APPENDIX A-1c: Geotechnical Data Report

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017
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A Report Prepared for:

US Army Corps of Engineers
915 Wilshire Boulevard, Suite 1040
Los Angeles, CA 90803

GEOTECHNICAL DATA REPORT
ALISO CREEK ENVIRONMENTAL RESTORATION PROJECT
TASK ORDER NO: 0008, CONTRACT NO. W912PL-06-D-0004
LAGUNA NIGUEL, CALIFORNIA

Project No. 2006-023.10

by

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1.0 INTRODUCTION

This data report presents the results of the geotechnical field investigation and laboratory testing performed by Diaz•Yourman & Associates (DYA) for the feasibility study of drop-grade-control structures located along Aliso Creek in Laguna Niguel, California. The United States Army Corps of Engineers (USACE) authorized this work on September 29, 2008.

The proposed improvements will be located in the Aliso and Wood Canyons Wilderness Park in Laguna Niguel, as shown on the Vicinity Map, Figure 1.

![Figure 1 - VICINITY MAP](image.png)

The approximate area of the proposed project is shown on the Site Plan, Figure 2.
The purpose of DYA's investigation was to provide geotechnical data for the design of the proposed project. The scope of our services consisted of the following tasks:

- Conducting a field investigation including a geophysical survey.
- Performing geotechnical laboratory tests on selected soil samples.
- Preparing this report documenting the results of the geotechnical laboratory tests.

DYA’s scope was limited to performing field borings, soil sample collection, and laboratory testing. We understand that the geotechnical design for the proposed drop-grade-control structures will be performed by others.
2.0 DATA REVIEW, FIELD INVESTIGATION, AND LABORATORY TESTING

Geotechnical data from the project vicinity presented in previous reports were reviewed to supplement site data collected during this investigation. A list of the documents reviewed is presented in the bibliography (Section 5.0).

2.1 FIELD INVESTIGATION

The field investigation, conducted on July 27 through July 29, 2009, consisted of drilling 10 borings (DYB-2 through DYB-11) at the locations shown on Figure 2. The boring locations were selected by the USACE design team and were chosen to provide coverage of the project site for the proposed drop-grade-control structures. The boring locations were located on the banks of the creek adjacent to both AWMA Road west of the creek and the service road east of the creek. The depths of borings, ranging from approximately 35 to 62 feet, were selected to extend to the depth of significant influence of the anticipated bedrock. Groundwater was encountered and after drilling was measured between 14 and 45 feet. Groundwater was not allowed to reach equilibrium for these measurements.

Details of the field investigation including sampling procedures are presented in Appendix A.

As part of the field investigation, a geophysical survey was performed in the vicinity of each boring location, along each creek bank. Details of the geophysical survey are presented in Appendix B.

2.2 LABORATORY TESTING

Soil samples collected from the borings were re-examined in the laboratory to substantiate field classifications. Selected soil samples were tested for moisture content, dry density, percent passing the No. 200 sieve, hydrometer, and Atterberg Limit tests. The soil samples tested are identified on the boring logs. Laboratory test data from the current investigation are summarized on the boring logs in Appendix A and presented on individual test reports in Appendix C.
3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The project site was located along Aliso Creek in an undeveloped area designated as a wildlife sanctuary west of Alicia Parkway and south of Aliso Creek Road in Laguna Niguel, California. An existing drop structure was located in the vicinity of Boring DYB-9. The existing ground surface elevation ranged from 45 feet to 165 feet above mean sea level (MSL). The South Orange County Wastewater Authority facility with an access bridge was located on the southern end of the project site in the vicinity of Boring DYB-2. The AWMA access/maintenance road was paved with asphalt concrete (AC) and was along the west bank of Aliso Creek. A dirt access/maintenance road generally followed the east bank of Aliso Creek.

3.2 GEOLOGIC SETTING

The project site was located within the San Joaquin Hills, which form the northwestern corner of the Peninsular Ranges Geomorphic Province. The rugged San Joaquin Hills are a northwest-trending anticlinal structure that have been incised by several drainages that outlet southwest to the Pacific Ocean (Grant and others, 1999).

The bedrock of the San Joaquin Hills is composed of Tertiary-aged marine and non-marine sedimentary rocks (Morton and others, 1974). Bedrock in the northeastern portion of the project area consists of slide-prone, siltstones and claystones of the Capistrano and Monterey Formations. These formations overlie the bedrock in the southwestern portion of the project area that consists of interbedded siltstone and sandstone of the Topanga Formation together with lesser amounts of the San Onofre Breccia Formation. Bedding attitudes within the northeastern portion of the project area generally strike north with dip values ranging from 10 to 25 degrees west. Within the southern portion of the project area, south of the inactive Temple Hill fault, bedding attitudes generally strike east-west with dip values ranging from 8 to 25 degrees south.

Numerous modern and ancient landslides have been mapped in the hills along Aliso Creek (Morton and others, 1974). Alluvium derived from the surrounding hills has filled in Aliso Canyon throughout the Quaternary. Subsequent uplift and incision by the modern Aliso Creek has created alluvial terraces on both sides of the creek. Movement of the large (>15 acres)
landslides within the area likely predates the recent Holocene alluvial terraces along the banks of Aliso Creek (Morton and others, 1974).

3.3 SUBSURFACE CONDITIONS

The subsurface soils encountered in the borings generally consisted of silty sands, clayey sands, silts and clays. The upper 30 feet of soils was loose to medium dense; below 30 feet, the soils were generally dense to very dense.

Borings DYB-2 and DYB-7 were located near the contact between the river terraces and the steep slopes of Aliso Canyon; bedrock in these borings was encountered at depths of 10 and 25 feet, respectively, and consisted of very dense and very hard claystone, siltstones, and sandstones of the Topanga Formation.

Boring DYB-4 was located near the center of the toe of ancient landslide (see Figure 3). The material in Boring DYB-4 below the terrace deposits from a depth of 28 feet to 49 feet is likely ancient landslide debris, below which lies the Topanga Formation. Boring DYB-6 is near the northern boundary of an ancient landslide and is also located on the Temple Hill fault. The material in Boring DYB-6 below the terrace deposits from 12 feet to 51 feet is generally medium dense and is likely fault breccia and gouge.

