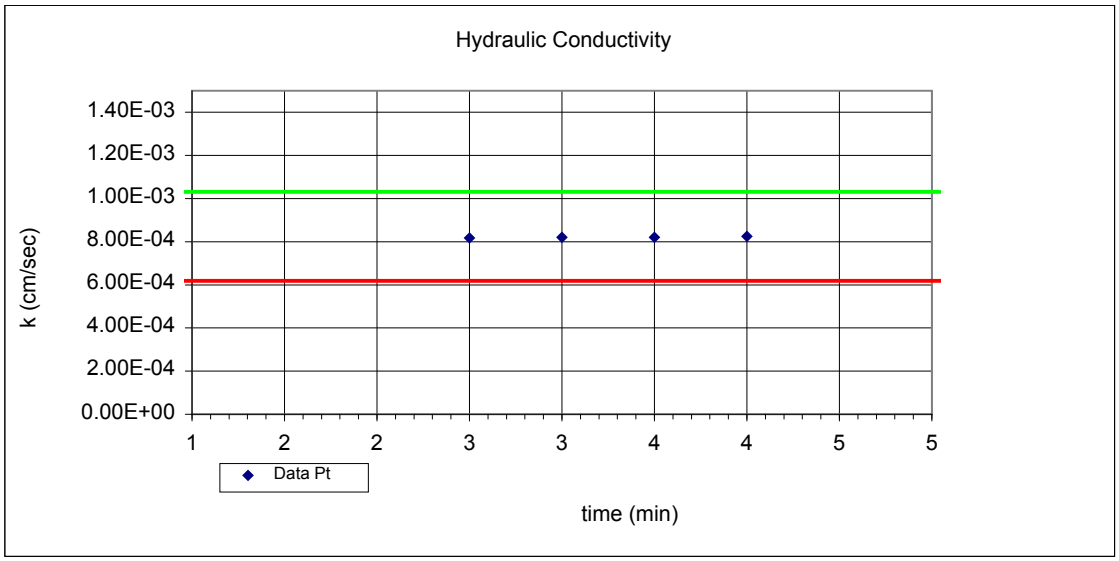
Testing Parameters:

Pressures:

Cell Pressure	P_C=	36.1	psi
Bottom Pressure	P_b=	25	psi
Top Pressure	P_T=	25	psi
Consolidation	=	11.1	psi
Confining Pressure	=	1598.4	psf

Permeant: Deaired Water		
Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.89	
Final Hydrualic Gradient=	1.88	

Results: **Average k (cm/sec)= 8.21E-04 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/8/2011

Boring/Sample Number: SM0003_003B #11 **Depth:** 25.4-26.0'
Material Description: SANDY SILT (ML), dark olive brown
%fines=53.3

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			Final Data:		
Sample Length =	12.5	cm	Sample Length =	12.2	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.19	cm
Area =	42.0	cm^2	Area =	40.6	cm^2
Volume =	525.2	cm^3	Volume =	493.6	cm^3
Wet Weight=	901.4	g	Wet Weight=	900.3	g
Moisture =	38.3	%	Moisture =	39.3	%
Dry Density =	1.24	g/cm^3	Dry Density =	1.31	g/cm^3
Dry Density =	77.5	pcf	Dry Density =	81.7	pcf
Saturation =	88.0	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

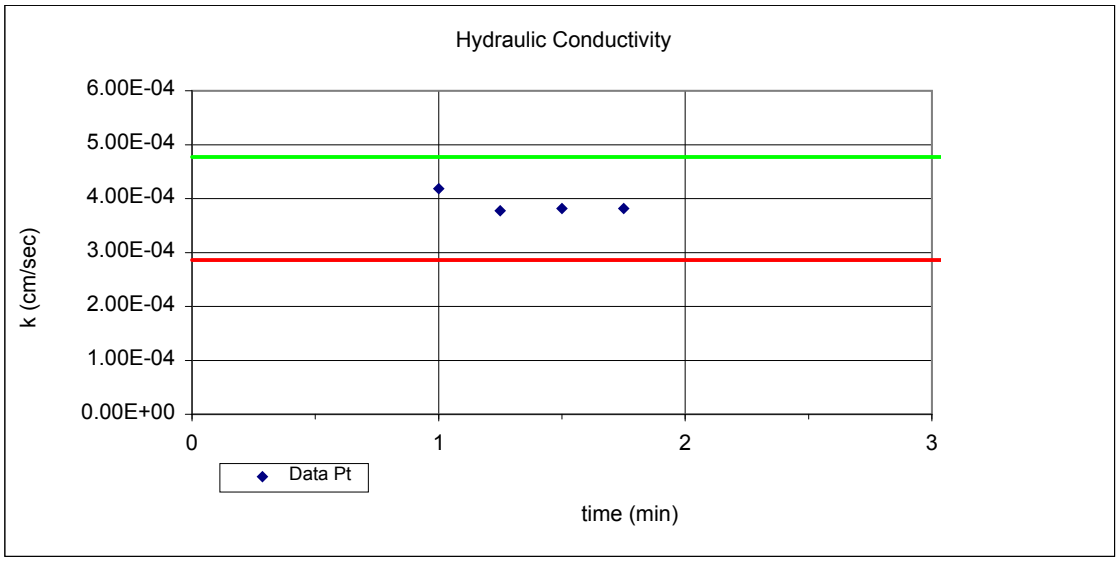
Testing Parameters:

Pressures:

Cell Pressure	P_C=	45.6	psi
Bottom Pressure	P_b=	35	psi
Top Pressure	P_T=	35	psi
Consolidation	=	10.6	psi
Confining Pressure	=	1526.4	psf

Permeant: Deaired Water		
Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	2.00	
Final Hydrualic Gradient=	2.00	

Results: **Average k (cm/sec)= 3.90E-04 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/4/2011

Boring/Sample Number: SM0003_003B #15C **Depth:** 36.4-37.0'
Material Description: SILTY SAND (SM), olive brown
%fines=26.5

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			Final Data:		
Sample Length =	14.7	cm	Sample Length =	14.6	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.20	cm
Area =	42.0	cm^2	Area =	40.7	cm^2
Volume =	617.2	cm^3	Volume =	593.3	cm^3
Wet Weight=	1141.4	g	Wet Weight=	1147.8	g
Moisture =	29.6	%	Moisture =	30.3	%
Dry Density =	1.43	g/cm^3	Dry Density =	1.48	g/cm^3
Dry Density =	89.1	pcf	Dry Density =	92.7	pcf
Saturation =	89.7	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

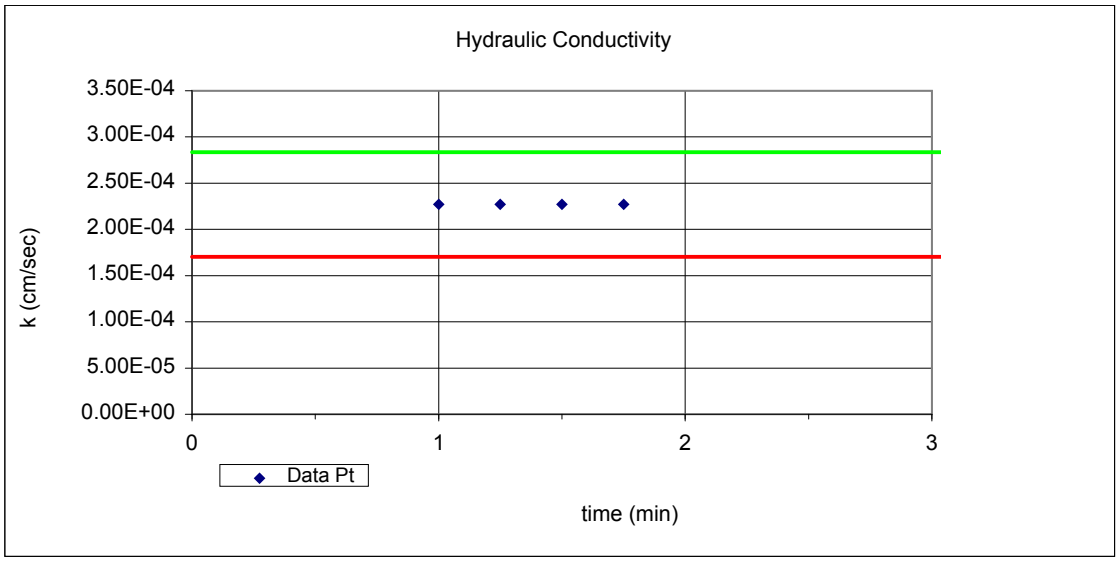
Testing Parameters:

Pressures:

Cell Pressure	P_C=	50.3	psi
Bottom Pressure	P_b=	35	psi
Top Pressure	P_T=	35	psi
Consolidation	=	15.3	psi
Confining Pressure	=	2203.2	psf

Permeant: Deaired Water		
Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.69	
Final Hydrualic Gradient=	1.70	

Results: **Average k (cm/sec)= 2.27E-04 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/9/2011

Boring/Sample Number: SM0007_015A #4 **Depth:** 14.4-14.9'
Material Description: SANDY SILT (ML), light olive brown
%fines=63.1

Sample Data:
Type of Sample = 3.0 SHELBY

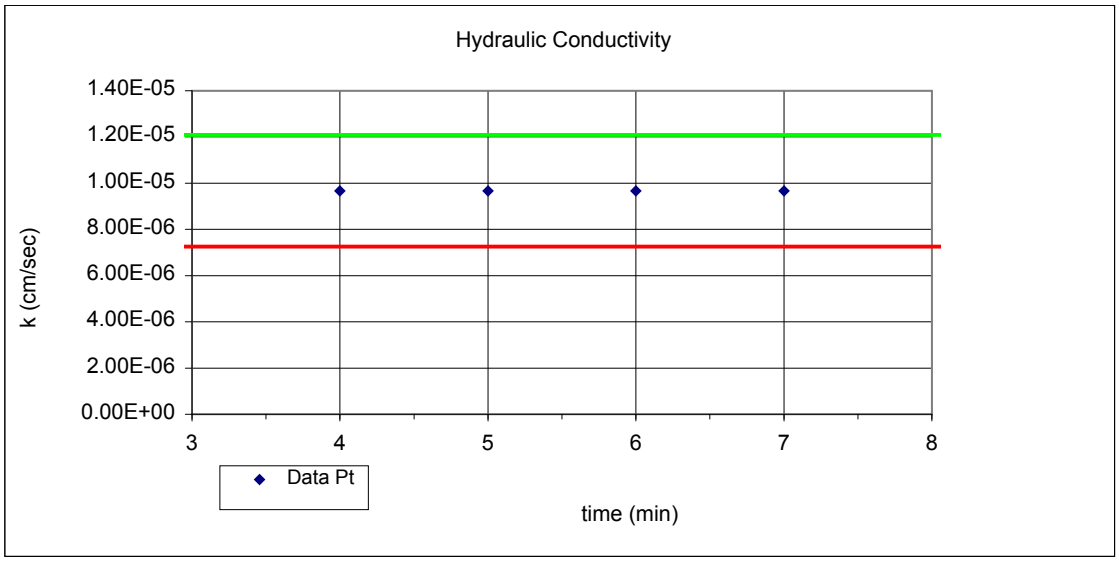
Initial Data:			Final Data:		
Sample Length =	13.7	cm	Sample Length =	13.6	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.10	cm
Area =	42.0	cm^2	Area =	39.6	cm^2
Volume =	577.5	cm^3	Volume =	537.0	cm^3
Wet Weight=	1021.5	g	Wet Weight=	1082.2	g
Moisture =	17.9	%	Moisture =	24.9	%
Dry Density =	1.50	g/cm^3	Dry Density =	1.61	g/cm^3
Dry Density =	93.6	pcf	Dry Density =	100.7	pcf
Saturation =	60.6	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

Testing Parameters:

Pressures:			
Cell Pressure	P_C=	92.6	psi
Bottom Pressure	P_b=	75	psi
Top Pressure	P_T=	75	psi
Consolidation	=	17.6	psi
Confining Pressure	=	2534.4	psf

Permeant: Deaired Water		
Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.83	
Final Hydrualic Gradient=	1.82	

Results: **Average k (cm/sec)= 9.67E-06 cm/sec**



Hydraulic Conductivity of Saturated Porous Material
ASTM D 5084 (Method A)

Project: Feather River West Levee
Project Number: 17326605.0305233
Date: 12/8/2011

Boring/Sample Number: SM0007_020A #3A **Depth:** 14.4-14.9'
Material Description: SANDY SILT (ML), dark olive brown
%fines=55.6

Sample Data:
Type of Sample = 3.0 SHELBY

Initial Data:			Final Data:		
Sample Length =	14.3	cm	Sample Length =	12.2	cm
Sample Diameter =	7.32	cm	Sample Diameter =	7.06	cm
Area =	42.0	cm^2	Area =	39.1	cm^2
Volume =	601.0	cm^3	Volume =	477.0	cm^3
Wet Weight=	905.4	g	Wet Weight=	972.9	g
Moisture =	13.0	%	Moisture =	23.5	%
Dry Density =	1.33	g/cm^3	Dry Density =	1.65	g/cm^3
Dry Density =	83.2	pcf	Dry Density =	103.1	pcf
Saturation =	34.3	%	Saturation =	100.0	%
Specific Gravity =	2.70	(assumed)	Specific Gravity =	2.70	(assumed)

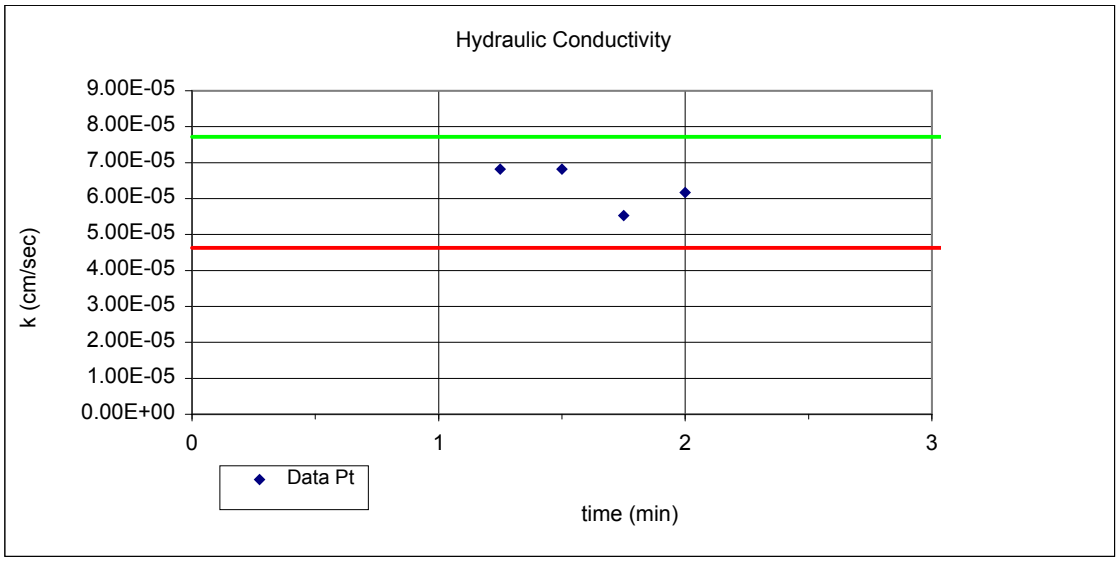
Testing Parameters:

Pressures:

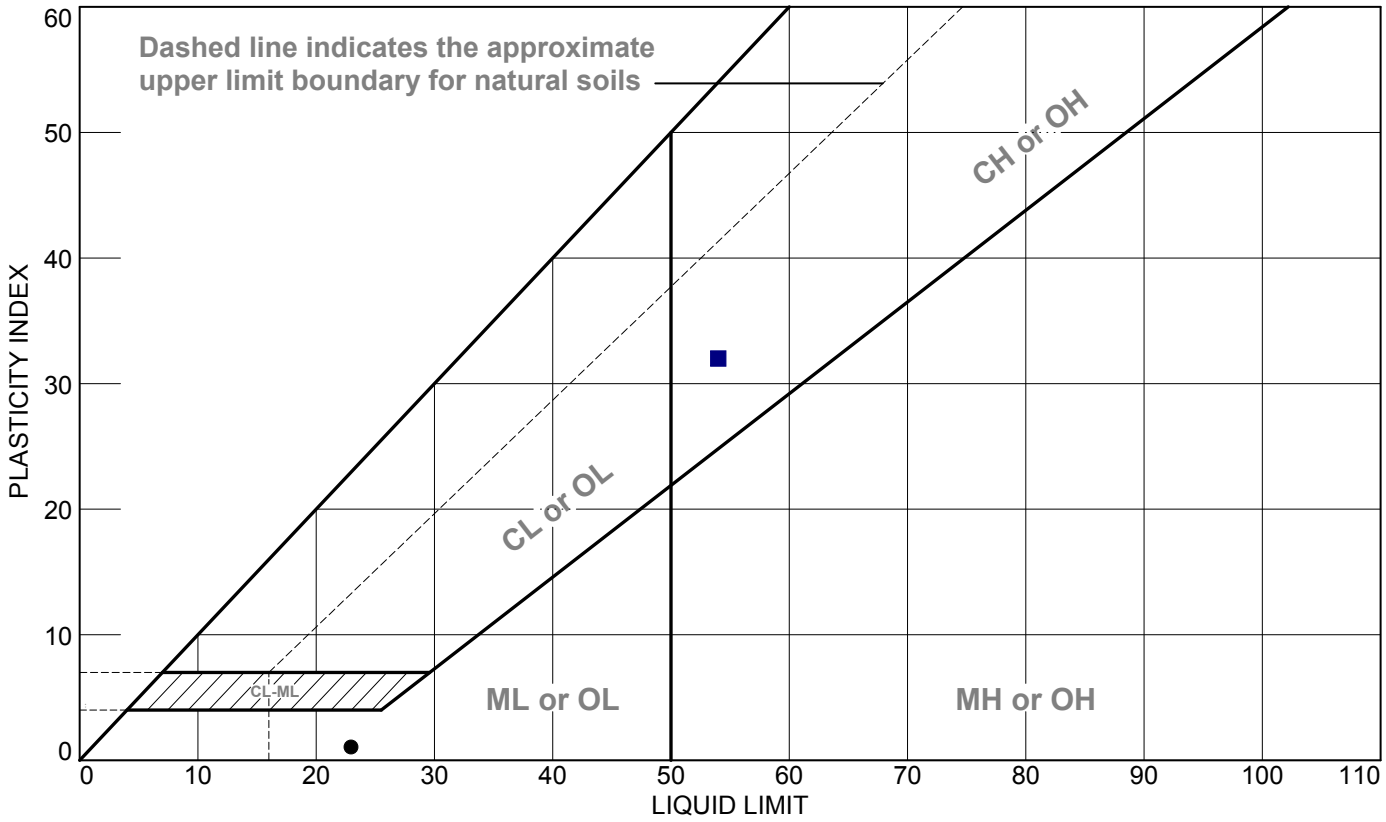
Cell Pressure	P_C=	91.13	psi
Bottom Pressure	P_b=	85	psi
Top Pressure	P_T=	85	psi
Consolidation	=	6.13	psi
Confining Pressure	=	882.72	psf

Permeant: Deaired Water		
Temp=	23.3	°C
Burette Area=	0.2	cm^2
Initial Hydraulic Gradient=	1.75	
Final Hydrualic Gradient=	1.75	

Results: **Average k (cm/sec)= 6.34E-05 cm/sec**



LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_018A	#3A	5.5-6.0'	10.3	22	23	1	ML
■	SM0007_018A	#18A	60.5-61.0'	26.0	22	54	32	CH

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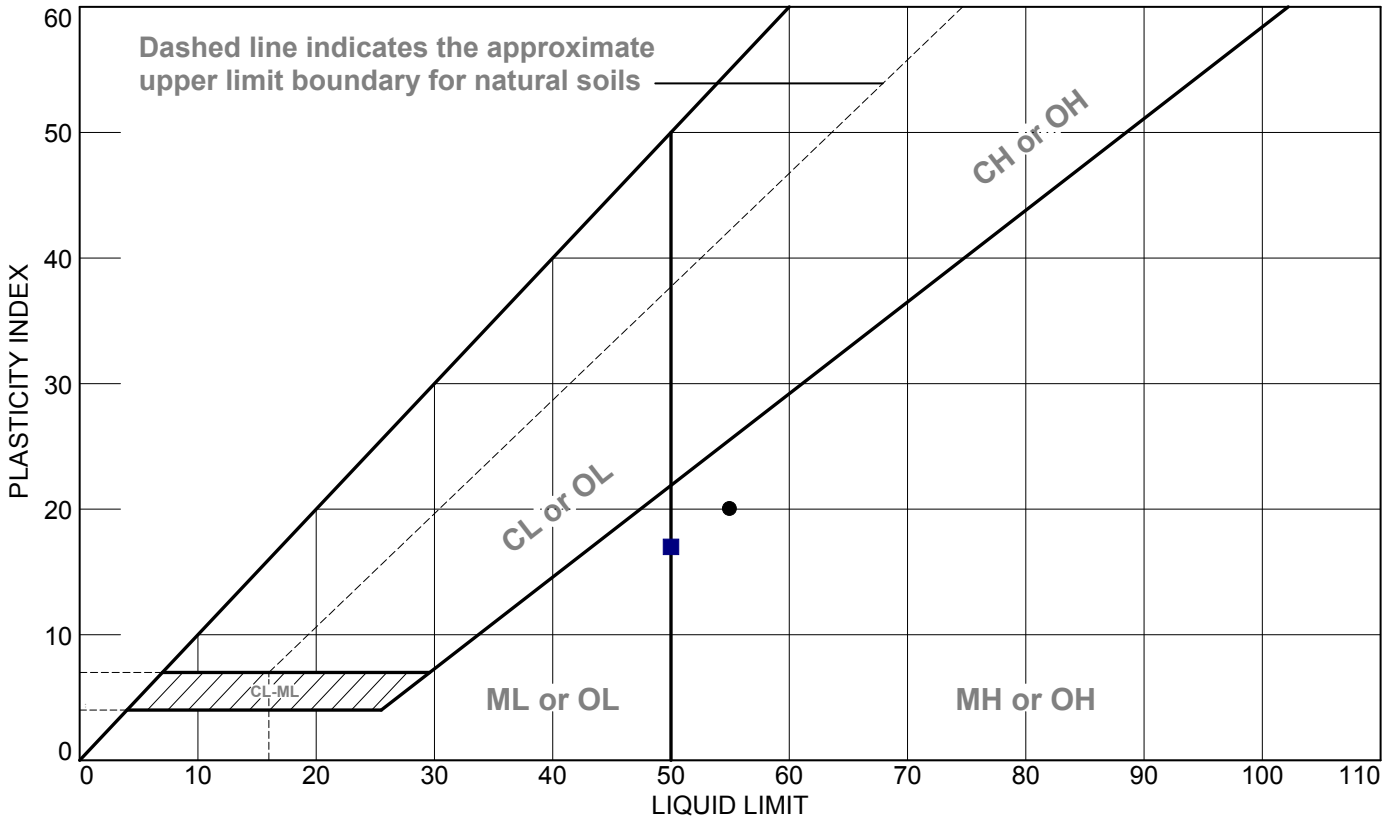
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_019A	#4B	10.75-11.5'	64.5	35	55	20	MH
■	SM0007_019A	#10A	55.5-56.0'	36.7	33	50	17	SM