Soils encountered in Borings DYB-3, DYB-5, DYB-8 and DYB-9 were loose to medium dense and located in a broad section of the alluvial terraces within Aliso Canyon. Borings DYB-10 and DYB-11 were located on a relatively wide portion of Aliso Creek near the confluence with Sulphur Creek. Water was encountered in Boring DYB-10 at a depth of 16 feet and drilling had to be stopped at 37 feet due to an increase in hydraulic head. The soil in Boring DYB-10 was loose to medium dense sands. The upper 35 feet of material in Boring DYB-11 consisted of medium dense to dense sands, which are overlying very dense siltstone of the Monterey Formation.

Groundwater was encountered during drilling operations and was measured at a depth between 14 and 45 feet. Due to the amount of fine-grained soils, groundwater was not able to be left to stabilize. The depth to historically-highest groundwater near the project site has been reported as approximately 5 feet below the ground surface (bgs; California Geological Survey [CGS], 2001).
Figure 3 - GEOLOGIC MAP

Legend

- DYB-11  DYA Boring Location
- SL23  Seismic Refraction Lines

Ref: ESRI World Imagery
Figure 4 - CROSS SECTION A-A'
Figure 6 - CROSS SECTION C-C'
NOTES: See Plate A1 for material geohit description.
Symbols at left of graphic column is based on ASTM D2487 and D2488.
Number to right of graphic column is equivalent uncorrected SPT blow count per foot.
(%) is the mole fraction content.
Vp = P wave velocity.

Figure 7 - CROSS SECTION D-D'
Figure 8 - OVERLAY SECTION D-D'
Figure 9 - CROSS SECTION E-E'
Figure 10 - OVERLAY SECTION E-E'
Figure 11 - CROSS SECTION F-F'

NOTES: See Figure A1 for material graphics description.
Symbol to left of graphic column is based on ASTM D2487 and D2498,
Number to right of graphic column is equivalent uncorrected SPT blow count per foot,
(%) is the moisture content,
Vs = P wave velocity
Figure 12 - OVERLAY SECTION F-F'
NOTES: See Plate A1 for material graphics description.
Symbol to left of graphic column is based on ASTM D2487 and GD45.
Number to right of graphic column is equivalent uncorrected SPT blow count per foot.
(1) is the moisture content.
Vs = P wave velocity.

Figure 13 - CROSS SECTION G-G'
Figure 14 - OVERLAY SECTION G-G'
Figure 15 - CROSS SECTION H-H'

NOTES: See Plate A1 for material graphics description.
Symbol to left of graphic column is based on ASTM D3447 and D4889,
Number to left of graphic column is equivalent uncorrected SPT blow count per foot,
(%) Is the moisture content,
Vp = P wave velocity
NOTES: See Plate A1 for material graphs description.
Symbols to left of graph column is based on ASTM D3249 and D3248.
Number to right of graph column is equivalent uncorrected SPT blow count per feet,
% is the moisture content.
Scale V 1:10, H 1:200

Figure 16 - OVERLAY SECTION H-H'
NOTES: See Figure A1 for material graphics description.
Symbols to left of graphic column is based on ASTM D2487 and D2486.
Number to right of graphic column is equivalent uncorrected SPT blow count per foot.
(%) is the moisture content,
Vp = P wave velocity

Figure 17 - CROSS SECTION I-I"
Figure 18 - OVERLAY SECTION I-I'
Notes: See Plate A1 for material descriptions.
Symbol to left of graphic column is based on ASTM D2487 and D2469.
Number to right of graphic column is equivalent uncorrected SPT blow count per foot.
% is the moisture content.
Vp = P wave velocity.
NOTES:
See Plate A1 for material pipe description.
Symbols to left of graphic column is based on ASTM D2487 and D3468.
Number to right of graphic column is equivalent uncorrected SPT blow count per foot.
% is the moisture content.
Vs = P-wave velocity.

Figure 22 - CROSS SECTION L-L'
Figure 23 - OVERLAY SECTION L-L'
NOTES: See Plate A-I for material graphics description.
Symbol to left of graphic column is based on ASTM D2487 and D2488.
Number to right of graphic column is equivalent uncorrected SPT blow count per foot,
(%) is the moisture content,
Vp = P wave velocity

Figure 24 - CROSS SECTION M-M'
Figure 25 - OVERLAY SECTION M-M'
4.0 LIMITATIONS

This letter report has been prepared for this project in accordance with generally accepted geotechnical engineering practices common to the local area. No other warranty, expressed or implied, is made.

The information contained in this report is based on the 10 borings drilled using hollow-stem auger and laboratory tests during the current investigation. The results of the field investigation indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations.

This report is intended for use only for the project described. In the event that any changes in the nature, design, or location of the facilities are planned, additional field and laboratory investigation may be necessary. We are not responsible for any claims, damages, or liability associated with the interpretation of subsurface data or reuse of the subsurface data without our express written authorization.
5.0 BIBLIOGRAPHY


California Division of Mines and Geology, 1974, Geology and Engineering Geologic Aspects of the San Juan Capistrano Quadrangle Orange County, California.


Tetra Tech, Inc., 2006, Aliso Creek Watershed Management Study, Orange County, California, Watershed Management Measures, Fig. 29-30, 32-33.

APPENDIX A

SUBSURFACE INVESTIGATION
APPENDIX A - SUBSURFACE INVESTIGATION

The field investigation for the proposed project consisted of drilling 10 borings (DYB-2 through DYB-11) to depths ranging from approximately 35 feet to 62 feet (Boring DYB-1 not used). The approximate boring locations are shown on Figure 2. Borings locations were selected in the field by the United States Army Corps of Engineers (USACE) design team. Borings locations were located using a hand-held GPS unit with 3 meters accuracy.

The borings were drilled by Layne Christensen on July 27 through July 29, 2009, with a truck-mounted CME-75 drill rig using hollow-stem auger drilling techniques. Our field engineer observed the drilling operations and collected drive samples for visual examination and subsequent laboratory testing. Drive samples were collected with a 2.4-inch-inside-diameter (3.0-inch-outside-diameter) modified California split-barrel sampler lined with brass tubes and a standard split-spoon penetrometer with dimensions in accordance with ASTM 3550 and 1586, respectively. Both samplers were driven with a 140-pound hammer falling 30 inches. An automatic trip hammer was used. A sampler driving refusal criteria of 50 hammer blows for less than 6 inches of penetration for the modified California or SPT samplers was used. The blows required to drive the modified California sampler were converted to equivalent standard penetration test (SPT) N-values by multiplying by 0.65 (N = 0.65 x modified California blows per foot). If the modified California sampler met driving refusal, then the prorated equivalent SPT blow count was further modified as noted above for samplers that did not meet sampler driving refusal.

Soils encountered in the borings were classified in general accordance with the ASTM Soil Classification System (ASTM D2487 and 2488), which is summarized on Plate A1. The boring logs presented on Plates A2 through A21 were prepared from visual examination of the samples, cuttings obtained during drilling operations, and the results of laboratory tests.

Groundwater was encountered during the field investigation at depths between 14 and 45 feet below the ground surface. Borings DYB-2 through DYB-9 were backfilled with cuttings, compacted, and any remains were spread onsite. Borings DYB-10 and DYB-11 were backfilled with cement/bentonite grout and cuttings were placed in 55-gallon barrels. The drummed cuttings were tested by American Integrated Services, Inc., determined to be nonhazardous, and properly disposed of offsite.
## SOIL CLASSIFICATION SYSTEM-ASTM D2487

### MAJOR DIVISIONS

<table>
<thead>
<tr>
<th>Coarse-Grained Soils</th>
<th>Gravel and Gravelly Soils</th>
<th>Clean Gravels (Little or No Fines)</th>
<th>GW</th>
<th>Clean Gravels, Gravelly Sands, Little or No Fines</th>
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<tr>
<td></td>
<td>Gravels with Fines</td>
<td>GM</td>
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<td>Silty Gravels, Gravelly Sand - Silt Mixtures</td>
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<td>GC</td>
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<td>Clayey Gravels, Gravelly Sand - Clay Mixtures</td>
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<td>More than 50% of Coarse Fraction Retained on No. 4 Sieve</td>
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<td>Sand and Sandy Soils</td>
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<td>Poorly Graded Sands, Gravelly Sand, Little or No Fines</td>
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<td>More than 50% of Coarse Fraction Passing on No. 4 Sieve</td>
<td>Sands with Fines (Appreciable Amount of Fines)</td>
<td>SM</td>
<td>Silty Sands, Sand - Silt Mixtures</td>
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<td>SC</td>
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<td>Clayey Sands, Sand - Clay Mixtures</td>
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<td>Fine-Grained Soils</td>
<td>Silts and Clays Liquid Limit Less Than 50</td>
<td>ML</td>
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<td>Organic Clays of Medium to High Plasticity, Organic Silts</td>
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<td>Highly Organic Soils</td>
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<td>PT</td>
<td>Peat, Humus, Swamp Soils with High Organic Contents</td>
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</tbody>
</table>

**NOTE:** Dual Symbols are used to indicate borderline soil classifications

- **NP** = Nonplastic
- **EI** = Expansion Index Test
- **SG** = Specific Gravity
- **SE** = Sand Equivalent
- **UC** = Unconfined Comp.
- **CD** = Consol. Drained Triaxial.
- **CU** = Consol. Undrained Triaxial.
- **UU** = Undrained, Unconsol. Triaxial.
- **RV** = R-Value
- **CA** = Chemical Analysis
- **DS** = Direct Shear
- **CN** = Consolidation
- **CP** = Collapse Potential
- **SA** = Grain size; **HD** = Hydrometer
- **MD** = Compaction Test
- **HC** = Hydraulic Conductivity Test

[SPT "N" = 0.65 x modified California blows per foot](#)

### SYMBOLS

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### TESTS

- **SPT "N"** = 0.65 x modified California blows per foot
- **“Push” Sampler**
- **Split Barrel “Drive” Sampler With Liner**
- **Standard Penetration Test (SPT) Sampler**
- **Bag Sample**
- **Concrete/Rock Core**
- **Groundwater Surface**

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**USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10**

Project No. 2006-023.10

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**PLATE A1**
<table>
<thead>
<tr>
<th>Elevation (feet)</th>
<th>Depth (feet)</th>
<th>Symbol</th>
<th>Blows per 6 inches</th>
<th>Blows per Foot</th>
<th>SPT N</th>
<th>Field Unc. Comp. Str. (ft)</th>
<th>Moisture Content (%)</th>
<th>Liquid Limit (%)</th>
<th>Plasticity Index (%)</th>
<th>Percent Passing #200 Sieve</th>
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**DESCRIPTION**

- **SILTY SAND (SM):** light olive brown, moist, medium dense, fine- to coarse-grained sand, trace fine gravel, rootlets
- **SANDY SILT (ML):** olive brown, dense, fine- to medium-grained sand, micaceous, oxidation
- **SANDY SILT (ML):** gray, moist, hard, fine-grained sand, micaceous, TOPANGA FORMATION
- **SILT with SAND (ML):** gray, moist, hard, fine-grained sand, trace fine to medium grained sand
- **SANDY SILT (ML):** gray, moist, hard, fine-grained sand
**LOG OF BORING**

**DYB- 2**

<table>
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<th>Elevation (feet)</th>
<th>Depth (feet)</th>
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<th>Field Unc. Comp. Str. (tsf)</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content (%)</th>
<th>Liquid Limit (%)</th>
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- **SILT (ML):** gray, moist, hard
- Refusal encountered at 37.5 feet
- Bottom of boring at 37.5 feet.
- Groundwater encountered at 33 feet.
- Backfilled with cuttings.
### Description of Soil Layers

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**Silty Clayey Sand (SC-SM):** brown, moist, very dense, fine- to coarse-grained sand, trace fine to coarse gravel

**Medium dense, rootlets, pin-hole porosity, slightly micaceous**

**Sandy Lean Clay (CL):** olive brown, moist, firm, low plasticity, fine- to medium-grained sand

**Wet, interbedded with poorly graded Sand**

**Clayey Sand (SC):** olive brown, wet, medium dense, fine- to medium-grained sand, some oxidation

---

**Log of Boring DYB-3**

USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10
POORLY GRADED SAND with CLAY (SP-SC): brown, wet, fine- to medium-grained sand, trace coarse gravel

CLAYEY SAND (SC): dark brown, wet, medium dense, fine- to medium-grained sand

brown, very dense, fine- to coarse-grained sand, cobbles, mottled with fat CLAY

LEAN CLAY (CL): bluish gray, wet, hard, low plasticity, fine-grained sand, TOPANGA FORMATION