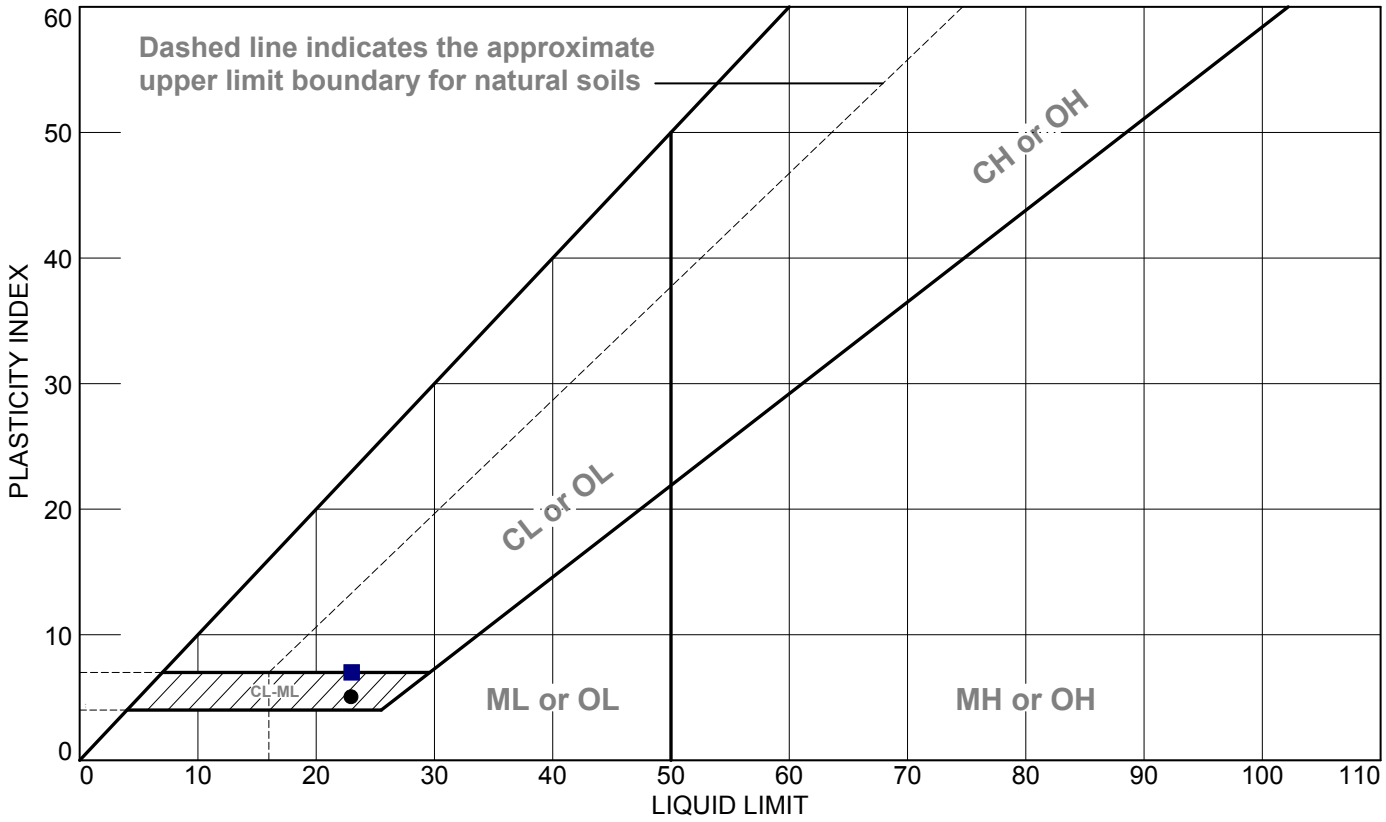
Blackburn Consulting

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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 2

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_026S	#2B	9.0-9.5'	12.8	18	23	5	CL-ML
■	SM0007_026S	#10B	47.0-48.0'		16	23	7	GC-GM

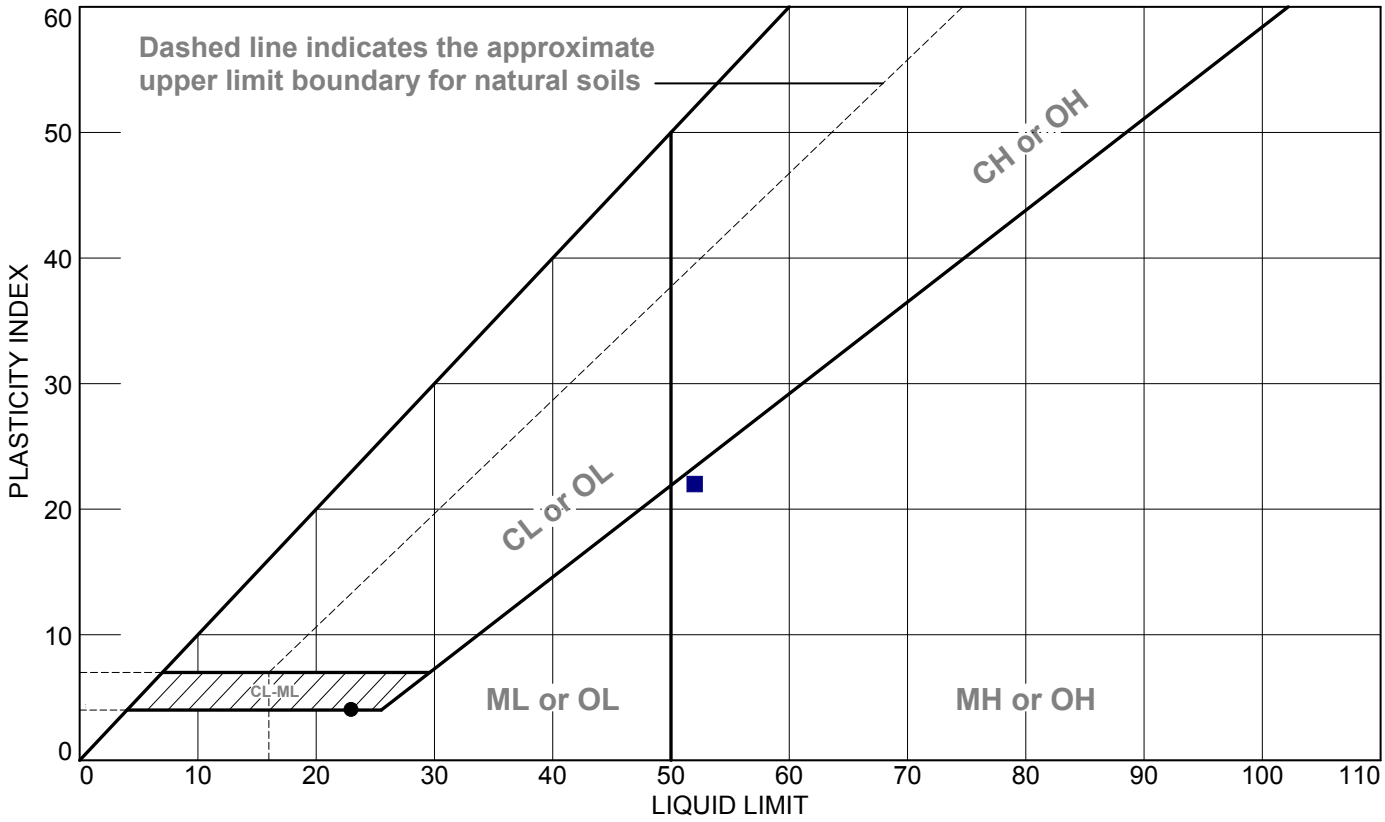
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 3

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_027S	#2B	9.0-10.0'	9.9	19	23	4	CL-ML
■	SM0007_027S	#12A	56.5-57.5'	46.7	30	52	22	MH

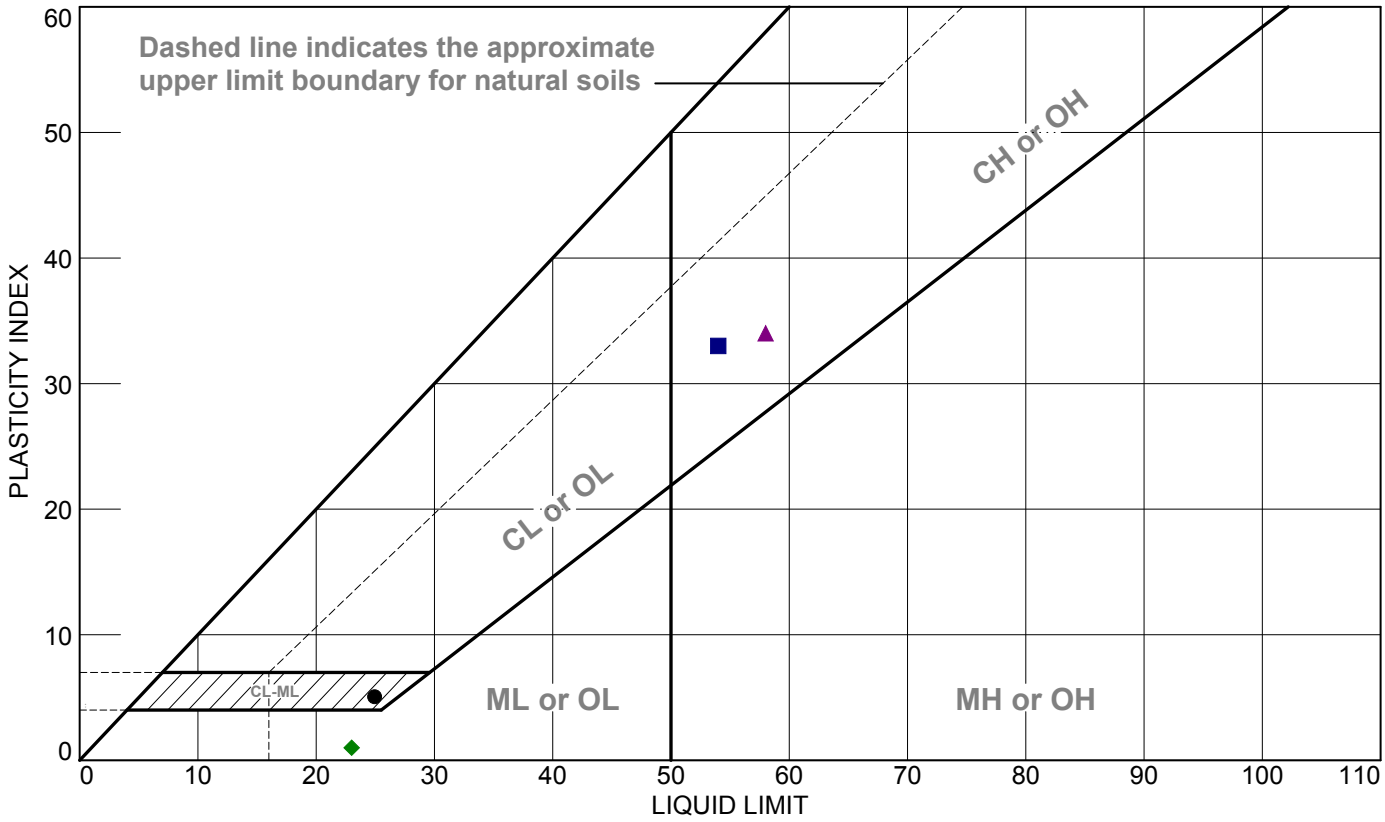
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 4

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_028S	#3A	10.0-11.0'	23.1	20	25	5	CL-ML
■	SM0007_028S	#10A	35.5-36.0'	28.9	21	54	33	CH
▲	SM0007_028S	#11A	37.5-38.5'	29.7	24	58	34	CH
◆	SM0007_028S	#11B	39.5-40.0'	20.4	22	23	1	SM

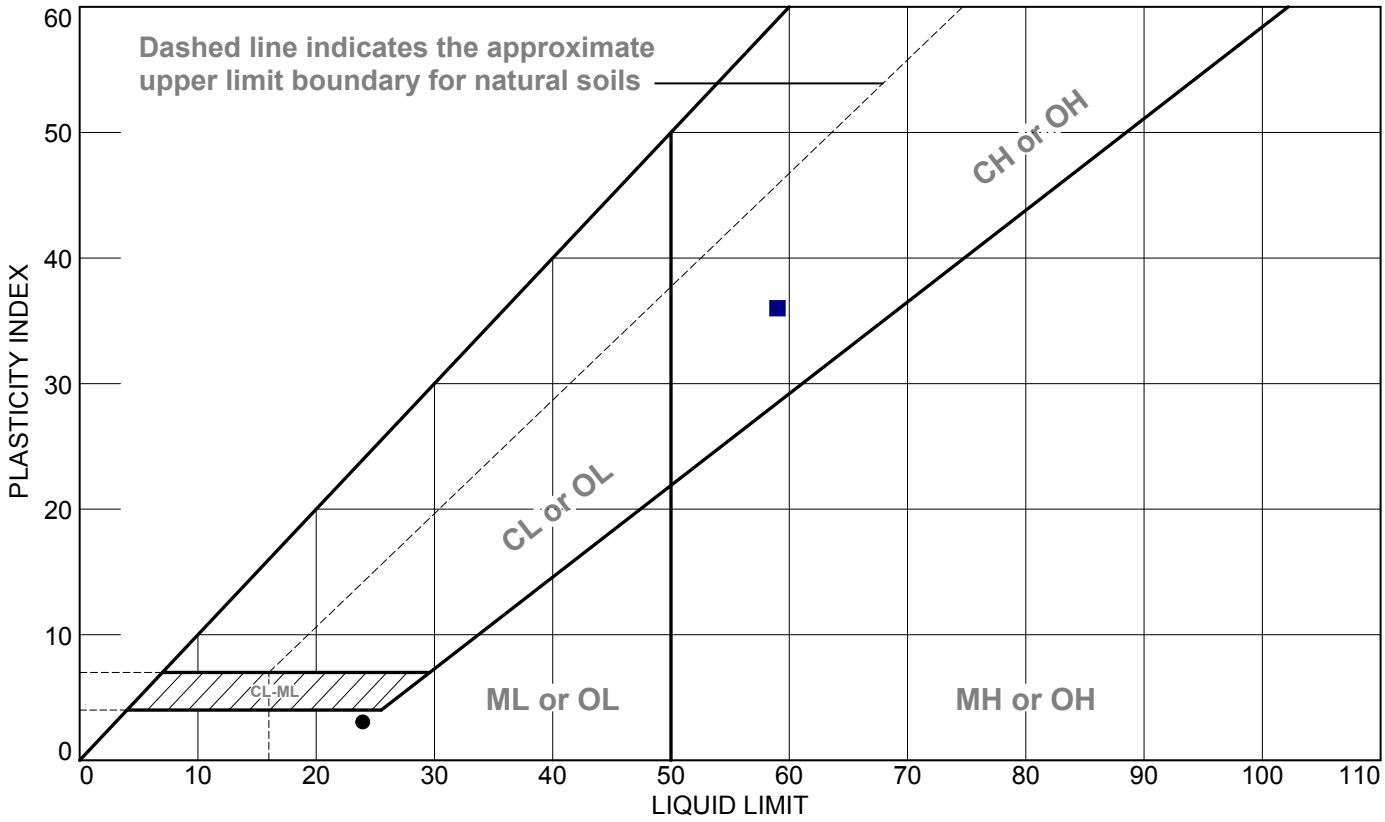
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 5

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_029S	#2A	8.0-9.0'	24.9	21	24	3	ML
■	SM0007_029S	#8A	35.0-36.0'	31.7	23	59	36	CH

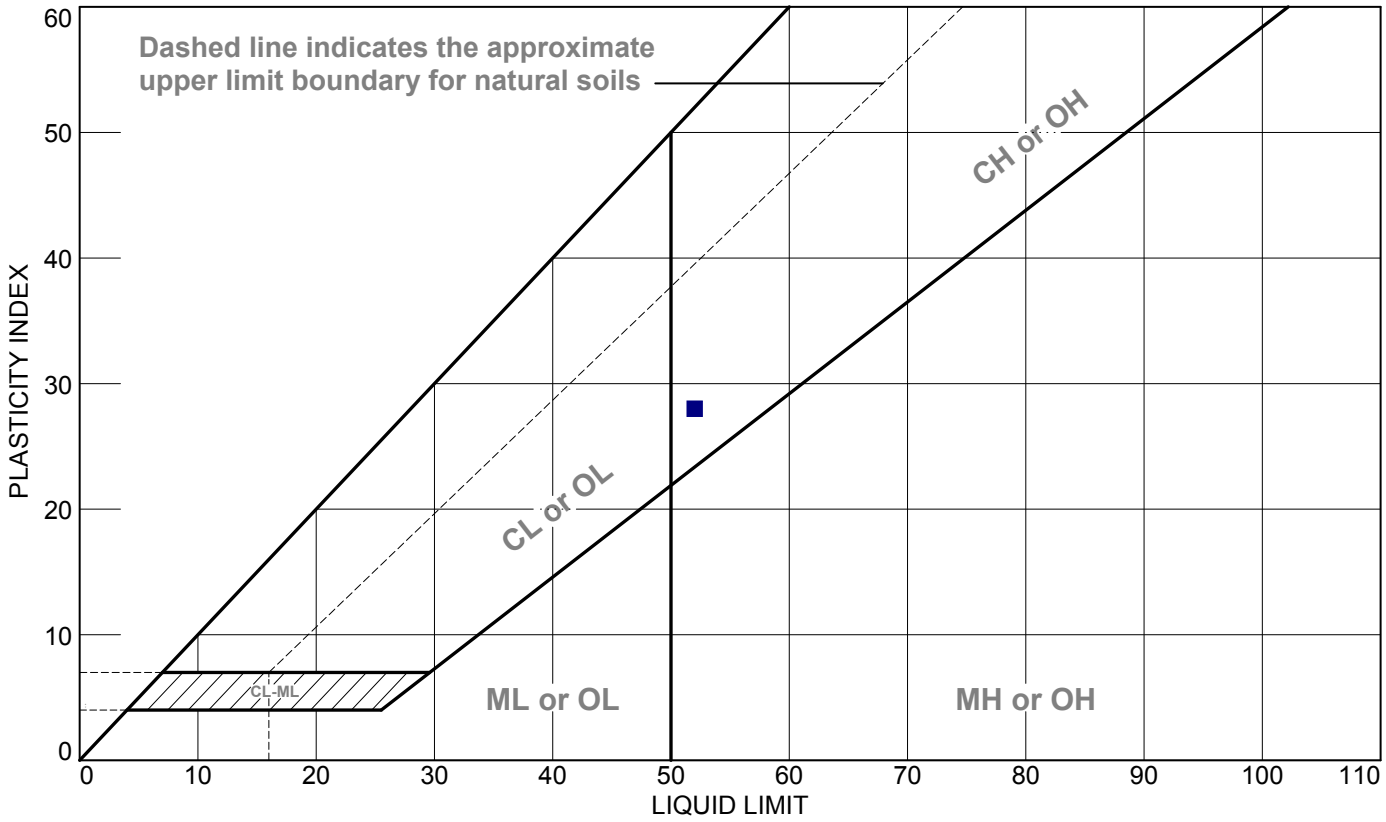
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 6

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_030S	#2A	6.0-7.0'	11.7				SM
■	SM0007_030S	#7A	34.0-35.0'	31.5	24	52	28	CH

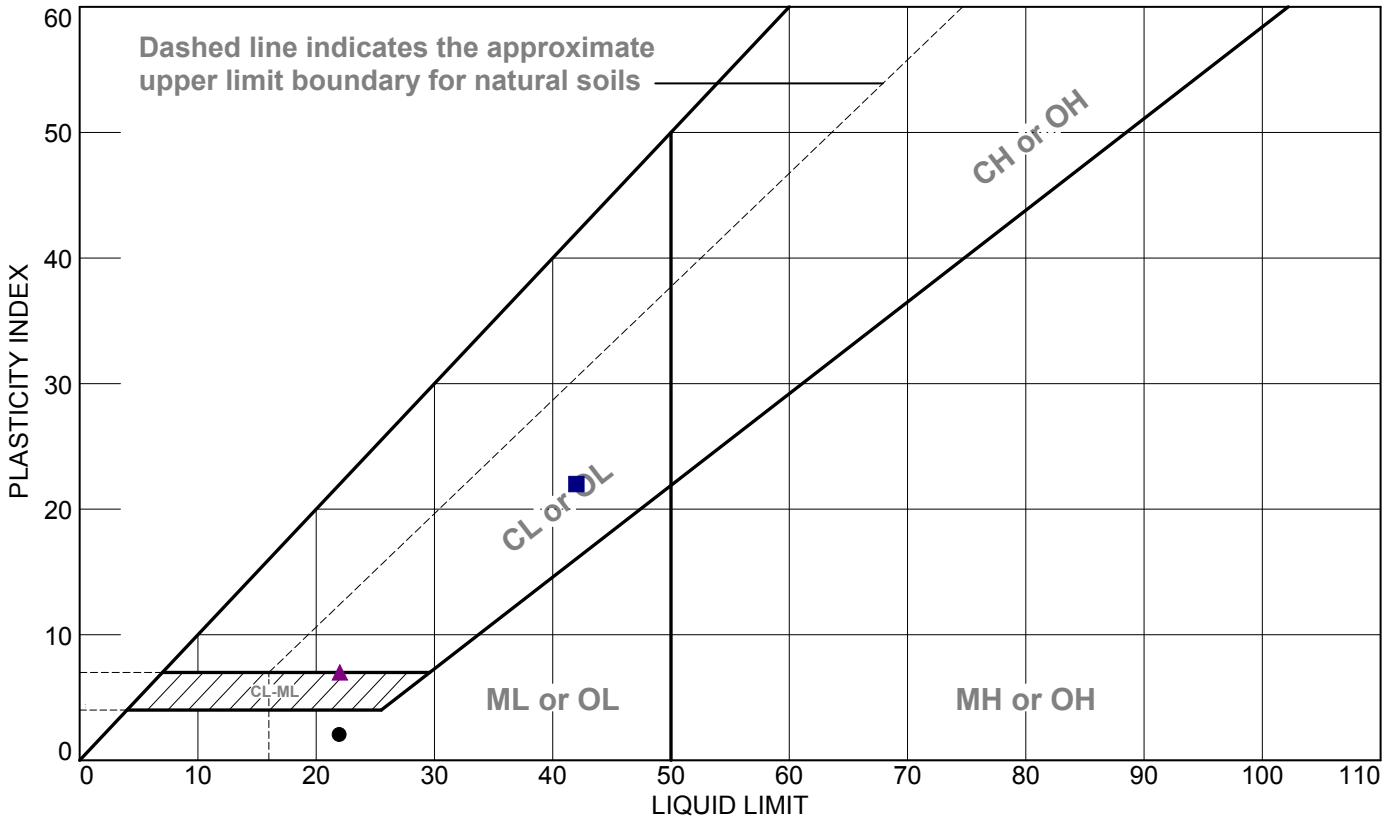
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 7

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_011S	#2A	6.0-6.5'	24.0	20	22	2	SM
■	SM0007_011S	#8A	36.0-36.5'	35.6	20	42	22	CL
▲	SM0007_011S	#13A	64.0-65.0'		15	22	7	SC-SM

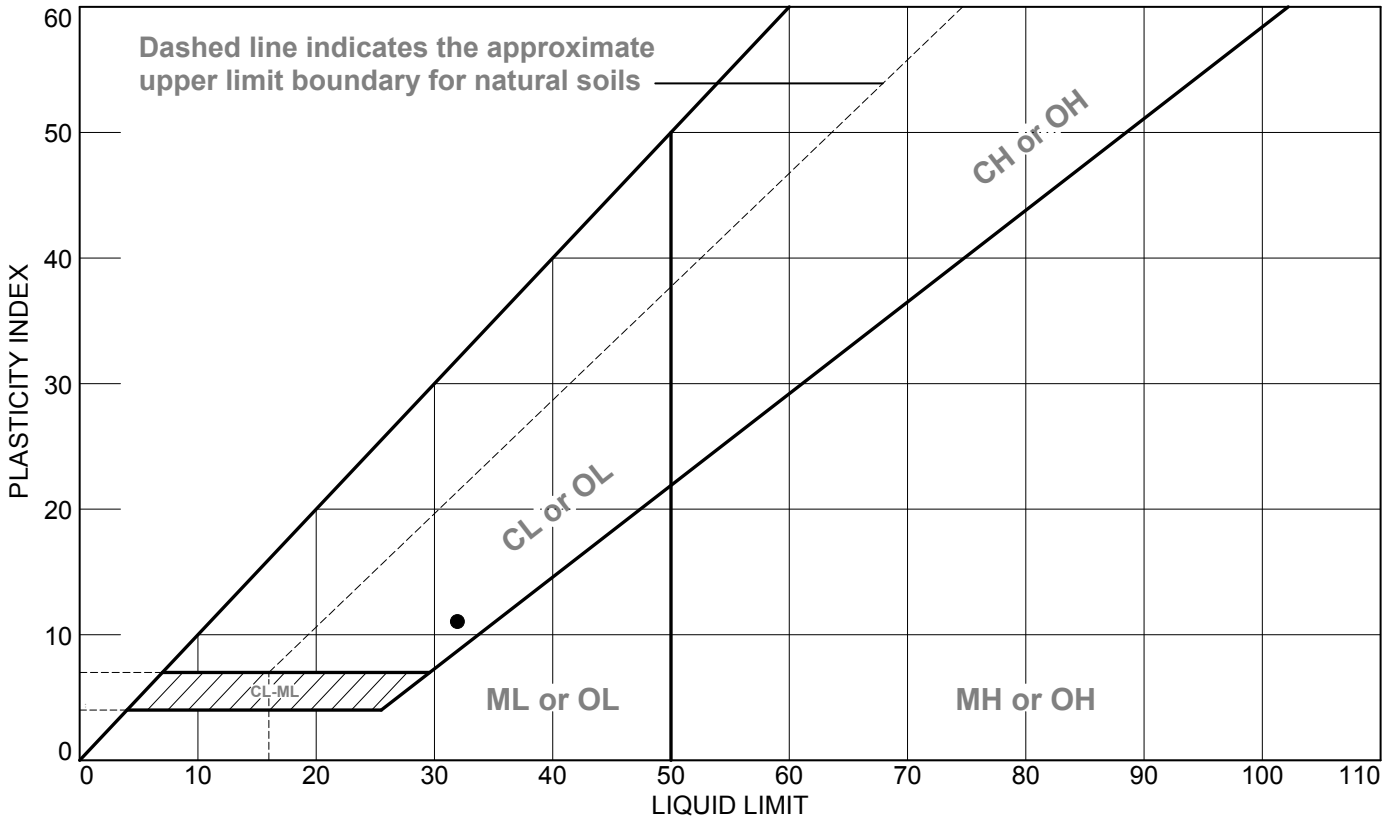
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W. Sacramento, CA

Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 8

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_011A	#15	70.0-71.5'	29.2	21	32	11	CL

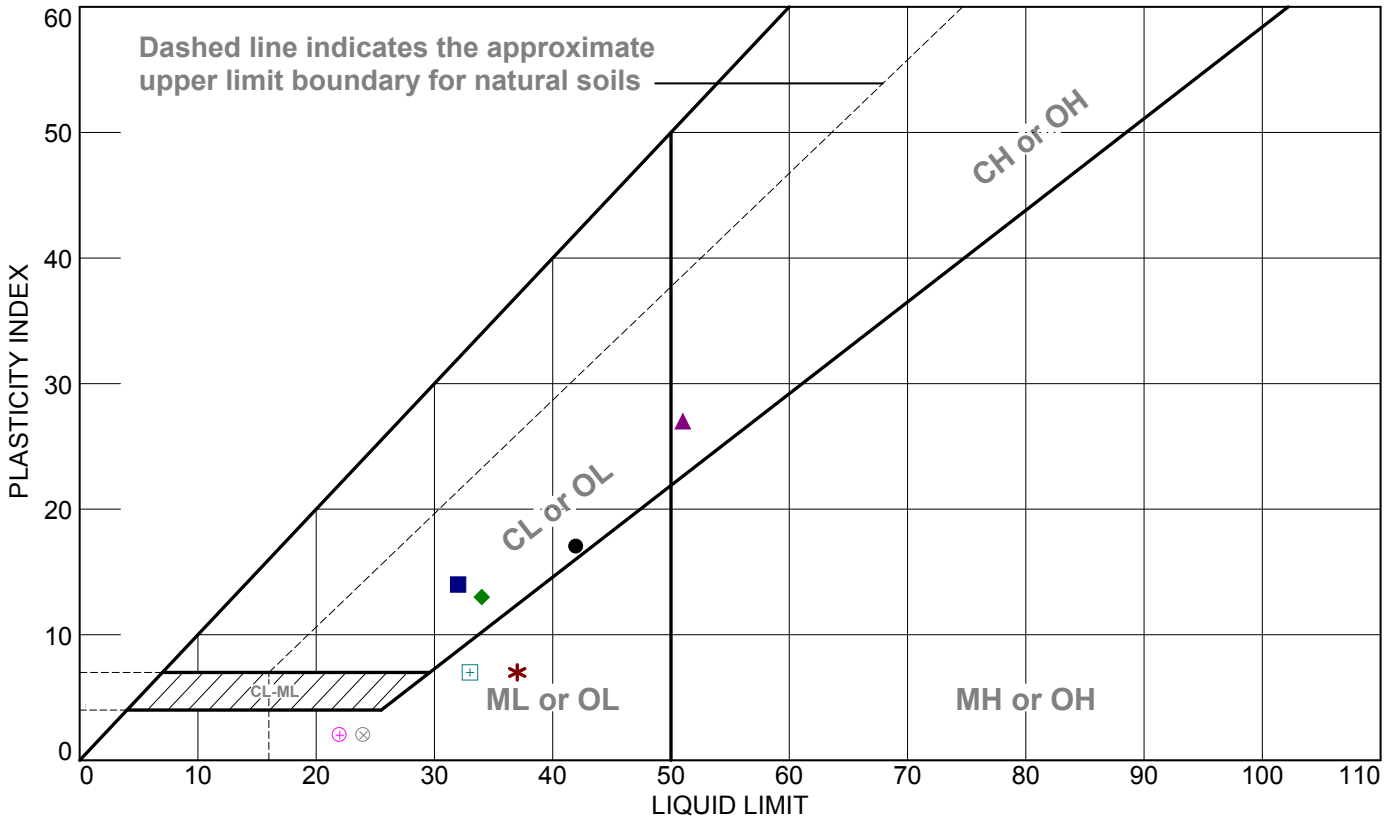
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 9

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0009_004B	#29	125.0-126.5'	28.7	25	42	17	CL
■	SM0007_011B	#8	20.0-21.5'	17.7	18	32	14	CL
▲	SM0007_007A	#19A	75.0-76.5'	28.0	24	51	27	CH
◆	SM0007_012B	#14A	61.0-61.5'	23.1	21	34	13	CL
▼	SM0007_013B	#10	30.0-31.5'	30.0	27	27	NP	SM
✱	SM0007_014B	#12A	38.0-38.5'	39.9	30	37	7	SM
⊕	SM0007_001S	#3A	12.0-13.0'	13.0	20	22	2	ML
⊞	SM0007_003S	#4	20.0-21.0'	17.9	26	33	7	ML
⊗	SM0003_003B	#11A	14.4-14.9'	23.6	22	24	2	ML

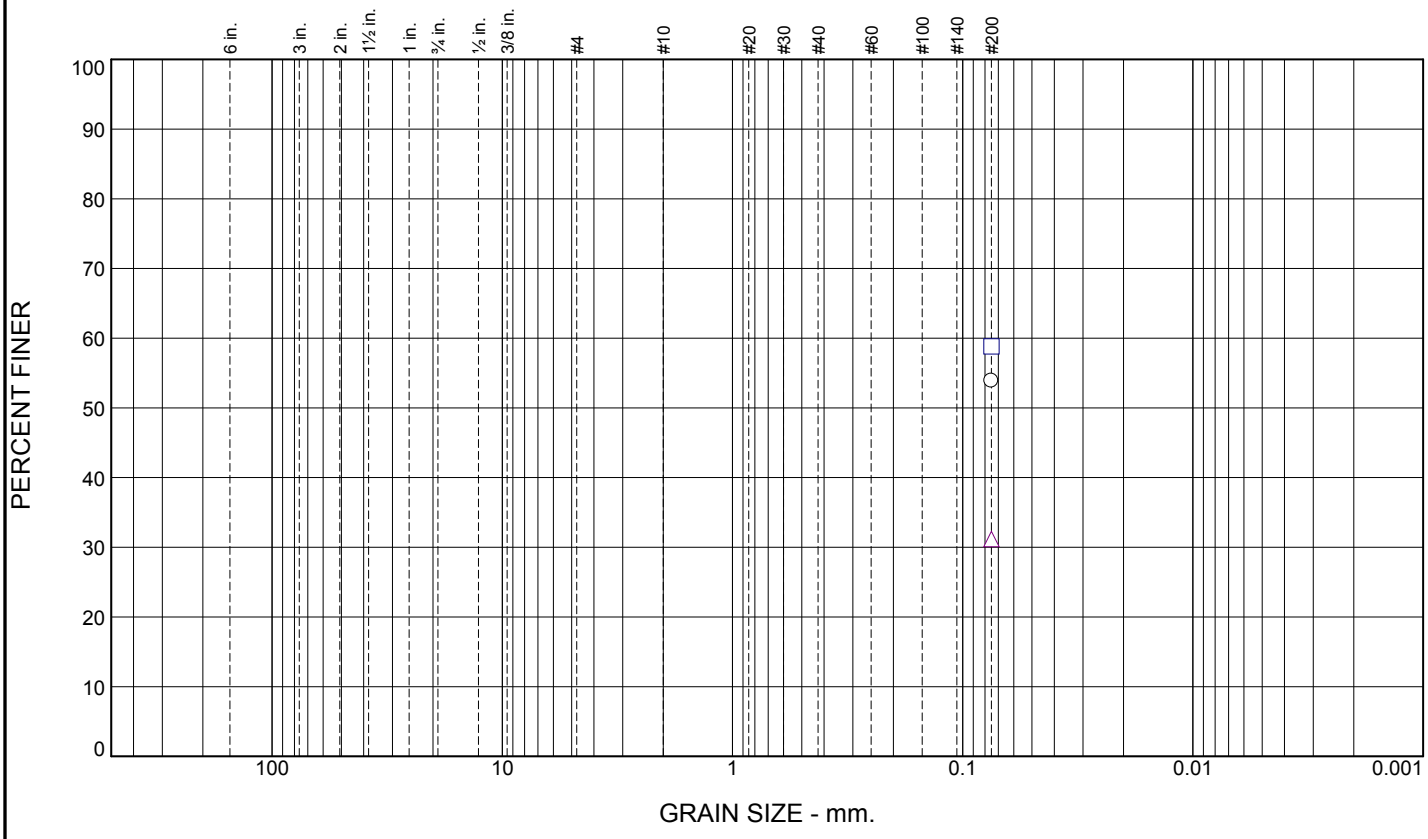
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Client: URS Corporation
Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure** LS7 - 10

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML			
□						ML	23	22	1
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	53.9	58.8	31.2

Material Description

○ SANDY SILT, dark yellowish brown

□ SANDY SILT, dark yellowish brown

△ SILTY SAND, brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_018A Depth: 3.0-3.5' Sample Number: #2A

□ Source of Sample: SM0007_018A Depth: 5.5-6.0' Sample Number: #3A

△ Source of Sample: SM0007_018A Depth: 20.0-21.5' Sample Number: #9A

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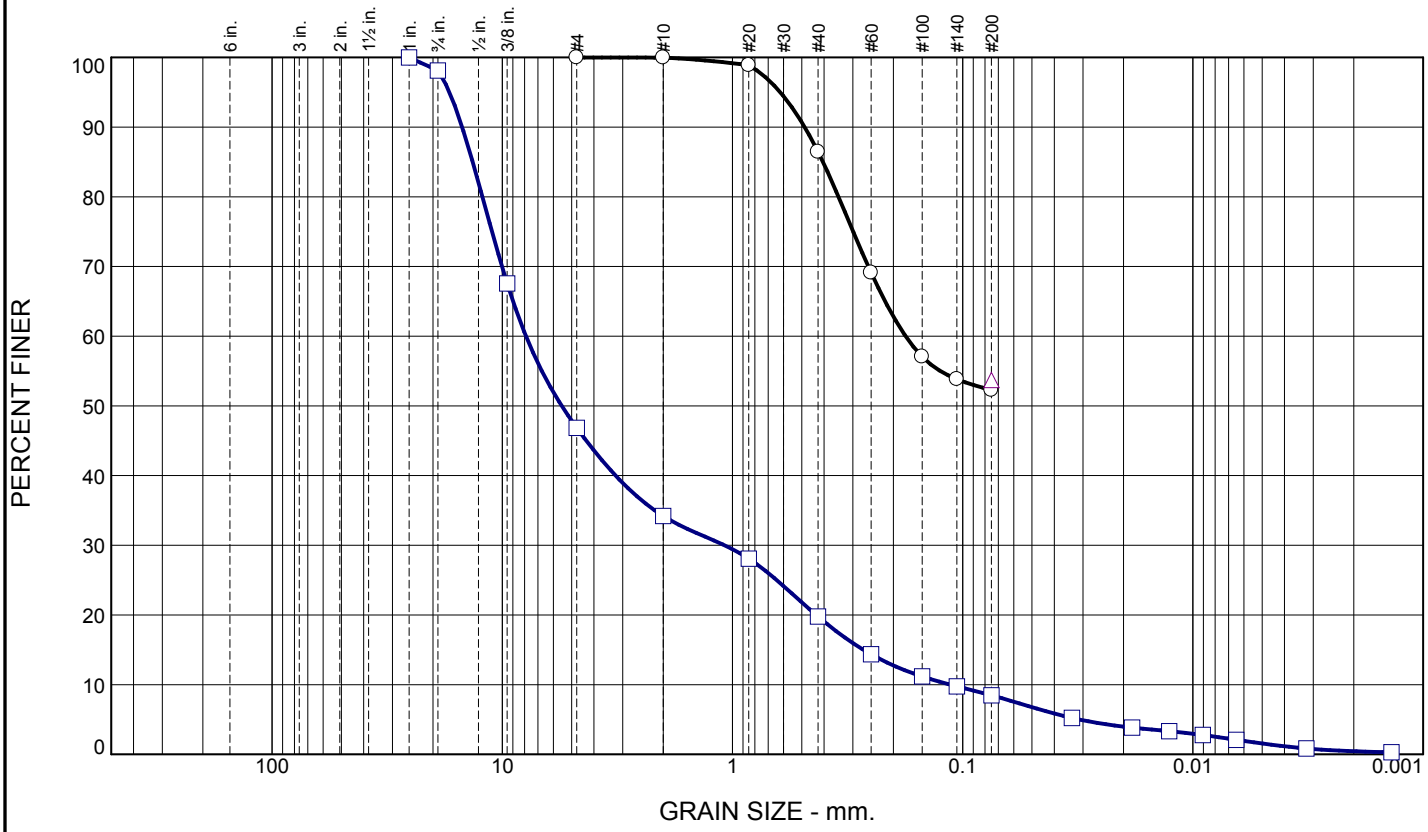
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	47.7	52.3		ML			
□	0.0	53.1	38.4	6.9	1.6	GW-GM			
△						CH	54	22	32

SIEVE inches size	PERCENT FINER ○	□	△
1		100.0	
.75		98.1	
.375		67.6	
	GRAIN SIZE		
D_{60}	0.1769	7.8869	
D_{30}		1.0834	
D_{10}		0.1131	
	COEFFICIENTS		
C_c		1.32	
C_u		69.71	

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	46.9	
#10	100.0	34.2	
#20	98.9	28.1	
#40	86.5	19.8	
#60	69.1	14.4	
#100	57.1	11.2	
#140	53.8	9.8	
#200	52.3	8.5	53.7

Material Description

○ SANDY SILT, dark grayish brown

□ Well-graded GRAVEL with SILT and SAND, olive

△ SANDY fat CLAY, dark greenish gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_018A Depth: 25.0-26.5' Sample Number: #10A

□ Source of Sample: SM0007_018A Depth: 40.0-42.0' Sample Number: #14A

△ Source of Sample: SM0007_018A Depth: 60.5-61.0' Sample Number: #18A

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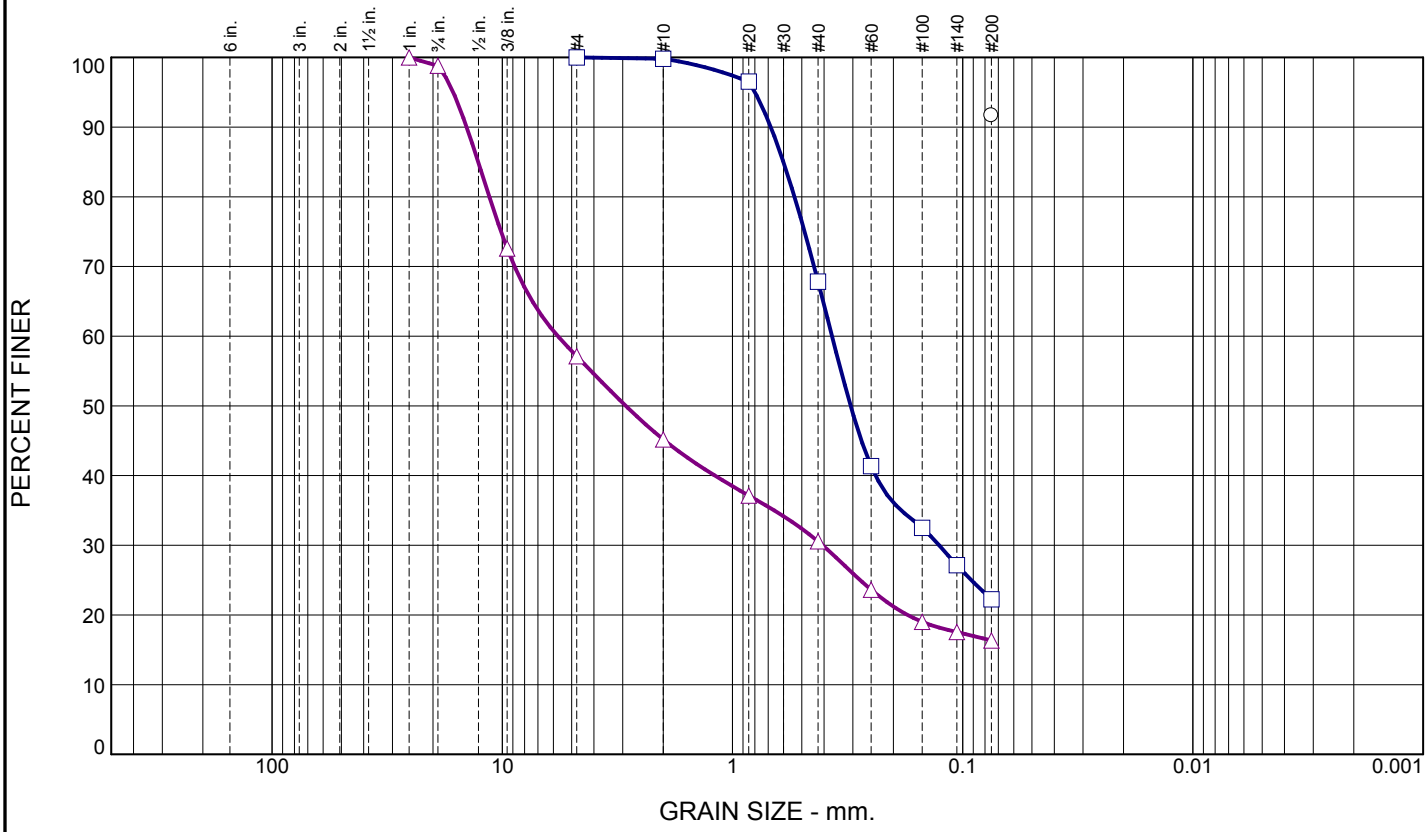
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 2

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						MH	55	35	20
□	0.0	0.0	77.8	22.2		SM			
△	0.0	42.9	40.8	16.3		GM			

SIEVE inches size	PERCENT FINER ○	□	△
1			100.0
.75			98.8
.375			72.6
GRAIN SIZE			
D_{60}		0.3695	5.7332
D_{30}		0.1266	0.4061
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	57.1
#10		99.8	45.2
#20		96.5	37.1
#40		67.8	30.6
#60		41.4	23.6
#100		32.5	19.0
#140		27.1	17.6
#200	91.7	22.2	16.3

Material Description

○ Elastic SILT, very dark gray

□ SILTY SAND, very dark gray

△ SILTY GRAVEL with SAND, olive gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_019A Depth: 10.75-11.5' Sample Number: #4B

□ Source of Sample: SM0007_019A Depth: 16.0-16.5' Sample Number: #5B

△ Source of Sample: SM0007_019A Depth: 25.0-27.0' Sample Number: #7A

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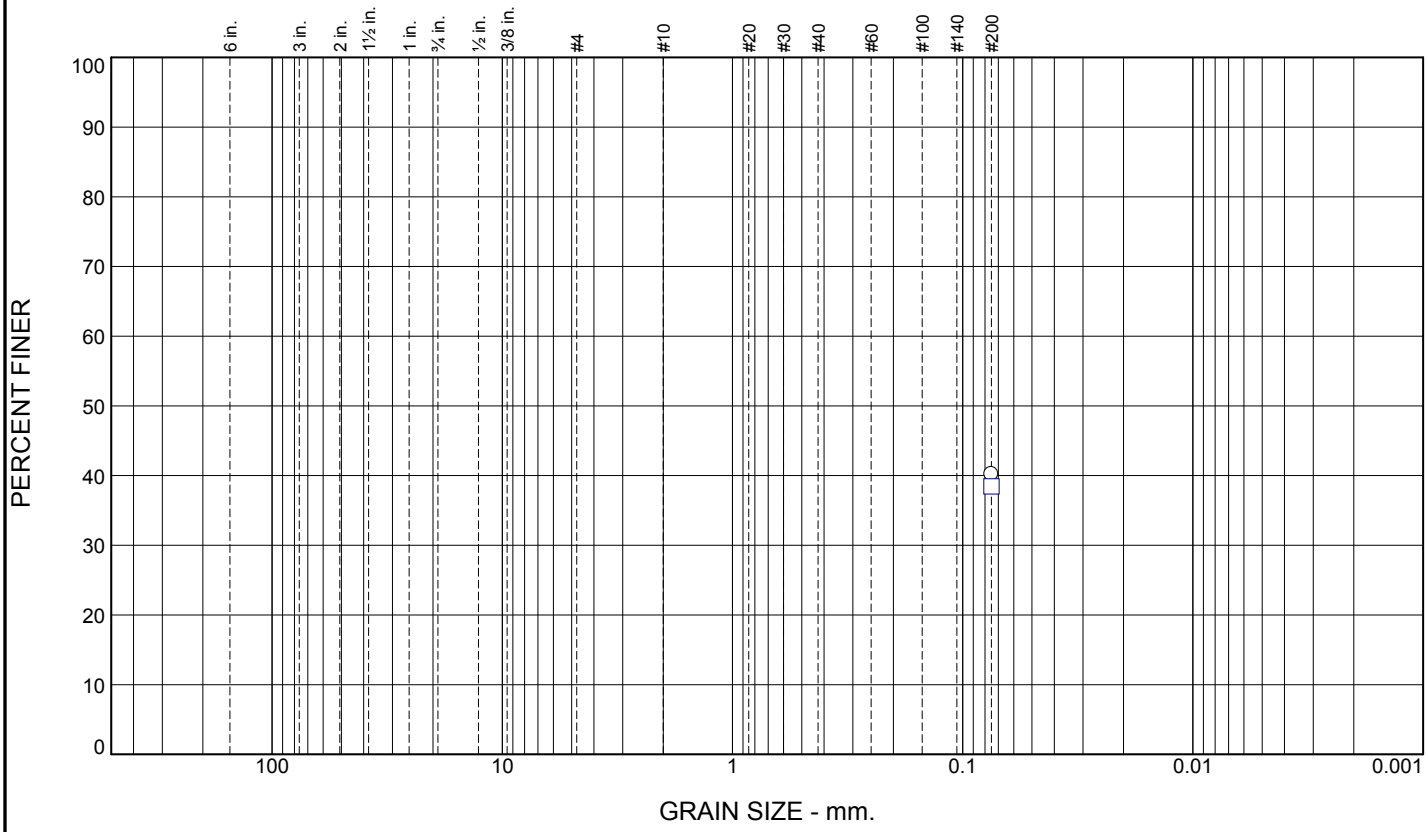
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 3

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	50	33	17
□						SM			

SIEVE inches size	○ PERCENT FINER	□ PERCENT FINER
GRAIN SIZE		
D_{60}		
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○ PERCENT FINER	□ PERCENT FINER
#200	40.2	38.5

Material Description

○ SILTY SAND, light olive brown

□ SILTY SAND, brown

REMARKS:

○

□

○ Source of Sample: SM0007_019A Depth: 55.5-56.0' Sample Number: #10A

□ Source of Sample: SM0007_019A Depth: 61.0-61.5' Sample Number: #11C

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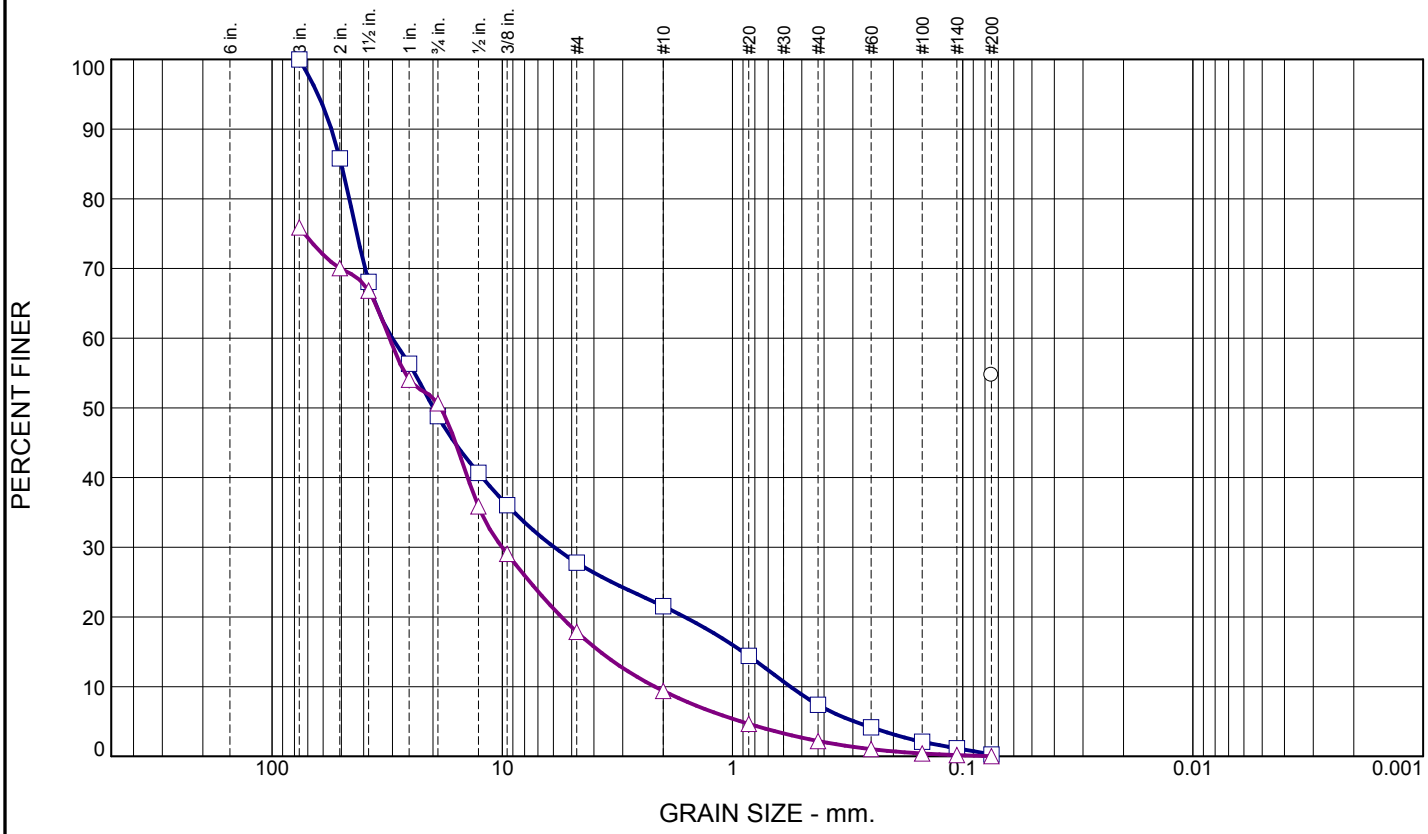
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 4

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL-ML	23	18	5
□	0.0	72.2	27.5	0.3		GW			
△		58.0	17.9	0.0		GW			

SIEVE inches size	PERCENT FINER ○	□	△
3		100.0	75.9
2		85.8	70.1
1.5		68.1	66.8
1		56.3	54.0
.75		48.8	50.7
.5		40.7	35.9
.375		36.0	29.1
GRAIN SIZE			
D_{60}		30.0810	30.9028
D_{30}		5.9414	10.0221
D_{10}		0.5604	2.1751
COEFFICIENTS			
C_c		2.09	1.49
C_u		53.68	14.21

SIEVE number size	PERCENT FINER ○	□	△
#4		27.8	17.9
#10		21.5	9.4
#20		14.4	4.7
#40		7.4	2.2
#60		4.2	1.0
#100		2.1	0.4
#140		1.2	0.2
#200	54.7	0.3	0.0

Material Description

○ SANDY SILTY CLAY, dark yellowish brown

□ Well-graded GRAVEL with SAND, very dark greenish gray

△ Well-graded GRAVEL with SAND, very dark greenish gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_026S Depth: 9.0-9.5' Sample Number: #2B

□ Source of Sample: SM0007_026S Depth: 23.5-24.5' Sample Number: #5C

△ Source of Sample: SM0007_026S Depth: 31.0-32.0' Sample Number: #7A

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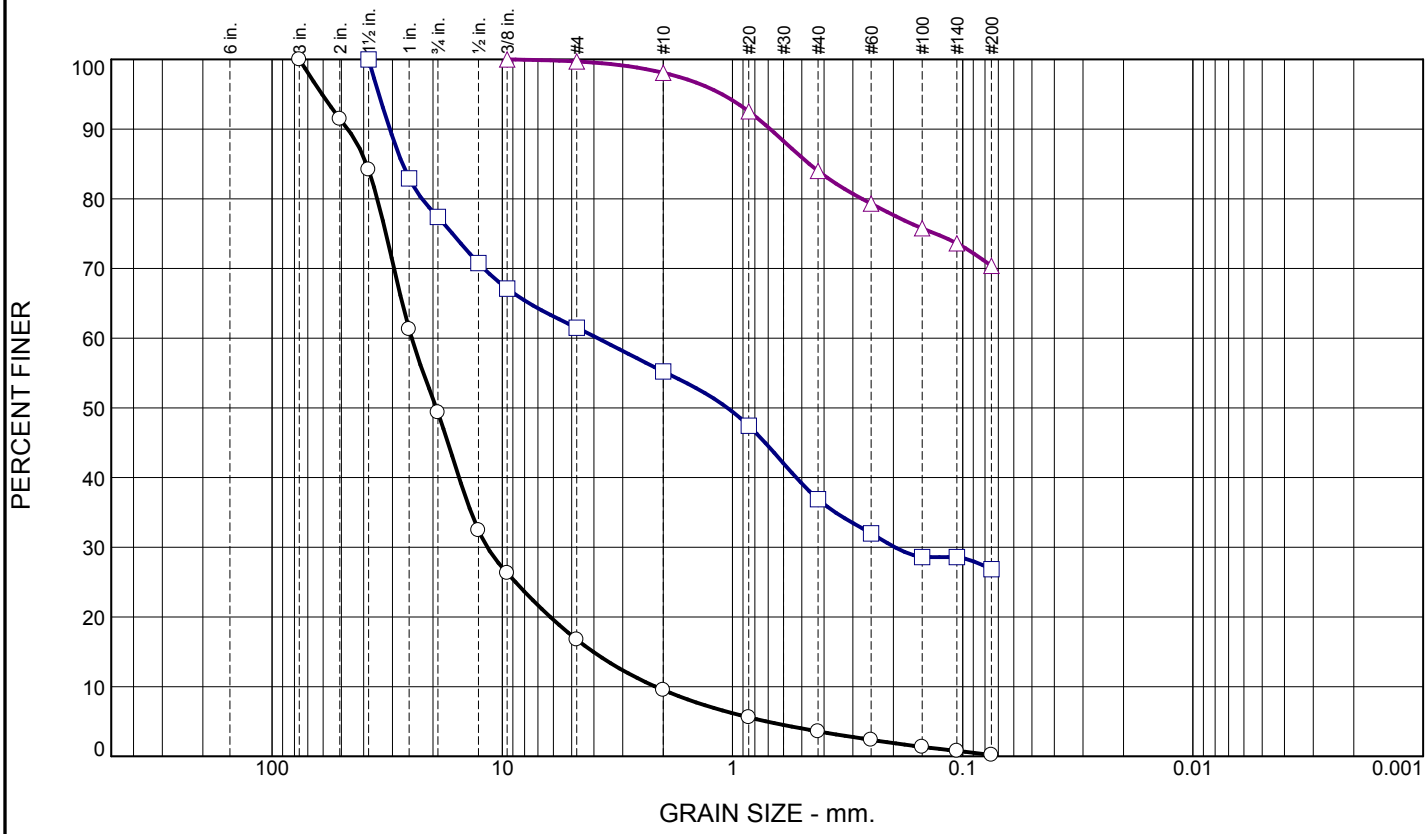
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 5

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	83.2	16.6	0.2		GW			
□	0.0	38.5	34.6	26.9		GC-GM	23	16	7
△	0.0	0.3	29.3	70.4		ML			

SIEVE inches size	PERCENT FINER ○	□	△
3	100.0		
2	91.5		
1.5	84.2	100.0	
1	61.3	82.9	
.75	49.4	77.4	
.5	32.4	70.8	
.375	26.3	67.1	100.0
	GRAIN SIZE		
D_{60}	24.7434	3.8484	
D_{30}	11.6132	0.1968	
D_{10}	2.1586		
	COEFFICIENTS		
C_c	2.53		
C_u	11.46		

SIEVE number size	PERCENT FINER ○	□	△
#4	16.8	61.5	99.7
#10	9.5	55.2	98.1
#20	5.6	47.4	92.6
#40	3.6	36.9	84.0
#60	2.4	32.0	79.3
#100	1.4	28.6	75.8
#140	0.8	28.6	73.6
#200	0.2	26.9	70.4

Material Description

○ Well-graded GRAVEL with SAND, olive

□ SILTY CLAYEY GRAVEL with SAND, olive

△ SILT with SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_026S Depth: 41.0-42.0' Sample Number: #9B

□ Source of Sample: SM0007_026S Depth: 47.0-48.0' Sample Number: #10B

△ Source of Sample: SM0007_026S Depth: 60.5-61.0' Sample Number: #13A

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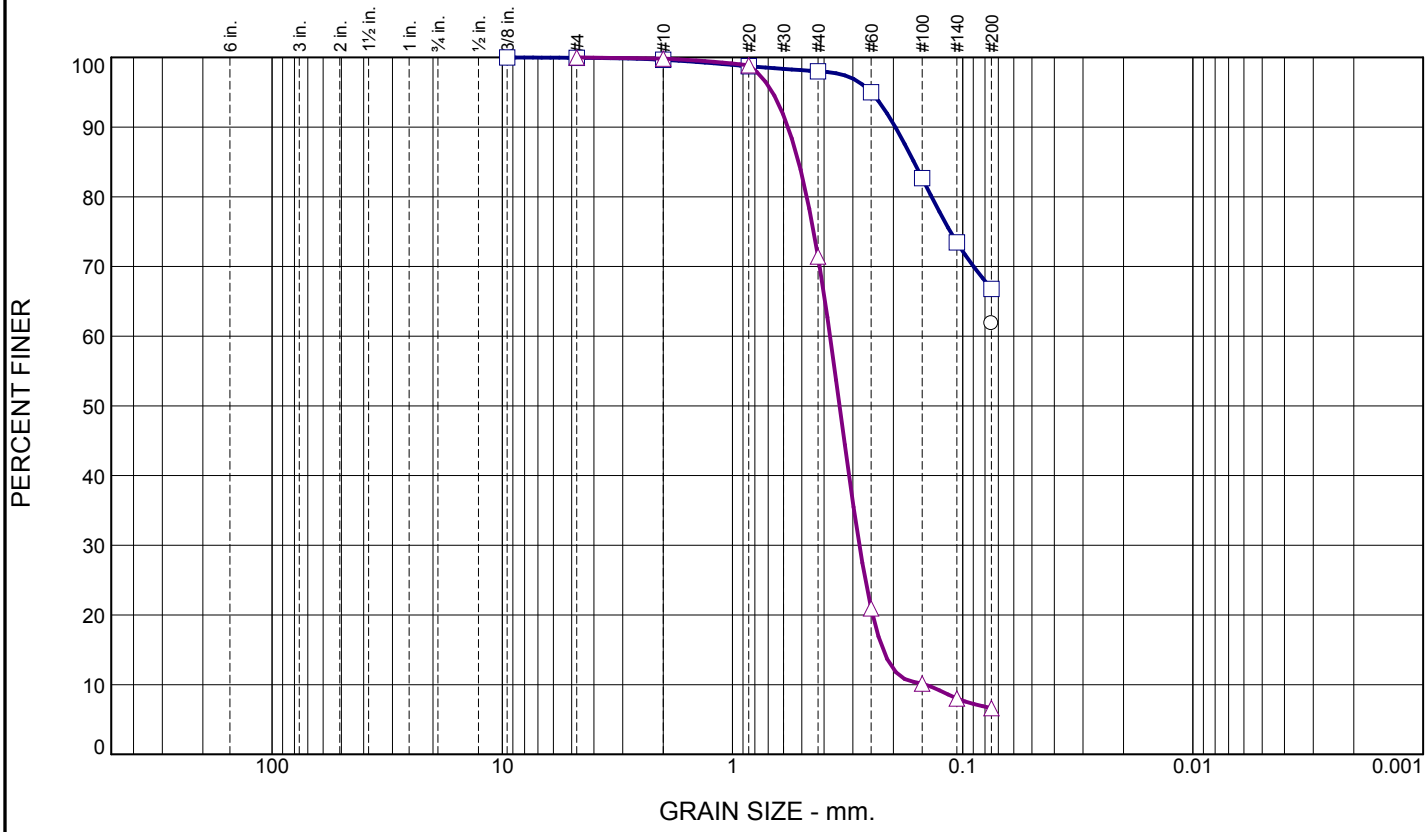
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 6

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL-ML	23	19	4
□	0.0	0.1	33.1	66.8		SM			
△	0.0	0.0	93.4	6.6		SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
.375		100.0	
GRAIN SIZE			
D_{60}			0.3769
D_{30}			0.2809
D_{10}			0.1447
COEFFICIENTS			
C_c			1.45
C_u			2.61

SIEVE number size	PERCENT FINER ○	□	△
#4		99.9	100.0
#10		99.7	99.8
#20		98.7	98.9
#40		98.0	71.4
#60		95.0	20.9
#100		82.7	10.1
#140		73.5	8.0
#200	61.9	66.8	6.6

Material Description

○ SANDY SILTY CLAY, dark yellowish brown

□ SANDY SILT, dark yellowish brown

△ Poorly-graded SAND with SILT, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_027S Depth: 9.0-10.0' Sample Number: #2B

□ Source of Sample: SM0007_027S Depth: 22.0-23.0' Sample Number: #5A

△ Source of Sample: SM0007_027S Depth: 32.0-33.0' Sample Number: #7B

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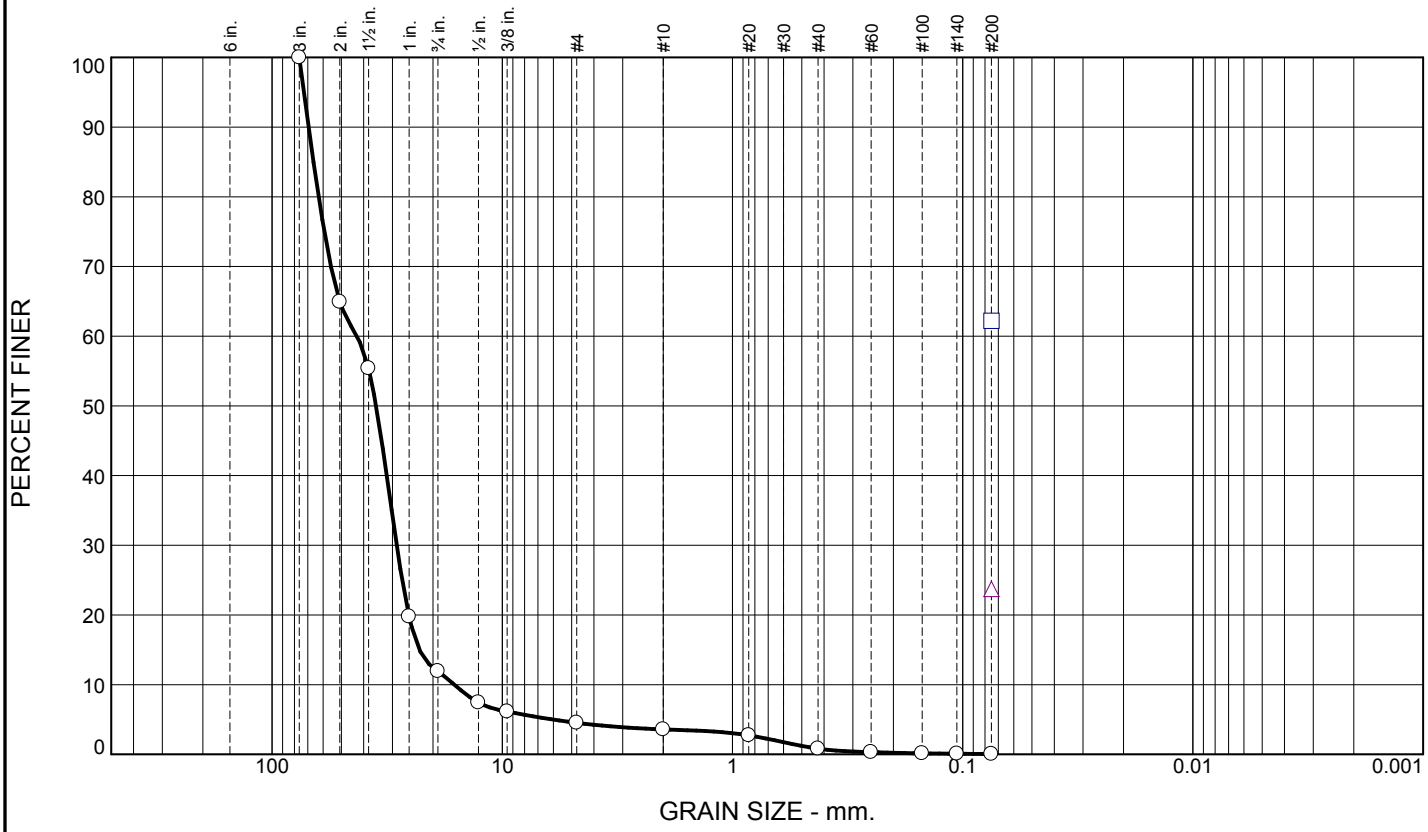
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 7

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	95.5	4.5	0.0		GP			
□						MH	52	30	22
△						SC			

SIEVE inches size	○	□	△
	PERCENT FINER		
3	100.0		
2	64.9		
1.5	55.4		
1	19.8		
.75	11.9		
.5	7.4		
.375	6.1		
	GRAIN SIZE		
D_{60}	42.8252		
D_{30}	28.7514		
D_{10}	16.1631		
	COEFFICIENTS		
C_c	1.19		
C_u	2.65		

SIEVE number size	○	□	△
	PERCENT FINER		
#4	4.5		
#10	3.6		
#20	2.7		
#40	0.8		
#60	0.3		
#100	0.1		
#140	0.1		
#200	0.0	62.2	23.7

Material Description

○ Poorly-graded GRAVEL, olive gray

□ SANDY elastic SILT, olive brown

△ CLAYEY SAND, dark greenish gray

REMARKS:

○

□

△

○ Source of Sample: SM0007_027S Depth: 44.0-45.0' Sample Number: #9B

□ Source of Sample: SM0007_027S Depth: 56.5-57.5' Sample Number: #12A

△ Source of Sample: SM0007_027S Depth: 64.0-64.5' Sample Number: #13D

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Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 8

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	46.0	52.0	2.0		SP			

SIEVE inches size	PERCENT FINER ○		
3	100.0		
2	88.8		
1.5	88.8		
1	74.7		
.75	68.0		
.5	62.7		
.375	59.9		
	GRAIN SIZE		
D_{60}	9.6292		
D_{30}	0.8194		
D_{10}	0.1919		
	COEFFICIENTS		
C_c	0.36		
C_u	50.17		

SIEVE number size	PERCENT FINER ○		
#4	54.0		
#10	45.1		
#20	30.7		
#40	18.9		
#60	12.8		
#100	7.6		
#140	4.6		
#200	2.0		

Material Description

○ Poorly-graded SAND with GRAVEL, olive gray

REMARKS:

○

○ Source of Sample: SM0007_027S Depth: 68.0-69.0' Sample Number: #15A

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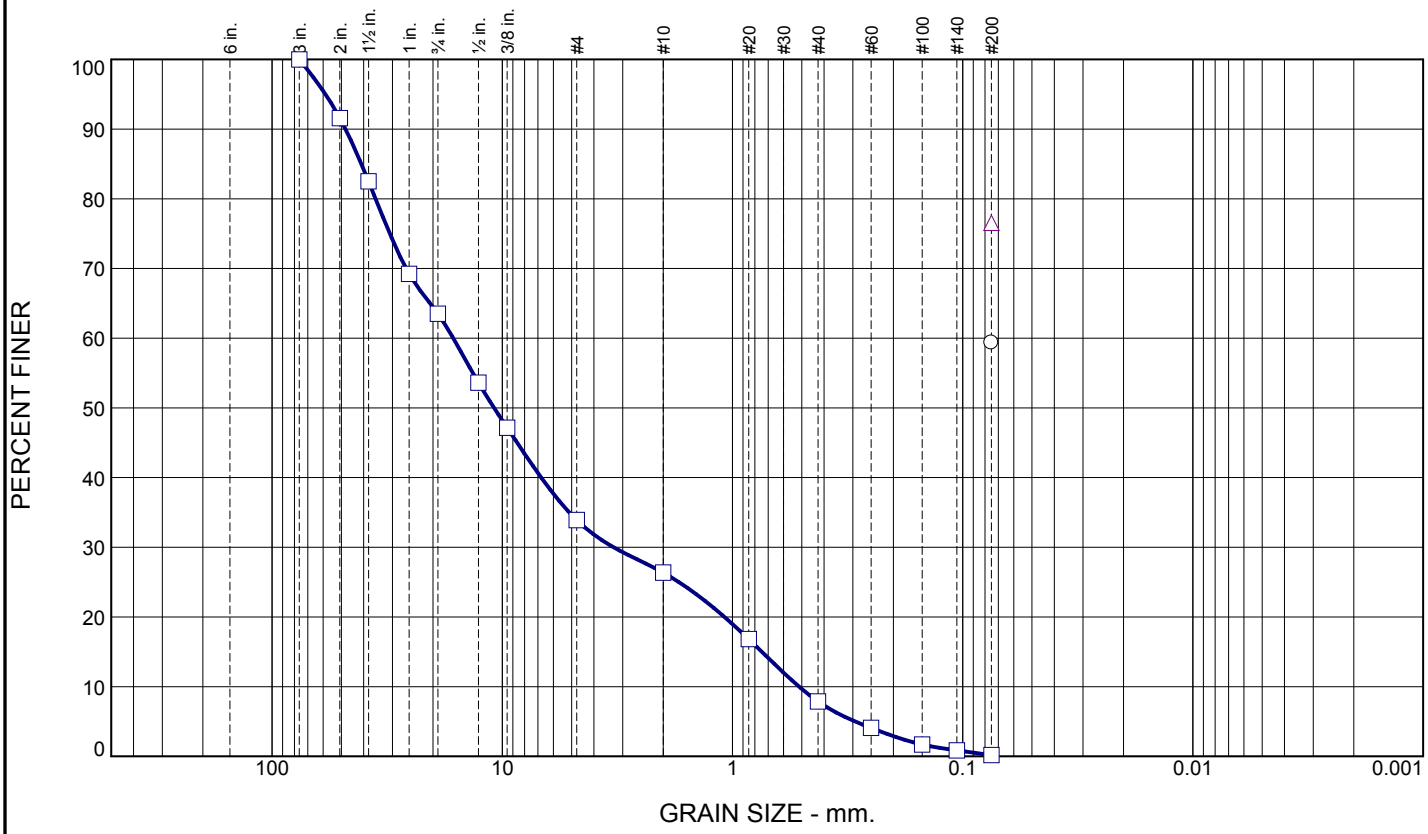
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Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 Figure LS7 - 9

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL-ML	25	20	5
□	0.0	66.1	33.7	0.2		GW			
△						CH	54	21	33

SIEVE inches size	PERCENT FINER ○	□	△
3		100.0	
2		91.6	
1.5		82.5	
1		69.2	
.75		63.5	
.5		53.6	
.375		47.2	
GRAIN SIZE			
D_{60}		16.3348	
D_{30}		3.2838	
D_{10}		0.5137	
COEFFICIENTS			
C_c		1.29	
C_u		31.80	

SIEVE number size	PERCENT FINER ○	□	△
#4		33.9	
#10		26.4	
#20		16.8	
#40		7.9	
#60		4.1	
#100		1.7	
#140		0.9	
#200	59.4	0.2	76.6

Material Description

○ SANDY SILTY-CLAY, dark reddish brown

□ Well-graded GRAVEL with SAND, olive brown

△ Fat CLAY with SAND, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_028S Depth: 10.0-11.0' Sample Number: #3A