Bottom of boring at 50.5 feet.
Groundwater encountered at 14.25 feet.
Backfilled with cuttings.
SILTY SAND with GRAVEL (SM): light olive brown, moist, medium dense, fine-grained sand, coarse gravel, rootlets

CLAYEY SAND (SC): olive brown, moist, medium dense to coarse-grained sand, trace fine gravel

CLAYEY SAND with GRAVEL (SC): olive brown, moist, firm, low plasticity, fine- to coarse-grained sand, fine gravel

LEAN CLAY with SAND (CL): olive brown, moist, firm, medium plasticity
**LOG OF BORING DYB- 4**

Page 2 of 2  
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10  
Project No. 2006-023.10

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Plate: DYLG1-2006; Prj ID: 2006-023.10 GPJ

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Page 2 of 2
**BORING LOCATION:** See Figure 2

**LATITUDE:** 33° 32' 14.2" N

**LONGITUDE:** 117° 44' 27.5" W

**DRILLING EQUIPMENT:** CME-75

**DRILLING METHOD:** Hollow Stem Auger

**BORING DIAMETER (inches):** 8

**BORING DEPTH (feet):** 61.5

**DATE STARTED:** 7/27/09

**DATE COMPLETED:** 7/27/09

**SPT HAMMER DROP:** 30 inches **WT:** 140 lbs

**DRIVE HAMMER DROP:** 30 inches **WT:** 140 lbs

**LOGGED BY:** KMV **CHECKED BY:** WD

**ELEVATION AND DATUM (feet):** 84 MSL

**BORING LOCATION:** See Figure 2

**LATITUDE:** 33° 32' 14.2" N

**LONGITUDE:** 117° 44' 27.5" W

**DRILLING EQUIPMENT:** CME-75

**DRILLING METHOD:** Hollow Stem Auger

**BORING DIAMETER (inches):** 8

**BORING DEPTH (feet):** 61.5

**DATE STARTED:** 7/27/09

**DATE COMPLETED:** 7/27/09

**SPT HAMMER DROP:** 30 inches **WT:** 140 lbs

**DRIVE HAMMER DROP:** 30 inches **WT:** 140 lbs

**LOGGED BY:** KMV **CHECKED BY:** WD

**DRIVE SAMPLER DIAMETER (inches)**

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**SPT HAMMER DROP**

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**DRIVE HAMMER DROP**

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**Field Unc. Comp. Str. (%f)**

- 91% for Silty Sand (SM)
- 29% for Silty Sand (SM)
- 14% for Silty Sand (SM)
- 12% for Silty Sand (SM)
- 10% for Silty Sand (SM)
- 8% for Silty Sand (SM)
- 6% for Silty Sand (SM)
- 4% for Silty Sand (SM)
- 2% for Silty Sand (SM)
- 0% for Silty Sand (SM)

**Liquid Limit (%)**

- 91% for Silty Sand (SM)
- 29% for Silty Sand (SM)
- 14% for Silty Sand (SM)
- 12% for Silty Sand (SM)
- 10% for Silty Sand (SM)
- 8% for Silty Sand (SM)
- 6% for Silty Sand (SM)
- 4% for Silty Sand (SM)
- 2% for Silty Sand (SM)
- 0% for Silty Sand (SM)

**Plasticity Index (%)**

- 91% for Silty Sand (SM)
- 29% for Silty Sand (SM)
- 14% for Silty Sand (SM)
- 12% for Silty Sand (SM)
- 10% for Silty Sand (SM)
- 8% for Silty Sand (SM)
- 6% for Silty Sand (SM)
- 4% for Silty Sand (SM)
- 2% for Silty Sand (SM)
- 0% for Silty Sand (SM)

**Percent Passing #200 Sieve**

- 91% for Silty Sand (SM)
- 29% for Silty Sand (SM)
- 14% for Silty Sand (SM)
- 12% for Silty Sand (SM)
- 10% for Silty Sand (SM)
- 8% for Silty Sand (SM)
- 6% for Silty Sand (SM)
- 4% for Silty Sand (SM)
- 2% for Silty Sand (SM)
- 0% for Silty Sand (SM)

**Other Tests**

- Field Unc. Comp. Str. (%f)
- Liquid Limit (%)
- Plasticity Index (%)
- Percent Passing #200 Sieve

**MOISTURE CONTENT (%)**

- 91% for Silty Sand (SM)
- 29% for Silty Sand (SM)
- 14% for Silty Sand (SM)
- 12% for Silty Sand (SM)
- 10% for Silty Sand (SM)
- 8% for Silty Sand (SM)
- 6% for Silty Sand (SM)
- 4% for Silty Sand (SM)
- 2% for Silty Sand (SM)
- 0% for Silty Sand (SM)

**USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10**

**Project No. 2006-023.10**

**PLATE A8**
SANDY LEAN CLAY (CL): greenish olive gray, wet, hard, fine-grained sand, trace shell fragments

SANDY SILT (ML): greenish gray, wet, firm, possible weathered bedrock

CLAYEY SAND (SC): olive gray, wet, medium dense, fine- to coarse-grained sand, oxidation

fine- to medium-grained sand

ELASTIC SILT (MH): dark gray, wet, high plasticity

POORLY GRADED SAND with SILT (SP-SM): olive gray, wet, medium dense, fine- to medium-grained sand

Bottom of boring at 61.5 feet.
Groundwater encountered at 27 feet.
Backfilled with cuttings.
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**SILTY SAND (SM):** light olive brown, moist, medium dense, fine- to medium-grained sand, trace fine gravel

**SANDY LEAN CLAY (CL):** brown, moist, loose, fine-grained sand

**SANDY LEAN CLAY (CL):** grayish brown, moist, firm, medium plasticity, fine- to medium-grained sand, trace fine to coarse gravel

**CLAYEY SAND with GRAVEL (SC):** olive brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, trace cobbles

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**LOG OF BORING**

**DYB-6**

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USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10

Project No. 2006-023.10
**LOG OF BORING**

**DYB- 6**

USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10

Project No. 2006-023.10

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**DESCRIPTION**

- **CLAYEY SAND (SC):** olive brown, wet, medium dense, fine-to-medium-grained sand, trace fine gravel
- **SANDY SILTY CLAY (CL-ML):** olive brown, wet, firm to hard, low plasticity, interlayered with poorly graded SAND
- **SILTY SAND (SM):** light olive brown, wet, medium dense, fine-to-coarse-grained sand, trace coarse gravel
- Gray, medium dense to dense, medium-to-coarse-grained sand, trace fine to coarse gravel

Bottom of boring at 51.5 feet. Groundwater encountered at 33 feet. Backfilled with cuttings.