□ Source of Sample: SM0007_028S Depth: 18.0-19.0' Sample Number: #4B

△ Source of Sample: SM0007_028S Depth: 35.5-36.0' Sample Number: #10A

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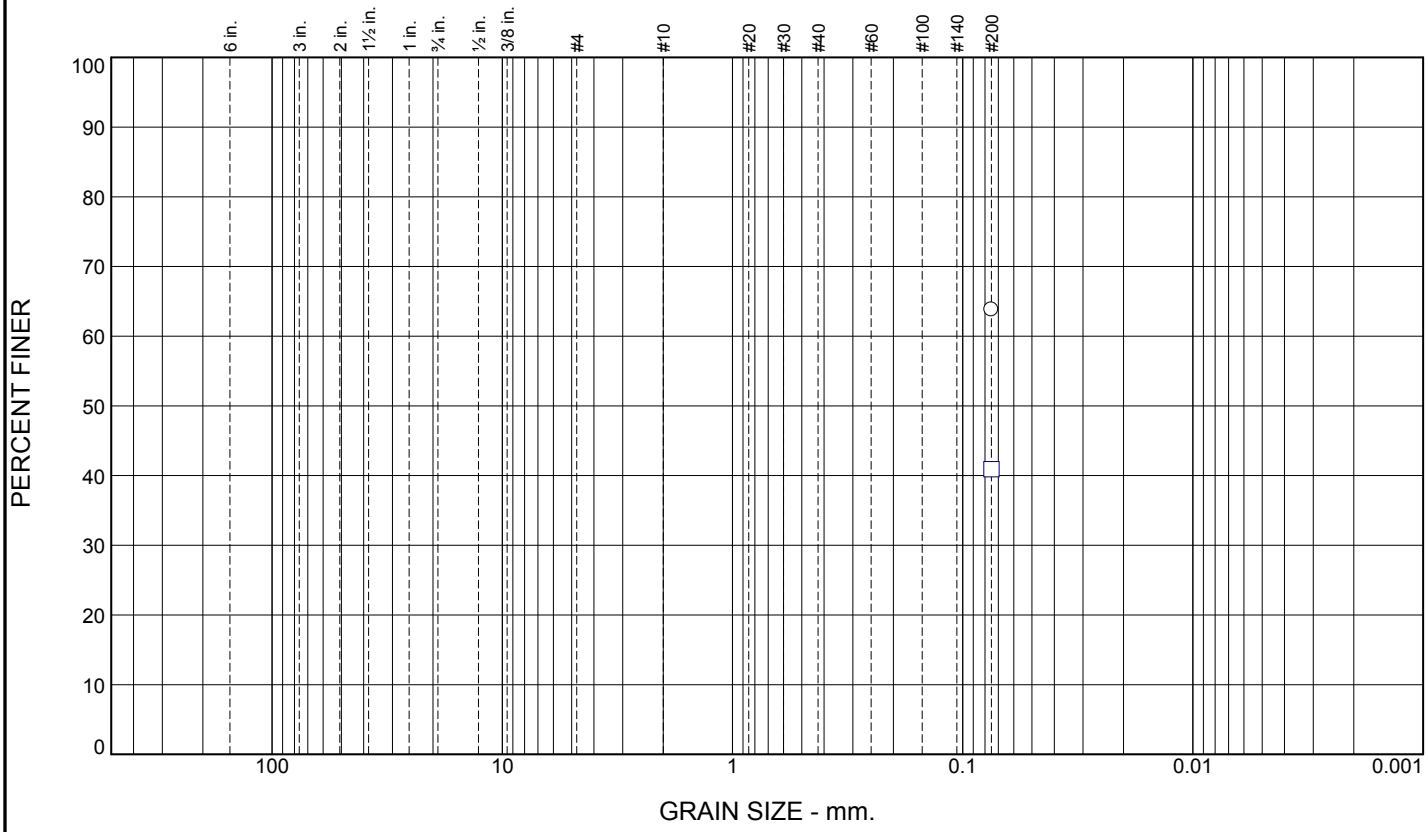
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 10

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CH	58	24	34
□						SM	23	22	1

SIEVE inches size	PERCENT FINER ○	□	
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#200	63.8	40.9	

Material Description

○ SANDY fat CLAY, light olive brown

□ SILTY SAND, olive

REMARKS:

○

□

○ Source of Sample: SM0007_028S Depth: 37.5-38.5' Sample Number: #11A

□ Source of Sample: SM0007_028S Depth: 39.5-40.0' Sample Number: #11B

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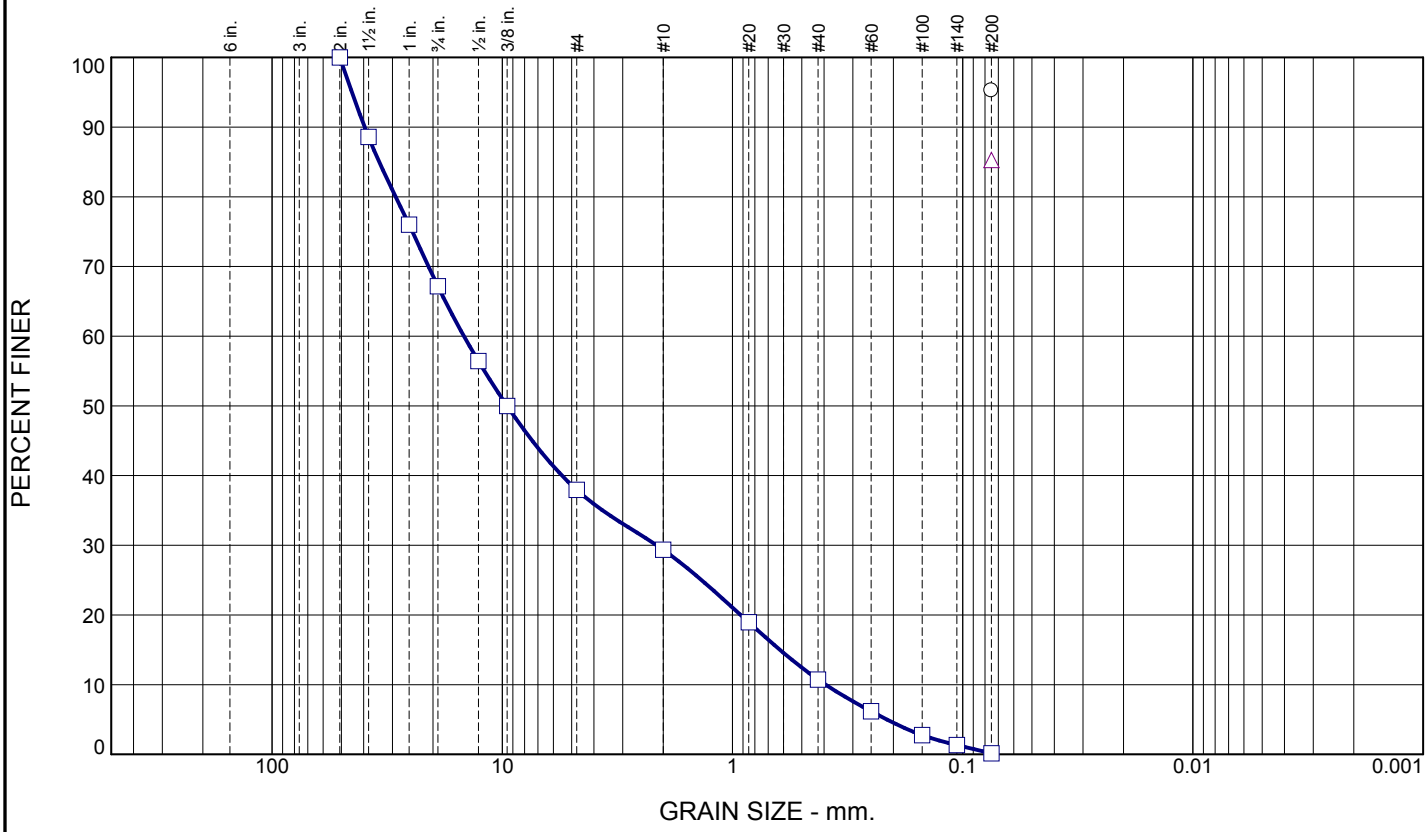
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 11

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	24	21	3
□	0.0	62.0	37.8	0.2		GP			
△						CH	59	23	36

SIEVE inches size	PERCENT FINER ○	□	△
2		100.0	
1.5		88.6	
1		76.0	
.75		67.2	
.5		56.4	
.375		50.0	
GRAIN SIZE			
D_{60}		14.6771	
D_{30}		2.1346	
D_{10}		0.3941	
COEFFICIENTS			
C_c		0.79	
C_u		37.24	

SIEVE number size	PERCENT FINER ○	□	△
#4		38.0	
#10		29.4	
#20		18.9	
#40		10.7	
#60		6.2	
#100		2.8	
#140		1.3	
#200	95.3	0.2	85.3

Material Description

○ SILT, dark brown

□ Poorly-graded GRAVEL with SAND, olive brown

△ Fat CLAY, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_029S Depth: 8.0-9.0' Sample Number: #2A

□ Source of Sample: SM0007_029S Depth: 19.0-20.0' Sample Number: #4E

△ Source of Sample: SM0007_029S Depth: 35.0-36.0' Sample Number: #8A

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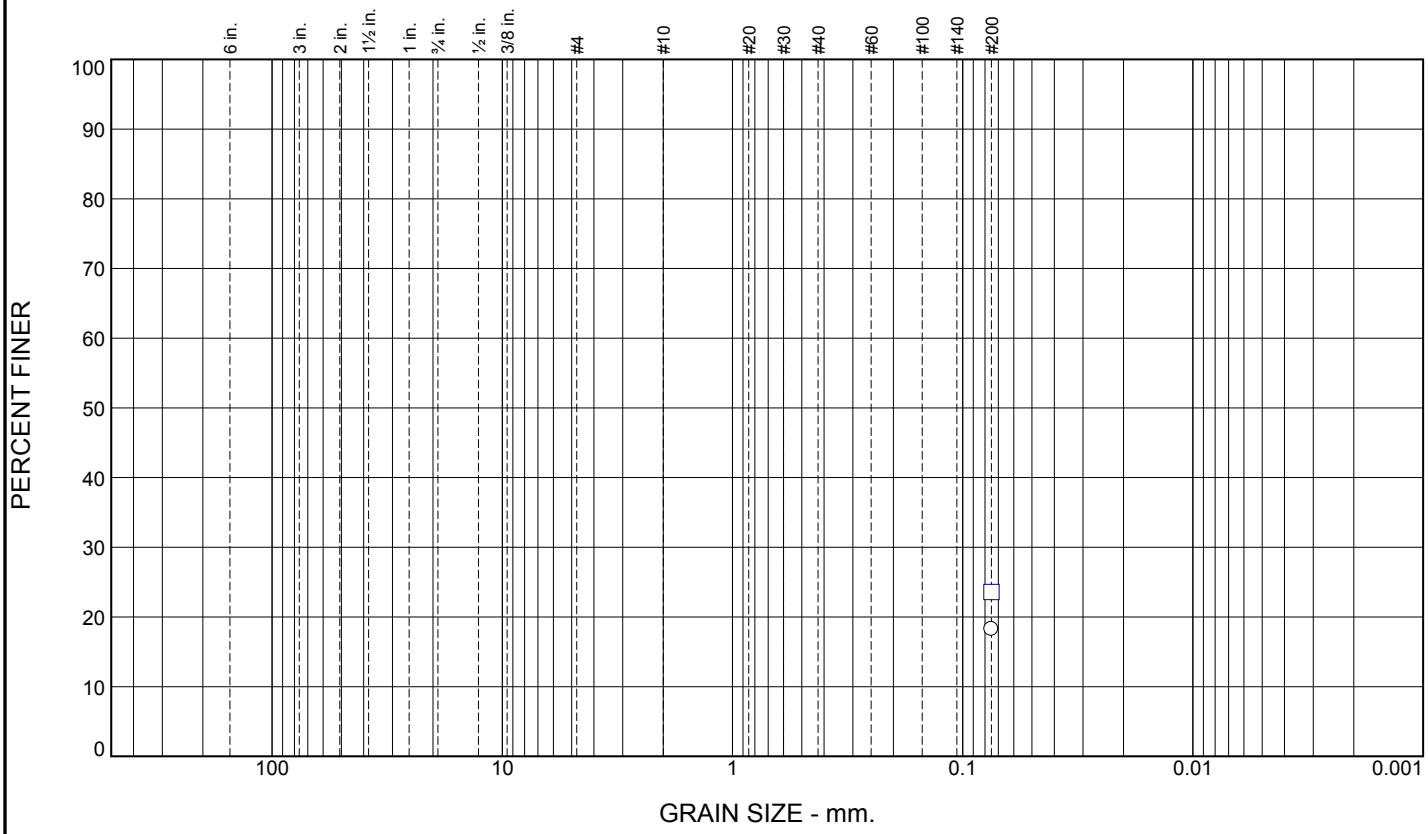
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 12

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						GM			

SIEVE inches size	PERCENT FINER ○	□	
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#200	18.3	23.6	

Material Description

○ SILTY SAND, olive

□ SILTY GRAVEL, olive brown

REMARKS:

○

□

○ Source of Sample: SM0007_029S Depth: 40.5-41.5' Sample Number: #9A

□ Source of Sample: SM0007_029S Depth: 44.5-45.0' Sample Number: #9B

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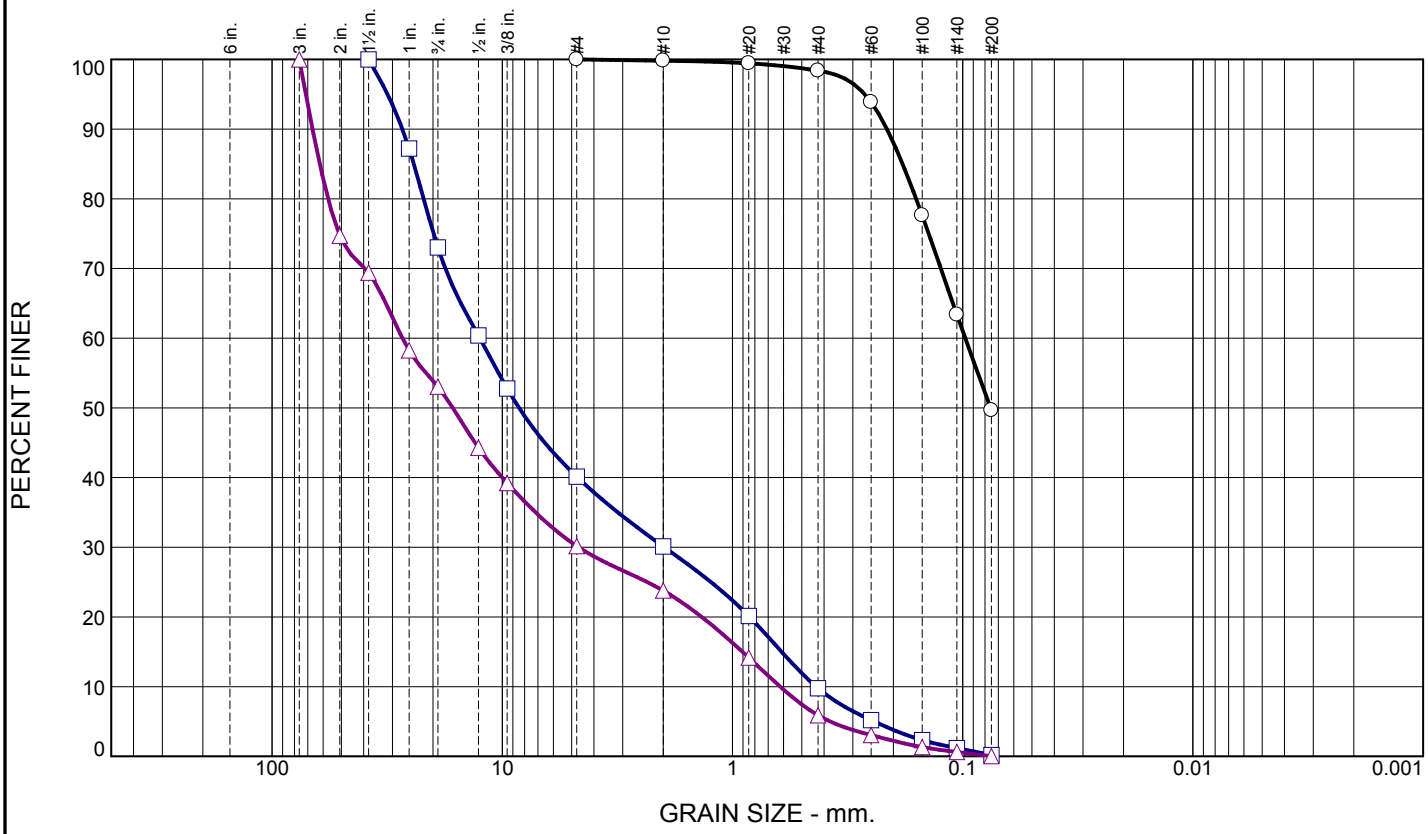
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 13

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	50.3	49.7		SM			
□	0.0	59.9	39.9	0.2		GP			
△	0.0	69.8	30.2	0.0		GW			

SIEVE inches size	PERCENT FINER ○	□	△
3			100.0
2			74.7
1.5		100.0	69.4
1		87.2	58.2
.75		73.0	53.0
.5		60.4	44.3
.375		52.8	39.2
	GRAIN SIZE		
D_{60}	0.0975	12.5090	27.1516
D_{30}		1.9772	4.6634
D_{10}		0.4331	0.6202
	COEFFICIENTS		
C_c		0.72	1.29
C_u		28.88	43.78

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	40.1	30.2
#10	99.8	30.1	23.8
#20	99.4	20.1	14.2
#40	98.4	9.8	5.9
#60	93.9	5.2	3.1
#100	77.6	2.3	1.3
#140	63.4	1.2	0.6
#200	49.7	0.2	0.0

Material Description

○ SILTY SAND, dark yellowish brown

□ Poorly-graded GRAVEL with SAND, olive brown

△ Well-graded GRAVEL with SAND, olive brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_030S Depth: 6.0-7.0' Sample Number: #2A

□ Source of Sample: SM0007_030S Depth: 16.0-17.0' Sample Number: #4A

△ Source of Sample: SM0007_030S Depth: 23.0-24.0' Sample Number: #5B

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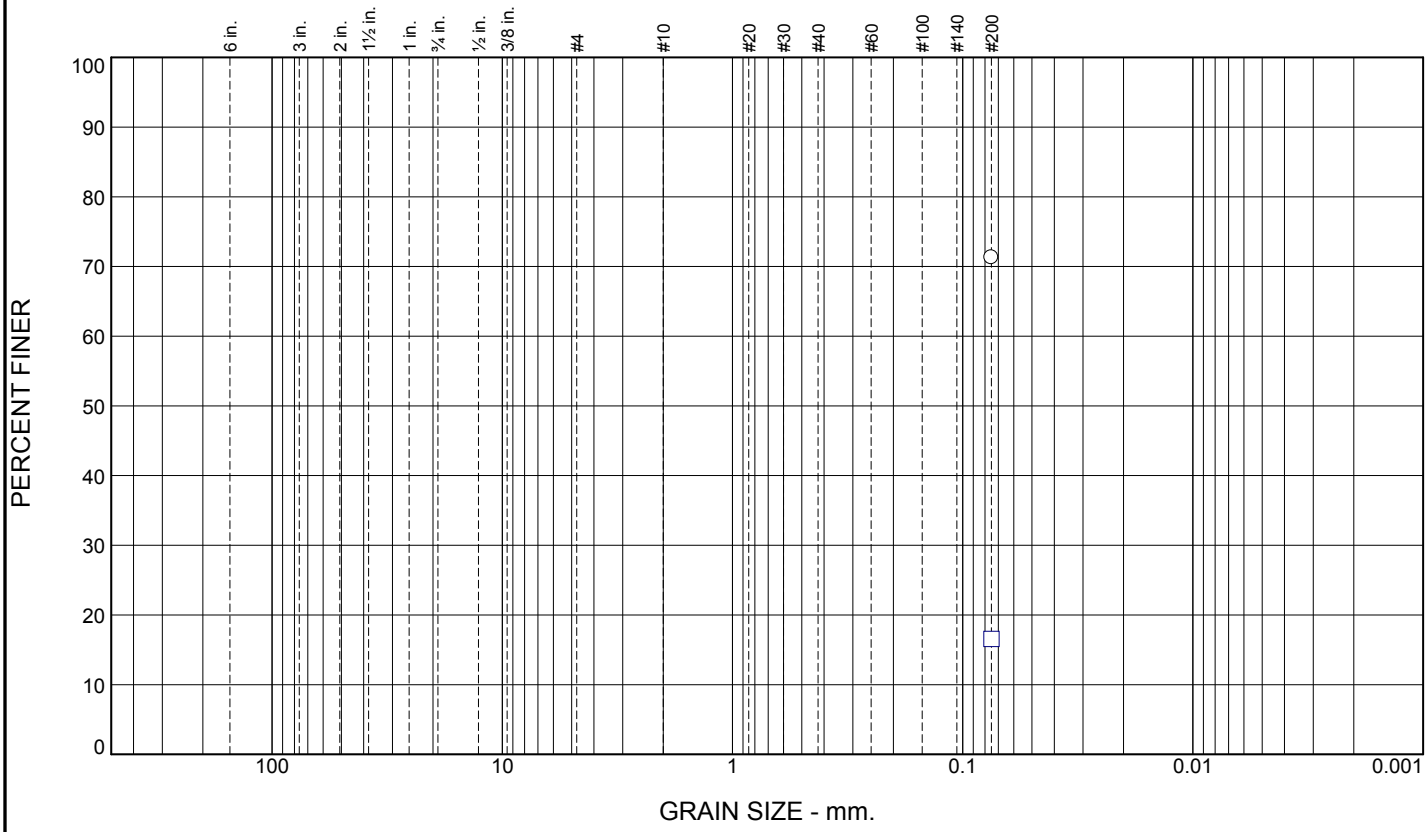
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 14

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CH	52	24	28
□						GC			

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
GRAIN SIZE		
D_{60}		
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#200	71.3	16.6

Material Description

○ Fat CLAY with SAND, olive brown

□ CLAYEY GRAVEL, olive brown

REMARKS:

○

□

○ Source of Sample: SM0007_030S Depth: 34.0-35.0' Sample Number: #7A

□ Source of Sample: SM0007_030S Depth: 40.5-41.5' Sample Number: #9A

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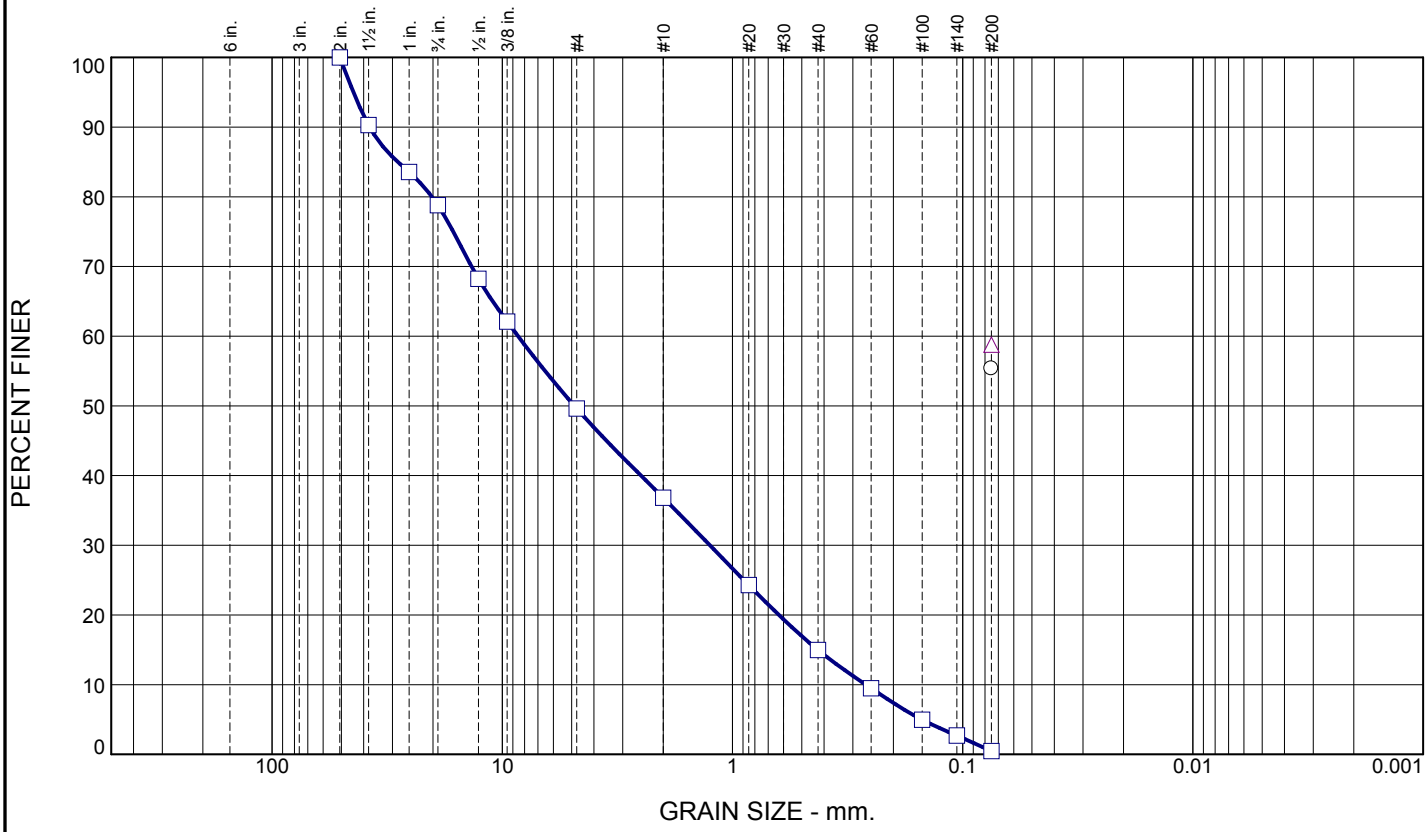
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 15