**Other Tests**

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**LOG OF BORING  DYB- 7**

**Page 1 of 2**

USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10  
Project No. 2006-023.10

---

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**SILTY SAND (SM):** brown, moist, loose, fine- to medium-grained sand, rootlets, porous, caliche stringers

**SILTY CLAYEY SAND (SC-SM):** olive brown, moist, loose, low plasticity, fine- to coarse-grained sand, trace fine gravel

**SILTY CLAYEY SAND (SC-SM):** olive brown, moist, very hard, low plasticity, fine- to coarse-grained sand, interlayered poorly graded SAND, TOPANGA FORMATION

**SILTY SAND (SM):** olive brown, moist, very dense, fine- to medium-grained sand

---

**ELEVATION AND DATUM (feet):** 88 MSL  
**LATITUDE:** 33° 32' 24.5" N  
**LONGITUDE:** 117° 44' 13.1" W  
**DRILLING EQUIPMENT:** CME-75  
**DRILLING METHOD:** Hollow Stem Auger  
**BORING DIAMETER (inches):** 8  
**BORING DEPTH (feet):** 34.5  
**DATE STARTED:** 7/28/09  
**DATE COMPLETED:** 7/28/09  
**SPT HAMMER DROP:** 30 inches  
**WT:** 140 lbs  
**DRIVE HAMMER DROP:** 30 inches  
**WT:** 140 lbs  
**DATE COMPLETED:** 7/28/09

---

**DRIVE SAMPLER DIAMETER (inches):** 2.4

---

**DATUM:**

- 22  in. 140 lbs  
- 30 inches 140 lbs

**DRIVE SAMPLER \( D_D \):**

- 22  in. 140 lbs  
- 30 inches 140 lbs

**ELEVATION AND DATUM (feet):**

- 88 MSL

---

**REFERENCE:**

- DRAFT

---

**PLATE:** A12
Bottom of boring at 34.5 feet.
Groundwater encountered at 30 feet.
Backfilled with cuttings.
<table>
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**DESCRIPTION**

- **SANDY SILT (ML):** gray, moist, very soft, fine-grained sand, rootlets, oxidation
- **soft, micaceous**
- **greenish gray, firm, nonplastic**
- **SILTY SAND (SM):** greenish gray, moist, loose, fine- to medium-grained sand, trace oxidation
- **SANDY LEAN CLAY (CL):** greenish gray, moist, firm, low plasticity, fine-grained sand, micaceous

**LOG OF BORING**

**DYB- 8**

Page 1 of 2

USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10 Project No. 2006-023.10
<table>
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**DESCRIPTION**

- **LEAN CLAY with SAND (CL):** greenish gray, moist, firm, high plasticity, trace fine grained sand
- **SILTY SAND (SM):** olive brown, wet, loose to medium dense, fine-grained sand
- **POORLY GRADED SAND with SILT (SP-SM):** olive brown, wet, loose, fine- to medium-grained sand
- **SANDY LEAN CLAY (CL):** gray, wet, firm, low plasticity, fine-grained sand, micaceous
- **SILT (ML):** gray, wet, firm, low plasticity, fine-grained sand

**Dry Density (pcf)**

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<th>Elevation (feet)</th>
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### Boring Information
- **Location:** See Figure 2

### Geotechnical Information
- **Silty Sand (SM):**
  - Dark brown, moist, loose, fine-grained sand, rootlets
  - Olive brown, low plasticity, some oxidation

- **Clayey Sand (SC):**
  - Olive brown, moist, loose, medium plasticity, fine- to medium-grained sand, trace fine gravel

- **Silt with Sand (ML):**
  - Greenish gray, moist, firm, low plasticity, fine-grained sand

- **Sandy Lean Clay (CL):**
  - Greenish gray, moist, firm, medium plasticity, fine-grained sand, trace fine gravel

- **Silty Sand (SM):**
  - Olive brown, moist, very loose, fine-grained sand, trace fine gravel

- **Fatty Clay (CH):**
  - Olive brown, moist, firm, high plasticity

### Boring Details
- **Date Started:** 7/28/09
- **Date Completed:** 7/29/09
- **SPT Hammer Drop:** 30 inches, WT: 140 lbs
- **Drive Hammer Drop:** 30 inches, WT: 140 lbs
- **Logging:** KMV
- **Checking:** SS
- **Drive Sampler Diameter:** ID: 2.4, OD: 3 in.

---

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**Additional Information:**
- **SPT N Blows per Foot**
- **Blows per 6 inches**
- **Field Unc. Comp. Str. (ft.)**
- **Density (pcf)**
- **Moisture Content (%)**
- **Liquid Limit (%)**
- **Plasticity Index (%)**
- **Percent Passing #200 Sieve**
- **Other Tests**
- **PID**
SILT (ML): greenish gray, moist, firm, low plasticity

POORLY GRADED SAND with SILT (SP-SM): bluish green, wet, medium dense, fine- to coarse-grained sand, trace fine to coarse gravel

Bottom of boring at 51.5 feet. Groundwater encountered at 37 feet. Backfilled with cuttings.
### LOG OF BORING DYB-10

**USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10**  
**Project No. 2006-023.10**

<table>
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<th>Elevation (feet)</th>
<th>Depth (inches)</th>
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<td><strong>CLAYEY SAND (SC):</strong> brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, rootlets, caliche stringers</td>
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<td>145</td>
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<td>oxidized, trace cobbles</td>
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<td><strong>SILTY SAND (SM):</strong> greenish gray, moist, loose, trace clay, micaceous, organics</td>
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<td>6</td>
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<td><strong>SANDY LEAN CLAY (CL):</strong> very dark gray, moist, firm, nonplastic, fine-grained sand, rootlets, micaceous, odor, grades to silty clay</td>
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<td><strong>CLAYEY SAND (SC):</strong> olive brown, wet, loose, fine- to medium-grained sand</td>
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<td></td>
<td><strong>SILTY SAND (SM):</strong> olive brown, wet, medium dense, medium-</td>
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</tbody>
</table>