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	22	20	2
□	0.0	50.4	49.1	0.5		GP			
△						CL	42	20	22

SIEVE inches size	PERCENT FINER ○	□	△
2		100.0	
1.5		90.3	
1		83.6	
.75		78.8	
.5		68.2	
.375		62.1	
GRAIN SIZE			
D_{60}		8.5375	
D_{30}		1.2537	
D_{10}		0.2636	
COEFFICIENTS			
C_c		0.70	
C_u		32.39	

SIEVE number size	PERCENT FINER ○	□	△
#4		49.6	
#10		36.8	
#20		24.3	
#40		15.0	
#60		9.5	
#100		5.0	
#140		2.7	
#200	55.4	0.5	58.8

Material Description

○ SANDY SILT, brown

□ Poorly-graded GRAVEL with SAND, olive gray

△ SANDY lean CLAY, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_011S Depth: 6.0-6.5' Sample Number: #2A

□ Source of Sample: SM0007_011S Depth: 32.0-33.0' Sample Number: #7A

△ Source of Sample: SM0007_011S Depth: 36.0-36.5' Sample Number: #8A

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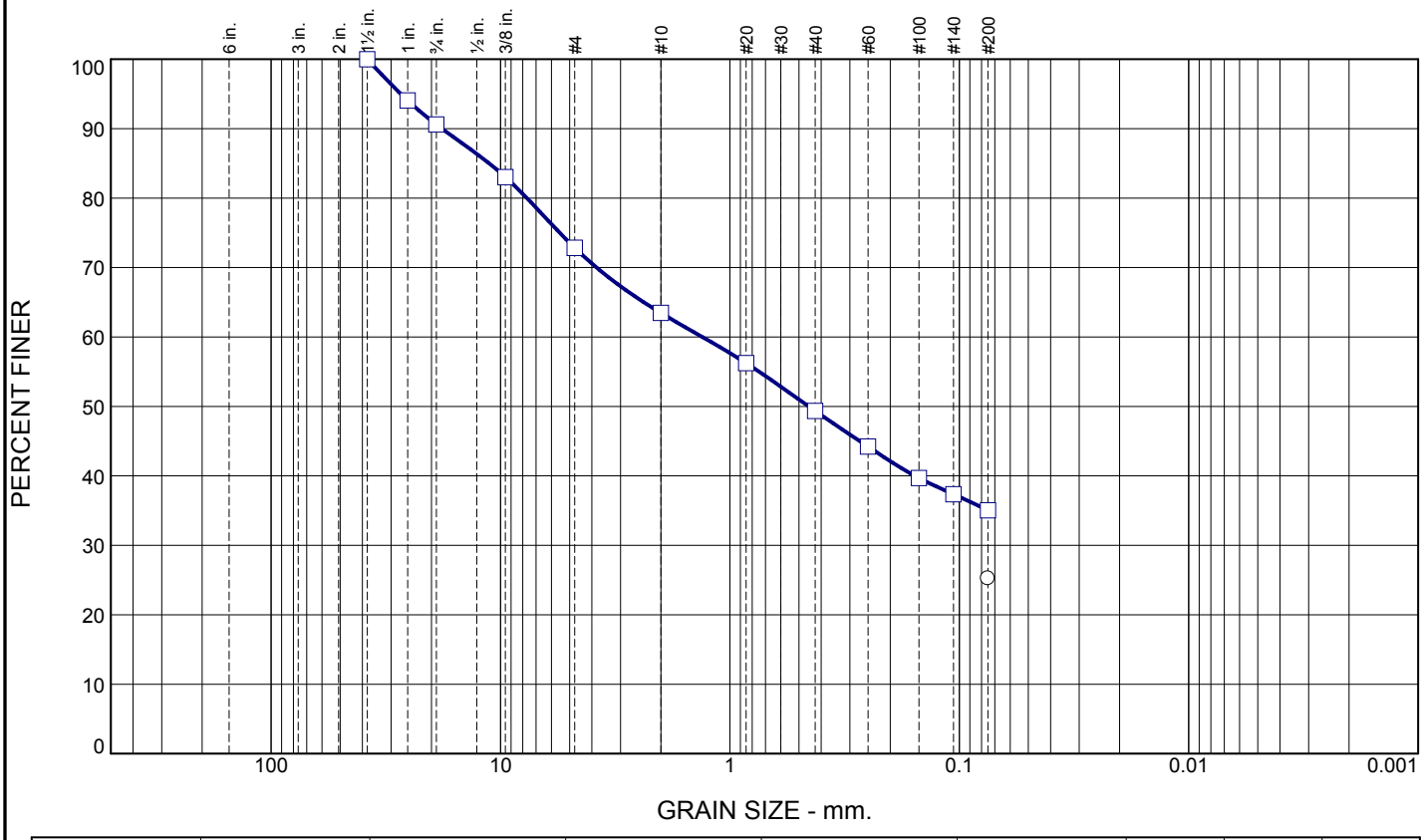
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 16

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						GC			
□	0.0	27.2	37.8	35.0		SC-SM	22	15	7

SIEVE inches size	○ PERCENT FINER	□ PERCENT FINER
1.5		100.0
1		94.1
.75		90.6
.375		83.0
GRAIN SIZE		
D_{60}		1.3181
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○ PERCENT FINER	□ PERCENT FINER
#4		72.8
#10		63.5
#20		56.2
#40		49.4
#60		44.2
#100		39.7
#140		37.4
#200	25.2	35.0

Material Description

○ CLAYEY GRAVEL, olive gray

□ SILTY CLAYEY SAND with GRAVEL, pale olive

REMARKS:

○

□

○ Source of Sample: SM0007_011S Depth: 59.25-60.0' Sample Number: #12B

□ Source of Sample: SM0007_011S Depth: 64.0-65.0' Sample Number: #13A

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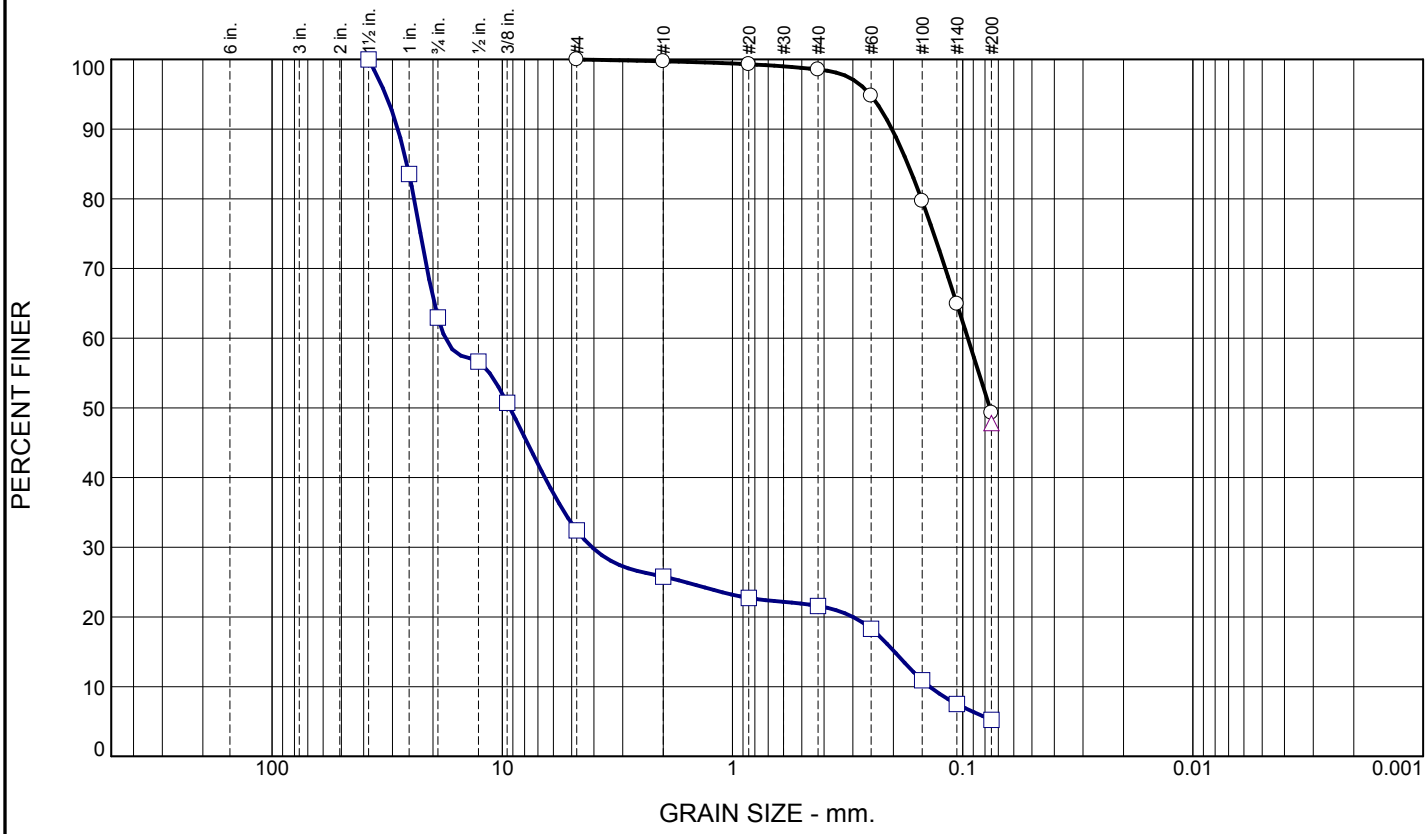
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 17

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	0.0	50.7	49.3		SM			
□	0.0	67.6	27.2	5.2		GP			
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
1.5		100.0	
1		83.6	
.75		63.0	
.5		56.6	
.375		50.7	
	GRAIN SIZE		
D_{60}	0.0950	17.6912	
D_{30}		4.0730	
D_{10}		0.1391	
	COEFFICIENTS		
C_c		6.74	
C_u		127.16	

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	32.4	
#10	99.7	25.8	
#20	99.3	22.7	
#40	98.5	21.6	
#60	94.8	18.3	
#100	79.7	10.9	
#140	64.9	7.5	
#200	49.3	5.2	47.8

Material Description

○ SILTY SAND, dark brown

□ Poorly-graded GRAVEL with SAND, light yellowish brown

△ SILTY SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_011A Depth: 10.0-11.5' Sample Number: #4

□ Source of Sample: SM0007_011A Depth: 25.0-26.5' Sample Number: #8

△ Source of Sample: SM0007_011A Depth: 65.0-66.5' Sample Number: #14

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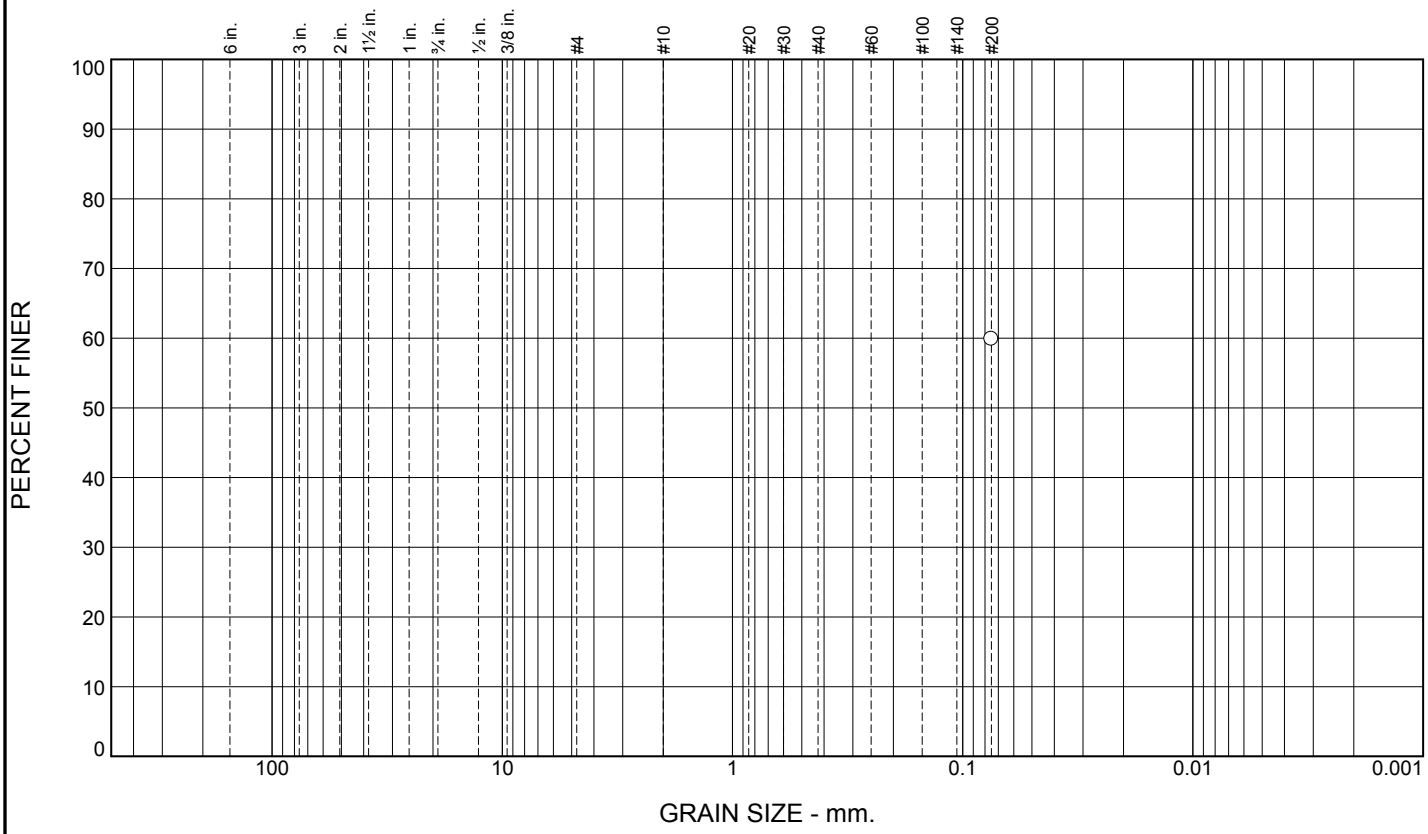
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 18

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	32	21	11

SIEVE inches size	PERCENT FINER ○		
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	59.9		

Material Description

○ SANDY lean CLAY, dark yellowish brown

REMARKS:

○

○ Source of Sample: SM0007_011A Depth: 70.0-71.5' Sample Number: #15

Blackburn Consulting

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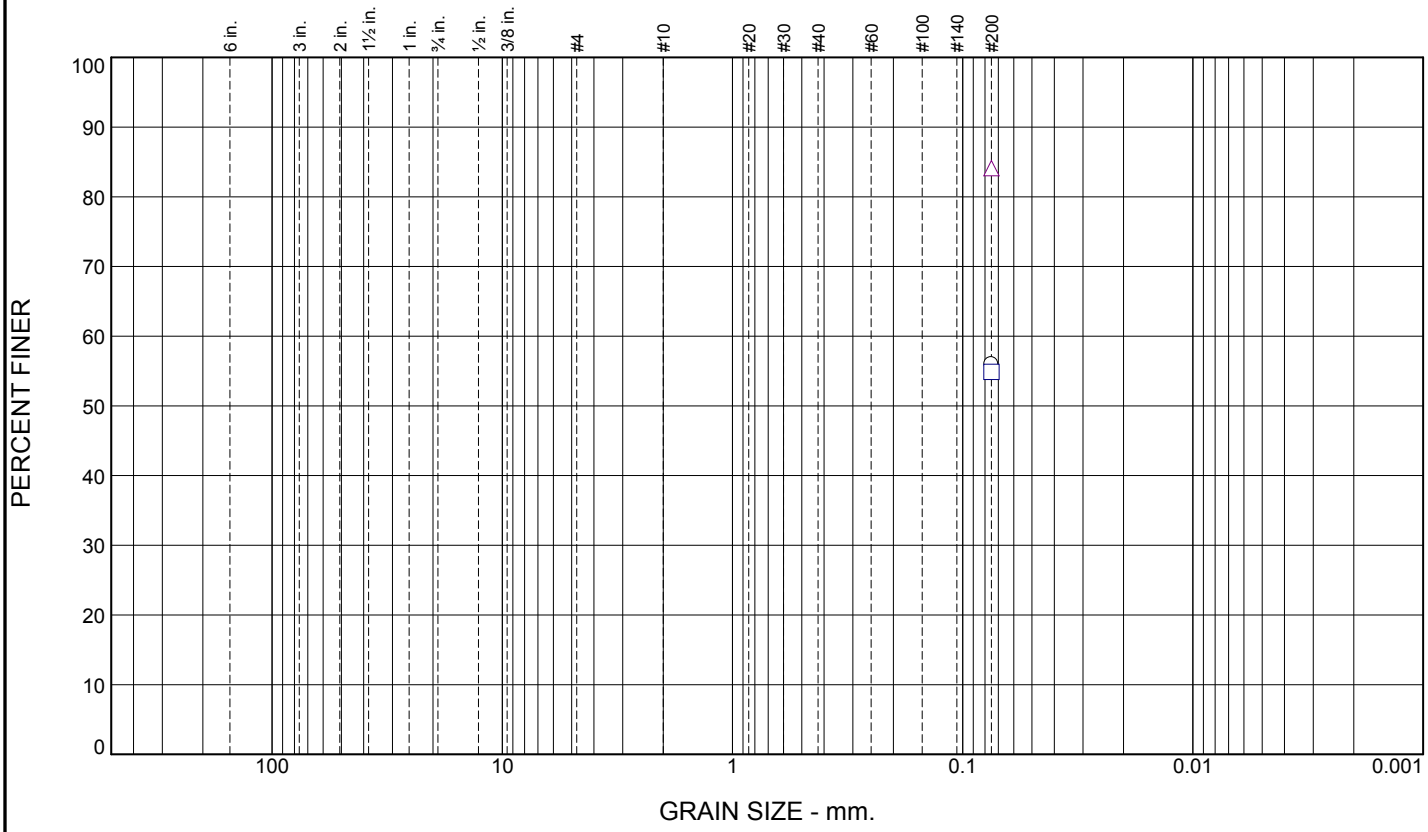
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 19

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	42	25	17
□						CL	32	18	14
△						CH	51	24	27

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	56.0	54.9	84.1

Material Description

○ SANDY lean CLAY, olive gray

□ SANDY Lean CLAY, yellowish brown

△ Fat CLAY with SAND, olive gray

REMARKS:

○

□

△

○ Source of Sample: SL0009_004B Depth: 125.0-126.5' Sample Number: #29

□ Source of Sample: SM0007_011B Depth: 20.0-21.5' Sample Number: #8

△ Source of Sample: SM0007_007A Depth: 75.0-76.5' Sample Number: #19A

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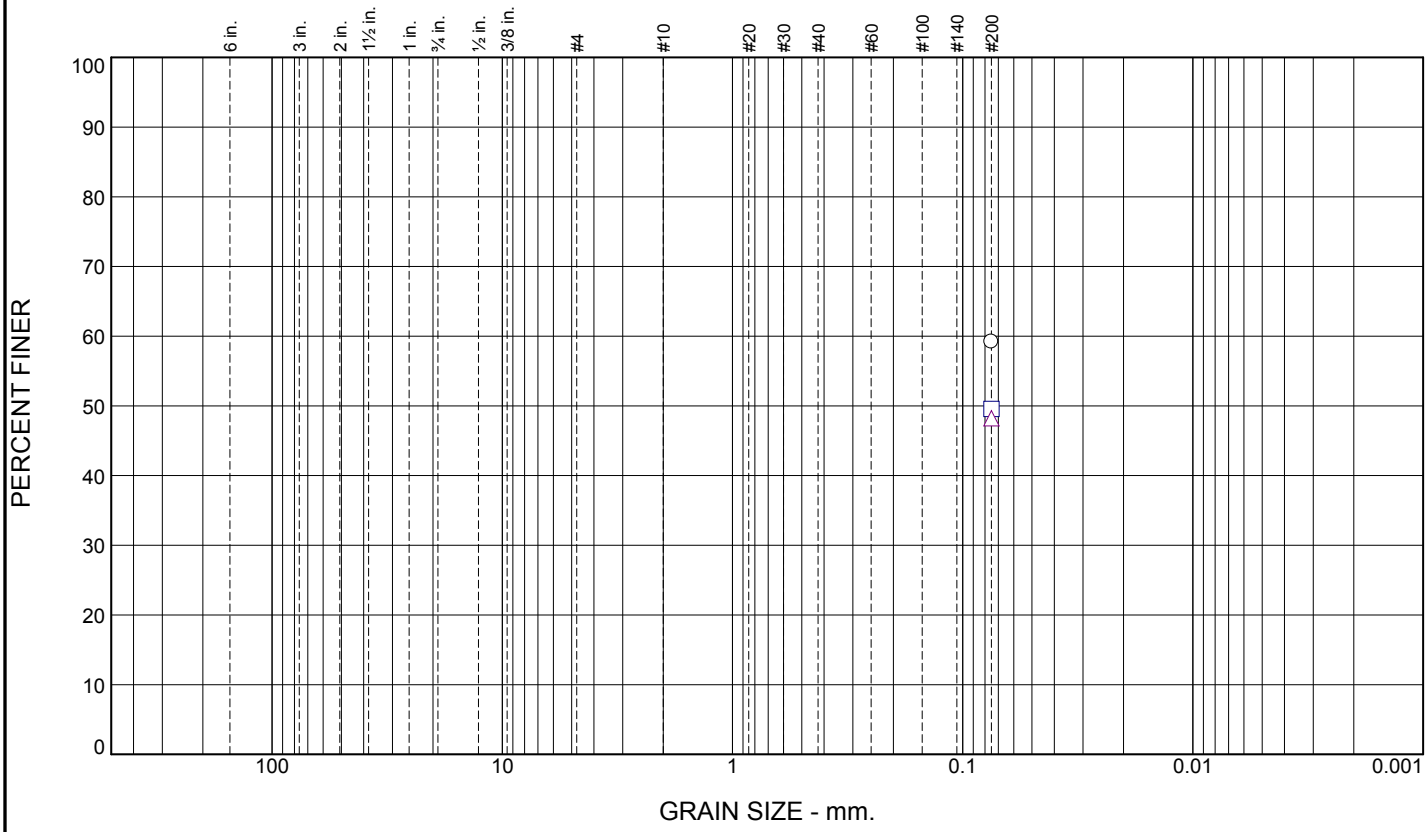
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 20

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	34	21	13
□						SM	27	27	NP
△						SM	37	30	7

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	59.2	49.6	48.2

Material Description

○ SANDY lean CLAY, light olive brown

□ SILTY SAND, dark yellowish brown

△ SILTY SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_012B Depth: 61.0-61.5' Sample Number: #14A

□ Source of Sample: SM0007_013B Depth: 30.0-31.5' Sample Number: #10

△ Source of Sample: SM0007_014B Depth: 38.0-38.5' Sample Number: #12A

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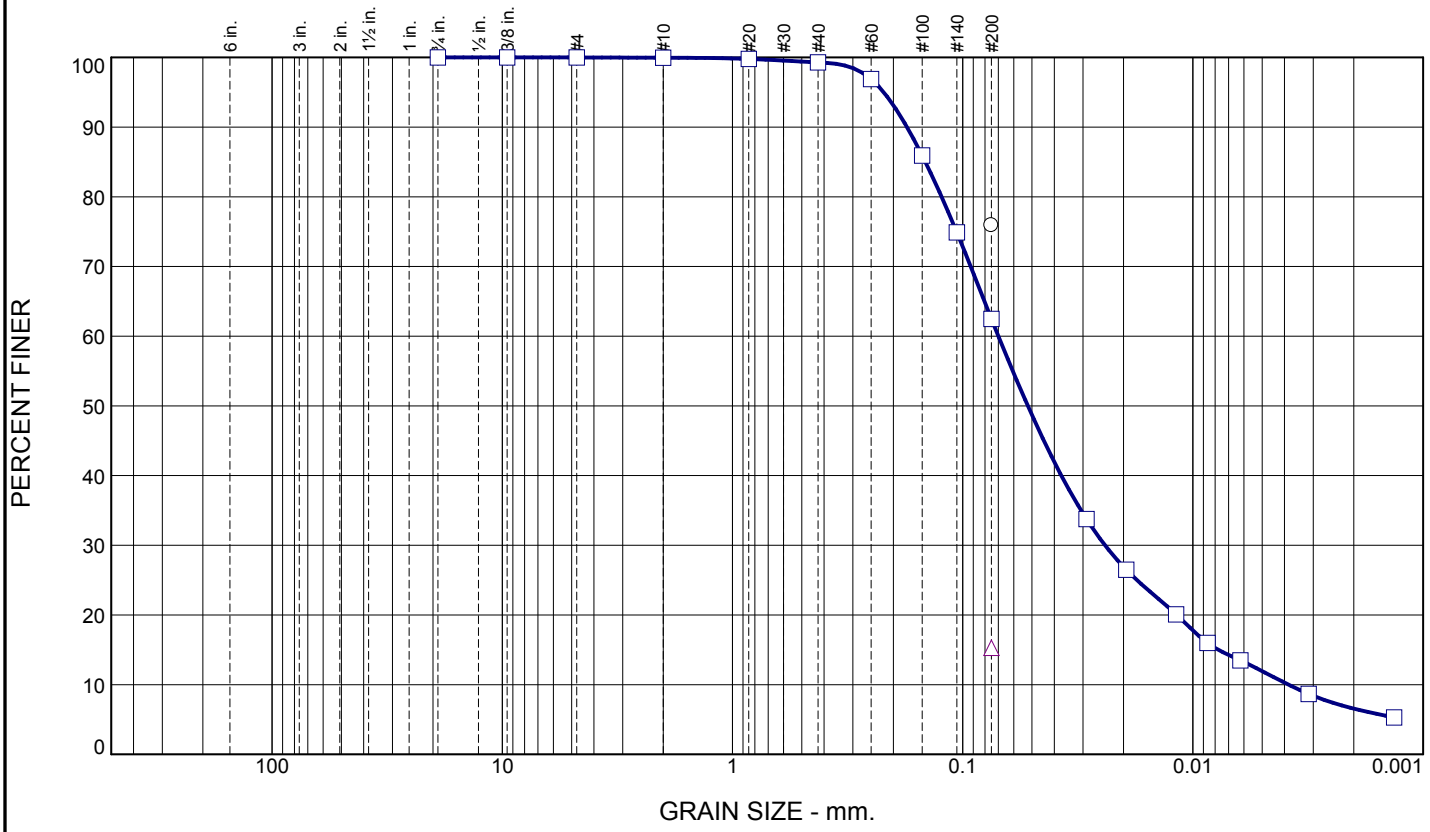
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 21

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	22	20	2
□	0.0	0.0	37.5	50.6	11.9	ML	33	26	7
△						SM			

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
3/8"		100.0	
GRAIN SIZE			
D_{60}		0.0700	
D_{30}		0.0241	
D_{10}		0.0038	
COEFFICIENTS			
C_c		2.16	
C_u		18.22	

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	
#10		100.0	
#20		99.8	
#40		99.3	
#60		96.9	
#100		85.9	
#140		74.9	
#200	75.9	62.5	15.3

Material Description

○ SILT with SAND, dark brown

□ SANDY SILT, dark yellowish brown

△ SILTY SAND, yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0007_001S Depth: 12.0-13.0' Sample Number: #3A

□ Source of Sample: SM0007_003S Depth: 20.0-21.0' Sample Number: #4

△ Source of Sample: SM0003_001B Depth: 26.4-27.0' Sample Number: #11B

Blackburn Consulting

W. Sacramento, CA

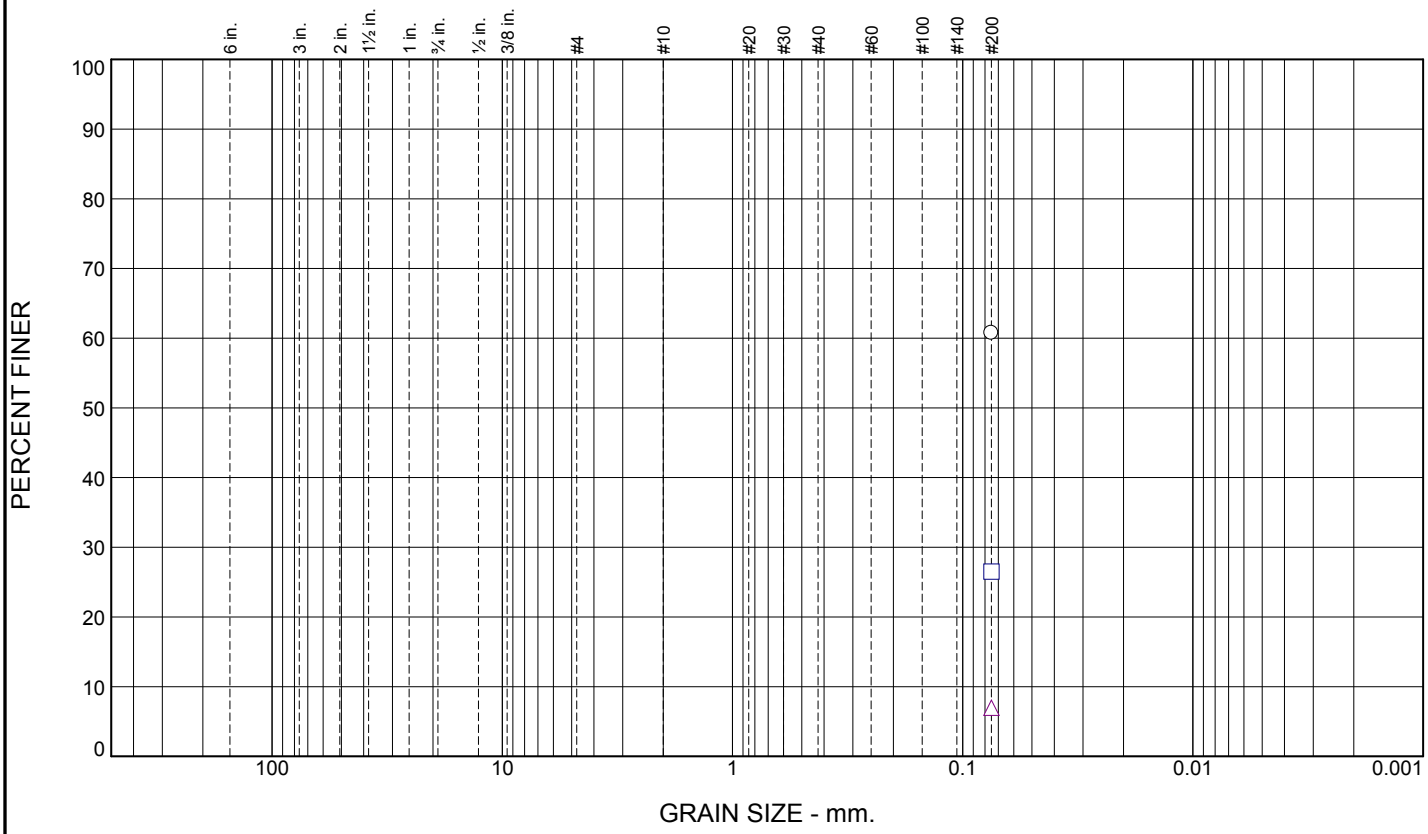
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 22

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						ML	24	22	2
□						SM			
△						SP-SM			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	60.8	26.5	7.0

Material Description

○ SANDY SILT, dark brown

□ SILTY SAND, olive brown

△ Poorly-graded SAND with SILT, dark yellowish brown

REMARKS:

○

□

△

○ Source of Sample: SM0003_003B Depth: 14.4-14.9' Sample Number: #11A

□ Source of Sample: SM0003_003B Depth: 36.4-37.0' Sample Number: #15C

△ Source of Sample: SL0001_005B Depth: 30.9-31.4' Sample Number: #13B

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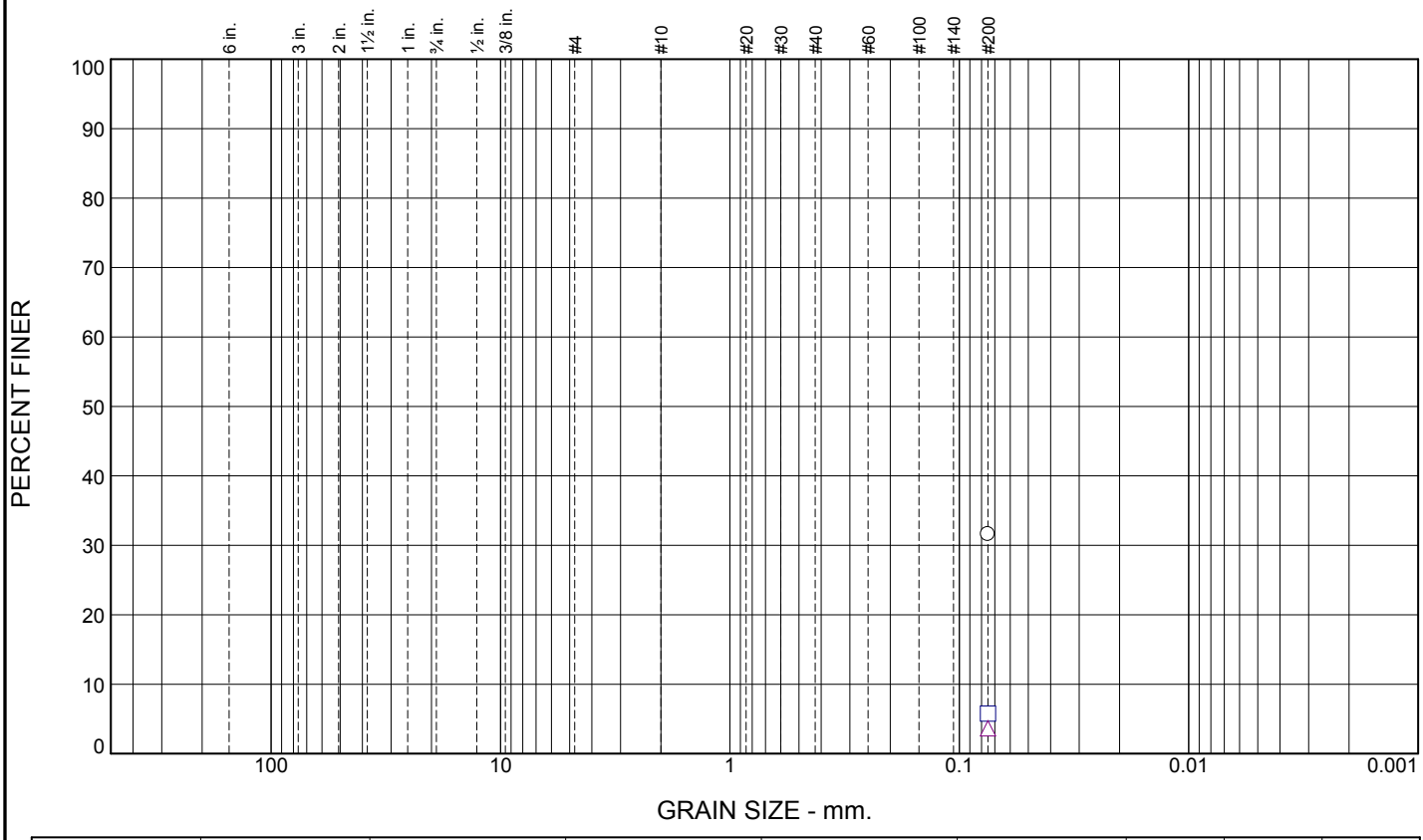
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 23

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM			
□						SP-SM			
△						SP			

SIEVE inches size	PERCENT FINER ○	□	△
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#200	31.6	5.8	3.7

Material Description

○ SILTY SAND, light yellowish brown

□ Poorly-graded SAND with SILT, yellowish brown

△ Poorly-graded SAND, light olive brown

REMARKS:

○

□

△

○ Source of Sample: SL0001_005B Depth: 36.4-37.0' Sample Number: #15C

□ Source of Sample: SL0001_007B Depth: 42.0-42.5' Sample Number: #19C

△ Source of Sample: SL0001_007B Depth: 37.4-38.0' Sample Number: #17C

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Client: URS Corporation

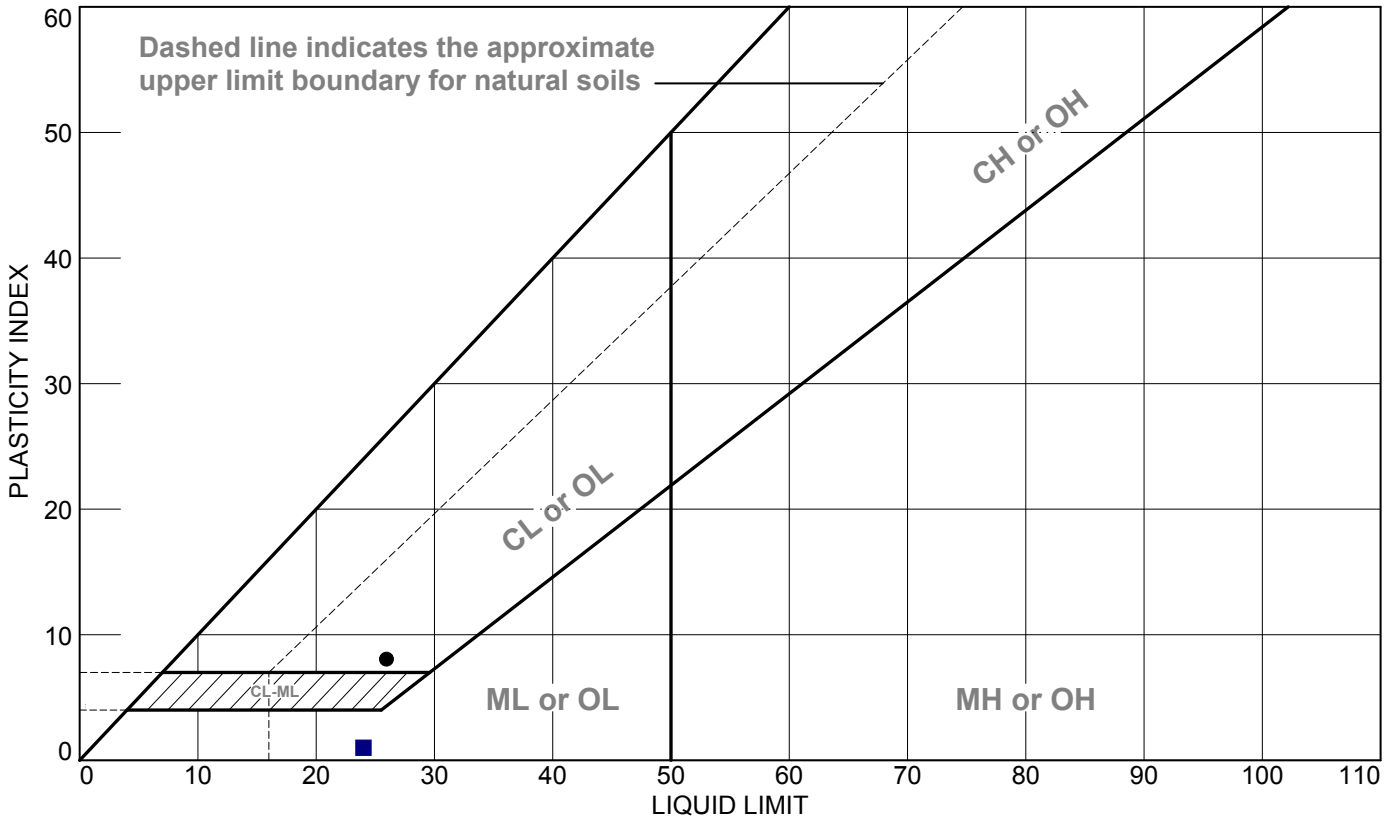
Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS7 - 24

Laboratory Schedule 8

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0009_004A	Bulk #2	5-10'	13.6	18	26	8	CL
■	SM0007_014A	Bulk	0-10'	12.2	23	24	1	ML

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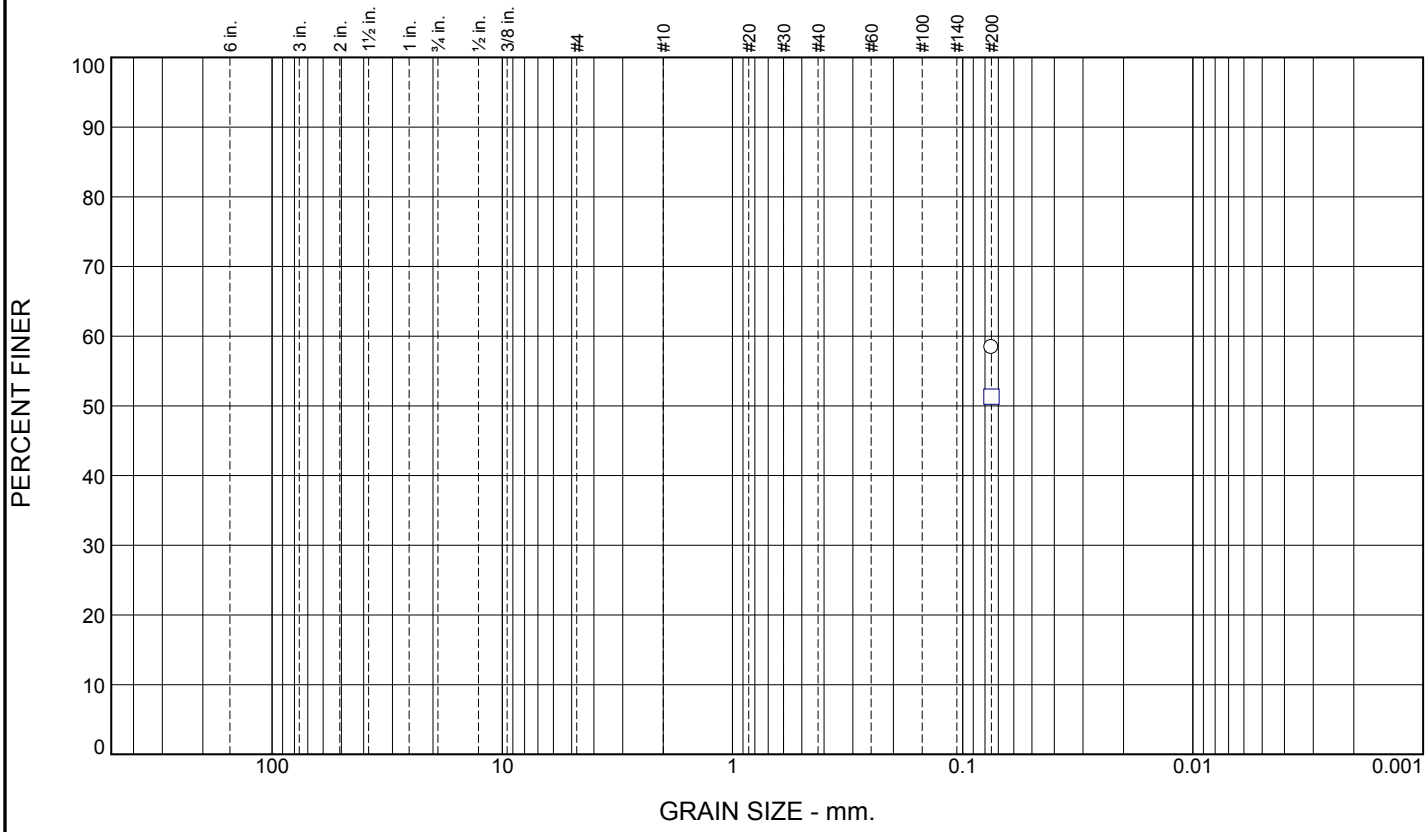
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS8 - 1

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						CL	26	18	8
□						ML	24	23	1

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
GRAIN SIZE		
D_{60}		
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#200	58.4	51.3

Material Description

○ SANDY lean CLAY, dark brown

□ SANDY SILT, dark brown

REMARKS:

○

□

○ Source of Sample: SL0009_004A Depth: 5-10' Sample Number: Bulk #2

□ Source of Sample: SM0007_014A Depth: 0-10' Sample Number: Bulk

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W. Sacramento, CA

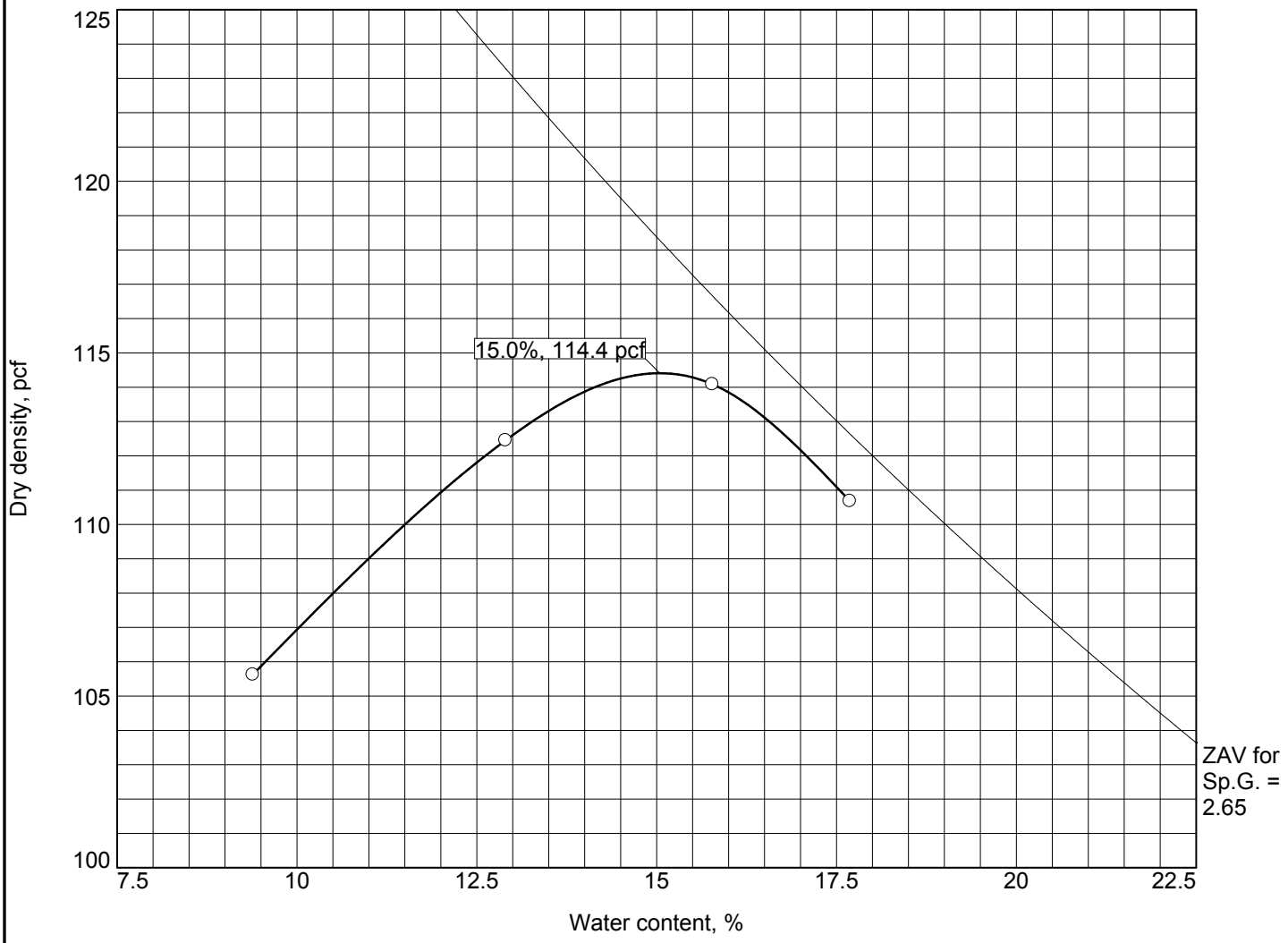
Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure LS8 - 1