**ELEVATION AND DATUM (feet):** 152 MSL  
**LATITUDE:** 33° 33’ 14.5” N  
**LONGITUDE:** 117° 43’ 7.0” W  
**DRILLING EQUIPMENT:** CME-75  
**DRILLING METHOD:** Hollow Stem Auger  
**BORING DIAMETER (inches):** 8  
**BORING DEPTH (feet):** 36.5  
**DATE STARTED:** 7/29/09  
**DATE COMPLETED:** 7/29/09  
**SPT HAMMER DROP:** 30 inches  
**WT:** 140 lbs  
**DRIVE HAMMER DROP:** 30 inches  
**WT:** 140 lbs  
**LOGGED BY:** KMV  
**CHECKED BY:** WD  
**DRIVE SAMPLER DIAMETER (inches):** ID: 2.4  
**OD: 3**
**LOG OF BORING DVB-10**

**USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10**

**PLATE A19**

**DESCRIPTION**

Bottom of boring at 36.5 feet. Groundwater encountered at 16 feet. Backfilled with bentonite, drummed cuttings. Change in water head caused disturbance in sands, boring abandoned due to clogged auger.

---

**moisture content (%)**

- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90
- 95
- 100
- 105
- 110
- 115
- 120

**dry density (pcf)**

- 10
- 30
- 50
- 70
- 90
- 110
- 130

**percent passing #200 sieve**

- 10
- 20
- 30
- 40
- 50
- 60

---

**Sampler Symbol**

- 11
- 21
- 31
- 41
- 51

**Blows per 6 Inches**

- 10
- 20
- 30
- 40
- 50

**SPT N Blows per Foot**

- 10
- 20
- 30
- 40
- 50

---

**Depth (feet)**

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110
- 120

**Elevation (feet)**

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110
- 120

---

**Sampling Points**

- 10
- 20
- 30
- 40
- 50

**Depth Markers**

- 10
- 20
- 30
- 40
- 50

---

**Notes**

- Field Unc. Comp. Str. (tsf)
- SPT N Blows per Foot
- Blows per 6 Inches
- Dry Density (pcf)
- Moisture Content (%)
- Liquid Limit (%)
- Plasticity Index (%)
- Percent Passing #200 Sieve
- Other Tests [PID]
POORLY GRADED SAND with SILT (SP-SM): light yellowish brown, moist, dense, fine- to medium-grained sand

medium dense

olive brown

dense

medium dense

POORLY GRADED SAND (SP): greenish olive, moist, medium dense, fine- to medium-grained sand
SANDY SILT (ML): greenish brown, wet, very hard, nonplastic, fine-grained sand, MONTEREY FORMATION

very dark gray, thin gray micaceous lenses

APPENDIX B
GEOPHYSICAL SURVEY
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August 31, 2009
Project No. 109152

Mr. Chris Diaz
Diaz Yourman & Associates
1616 East 17th Street
Santa Ana, CA 92705

Subject: Seismic Refraction Survey
Aliso Creek
Aliso Viejo, California

Dear Mr. Diaz:

In accordance with your authorization, we have performed a seismic refraction survey for the Aliso Creek Environmental Restoration project located in the Aliso Viejo area of Orange County, California. Specifically, our survey consisted of performing 23 seismic refraction lines at select locations along the banks of Aliso Creek. The purpose of the study was to develop a subsurface velocity profile of the study areas and to evaluate the apparent rippability of the shallow subsurface materials. This report presents our survey methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Sincerely,

SOUTHWEST GEOPHYSICS, INC.

Principal Geologist/Geophysicist

Principal Geologist/Geophysicist

HV/PFL/hv
Distribution: Addressee (electronic)
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Figure 4e  – Seismic Profiles, SL-9 and SL-10
Figure 4f  – Seismic Profiles, SL-11 and SL-12
Figure 4g  – Seismic Profiles, SL-13 and SL-14
Figure 4h  – Seismic Profiles, SL-15 and SL-16
Figure 4i  – Seismic Profiles, SL-17 and SL-18
Figure 4j  – Seismic Profiles, SL-19 and SL-20
Figure 4k  – Seismic Profiles, SL-21 and SL-22
Figure 4l  – Seismic Profile, SL-23
INTRODUCTION
In accordance with your authorization, we have performed a seismic refraction survey for the Aliso Creek Environmental Restoration project located in the Aliso Viejo area of Orange County, California (Figure 1). Specifically, our survey consisted of performing 23 seismic refraction lines at select locations along the banks of Aliso Creek. The purpose of the study was to develop a subsurface velocity profile of the study areas and to evaluate the apparent rippability of the shallow subsurface materials. This report presents our survey methodology, equipment used, analysis, and results.

SCOPE OF SERVICES
Our scope of services included:
- Performance of 23 seismic refraction lines at the project site.
- Compilation and analysis of the data collected.
- Preparation of this report presenting our results, conclusions, and recommendations.

SITE DESCRIPTION
The study area included preselected locations along the sides of Aliso Creek roughly between the wastewater treatment plant and Aliso Parkway. The specific areas were selected by your office prior to our survey. The site predominantly consists of undeveloped land with paved and unpaved service roads. The wastewater treatment plant is situated near the southern end of the study area. A ranger station and unpaved parking area are located near the north end of the study area. In general, the terrain at and near the study areas consist of flat to moderately steep slopes. Vegetation in the area includes annual grass, brush and trees. Outcrops of bedrock material are present along several of the service road cuts. Figures 2a through 2g, and 3a through 3d depict the general site conditions.

SURVEY METHODOLOGY
A seismic P-wave (compression wave) refraction survey was conducted at the project site to evaluate the rippability characteristics of the subsurface materials and to develop a subsurface velocity profile of the study areas. The seismic refraction method uses first-arrival times of re-
fracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component geophones, and recorded with a 24-channel Geometrics StrataView seismograph. The travel times of the seismic P-waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials. Twenty-three seismic lines/profiles (SL-1 through SL-23) were conducted at the project site. The locations of the lines, which were generally selected by your office, are depicted on Figures 2a through 2g. Except for lines SL-2, SL-10, and SL-18, shot points were conducted at each end of the lines, at the midpoint, and at intermediate points between the midpoint and the end of the line. Due to the relatively short length of lines SL-2, SL-10, and SL-18 the intermediate shot points were omitted.

The refraction method requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above will not be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by core stones/outcrops, can also result in the misinterpretation of the subsurface conditions.

In general, seismic wave velocities can be correlated to material density and/or rock hardness. The relationship between rippability and seismic velocity is empirical and assumes a homogeneous mass. Localized areas of differing composition, texture, and/or structure may affect both the measured data and the actual rippability of the mass. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

The rippability values presented in Table 1 are based on our experience with similar materials and assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristics, such as fracture spacing and orientation, play a significant role in determining rock rippability. These characteristics may also vary with location and depth.
For trenching operations, the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in a narrow trench, should be anticipated.

<table>
<thead>
<tr>
<th>Seismic P-wave Velocity</th>
<th>Rippability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2,000 feet/second</td>
<td>Easy</td>
</tr>
<tr>
<td>2,000 to 4,000 feet/second</td>
<td>Moderate</td>
</tr>
<tr>
<td>4,000 to 5,500 feet/second</td>
<td>Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>5,500 to 7,000 feet/second</td>
<td>Very Difficult, Probable Local to General Blasting</td>
</tr>
<tr>
<td>Greater than 7,000 feet/second</td>
<td>Blasting Generally Required</td>
</tr>
</tbody>
</table>

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook (Caterpillar, 2004). Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

5. RESULTS

Table 2 lists the average P-wave velocities and depths calculated from the seismic refraction traverses conducted during this evaluation. The approximate locations of the seismic refraction traverses are shown on the Seismic Line Location Maps (Figures 2a through 2g). Layer velocity profiles are included in Figures 4a through 4l. Please note the vertical scale changes for the profiles. It should also be noted that, as a general rule, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the refraction line. The lengths of the seismic refraction lines are listed with their interpretations in Table 2.

In general, the results of the seismic lines are reasonably consistent. Three distinct layers were revealed in the data for SL-1 and SL-2 and two distinct layers were observed along lines SL-3 through SL-23. As presented in Figure 2a, lines SL-1 and SL-2 are located at the southern portion of the site near the wastewater treatment plant.
Table 2 – Seismic Traverse Results

<table>
<thead>
<tr>
<th>Traverse No. And Length</th>
<th>P-wave Velocity feet/second</th>
<th>Approximate Depth to Bottom of Layer in feet</th>
<th>Rippability*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-1 190 feet</td>
<td>V1 = 1,550, V2 = 2,300, V3 = 5,450</td>
<td>0 – 12, 30 – 34, ---</td>
<td>Easy, Moderate, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-2 100 feet</td>
<td>V1 = 1,350, V2 = 2,850, V3 = 5,400</td>
<td>3 – 6, 12 – 20, ---</td>
<td>Easy, Moderate, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-3 240 feet</td>
<td>V1 = 1,200, V2 = 4,800</td>
<td>20 – 30, ---</td>
<td>Easy, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-4 240 feet</td>
<td>V1 = 2,100, V2 = 5,700</td>
<td>12 – 17, ---</td>
<td>Moderate, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-5 220 feet</td>
<td>V1 = 1,250, V2 = 4,950</td>
<td>16 – 23, ---</td>
<td>Easy, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-6 240 feet</td>
<td>V1 = 1,250, V2 = 5,650</td>
<td>22 – 24, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-7 240 feet</td>
<td>V1 = 1,450, V2 = 6,300</td>
<td>20 – 22, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-8 240 feet</td>
<td>V1 = 1,900, V2 = 5,500</td>
<td>11 – 14, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-9 240 feet</td>
<td>V1 = 1,200, V2 = 4,950</td>
<td>26 – 28, ---</td>
<td>Easy, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-10 125 feet</td>
<td>V1 = 1,650, V2 = 5,500</td>
<td>10 – 17, ---</td>
<td>Very Difficult, Probable Blasting</td>
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<td>SL-11 240 feet</td>
<td>V1 = 1,600, V2 = 5,450</td>
<td>13 – 17, ---</td>
<td>Easy, Difficult, Possible Local Blasting</td>
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<tr>
<td>SL-12 200 feet</td>
<td>V1 = 1,350, V2 = 6,050</td>
<td>7 – 16, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-13 240 feet</td>
<td>V1 = 1,650, V2 = 5,700</td>
<td>18 – 28, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-14 200 feet</td>
<td>V1 = 1,600, V2 = 8,650</td>
<td>11 – 21, ---</td>
<td>Easy, Blasting Generally Required</td>
</tr>
<tr>
<td>SL-15 220 feet</td>
<td>V1 = 1,450, V2 = 6,150</td>
<td>20 – 25, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-16 240 feet</td>
<td>V1 = 1,400, V2 = 5,650</td>
<td>16 – 19, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
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<tr>
<td>SL-17 240 feet</td>
<td>V1 = 1,700, V2 = 5,200</td>
<td>21 – 26, ---</td>
<td>Easy, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-18 140 feet</td>
<td>V1 = 2,800, V2 = 5,200</td>
<td>7 – 21, ---</td>
<td>Moderate, Difficult, Possible Local Blasting</td>
</tr>
<tr>
<td>SL-19 240 feet</td>
<td>V1 = 1,400, V2 = 6,150</td>
<td>17 – 20, ---</td>
<td>Easy, Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-20 240 feet</td>
<td>V1 = 1,250, V2 = 5,450</td>
<td>13 – 16, ---</td>
<td>Easy, Difficult, Possible Local Blasting</td>
</tr>
</tbody>
</table>
Table 2 – Seismic Traverse Results

<table>
<thead>
<tr>
<th>Traverse No. And Length</th>
<th>P-wave Velocity feet/second</th>
<th>Approximate Depth to Bottom of Layer in feet</th>
<th>Rippability*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-21</td>
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<td>---</td>
<td>Very Difficult, Probable Blasting</td>
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<tr>
<td>SL-22</td>
<td>V1 = 1,300 V2 = 6,050</td>
<td>13 – 17</td>
<td>Easy</td>
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<tr>
<td></td>
<td></td>
<td>---</td>
<td>Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>SL-23</td>
<td>V1 = 1,200 V2 = 6,200</td>
<td>33– 38</td>
<td>Easy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>---</td>
<td>Very Difficult, Probable Blasting</td>
</tr>
</tbody>
</table>

* Rippability criteria based on the use of a Caterpillar D-9 dozer ripping with a single shank

6. CONCLUSIONS
In general, the results from our seismic survey revealed two distinct geologic layers in the area of the seismic traverses, with the exception of SL-1 and SL-2, which revealed 3 layers. The velocities calculated for the layers are generally consistent along the study area, especially for the uppermost layer. Based on our site observations and discussions with you, the layers detected have been interpreted to be surficial soil (topsoil, colluvium, alluvium, or fill) underlain by bedrock with varying degrees of weathering and moisture. The typical velocity range for Layer 1 is generally 1,200 to 2,000 feet per second and 4,800 to 6,400 feet per second for Layer 2. The average velocity derived for Layer 1 (excluding SL-1 and SL-2) was roughly 1,550 feet per second, and 5,750 feet per second for Layer 2. These velocities for Layers 1 and 2 reasonably represent surficial soils such as alluvium and weathered sedimentary bedrock, respectively. It should be noted, however, that the velocity of saturated consolidated sediments can be as high as those measured for Layer 2.