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
5-10'	CL		13.6	2.65	26	8		58.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 114.4 pcf Optimum moisture = 15.0 %	SANDY lean CLAY, dark brown

Project No. 17326605.0305233 **Client:** URS Corporation
Project: Feather River West Levee

○ **Sample Source:** SL0009_005A **Depth:** 5-10' **Sample No.:** Bulk #2

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Remarks:

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.0-10.0'	ML		12.2	2.70	24	1		51.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 111.1 pcf Optimum moisture = 16.1 %	SANDY SILT, dark brown

Project No. 17326605.0305233 **Client:** URS Corporation

Project: Feather River West Levee

○ **Sample Source:** SM0007_014A **Depth:** 0.0-10.0' **Sample No.:** Bulk

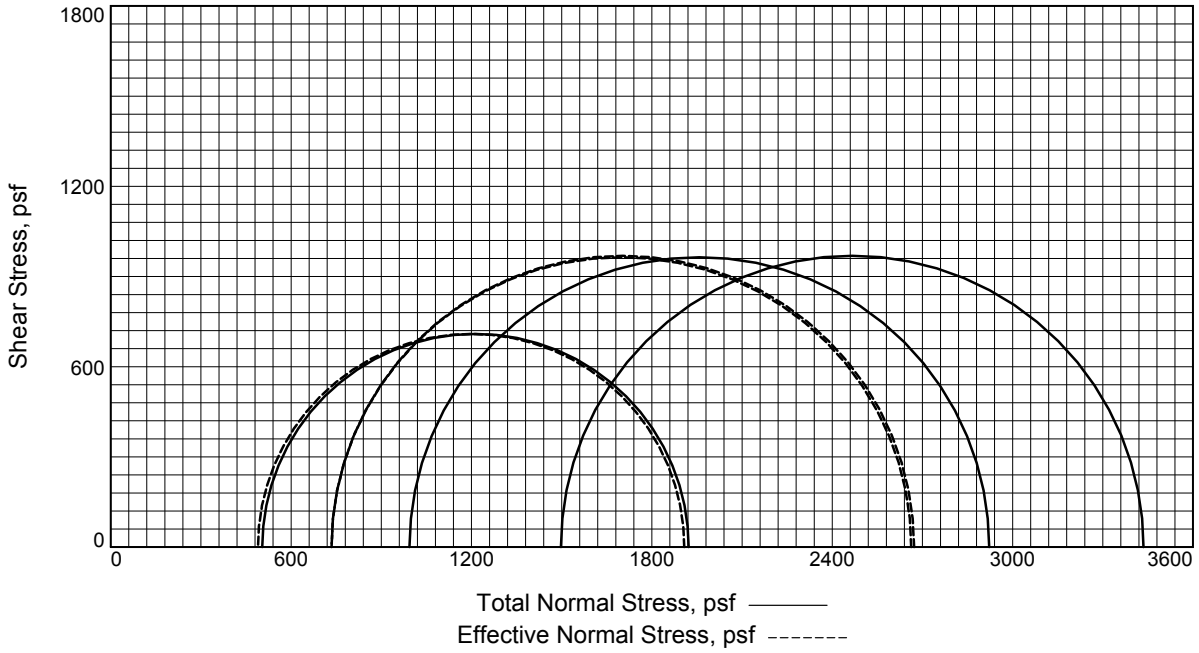
Blackburn Consulting

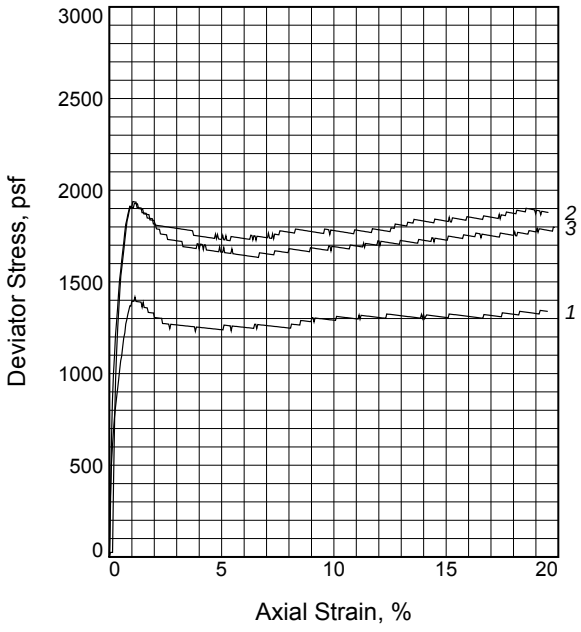
W. Sacramento, CA

Remarks:

Figure

Tested By: DLM





Sample No.		1	2	3
Initial	Water Content, %	15.0	15.0	14.9
	Dry Density, pcf	109.8	111.7	110.8
	Saturation, %	75.7	79.2	77.2
	Void Ratio	0.5353	0.5096	0.5214
	Diameter, in.	2.401	2.415	2.398
	Height, in.	5.041	4.937	5.097
At Test	Water Content, %	21.0	19.5	20.4
	Dry Density, pcf	107.5	110.3	108.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5672	0.5278	0.5504
	Diameter, in.	2.433	2.430	2.427
	Height, in.	5.013	4.935	5.072
Strain rate, in./min.		0.001	0.001	0.001
Eff. Cell Pressure, psf		504.0	993.6	1497.6
Fail. Stress, psf		1418.2	1928.3	1937.9
Excess Pore Pr., psf		14.4	259.2	763.2
Strain, %		1.1	1.1	1.0
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1907.8	2662.7	2672.3
$\bar{\sigma}_3$ Failure, psf		489.6	734.4	734.4

Type of Test:
CU with Pore Pressures

Sample Type: Bulk

Description: SANDY lean CLAY, dark brown

Assumed Specific Gravity= 2.7

Remarks: Sample remolded to 97% of maximum density based on ASTM D698 at optimum moisture content.
LL=26, PI=8, %fines=58.4

Figure _____

Client: URS Corporation

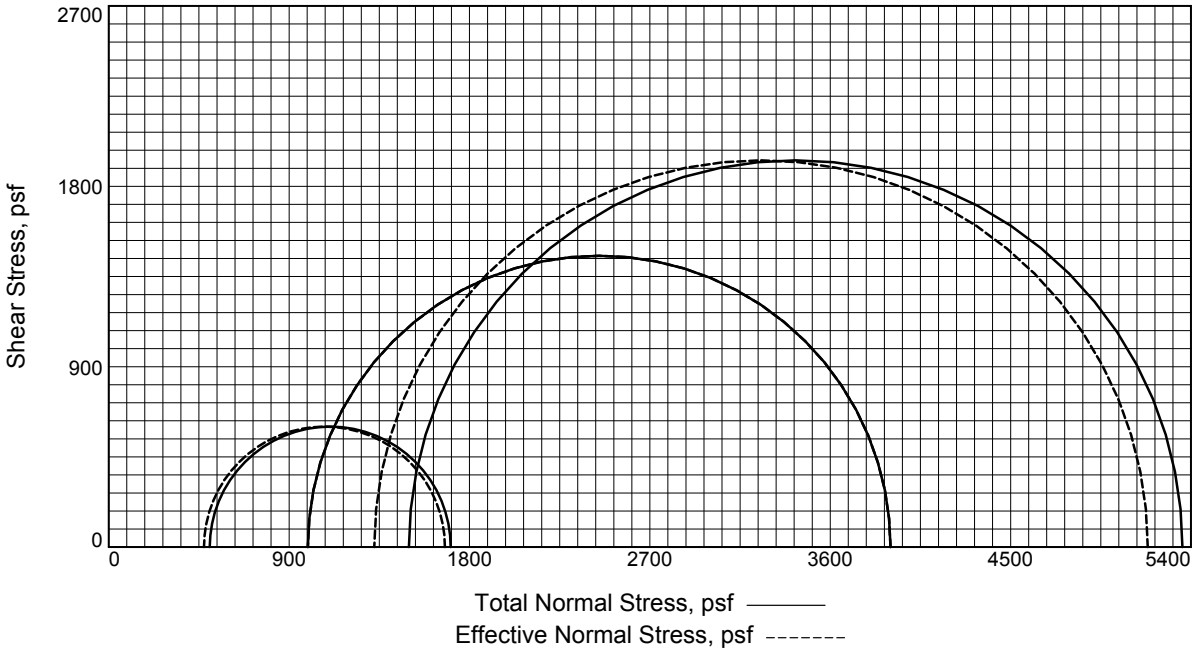
Project: Feather River West Levee

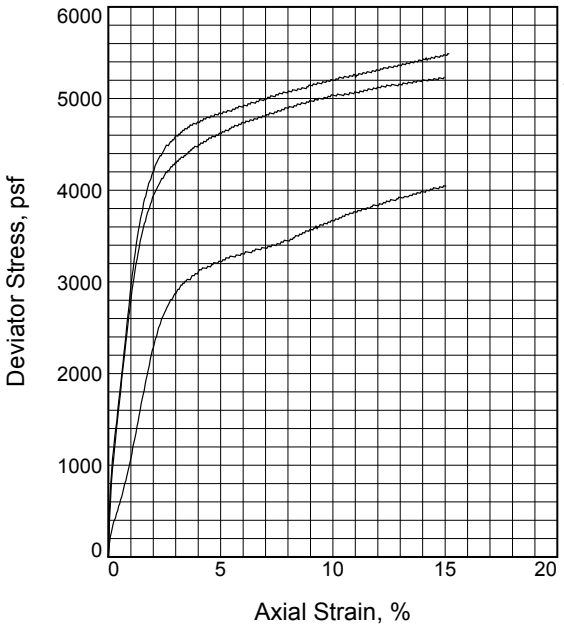
Source of Sample: SL0009_005A **Depth:** 5-10'

Sample Number: Bulk #2

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA





Sample No.		1	2	3
Initial	Water Content, %	15.4	15.4	15.5
	Dry Density, pcf	106.8	107.0	108.9
	Saturation, %	71.8	72.4	76.2
	Void Ratio	0.5783	0.5755	0.5476
	Diameter, in.	2.401	2.415	2.398
	Height, in.	5.050	5.050	4.964
At Test	Water Content, %	23.3	22.8	22.2
	Dry Density, pcf	103.5	104.3	105.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6289	0.6156	0.6007
	Diameter, in.	2.447	2.448	2.441
	Height, in.	5.017	5.041	4.956
Strain rate, in./min.		0.001	0.001	0.001
Eff. Cell Pressure, psf		504.0	993.6	1497.6
Fail. Stress, psf		1202.1	2906.9	3859.5
Excess Pore Pr., psf		28.8	0.0	172.8
Strain, %		1.1	1.1	1.6
Ult. Stress, psf				
Excess Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1677.3	3900.5	5184.3
$\bar{\sigma}_3$ Failure, psf		475.2	993.6	1324.8

Type of Test:
CU with Pore Pressures

Sample Type: Bulk

Description: SANDY SILT, dark brown

Assumed Specific Gravity= 2.7

Remarks: Sample remolded to 97% of maximum density based on ASTM D698 at optimum moisture content.
LL=24, PI=1, %fines=51.3

Figure _____

Client: URS Corporation

Project: Feather River West Levee

Source of Sample: SM0007_014A **Depth:** 0-10'

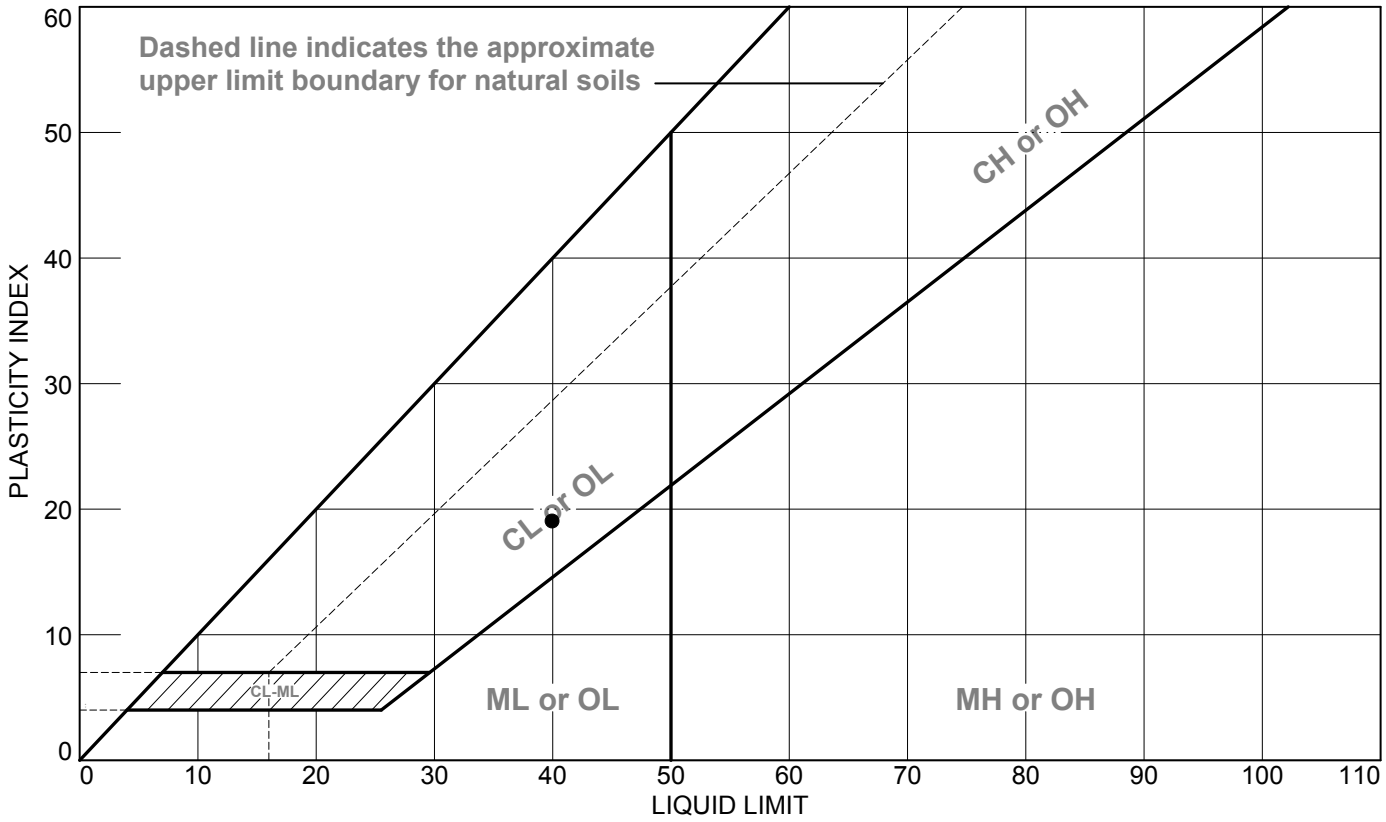
Sample Number: Bulk

Proj. No.: 17326605.0305233 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Blackburn Consulting
W. Sacramento, CA

Laboratory Schedule 9

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SL0001_001S	5	115.0-116.0'		21	40	19	CL

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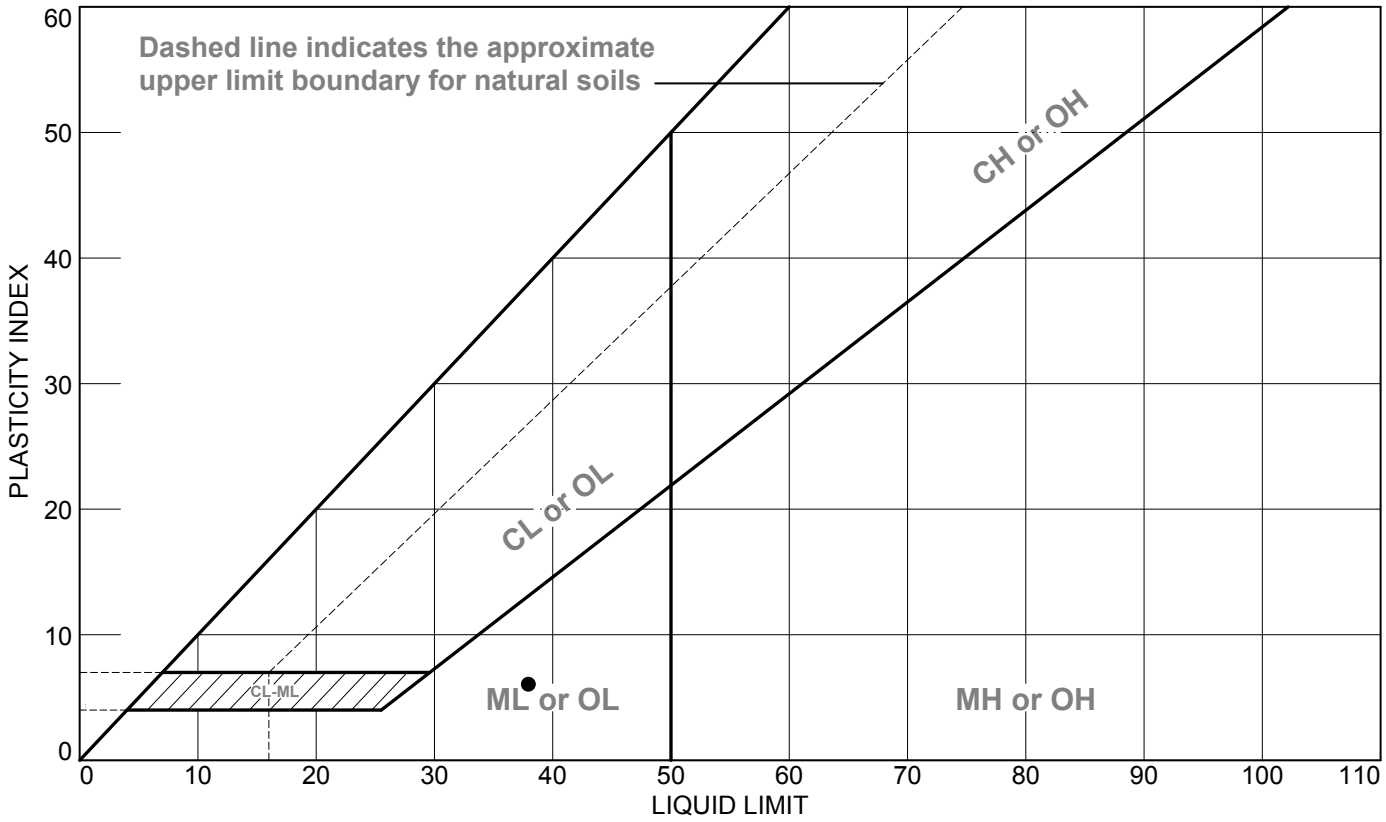
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	SM0007_032S	16	37.5-38.5'		32	38	6	SM

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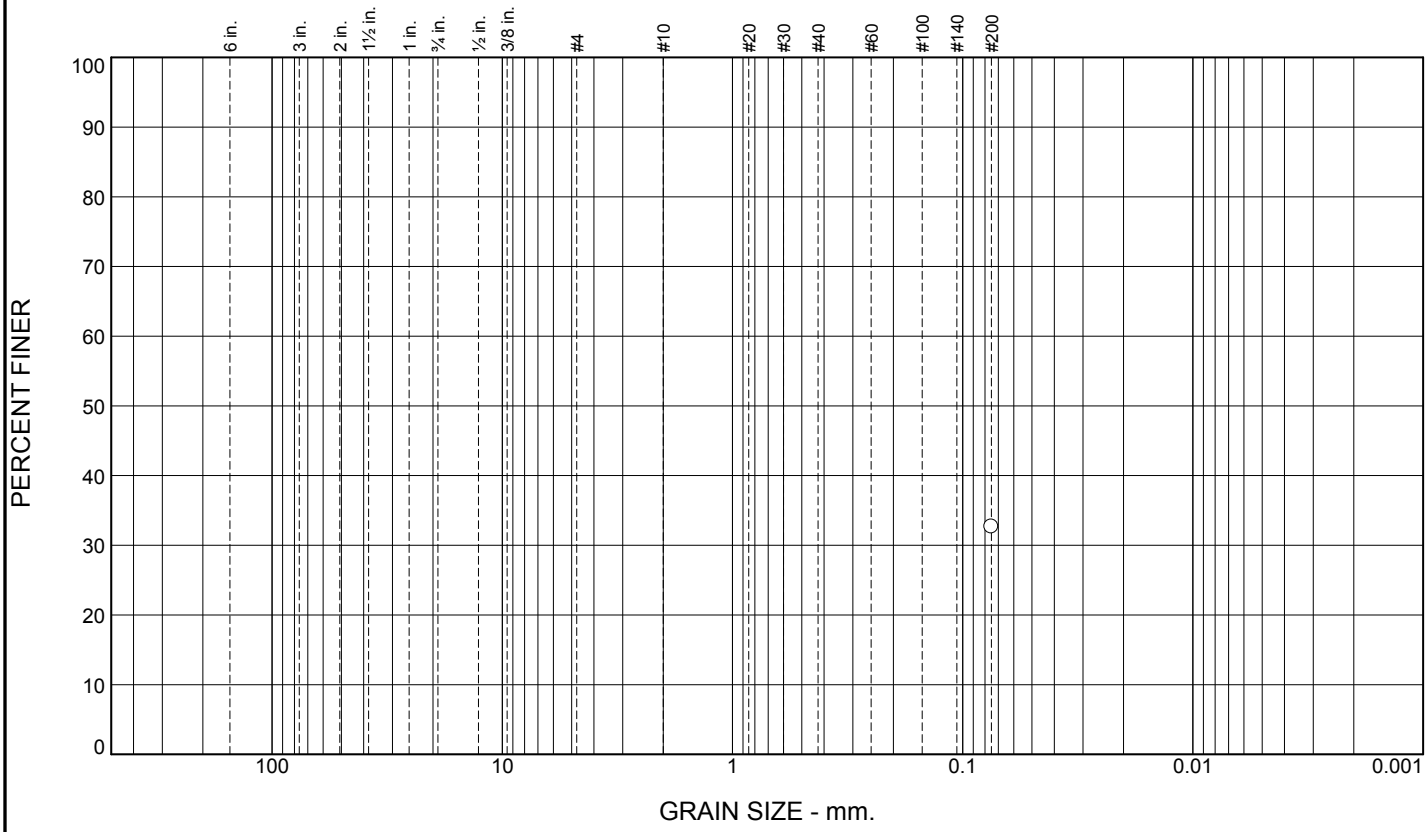
W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233 **Figure**

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○						SM	38	32	6

SIEVE inches size	PERCENT FINER ○		
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#200	32.7		

Material Description

○ SILTY SAND, yellowish brown

REMARKS:

○

○ Source of Sample: SM0007_032S Depth: 37.5-38.5' Sample Number: 16

Blackburn Consulting

W. Sacramento, CA

Client: URS Corporation

Project: Feather River West Levee

Project No.: 17326605.0305233

Figure

West Sacramento Office:
2491 Boatman Ave • West Sacramento, CA 95691
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blackburn consulting

Main Office: (530) 887-1494
11521 Blocker Drive, Suite 110 • Auburn, CA 95603
West Sacramento Office: (916) 375-8706

Geotechnical • Construction Services • Forensics

BCI File No.: 1967.3
January 16, 2012

Rob Nixon
URS Corporation
2870 Gateway Oaks Drive, Suite 150
Sacramento, CA 95833

Subject: **QC/QA Procedure for Laboratory Test Results**
SBFCA FRWL Project

Project QC/QA procedures are as follows:

Test results are recorded on standard laboratory worksheets which are submitted to the Geotechnical Laboratory Manager (Kristy Chapman), who reviews them prior to preparing a test report. When the laboratory testing reports are completed, they are submitted to the Geotechnical Services Manager (Bob Lokteff) for review. The original lab testing schedules and worksheets are then filed in the lab testing folder and saved for 5 years per AASHTO R18. Completed lab reports are placed in the project folder and filed. Lab results and reports are then submitted to URS. Lab tests performed by other labs are reported as received on their own letterhead if applicable.

If we can provide further services or if you have any questions, please call.

Sincerely,

BLACKBURN CONSULTING

Kristy A. Chapman
Geotechnical Laboratory Manager

Reviewed by:

Robert B. Lokteff, P.E.
Principal, Senior Engineer

Copies: 1 to Addressee

Lab Certifications
AMRL 4122
Caltrans 248
CCRL 2342
USACE

APPENDIX K

Historical Report Information

(Included on Disk)