During our site visit, we noted the presence of numerous rock outcrops and core stones on the slopes. The presence of these outcrops at the site, indicate differential weathering of the onsite bedrock materials. Furthermore, some scatter was noted in the first-arrivals indicating the presence of inhomogeneities in the subsurface materials.
7. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Southwest Geophysics, Inc. should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties’ sole risk.
8. SELECTED REFERENCES


Rimrock Geophysics, 2003, Seismic Refraction Interpretation Programs (SIPwin), V-2.76.

SEISMIC PROFILES
SL-5 AND SL-6

Aliso Creek
Aliso Viejo, California

Figure 4c

Project No.: 109152
Date: 08/09
SEISMIC PROFILES
SL-7 AND SL-8
Aliso Creek
Aliso Viejo, California
Figure 4d
SEISMIC PROFILES
SL-9 AND SL-10

Aliso Creek
Aliso Viejo, California

Figure 4e
SEISMIC PROFILES
SL-11 AND SL-12

Aliso Creek
Aliso Viejo, California

Figure 4f
SEISMIC PROFILES
SL-13 AND SL-14

Aliso Creek
Aliso Viejo, California

Figure 4g

Project No.: 109152
Date: 08/09
SEISMIC PROFILES
SL-15 AND SL-16

SL-15

1442 ft/s

SL-16

1411 ft/s

5634 ft/s

Aliso Creek
Aliso Viejo, California

Figure 4h
SEISMIC PROFILES
SL-17 AND SL-18

Aliso Creek
Aliso Viejo, California

Figure 4i
APPENDIX C
LABORATORY TESTING
APPENDIX C - LABORATORY TESTING

DYA selected soil samples to be tested and the tests to be performed on the selected samples by DYA. Laboratory data are summarized on the boring logs in Appendix A and presented on Plates A1 through A21. We have reviewed and concur with the test results and accept full responsibility for their use in our analysis. A summary of the geotechnical laboratory testing is presented in Table C1.

<table>
<thead>
<tr>
<th>TEST NAME</th>
<th>PROCEDURE</th>
<th>PURPOSE</th>
<th>LOCATION</th>
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<tr>
<td>Moisture Content, Dry Density</td>
<td>ASTM D2216-92</td>
<td>Classification, index properties</td>
<td>Boring Logs</td>
</tr>
<tr>
<td>Grain-Size Distribution</td>
<td>ASTM D422-63</td>
<td>Classification, index properties</td>
<td>Plates C1 through C8</td>
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<tr>
<td>Atterberg Limits</td>
<td>ASTM D-4318-93</td>
<td>Expansion potential, classification, index properties</td>
<td>Plates C9 through C12</td>
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</tbody>
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Note:
- ASTM = American Society for Testing and Materials
### Laboratory Testing by:

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<th>Symbol</th>
<th>Source</th>
<th>Depth (feet)</th>
<th>Classification</th>
<th>Natural M. C. (%)</th>
<th>Liquid Limit (%)</th>
<th>Plasticity Index (%)</th>
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PARTICLE SIZE ANALYSIS
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10
PLATE PARTICLE SIZE ANALYSIS

Laboratory Testing by:

<table>
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<tr>
<th>Symbol</th>
<th>Source</th>
<th>Depth (feet)</th>
<th>Classification</th>
<th>Natural M. C. (%)</th>
<th>Liquid Limit (%)</th>
<th>Plasticity Index (%)</th>
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PARTICLE SIZE ANALYSIS

USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10

PLATE

C3
PARTICLE SIZE ANALYSIS
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10

PLATE C4
### PARTICLE SIZE ANALYSIS

**USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10**

**Project No. 2006-023.10**

---

#### Laboratory Testing by:

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<tr>
<th>Symbol</th>
<th>Source</th>
<th>Depth (feet)</th>
<th>Classification</th>
<th>Natural M. C. (%)</th>
<th>Liquid Limit (%)</th>
<th>Plasticity Index (%)</th>
<th>% Passing #200 Sieve</th>
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#### Table of U.S. Standard Sieve Numbers

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#### Table of Grain Size in Millimeters

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COBBLES  |  GRAVEL  |  SAND  |  SILT or CLAY

Laboratory Testing by:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Source</th>
<th>Depth (feet)</th>
<th>Classification</th>
<th>Natural M. C. (%)</th>
<th>Liquid Limit (%)</th>
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<th>% Passing #200 Sieve</th>
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PARTICLE SIZE ANALYSIS
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10

PLATE C6
### Particle Size Analysis

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**Particle Size Analysis**

USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10

PLATE C7
PARTICLE SIZE ANALYSIS
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10

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PLASTICITY CHART
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10

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- DDB-5
- DDB-6
- DDB-7
- DDB-8
- CL-
- CH or OH
- ML or OL
- MH or OH
- U-LINE
- A-LINE

**Laboratory Testing by:**
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10 Project No. 2006-023.10

**Source:**
NP

**Classification:**
- M. C. (%)
- Liquid Limit (%)
- Plasticity Index (%)
- % Passing #200 Sieve

**PLASTICITY INDEX (%)**

**LIQUID LIMIT (%)**

**PLASTICITY CHART**

**U-LINE**

**A-LINE**

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PLASTICITY CHART
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10
Project No. 2006-023.10
Laboratory Testing by:

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**PLASTICITY CHART**  
USACE Aliso Creek Ecosystem Restoration Feasibility Study TO10  
Project No. 2006-023.10  
PLATE C10
Laboratory Testing by:

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<th>Plastic Limit (%)</th>
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QUALITY CONTROL REVIEWER

Saroj Weeraratne, Ph.D., P.E., G.E.
Senior Engineer

SW:cfp
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